



High-function General-purpose Inverter

RX2 Series

User's Manual

3G3RX2-□□□□□



NOTE

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Introduction

Thank you for purchasing the High-function General-purpose Inverter (Model: 3G3RX2).

This manual describes the installation and wiring methods of the 3G3RX2 Series Inverter, and parameter setting methods which are required for the operation, as well as troubleshooting and inspection methods.

Intended Readers

This manual is intended for the following individuals.

Those who have electrical knowledge (certified electricians or individuals who have equivalent knowledge) and also are qualified for one of the following:

- Introducing control equipment
- Designing control system
- Installing and connecting control systems
- Managing control systems and facilities

Notice

This manual contains information you need to know to correctly use the High-function General-purpose Inverter (Model: 3G3RX2).

Before using the inverter, read this manual and gain a full understanding of the information provided herein.

After you finished reading this manual, keep it in a convenient place so that it can be referenced at any time.

Make sure this manual is delivered to the end user.

Manual Configuration

This user's manual consists of the following sections.

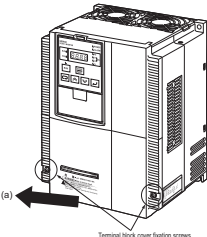
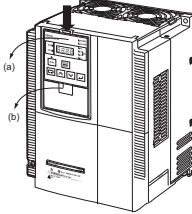
Read the necessary sections with a reference of the following table.

| Section/Title | | Outline |
|---------------|----------------------------|--|
| Section 1 | Overview | This section provides the features of this product, specifications, external dimensions, and part names. |
| Section 2 | Design | This section describes the installation and wiring methods for this product. |
| Section 3 | Operation | This section describes the followings: <ul style="list-style-type: none"> • Operation methods • Parts name in digital operator for test run • Its key operation |
| Section 4 | Test Run | This section describes how to perform a test run. |
| Section 5 | Monitor | This section describes various monitoring functions built-in an inverter. |
| Section 6 | Basic Parameter Settings | This section describes settings of connections to each destination of frequency commands and operation commands. |
| Section 7 | Advanced Settings | This section describes various functions built-in an inverter. |
| Section 8 | Applied Settings | This section describes functions other than Section.6 and 7. |
| Section 9 | Communications Functions | This section describes the general-purpose serial communications functions (RS-485 communication). |
| Section 10 | DriveProgramming | This section describes the features of the DriveProgramming. |
| Section 11 | Options | This section describes the specifications and external dimension of peripheral equipment. |
| Section 12 | Troubleshooting | This section describes how to analyze the cause and take countermeasures if the inverter fails, and provides troubleshooting for possible troubles. |
| Section 13 | Maintenance and Inspection | This section describes the maintenance and periodical inspection items. |
| Appendices | | This section describes the technical information and parameters. |

Manual Structure

Page Structure and Symbol Icons

The following page structure and symbol icons are used in this manual.

| | | |
|---|---|--|
| <p>Level 2 heading</p> <p>Level 3 heading</p> <p>Operation Steps Describes the operation steps.</p> <p>Note, Supplementary Information, Reference Target A note, supplementary information, reference target, etc. are provided with difference icons.</p> <p>Manual Name</p> | <div style="border: 1px solid black; padding: 10px;"> <div style="text-align: right; border-bottom: 1px solid black; padding-bottom: 5px;">2 Design</div> <div style="border-bottom: 1px solid black; padding-bottom: 5px;">2-2 Removal of Each Part</div> <div style="border-bottom: 1px solid black; padding-bottom: 5px;">2-2-1 Removing Covers</div> <p>Before wiring each terminal block, you need to remove the terminal block cover and the backing plate. In addition, to install a PG Board or communications unit, you must remove the Digital Operator, spacer cover, terminal block cover, and front cover beforehand. This section describes how to remove these covers. To reinstall it, reverse the removal procedure.</p> <div style="border-bottom: 1px solid black; padding-bottom: 5px;">Removing Terminal Block Cover</div> <ol style="list-style-type: none"> 1 Loosen the terminal block cover fixation screws. There are two terminal block cover fixation screws, one for each side of the cover. Larger capacity Inverter models have three terminal block cover fixation screws. 2 Remove the terminal block cover in the direction of (a) while holding it from the bottom. <div style="text-align: right; margin-right: 50px;">  <p style="font-size: small;">Terminal block cover fixation screws</p> </div> <div style="border-bottom: 1px solid black; padding-bottom: 5px;">Removing Digital Operator and Spacer Cover</div> <ol style="list-style-type: none"> 1 Remove the Digital Operator in the direction of (a) by pushing the lip on the top. 2 In the same way, remove the spacer cover in the direction of (b). <div style="text-align: right; margin-right: 50px;">  </div> <div style="font-size: x-small; margin-top: 10px;">High-function General-purpose Inverter 3G3RX-V1 User's Manual (I578-E1) 2 - 9</div> </div> | <p>Level 1 heading</p> <p>Level 2 heading</p> <p>Level 3 heading Shows which paragraph the content of the current</p> <p>Section Number of Level 1 heading Shows which section the content of the current page belongs to.</p> |
|---|---|--|

Note The above page is only a sample for illustrative purposes. It is not the actual content of the manual.

Special Information

Special information in this manual is classified as follows:



Precautions for Safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.



Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.



Additional Information

Additional information to read as required.

This information is provided to increase understanding or make operation easier.

Sections in this Manual

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NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

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Change in Specifications

Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

Errors and Omissions

Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Safety Precautions

To ensure that the High-function General-purpose Inverter (Model: 3G3RX2) is used safely and correctly, be sure to read this Safety Precautions section and the main text before using the product.

Learn all items you should know before use, regarding the equipment as well as required safety information and precautions.




Make an arrangement so that this manual also gets to the end user of this product.

After reading this manual, keep it in a convenient place so that it can be referenced at any time.

Indications and Meanings of Safety Information

In this user's manual, the following precautions and signal words are used to provide information to ensure the safe use of the High-function General-purpose Inverter (Model: 3G3RX2). The information provided here is vital to safety. Strictly observe the precautions provided.

Meanings of Signal Words


| | |
|--|--|
|  DANGER | Indicates an imminently hazardous situation which, if not avoided, is likely to result in serious injury or may result in death. Additionally there may be severe property damage. |
|  WARNING | Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage. |
|  Caution | Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage. |


Explanation of Symbols


| | |
|--|---|
| | <p>⊘ This symbol indicates a prohibited item (an item you must not do). The specific instruction is indicated using an illustration or text inside or near ⊘ . The symbol shown to the left indicates “disassembly prohibited.”</p> |
| | <p>⚠ This symbol indicates danger and caution. The specific instruction is indicated using an illustration or text inside or near ⚠ . The symbol shown to the left indicates “beware of electric shock.”</p> |
| | <p>⚠ This symbol indicates danger and caution. The specific instruction is indicated using an illustration or text inside or near ⚠ . The symbol shown to the left indicates “non-specific general danger.”</p> |
| | <p>⚠ This symbol indicates caution (including warning). The specific instruction is indicated using an illustration or text inside or near ⚠ . The symbol shown to the left indicates “risk of hot surface.”</p> |
| | <p>● This symbol indicates a compulsory item (an item that must be done). The specific instruction is indicated using an illustration or text inside or near ● . The symbol shown to the left indicates “general compulsory items.”</p> |
| | <p>● This symbol indicates a compulsory item (an item that must be done). The specific instruction is indicated using an illustration or text inside or near ● . The symbol shown to the left indicates “grounding required.”</p> |


Precautions for Correct Use


 WARNING


Turn off the power supply and implement wiring correctly.
 Not doing so may result in a serious injury due to an electric shock. 


Wiring work must be carried out only by qualified personnel.
 Not doing so may result in a serious injury due to an electric shock. 


Do not change wiring and slide switches (SW1 to SW6), put on or take off Operator and optional devices, replace cooling fans while the input power is being supplied. Doing so may result in a serious injury due to an electric shock. 


Be sure to ground the unit. Not doing so may result in a serious injury due to an electric shock or fire.
 (200-V class: type-D grounding, 400-V class: type-C grounding) 

Do not remove the terminal cover during the power supply and 15 minutes^{*1*2} after the power shut off. Doing so may result in a serious injury due to an electric shock. 

Do not operate the Operator or switches with wet hands.
 Doing so may result in a serious injury due to an electric shock. 

Inspection of the inverter must be conducted after the power supply was turned off. Not doing so may result in a serious injury due to an electric shock. 

The main power supply is not necessarily shut off even if the emergency shut off function is activated. 

Do not touch the inverter fins, braking resistors and the motor, which become too hot during the power supply and for some time after the power shut off. Doing so may result in a burn. 

*1. 10 minutes: For models 3G3RX2-A2004 to A2220 and 3G3RX2-A4007 to A4220

*2. 15 minutes: For models 3G3RX2-A2300 to A2550 and 3G3RX2-A4300 to B413K

Caution

Be sure to confirm safety before conducting maintenance, inspection or parts replacement.



Do not connect resistors to the terminals (PD/+1, P/+, N/-) directly. Doing so might result in a small-scale fire, heat generation, or damage to the unit.



Install a stop motion device to ensure safety. Not doing so might result in a minor injury.
(A holding brake is not a stop motion device designed to ensure safety.)



Be sure to use a specified type of braking resistor/regenerative braking unit. In case of a braking resistor, install a thermal relay that monitors the temperature of the resistor. Not doing so might result in a moderate burn due to the heat generated in the braking resistor/regenerative braking unit. Configure a sequence that enables the inverter power to turn off when unusual overeating is detected in the braking resistor/regenerative braking unit.



The inverter has high voltage parts inside which, if short-circuited, might cause damage to itself or other property. Place covers on the openings or take other precautions to make sure that no metal objects such as cutting bits or lead wire scraps go inside when installing and wiring.



Take safety precautions such as setting up a molded-case circuit breaker (MCCB) that matches the inverter capacity on the power supply side. Not doing so might result in damage to property due to the short circuit of the load.



Do not dismantle, repair or modify the product.
Doing so may result in an injury.



If a parameter is set incorrectly when starting up, adjusting, maintaining, or replacing, an unexpected operation may occur.



If the DriveProgramming stops during multi-function output, the output status is held. Take safety precautions such as stopping peripheral devices.



Place covers on the openings or take other precautions to make sure that no metal objects such as cutting bits or lead wire scraps go inside when installing the PG Unit and wiring.



Precautions for Safe Use

Installation and Storage

Do not store or use the product in the following places.

- Locations subject to direct sunlight.
- Locations subject to ambient temperature exceeding the specifications.
- Locations subject to relative humidity exceeding the specifications.
- Locations subject to condensation due to severe temperature fluctuations.
- Locations subject to corrosive or flammable gases.
- Locations subject to exposure to combustibles.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

Transportation, Installation, and Wiring

- Do not drop or apply strong impact on the product. Doing so may result in damaged parts or malfunction.
- Do not hold by the front cover and terminal cover, but hold by the fins during transportation.
- Confirm that the rated input voltage of the inverter is the same as AC power supply voltage.
- Do not connect an AC power supply voltage to the control input/output terminals. Doing so may result in damage to the product.
- Be sure to tighten the screws on the terminal block securely. Wiring work must be done after installing the unit body.
- Do not connect any load other than a three-phase inductive motor to the U, V, and W output terminals.
- Take sufficient shielding measures when using the product in the following locations. Not doing so may result in damage to the product.
 - Locations subject to static electricity or other forms of noise.
 - Locations subject to strong magnetic fields.
 - Locations close to power lines.
- When using DriveProgramming, confirm that the program data is downloaded normally before starting operation.
- Connect the PG Unit to the Inverter tightly with fixing screws. In addition, be sure to connect terminal wires on the PG Unit securely.

Operation and Adjustment

- Be sure to confirm the permissible range of motors and machines before operation because the inverter speed can be changed easily from low to high.
- Provide a separate holding brake if necessary.
- If the clock command is used in DriveProgramming, an unexpected operation may occur due to weak battery. Take measures such as detecting a weak battery by [E042] RTC Error and stopping the inverter or programs. When the LCD Operator is removed or disconnected, DriveProgramming is in a waiting status by the clock command.
- Be sure to confirm the RUN signal is turned off before resetting the alarm because the machine may abruptly start.
- Do not come close to the machine when you enable “restart” setting that results in automatic start after a deceleration stop (bA-30, bb-20, bb-21), the machine may abruptly start after the power is turned on.
- Provide a separate emergency stop switch because the STOP Key on the Operator is valid only when function settings are performed.
- When checking a signal during the power supply and the voltage is erroneously applied to the control input terminals, the motor may start abruptly. Be sure to confirm safety before checking a signal.
- Check whether the motor rotation direction is correct and unusual sound or vibration occurs during operation.

Maintenance and Inspection

- The capacitor service life is influenced by the ambient temperature. Refer to “Smoothing Capacitor Life Curve” described in the manual. When a capacitor reaches the end of its service life and does not work as the product, you need to replace the capacitor.
- When disposing of LCD operators and wasted batteries, follow the applicable ordinances of your local government. When disposing of the battery, insulate it using tape.



廢電池請回收

The following display must be indicated when products using lithium primary batteries (with more than 6 ppb of perchlorate) are transported to or through the State of California, USA.

Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate

Label or mark the above display on the exterior of all outer shipping packages of your products when exporting your products which the lithium primary batteries (with more than 6 ppb of perchlorate) are installed to the State of California, USA.

- Do not short + and –, charge, disassemble, heat, put into the fire, or apply strong impact on the battery. The battery may leak, explode, produce heat or fire. Never use the battery which was applied strong impact due to such as fall on the floor, it may leak.
- UL standards establish that the battery shall be replaced by an expert engineer. The expert engineer must be in charge of the replacement and also replace the battery according to the method described in this manual.
- When the display of LCD Operator can not be recognized due to the service life, replace the LCD Operator.

Precautions for Correct Use

Installation

Mount the product vertically on a wall with the product's longer sides upright.

The material of the wall must be nonflammable such as a metal plate.

Restart Selection Function

Do not come close to the machine when using Instantaneous power failure/under-voltage trip (bb-24) or over-current (bb-28) because the machine may abruptly start after the alarm cleared.

Maintenance and Parts Replacement

- Generally speaking, inverters contain components and will operate properly only when each component operates normally. Some of the electrical components require maintenance depending on application conditions. Periodic inspection and replacement are necessary to ensure proper long-term operation of Inverters.
- When a cooling fan reaches the end of its service life, replace it.

Product Disposal

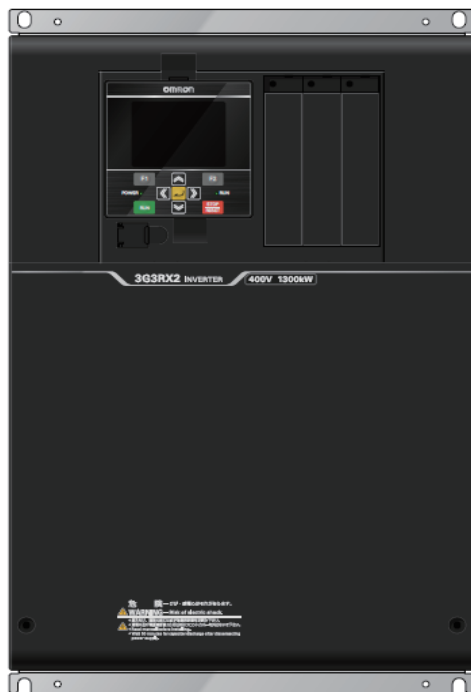
Comply with the local ordinance and regulations when disposing of the product.



Dispose of in accordance with WEEE Directive

Warning Label

- This product bears a warning label at the following location to provide handling warnings.
- Be sure to follow the instructions.
The appearance differs depending on the capacity of the inverter.



Warning Description

危険 — けが・感電のおそれがあります。

⚠ WARNING — Risk of electric shock.

- 据え付け、運転の前には必ず取扱説明書をお読み下さい。
- 通電中及び電源遮断後10分以内はフロントカバーを外さないで下さい。
- Read manual before installing.
- Wait 10 minutes for capacitor discharge after disconnecting power supply.

Regulations and Standards

To export (or provide to nonresident aliens) any part of this product that falls under the category of goods (or technologies) for which an export certificate or license is mandatory according to the Foreign Exchange and Foreign Trade Control Law of Japan, an export certificate or license (or service transaction approval) according to this law is required.

| Markings | | Standards |
|----------|-----------|---|
| CE | EMC | EN 61800-3:2004+A1:2012 |
| | Machinery | IEC61800-5-2: 2016 STO SIL3 ISO13849-1: 2015 Cat.4 PLe IEC61800-5-1/A1:2016 |
| UL | US | UL61800-5-1 |
| | CA | CSA C22.2 No. 274 |
| | FS | IEC61800-5-2:2016 STO SIL3 ISO13849-1:2015 Cat.4 PLe |
| KC | | KN61800-3 |
| EAC | | - |
| RCM | | EN 61800-3:2004+A1:2012 |

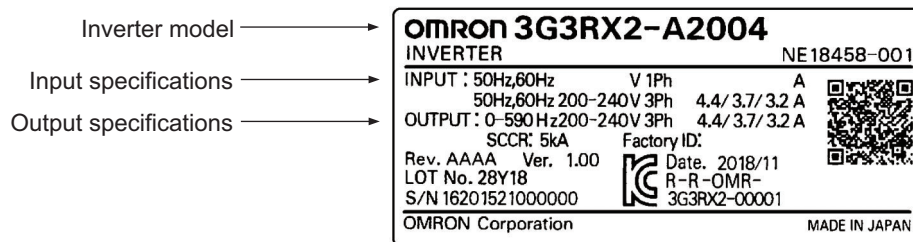
Items to Check after Unpacking

After unpacking, check the following items.

- Is this the model you ordered?
- Was there any damage sustained during shipment?

Checking the Nameplate

The nameplate is affixed to the product.



Checking the Model

3 G 3 R X2 - A 2 0 5 5

Maximum applicable motor capacity (normal duty rating [ND])

| | |
|-----|---------|
| 004 | 0.4 kW |
| 007 | 0.75 kW |
| 015 | 1.5 kW |
| 022 | 2.2 kW |
| 037 | 3.7 kW |
| 055 | 5.5 kW |
| 075 | 7.5 kW |
| 110 | 11 kW |
| 150 | 15 kW |
| 185 | 18.5 kW |
| 220 | 22 kW |
| 300 | 30 kW |
| 370 | 37 kW |
| 450 | 45 kW |
| 550 | 55 kW |
| 750 | 75 kW |
| 900 | 90 kW |
| 11K | 110 kW |
| 13K | 132 kW |

Voltage class

| | |
|---|-------------------------------|
| 2 | 3-phase 200 VAC (200-V class) |
| 4 | 3-phase 400 VAC (400-V class) |

Enclosure rating

| | |
|---|-------------------|
| A | IP20/UL open type |
| B | IP00/UL open type |

Checking the Accessories

The instruction manual is the only accessory included in the High-function General-purpose Inverter (Model: 3G3RX2).

Mounting screws and other necessary parts must be provided by the user.

LCD operator does not come with battery. When you desire to display time and date in LCD operator, prepare the optional battery (CR2032, 3V). As for the method for setting the battery and for its use, refer to section 3-1-5 *How to Set Battery and the Time Setting* on page 3-12.

| Accessory | 3G3RX2-A2004/ -A2007/ -A2015/ -A2022/ -A2037/ -A2055/ -A2075/ -A2110/ -A2150/ -A2185/ -A2300/ -A4007/ -A4015/ -A4022/ -A4037/ -A4055/ -A4075/ -A4110/ -A4150/ -A4185/ -A4220/ -A4300 | 3G3RX2-A2220 | 3G3RX2-A2370/ -A2450/ -A2550/ -A4370/ -A4450/ -A4550/ -B4750/ -B4900/ -B411K/ -B413K |
|---------------------------------------|---|--------------|---|
| LCD Operator | 1 (equipped with this inverter) | | |
| User's Manual | 1 | | |
| Sheet supporting 25 foreign languages | 1 | | |
| Warning Label Sheet | 1 | | |
| Spacer, Screw (M3×8) | - | each 4 | - |
| Eye-bolts (M8 CB08EY 2M) | - | - | 2 |

Related Manuals

Please see the manuals below for related product information.

| Name | Catalog No. |
|---|-------------|
| Regenerative Braking Unit 3G3AX-RBU User's Manual | I563 |
| CX-Drive Operation Manual | W453 |
| DriveProgramming User's Manual | I622 |

For the PG option, refer to *2-3-6 Wiring for PG Option Unit* on page 2-63 in this manual.

Revision History

The manual revision code is a number appended to the end of the catalog number found in the bottom right-hand corner of the front and back covers.

Example

| | |
|----------------|-------------------|
| Cat.No. | I620-E1-01 |
|----------------|-------------------|

↑
Revision code

| Revision code | Revision date | Revised Content |
|---------------|---------------|---------------------|
| 01 | March 2019 | Original production |

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Section 2 Design

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1

Overview

This section provides an overview of the 3G3RX2 Series features, standard specifications, and external dimensions by inverter capacity.

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1-1 Overview of Functions

The High-function General-purpose Inverter (Model: 3G3RX2) is a human- and environmental-friendly inverter suitable for a variety of applications. It provides various features, such as convenient functions intended for ease of use and diverse I/O. In addition, the 3G3RX2 Series complies with safety standards for any nations such as IEC Standard. You can use this product as a world standard inverter.

1-1-1 Features of 3G3RX2 Series Inverter

The 3G3RX2 Series Inverter has the following features.

Enhanced Application Support

The 3G3RX2 Series provides high performance and high functionality, which are the requirements of a general-purpose inverter. It enhances the capability to support applications and addresses diverse needs with optimal performance.

● Adoption of the Triple Rating Function (Normal Duty, Low Duty and Very Low Duty)

At 3G3RX2 the previous heavy and light load modes were renewed to **Normal Duty (ND)**, **Low Duty (LD)** and **Very Low Duty (VLD)** to provide the triple rating function.

The Low Duty is available for a fan, pump, or other device that operates at the rated motor torque or less in a normal state. Setting the **Low Duty** causes the rated current of the inverter to increase, enabling the inverter to drive a motor that is one size larger in capacity.

However, pay attention to when selecting an inverter because the overload capacity decreases to 1 minute, 120% of the rated current.



Precautions for Correct Use

Switching the **Normal, Low and Very Low Duty** changes the setting ranges and default data of the related parameters. Refer to *6-1-1 Inverter Load Rating Settings* on page 6-3 for details.

● Implementation of the Programming Function

The 3G3RX2 Series has the built-in simple sequence function (DriveProgramming), which enables a stand-alone inverter to perform simple sequence control.

You can create programs easily in flowchart or text language method by using the CX-Drive.

For details, refer to the *DriveProgramming User's Manual* (Cat. No. I622).

● Implementation of the Vector Control Functions

With sensorless vector control, the inverter realizes a high starting torque at 200% of the motor rating in 0.3 Hz.

With 0-Hz sensorless vector control, the inverter can also output a high starting torque at 150% of the motor rating in even lower frequencies.

The inverter has various vector control functions as listed below, in addition to V/f control.

- Sensorless vector control
- 0-Hz sensorless vector control
- Sensor vector control

● Availability of Position Control by the Feedback

The inverter can realize accurate position control by feeding back the load-side position information, just like a servo system. It is effective to save costs for the whole system because the position control system with a motor over 15 kW is available, and also other position controllers are unnecessary if the inverter's internal position control function is used.

This inverter has the following position control functions.

- Absolute position control mode and high-resolution absolute position control mode that can control up to 8 points
- Pulse train position control mode that can control via pulse input from the host controller
- Orientation function that controls a rotating shaft to stop at a fixed position

● PID Control Function

The inverter provides PID control that adjusts the feedback value to match the target value.

This is available to the process control such as temperature, pressure, flow rate without temperature controller or external controller.

● Power Interruption Restart Function

If a momentary power interruption occurs during operation, the inverter automatically recognizes the rotation speed of the motor at power recovery, without detecting undervoltage, to enable a smooth restart.

● Stall Prevention Function

Induction motors may stall (or step out) if a large load is applied due to rapid acceleration or load fluctuation.

This inverter has the overload limit function that prevents such a stall condition and ensures a persistent operation.

Ease of Use

The 3G3R2 Series Inverter contributes to the reduction of man-hours in all phases of inverter-related work: from wiring, parameter setting, operation, through to maintenance.

● Removable Color LCD Digital Operator Equipped

This inverter has a removable LCD Digital Operator as standard equipment.

This Color LCD Display is equipped to provide easier view of the monitor for parameter settings. You can save inverter data to LCD operator and it can be used as a copy unit.

By connecting the optional special cable, it is possible to operate the Digital Operator at hand or install it to the front face of the control panel. This is convenient during setup or maintenance operation.

When the optional battery (CR2032, 3V) is set in the LCD operator, date and time can be displayed in the error history. This display is useful in troubleshooting when an error occurs.

● Safe Torque OFF (STO) Function

Safe Torque OFF (STO) function complying with IEC61800-5-2 is equipped. By a signal from safety devices like emergency shutoff button, the motor current can be shutoff to stop the motor safely.

● Modbus Communication Function as Standard

The inverter has the RS485 communications circuit and the Modbus communication protocol as standard.

You can use Modbus communication to control and monitor the inverter status, or read and write various parameter settings.

● Simplified Parameter Setting by User Parameters

This inverter provides User Selection (UA-31 to UA-62) as user parameters. You can register parameters that are frequently used to simplify the parameter setting and adjustment.

It is also possible to automatically register changed parameters as user parameters.

Environmental Consideration

OMRON gives consideration to not only the inverter, but also the service life and energy efficiency of the connected motor.

This inverter, as a standard product, complies with the RoHS directive and international standards to realize an environmental-friendly inverter.

● Measures against Noise and Harmonic Interference for Peripheral Protection

The inverter has the built-in EMC noise filter as standard as a measure against noise for compliance with the EMC directive.

By connecting the optional radio noise filters and DC reactors, the specifications which complies with the standard by Ministry of Land, Infrastructure, Transport and Tourism of Japan are achieved.

● Long Life Design

The inverter has a design life of 10 years through the use of long-life parts for its capacitors, fan, and other consumables. Using an inverter for a longer period than ever before has an advantage in extending the life of your facility.

● Automatic Energy-saving Function

The automatic energy-saving function automatically adjusts the output power of the inverter operating at a constant speed to the minimum. It has an energy-saving effect in applications such as a fan or pump.

● Compliance with Safety Standards

The inverter complies with safety standard for any nations such as IEC Standard.

● Complies with RoHS Directive

This inverter, as a standard product, complies with the RoHS Directive that restricts the use of 10 hazardous substances.

1-1-2 Classes of 3G3RX2 Series Inverter

There are two voltage classes for 3G3RX2 Series Inverters: 3-phase 200 VAC and 3-phase 400 VAC.

The applicable motor capacity is 0.4 to 132 kW.

All models comply as standard with the EC Directives

| Rated voltage | Enclosure rating | Max. applicable motor capacity | Model |
|-----------------|------------------|--------------------------------|--------------|
| 3-phase 200 VAC | IP20 | 0.4 kW | 3G3RX2-A2004 |
| | | 0.75 kW | 3G3RX2-A2007 |
| | | 1.5 kW | 3G3RX2-A2015 |
| | | 2.2 kW | 3G3RX2-A2022 |
| | | 3.7 kW | 3G3RX2-A2037 |
| | | 5.5 kW | 3G3RX2-A2055 |
| | | 7.5 kW | 3G3RX2-A2075 |
| | | 11 kW | 3G3RX2-A2110 |
| | | 15 kW | 3G3RX2-A2150 |
| | | 18.5 kW | 3G3RX2-A2185 |
| | | 22 kW | 3G3RX2-A2220 |
| | | 30 kW | 3G3RX2-A2300 |
| | | 37 kW | 3G3RX2-A2370 |
| | | 45 kW | 3G3RX2-A2450 |
| | | 55 kW | 3G3RX2-A2550 |
| 3-phase 400 VAC | IP20 | 0.75 kW | 3G3RX2-A4007 |
| | | 1.5 kW | 3G3RX2-A4015 |
| | | 2.2 kW | 3G3RX2-A4022 |
| | | 3.7 kW | 3G3RX2-A4037 |
| | | 5.5 kW | 3G3RX2-A4055 |
| | | 7.5 kW | 3G3RX2-A4075 |
| | | 11 kW | 3G3RX2-A4110 |
| | | 15 kW | 3G3RX2-A4150 |
| | | 18.5 kW | 3G3RX2-A4185 |
| | | 22 kW | 3G3RX2-A4220 |
| | | 30 kW | 3G3RX2-A4300 |
| | | 37 kW | 3G3RX2-A4370 |
| | | 45 kW | 3G3RX2-A4450 |
| | | 55 kW | 3G3RX2-A4550 |
| | | IP00 | 75 kW |
| | 90 kW | | 3G3RX2-B4900 |
| | 110 kW | | 3G3RX2-B411K |
| | 132 kW | | 3G3RX2-B413K |

Model Criteria

3 G 3 R X 2 - A 2 0 5 5

Max. Applicable Motor Capacity Standard Rating (normal duty rating [ND])

| | |
|-----|---------|
| 004 | 0.4 kW |
| 007 | 0.75 kW |
| 015 | 1.5 kW |
| 022 | 2.2 kW |
| 037 | 3.7 kW |
| 055 | 5.5 kW |
| 075 | 7.5 kW |
| 110 | 11 kW |
| 150 | 15 kW |
| 185 | 18.5 kW |
| 220 | 22 kW |
| 300 | 30 kW |
| 370 | 37 kW |
| 450 | 45 kW |
| 550 | 55 kW |
| 750 | 75 kW |
| 900 | 90 kW |
| 11K | 110 kW |
| 13K | 132 kW |

Voltage class

| | |
|---|-------------------------------|
| 2 | 3-phase 200 VAC (200-V class) |
| 4 | 3-phase 400 VAC (400-V class) |

Enclosure rating

| | |
|---|-------------------|
| A | IP20/UL open type |
| B | IP00/UL open type |

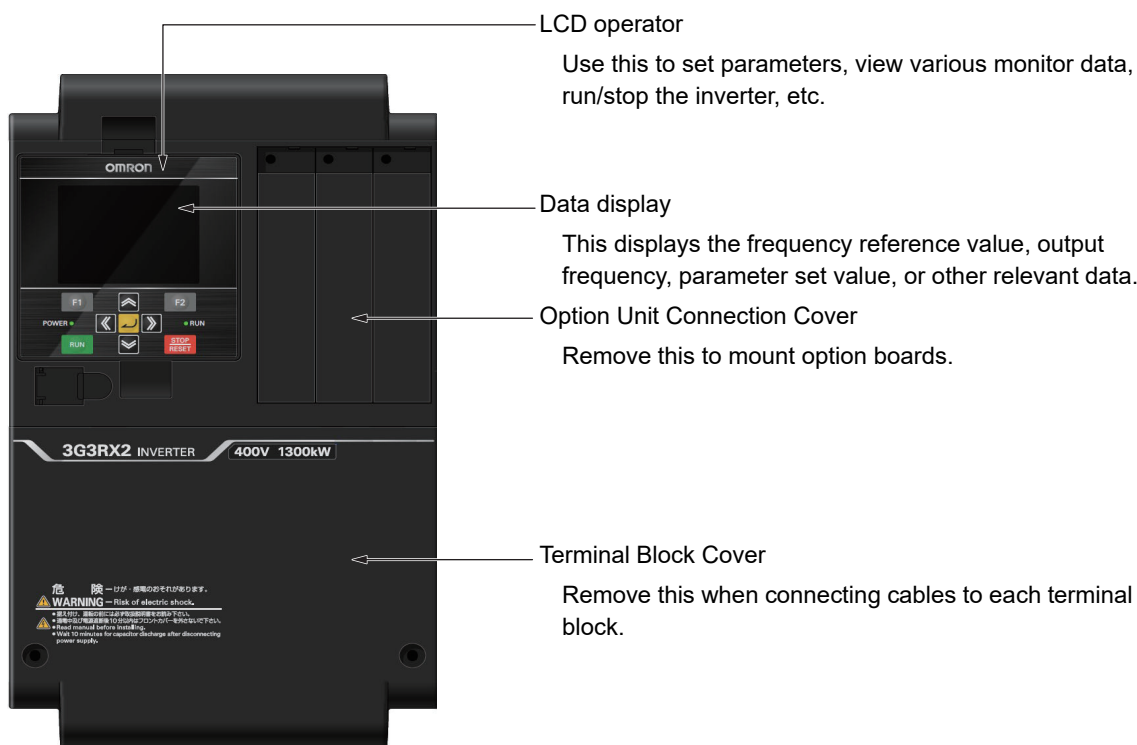
1-1-3 Compliance with International Standards

Because the 3G3RX2 Series complies as standard with the international IEC standard, the series conform to any standard for any nations including European nations.

| | | Applicable standard |
|-----|-----------|---|
| CE | EMC | EN 61800-3:2004+A1:2012 |
| | Machinery | IEC61800-5-1/A1:2016 IEC61800-5-2:2016 STO SIL3 ISO13849-1:2015 Cat.4 PLe |
| UL | US | UL61800-5-1 |
| | CA | CSA C22.2 No. 274 |
| | FS | IEC61800-5-2:2016 STO SIL3 ISO13849-1:2015 Cat.4 PLe |
| KC | | KN61800-3 |
| EAC | | - |
| RCM | | EN 61800-3:2004+A1:2012 |

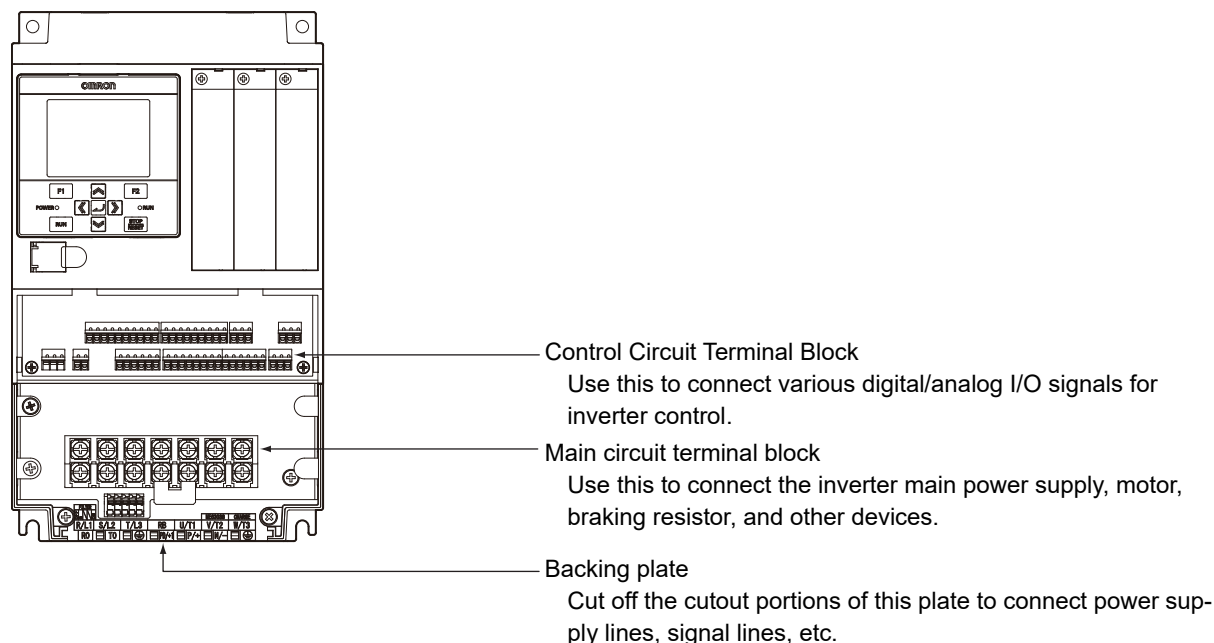
1-2 Appearance and Part Names

The following shows the front view when the product is unpacked (an example of 3G3RX2-A2055/A2075/A2110/A4055/A4075/A4110).



Open the terminal block cover to wire the main circuit terminal block and the control circuit terminal block.

Moreover, you can open the Option Unit Connection Cover to mount option boards.



1-3 Specifications

1-3-1 Standard Specifications

Refer to *Derating of Rated Output Current* on page 2-10.

Common Specifications

| | | |
|--|---|---|
| Control mode (output to the motor) | Sine wave PWM control voltage output (line sine wave modulation) | |
| Output frequency range ^{*1} | 0.00 to 590.00Hz | |
| Frequency accuracy | Digital command $\pm 0.01\%$ and analog command $\pm 0.2\%$ (25°C $\pm 10^\circ\text{C}$) against the maximum frequency | |
| Frequency resolution | Digital setting: 0.01Hz Analog setting: maximum frequency/4000 (Ai1 terminal/Ai2 terminal: 12bit/0 to +10V or 0 to +20mA, Ai3 terminal 12bit/-10 to +10V) | |
| Control mode (frequency/voltage calculation) ^{*2} | IM | V/f control (fixed torque/reduced torque/free), automatic boost control, cascade model sensorless vector control, 0 Hz range sensorless vector control, vector control with sensor. |
| | SM/PMM | Synchronous starting sensorless vector control, IVMS starting smart sensorless vector control |
| Speed fluctuation ^{*3} | $\pm 0.5\%$ (during sensorless vector control) | |
| Acceleration or deceleration time | 0.00 to 3600.00sec (linear, S-shaped, U-shaped, reverse U-shaped, EL-S shaped) | |
| Display monitor | Output frequency, output current, output torque, trip history, I/O terminal status, I/O power ^{*4} , P-N voltage. | |
| Starting functions | Start after DC braking, frequency collection start, frequency entrainment start, reduced voltage start, retry start | |
| Stopping functions | Free-run stop, DC braking after deceleration stop or terminal DC braking (braking power, operating speed adjustment) | |
| Stall prevention function | Overload restraining function, overcurrent suppression function, overvoltage suppression function | |
| Protective function ^{*5} | Overcurrent error, Motor overload error, Braking resistor Overload error, Overvoltage error, Memory error, Undervoltage error, Current detector error, CPU error, External trip error, USP error, Ground fault error, Incoming over voltage error, Instantaneous power failure error, Temperature detector error, Cooling fan rotation speed reduction temperature error, Temperature error, Input open-phase error, IGBT error, Output open-phase error, Thermistor error, Brake error, Low-speed range overload error, Controller overload error, RS485 communication error, Operator keypad disconnection error. | |
| Other functions | V/f free settings (7 points), Upper/lower limit frequency limiter, Frequency jump, Curve acceleration/deceleration, Manual torque boost, Energy-saving operation, Analog output adjustment function, Minimum frequency, Carrier frequency adjustment, Motor electronic thermal function (free setting is also possible), Inverter electronic thermal function, External start/end (volume/ratio), Frequency input selection, Trip retry, Restart after instantaneous stop, Output of signals, Initialization settings, PID control, Automatic deceleration at power shut-off, Brake control function, and Auto-tuning for commercial switching function (online/offline). | |

| | | | | | |
|--------------------------|---|--|---|--|--|
| Input | Frequency setting | Standard operator keypad | Parameter setting using arrow keys | | |
| | | External signals *6 | Ai1/Ai2 terminal (when changing voltage) | Setting through input of 0 to 10VDC voltage (input impedance: 10kΩ) | |
| | | | Ai1/Ai2 terminal (when changing current) | Setting through input of 0 to 20mA current (input impedance: 100Ω) | |
| | | | Ai3 terminal | Setting through input of -10 to +10V voltage (input impedance: 10kΩ) | |
| | | | Multistage speed terminal (use of input terminal function) | 15 speed | |
| | | | Pulse string input (A/B terminal, use of input terminal function) | 32kHz×2 at maximum | |
| | External port | Setting via RS485 serial communication (protocol: Modbus-RTU) | | | |
| | Normal rotation/reverse rotation Run/stop | Standard operator keypad | Execution with the RUN /STOP key (normal rotation/reverse rotation can be switched by setting parameters) | | |
| | | External signals | Normal rotation operation (FW)/reverse rotation (RV) (when an input terminal function is assigned) 3-wire input available (when an input terminal function is assigned) | | |
| | | External port | Setting via RS485 serial communication (protocol: Modbus-RTU (maximum: 115.2kbps) | | |
| | Input terminal function | 11 terminals (input of pulse string is available on terminal A and B) | | | |
| | | FW (Normal rotation)/RV (Reverse rotation), CF1-4 (Multistage speed 1-4), SF1-7 (Multistage speed bit 1-7), ADD (Addition of frequency), SCHG (Switching of frequency command), STA (3-wire start)/STP (3-wire stop)/F_R (3-wire normal/reverse), AHD (Retention of analog command), FUP (Increase of speed via remote operation/FDN (Deceleration via remote operation), UDC (Deletion of data via remote operation), F-OP (Forced command switching), SET (Second control), RS (Reset), JG (Jogging), DB (External current braking), 2CH (2-stage acceleration/deceleration), FRS (Free-run stop), EXT (External abnormality), USP (Prevention of restart after restoration of power), CS (Commercial switching), SFT (Soft-lock), BOK (Brake check), OLR (Overload restriction switching), KHC (Clearance of integrated input power), OKHC (Clearance of integrated output power), PID (PID1 disabled), PIDC (PID1 integration reset), PID2 (PID2 disabled), PIDC2 (PID2 integration reset), SVC1-4 (PID1 multistage target values 1-4), PRO (PID gain switching), PIO (PID output switching), SLEP (SLEEP condition satisfied)/WAKE (WAKE condition satisfied), TL (Torque restriction enabled), TRQ1, 2 (Switching of torque limit 1,2), PPI (Switching of P/PI control), CAS (Switching of control gain), FOC (Preparatory excitation), ATR (Torque control enabled), TBS (Torque bias enabled), LAC (Cancellation of acceleration/deceleration), Mi1-11 (General-purpose input 1-11), PCC (Clearance of pulse counter), ECOM (Start of EzCOM), PRG (Program run), HLD (Acceleration/deceleration stop), REN (Operation permission signal), PLA (Pulse string input A), and PLB (Pulse string input B) | | | |
| | | Backup power supply terminal | P+/P-: DC24V input (allowable input voltage: 24V±10%) | | |
| | | STO input terminal | 2 terminals (simultaneous input) | | |
| | | Thermistor input terminal | 1 terminal (possible to switch between positive temperature coefficient/negative temperature coefficient resistance element) | | |
| Output | | Output terminal function | Transistor output 5 terminal, 1a contact relay 1 point, 1c contact relay 1 point | | |
| | | Relay and alarm relay (16, AL) | RUN (During operation), FA1-5 (Reached signal), IRDY (Operation ready completion), FWR (During normal rotation operation), RVR (During reverse rotation operation), FREF (Frequency command operator keypad), REF (Operation command operator keypad), SETM (Second control under selection), AL (Alarm signal), MJA (Severe failure signal), OTQ (Over torque) *7, IP (During instantaneous power failure), UV (Under insufficient voltage), TRQ (During torque limitation), IPS (During power failure deceleration), RNT (RUN time over), ONT (Power on time over), THM (Electronic thermal warning), THC (Electronic thermal warning), WAC (Capacitor life advance notice), WAF (Fan life advance notice), FR (Operation command signal), OHF (Cooling fin heating advance notice), LOC/LOC2 (Low-current signal), OL/OL2 (Overload advance notice), BRK (Brake release), BER (Brake abnormality), ZS (Zero-speed detection signal), OD/OD2 (PID deviation excessive), FBV/FBV2 (PID feedback comparison), NDc (Communication disconnection), Ai1Dc/Ai2Dc/Ai3Dc (Analog disconnection Ai1/Ai2/Ai3), WCAi1/WCAi2/WCAi3 (Window comparator Ai1/Ai2/Ai3), LOG1-7 (Logical operation result 1-7), MO1-7 (General output 1-7), and OVS (Receiving overvoltage). | | |
| | EDM output terminal | Output for STO diagnosis | | | |
| | Monitor output terminal *8 | Possible to output through selection from monitor data of parameters | | | |
| EMC filter switching *9 | | Possible to enable the EMC noise filter (switching method is different depending on the model) | | | |
| External access to PC | | USB Micro-B | | | |
| Use environment | Ambient temperature *10 | ND (normal duty) | -10 to 50°C | | |
| | | LD (low duty) | -10 to 45°C | | |
| | | VLD (very low duty) | -10 to 40°C | | |
| | Storage temperature *11 | -20 to 65°C | | | |
| | Humidity | 20-90%RH (location free of condensation) | | | |
| Vibration *12 | 5.9m/s ² (0.6G) 10 to 55Hz: 3G3RX2-A2004 to A2220/3G3RX2-A4007 to A4220 2.94m/s ² (0.3G) 10 to 55Hz: 3G3RX2-A2300 to A2550/3G3RX2-A4300 to A413K | | | | |
| Use location *13 | 1000 m altitude or lower (location free from corrosive gas, oil mist, and dust) | | | | |
| Expected Life time | | Smoothing capacitor 10 years Designed life of cooling fan 10 years (models equipped with a cooling fan) free from dust Memory element on the control circuit board | | | |
| Applicable standards *14 | | Compliance with UL/cUL/CE standards, RCM, Functional Safety SIL3/PLE | | | |
| Painting color | | Black | | | |
| Operating, display | | LCD Operator *15 | | | |
| Number of option slots | | 3 ports | | | |
| Other options | | Braking resistor, AC reactor, DC reactor, noise filter | | | |

*1. The output frequency range depend on the control and motor used. When running the inverter exceeding 60Hz, check the maximum allowable frequency with the manufacturer of the motor.

- *2. When the control mode is changed, unless the motor constant is appropriately configured, you cannot obtain the desired starting torque or the inverter may trip.
- *3. The variable range of motor speed may vary depending on your system or the environment where the motor is used. Please contact us for details.
- *4. Both the input power and output power are reference values, which are not appropriate for use in calculation of efficiency values, etc. To obtain an accurate value, use an external device.
- *5. The IGBT error [E030] is generated by the protective function not only for short circuit protection but also when IGBT is damaged. Depending on the operating conditions of the inverter, the overcurrent error [E001] may occur, instead of the IGBT error.
- *6. At the factory default setting, when voltage and current on Ai1/Ai2 terminal is changed using a switch, with input of voltage at 9.8V and current at 19.8mA, the maximum frequency is commanded. To change characteristics, make adjustments using the analog start/end function.
- *7. The threshold for signal output varies depending on the motor to be combined with the inverter, parameter adjustment, etc.
- *8. The output data of analog voltage monitor and analog current monitor are reference values for connecting an analog meter. Due to the meter to be connected and variation in analog output circuit, the maximum output value may slightly vary from 10V or 20mA. To change characteristics, make adjustments using the Ao1 adjustment and Ao2 adjustment functions. Some monitor data cannot be output.
- *9. To enable the EMC filter, connect with a power supply grounded at a neutral point. Otherwise, the leakage current may increase.
- *10. Use the 400V class inverter at an input voltage of 500VAC or below. If input voltage exceeds 500VAC due to fluctuation of power, use the inverter at 40°C or lower ambient temperature.
- *11. The storage temperature is the temperature during transport.
- *12. To be in accordance with the testing method specified in JIS C 60068-2-6: 2010 (IEC 60068-2-6:2007)
- *13. When the inverter is used in a location at 1000m or higher altitude, air pressure reduces approximately 1% every 100m elevation. Perform 1% current derating and conduct evaluation for every 100m elevation.
- *14. For insulation distance, comply with UL and CE standards
- *15. When a clock function is used, the optional battery (CR2032, 3V) is required. When you purchase, this LCD operator does not come with the battery.

1-3-2 200V Class Specifications

| 3G3RX2-A2□□□□□ | | A2004 | A2007 | A2015 | A2022 | A2037 | A2055 | A2075 | A2110 | A2150 | A2185 | A2220 | A2300 | A2370 | A2450 | A2550 | | |
|--|--|--|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|-------|-------|-------|-------|-------|
| Applicable motor (4-pole) capacity (kW) | VLD | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | | |
| | LD | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | | |
| | ND | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | | |
| Output | Rated output current (A) | VLD | 4.4 | 8.0 | 10.4 | 15.6 | 22.8 | 33.0 | 46.0 | 60.0 | 80.0 | 93.0 | 124 | 153 | 185 | 229 | 295 | |
| | | LD | 3.7 | 6.3 | 9.4 | 12.0 | 19.6 | 30.0 | 40.0 | 56.0 | 73.0 | 85.0 | 113 | 140 | 169 | 210 | 270 | |
| | | ND | 3.2 | 5.0 | 8.0 | 11.0 | 17.5 | 25.0 | 32.0 | 46.0 | 64.0 | 76.0 | 95.0 | 122 | 146 | 182 | 220 | |
| | Overload current rating | VLD | 110% 60sec / 120% 3sec | | | | | | | | | | | | | | | |
| | | LD | 120% 60sec / 150% 3sec | | | | | | | | | | | | | | | |
| | | ND | 150% 60sec / 200% 3sec | | | | | | | | | | | | | | | |
| | Rated output voltage | | 3-phase (3-wire) 200 to 240V (depending on receiving voltage) | | | | | | | | | | | | | | | |
| | Rated capacity (kVA) | 200V | VLD | 1.5 | 2.8 | 3.6 | 5.4 | 7.9 | 11.4 | 15.9 | 20.8 | 27.7 | 32.2 | 43.0 | 53.0 | 64.1 | 79.3 | 102.2 |
| | | | LD | 1.3 | 2.2 | 3.3 | 4.2 | 6.8 | 10.4 | 13.9 | 19.4 | 25.3 | 29.4 | 39.1 | 48.5 | 58.5 | 72.7 | 93.5 |
| | | | ND | 1.1 | 1.7 | 2.8 | 3.8 | 6.1 | 8.7 | 11.1 | 15.9 | 22.2 | 26.3 | 32.9 | 42.3 | 50.6 | 63.0 | 76.2 |
| 240V | | VLD | 1.8 | 3.3 | 4.3 | 6.5 | 9.5 | 13.7 | 19.1 | 24.9 | 33.3 | 38.7 | 51.5 | 63.6 | 76.9 | 95.2 | 122.6 | |
| | | LD | 1.5 | 2.6 | 3.9 | 5.0 | 8.1 | 12.5 | 16.6 | 23.3 | 30.3 | 35.3 | 47.0 | 58.2 | 70.3 | 87.3 | 112.2 | |
| | | ND | 1.3 | 2.1 | 3.3 | 4.6 | 7.3 | 10.4 | 13.3 | 19.1 | 26.6 | 31.6 | 39.5 | 50.7 | 60.7 | 75.7 | 91.5 | |
| Input | Rated input current (A) *1 | VLD | 5.2 | 9.5 | 12.4 | 18.6 | 27.1 | 39.3 | 54.8 | 71.4 | 95.2 | 110.7 | 147.6 | 182.1 | 220.2 | 272.6 | 351.2 | |
| | | LD | 4.4 | 7.5 | 11.2 | 14.3 | 23.3 | 35.7 | 47.6 | 66.7 | 86.9 | 101.2 | 134.5 | 166.7 | 201.2 | 250.0 | 321.4 | |
| | | ND | 3.8 | 6.0 | 9.5 | 13.1 | 20.8 | 29.8 | 38.1 | 54.8 | 76.2 | 90.5 | 113.1 | 145.2 | 173.8 | 216.7 | 261.9 | |
| | Rated input AC voltage | | Control power supply: Power supply single phase 200 to 240V/allowable variation range 170 to 264V, 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz) Main circuit power supply: 3-phase (3-wire) 200 to 240V/allowable variation range 170 to 264V, 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz) | | | | | | | | | | | | | | | |
| Power supply equipment capacity (kVA) *2 | VLD | 2.0 | 3.6 | 4.7 | 7.1 | 10.3 | 15.0 | 20.9 | 27.2 | 36.3 | 42.2 | 56.3 | 69.4 | 83.9 | 103.9 | 133.8 | | |
| | LD | 1.7 | 2.9 | 4.3 | 5.4 | 8.9 | 13.6 | 18.1 | 25.4 | 33.1 | 38.6 | 51.3 | 63.5 | 76.7 | 95.3 | 122.5 | | |
| | ND | 1.5 | 2.3 | 3.6 | 5.0 | 7.9 | 11.3 | 14.5 | 20.9 | 29.0 | 34.5 | 43.1 | 55.3 | 66.2 | 82.6 | 99.8 | | |
| Carrier frequency operating range *3 | VLD | 0.5 to 10.0kHz | | | | | | | | | | | | | | | | |
| | LD | 0.5 to 12.0kHz | | | | | | | | | | | | | | | | |
| | ND | 0.5 to 16.0kHz | | | | | | | | | | | | | | | | |
| Motor start torque *4 | | 200%/0.3Hz | | | | | | | | | | | | | | | | |
| Braking | Regenerative braking | Equipped with BRD circuit (with a discharging resistor separately installed) | | | | | | | | | | | Regenerative braking unit separately installed | | | | | |
| | Minimum resistance that can be connected (Ω) | 50 | 50 | 35 | 35 | 35 | 16 | 10 | 10 | 7.5 | 7.5 | 5 | --- | --- | --- | --- | | |
| Dimension | Height (mm) | 255 | 255 | 255 | 255 | 255 | 260 | 260 | 260 | 390 | 390 | 390 | 540 | 550 | 550 | 700 | | |
| | Width (mm) | 150 | 150 | 150 | 150 | 150 | 210 | 210 | 210 | 245 | 245 | 245 | 300 | 390 | 390 | 480 | | |
| | Depth (mm) | 140 | 140 | 140 | 140 | 140 | 170 | 170 | 170 | 190 | 190 | 190 | 195 | 250 | 250 | 250 | | |
| Protective construction | | IP20*5 / UL open type | | | | | | | | | | | | | | | | |
| Approximate mass (kg) | | 3 | 3 | 3 | 3 | 3 | 6 | 6 | 6 | 10 | 10 | 10 | 22 | 33 | 33 | 47 | | |

*1. The rated input currents shown in the table are the values when the rated current is output. The values vary depending on impedance on the power supply (wiring, breaker, input reactor option, etc.)

*2. The power supply equipment capacities shown in the table are the values when 220V rated current is output. The values vary depending on impedance on the power supply (wiring, breaker, input reactor option, etc.)

*3. The setting of rated values for carrier frequencies [bb101]/[bb201] are internally limited in accordance with the description. Also, it is recommended to set values equivalent to or above (maximum output frequency for driving ×10) Hz for the setting of carrier frequencies [bb101]/[bb201]. Also, in the case of induction motor (IM) control, for items other than those subject to V/f control, it is recommended to set carrier frequency at 2kHz or more. In the case of synchronous motor (SM)/permanent magnet motor (PMM) control, it is recommended to set carrier frequency at 8kHz or more.

*4. The value of the sensor-less vector control applied to the ND rating in the Standard motor. Torque characteristics may vary depending on the control method and the motor used.

*5. Based on self declaration.

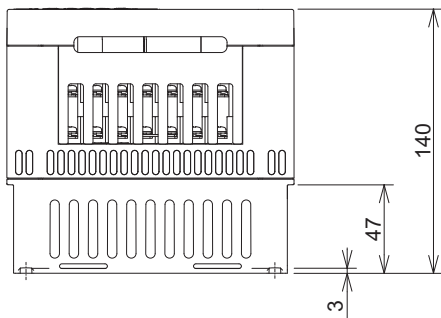
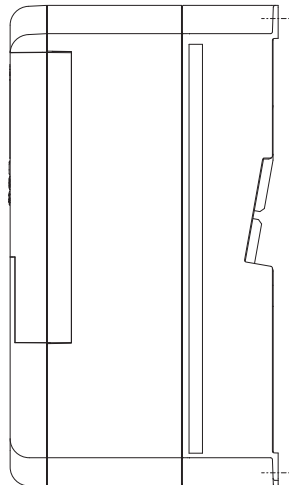
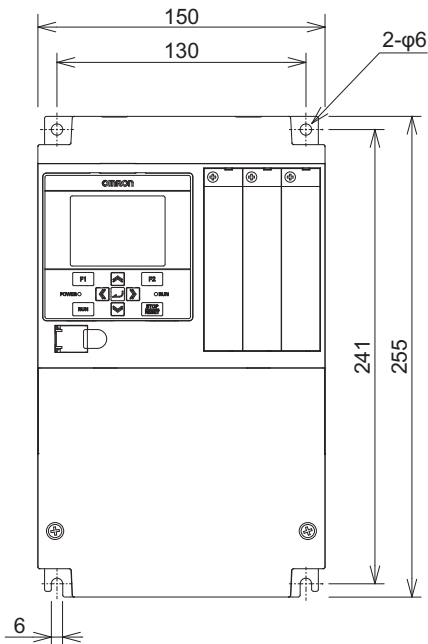
1-3-3 400V Class Specifications

| 3G3RX2-□□□□□ | | A4007 | A4015 | A4022 | A4037 | A4055 | A4075 | A4110 | A4150 | A4185 | A4220 | A4300 | A4370 | A4450 | A4550 | B4750 | B4900 | B411K | B413K | | |
|---|--|-----------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|-------|---------------------|----------------|-------|-------|-------|
| Applicable motor (4-pole) capacity (kW) | VLD | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90 | 110 | 132 | 160 | | |
| | LD | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90 | 110 | 132 | 160 | | |
| | ND | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90 | 110 | 132 | | |
| Output | Rated output current (A) | VLD | 4.1 | 5.4 | 8.3 | 12.6 | 17.5 | 25.0 | 31.0 | 40.0 | 47.0 | 62.0 | 77.0 | 93.0 | 116 | 147 | 176 | 213 | 252 | 316 | |
| | | LD | 3.1 | 4.8 | 6.7 | 11.1 | 16.0 | 22.0 | 29.0 | 37.0 | 43.0 | 57.0 | 70.0 | 85.0 | 105 | 135 | 160 | 195 | 230 | 290 | |
| | | ND | 2.5 | 4.0 | 5.5 | 9.2 | 14.8 | 19.0 | 25.0 | 32.0 | 39.0 | 48.0 | 61.0 | 75.0 | 91.0 | 112 | 150 | 180 | 217 | 260 | |
| | Overload current rating | VLD | 110% 60sec / 120% 3sec | | | | | | | | | | | | | | | | | | |
| | | LD | 120% 60sec / 150% 3sec | | | | | | | | | | | | | | | | | | |
| | | ND | 150% 60sec / 200% 3sec | | | | | | | | | | | | | | | | | | |
| | Rated output voltage | | 3-phase (3-wire) 380 to 500V (depending on receiving voltage) | | | | | | | | | | | | | | | | | | |
| | Rated capacity (kVA) | 400V | VLD | 2.8 | 3.7 | 5.8 | 8.7 | 12.1 | 17.3 | 21.5 | 27.7 | 32.6 | 43.0 | 53.3 | 64.4 | 80.4 | 101.8 | 121.9 | 147.6 | 174.6 | 218.9 |
| | | | LD | 2.1 | 3.3 | 4.6 | 7.7 | 11.1 | 15.2 | 20.1 | 25.6 | 29.8 | 39.5 | 48.5 | 58.9 | 72.7 | 93.5 | 110.9 | 135.1 | 159.3 | 200.9 |
| | | | ND | 1.7 | 2.8 | 3.8 | 6.4 | 10.3 | 13.2 | 17.3 | 22.2 | 27.0 | 33.3 | 42.3 | 52.0 | 63.0 | 77.6 | 103.9 | 124.7 | 150.3 | 180.1 |
| 500V | | VLD | 3.6 | 4.7 | 7.2 | 10.9 | 15.2 | 21.7 | 26.8 | 34.6 | 40.7 | 53.7 | 66.7 | 80.5 | 100.5 | 127.3 | 152.4 | 184.5 | 218.2 | 273.7 | |
| | | LD | 2.7 | 4.2 | 5.8 | 9.6 | 13.9 | 19.1 | 25.1 | 32.0 | 37.2 | 49.4 | 60.6 | 73.6 | 90.9 | 116.9 | 138.6 | 168.9 | 199.2 | 251.1 | |
| | | ND | 2.2 | 3.5 | 4.8 | 8.0 | 12.8 | 16.5 | 21.7 | 27.7 | 33.8 | 41.6 | 52.8 | 65.0 | 78.8 | 97.0 | 129.9 | 155.9 | 187.9 | 225.2 | |
| Input | Rated input current (A) *1 | VLD | 4.9 | 6.4 | 9.9 | 15.0 | 20.8 | 29.8 | 36.9 | 47.6 | 56.0 | 73.8 | 91.7 | 110.7 | 138.1 | 175.0 | 209.5 | 253.6 | 300.0 | 376.2 | |
| | | LD | 3.7 | 5.7 | 8.0 | 13.2 | 19.0 | 26.2 | 34.5 | 44.0 | 51.2 | 67.9 | 83.3 | 101.2 | 125.0 | 160.7 | 190.5 | 232.1 | 273.8 | 345.2 | |
| | | ND | 3.0 | 4.8 | 6.5 | 11.0 | 17.6 | 22.6 | 29.8 | 38.1 | 46.4 | 57.1 | 72.6 | 89.3 | 108.3 | 133.3 | 178.6 | 214.3 | 258.3 | 309.5 | |
| | Rated input AC voltage | | Control power supply: Power supply single phase 380 to 500V (allowable variation range 323 to 550V), 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz) Main circuit power supply: 3-phase (3-wire) 380 to 500V (allowable variation range) 323 to 550V, 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz) | | | | | | | | | | | | | | | | | | |
| | Power supply equipment capacity (kVA) *2 | | VLD | 3.7 | 4.9 | 7.5 | 11.4 | 15.9 | 22.7 | 28.1 | 36.3 | 42.6 | 56.3 | 69.9 | 84.4 | 105.2 | 133.4 | 159.7 | 193.2 | 228.6 | 286.7 |
| Carrier frequency range *3 | LD | | 0.5 to 10.0kHz | | | | | | | | | | | | | | | 0.5 to 8.0kHz | | | |
| | LD | | 0.5 to 12.0kHz | | | | | | | | | | | | | | | 0.5 to 8.0kHz | | | |
| | ND | | 0.5 to 16.0kHz | | | | | | | | | | | | | | | 0.5 to 10.0kHz | | | |
| Motor start torque *4 | | 200%/0.3Hz | | | | | | | | | | | | | | | 180%/0.3Hz | | | | |
| Braking | Regenerative braking | | Equipped with braking resistance circuit (with a discharging resistor separately installed) | | | | | | | | | | | | Regenerative braking unit separately installed | | | | | | |
| | Minimum resistance that can be connected (Ω) | | 100 | 100 | 100 | 70 | 70 | 35 | 35 | 24 | 24 | 20 | 15 | 15 | - | - | - | - | - | - | |
| Dimension | Height (mm) | | 255 | 255 | 255 | 255 | 260 | 260 | 260 | 390 | 390 | 390 | 540 | 550 | 550 | 550 | 700 | 700 | 740 | 740 | |
| | Width (mm) | | 150 | 150 | 150 | 150 | 210 | 210 | 210 | 245 | 245 | 245 | 300 | 390 | 390 | 390 | 390 | 390 | 480 | 480 | |
| | Depth (mm) | | 140 | 140 | 140 | 140 | 170 | 170 | 170 | 190 | 190 | 190 | 195 | 250 | 250 | 250 | 270 | 270 | 270 | 270 | |
| Protective construction | | IP20*5 / UL open type | | | | | | | | | | | | | | | IP00 / UL open type | | | | |
| Approximate mass (kg) | | 3 | 3 | 3 | 3 | 6 | 6 | 6 | 8.5 | 8.5 | 8.5 | 22 | 31 | 31 | 31 | 41 | 41 | 53 | 53 | | |

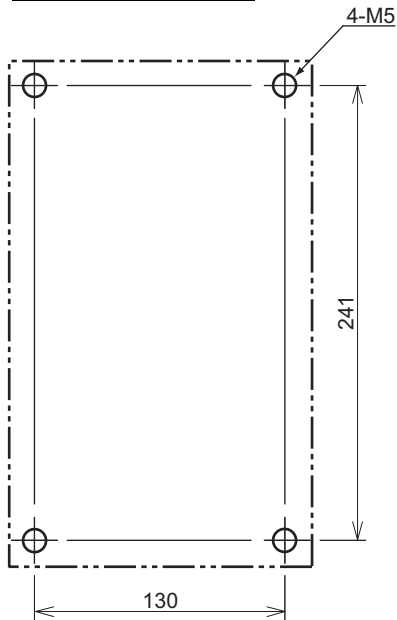
- *1. The rated input currents shown in the table are the values when the rated current is output. The values vary depending on impedance on the power supply (wiring, breaker, input reactor option, etc.)
- *2. The power supply equipment capacities shown in the table are the values when 220V rated current is output. The values vary depending on impedance on the power supply (wiring, breaker, input reactor option, etc.)
- *3. The setting of rated values for carrier frequencies [bb101]/[bb201] are internally limited in accordance with the description. Also, it is recommended to set values equivalent to or above (maximum output frequency for driving ×10) Hz for the setting of carrier frequencies [bb101]/[bb201]. Also, in the case of induction motor (IM) control, for items other than those subject to V/f control, it is recommended to set carrier frequency at 2kHz or more. In the case of synchronous motor (SM)/permanent magnet motor (PMM) control, it is recommended to set carrier frequency at 8kHz or more.
- *4. The value of the sensor-less vector control applied to the ND rating in the Standard motor. Torque characteristics may vary depending on the control method and the motor used.
- *5. Based on self declaration.

1-3-4 External Dimensions

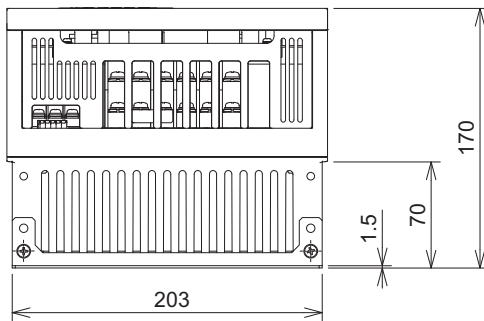
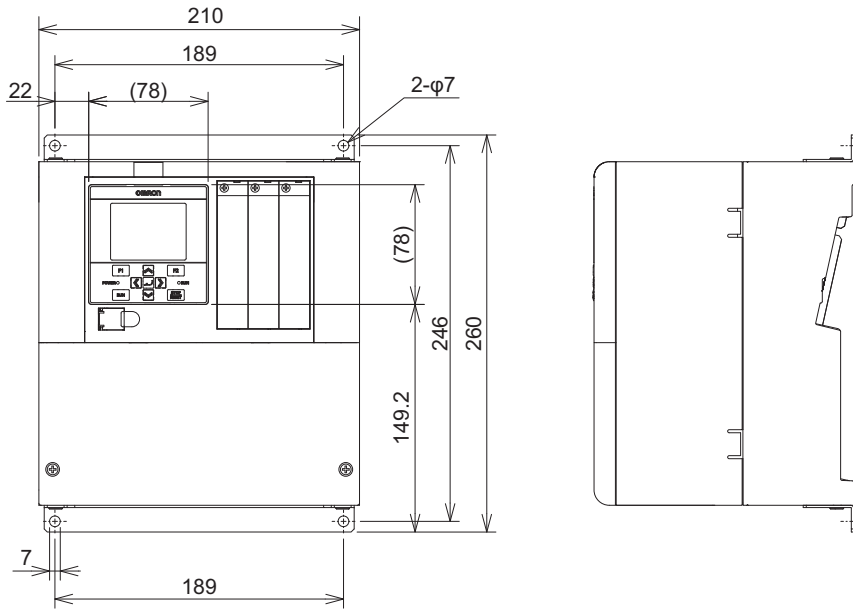
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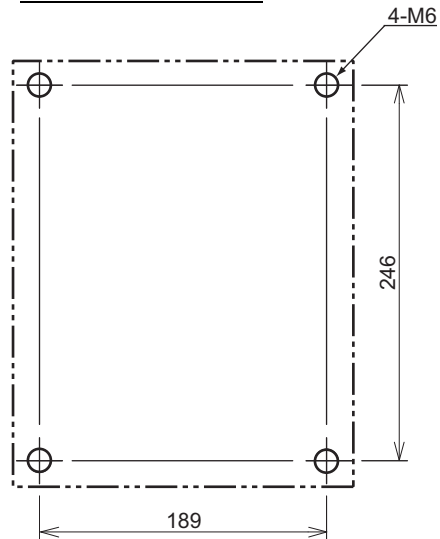
Installation dimensions



● 3G3RX2-A2055/A2075/A2110/A4055/A4075/A4110



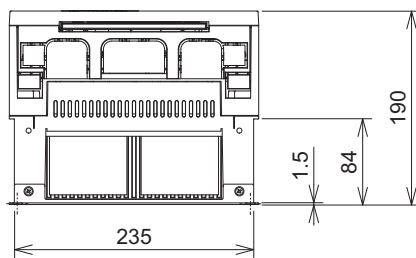
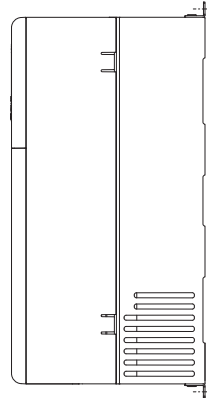
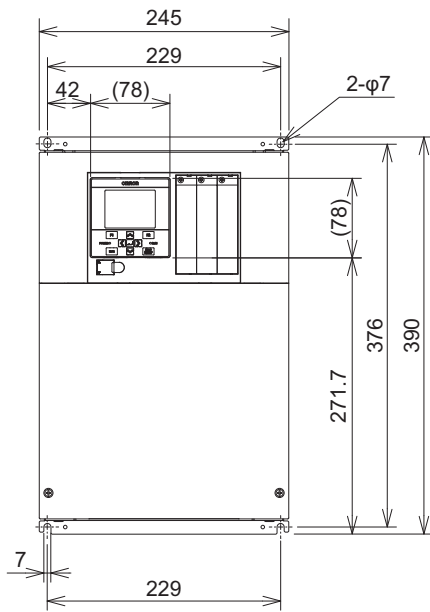
Installation dimensions



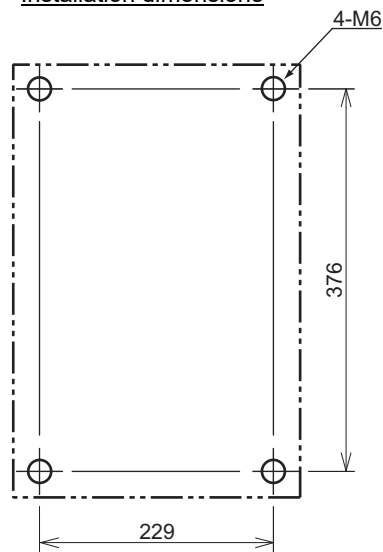
Precautions for Correct Use

In case you operate 3G3RX2-A2110 at **Low Duty (LD)** or **Very Low Duty (VLD)**, the inverter is subject to the restriction of installing method. As for the details, refer to *2-1-2 Precaution for Installation* on page 2-4.

● 3G3RX2-A2150/A2185/A2220/A4150/A4185/A4220



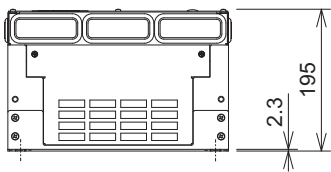
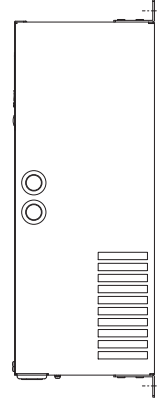
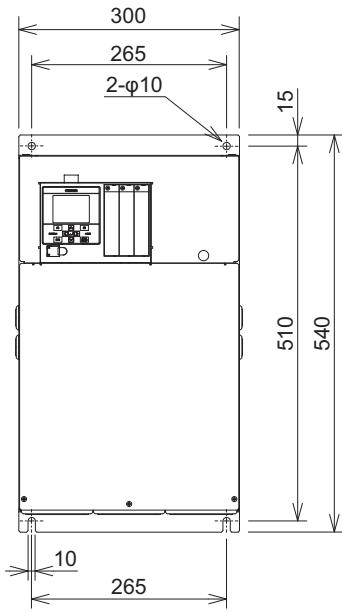
Installation dimensions



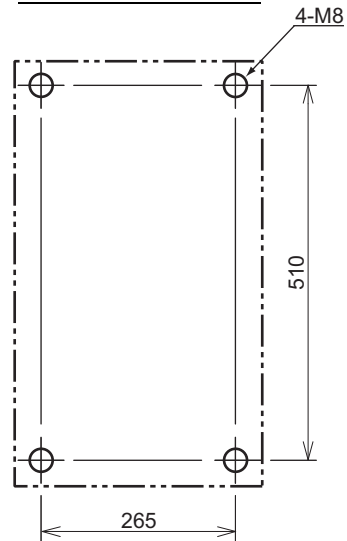
Precautions for Correct Use

In case you operate 3G3RX2-A2220 at **Very Low Duty (VLD)**, the inverter is subject to the restriction of installing method. As for the details, refer to 2-1-2 *Precaution for Installation* on page 2-4.

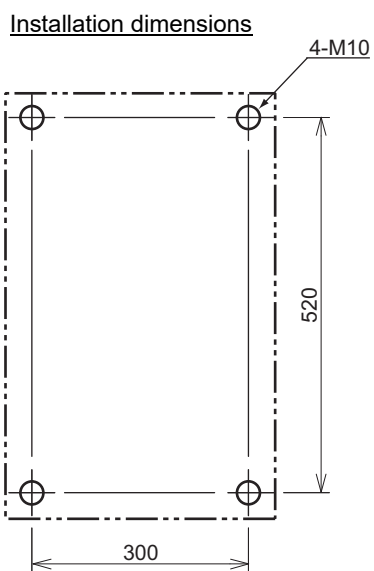
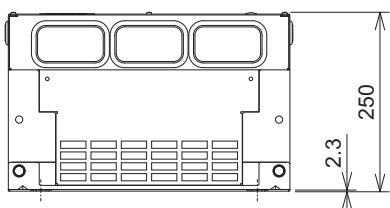
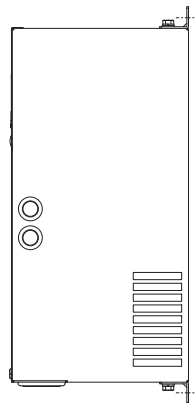
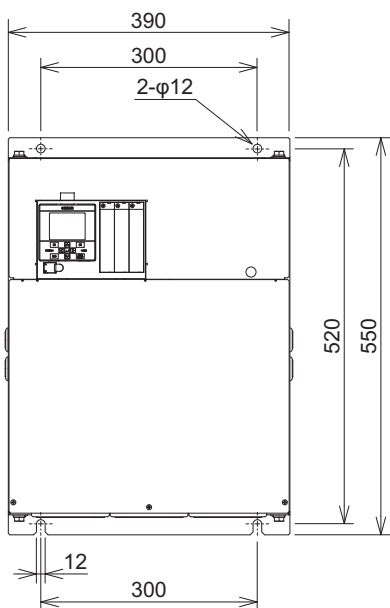
● 3G3RX2-A2300/A4300



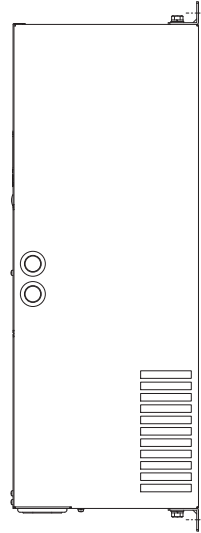
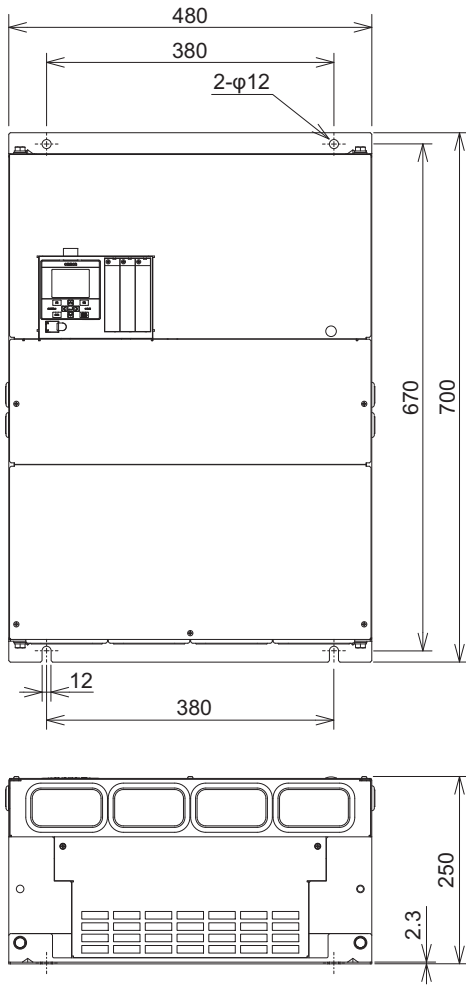
Installation dimensions



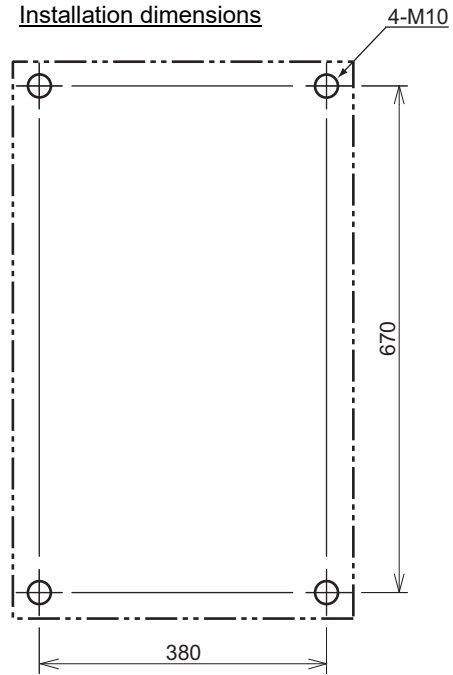
● 3G3RX2-A2370/A2450/A4370/A4450/A4550



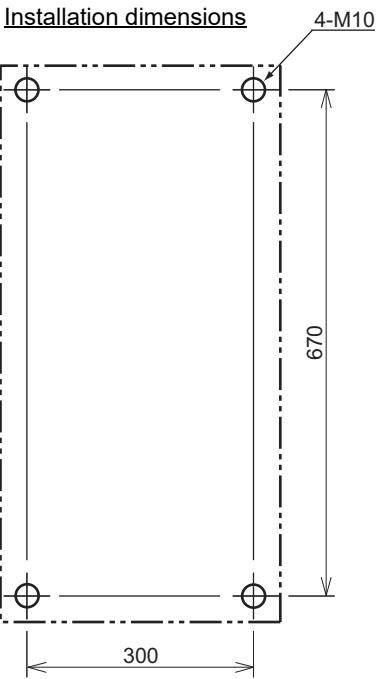
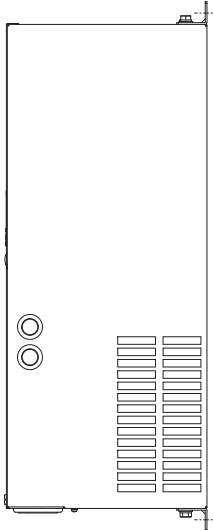
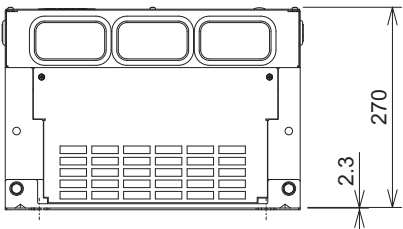
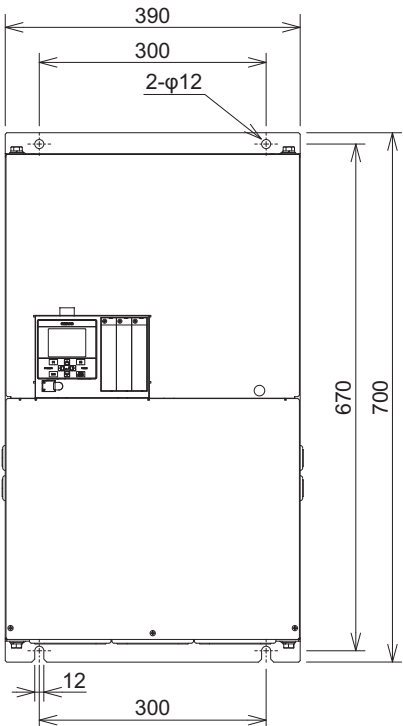
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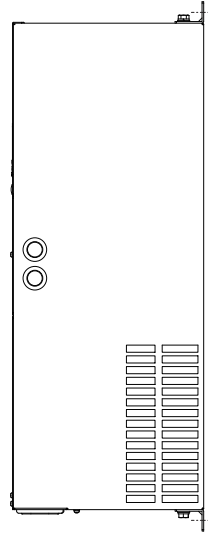
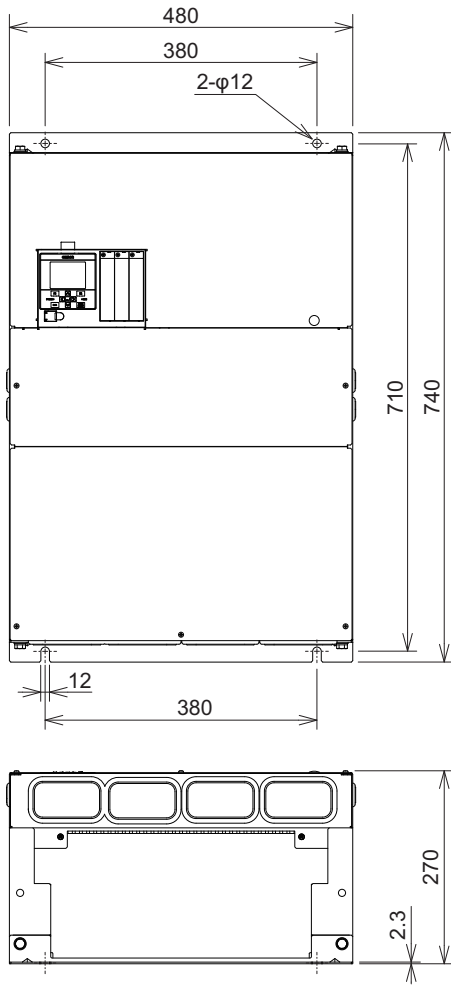
Installation dimensions



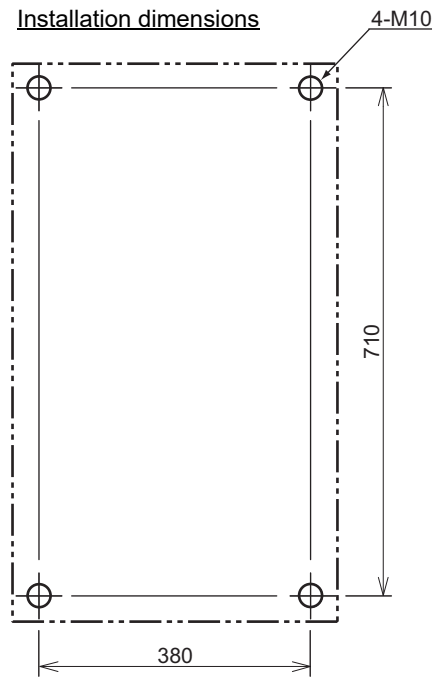
● 3G3RX2-B4750/B4900



● 3G3RX2-B411K/B413K



Installation dimensions



1-4 Restrictions

Limitation on 0-Hz Sensorless Vector Control






When 0-Hz sensorless vector control is used, a large current flows at low frequencies. To protect the inverter against overload, select and use an inverter whose rated capacity is one size larger than the rated capacity of the motor.







2

Design

This section describes the installation and wiring methods.

| | | |
|------------|--|-------------|
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| 2-1-2 | Precaution for Installation | 2-4 |
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| 2-3-13 | Reference Manual for Options | 2-80 |

|  WARNING | |
|---|---|
| Turn off the power supply and implement wiring correctly. Not doing so may result in a serious injury due to an electric shock. |  |
| Wiring work must be carried out only by qualified personnel. Not doing so may result in a serious injury due to an electric shock. |  |
| Do not change wiring and slide switches (SW1 to SW6), put on or take off Operator and optional devices, replace cooling fans while the input power is being supplied. Doing so may result in a serious injury due to an electric shock. |  |
| Be sure to ground the unit. Not doing so may result in a serious injury due to an electric shock or fire. (200-V class: type-D grounding, 400-V class: type-C grounding) |  |

|  Caution | |
|---|---|
| Do not connect resistors to the terminals (PD/+1, P/+, N/-) directly. Doing so might result in a small-scale fire, heat generation, or damage to the unit. |  |
| Install a stop motion device to ensure safety. Not doing so may result in a minor injury. (A holding brake is not a stop motion device designed to ensure safety.) |  |
| Be sure to use a specified type of braking resistor and regenerative braking unit. In case of using a braking resistor, install a thermal relay that monitors the temperature of the resistor. Not doing so may result in a moderate burn due to the heat generated in the braking resistor/regenerative braking unit. Configure a sequence that enables the inverter power to turn off when unusual overheating is detected in the braking resistor and regenerative braking unit. |  |
| The inverter has high voltage parts inside which, if short-circuited, might cause damage to itself or other property. Place covers on the openings or take other precautions to make sure that no metal objects such as cutting bits or lead wire scraps go inside when installing and wiring. |  |
| Setting wrong parameter at startup, adjustment, maintenance and exchange may result in severe damage. Operate the device after sufficient checking. |  |

Safety Information

Installation and Storage

Do not store or use the product in the following places.

- Locations subject to direct sunlight.
- Locations subject to ambient temperature exceeding the specifications.
- Locations subject to relative humidity exceeding the specifications.
- Locations subject to condensation due to severe temperature fluctuations.
- Locations subject to corrosive or flammable gases.
- Locations subject to exposure to combustibles.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

2

Transportation, Installation, and Wiring

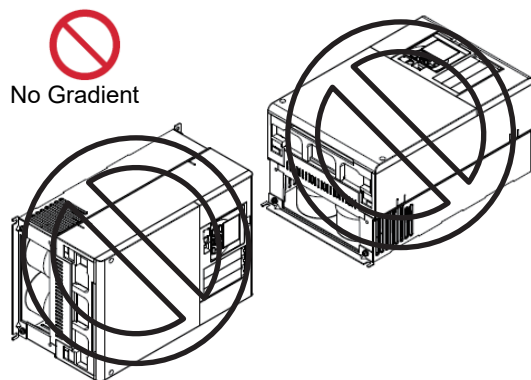
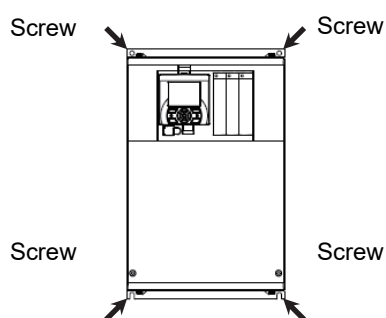
- Do not drop or apply strong impact on the product. Doing so may result in damaged parts or malfunction.
- Do not hold by the front cover and terminal cover, but hold by the fins during transportation.
- Confirm that the rated input power voltage of the inverter is the same as AC power supply voltage.
- Do not connect an AC power supply voltage to the control input/output terminals. Doing so may result in damage to the product.
- Be sure to tighten the screws on the terminal block securely. Wiring work must be done after installing the unit body.
- Do not connect any load other than a three-phase inductive motor to the U, V, and W output terminals.
- Take sufficient shielding measures when using the product in the following locations. Not doing so may result in damage to the product.
 - Locations subject to static electricity or other forms of noise
 - Locations subject to strong magnetic fields
 - Locations close to power lines
- When using the DriveProgramming, confirm that the program data is downloaded normally before starting operation.

2-1 Installation

2-1-1 Inverter Installation

Mount the 3G3RX2 Series Inverter vertically on a wall withstanding the weight and vibration with screws.

Not installing the product vertically on the wall may cause loosing cooling capacity and cause trips and damages.



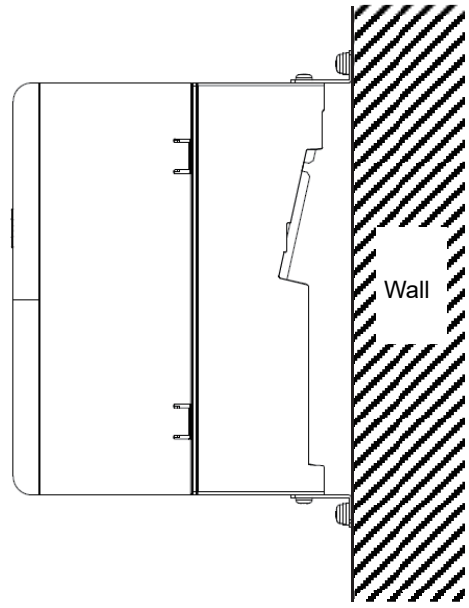
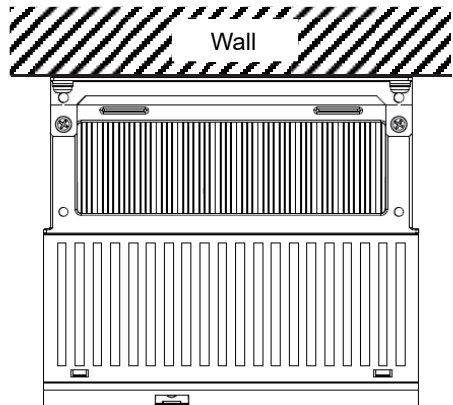
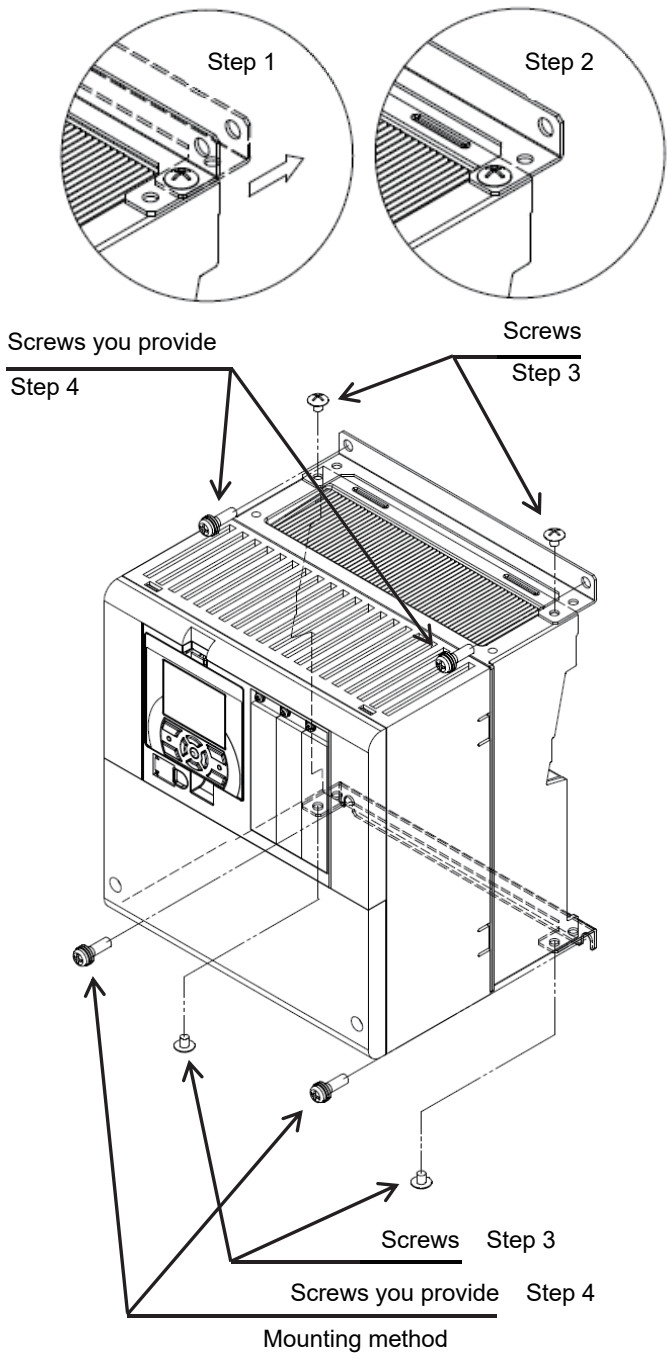
For the mounting dimensions, refer to 1-3-4 *External Dimensions* on page 1-13.

2-1-2 Precaution for Installation

When you use 3G3RX2-A2110 at Low Duty (LD) / Very Low Duty (VLD) or 3G3RX2-A2220 at Very Low Duty (VLD), you must attach the main body on the wall in a special way as shown the instruction below.

Mounting of 3G3RX2-A2110:

- 1** Unscrew the four screws temporarily fixing the mounting fittings (top and bottom) as factory shipping
- 2** Pull and slide the fittings (top and bottom) to match the next hole on the fittings to the screw holes on the main body.
- 3** Fix the fittings on the main body by the four screws you removed at step 1. (Torque: 2.2 to 2.5 N·m)
- 4** Fix the main body on the wall with four other screws you provide.



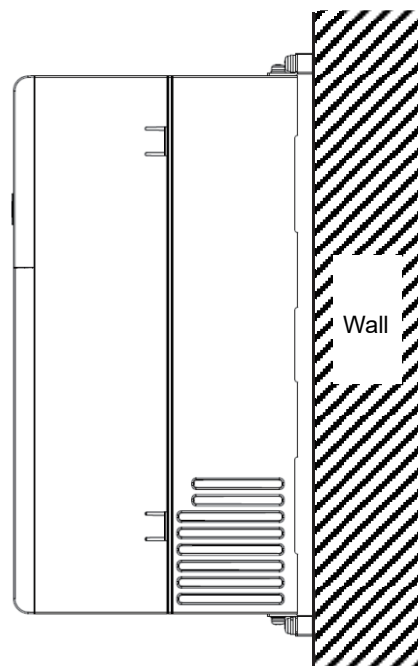
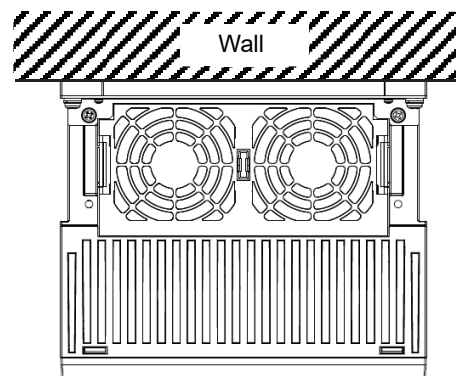
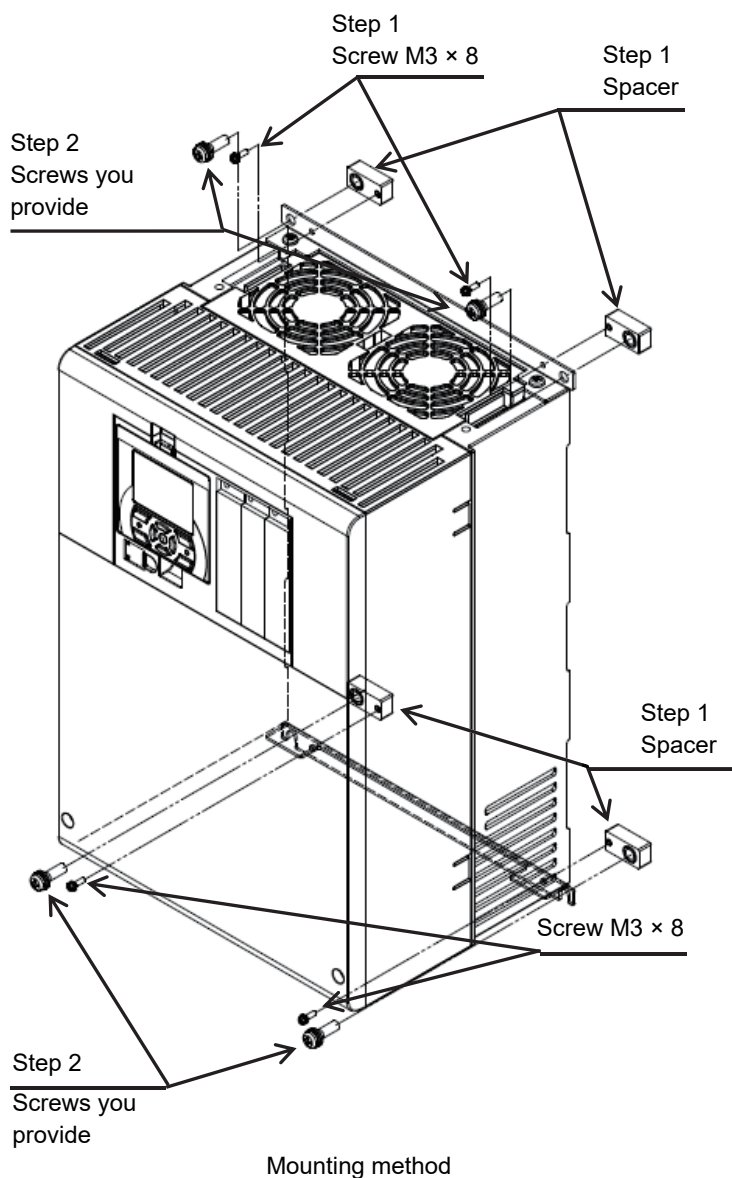
Right side view

⚠ Precautions for Correct Use

Set [Ub-03]=00(VLD) or [Ub-03]=01(LD) for Light Duty or Very Light Duty respectively.

Mounting of 3G3RX2-A2220:

- 1** Fix the four spacers to the main body at the fittings both on the top and bottom using four M3×8 screws included in the pack (Torque: 0.6 to 0.8 N·m).
- 2** Fix the main body on the wall with four other screws you provide.



Precautions for Correct Use

Set [Ub-03]=00 for Very Light Duty (VLD)

2-1-3 Installation Environment

Operating Environment Conditions

Install the inverter in a location that meets the following conditions.

| Rating | Operating ambient temperature ^{*1} | Operating ambient humidity |
|-----------------------|---|-----------------------------------|
| ND (Normal Duty) | - 10 to 50°C | 20% to 90% (with no condensation) |
| LD (Light Duty) | - 10 to 45°C | 20% to 90% (with no condensation) |
| VLD (Very Light Duty) | - 10 to 40°C | 20% to 90% (with no condensation) |

*1. The operation of 1,400V-class inverter is only allowed at input voltage below 500 VAC. In case the voltage exceeds 500 VAC by power supply fluctuation, operate the inverter below 40°C in ambient temperature.

Installation Conditions

Inverters might be heated up to 150°C and might cause fire accident. Install the inverter on the non-flammable vertical wall (made of metals and others).

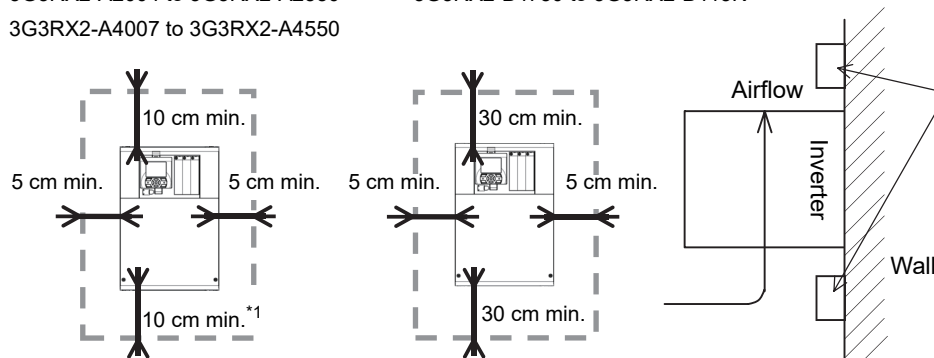
Keep the inverter clear of heating elements such as a braking resistor or reactor so that the heat emitted does not influence the operation.

If the inverter is installed in a control panel, take into consideration dimensions and ventilation to keep the ambient temperature within the range of the specifications.

To allow heat radiation from inside the inverter, provide the clearance specified in the figure below. Do not install more than one inverter side by side without clearance.

3G3RX2-A2004 to 3G3RX2-A2550
3G3RX2-A4007 to 3G3RX2-A4550

3G3RX2-B4750 to 3G3RX2-B413K



*1. Save the space for maintenance in the following sites at 22 cm or more. After that, install the inverter.

- 3G3RX2-A2150 to 3G3RX2-A2220
- 3G3RX2-A4150 to 3G3RX2-A4220

The inverter is needed to be taken off when consumable components are replaced on the following models.

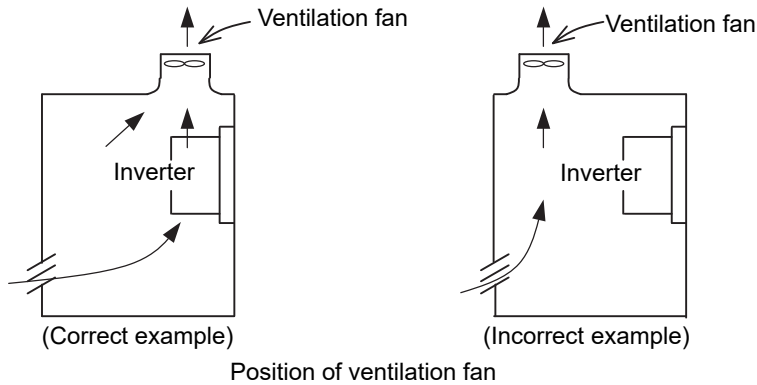
- 3G3RX2-A2055 to 3G3RX2-A2110
- 3G3RX2-A4055 to 3G3RX2-A4110

Ambient Temperature Control

To ensure reliable operation, use the inverter in an environment subject to minimal temperature rise as much as possible.

When mounting multiple inverters in an enclosure with a ventilation fan, carefully design the layout of the ventilation fan, air intake port, and inverters.

An inappropriate layout will reduce the inverter-cooling effect and raise the ambient temperature. Plan the layout so that the inverter ambient temperature will remain within the allowable range. A ventilation fan located directly above the inverter could drop dust on it. To prevent this, move the inverter horizontally to a suitable position.



Entry of Foreign Objects during Installation

Place a cover over the inverter or take other preventative measures to prevent foreign objects, such as drill filings, from entering the inverter during installation.

Be sure to remove the cover after installation is completed. Using the inverter with the cover placed results in poor ventilation, which causes the inverter to overheat.

Loss according to the Inverter Capacity

For the calculation of heat radiation from a cabinet, the following table shows the amount of heat generation (loss) according to the inverter capacity.

| Voltage | Loss at 100% load (W) | | | | | |
|---------|-----------------------|------|------|------|------|------|
| | 200V | | | 400V | | |
| | ND | LD | VLD | ND | LD | VLD |
| 0.4 | 50 | 53 | 65 | | | |
| 0.75 | 65 | 80 | 105 | 62 | 67 | 76 |
| 1.5 | 93 | 118 | 135 | 94 | 98 | 104 |
| 2.2 | 142 | 162 | 197 | 96 | 107 | 134 |
| 3.7 | 225 | 253 | 314 | 145 | 163 | 189 |
| 5.5 | 348 | 365 | 420 | 235 | 260 | 290 |
| 7.5 | 376 | 400 | 520 | 240 | 280 | 306 |
| 11 | 498 | 625 | 754 | 260 | 306 | 380 |
| 15 | 742 | 922 | 1059 | 361 | 444 | 482 |
| 18.5 | 964 | 1167 | 1332 | 495 | 601 | 633 |
| 22 | 1163 | 1263 | 1377 | 687 | 805 | 860 |
| 30 | 1317 | 1536 | 1698 | 783 | 854 | 920 |
| 37 | 1534 | 1801 | 2092 | 812 | 880 | 971 |
| 45 | 1625 | 1940 | 2300 | 1047 | 1218 | 1300 |
| 55 | 1878 | 2669 | 3046 | 1130 | 1488 | 1592 |
| 75 | | | | 1570 | 1811 | 2020 |
| 90 | | | | 2034 | 2150 | 2359 |
| 110 | | | | 2219 | 2397 | 2557 |
| 132 | | | | 3872 | 4352 | 4598 |

Derating of Rated Output Current

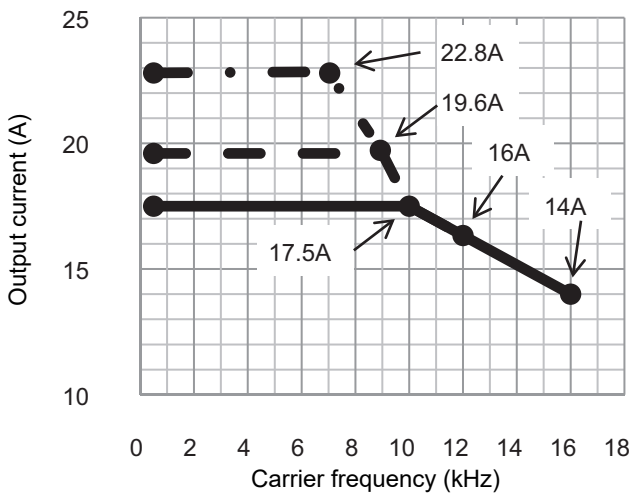
Please use the inverter within the current range in accordance with the derating tables of respective models. If you use the inverter exceeding the derating range, note that the inverter may be damaged or its life may be shortened.

- 50°C: ND rating (normal duty rating)
- - -● 45°C: LD rating (low duty rating)
- . - .● 40°C: VLD rating (very low duty rating)

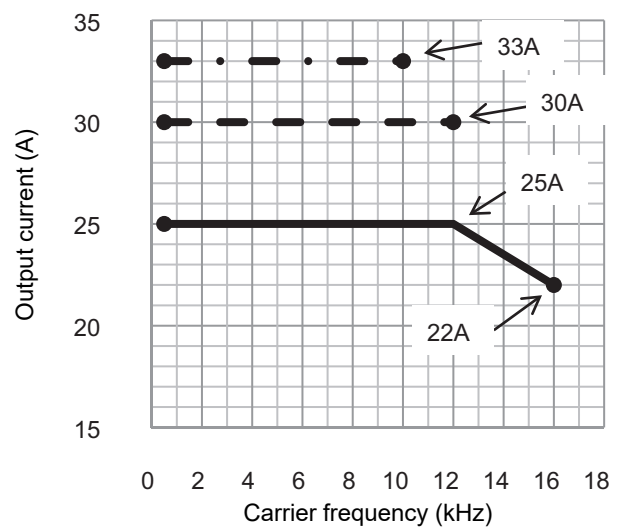
● 200 V class

3G3RX2-A2004/A2007/A2015/A2022 Derating is not required.

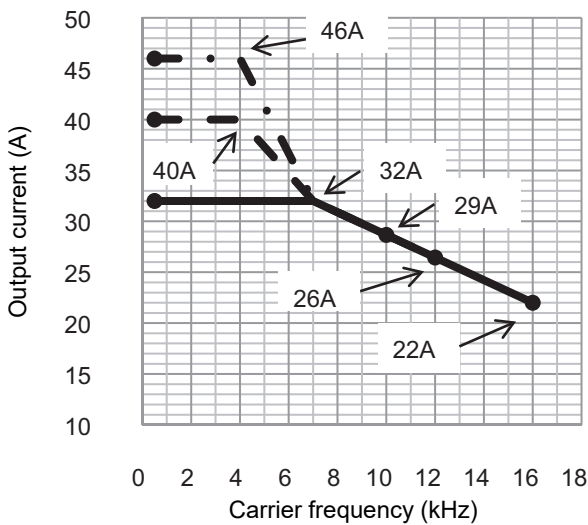
• 3G3RX2-A2037



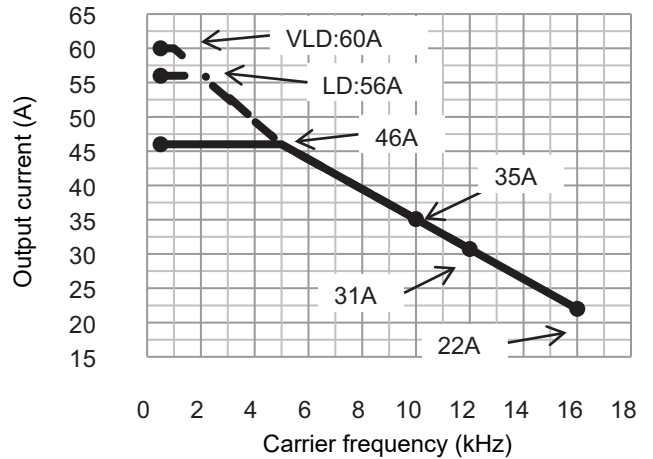
• 3G3RX2-A2055



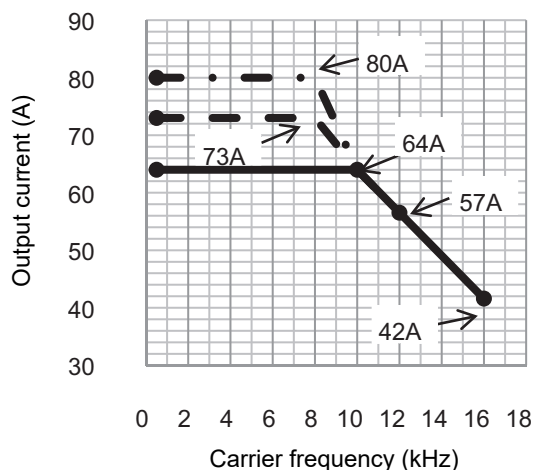
• 3G3RX2-A2075



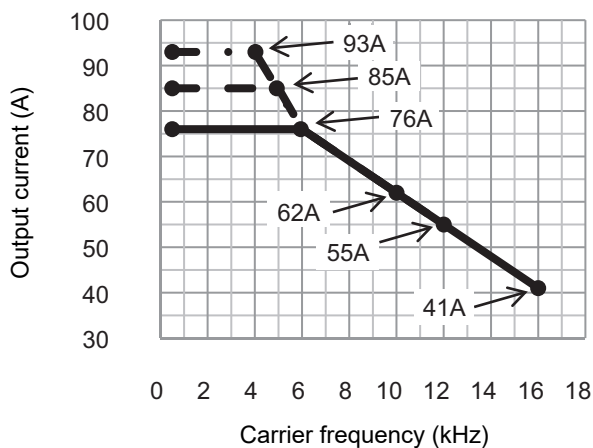
• 3G3RX2-A2110



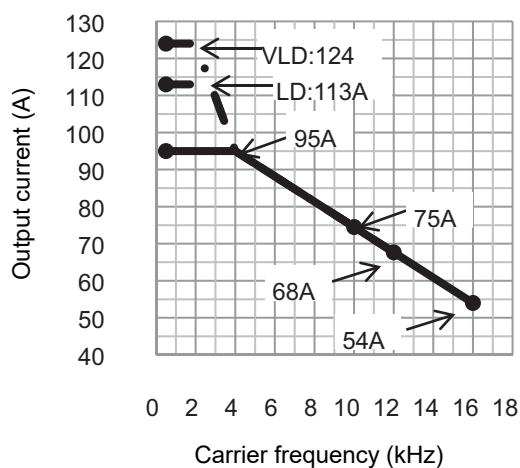
• 3G3RX2-A2150



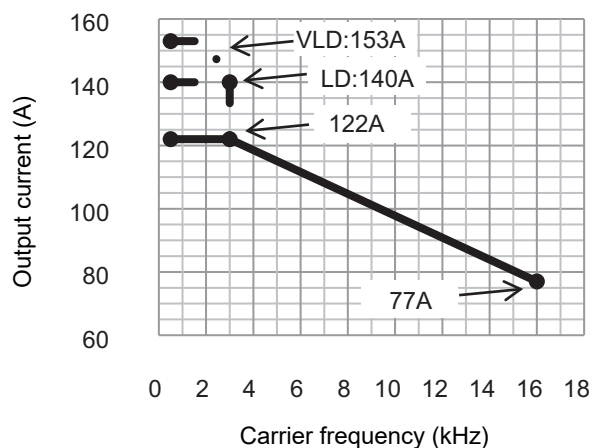
• 3G3RX2-A2185



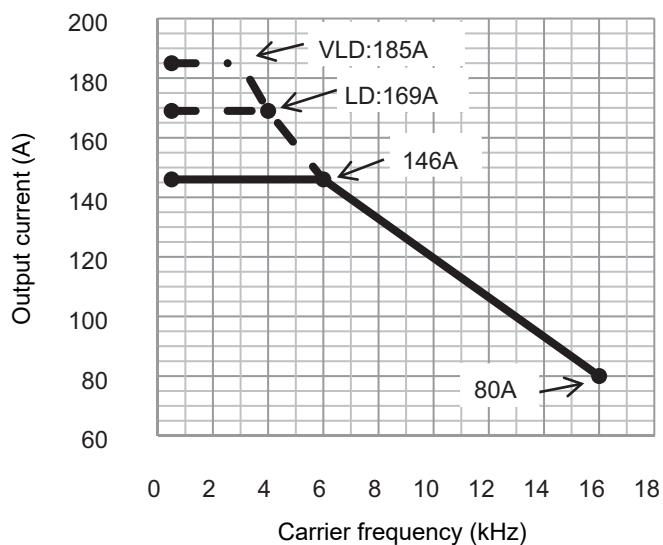
• 3G3RX2-A2220



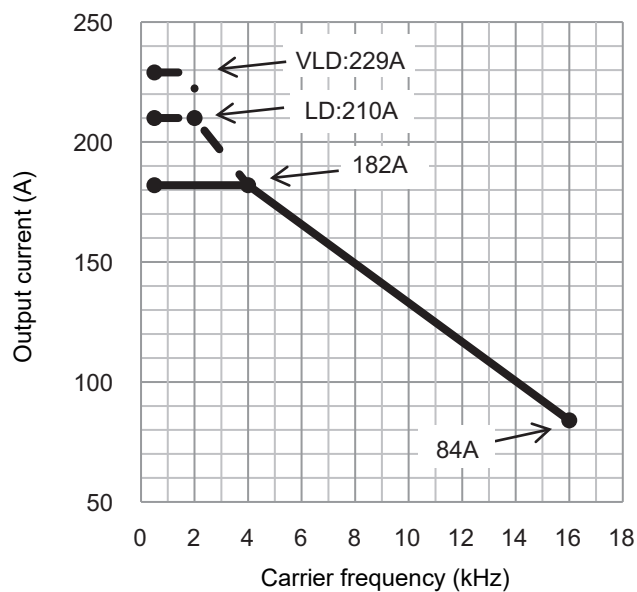
• 3G3RX2-A2300



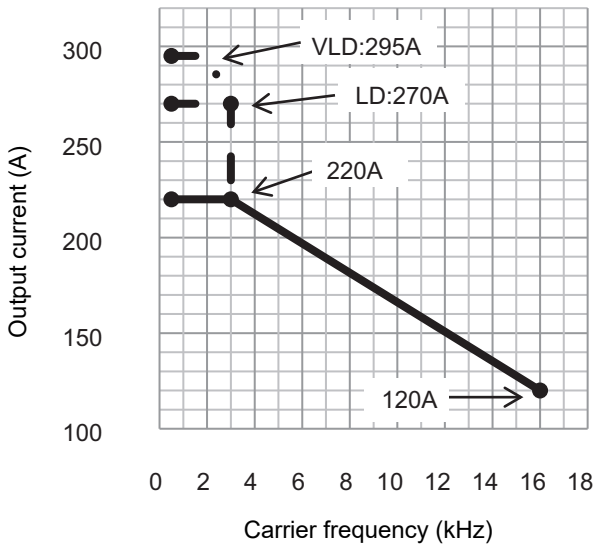
• 3G3RX2-A2370



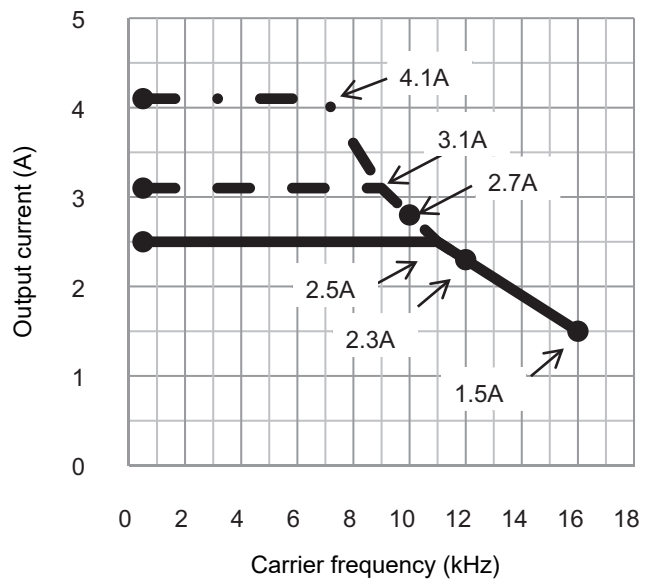
• 3G3RX2-A2450



• 3G3RX2-A2550

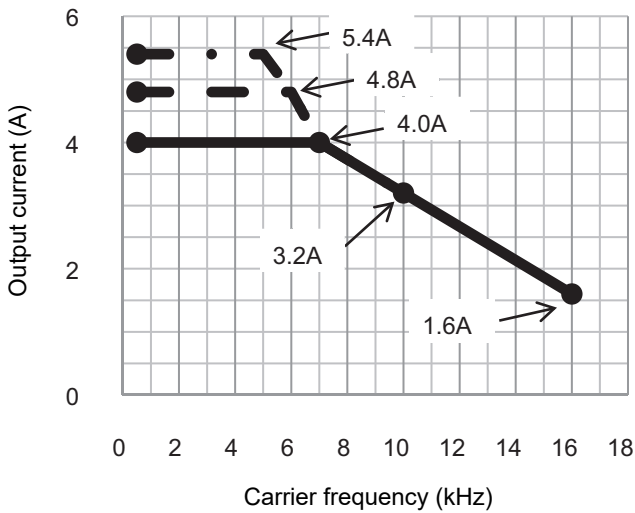


• 3G3RX2-A4007

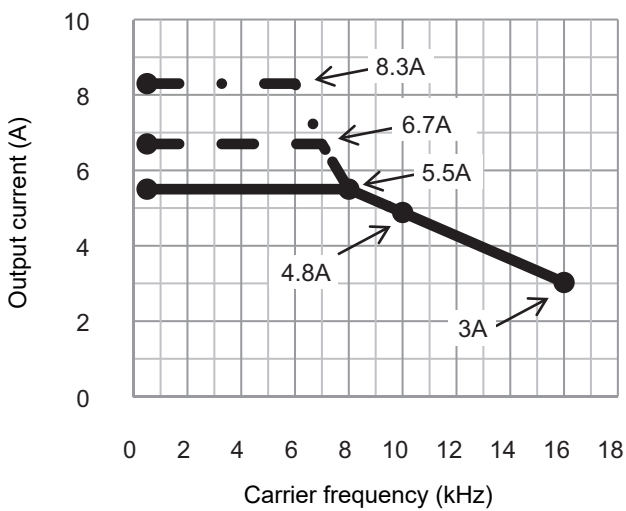


● 400 V class

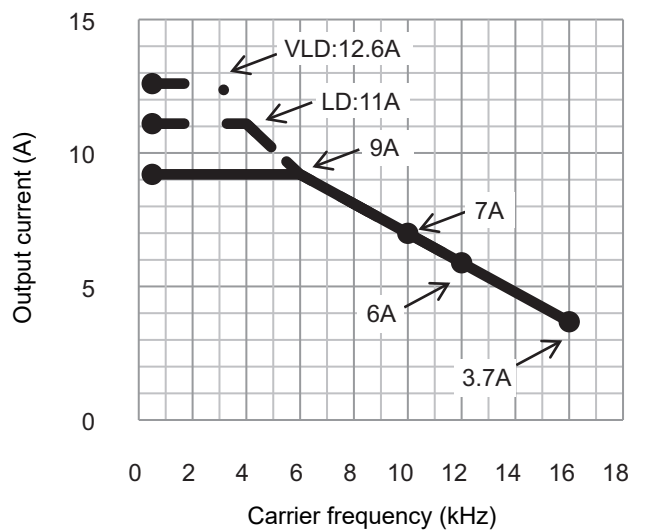
• 3G3RX2-A4015



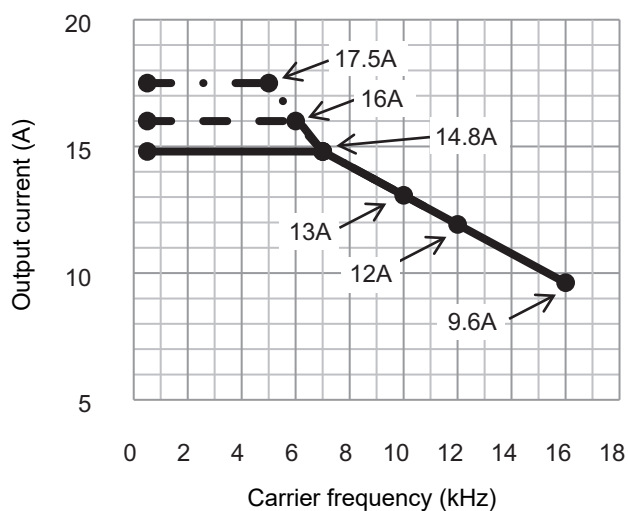
• 3G3RX2-A4022



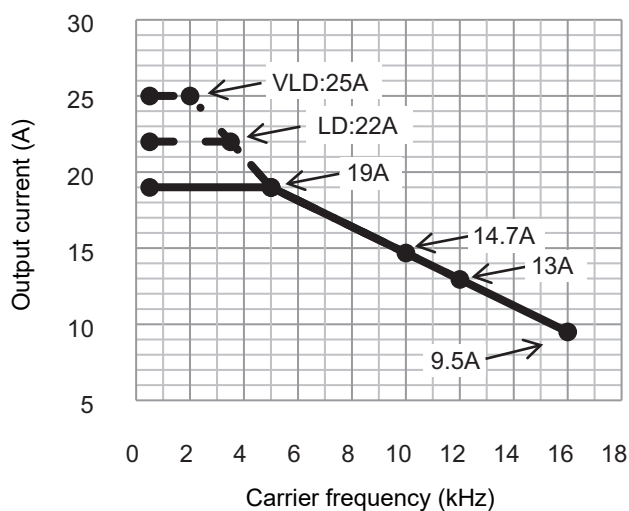
• 3G3RX2-A4037



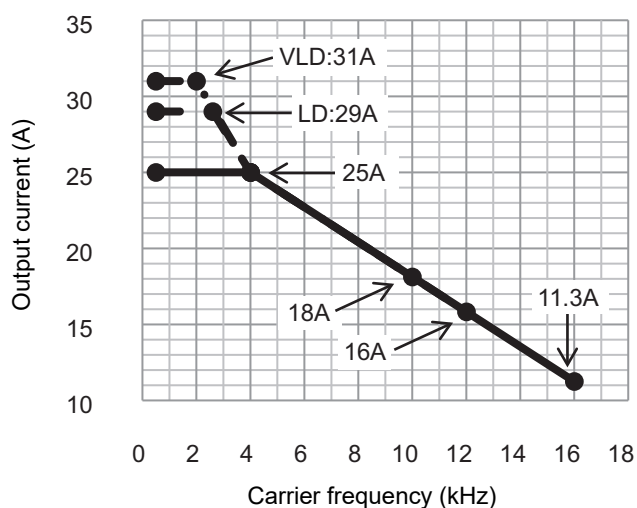
• 3G3RX2-A4055



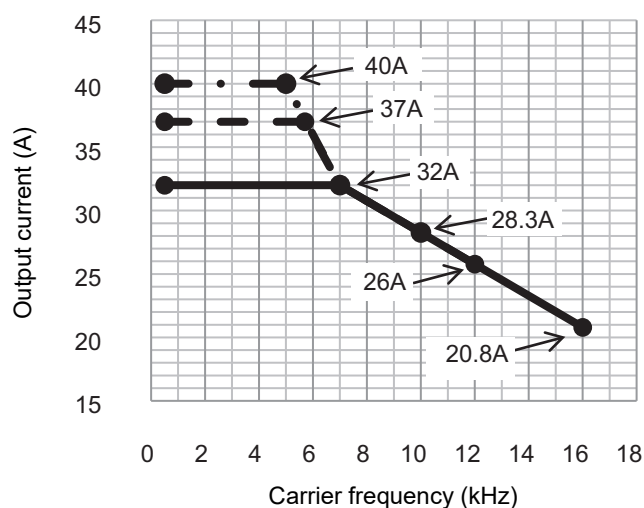
• 3G3RX2-A4075



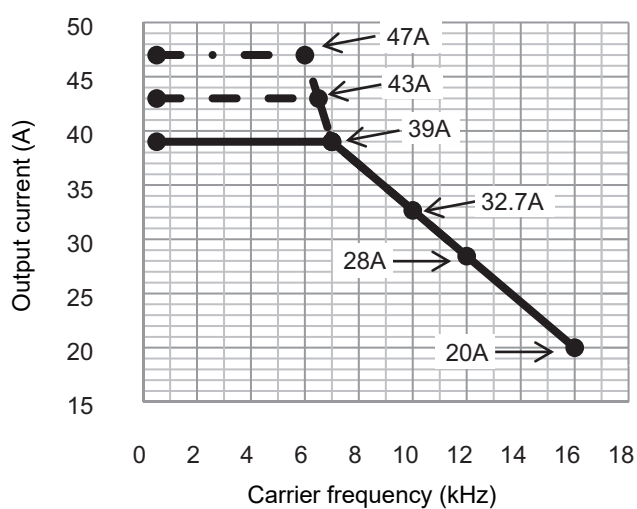
• 3G3RX2-A4110



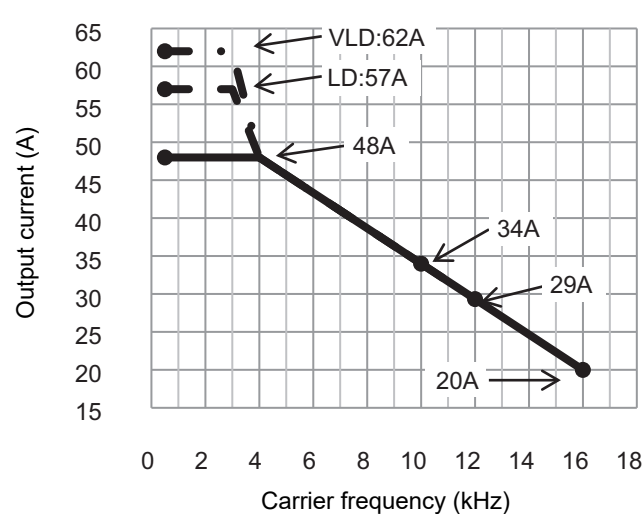
• 3G3RX2-A4150



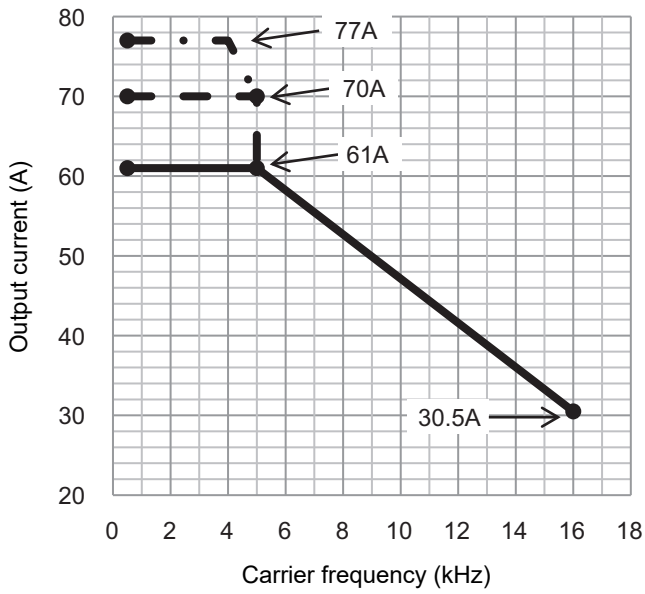
• 3G3RX2-A4185



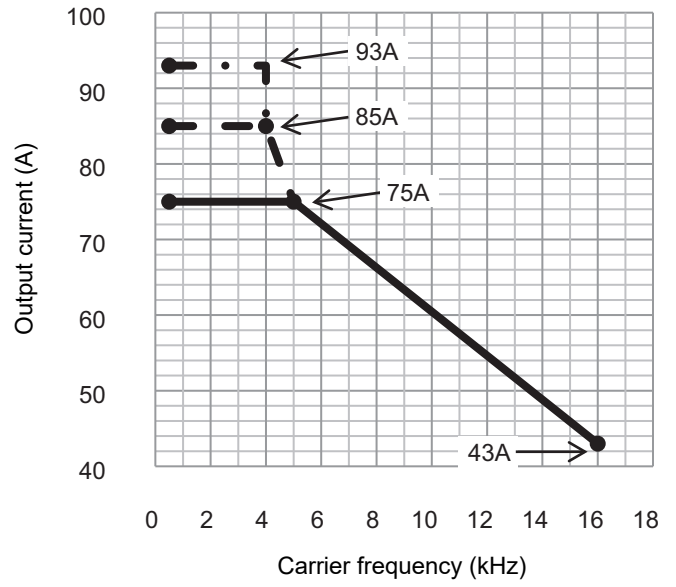
• 3G3RX2-A4220



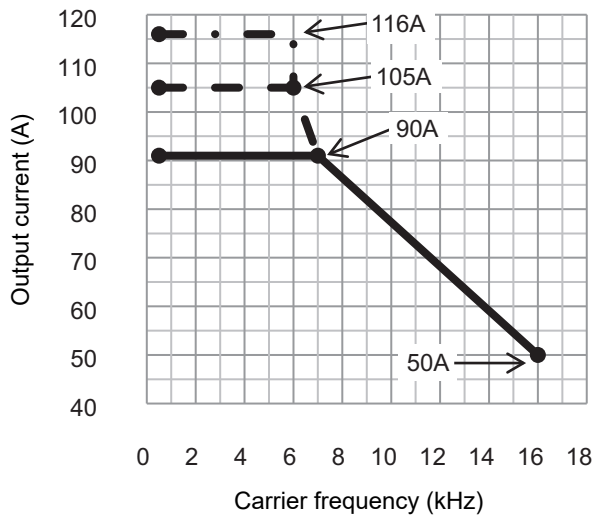
• 3G3RX2-A4300



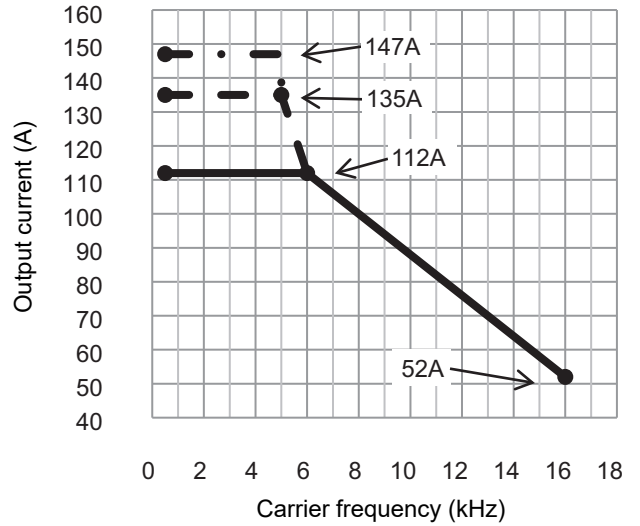
• 3G3RX2-A4370



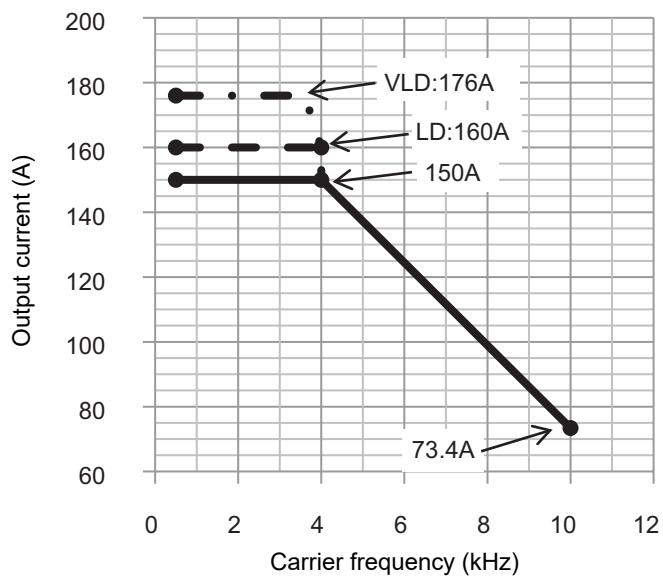
• 3G3RX2-A4450



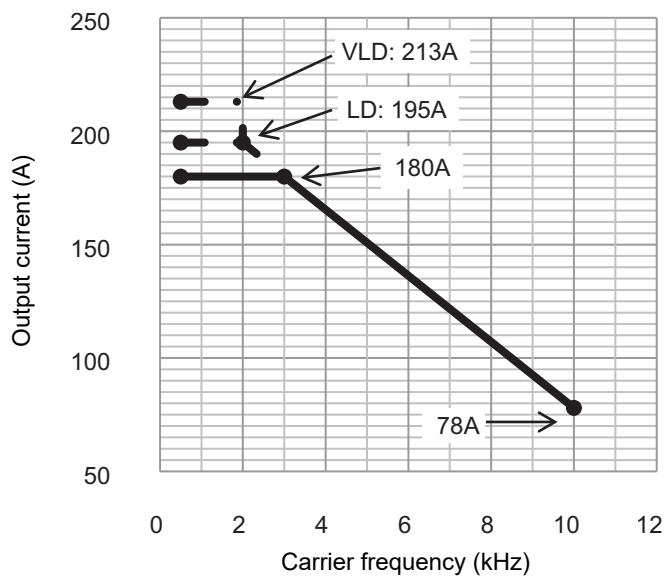
• 3G3RX2-A4550



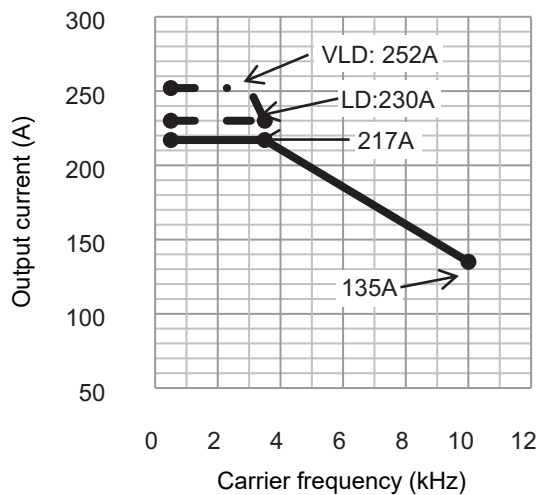
• 3G3RX2-B4750



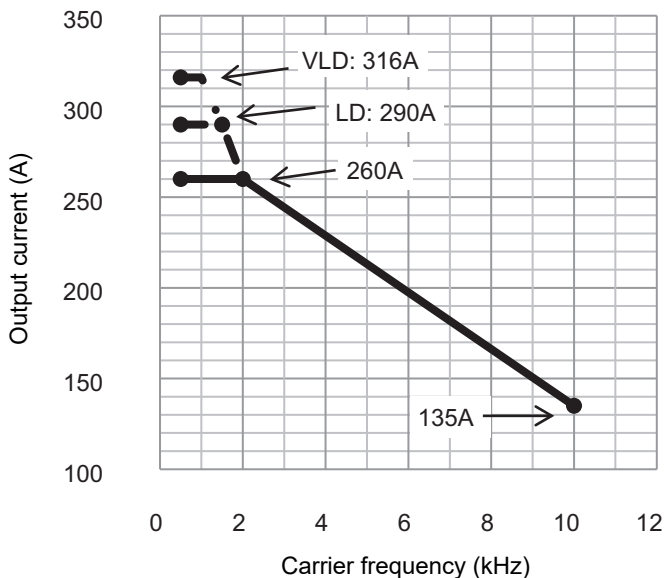
• 3G3RX2-B4900



• 3G3RX2-B411K



• 3G3RX2-B413K



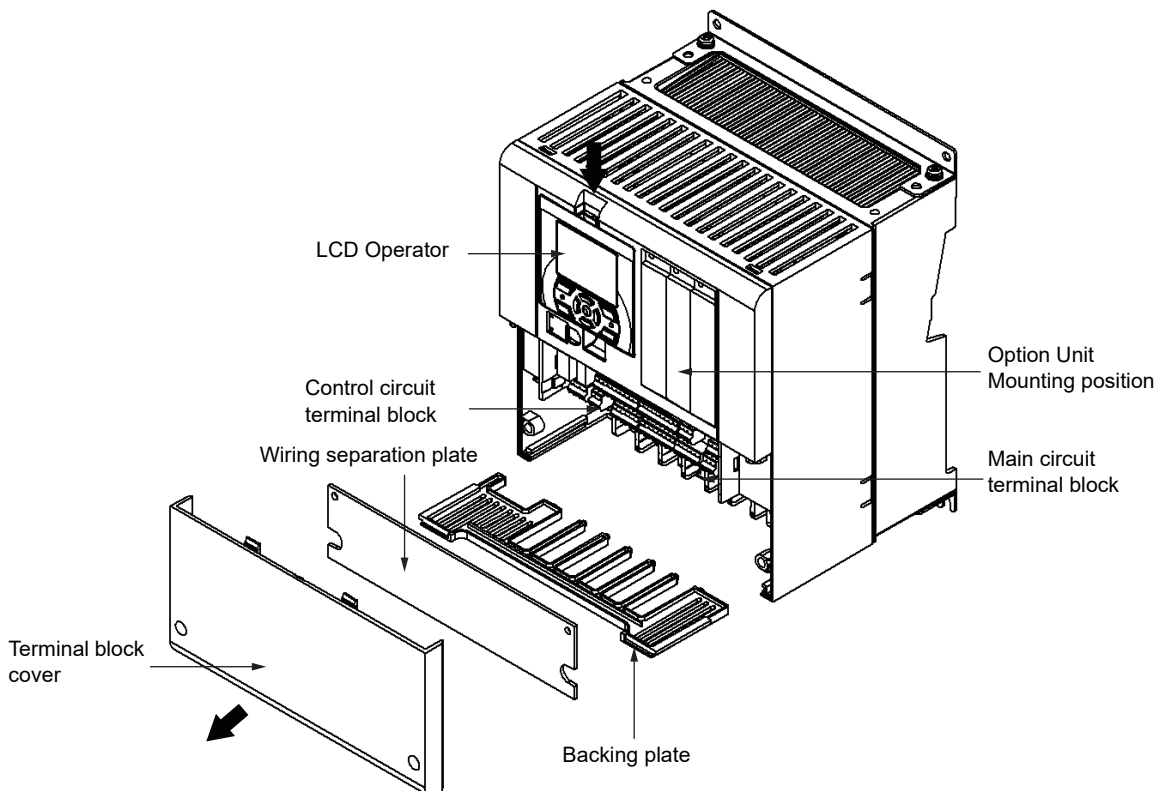
2-2 Removal of Each Part

2-2-1 Removing Cover

Before wiring each terminal block, you need to remove the terminal block cover and the backing plate. In addition, to install a PG Option Unit, you must remove the Option Unit Cover beforehand. This section describes how to remove them. To reinstall it, reverse the removal procedure.

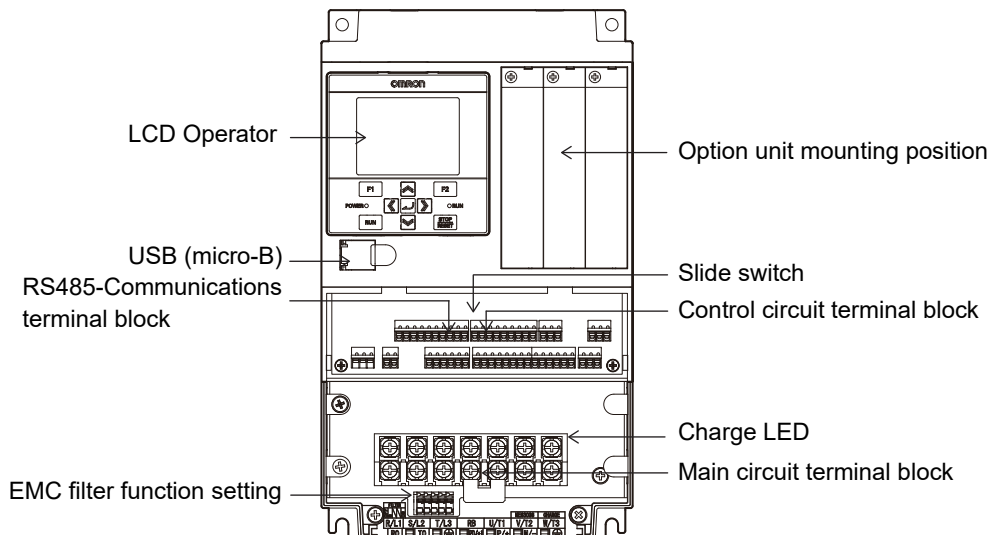
Removing Terminal Block Cover, LCD Operator, Backing Plate and Option Unit Cover

- 1** By removing the cover of the terminal block, you can check the control circuit terminal block. By removing the wiring separation plate and backing plate, you can check the main circuit terminal block.
- 2** By pushing the upper lip part to the direction of arrow, remove the LCD operator.
- 3** Take out the LCD operator into the arrow direction after removal of the cover of the terminal block.
- 4** Unscrew and remove the Option Unit Mounting Position Cover when you desire to connect option units. Because you need the screws when you install option units, do not lose them. The cover you removed is necessary when you remove the option unit to restore the original status.



2-2-2 Terminal Blocks

Before wiring each terminal block, remove the terminal block cover and the backing plate. Wiring to the terminal blocks and setting vary depending on the model. Here is the example of 3G3RX2-A2004. Refer to 2-3-4 *Wiring for Main Circuit Terminals* on page 2-32 for detail.



Positions of the main circuit terminal block, EMC filter function setting, charge indicator, arrangement of terminals and setting methods vary depending on models.

| Name | Description |
|------------------------------------|---|
| LCD Operator | For data display and input operation |
| Control circuit terminal block | The terminal block for connecting various digital/analog I/O devices used for inverter control. |
| Main circuit terminal block | The terminal block for connecting the main power supply for the inverter, outputs to the motor, Braking Resistor, etc. |
| Mounting position of option unit | The position where the option unit is mounted. |
| EMC filter function setting | For switching filter function in order to conform the inverter to EMC Directives in EC Directives. |
| RS485-communication terminal block | The communications terminal for RS485 communication between the inverter and external control equipment. |
| Charge LED | Lights up even after power supply shutoff if the main circuit DC voltage (between the terminal P and N) is approximately 45 V or higher. Make sure the charge indicator is not lit before wiring etc. |
| Slide switch SW1 | Enables or disables the emergency shutoff function. |
| USB (micro-B) | The USB connector of micro-B for connecting PC |

2-2-3 Preparing Backing Plate

In Case of Backing Plate 1 and 2

When AL terminal is wired with high voltage, pull and separate the backing plate from control circuit wiring.

● Backing Plate 1

3G3RX2-A2055 to 3G3RX2-A2110

3G3RX2-A4055 to 3G3RX2-A4110

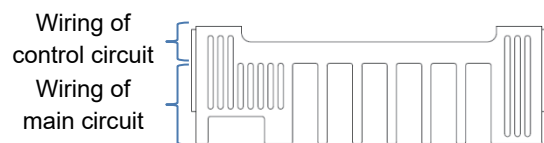
● Backing Plate 2

3G3RX2-A2150 to 3G3RX2-A2220

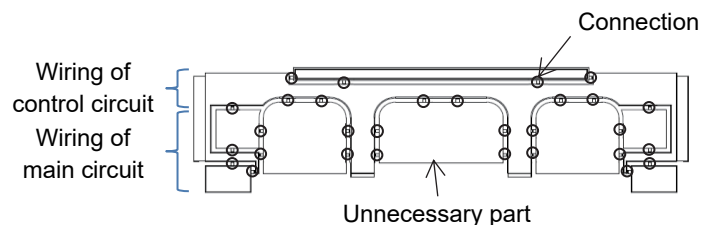
3G3RX2-A4150 to 3G3RX2-A4220

When wiring cables, cut the points between the backing plate and unnecessary portions with nippers or a wire cutter, and remove.

• Backing plate 1



• Backing plate 2



In Case of Backing Plate 3

- **Backing Plate 3**

3G3RX2-A2300 to 3G3RX2-A2550

3G3RX2-A4300 to 3G3RX2-B413K

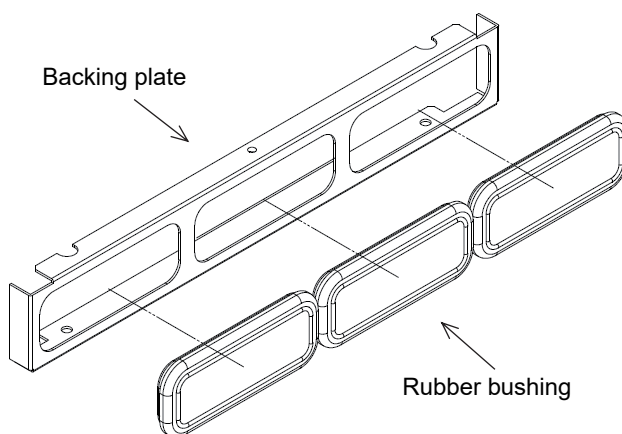
- **When a Conduit Tube Is Not Connected**

Cut the rubber bushing to create a notch using nippers or a cutter for wiring.

- **When a Conduit Tube Is Connected**

Remove the rubber bushing in the portion where a conduit tube is to be connected, and then connect the conduit tube.

Backing plate 3



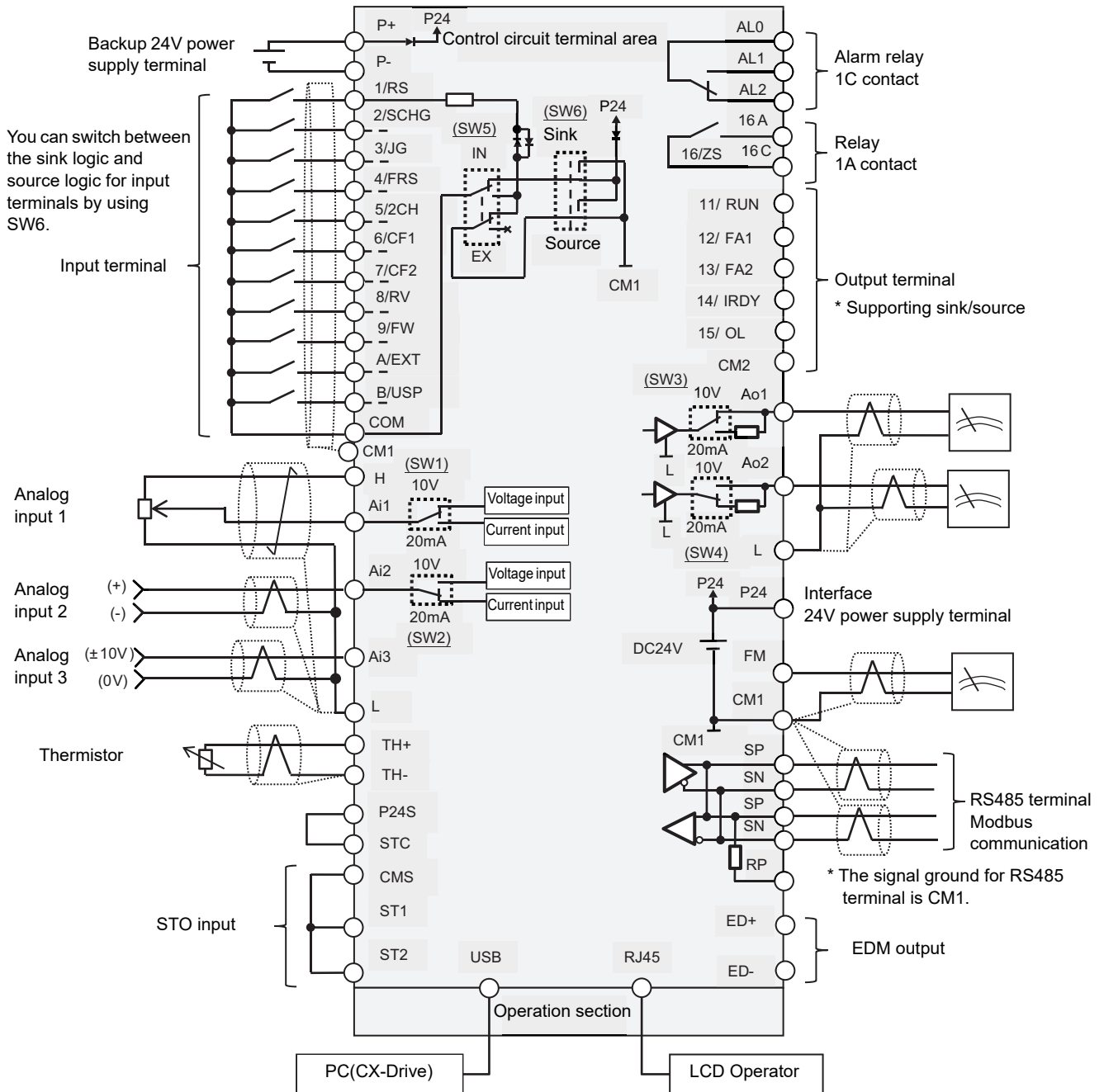
Precautions for Safe Use

Do not remove the rubber bushing unless you connect a cable conduit. Doing so may result in damage to the cable sheath by the inner edge of the backing plate, resulting in a short-circuit or ground fault.

2-3 Wiring

2-3-1 Standard Connection Diagram

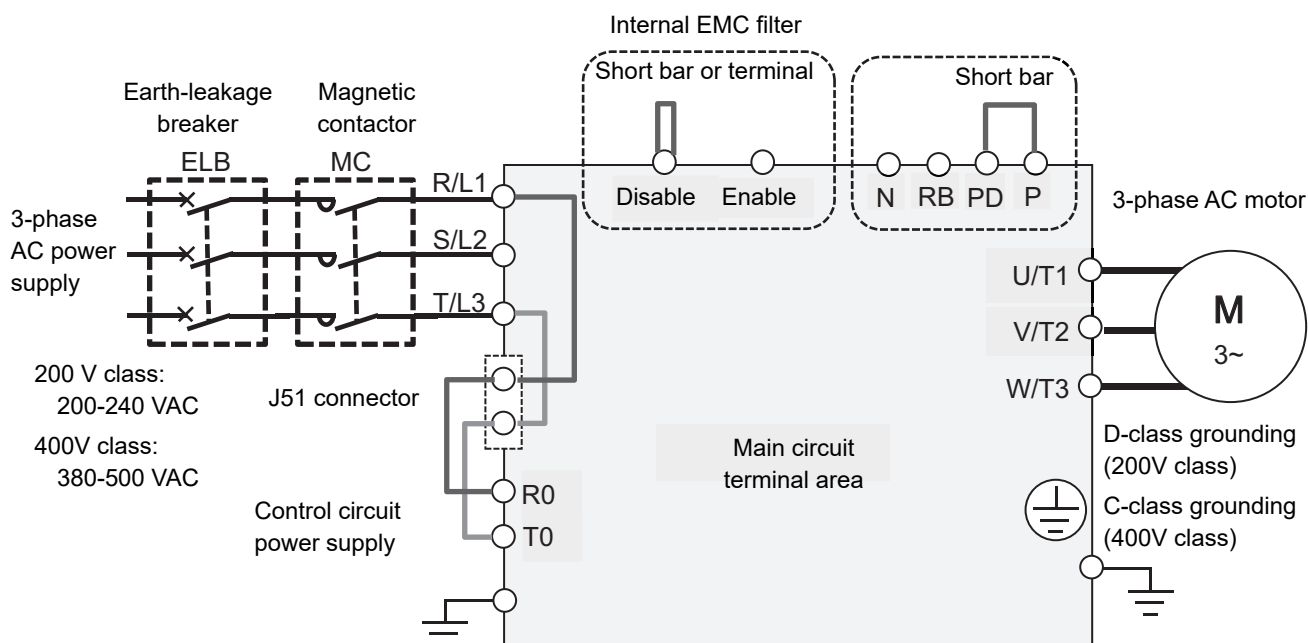
Outline of control circuit



2-3-2 Arrangement and Function of Main Circuit Terminal Block

The table below shows the arrangement of the main circuit terminal block and description of each terminal.

Main Circuit Terminal Block



Precautions for Correct Use

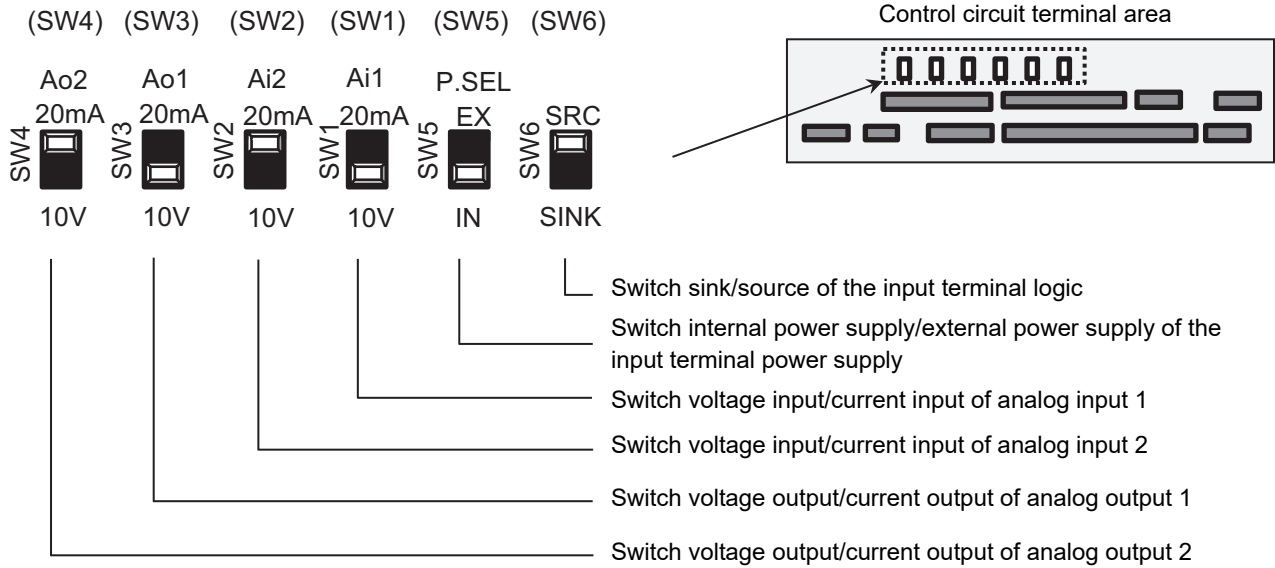
- EMC filter is enabled at factory default setting.
- P-PD is short-circuited when shipped from the factory. If P-PD is not connected, power is not supplied to the main circuit, which disables operation.

| Terminal symbol | Terminal name | Description |
|---------------------|---|--|
| R,S,T (L1,L2,L3) | Input terminal for main power supply | Connect to the AC power supply. |
| U,V,W (T1,T2,T3) | Inverter output terminal | Connect to the 3-phase motor. |
| PD,P (+,+) | DC reactor connection terminal | Remove the short bar between PD and P terminals, and connect the optional reactor DCL for improving power factor. |
| P,RB (+,RB) | Connection terminal for external braking resistor | Connect the optional external braking resistor. For models equipped with the braking resistor circuit, see <i>1-3-3 400V Class Specifications</i> on page 1-12. Models not equipped with the braking resistor circuit do not have the RB terminal. |
| P,N (+,-) | Connection terminal for regenerative braking unit | Connect the optional regenerative braking unit BRD. |
| ⊕ | Inverter earth terminal | The earth terminal for the Inverter case. Please connect this terminal to the ground. Conduct class-D ground work for 200V class, and class-C ground work for 400V class. |

2-3-3 Arrangement and Function of Control Circuit Terminal Block

The diagram and table below describe arrangement and function of control circuit terminal block and switch settings.

Switch Configurations



| Indication | SW name | Description |
|----------------|---|---|
| Ai1 (SW1) | Analog input 1 switch | Switches input specification of analog input 1 (Ai1 terminal). 10 V: Voltage input is available. 20 mA: Current input is available. |
| Ai2 (SW2) | Analog input 2 switch | Switches input specification of analog input 2 (Ai2 terminal). 10 V: Voltage input is available. 20 mA: Current input is available. |
| Ao1 (SW3) | Analog output 1 switch | Switches output specification of analog output 1 (Ao1 terminal). 10 V: Sets to voltage output. 20 mA: Sets to current output. |
| Ao2 (SW4) | Analog output 2 switch | Switches output specification of analog output 2 (Ao2 terminal). 10 V: Sets to voltage output. 20 mA: Sets to current output. |
| P.SEL (SW5) | Switching the method of power supply to the input terminals | Switches the method of power supply to the input terminals. IN: Uses the internal power supply EX: Uses the external power supply (In the case of EX, a power supply is required between the input terminals and COM.) |
| SRC/SINK (SW6) | Switch of sink/source for the input terminals | Switches the sink/source logic for input terminals. This switch is enabled when SW5 is IN. SINK: Enables sink logic. SRC: Enables source logic. |



Precautions for Correct Use

- Using a switch under power-on condition may cause failure. Use the switch only after turning off the power and confirming that the POWER lamp on the operator keypad is off.
- The factory default setting is shown below. If the switch status does not match the actual input and output specifications, it may cause failure. Make sure to check that input and output to be used and switch characteristics are the same.

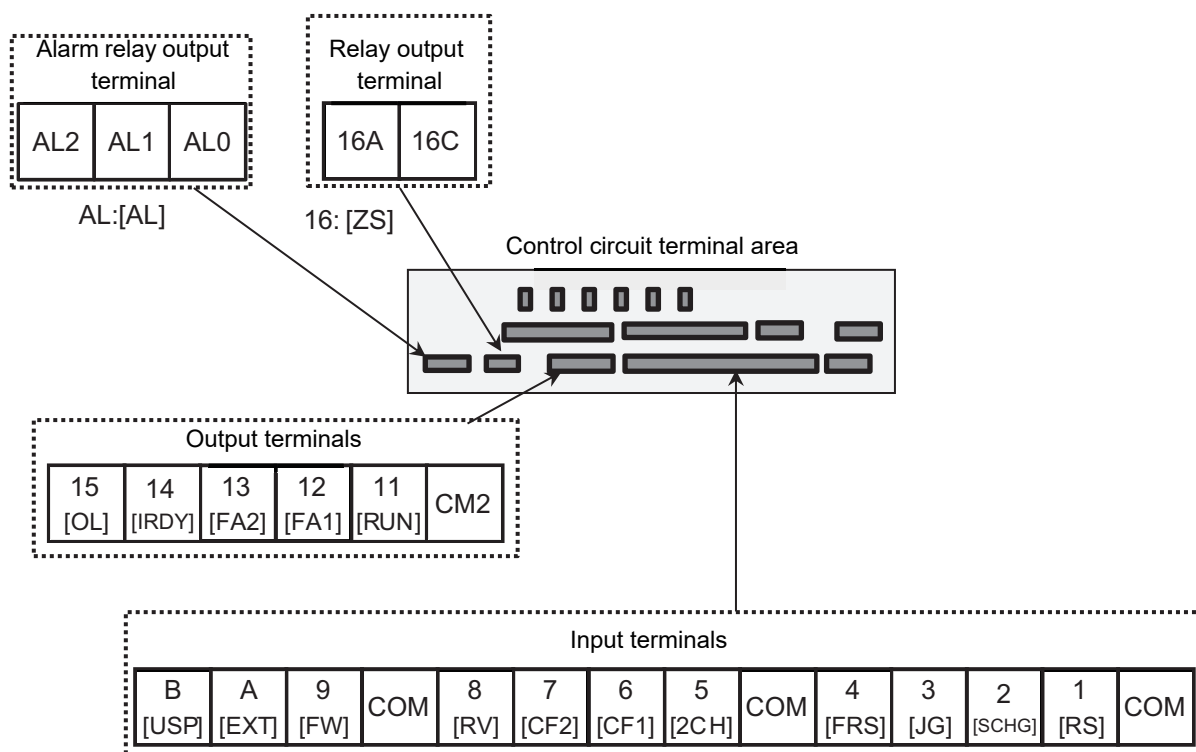
Analog input terminal settings: Ai1 (SW1) = Voltage input (10 V),
Ai2 (SW2) = Current input (20 mA)

Analog output terminal settings: Ao1 (SW3) = Voltage output (10 V),
Ao2 (SW4) = Current output (20 mA)

Switches power supply method of I/O terminal: P.SEL (SW5) = External power supply (EX)

Switches I/O terminal sink/source: SRC/SINK (SW6) = Source (SRC)

Wiring Portion under Control Circuit



[] indicates the factory default setting.

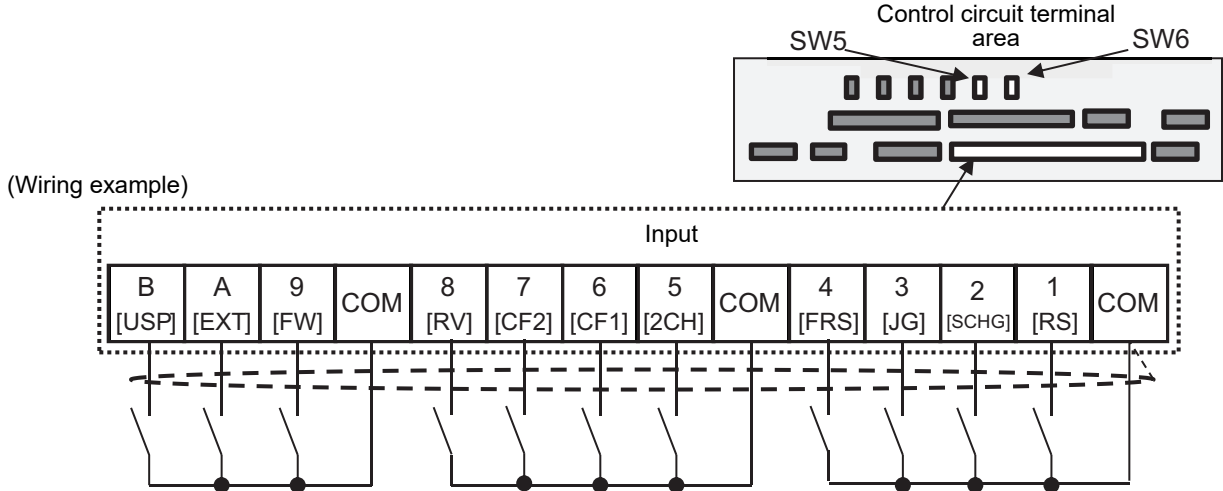


Precautions for Correct Use

- You can switch between the sink/source logic of input terminal by SW6
- When connecting contacts to control circuit terminals, use a relay that does not generate contact failure even at weak current or voltage emitted from cross-bar twin contacts.
- When connecting a relay with output terminals, connect a diode for absorbing surge in parallel with the coil. Otherwise, internal elements may burn.

● **Input Terminals**

- All COM terminals are at the same potential.
- When connecting a power supply between 1-9, A, B and COM, switch SW5 to the external power supply (EX).
- You can switch between the sink/source logic of input terminals by SW6.

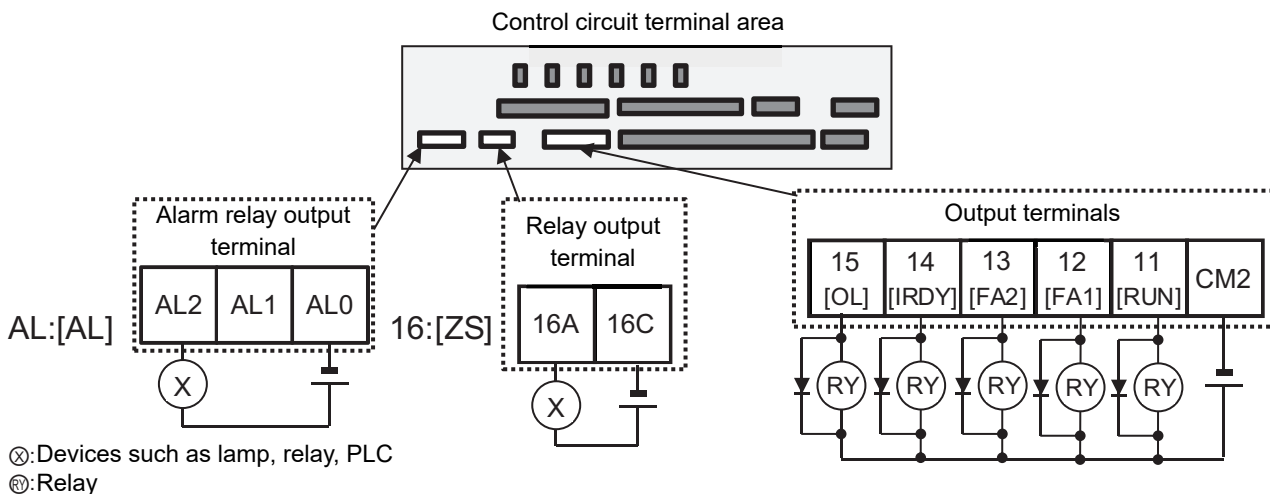


- [] indicates the factory default setting.

| | | Terminal symbol | Terminal name | Description | Electrical characteristics | | |
|----------------|---------------|-----------------|--|--|---|---|---|
| Input terminal | Digital input | Contact/pulse | Contact | 9, 8, 7, 6, 5, 4, 3, 2, 1 | Input terminal | You can select terminal functions using the parameter settings corresponding to each terminal. You can switch between the sink logic and source logic by switching SINK/SRC of SW6. | Voltage between each input/COM <ul style="list-style-type: none"> • ON voltage Min. DC18V • OFF voltage Max. DC3V • Maximum allowable voltage DC27V • Load current 5.6mA (at DC27V) |
| | | | A | Pulse input-A | When [CA-90] is set to 00, A, and B terminals can be used as input terminals. | Voltage between each input/COM <ul style="list-style-type: none"> • ON voltage Min. DC18V • OFF voltage Max. DC3V • Maximum allowable voltage DC27V • Load current 5.6mA (at DC27V) • Maximum 32kpps pulse input | |
| | B | Pulse input-B | You can select terminal functions corresponding to each terminal. When [CA-90] is not set to 00, they are used as terminals for pulse string input. The maximum input pulse is 32kpps. | | | | |
| | Common | COM | Common for input terminal | Common terminals for digital input terminals (1,2,3,4,5,6,7,8,9,A,B). There are three COM terminals. | | | |

● **Output Terminals**

(Wiring example)



⊗: Devices such as lamp, relay, PLC
 ⊕: Relay

[] indicates the factory default setting.



Precautions for Correct Use

Make sure to use diode. Otherwise the internal circuit may be damaged.

| | Terminal symbol | Terminal name | Description | Electrical characteristics |
|-----------------|----------------------|-------------------|--|---|
| Output terminal | 15,14 13,12 11 | Output terminal | You can select terminal functions using the parameter settings corresponding to each terminal. These terminals can be used both in sink logic or source logic. | Open collector output <ul style="list-style-type: none"> Between each terminal and CM2 Voltage drop at ON: 4V or below Maximum allowable voltage: 27V Maximum allowable current: 50mA |
| | | | | |
| | 16A 16C | 1a relay terminal | A relay for contact A output. | Maximum capacity of contact <ul style="list-style-type: none"> AC250V, 2A (resistance)/ AC250V, 1A (induction) Minimum capacity of contact <ul style="list-style-type: none"> DC1V, 1mA |
| | | | | |



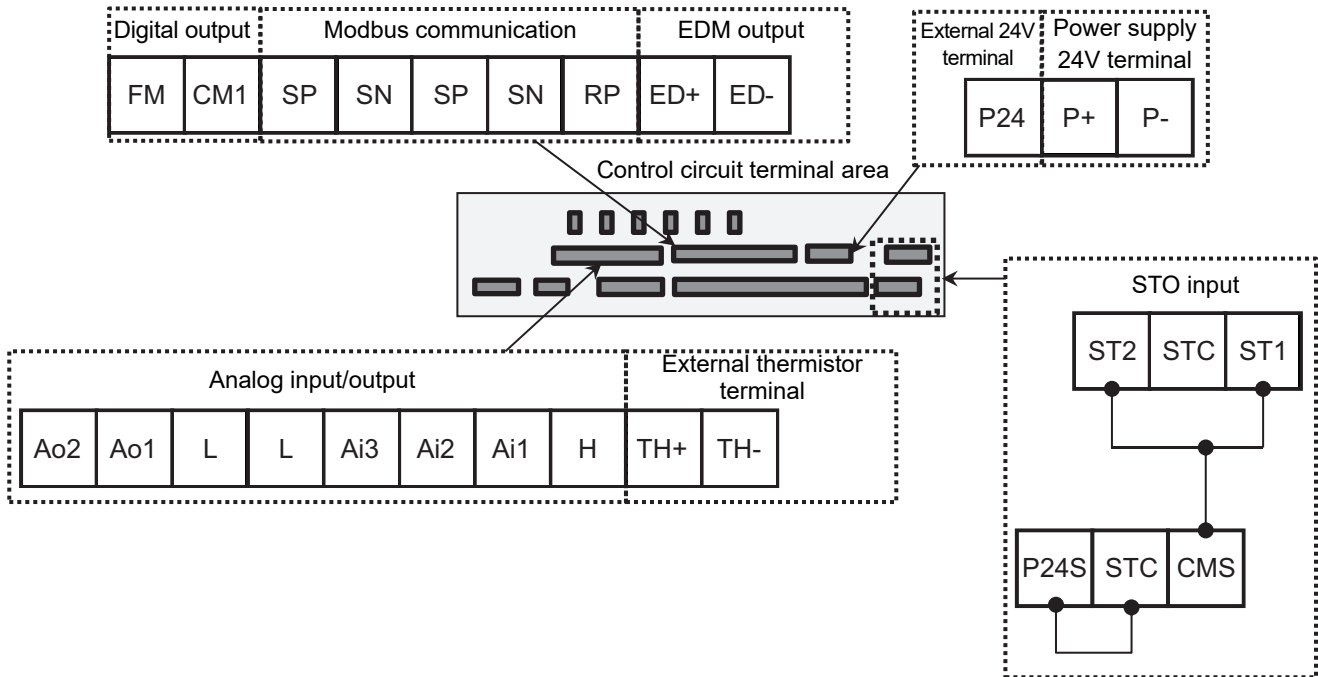
Precautions for Correct Use

- [AL] function is assigned to [CC-07] C contact relay of AL1-AL0/AL2-AL0 as initial state. Set the alarm signal of output terminal 017 [AL] function to any of [CC-01] to [CC-07] and outputs the signal.

The behavior of alarm relay AL1-AL0/AL2-AL0 is shown in the below table.

| [CC-17] | Control power supply | Inverter error output | Output terminal states | |
|---------|----------------------|-----------------------|------------------------|---------|
| | | | AL1-AL0 | AL2-AL0 |
| 00 | ON | Normal | Open | Close |
| | | Alarm output | Close | Open |
| | OFF | - | Open | Close |
| 01 | ON | Normal | Close | Open |
| | | Alarm output | Open | Close |
| | OFF | - | Open | Close |

Wiring Portion Above Control Circuit

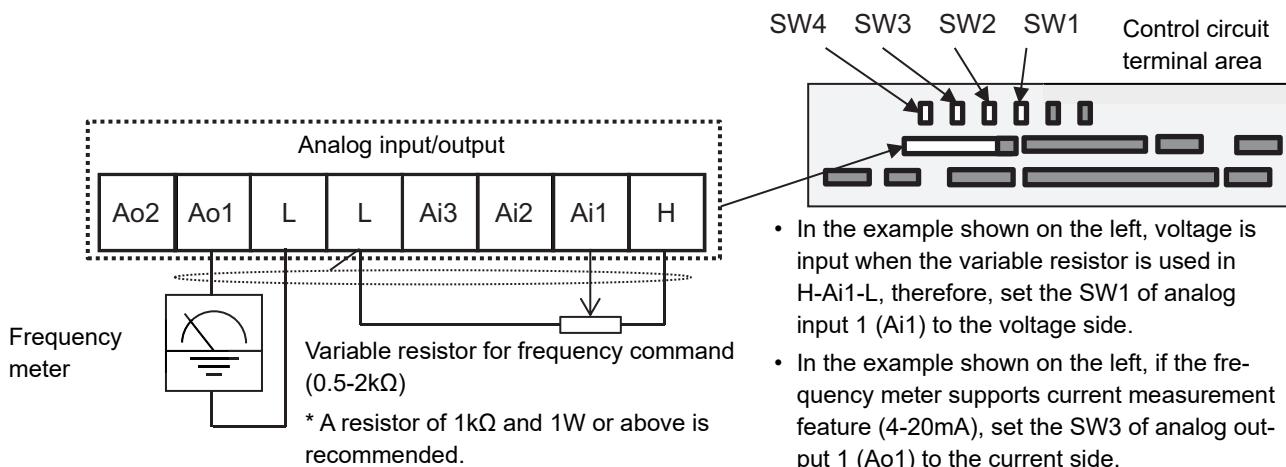


Precautions for Correct Use

- Factory default settings are shown below. You can change the setting for your needs.
 Analog input terminal setting switch: Ai1 (SW1) = Voltage input, Ai2 (SW2) = Current input
 Analog output terminal setting switch: Ao1 (SW3) = Voltage output, Ao2 (SW4) = Current output
- When shipped from the factory, wiring is performed so that STO input is disabled.
- Do not short between the analog power supply H and L terminals, power supply P+ and P- terminals, P24 and P- terminals, P+ and CM1 terminals, and P24 and CM1 terminals. Otherwise, the inverter may fail.

● Analog Input/Output

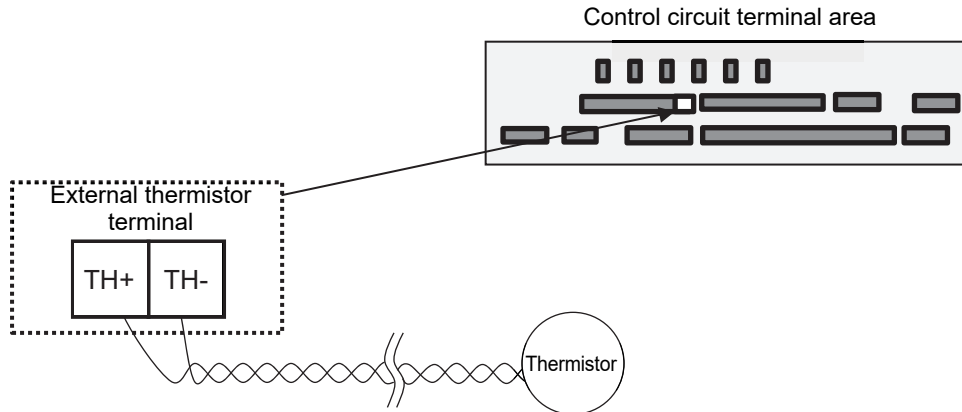
(Wiring example)

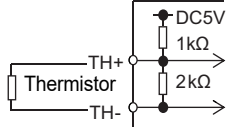


| | Terminal symbol | Terminal name | Description | Electrical characteristics | |
|---|-----------------|--|--|--|---|
| Analog input terminal for switching voltage and current | Power supply | L | Analog power common | Common terminals for analog input terminals (Ai1, Ai2, Ai3) and analog output terminals (Ao1, Ao2). There are two L terminals. | |
| | | H | Power supply for setting speed | This is a 10V VDC power supply. It is used when using analog input terminals (Ai1, Ai2, Ai3) and variable resistor for inputting voltage. | Maximum allowable input current 20mA |
| | Analog input | Ai1 | Analog input terminal 1 (voltage/current switching SW1) | For Ai1 and Ai2, 0-10 VDC voltage input and 0-20 mA current input can be switched using a switch for use. It can be used for input frequency command or feedback. | In the case of voltage input: |
| | | Ai2 | Analog input terminal 2 (voltage/current switching SW2) | | <ul style="list-style-type: none"> • Input impedance about 10kΩ • Allowable input voltage -0.3 to 12V In the case of current input: |
| | | Ai3 | Analog input terminal 3 | | <ul style="list-style-type: none"> • Input impedance about 100Ω • Maximum allowable input current 24 mA Only voltage input: |
| | Analog output | Ao1 | Analog output terminal 1 (voltage/current switching SW3) | For Ao1 and Ao2, 0-10 VDC voltage output and 0-20 mA current output can be switched using a switch as output of information monitor data of the inverter. | In the case of voltage output: |
| Ao2 | | Analog output terminal 2 (voltage/current switching SW4) | <ul style="list-style-type: none"> • Maximum allowable output current 2 mA • Output voltage accuracy ±10% (Ambient temperature: 25±10°C) In the case of current input: | | |
| | | | | <ul style="list-style-type: none"> • Allowable load impedance 250Ω or below • Output current accuracy: ±20% (Ambient temperature: 25±10°C) | |

● External Thermistor

(Wiring example)



| | Terminal symbol | Terminal name | Description | Electrical characteristics |
|---------------------|-----------------|--------------------------------|--|---|
| Thermistor terminal | TH+ | External thermistor input | When an external thermistor is connected, and resistance abnormality occurs due to abnormal temperature, etc., trip the inverter. | 0 to 5 VDC [Input circuit]  |
| | TH- | Common for external thermistor | Connect the thermistor with TH+ and TH-. The level of detecting resistance abnormality can be adjusted from 0 to 10000Ω. [Recommended thermistor characteristics] Recommended product: SHIBAURA ELECTRONICS Co., Ltd. PB-41E Allowable rated power: 100mW or more Impedance at abnormal temperature: 3kΩ | |



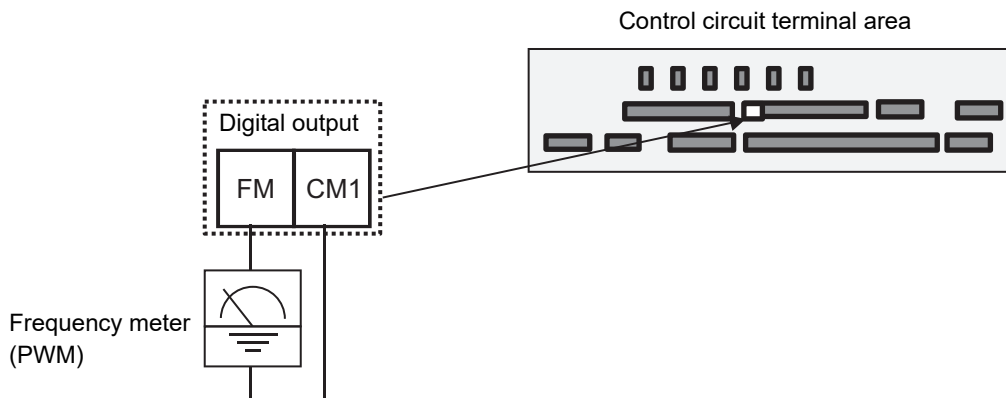
Precautions for Correct Use

To prevent malfunctioning, note the following when performing wiring.

- For connection to the TH terminal, twist only wires connecting to TH+ and TH-, and separate them from other wires.
- Since the current flowing in the thermistor is very weak, separate the wires from main circuit line (power line).
- The length of wiring to the thermistor shall be within 20m.

● FM Output Terminal

(Wiring example)

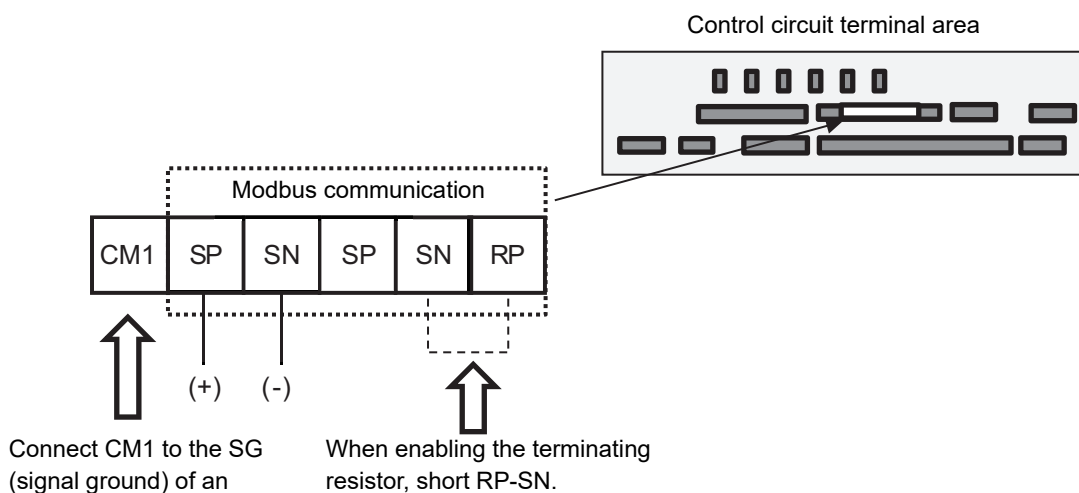


For FM output, you can choose the PWM output method at 6.4 ms fixed interval or pulse output method in which pulse frequency varies. You can control FM output by setting parameters.

| | | Terminal symbol | Terminal name | Description | Electrical characteristics |
|----------------|----------------|-----------------|----------------------------|--|--|
| Digital output | Monitor output | FM | Digital monitor (voltage) | For digital monitor output, you can choose the PWM output method at 6.4ms interval or pulse output method with about 50% duty in which frequency varies. | Pulse string output DC0-10V <ul style="list-style-type: none"> • Maximum allowable current 1.2mA • Maximum frequency 3.60kHz |
| | | CM1 | Common for digital monitor | The common terminal for digital monitor. | |

● **RS485 Communication Terminal Block**

Arrangement and configuration of RS485 Communication Terminal Block are described below:
(Wiring example)



Connect CM1 to the SG (signal ground) of an external device.

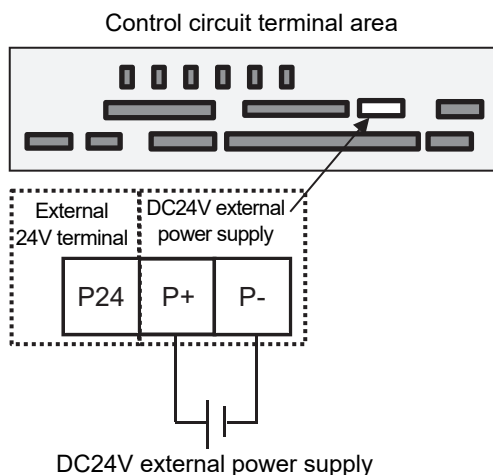
When enabling the terminating resistor, short RP-SN.

SP and SN terminals with the same names are internally connected respectively, so they can be used for wiring multiple terminals.

| | | Terminal symbol | Terminal name | Description | Electrical characteristics |
|---------------------|----------------------|-------------------------|--|---|---|
| RS485 communication | Serial communication | SP SN RP (CM1) | RS-485 terminal for Modbus communication | SP terminal: RS-485 differential (+) signal SN terminal: RS-485 differential (-) signal RP terminal: Connect to SP via the terminating resistor CM1 terminal: Connect with the signal ground of an external communication device. (also used by FM terminal) There are two SP terminals and SN terminals each, which are connected internally. Maximum baud rate is 115.2kbps. | Equipped with terminating resistor (120Ω) Enable: Short RP-SN Disable: Open RP-SN |

● **Power Input/Output**

(Wiring example)

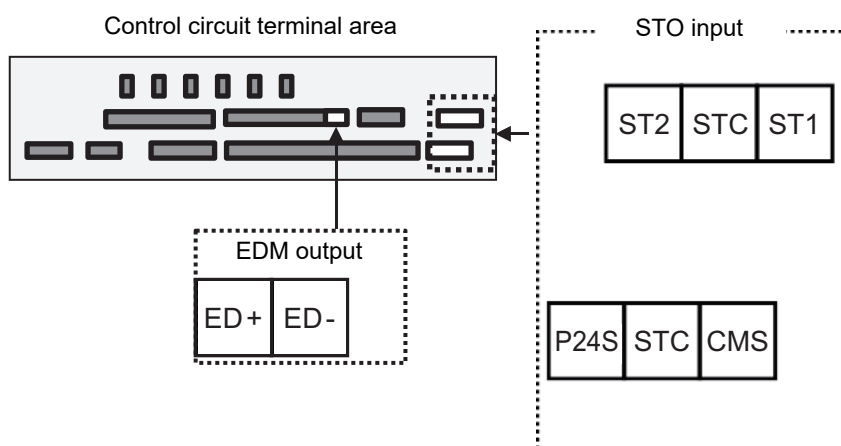


When 24 V power is supplied to P+ and P- from an external source, change of parameters and communication of optional devices are enabled even without main power supply.

| | | Terminal symbol | Terminal name | Description | Electrical characteristics |
|------------------|-------------|-----------------|-----------------------------------|--|---|
| 24V power supply | Power input | P24 | 24V output power terminal | 24 VDC power supply for contact signal The common terminal is P-. | 100mA output at maximum |
| | | P+ | External 24V input terminal (24V) | Input an external 24 VDC power to the inverter. With input of 24 V power, you can change parameter settings or operate optional communication without using a control power supply | Allowable input voltage 24 VDC±10% Maximum power consumption 1A |
| | | P- | Terminal for P24/P+ (0 (zero) V) | | |

● STO Terminal

| Terminal symbol | Terminal name |
|-----------------|----------------------------------|
| P24S | 24V output power terminal |
| CMS | Common terminal for STO terminal |
| STC | Logic switching terminal |
| ST1 | STO input 1 |
| ST2 | STO input 2 |
| ED+ | Monitoring output terminal |
| ED- | Monitoring output common |



As for the terminal function, see section 2-3-9 *Wiring for STO Function* on page 2-73.

2-3-4 Wiring for Main Circuit Terminals

Outline of Applicable Peripheral Devices

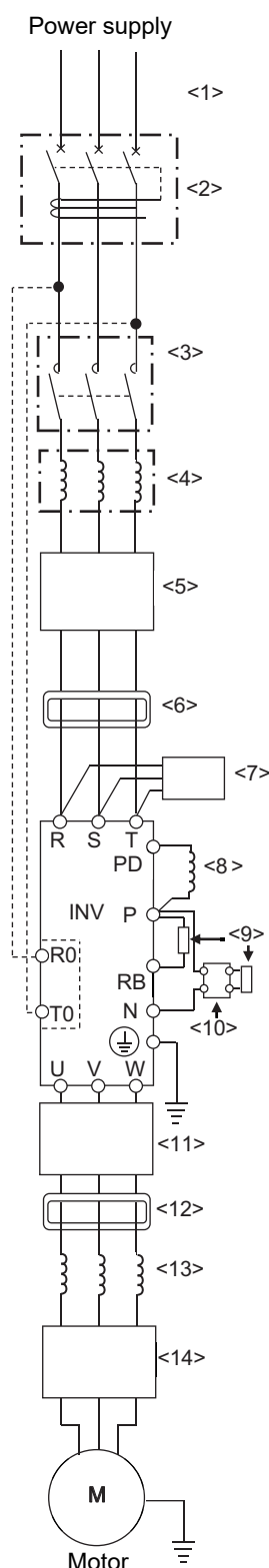
Configuration diagram and functions of the inverter and main circuit peripheral are described below:



Precautions for Correct Use

- Those devices are only applicable in case the standard 3-phase induction motor with four poles.
- Breakers must be selected in consideration of break capacity.
(Use a type applicable for inverter)
- Use an earth-leakage breaker (ELB) for your safety.
- Use a 75°C heatproof copper wire (HIV wire).
- If the wiring length exceeds 20 meters, heavier power lines need to be applied.
- Select for alarm output contact of 0.75 mm².
- Tighten the terminal screws at a specified torque. If they are not tightened enough, it may cause short circuit or fire. If they are tightened too much, it may damage the terminal block or inverter.
- Select variable sensitive currents for earth-leakage breaker (ELB) depending on the total wire length between the inverter and power supply and between the inverter and motor. Select a time-delay type of earth-leakage breaker. Otherwise a high-speed inverter may malfunction.
- When wiring a CV line in a metal pipe, leak current is approximately 30 mA/km.
- Because the relative permittivity of IV wire is high, the current increases by about eight times. Therefore, use an item with 8 times sensitive current that is shown on the table below. In case the total length of wire exceeds 100 meters, use a CV wire.

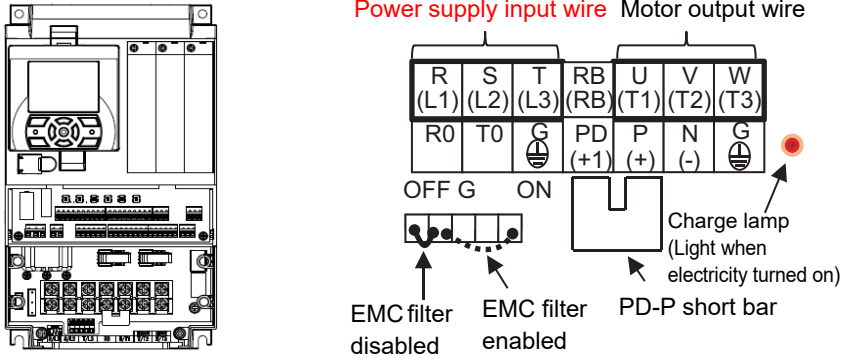
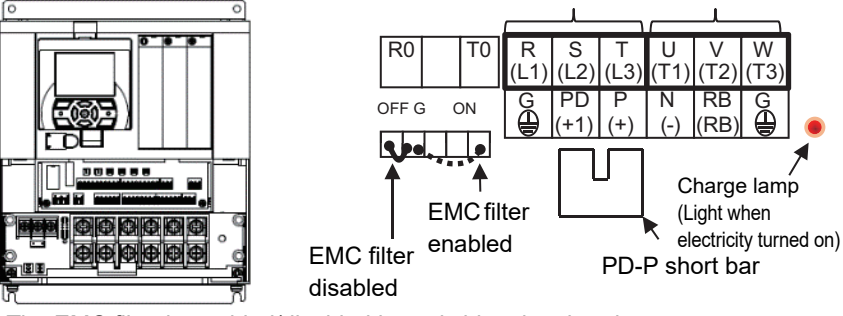
| Total wiring length | Sensitive current (mA) |
|---------------------|------------------------|
| 100 m or shorter | 50 |
| 300 m or shorter | 100 |



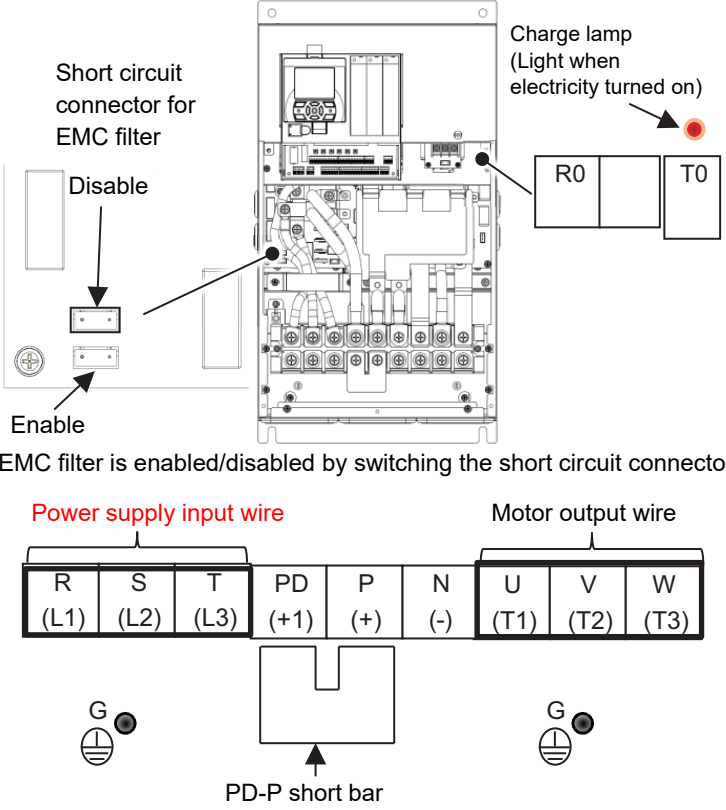
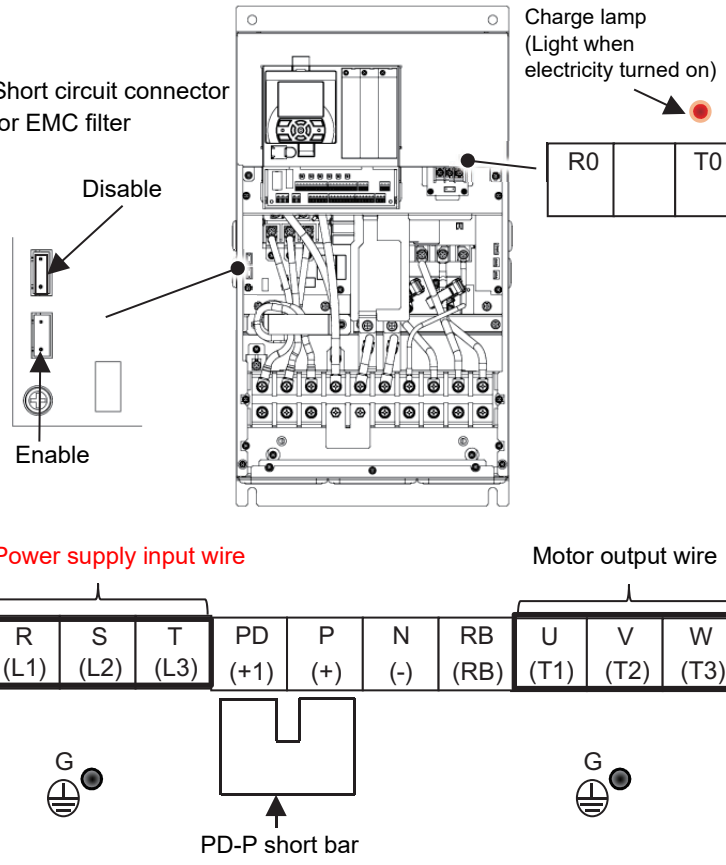
| No. | Name | Function |
|------|--|---|
| <1> | Wire | See <i>Recommended Wire Diameter, Wiring Tools, and Crimping Terminals</i> on page 2-43. |
| <2> | Earth-leakage breaker (ELB) | |
| <3> | Magnetic contactor (MC) | |
| <4> | Input side reactor | This is applied as a countermeasure against harmonic suppression, or when imbalance of power supply voltage is 3% or above, or when power supply capacity is 500kVA or above. It is also used when a rapid change is made to power supply voltage. It is also effective in improving power factor. |
| <5> | Inverter noise filter | This reduces the conductive noise that is generated from the inverter and transferred to the wire. Connect to the primary side (input side) of inverter. |
| <6> | Radio noise filter (zero-phase reactor) | When the inverter is used, noise may be generated on an adjacent radio or other devices through wiring on the power supply side. This is used for reducing the noise (reducing radiation noise). |
| <7> | Input-side radio noise filter (capacitor filter) | This reduces the radiation noise that is emitted from the wire on the input side. |
| <8> | DC reactor | This suppresses harmonics generated from the inverter. |
| <9> | Braking resistor | This is used for increasing the braking torque of inverter, repeating power on and off at high interval, or reducing the speed of high load caused by moment of inertia. |
| <10> | Regenerative braking unit | |
| <11> | Output-side noise filter | This is installed between the inverter and motor to reduce the radiation noise that is emitted from the wire. It is used to reduce radio interference on radios or televisions or prevent malfunctioning of measurement instruments and sensors. |
| <12> | Radio noise filter (zero-phase reactor) | This is applied for reducing noise generated on the output side of inverter. (It can be used on both the input side and output side.) |
| <13> | Output-side AC reactor | When a general-use motor is driven by the inverter, compared with when it is run by commercial power supply, larger vibration may be generated. By connecting this device between the inverter and motor, you can reduce the vibration of motor. Also, if the wiring length between the inverter and motor is long (10m or longer), by inserting a reactor, you can prevent malfunctioning of the thermal relay caused by harmonic attributable to switching of inverter. You can also use a current sensor instead of the thermal relay. |
| <14> | LCR filter | This is a filter installed between the inverter and motor. It improves output current and voltage waveform to reduce motor vibration, noise, and radiation noise emitted from the wire to convert output-side waveform to sine wave. It is also effective in suppressing surge voltage. |

Arrangement of Main Circuit Terminals

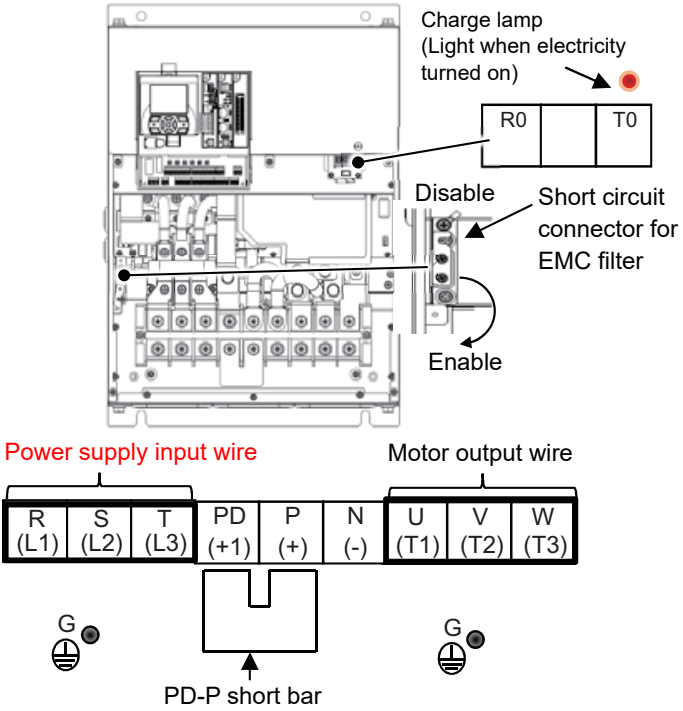
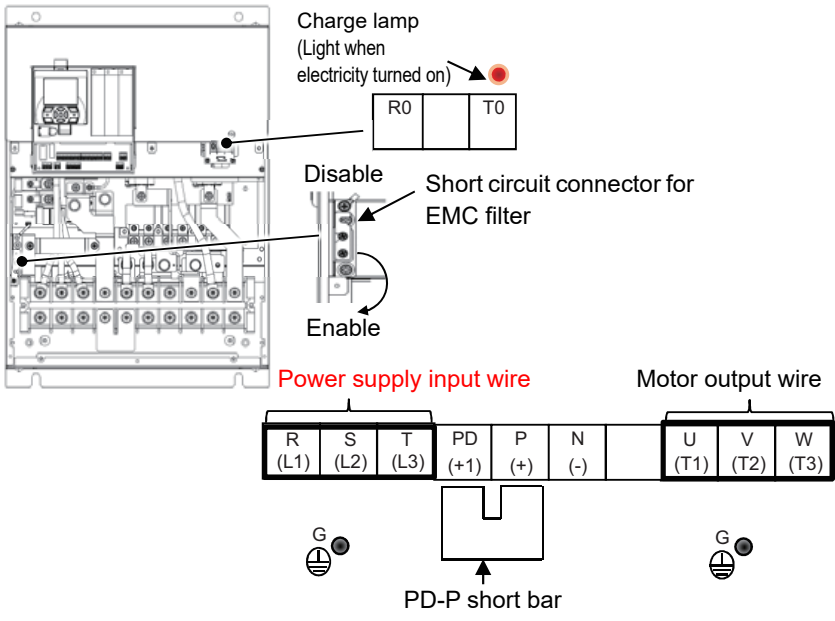
The arrangement of inverters' main circuit terminals are shown in the following diagrams.

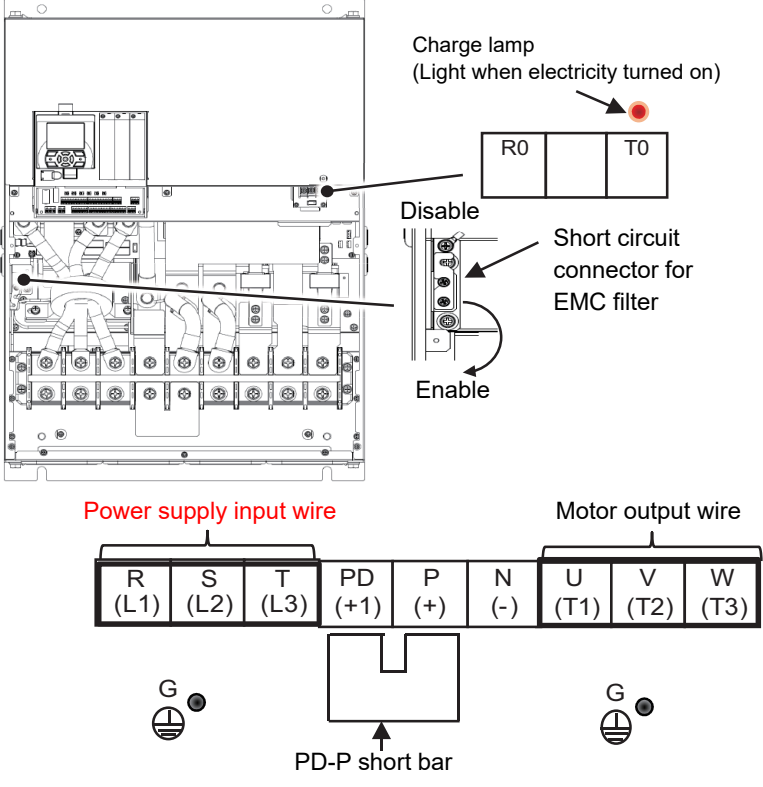
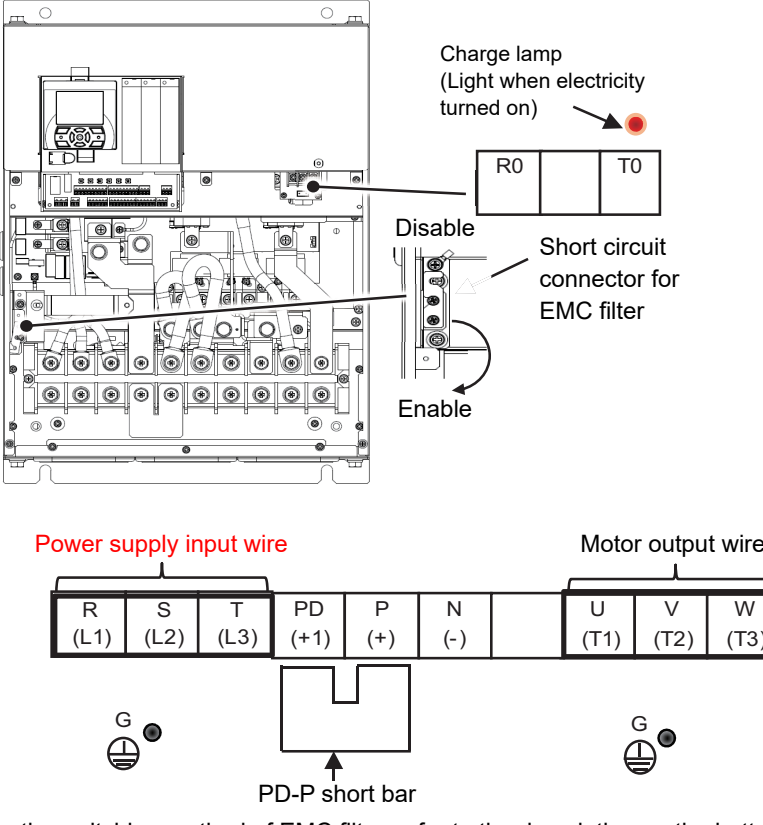
| Arrangement of Terminals | Model |
|--|---|
|  <p>Power supply input wire Motor output wire</p> <p>OFF G ON</p> <p>EMC filter disabled EMC filter enabled</p> <p>Charge lamp (Light when electricity turned on)</p> <p>PD-P short bar</p> <p>* The EMC filter is enabled/disabled by switching the short bar connector.</p> | <p>3G3RX2-A2004 3G3RX2-A2007 3G3RX2-A2015 3G3RX2-A2022 3G3RX2-A2037 3G3RX2-A4007 3G3RX2-A4015 3G3RX2-A4022 3G3RX2-A4037</p> <p>R0, T0: M4 Earth terminal: M4 Others: M4</p> |
|  <p>Power supply input wire Motor output wire</p> <p>OFF G ON</p> <p>EMC filter disabled EMC filter enabled</p> <p>Charge lamp (Light when electricity turned on)</p> <p>PD-P short bar</p> <p>* The EMC filter is enabled/disabled by switching the short bar connector.</p> | <p>3G3RX2-A2055 3G3RX2-A2075 3G3RX2-A4055 3G3RX2-A4075</p> <p>R0, T0: M4 Earth Terminal: M5 Others: M5</p> <p>3G3RX2-A2110 3G3RX2-A4110</p> <p>R0, T0: M4 Earth Terminal: M6 Others: M6</p> |

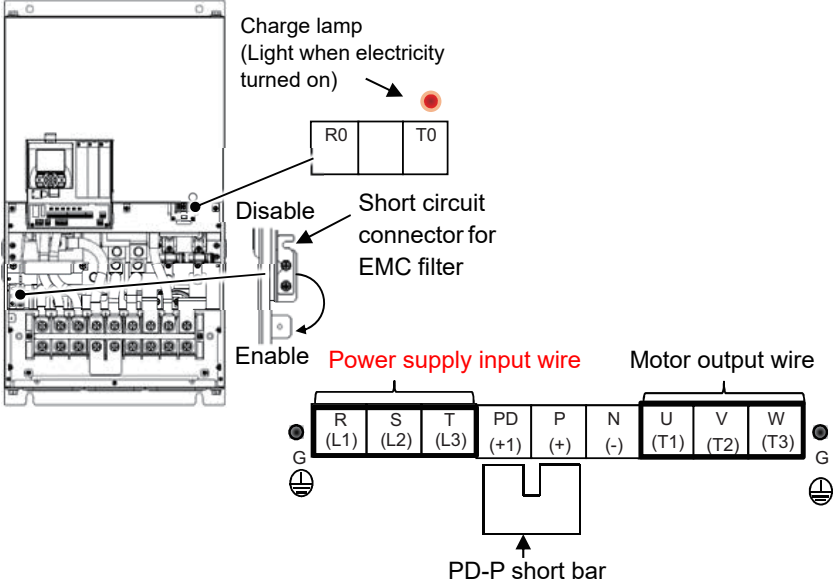
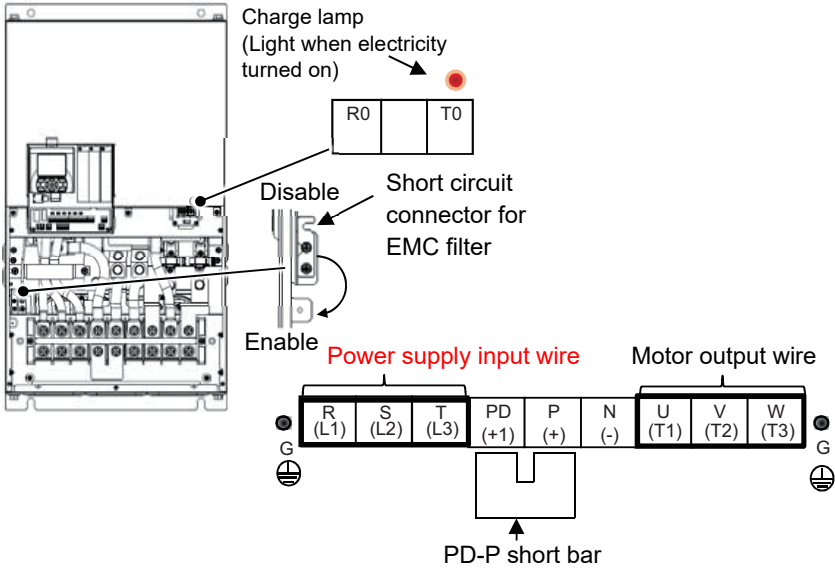
| Arrangement of Terminals | Model |
|---|--|
| <p>Earth terminal (with short bar)</p> <p>Charge lamp (Light when electricity turned on)</p> <p>R0 T0</p> <p>Power supply input wire</p> <p>R (L1) S (L2) T (L3) PD (+1) P (+) N (-)</p> <p>RB (RB)</p> <p>U (T1) V (T2) W (T3)</p> <p>Motor output wire</p> <p>G</p> <p>Earth terminal for enabling EMC filter</p> <p>PD-P short bar</p> <p>Earth terminal (with short bar)</p> <p>* The EMC filter is enabled by replacing the grounding screw equipped with short bar with the earth terminal for enabling the EMC filter.</p> <p>Fix the short bar with two screws.</p> | <p>3G3RX2-A2150 3G3RX2-A2185 R0,T0 : M4 Earth Terminal : M6 Others : M6</p> <p>3G3RX2-A2220 R0,T0 : M4 Earth Terminal: M6 Others: M8</p> |
| <p>Charge lamp (Light when electricity turned on)</p> <p>R0 T0</p> <p>Power supply input wire</p> <p>R (L1) S (L2) T (L3) U (T1) V (T2) W (T3)</p> <p>Motor output wire</p> <p>G</p> <p>OFF G ON</p> <p>EMC filter disabled</p> <p>EMC filter enabled</p> <p>PD-P short bar</p> <p>* The EMC filter is enabled/disabled by switching the short bar connector.</p> | <p>3G3RX2-A4150 3G3RX2-A4180 3G3RX2-A4220</p> <p>R0,T0 : M4 Earth terminal: M6 Others: M6</p> |

| Arrangement of Terminals | Model |
|---|---|
|  <p>Short circuit connector for EMC filter</p> <p>Disable</p> <p>Enable</p> <p>Charge lamp (Light when electricity turned on)</p> <p>R0 T0</p> <p>Power supply input wire</p> <p>Motor output wire</p> <p>R (L1) S (L2) T (L3) PD (+1) P (+) N (-) U (T1) V (T2) W (T3)</p> <p>G G</p> <p>PD-P short bar</p> <p>* The EMC filter is enabled/disabled by switching the short circuit connector.</p> | <p>3G3RX2-A2300</p> <p>R0,T0 : M4 Earth terminal: M6 Others: M8</p> |
|  <p>Short circuit connector for EMC filter</p> <p>Disable</p> <p>Enable</p> <p>Charge lamp (Light when electricity turned on)</p> <p>R0 T0</p> <p>Power supply input wire</p> <p>Motor output wire</p> <p>R (L1) S (L2) T (L3) PD (+1) P (+) N (-) RB (RB) U (T1) V (T2) W (T3)</p> <p>G G</p> <p>PD-P short bar</p> <p>* The EMC filter is enabled/disabled by switching the short circuit connector.</p> | <p>3G3RX2-A4300</p> <p>R0,T0 : M4 Earth terminal: M6 Others: M8</p> |

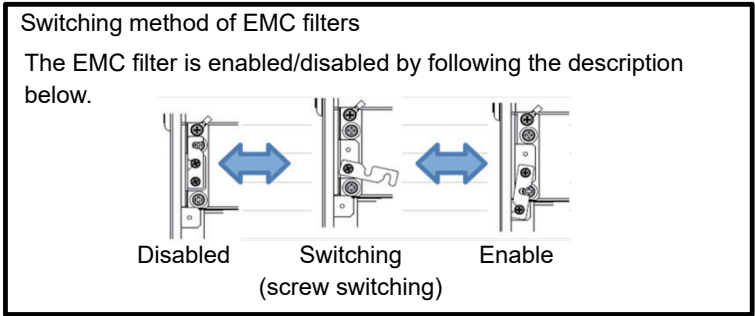
| Arrangement of Terminals | Model |
|--|---|
| <p>Charge lamp (Light when electricity turned on)</p> <p>R0 T0</p> <p>Disable Short circuit connector for EMC filter Enable</p> <p>Power supply input wire Switching (screw switching) Motor output wire</p> <p>R S T PD P N U V W (L1) (L2) (L3) (+1) (+) (-) (T1) (T2) (T3)</p> <p>G G</p> <p>PD-P short bar</p> <p>* The EMC filter is enabled/disabled by switching the short circuit bar.</p> | <p>3G3RX2-A2370</p> <p>R0,T0 : M4 Earth terminal: M8 Others: M8</p> |
| <p>Short circuit connector for EMC filter Disable Enable Charge lamp (Light when electricity turned on) R0 T0</p> <p>Power supply input wire Motor output wire</p> <p>R S T PD P N RB U V W (L1) (L2) (L3) (+1) (+) (-) (RB) (T1) (T2) (T3)</p> <p>G G</p> <p>PD-P short bar</p> <p>* The EMC filter is enabled/disabled by switching the short circuit bar.</p> | <p>3G3RX2-A4370</p> <p>R0,T0 : M4 Earth terminal: M8 Others: M8</p> |

| Arrangement of Terminals | Model |
|---|---|
|  <p>Charge lamp (Light when electricity turned on)</p> <p>R0 T0</p> <p>Disable Enable</p> <p>Short circuit connector for EMC filter</p> <p>Power supply input wire</p> <p>Motor output wire</p> <p>R (L1) S (L2) T (L3) PD (+1) P (+) N (-) U (T1) V (T2) W (T3)</p> <p>G G</p> <p>PD-P short bar</p> <p>* For the switching method of EMC filter, refer to the description on the bottom of the table.</p> | <p>3G3RX2-A2450</p> <p>R0,T0 : M4 Earth terminal: M8 Others: M8</p> |
|  <p>Charge lamp (Light when electricity turned on)</p> <p>R0 T0</p> <p>Disable Enable</p> <p>Short circuit connector for EMC filter</p> <p>Power supply input wire</p> <p>Motor output wire</p> <p>R (L1) S (L2) T (L3) PD (+1) P (+) N (-) U (T1) V (T2) W (T3)</p> <p>G G</p> <p>PD-P short bar</p> <p>* For the switching method of EMC filter, refer to the description on the bottom of the table.</p> | <p>3G3RX2-A4450</p> <p>R0,T0 : M4 Earth terminal: M8 Others: M8</p> |

| Arrangement of Terminals | Model |
|--|--|
|  <p>Charge lamp (Light when electricity turned on)</p> <p>Disable</p> <p>Short circuit connector for EMC filter</p> <p>Enable</p> <p>Power supply input wire</p> <p>Motor output wire</p> <p>R (L1) S (L2) T (L3) PD (+1) P (+) N (-) U (T1) V (T2) W (T3)</p> <p>G</p> <p>PD-P short bar</p> <p>G</p> <p>* For the switching method of EMC filter, refer to the description on the bottom of the table.</p> | <p>3G3RX2-A2550</p> <p>R0, T0: M4 Earth terminal: M8 Others: M10</p> |
|  <p>Charge lamp (Light when electricity turned on)</p> <p>Disable</p> <p>Short circuit connector for EMC filter</p> <p>Enable</p> <p>Power supply input wire</p> <p>Motor output wire</p> <p>R (L1) S (L2) T (L3) PD (+1) P (+) N (-) U (T1) V (T2) W (T3)</p> <p>G</p> <p>PD-P short bar</p> <p>G</p> <p>* For the switching method of EMC filter, refer to the description on the bottom of the table.</p> | <p>3G3RX2-A4550</p> <p>R0, T0 : M4 Earth terminal: M8 Others: M8</p> |

| Arrangement of Terminals | Model |
|---|--|
|  <p>Charge lamp (Light when electricity turned on)</p> <p>Disable</p> <p>Short circuit connector for EMC filter</p> <p>Enable</p> <p>Power supply input wire</p> <p>Motor output wire</p> <p>R (L1) S (L2) T (L3) PD (+1) P (+) N (-) U (T1) V (T2) W (T3)</p> <p>PD-P short bar</p> <p>* For the switching method of EMC filter, refer to the description on the bottom of the table.</p> | <p>3G3RX2-B4750</p> <p>R0,T0 : M4 Earth terminal: M8 Others: M10</p> |
|  <p>Charge lamp (Light when electricity turned on)</p> <p>Disable</p> <p>Short circuit connector for EMC filter</p> <p>Enable</p> <p>Power supply input wire</p> <p>Motor output wire</p> <p>R (L1) S (L2) T (L3) PD (+1) P (+) N (-) U (T1) V (T2) W (T3)</p> <p>PD-P short bar</p> <p>* For the switching method of EMC filter, refer to the description on the bottom of the table.</p> | <p>3G3RX2-B4900</p> <p>R0,T0 : M4 Earth terminal: M8 Others: M10</p> |

| Arrangement of Terminals | Model |
|--|---|
| <p>Charge lamp (Light when electricity turned on)</p> <p>R0 T0</p> <p>Disable Short circuit connector for EMC filter</p> <p>Enable</p> <p>Power supply input wire</p> <p>Motor output wire</p> <p>R (L1) S (L2) T (L3) PD (+1) P (+) N (-) U (T1) V (T2) W (T3)</p> <p>G G</p> <p>PD-P short bar</p> <p>* For the switching method of EMC filter, refer to the description on the bottom of the table.</p> | <p>3G3RX2-B411K</p> <p>R0,T0 : M4 Earth terminal: M8 Others : M10</p> |
| <p>Charge lamp (Light when electricity turned on)</p> <p>R0 T0</p> <p>Disable Short circuit connector for EMC filter</p> <p>Enable</p> <p>Power supply input wire</p> <p>Motor output wire</p> <p>R (L1) S (L2) T (L3) PD (+1) P (+) N (-) U (T1) V (T2) W (T3)</p> <p>G G</p> <p>PD-P short bar</p> <p>* For the switching method of EMC filter, refer to the description on the bottom of the table.</p> | <p>3G3RX2-B413K</p> <p>R0,T0 : M4 Earth terminal: M8 Others: M10</p> |



Recommended Wire Diameter, Wiring Tools, and Crimping Terminals

Refer to the below table for the wiring to the inverter, the crimping terminal and the tightening torque of the terminal screw.

● 200 V class

| Model 3G3RX2-**** | Rated settings | Power line AWG (mm ²) R,S,T,U,V,W, P,PD,N | Ground line AWG (mm ²) | Braking resistor AWG between P and RB (mm ²) | Screw size of power line terminal | Crimping terminal power line/ ground line | Tightening torque N·m |
|----------------------|-------------------|--|---------------------------------------|---|---|--|-----------------------------|
| A2004 | ND | 14(2.1) | 14(2.1) | 14(2.1) | M4 | 2-4/2-4 | 1.4 |
| | LD | | | | | | |
| | VLD | | | | | | |
| A2007 | ND | 14(2.1) | 14(2.1) | 14(2.1) | M4 | 2-4/2-4 | 1.4 |
| | LD | | | | | | |
| | VLD | | | | | | |
| A2015 | ND | 14(2.1) | 14(2.1) | 14(2.1) | M4 | 2-4/2-4 | 1.4 |
| | LD | | | | | | |
| | VLD | | | | | | |
| A2022 | ND | 14(2.1) | 14(2.1) | 14(2.1) | M4 | 2-4/2-4 | 1.4 |
| | LD | | | | | | |
| | VLD | | | | | 5.5-4/5.5-4 | |
| A2037 | ND | 10(5.3) | 10(5.3) | 10(5.3) | M4 | 5.5-4/5.5-4 | 1.4 |
| | LD | | | | | | |
| | VLD | | | | | | |
| A2055 | ND | 8(8.4) | 8(8.4) | 8(8.4) | M5 | 8-5/8-5 | 3.0 |
| | LD | | | | | | |
| | VLD | | | | | | |
| A2075 | ND | 8(8.4) | 6(13.3) | 8(8.4) | M5 | 8-5/8-5 | 3.0 |
| | LD | | | | | | |
| | VLD | | | 6(13.3) | | | |
| A2110 | ND | 6(13.3) | 6(13.3) | 6(13.3) | M6 | 14-6/14-6 | 4.0 |
| | LD | | | | | | |
| | VLD | | | 4(21.2) | | 22-6/14-6 | |
| A2150 | ND | 4(21.2) | 6(13.3) | 4(21.2) | M6 | 22-6/14-6 | 2.5 to 3.0 |
| | LD | | | | | | |
| | VLD | | | 3(26.7) | | 38-6/14-6 | |
| A2185 | ND | 3(26.7) | 6(13.3) | 3(26.7) | M6 | 38-6/14-6 | 2.5 to 3.0 |
| | LD | | | | | | |
| | VLD | | | 2(33.6) | | 60-6/14-6 | |
| A2220 | ND | 1(42.4) | 6(13.3) | 1(42.4) | M8 | 60-8/14-6 | 5.5 to 6.6 |
| | LD | | | | | | |
| | VLD | | | 1/0(53.5) | | 70-8/14-6 | |
| A2300 | ND | 2/0(67.4) | 4(21.2) | - | M8 | 70-8/22-6 | 6.0 |
| | LD | | | | | | |
| | VLD | | | 1/0×2 (53.5×2) | | 60-8/22-6 | |
| A2370 | ND | 4/0(107.2) | 4(21.2) | - | M8 | 100-8/22-8 | 15.0 |
| | LD | | | | | | |
| | VLD | | | 1/0×2 (53.5×2) | | 60-8/22-8 | |
| A2450 | ND | 1/0×2 (53.5×2) | 4(21.2) | - | M8 | 60-8/22-8 | 6.0 to 10.0 |
| | LD | | | | | | |
| | VLD | | | 2/0×2 (67.4×2) | | 70-8/22-8 | |
| A2550 | ND | 350kc(177) | 3(26.7) | - | M10 | 180-10/38-8 | 19.6 |
| | LD | | | | | | |
| | VLD | | | 3/0×2 (85.0×2) | | 80-10/38-8 | |

● 400 V class

| Model 3G3RX2-**** | Rated settings | Power line AWG (mm ²) R,S,T,U,V,W, P,PD,N | Ground line AWG (mm ²) | Braking resistor AWG between P and RB (mm ²) | Screw size of power line terminal | Crimping terminal power line/ ground line | Tightening torque N·m |
|----------------------|-------------------|--|---------------------------------------|---|---|--|--------------------------------------|
| A4007 | ND | 14(2.1) | 14(2.1) | 14(2.1) | M4 | 2-4/2-4 | 1.4 |
| | LD | | | | | | |
| | VLD | | | | | | |
| A4015 | ND | 14(2.1) | 14(2.1) | 14(2.1) | M4 | 2-4/2-4 | 1.4 |
| | LD | | | | | | |
| | VLD | | | | | | |
| A4022 | ND | 14(2.1) | 14(2.1) | 14(2.1) | M4 | 2-4/2-4 | 1.4 |
| | LD | | | | | | |
| | VLD | | | | | | |
| A4037 | ND | 14(2.1) | 14(2.1) | 14(2.1) | M4 | 2-4/2-4 | 1.4 |
| | LD | | | | | | |
| | VLD | 12(3.3) | 12(3.3) | 12(3.3) | | 5.5-4/5.5-4 | |
| A4055 | ND | 12(3.3) | 12(3.3) | 12(3.3) | M5 | 5.5-5/5.5-5 | 3.0 |
| | LD | | | | | | |
| | VLD | 10(5.3) | 10(5.3) | 10(5.3) | | | |
| A4075 | ND | 10(5.3) | 10(5.3) | 10(5.3) | M5 | 5.5-5/5.5-5 | 3.0 |
| | LD | | | | | | |
| | VLD | 8(8.4) | 8(8.4) | 8(8.4) | | 8-5/8-5 | |
| A4110 | ND | 8(8.4) | 8(8.4) | 8(8.4) | M6 | 8-6/8-6 | 4.0 |
| | LD | | | | | | |
| | VLD | | | | | | |
| A4150 | ND | 8(8.4) | 8(8.4) | 8(8.4) | M6 | 8-6/8-6 | 4.0 |
| | LD | | | | | | |
| | VLD | | | | | | |
| A4185 | ND | 8(8.4) | 8(8.4) | 8(8.4) | M6 | 8-6/8-6 | 4.0 |
| | LD | 6(13.3) | | 6(13.3) | | 14-6/8-6 | |
| | VLD | | | | | | |
| A4220 | ND | 6(13.3) | 8(8.4) | 6(13.3) | M6 | 14-6/8-6 | 4.0 |
| | LD | 4(21.2) | | 4(21.2) | | 22-6/8-6 | |
| | VLD | | | | | | |
| A4300 | ND | 3(26.7) | 6(13.3) | - | M8 | 38-8/14-6 | 6.0 |
| | LD | 2(33.6) | | | | 60-8/14-6 | |
| | VLD | 1(42.4) | | | | | |
| A4370 | ND | 1(42.4) | 6(13.3) | - | M8 | 60-8/14-8 | 15.0 |
| | LD | | | | | | |
| | VLD | | | | | | |
| A4450 | ND | 1(42.4) | 6(13.3) | - | M8 | 60-8/14-8 | 6.0 to 10.0 |
| | LD | 1/0(53.5) | | | | 70-8/14-8 | |
| | VLD | 2/0(67.4) | | | | 70-8/22-8 | |
| A4550 | ND | 2/0(67.4) | 4(21.2) | - | M8 | 60-8/22-8 | 6.0 to 10.0 |
| | LD | 1/0×2 | | | | | |
| | VLD | (53.5×2) | | | | | |
| B4750 | ND | 1/0×2 (53.5×2) | 4(21.2) | - | M10 | 60-10/22-8 | 10.0 to 12.0/ 11.7 (16.5/12.5) |
| | LD | | | | | | |
| | VLD | | | | | | |
| B4900 | ND | 1/0×2 | 3(26.7) | - | M10 | 60-10/38-8 | 10.0 to 12.0/ 11.7 (16.5/12.5) |
| | LD | (53.5×2) | | | | 70-10/38-8 | |
| | VLD | 2/0×2 (67.4×2) | | | | | |
| B411K | ND | 2/0×2 | 1(42.4) | - | M10 | 70-10/60-8 | 10.0 to 12.0/ 11.7 (16.5/12.5) |
| | LD | (67.4×2) | | | | 80-10/60-8 | |
| | VLD | 3/0×2 (85.0×2) | | | | | |

| Model 3G3RX2-**** | Rated settings | Power line AWG (mm ²) R,S,T,U,V,W, P,PD,N | Ground line AWG (mm ²) | Braking resistor AWG between P and RB (mm ²) | Screw size of power line terminal | Crimping terminal power line/ ground line | Tightening torque N·m |
|----------------------|----------------|--|---------------------------------------|--|---|--|--------------------------------------|
| B413K | ND | 3/0×2 (85.0×2) | 1(42.4) | - | M10 | 80-10/60-8 | 10.0 to 12.0/ 11.7 (16.5/12.5) |
| | LD | 4/0×2 (107×2) | | | | 100-10/60-8 | |
| | VLD | 250kcmil×2 (127×2) | | | | 150-10/60-8 | |

Wiring of Main Power Supply Input Terminal (R/L1, S/L2, T/L3)

Wiring of main power supply input terminal, peripherals and others are described here.

● Establishing Breakers for Wiring

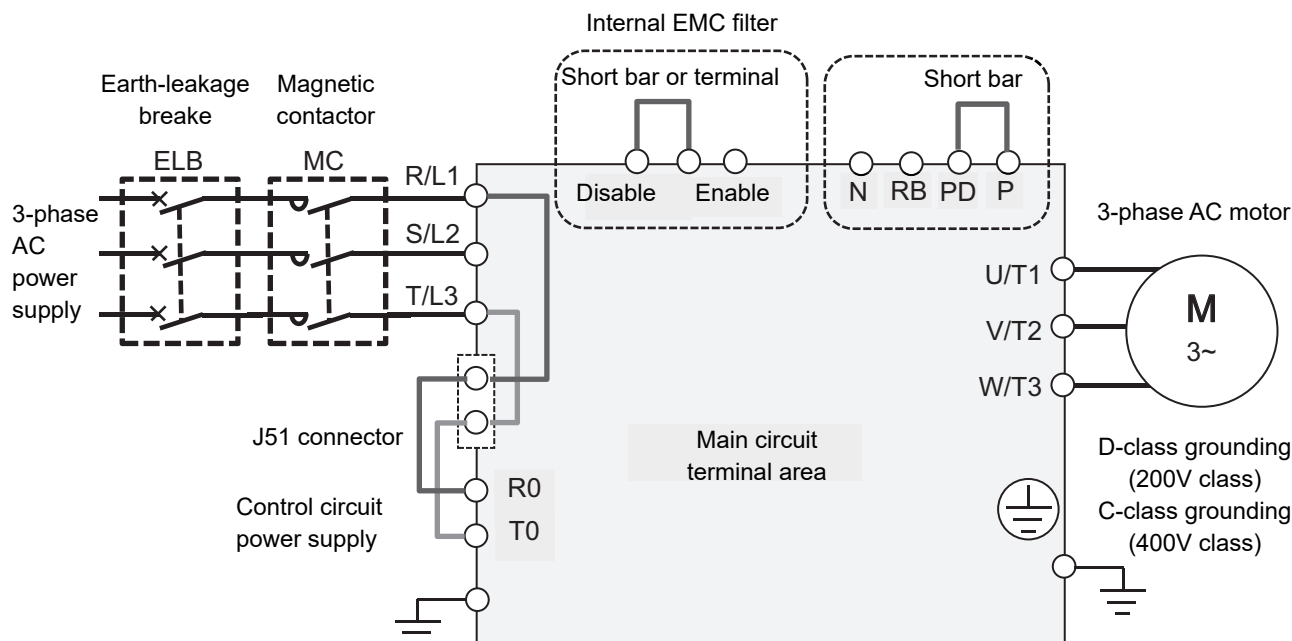
Connect R, S, T (L1, L2, L3) to the AC power supply.

Connect U, V, W (T1, T2, T3) to the motor.

Driving a 200-Volt motor by a 400-Volt inverter may result in fire.

The input power supply must be in the range shown below:

| Voltage class | Input range |
|---------------|---|
| 200 V class | 200 to 240 VAC (allowable variation range: +10%/-15%) Power supply frequency 50 Hz/60 Hz (variation range ±5%) |
| 400 V class | 380 to 500 VAC (allowable variation range: +10%/-15%) Power supply frequency 50 Hz/60 Hz (variation range ±5%) |



● Installing Earth Leakage Breaker

When selecting the earth leakage breaker to use between the power supply and the main power supply input terminals (R, S, T), consider the following two points.

High-frequency leakage current from inverter

The inverter produces a high-frequency leakage current due to its high-speed output switching.

In general, a leakage current of approximately 100 mA will flow for the power cable length of 1 m per inverter. Moreover, an additional leakage current of approximately 5 mA will flow with the increasing length by 1 m.

Therefore, earth leakage breaker that will be used at the power supply input shall be the followings:

- It must remove a leakage current with high frequency.
- It must detect only leakage current in a frequency band that is hazardous to human beings.
- It shall be for an inverter.
- Use an earth leakage breaker that is dedicated for an inverter. Pay an attention that the breaker with a sensitive current of 10 mA or more shall be selected per an inverter.
- When the general earth leakage breaker (to detect a high frequency leakage current) is used, it must be selected with the sensitive current 200 mA or more and the operation time of 0.1 sec. or more per an inverter. However, since even a low frequency sensitive current has a high value, the effect to prevent an electric shock may reduce. Select it at a location that a human being unlikely touch to protect other devices.

Leakage current of EMC noise filter

EMC noise filter is designed in conformity with CE standard in Europe.

When the noise filter designed according to neutral ground based on Europe power supply specification is used with S-phase ground in-house, a leakage current increase.

- With the condition of the noise filter installation in which a leakage current is strictly regulated on the use in-house, when the installation site is not applicable to EMC regulation, disable built-in EMC noise filter and consider use of 3G3AX-ZCL and a ferrite core as a measure against a noise.
- EMC noise filter for 3G3RX2 is enabled at factory default setting. If unnecessary, change from enable to disable. As for the changing method, refer to *2-3-2 Arrangement and Function of Main Circuit Terminal Block* on page 2-21.
- Confirm the following: while the use of the noise filter (3G3AX-NFI) at input side of an external option leads to a noise reduction, it does to a generation of a leakage current.

● External Filter

Refer to the following table.

It is efficient to improve the status on whether it conforms to EMC or not.

When setting the light duty mode, select a maximum applicable motor capacity of the light duty mode.

| Power Supply | Model | Maximum applicable motor capacity (kW) | | Input Current | Leakage Current (mA max.) with 60Hz |
|-------------------------------------|-------------|--|-----------------|---------------|-------------------------------------|
| | | 3-phase 200 VAC | 3-phase 400 VAC | | |
| Three-phase AC200 V / AC400 V | 3G3AX-EFI41 | 0.4, 0.75 | 0.4 to 2.2 | 7A | 150 |
| | 3G3AX-EFI42 | 1.5 | 3.7 | 10A | 150 |
| | 3G3AX-EFI43 | 2.2, 3.7 | 5.5, 7.5 | 20A | 170 |
| | 3G3AX-EFI44 | 5.5 | 11 | 30A | 170 |
| | 3G3AX-EFI45 | 7.5 | 15 | 40A | 170 |
| | 3G3AX-EFI46 | - | 18.5 | 50A | 250 |
| | 3G3AX-EFI47 | 11 | 22 | 60A | 250 |
| | 3G3AX-EFI48 | 15 | 30 | 80A | 250 |
| | 3G3AX-EFI49 | 18.5 | 37 | 100A | 250 |
| | 3G3AX-EFI4A | 22, 30 | 45, 55 | 150A | 250 |
| 3G3AX-EFI4B | 37 | 75, 90 | 200A | 250 | |

● Installing Magnetic Contactor

To shut off the main circuit power supply with a sequence, you can use a magnetic contactor (MC) on the inverter side closer than a molded case circuit-breaker (MCCB).

However, do not run or stop the inverter by turning ON/OFF a magnetic contactor established at the input and output side of power supply of inverter. Otherwise, it may cause damage on the inverter.

Use the RUN command signal (FW/RV) via the control circuit terminal of the inverter.

- Construct a sequence that turns OFF the power supply via the alarm output signal of the inverter.
- To use one or more braking resistors/regenerative braking units, construct a sequence that turns OFF a magnetic contactor via a thermal relay contact in each unit.



Precautions for Correct Use

Do not shut off the power supply more than once in 3 minutes. Doing so may result in inverter damage.

● Inrush Current Flow When the Inverter Power Supply Is Turned ON

When the inverter power supply is turned ON, the charging current, which is called inrush current, flows in the main circuit board capacitor.

The table below shows the reference values at a power supply voltage of 240 V or 480 V when the power supply impedance is low. Take this into consideration when selecting the inverter power supply.

- With a low-speed no-fuse breaker, an inrush current 10 times the rated current can flow for 20 ms.
- To turn ON the power supply for multiple inverters simultaneously, select a no-fuse breaker with a 20-ms allowable current greater than the total inrush current shown in the following table.

| Three-phase 200 V Level | | Three-phase 400 V Level | |
|-------------------------|-----------------------|-------------------------|-----------------------|
| 3G3RX2- | Inrush Current (Ao-P) | 3G3RX2- | Inrush Current (Ao-P) |
| A2004-A2007 | 24 | A4007-A4037 | 23 |
| A2015-A2037 | 17 | A4055-A4110 | 34 |
| A2055-A2110 | 45 | A4150-A4220 | 68 |
| A2150-A2220 | 89 | A4300-A4370 | 39 |
| A2300 | 54 | A4450-A4550 | 65 |
| A2370-A2550 | 96 | A4750-A4950 | 130 |
| | | A411K-A413K | 260 |

● Main Power Supply Phase Loss and Single-phase Input

This inverter is designed for 3-phase power supply input. It cannot be used with a single-phase power supply. Similarly, do not use the inverter in an input phase lost state of the 3-phase power supply. Doing so may result in inverter damage.

Be sure to check the wiring for the 3-phase power supply before using the inverter. Note that the inverter operates without detecting a phase loss if it occurs in the phase S as shown below.

| Phase loss | State |
|------------|---|
| Phase R | The inverter does not operate. |
| Phase T | |
| Phase S | The inverter operates in a single-phase. |
| | Under voltage or over current could occur, which could lead to the inverter broken. |

⚠ WARNING

Do not remove the terminal cover during the power supply and 15 minutes^{*1*2} after the power shut off. Doing so may result in a serious injury due to an electric shock.



*1. 10 minutes: For models 3G3RX2-A2004 to A2220 and 3G3RX2-A4007 to A4220

*2. 15 minutes: For models 3G3RX2-A2300 to A2550 and 3G3RX2-A4300 to B413K



Precautions for Safe Use

Even when the inverter is in an input phase lost state, built-in capacitors are charged, which may result in an electric shock or injury.

● Power Supply Environment

In the following cases, the internal converter module (rectifier) may be damaged.

Take countermeasures such as installing an AC reactor on the main circuit input side of the inverter.

- The power supply voltage unbalance factor is 3% or more.
- The power supply capacity is at least 10 times larger than the inverter capacity and, at the same time, 500 kVA or more.
- Rapid change in the power supply voltage occurs.

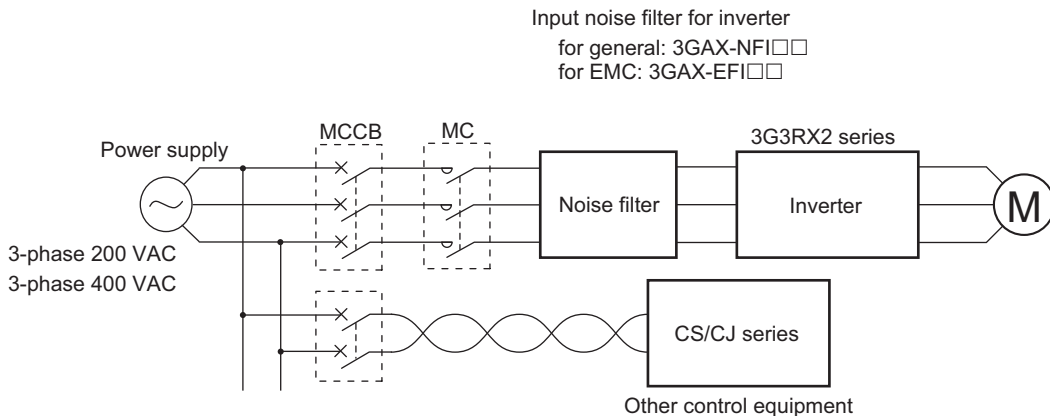
Example: the phase advance capacitor is turned on/off

● Installing Input Surge Absorber

When using an inductive load (such as a magnetic contactor, magnetic relay, magnetic valve, solenoid, or electromagnetic brake), use a surge absorber or diode together.

● Installing Input Noise Filter

The inverter performs high-speed output switching, which may cause the noise flow from the inverter to power supply lines that negatively affects on peripheral equipment. Therefore, it is recommended to use an input noise filter to reduce noise flowing out to power supply lines. This also helps to reduce noise that enters the inverter from power supply lines.



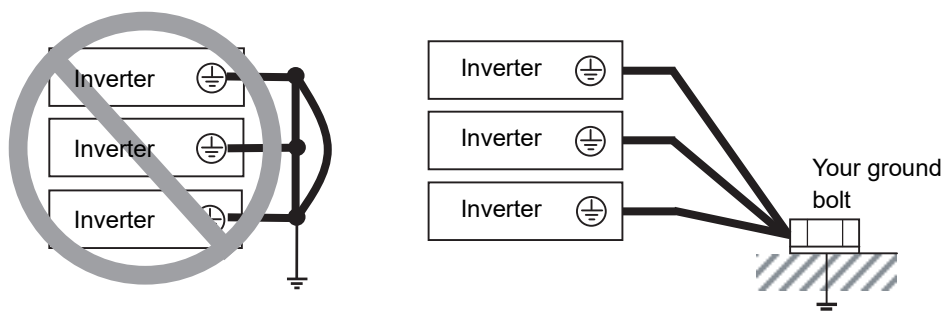
Wiring for Ground Terminal (G ⊕)

To prevent electric shock, be sure to ground the inverter and the motor.

The 200-V class should be connected to the ground terminal under type-D grounding conditions (conventional Class 3 grounding conditions: 100 Ω or less ground resistance). The 400-V class should be connected to the ground terminal under type-C grounding conditions (conventional special Class 3 grounding conditions: 10 Ω or less ground resistance).

For the ground cable, use the applicable cable or a cable with a larger diameter. Make the cable length as short as possible.

When several inverters are connected, the ground cable must not be connected across several inverters or looped. Otherwise, the inverters and peripheral control equipment may malfunction.



Harmonic Current Measures and DC/AC Reactor Wiring (PD, P)

In recent years, there is an increasing concern about suppressing the harmonic currents to the power supply line in accordance with “Guideline to reduce harmonic emissions caused by electrical and electronic equipment for household and general use.”

The following provides an overview of harmonics and measures against harmonics implemented in this inverter.

● Harmonics

The voltage or current whose frequency is an integral multiple of certain standard frequency (base frequency) is called a harmonic.

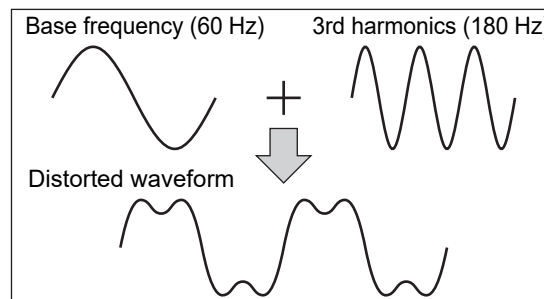
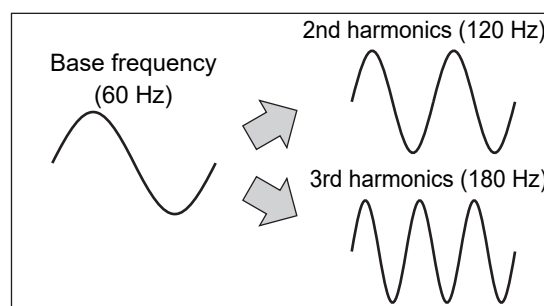
If a commercial power supply frequency of 60 Hz (50 Hz) is the reference frequency, the harmonics of that signal is:

$x2 = 120 \text{ Hz}$ (100 Hz),

$x3 = 180 \text{ Hz}$ (150 Hz), and so on.

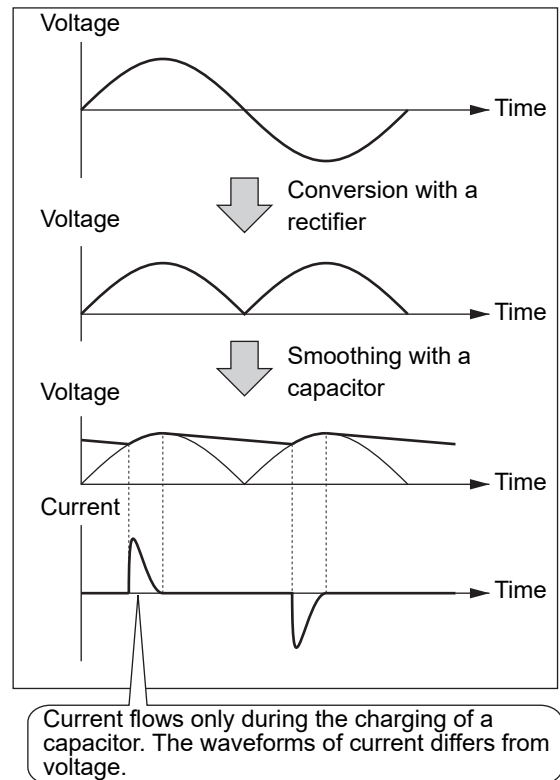
● Reason Why Harmonics Cause Problems

As the number of harmonics increases, the waveform of the commercial supply has more distortion. This distortion causes the malfunction of the connected equipment or leads to abnormal heat generation.



● Causes of Harmonics

- General electrical equipment internally converts AC input power (commercial power) into DC power. At this time, harmonic currents occur because of the difference in the current flow direction between AC power and DC power.
- In an AC-to-DC power conversion, the rectifier converts the input power into a unidirectional voltage, which is then smoothed by the capacitor. As a result, the current charged into the capacitor has a waveform that contains harmonic components.
- This inverter also performs an AC-to-DC conversion as with other electrical equipment, which allows current with harmonic components to flow. In particular, the inverter has more current than other equipment, so the number of harmonic components in current is larger.



● DC/AC Reactor

To suppress harmonic currents, use the DC (direct current) and AC (alternating current) reactors.

The DC/AC reactor functions to suppress a steep change in the current.

The DC reactor has higher harmonics suppression ability, so even higher suppression ability can be expected when used in conjunction with the AC reactor.

Suppressing harmonic currents also leads to the improvement in the power factor on the input side of the inverter.

● Before Wiring

The DC reactor is connected to the DC power supply located inside the inverter. Before wiring, be sure to turn off the power supply and make sure that the charge indicator is not lit.

Wire the inverter so that the heat from DC reactor (DCL) does not give any influences on the inverter.

Before connecting the DC reactor DCL option, remove this short-circuit bar between PD and P.

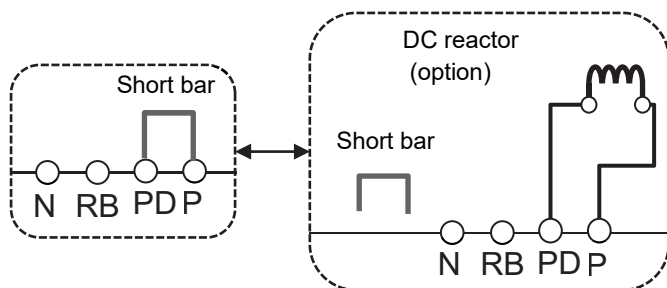
Note that the length of the DC reactor connection cable must be 5 m or shorter. Otherwise, you cannot have enough results you desire.

In case you do not use DC reactor DCL option, do NOT remove the PD-P short bar.

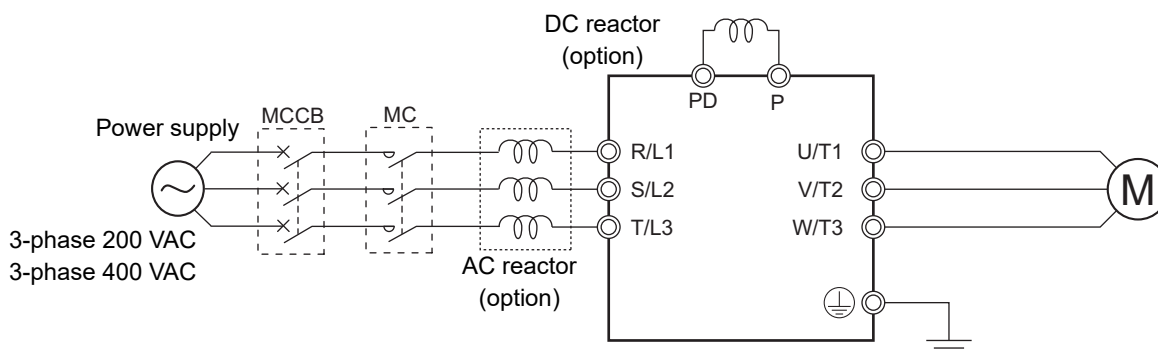
If you remove the short-circuit bar with the DC reactor unconnected, the inverter cannot operate because no power is supplied to its main circuit.

● **Wiring Method**

With DC reactor



With DC reactor and AC reactor



● **Effect of Reactors**

Through the use of the DC/AC reactor, the rate of harmonic current occurrences can be reduced as shown in the table of typical examples below.

| Measure against harmonics | Harmonic current occurrence rate [%] | | | | | | | |
|---------------------------|--------------------------------------|------|------|------|------|------|------|------|
| | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
| None (Inverter only) | 65 | 41 | 8.5 | 7.7 | 4.3 | 3.1 | 2.6 | 1.8 |
| With AC reactor | 38 | 14.5 | 7.4 | 3.4 | 3.2 | 1.9 | 1.7 | 1.3 |
| With DC reactor | 30 | 13 | 8.4 | 5 | 4.7 | 3.2 | 3.0 | 2.2 |
| With DC and AC Reactors | 28 | 9.1 | 7.2 | 4.1 | 3.2 | 2.4 | 1.6 | 1.4 |

● **Guideline for Reactor Selection**

When implementing measures against harmonics, first install a DC reactor and evaluate its effect. Then, if further reduction is required, add an AC reactor.

To implement harmonic countermeasures in consideration of the power supply environment, first install an AC reactor and evaluate its effect. Then, if further reduction is required, add a DC reactor.

If you have multiple inverters and use the AC reactor, use one AC reactor for each inverter. Using only one AC reactor for more than one inverter does not provide sufficient reduction.

Wiring for Inverter Output Terminals (U/T1, V/T2, W/T3)

The following describes the wiring for the inverter output terminals (U/T1, V/T2, W/T3).

● Never Connect Power Supply to Output Terminals

Never connect the power supply to the output terminals U/T1, V/T2, W/T3.

The inverter is damaged internally if power supply voltage is applied to the output terminals.

● Never Short or Ground Output Terminals

Do not touch the output terminals with bare hand or contact the output wires with the inverter's case.

Doing so may result in electric shock or ground fault.

Be careful not to short the output wires.

● Do Not Use Phase Advance Capacitors/noise Filters

Never connect a phase advance capacitor or LC/RC noise filter for general-purpose power supplies to the output circuit.

Doing so may result in damage to the inverter or burnout of these parts.

● Do Not Use Magnetic Switches

Do not connect any magnetic switches or magnet contactor to the output circuit.

If a load is connected to the inverter in operation, the inverter's overcurrent protection circuit is activated due to the inrush current.

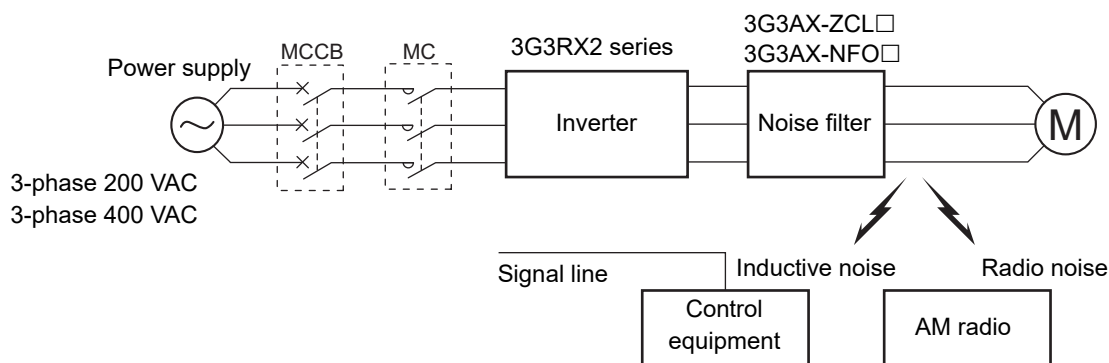
● Precautions for Connecting More Than One Motor to Inverter's Output Terminals

If connecting more than one motor to the output terminals of the inverter, note the following three points.

- Make sure that the ND-rated current (Normal Duty) of the inverter is higher than the sum of the rated current values of the connected motors. Select an inverter with a sufficient capacity, taking emergency situations into consideration.
- The inverter cannot provide overload protection for individual motors, because it only detects a sum of the current values for all the connected motors. Install a thermal relay for each motor. The RC value of each thermal relay must be 1.1 times larger than the rated current of the motor.
- Set the inverter to detect only overloading that occurred in it by setting the Electronic Thermal Level to the rated output current of the inverter.

● Installing Output Noise Filter

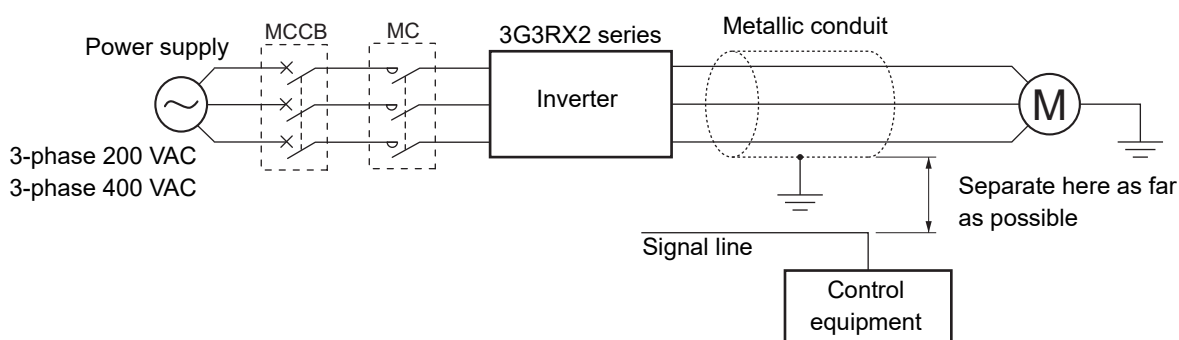
Connecting a noise filter to the output side of the inverter enables the reduction of radio noise and inductive noise.



| Noise | Description |
|-----------------|---|
| Inductive noise | Produced by electromagnetic induction, this noise causes malfunction of control equipment due to noise in signal lines. |
| Radio noise | The electromagnetic waves emitted from the inverter body or cables cause noise in radio receivers. |

● Measures against Inductive Noise

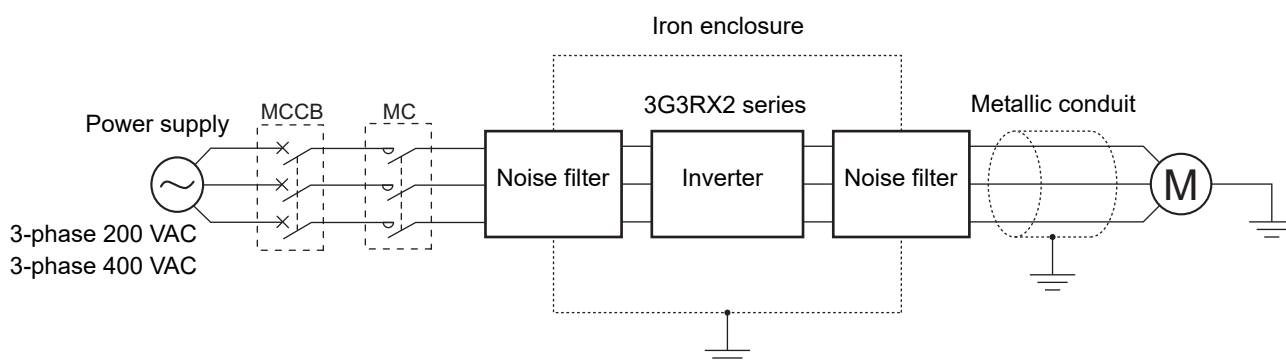
In addition to the noise filter described above, you can suppress the inductive noise produced on the output side by connecting a bundle of wires through a grounded metal conduit. Separate the metal conduit as far as possible from the signal line in order to suppress the influence of inductive noise.



● Measures against Radio Noise

Besides the I/O wires, radio noise is radiated from the inverter itself. This radio noise can be reduced by installing noise filters on both the input and output sides of the inverter and by installing and shielding the inverter body in a grounded iron enclosure etc.

Keep the cables between the inverter and the motor as short as possible.



● Cable Length Between Inverter and Motor

If the length of the cables between the inverter and the motor is long, consider how to address the following problems.

- Voltage drop in output cables. As the cable length between the inverter and the motor increases, the resistance in the cables becomes higher and accordingly the amount of voltage drop in the inverter output voltage becomes larger. This causes a decrease in the voltage that is to the motor, which results in a low output torque.

If the cable is long, take measures to reduce the resistance, for example, by selecting cables whose wire diameter is larger than specified.

- Surge in long cables

If the cable length exceeds 20 m, a surge voltage (approximately 1200 V maximum for 400-V class) may be generated at the motor terminal depending on the stray capacitance or inductance of the cable, which may result in motor burnout.

In particular, when using a 400-V class inverter with a cable length of over 20 m, it is recommended to use a dedicated inverter motor. Dedicated inverter motors are designed to support the above surge voltage level.

- Leakage current from output cables

As the cable length between the inverter and the motor increases, stray capacitance increases between the inverter output and the ground. The increase in the stray capacitance on the output side of the inverter causes an increase of the high-frequency leakage current.

This high-frequency leakage current may negatively affect the current detector in the inverter output section or peripheral equipment. It is recommended to keep the wiring distance between the inverter and the motor at 100 m or shorter.

If your system configuration requires the wiring distance of over 100 m, take measures to decrease the stray capacitance. The applicable measures are such as not wiring in a metal duct and using a separate cable for each phase.

In addition, set a carrier frequency appropriate for the wiring distance between the inverter and the motor according to the table below.

| Wiring distance between inverter and motor | 50 m max. | 100 m max. | Over 100 m |
|--|-------------|------------|------------|
| Carrier frequency | 10 kHz max. | 5 kHz max. | 2.5 kHz |

External Braking Resistor Connection Terminal (P, RB)/ Regenerative Braking Unit Connection Terminal (P, N)

When driving a load with a large inertia or a vertical shaft, regenerated energy is fed back to the inverter when it is decelerating or generating downward movement.

If the amount of regenerative energy exceeds the allowable amount for the inverter, an overvoltage is detected. Use braking resistors or regenerative braking units to prevent this.

● 200 V Class Models with 22 kW or Lower/400 V Class Models with 37 kW or Lower

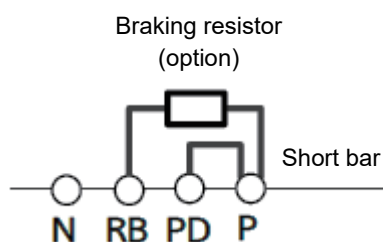
The models have a built-in regenerative braking circuit.

To improve the braking capacity, connect the optional external braking resistor to these terminals (P, RB).



Precautions for Safe Use

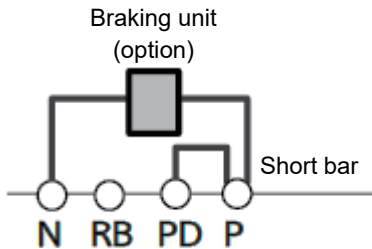
- Be sure to install a circuit that detects overheating of the braking resistor via alarm contacts (thermal relay output terminals) and shuts off the input power supply of the inverter.
- Do not connect a resistor whose resistance is lower than the minimum connection resistance value specified in the standard specifications table. Doing so may result in damage to the regenerative braking circuit.
- When using the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC) with a 400-V class inverter, be sure to connect two braking resistors of the same model in series. Using the inverter with only one braking resistor connected may cause damage to the braking resistor.



● **200 V Class Models with 30 kW or Higher/400 V Class Models with 45 kW or Higher**

These models have no built-in regenerative braking circuit.

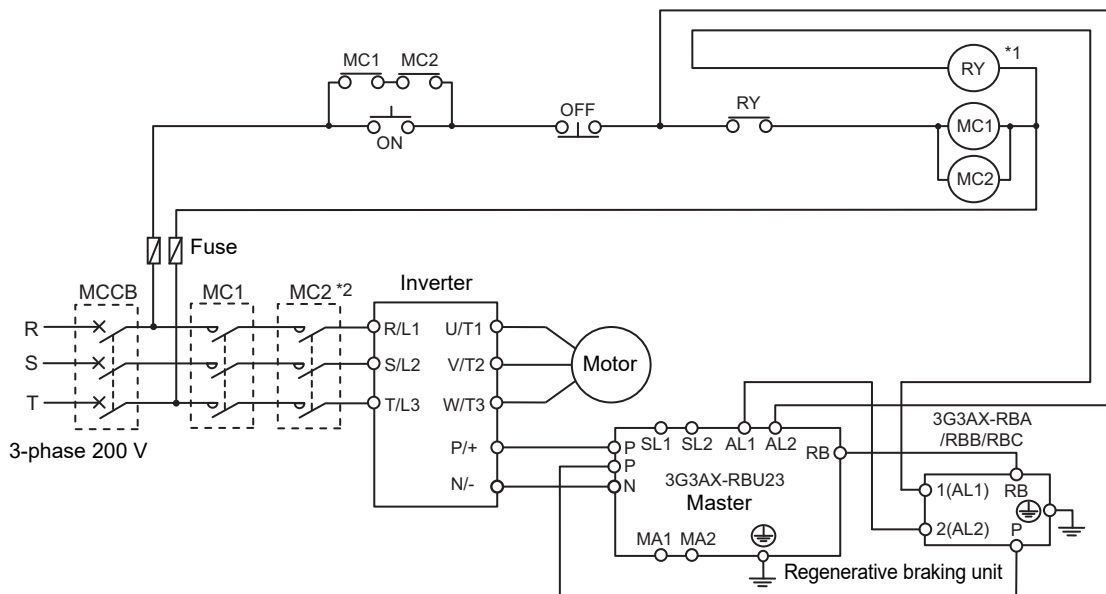
To improve the braking capacity, use the optional external braking resistor(s) and regenerative braking unit(s). In this case, connect the terminals (P, N) of the regenerative braking unit to the inverter's terminals (P, N).



Precautions for Safe Use

- Be sure to install a circuit that detects overheating of the regenerative braking unit(s) and braking resistor(s) via alarm contacts (thermal relay output terminals) and shuts off the input power supply of the inverter.
- Do not connect a resistor whose resistance is lower than the connection resistance value specified in the specifications table for that regenerative braking unit. Doing so may result in damage to the regenerative braking unit.
- When using the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC) with a 400-V class Regenerative Braking Unit (Model: 3G3AX-RBU41/RBU42/RBU43), be sure to connect two braking resistors of the same model in series. Using the Regenerative Braking Unit with only one braking resistor connected may cause damage to the braking resistor.
- When using the Regenerative Braking Unit (Model: 3G3AX-RBU21/RBU22/RBU41) with a built-in braking resistor with the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC), remove the built-in resistor according to the manual for the regenerative braking unit. Using the Regenerative Braking Unit with the built-in resistor connected may cause burnout of the built-in resistor.

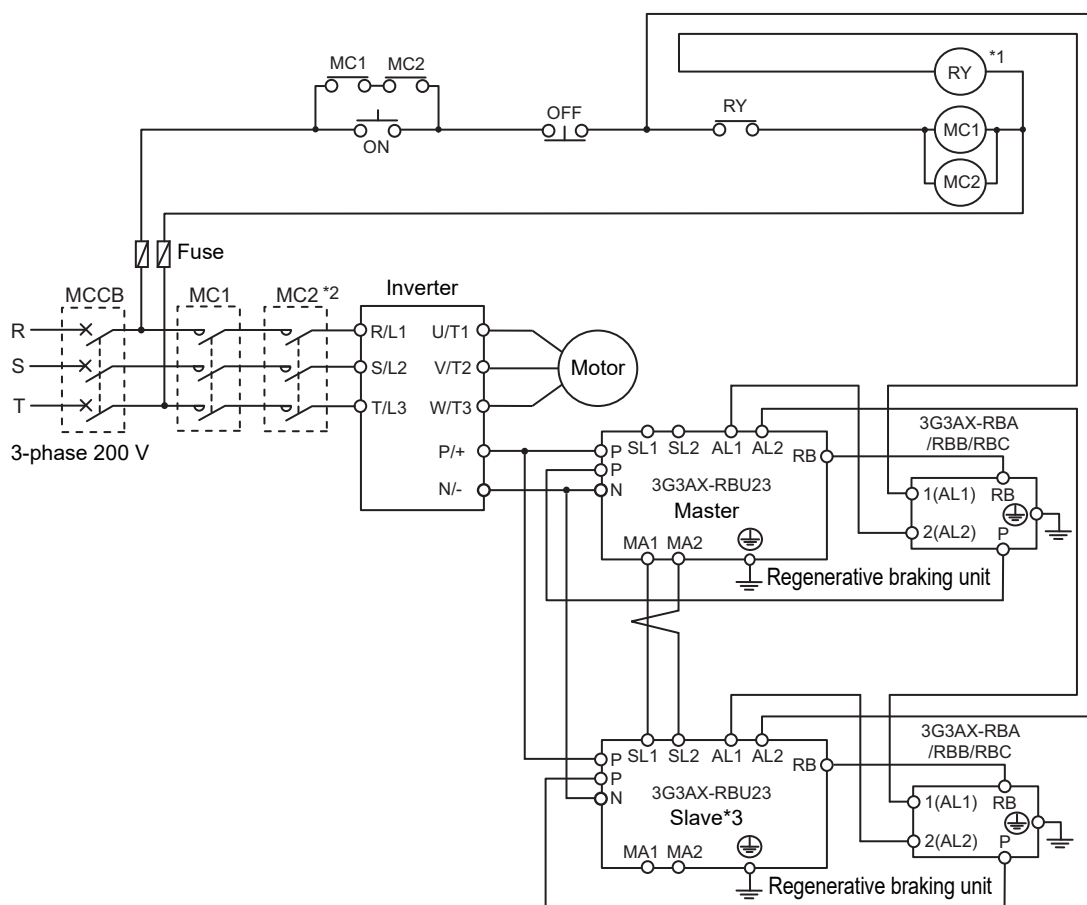
- Wiring diagram for connecting one Regenerative Braking Unit (Model: 3G3AX-RBU23)



*1. For RY, select the contact rating according to the ratings of the coils MC1 and MC2.

*2. MC1 and MC2 are used not only to provide redundancy, but also to meet safety standards.

- Wiring diagram for connecting two Regenerative Braking Units (Model: 3G3AX-RBU23)



- *1. For RY, select the contact rating according to the ratings of the coils MC1 and MC2.
- *2. MC1 and MC2 are used not only to provide redundancy, but also to meet safety standards.
- *3. You need to set DIP switch to regenerative braking unit as a slave, and wire terminal SL1 and SL2.

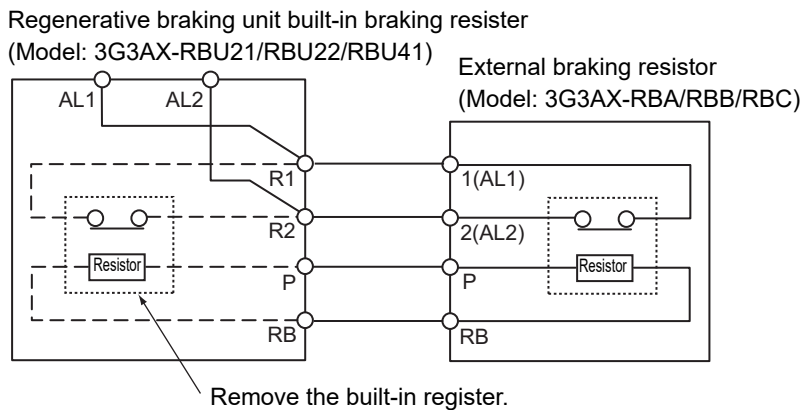


Precautions for Correct Use

- Each braking resistor has alarm contact (thermal relay output) terminals as shown below. Be sure to perform wiring for these terminals.

| Model | Alarm contact terminals |
|-----------------|---------------------------------------|
| 3G3AX-RBA□/RBB□ | Between terminal 1 and terminal 2 |
| 3G3AX-RBC□ | Between terminal AL1 and terminal AL2 |

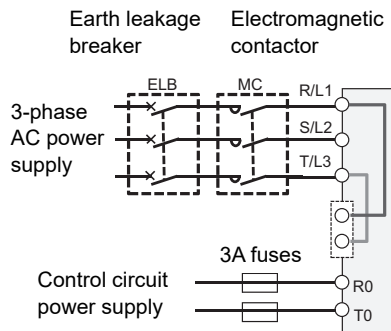
- To remove the built-in register from the Regenerative Braking Unit with a Built-in Braking Resistor (Model: 3G3AX-RBU21/RBU22/RBU41) in order to use the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC), remove the wiring of thermal relay for the built-in resistor and connect the alarm contact (thermal relay output) terminals of the braking resistor with the terminals R1 and R2.



Connection for Separating Inverter Control Circuit Power Supply from Main Power Supply

If the inverter protection circuit is activated to shut off the magnetic contactor of the input power supply, the power to the inverter control circuit is also turned off, and the alarm signal [AL] cannot be retained. If the alarm signal must be retained, use control circuit power supply terminals R0 and T0. Connect control circuit power supply terminals R0 and T0 with the primary circuit of the magnetic contactor according to the following procedure.

(Connection method)
Receiving electricity specifications
200-V class:
200 to 240 VAC (+10%, -15%)
(50/60 Hz ±5%)
(282 to 339 VDC)
400-V class:
380 to 500 VAC (+10%, -15%)
(50/60 Hz ±5%)
(537 to 707 VDC)



- (1) Disconnect the connected wire to R0 and T0.
- (2) Disconnect the J51 connector.
- (3) Connect the control circuit power supply cable to R0 and T0.



Precautions for Correct Use

To separate the control circuit power supply (Ro, To) from the main circuit power supply (R, S, T), observe the following instructions:

- For wiring between terminals Ro and To (terminal screw size: M4), use a cable of 1.25 mm² or heavier.
- Connect a 3 A fuse to the control circuit power supply cable.
- If the control circuit power supply (Ro, To) is turned on before the main circuit power supply (R, S, T), ground fault detection at power-on is disabled.
- If you supply direct current power supply to the control circuit power supply (R0, T0), set the output terminal NO/NC selection [CC-11] – [CC-17] to “00.” Otherwise when the direct current is shut off, output signal may chatter.
- For the terminals Ro and To, the tightening torque should be as follows.
M4: 1.2 N·m (1.4 N·m max.)

2-3-5 Wiring for Control Circuit Terminals

Wiring for Control Circuit Terminals

The terminals L, COM and CM2 are insulated from each other via the input and output signal common terminals. Do NOT short-circuit or ground terminals. Do NOT ground terminals via external equipment, either. When finished wiring, check the external equipment ground conditions.

For wiring to the control circuit terminals, use twisted-pair shielded wires. Connect the shielded wire to each common terminal.

Twist a cable connected to the terminal TH (thermistor input) with a cable of the terminal SC individually, and separate them from other SC common cables. Since the current flowing through the thermistor is weak, separate the thermistor cable from main circuit wiring (power lines). The thermistor connection cable should be 20 m or shorter.

Connect diodes to output terminals and relay output terminals for the countermeasure of reverse electric power.

The control circuit terminal block has two rows of terminals. Start wiring from the lower terminals. Wiring from the upper terminals makes it difficult to wire the lower terminals.



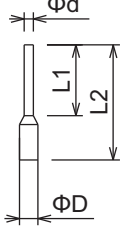
Precautions for Correct Use

- Wiring the I/O signal lines for more than one inverter results in creating a sneak path in the circuit. Connect a diode for sneak current prevention.
- The control circuit connection cables should be 20 m or shorter. Otherwise the inverter may not perform specified characteristics due to voltage reduction or other reasons. When it is inevitable to use a connecting wire shorter than 20 meters, apply analog insulating signal converter and confirm it performs correctly.
- Separate the cables for control circuit terminal connection from the main circuit cable (power lines) and the relay control circuit cable. If you cannot avoid crossing cables each other, try to keep them at right angles to each other. Not doing so may result in the inverter malfunction. Separate signal lines from power supply lines when wiring.
- Do not short-circuit the analog power supply terminals FS and FC and/or the interface power supply terminals P24 and SC. Doing so may result in failure of the inverter.
- After wiring, pull the wire slightly to confirm that it is connected properly.

● Recommended Terminals for Wiring

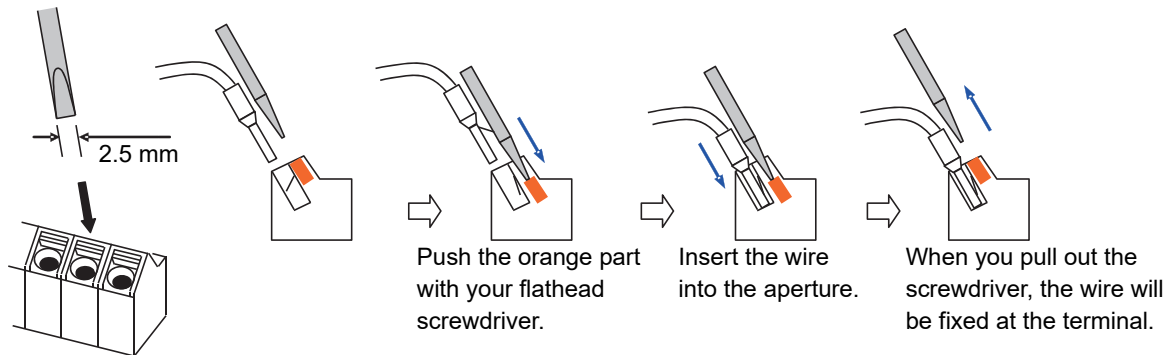
Spring-clamp types of terminals are used for the control circuit terminal blocks. We recommend rod-terminals in the following specifications for improvement of wiring and reliability of connecting.

Pin-terminals with sleeves.

| Wire size mm ² (AWG) | L1 [mm] | L2 [mm] | Φd [mm] | ΦD [mm] |  |
|------------------------------------|---------|---------|---------|---------|---|
| 0.25 (24) | 8 | 12.5 | 0.8 | 2.0 | |
| 0.34 (22) | 8 | 12.5 | 0.8 | 2.0 | |
| 0.5 (20) | 8 | 14 | 1.1 | 2.5 | |
| 0.75 (18) | 8 | 14 | 1.3 | 2.8 | |

● Wiring Method

- 1** Push the orange colored part on the control circuit terminal block with a flathead screwdriver (2.5 mm widths or narrower), and the wire-inserting aperture (the circular hole) will open.
- 2** While you are holding the screwdriver in the hole, insert the wire or rod-terminal into the wire-inserting aperture.
- 3** When you pull out the screwdriver, the wire will be fixed at the terminal.

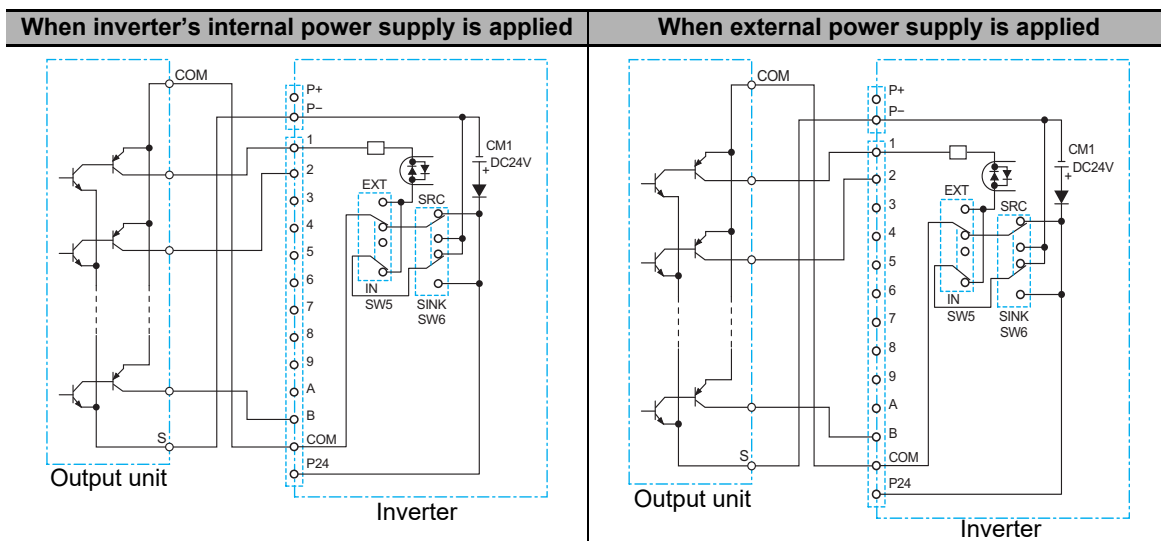


Precaution for Pulling Out the Wire

Pull the wire out of the terminal block, while you keep opening the wire-inserting aperture by pushing the orange part with your screwdriver.

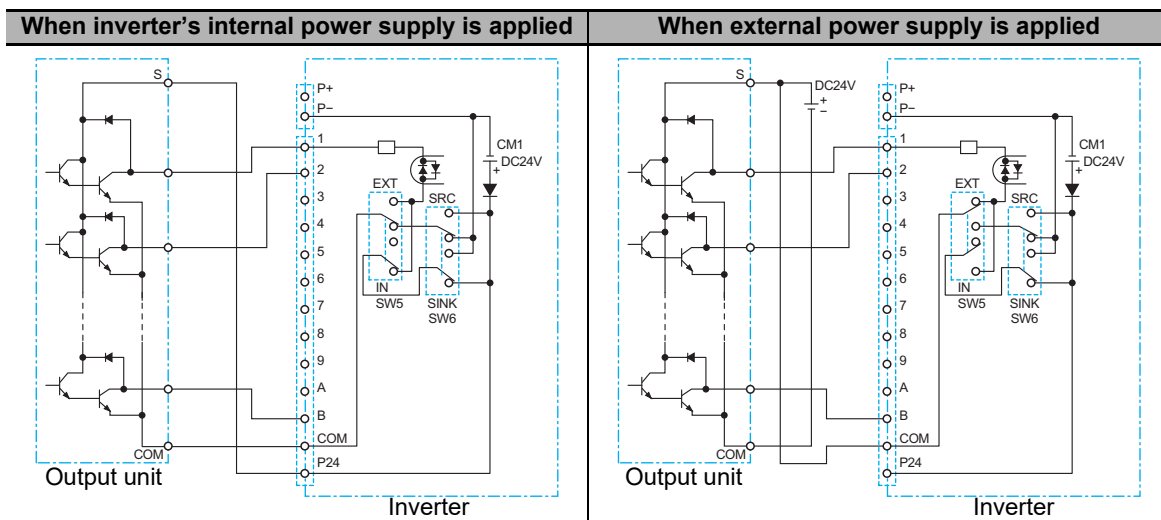
Input Terminals and Programmable Controller Connection

● Source Logic



- If you apply the inverter's internal power supply, set SW5 to IN.
- If you apply the external power supply, set SW5 to EXT.
- If you connect output unit of source type, set SW6 to SRC.

● Sink Logic



- If you apply the inverter's internal power supply, set SW5 to IN.
- If you apply the external power supply, set SW5 to EXT.
- If you connect output unit of sink type, set SW6 to SINK.

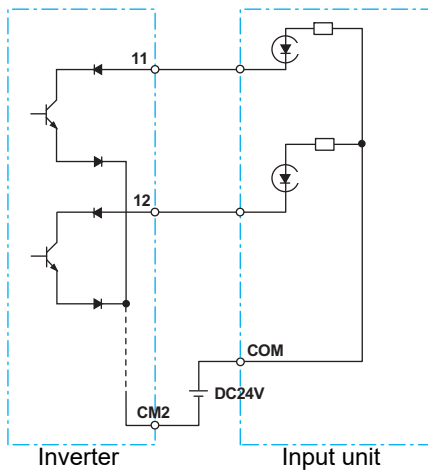


Precautions for Correct Use

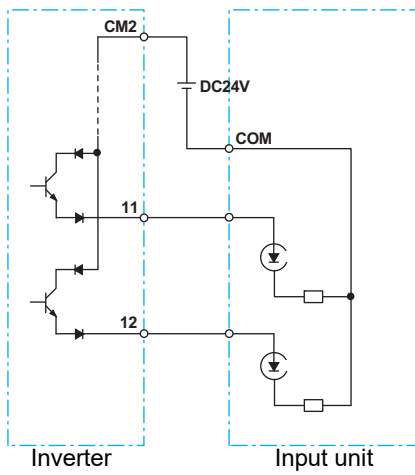
- Confirm the SW6-position for switching the sink/source logic, before turning on the main power supply. Not doing so may result in damage of the inverter or its peripheral unit.
- Make sure you must turn on the programmable controller and its external power supply at first before you turn on the inverter's power supply. Otherwise inverter's inner data may be altered.

Output Terminals and Programmable Controller Connection

● Sink Logic



● Source Logic



2-3-6 Wiring for PG Option Unit

To use PG vector control with this inverter, you need to mount and wire the PG Option Unit 3G3AX-RX2-PG01. Then, install a detector (encoder) to the motor rotating shaft and wire it to the PG Option Unit. For the detector (encoder), use a line-driver output type encoder. This is required for PG vector control, position control, or torque control operation.

Terminal Functions

| | Terminal name | Terminal symbol | Functions | | Electric specifications | |
|-----------------|------------------------------------|--|---|-----------------|-------------------------|---|
| | | | | Common terminal | | |
| Input terminal | Pulse train position command input | SAP SAN SBP SBN RSA RSB | <ul style="list-style-type: none"> Pulse train input procedure MD0: 90° phase difference pulse MD1: Forward/Reverse signal, pulse train MD2: Forward pulse/Reverse pulse Mode settings is made in the pulse train mode selection (ob-11). RSA: Termination resistor ON/OFF terminal between SAP and SAN RSB: Termination resistor ON/OFF terminal between SBP and SBN Termination resistor settings Built-in termination resistor: 150 Ω, switch between enabled and disabled with the wiring RSA, RSB terminals released: Built-in termination resistor disabled RSA-SAN short-circuit, RSB-SBN short-circuit: Built-in termination resistor enabled | | | 5V DC receiver input (RS-422 compliance) |
| | Encoder signal input | EAP EAN EBP EBN EZP EZN | A, B, Z: Rotary encoder signal input | | | Photo coupler input (Corresponds to the 5V DC line driver output type rotary encoder) |
| Output terminal | Encoder signal output | AP AN BP BN ZP ZN | Output the encoder signal input. (Pulse ratio 1 : 1) | | | 5V DC line driver output (RS-422 compliance) |
| | Power supply for encoder | EP5 EP12 | +5V DC power supply +12V DC power supply | EG | | Total supply capacity of EP5 and EP12 (250 mA max.) |
| | Functional Grounding terminal | FG | Connect to the Functional Grounding connection. (Screw size: M3) | | | |

Specifications

| Item | | Specifications | |
|--|-------------------------------|--|-------------------------------|
| Model | | 3G3AX-RX2-PG01 | |
| Dimensions (width × height × depth) | | 20.5×98.0×70.0 mm | |
| Weight | | 170 g | |
| Environment | Ambient operating temperature | -10 to 50°C | With no icing or condensation |
| | Ambient operating humidity | 20 to 90% RH | |
| | Storage temperature*1 | -20 to 65°C | |
| | Vibration resistance | 5.9 m/s ² (0.6G), 10 to 55 Hz | |
| | Protective structure | IP00 | |
| Encoder feedback | | <ul style="list-style-type: none"> • Standard encoder pulse number: 1024 pulse/r • Max. input pulse number: 200k pulse/s | |
| Position command | | Max. input pulse number: 200k pulse/s | |
| Protection function | | <ul style="list-style-type: none"> • Encoder cable breakage protection • RX2-PG Connection Error | |

*1. The storage temperature is the temperature during transportation.

PG Option Unit mounting

Install the PG Option Unit to SLOT 2 in the inverter's Cassette Option Connection.

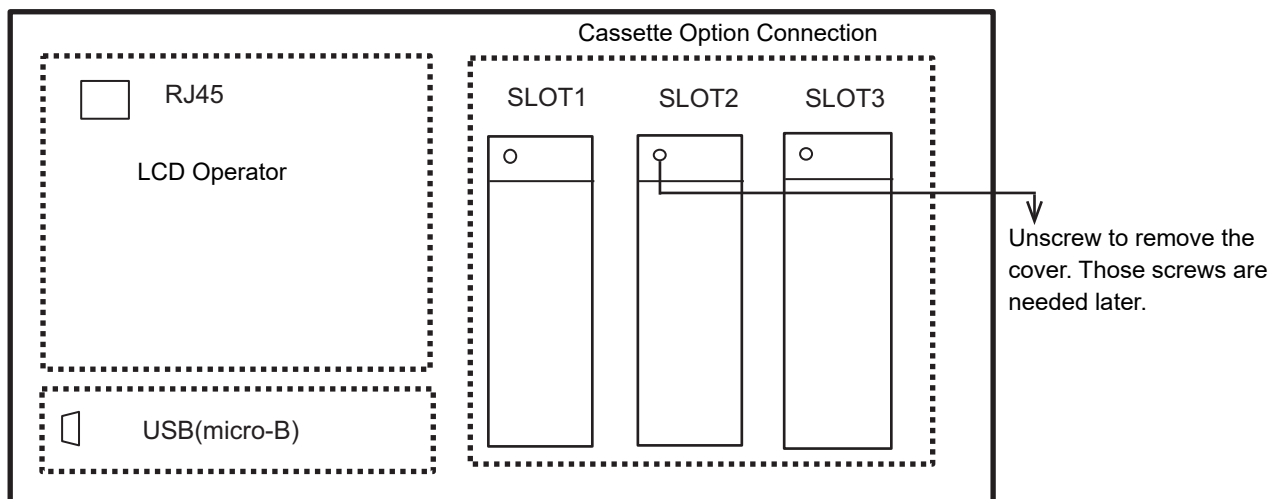


Precautions for Correct Use

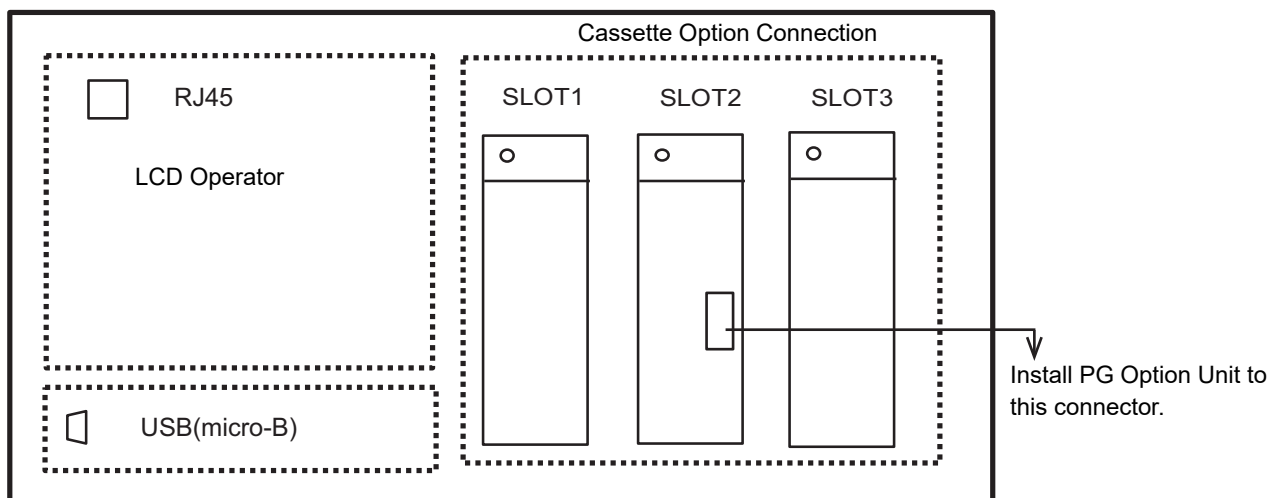
If you install PG Option Unit to SLOT1, the inverter cannot be operated due to the power disconnection.

If you install PG Option Unit to SLOT3, the inverter and PG Option unit may result in damage due to connector's interference.

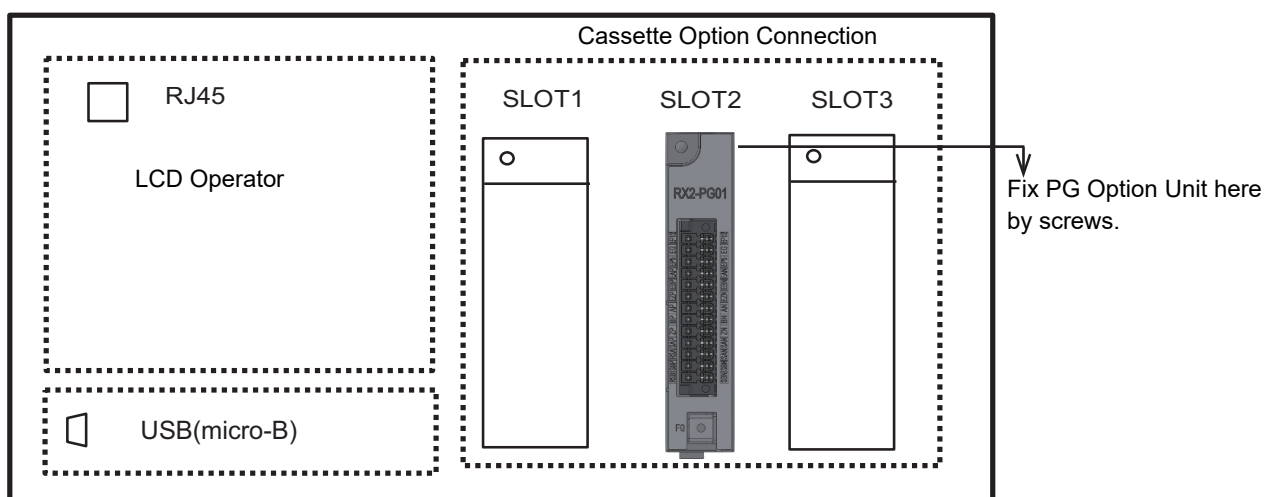
- (a) Remove the cover on the Cassette Option Connection of the main body. The cover is not needed any more but it must be retained because it may be needed in case you operate the inverter temporarily when option unit fails. The screws which had fixed the cover are needed for fixing the PG Option Unit.



(b) Install PG Option Unit to the connector in SLOT2. Do NOT use the other connector located above for PG Option Unit.



(c) Install the PG Option Unit to SLOT2 using the screws which you unscrewed at step 1. Then, connect FG terminal to the function ground.

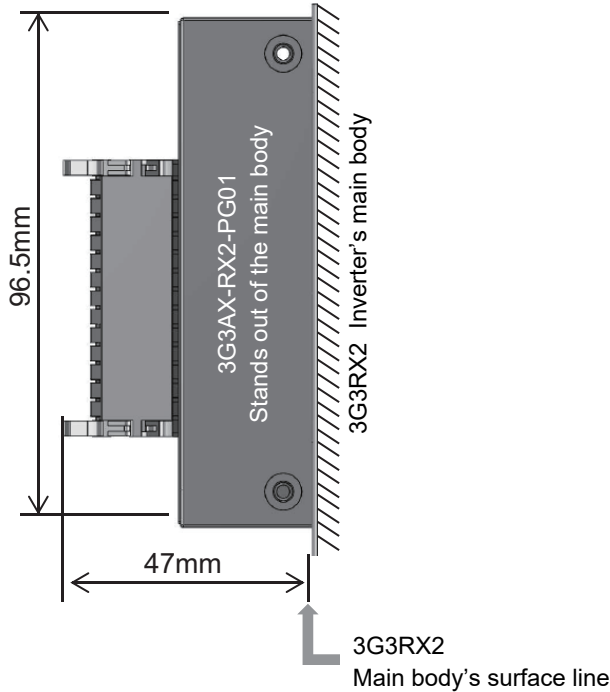


 **Precautions for Correct Use**

- To mount the PG Option Unit, be sure to tightly fix it with the two provided fixing screws after putting the connector securely in place. Otherwise, the inverter cannot operate properly.
- When removing the PG Option Unit from the inverter, be sure to back the cover of the inverter to the original position.

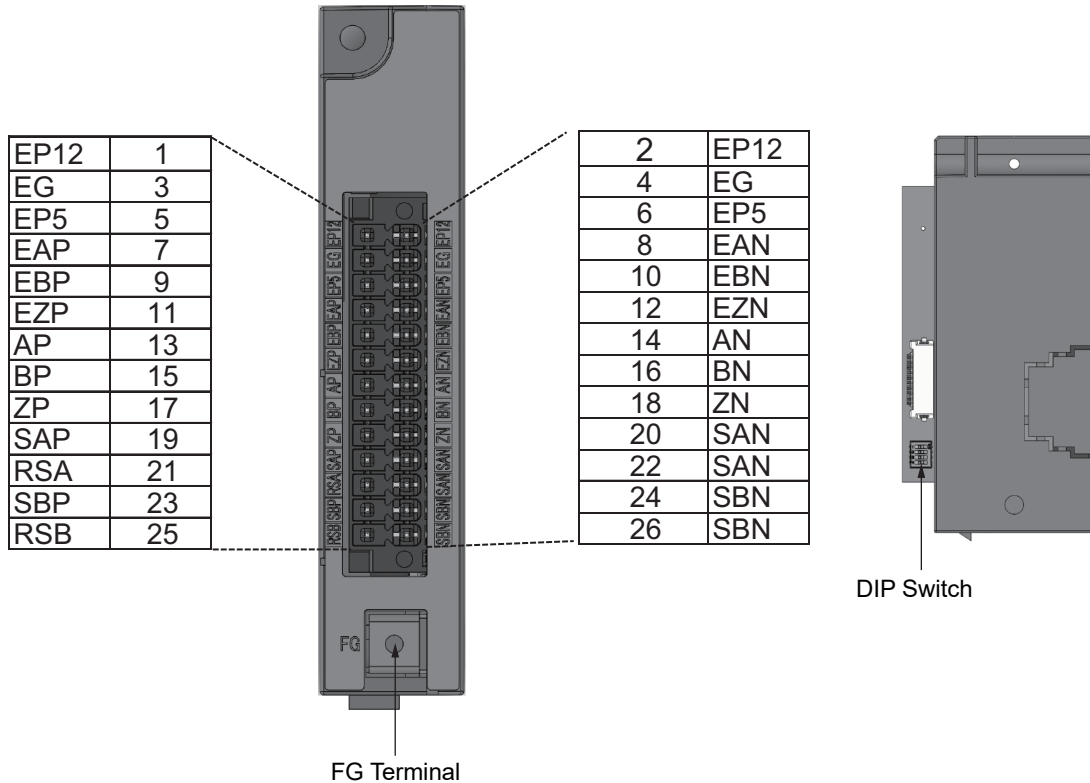
Installation Dimension of PG Option Unit

When you install PG Option Unit 3G3AX-RX2-PG01 to the inverter, it will stand out of the inverter's front surface as following dimension. When you install the unit, take a special care for it.



Terminal Arrangement on PG Option Unit

The arrangement of the terminals on the PG Option Unit 3G3AX-RX2-PG01 is shown below.



● Input Terminals

| Terminal code | Terminal name | Function description | Electronic specifications |
|--|------------------------------------|--|---|
| SAP SAN SBP SBN RSA RSB | Pulse train position command input | <ul style="list-style-type: none"> Pulse train mode selection (P013)*¹ <ul style="list-style-type: none"> Mode 0: 90° phase difference pulse train Mode 1: Forward/Reverse command + pulse train Mode 2: Forward pulse + Reverse pulse RSA: Terminating resistor ON/OFF terminal between SAP and SAN RSB: Terminating resistor ON/OFF terminal between SBP and SBN Built-in terminating resistor value: 150 Ω | Line-driver input 5-VDC receiver input (RS-422 compliant) |
| EAP EAN EBP EBN EZP EZN | Encoder signal input | A/B/Z: Encoder signal input | Photocoupler input (5 VDC line-driver output type rotary encoders supported) |

*1. Select the pulse train mode with the inverter parameter P013.

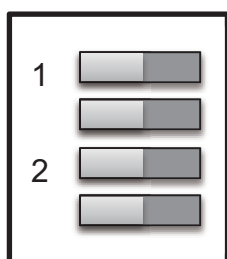
● Output Terminals

| Terminal code | Terminal name | Function description | Electronic specifications |
|----------------------------------|-----------------------|--|--|
| AP AN BP BN ZP ZN | Encoder signal output | Output encoder input pulses in a ratio 1 to 1. | 5 VDC line-driver output (RS-422 compliant) |
| EP5 EP12 EG (Common) | Encoder power supply | EP5: 5 VDC power supply EP12: 12 VDC power supply | Total power supply capacity of EP5 and 12: 250 mA max. |

● DIP Switch

When you slide the dip switch to the left it can be turned OFF and right to turn ON.

All the dip switches are turned OFF at the factory default setting. Set the switches before installing the device.



SW

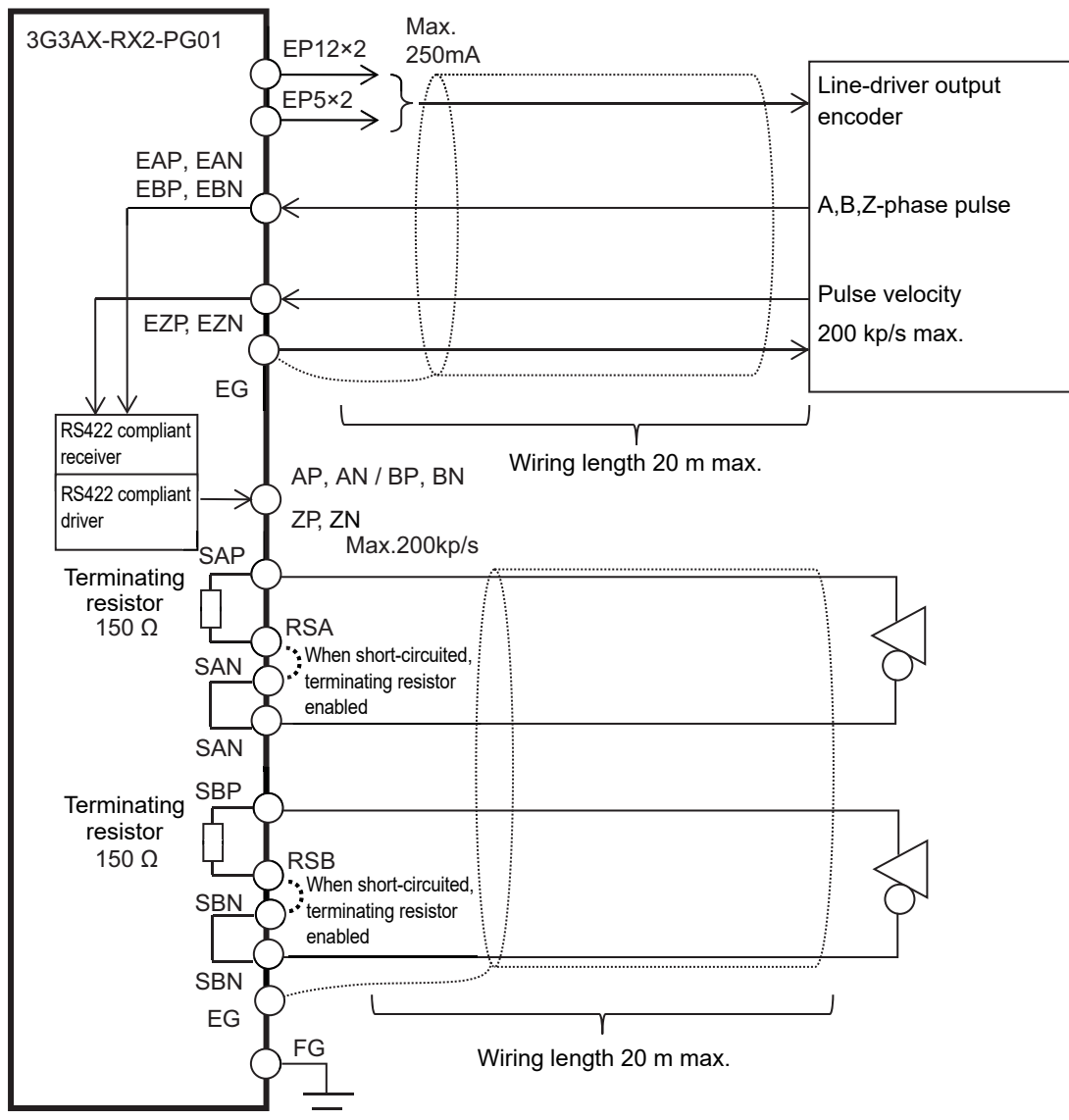
ON

The switches are located behind the unit. You must set the terminal before installation.

| Switch number | Setting description | |
|---------------|---------------------|--|
| 1 | ON | Encoder A and B phase disconnecting detection enabled |
| | OFF | Encoder A and B phase disconnecting detection disabled |
| 2 | ON | Encoder Z phase disconnecting detection enabled |
| | OFF | Encoder Z phase disconnecting detection disabled |
| 3 | ON | Do not change the setting |
| | OFF | |
| 4 | ON | Do not change the setting |
| | OFF | |

Wiring of PG Option Unit

The following describes the wiring of PG Option Unit 3G3AX-RX2-PG01.



The wire length between the encoder and PG Option Unit must be 20 m or shorter.

Use twist pair for the signal line.

When you connect cables, we recommend you to connect an encoder's shielded wire to EG terminal on PG Option Unit. If the cable is not shielded properly, the inverter may incorrectly perform due to the influences of external noises. Generally, shield wires are connected to common signal terminal or chassis earth terminal. However do not connect at multiple points.

Connect FG terminal of PG Option Unit to Function Ground.

If you link-up the encoder power supply terminal of PG Option Unit by relay amplifier, distance among the relay amplifier, PG Option Unit must be 20 meters or shorter.

When you connect a cable between the relay amplifier and PG Option Unit, we recommend you to connect the shielded wire to EG terminal at PG Option Unit.

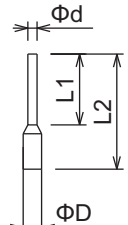
As for the connection between relay amplifier and encoder (connecting method and cable length), ask and confirm the input specifications of relay amplifier to the producer before connecting.

In case the wiring to PG Option Unit exceeds 20 meters, the inverter performs improperly due to the influences of external noise. Take a special care for the wiring of relay amplifier for it.

When you supply the power to the encoder from devices other than PG Option Unit, connect the common of encoder power supply (basic potential) to EG terminal at PG Option Unit.

● Recommending Terminals

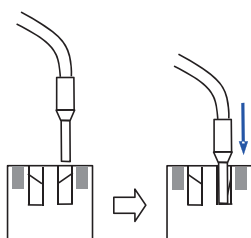
For the improvement of easy wiring and credibility, we recommend those pin-terminals shown in the table below for signal lines.

| Wire size mm ² (AWG) | L1 [mm] | L2 [mm] | Φd [mm] | ΦD [mm] | |
|------------------------------------|---------|---------|---------|---------|---|
| 0.25 (24) | 10.0 | 14.5 | 0.8 | 2.0 |  |
| 0.34 (22) | 10.0 | 14.5 | 0.8 | 2.0 | |
| 0.5 (20) | 10.0 | 16 | 1.1 | 2.5 | |
| 0.75 (18) | 10.0 | 16 | 1.3 | 3.4 | |

Note Those specifications above are different from the recommended pin-terminals for the inverter's main body.

● Insertion Method

Insert the pin-terminal to the terminal block of PG Option Unit. A proper pin-terminal can be inserted without tools.

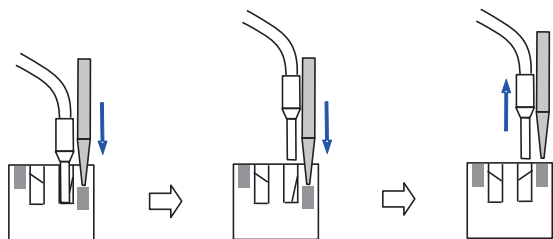


Insert the wire here.

In case you use improper pin-terminals, insert the cable by the order of steps of pull-out method with a flathead screwdriver shown below.

● Pullout Method

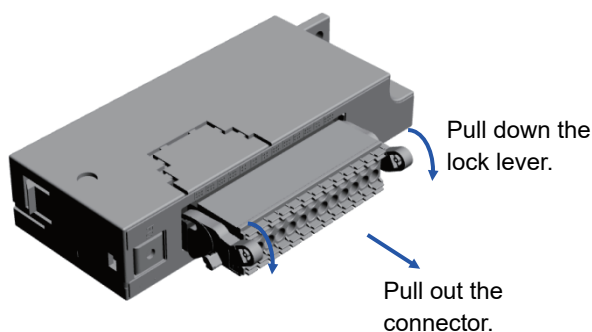
- 1** Push the gray colored part on the PG Option Unit terminal block with a flathead screwdriver (2.5 mm widths or narrower), and the aperture for wire-inserting will open.
- 2** While you are holding the screwdriver in the hole, pull out the wire or pin-terminal.
- 3** Pull out the screwdriver.



Push the gray colored part with your flathead screwdriver. Pull out the wire. Pull out the screw driver.

● Method of Disconnecting the Connector

- 1** Pull down the lock lever to the direction indicated by the arrow to release the lock.
- 2** Pull out the connector.



PG Option Unit Disconnection Detection

The encoder input terminal ((EAP/EAN/EBP/EBN/EZP/EZN) has a function to detect disconnection when the wires are not connected. When you do not connect any encoders (EAP/EAN/EBP/EBN/EZP/EZN not connected), turn the DIP switch 1 and 2 to OFF in order to disable the disconnection function.

As for the encoder without Z-phase, turn the DIP switch 2 to OFF to disable the detection of Z-phase disconnection.

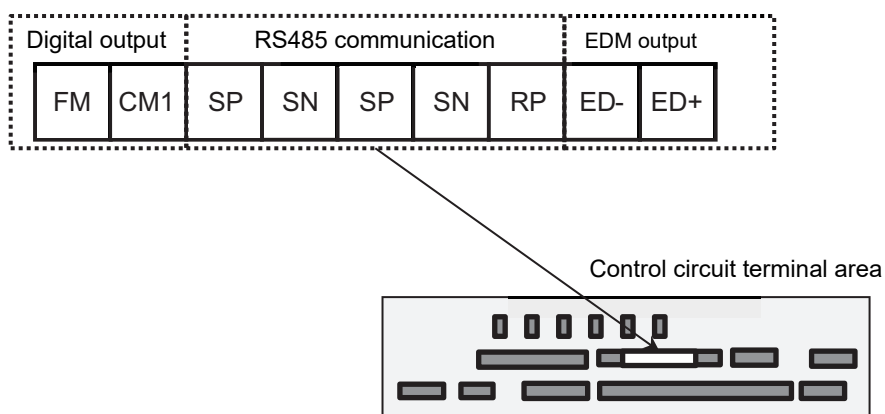
2-3-7 Wiring for RS485-Communication Terminals

The 3G3RX2 Series has an RS485 communications capability that enables the inverter to communicate with an external controller from its RS485 communications terminal block on the control terminal block PCB.

For the communications protocol, the inverter supports the Modbus communication.

This section describes the wiring procedure for the RS485 communications terminal block and the installation of the terminating resistor.

Wiring for RS485 Communications Terminal Block



| Abbreviated Terminal Name | Description | Function |
|---------------------------|--|--|
| SP | RS485 Sending/receiving terminal + side | At + side of Sending/receiving signal of RS485 communications |
| SN | RS485 Sending/receiving terminal - side | At - side of Sending/receiving signal of RS485 communications |
| RP | Enable terminating resistor terminal | A terminal which enables internal terminating resistor (100Ω). The internal terminating resistor can be enabled when you connect – side of RS485 communication sending/receiving terminal (for connecting terminating resistor) to RP. |
| (SN) | RS485 Sending/receiving terminal - side (for connecting terminating resistors) | |
| (CM1) | Signal ground | You can connect a signal ground of an external communication device. (Also for FM terminal) |

Wire size

| Screw size | Tightening torque [N·m] | Wire type | Wire size [mm ²] |
|------------|-------------------------|---------------------------------|---|
| M2 | 0.22 to 0.25 | Solid wire | 0.14 to 1.5 (If two equal-sized wires are connected to one pole: 0.14 to 0.5) |
| | | Stranded wire | 0.14 to 1.0 (If two equal-sized wires are connected to one pole: 0.14 to 0.2) |
| | | Stranded wire with pin terminal | 0.25 to 0.5 |

● Wiring Method

Connect the communication wire to the control circuit terminal block.



Precautions for Correct Use

- Separate signal lines for control from the main circuit cable and other power supply/power lines when wiring.
- Do not solder the wire ends. Doing so may result in a contact failure.
- When pin terminals are not used, the wire strip length must be approximately 5.0 mm.
- Connect the shielded wire to the terminal CM1 (frequency reference common) of the 3G3RX2 Series. Do not connect it to the controller.
- Insulate the cable shielded wire with tape or some other means to prevent them from contact with other signal lines or equipment.

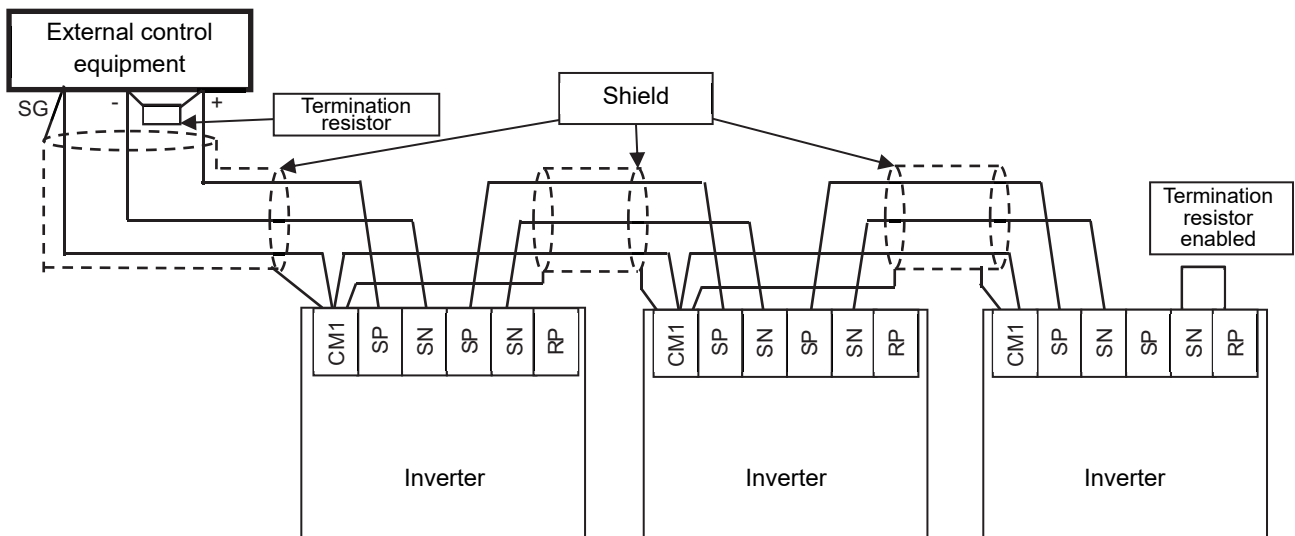
Terminating Resistor Installation

Connect each inverter in parallel as shown below.

For the terminating inverter, short-circuit between terminals RP and SN.

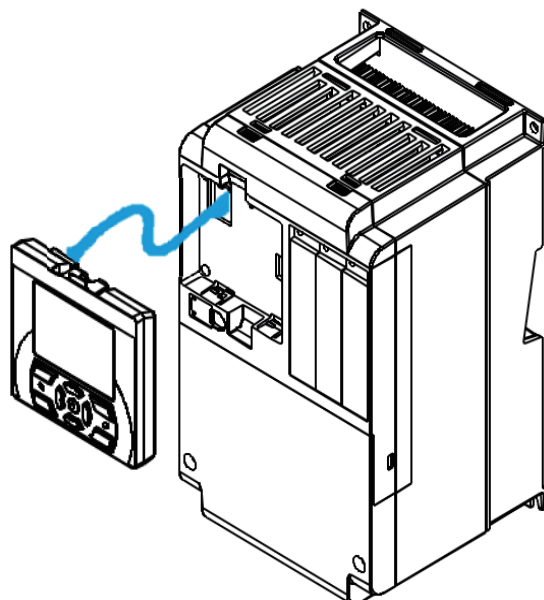
When you connect only one inverter, also short-circuit between terminals RP and SN.

For this inverter, the built-in terminating resistor (100Ω) can be connected by shorting the terminals PR and SN.



2-3-8 Wiring for Digital Operator

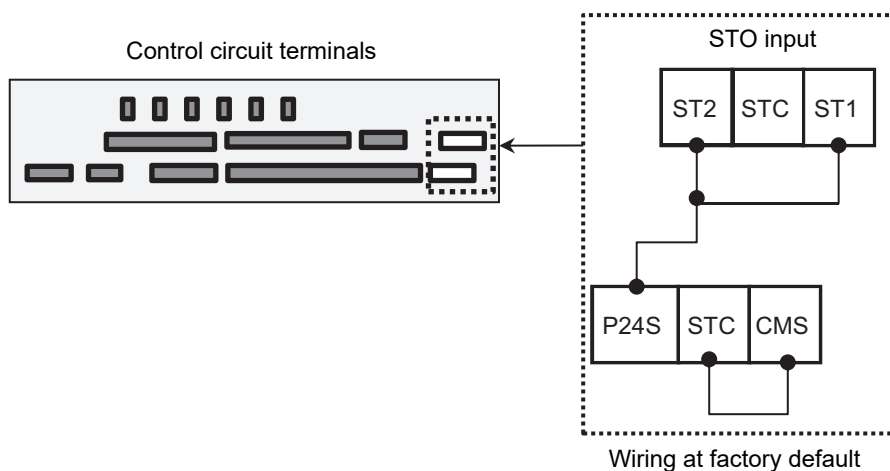
The LCD operator can be used with the panel being taken out the enclosure of the inverter. You can take out the Digital Operator outside the main body for operation. Use optional cables 3G3AX-OPCN 1 (1m) or 3G3AX-OPCN-3 (3m). While power is supplied to the inverter, do not attach or remove the Digital Operator.

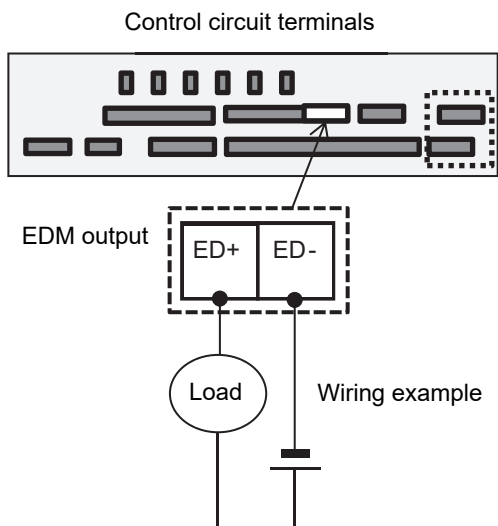


Height: 78mm, Width: 78mm

2-3-9 Wiring for STO Function

The following describes STO input used at STO function and EDM output.





| Terminal code | Terminal name | Description | Electronic characteristics |
|---------------|---|--|---|
| P24S | 24-V Output terminal (dedicated for STO input) | 24-VDC power supply for contact signals dedicated for ST1/ST2 terminal. Common is CMS. | Maximum output current is 100 mA |
| CMS | 24-V output terminal common (dedicated for STO input) | Common terminal of 24-VDC power supply for contact signals dedicated for ST1/ST2 terminal | |
| STC | Input logic switching terminal | This is a STO input logic switching terminal. The input logic can be changed by changing the position of short bar. In case of using external power supply, remove short bars and then it is used as ST1/ST2 input common. | <at sink logic> Short bar: connect between P24S and STC. <at source logic> Short bars: connect between CMS and STC. |
| ST1/ST2 | STO input terminal | Input terminal of STO | Voltage between ST1-STC/ST2-STC <ul style="list-style-type: none"> • ON voltage 15 VDC min. • OFF voltage 5 VDC max. • Maximum allowable voltage 27 VDC • Load current 5.8 mA (at 27 VDC) Internal resistance: 4.7 kΩ |
| ED+ | EDM signal output terminal (+) | + side terminal of EDM signal (STO status monitor) | Open collector output <ul style="list-style-type: none"> • Between ED+/ED- • Voltage depression 4 V or below at ON • Maximum allowable voltage 27 V • Maximum allowable current 50 mA |
| ED- | EDM signal output terminal (-) | - side terminal of EDM signal (STO status monitor) | |

2-3-10 Conditions of Conformity of EU Directives

Specifications

| | |
|-----------|--|
| EMC | EN61800-3:2004/A1:2012 |
| Machinery | IEC61800-5-2:2016 EN ISO 13849-1:2014 EN61800-5-1:2007 |

- This is a product designed for industrial environments. Use in residential area may cause radio interference, in which case the user may be required to take adequate measures to reduce interference.
- This type of PDS is not intended to be used on a low-voltage public network which supplies domestic premises.

Manufacturer and EU Representative

Manufacturer: OMRON Corporation
Shiokoji Horikawa, Shimogyo-ku, Kyoto, 600-8530 Japan

Representative and Importer in EU: OMRON EUROPE B.V.
Wegalaan 67-69, 2132 JD Hoofddorp, The Netherlands

GENERAL:

3G3RX2 series Type inverter is open type AC Inverter with three phase input and three phase output. It is intended to be used in an enclosure. It is used to provide both an adjustable voltage and adjustable frequency to the ac motor. The inverter automatically maintains the required volts-Hz ratio allowing the capability through the motor speed range. It is multi-rated device and the ratings are selectable according to load types by operator with key pad operation.

Compatibility Conditions of EMC Directives

CAUTION for EMC

(Electromagnetic Compatibility)

3G3RX2 series inverter conforms to requirements of Electromagnetic Compatibility (EMC) Directive (2014/30/EU). However, when using the inverter in Europe, you must comply with the following specifications and requirements to meet the EMC Directive and other standards in Europe:



This equipment must be installed, adjusted, and maintained by qualified engineers who have expert knowledge of electric work, inverter operation, and the hazard circumstances that can occur. Otherwise, personal injury may result.

1. Power supply requirements
 - a) Voltage fluctuation must be -15% to +10% or less.
 - b) Voltage imbalance must be $\pm 3\%$ or less.
 - c) Frequency variation must be $\pm 4\%$ or less.
 - d) Total harmonic distortion (THD) of voltage must be $\pm 10\%$ or less.
2. Installation requirement
 - a) 3G3RX2 series includes a built-in EMC filter. The built-in EMC filter must be activated.
 - b) According to EN61800-3 it is mandatory to mention that any inverter with only C3 filter inside may NOT be connected to a low voltage public power supply in residential areas since for these installations C1 is required.

- c) In case of external filter for C2, an additional note is required according to EN61800-3 that “this product may emit high frequency interference in residential areas which may require additional EMC measures”.
- d) According to the EN6100-3-12, an additional AC reactor or DC choke should be installed for reducing harmonics in power line.

3. Wiring requirements

- a) A shielded wire (screened cable) must be used for motor wiring, and the length of the cable must be according to the following table.
- b) The carrier frequency must be set according to the following table to meet an EMC requirement.
- c) The main circuit wiring must be separated from the control circuit wiring.

4. Environmental requirements (to be met when a filter is used)

- a) 3G3RX2 series inverter that is activated built-in EMC filter must be according to 3G3RX2 series specifications.

Table 1

| Model 3G3RX2 | Cat. | Cable length | Carrier frequency | Model 3G3RX2 | Cat. | Cable length | Carrier frequency |
|--------------|------|--------------|-------------------|--------------|------|--------------|-------------------|
| A2004 | C3 | 10m | 2kHz | -- | -- | -- | -- |
| A2007 | C3 | 10m | 2kHz | A4007 | C3 | 10m | 2kHz |
| A2015 | C3 | 10m | 2kHz | A4015 | C3 | 10m | 2kHz |
| A2022 | C3 | 10m | 2kHz | A4022 | C3 | 10m | 2kHz |
| A2037 | C3 | 10m | 2kHz | A4037 | C3 | 10m | 2kHz |
| A2055 | C3 | 5m | 2kHz | A4055 | C3 | 5m | 2kHz |
| A2075 | C3 | 5m | 2kHz | A4075 | C3 | 5m | 2kHz |
| A2110 | C3 | 5m | 2kHz | A4110 | C3 | 5m | 2kHz |
| A2150 | C3 | 10m | 1kHz | A4150 | C3 | 10m | 2kHz |
| A2185 | C3 | 10m | 1kHz | A4185 | C3 | 10m | 2kHz |
| A2220 | C3 | 10m | 1kHz | A4220 | C3 | 10m | 2kHz |
| A2300 | C3 | 5m | 2kHz | A4300 | C3 | 5m | 2kHz |
| A2370 | C3 | 5m | 2kHz | A4370 | C3 | 5m | 2kHz |
| A2450 | C3 | 5m | 2kHz | A4450 | C3 | 5m | 2kHz |
| A2550 | C3 | 5m | 2kHz | A4550 | C3 | 5m | 2kHz |
| --- | --- | --- | --- | B4750 | C3 | 3m | 2kHz |
| --- | --- | --- | --- | B4900 | C3 | 3m | 2kHz |
| --- | --- | --- | --- | B411K | C3 | 3m | 2kHz |
| --- | --- | --- | --- | B413K | C3 | 3m | 2kHz |

- For the power supply lines of the inverter, use a shield braided cable with a minimum cable length, and connect via an EMC compliant input noise filter.
- Ground the cable shield.
- Keep the ground cable as short as possible. For 400-V class inverters, the ground terminal must be connected to the neutral point of a power supply. Also ground the metal control panel as well as the door simultaneously.
- Use shield braided cables also for connection between the inverter and the motor. Keep the cable as short as possible at a length 20 m or less, with the cable shield grounded. Installing a clamp filter near the inverter output terminals is an effective countermeasure.
- Connect the cable shield directly to an earth (ground) plate with a conductive cable clamp.
- With the motor frame grounded directly, connect the ground cable from the motor directly to an EMC compliant input noise filter.
- For the control panel door, use a conductive gasket to improve the shielding effect.
- In the same control panel, do not install equipment that generates by design electromagnetic waves, especially radio waves.

Conditions of Electrical Safety (LVD)

The condition in the next section UL standard explain the condition of the electrical safety. It is necessary to comply with the description items such as temperature condition, installation condition etc.

2-3-11 Compatibility Conditions of UL/CSA Standards

Standards

| | |
|----|---|
| US | UL61800-5-1 |
| CA | CSA 22.2 No.274 |
| FS | IEC61800-5-2:2016 STO SIL3 ISO13849-1:2015 Cat.4 PLe |

UL CAUTION

GENERAL:

Model 3G3RX2 series inverter is an open type AC Inverter with three phase input and three phase output. It is intended to be used in an enclosure. It is used to provide both an adjustable voltage and adjustable frequency to the ac motor. The inverter automatically maintains the required volts-Hz ratio allowing the capability through the motor speed range. It is a multi-rated device and the ratings are selectable according to load types by operator with key pad operation.

| | |
|--------------------------------------|--|
| Markings: | |
| Maximum Surrounding Temperature: | |
| ND (Normal Duty): | 50°C |
| LD (Low Duty): | 50°C*1 |
| VLD (Very Low Duty): | 45°C*1 |
| Storage Environment rating: | 65°C (for transportation) |
| Instruction for installation: | pollution degree 2 environment and Over voltage category III |
| Electrical Connections: | See [Main circuit Wiring Diagram] of this Instruction Manual |
| Interconnection and wiring diagrams: | See [Outline of control circuit] of this Instruction Manual |

*1. For actual use, use within the temperature range indicated in the common specifications.

● 3G3RX2 Series Models Short Circuit Rating and Overcurrent Protection Device Rating

- 3G3RX2-A2□□□ series models

Suitable for use on a circuit capable of delivering not more than (a) rms symmetrical amperes, at (b) V maximum. (see table below)

- 3G3RX2-A4□□□ 3G3RX2-B4□□□ series models

Suitable for use on a circuit capable of delivering not more than (a) rms symmetrical amperes, at (b) V maximum. (see table below)

| | 3G3RX2-□□□□□ | (a) | (b) |
|------|------------------------------|-------------|------|
| 200V | A2004 to A2220 | 5,000A rms | 240V |
| | A2300 to A2550 | 10,000A rms | 240V |
| 400V | A4007 to A4220 | 5,000A rms | 500V |
| | A4300 to A4550, B4750, B4900 | 10,000A rms | 500V |
| | B411K, B413K | 18,000A rms | 500V |

● **Integral**

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Canadian Electrical Code, part1 or the equivalent. (For Canada)

Field Wiring Terminal Conductor Size and Torque Values Making for Field Wiring Terminal

| Model 3G3RX2 | Load Type | Required Torque (N·m) | Conductor size (AWG) | Model 3G3RX2 | Load Type | Required Torque (N·m) | Conductor size (AWG) |
|--------------|-----------|-----------------------|----------------------|--------------|-----------|-----------------------|----------------------|
| A2004 | VLD | 1.4 | 14 | | | | |
| | LD | | | | | | |
| | ND | | | | | | |
| A2007 | VLD | 1.4 | 14 | A4007 | VLD | 1.4 | 14 |
| | LD | | | | | | |
| | ND | | | | | | |
| A2015 | VLD | 1.4 | 14 | A4015 | VLD | 1.4 | 14 |
| | LD | | | | | | |
| | ND | | | | | | |
| A2022 | VLD | 1.4 | 10 | A4022 | VLD | 1.4 | 14 |
| | LD | | | | | | |
| | ND | | | | | | |
| A2037 | VLD | 1.4 | 10 | A4037 | VLD | 1.4 | 12 |
| | LD | | | | 14 | | |
| | ND | | | | | | |
| A2055 | VLD | 3 | 8 | A4055 | VLD | 3 | 10 |
| | LD | | | | 12 | | |
| | ND | | | | | | |
| A2075 | VLD | 3 | 6 | A4075 | VLD | 3 | 8 |
| | LD | | 8 | | 10 | | |
| | ND | | | | | | |
| A2110 | VLD | 4 | 4 | A4110 | VLD | 4 | 8 |
| | LD | | 6 | | | | |
| | ND | | | | | | |
| A2150 | VLD | 2.5 to 3.0 | 3 | A4150 | VLD | 4 | 8 |
| | LD | | 4 | | | | |
| | ND | | | | | | |
| A2185 | VLD | 2.5 to 3.0 | 1 | A4185 | VLD | 4 | 6 |
| | LD | | 2 | | 8 | | |
| | ND | | 3 | | | | |
| A2220 | VLD | 5.5 to 6.6 | 2/0 | A4220 | VLD | 4 | 4 |
| | LD | | 1/0 | | 6 | | |
| | ND | | 1 | | | | |
| A2300 | VLD | 6 | Parallel of 1/0 | A4300 | VLD | 6 | 1 |
| | LD | | 2/0 | | 2 | | |
| | ND | | | | 3 | | |
| A2370 | VLD | 6 to 10 | Parallel of 1/0 | A4370 | VLD | 15 | 1 |
| | LD | | Parallel of 1/0 | | | | |
| | ND | 15 | 4/0 | | | | |

| Model 3G3RX2 | Load Type | Required Torque (N·m) | Conductor size (AWG) | Model 3G3RX2 | Load Type | Required Torque (N·m) | Conductor size (AWG) |
|--------------|-----------|-----------------------|----------------------|--------------|-----------|-----------------------|----------------------|
| A2450 | VLD | 6 to 10 | Parallel of 2/0 | A4450 | VLD | 15 | 1/0 |
| | LD | | Parallel of 1/0 | | LD | | 1 |
| | ND | | Parallel of 1/0 | | ND | | |
| A2550 | VLD | 10 to 12 | Parallel of 3/0 | A4550 | VLD | 6 to 10 | Parallel of 1/0 |
| | LD | | Parallel of 3/0 | | LD | 15 | 2/0 |
| | ND | | 350kcmil | | ND | 1/0 | |
| | | | | B4750 | VLD | 10 to 12 | Parallel of 1/0 |
| | | | | | LD | | |
| | | | | | ND | | |
| | | | | B4900 | VLD | 10 to 12 | Parallel of 2/0 |
| | | | | | LD | | Parallel of 1/0 |
| | | | | | ND | | |
| | | | | B411K | VLD | 10 to 12 | Parallel of 3/0 |
| | | | | | LD | | Parallel of 2/0 |
| | | | | | ND | | |
| | | | | B413K | VLD | 10 to 12 | P. of 250kxmil |
| | | | | | LD | | Parallel of 4/0 |
| | | | | | ND | | Parallel of 3/0 |

Note 1. Temperature rating of field wiring installed conductors is 75°C only.

2. Use Copper conductors only.

Required Protection by Fuse and Circuit-breakers

● 200V class

| Model 3G3RX2 | Type | Fuse | | Circuit Breaker | |
|--------------|--------------|----------------|-------------|-----------------|-------------|
| | | Maximum Rating | | Maximum Rating | |
| | | Voltage (V) | Current (A) | Voltage (V) | Current (A) |
| A2004 | Class J or T | 600 | 15 | - | - |
| A2007 | Class J or T | 600 | 30 | - | - |
| A2015 | Class J or T | 600 | 40 | - | - |
| A2022 | Class J or T | 600 | 40 | - | - |
| A2037 | Class J or T | 600 | 50 | - | - |
| A2055 | Class J or T | 600 | 100 | - | - |
| A2075 | Class J or T | 600 | 150 | - | - |
| A2110 | Class J or T | 600 | 150 | - | - |
| A2150 | Class J or T | 600 | 150 | - | - |
| A2185 | Class J or T | 600 | 200 | - | - |
| A2220 | Class J or T | 600 | 200 | - | - |
| A2300 | Class J or T | 600 | 300 | - | - |
| A2370 | Class J or T | 600 | 300 | - | - |
| A2450 | Class J or T | 600 | 400 | - | - |
| A2550 | Class J or T | 600 | 500 | - | - |

● 400V class

| Model 3G3RX2 | Type | Fuse | | Circuit Breaker | |
|-----------------|--------------|----------------|-------------|-----------------|-------------|
| | | Maximum Rating | | Maximum Rating | |
| | | Voltage (V) | Current (A) | Voltage (V) | Current (A) |
| A4007 | Class J or T | 600 | 15 | - | - |
| A4015 | Class J or T | 600 | 20 | - | - |
| A4022 | Class J or T | 600 | 30 | - | - |
| A4037 | Class J or T | 600 | 30 | - | - |
| A4055 | Class J or T | 600 | 75 | - | - |
| A4075 | Class J or T | 600 | 75 | - | - |
| A4110 | Class J or T | 600 | 75 | - | - |
| A4150 | Class J or T | 600 | 100 | - | - |
| A4185 | Class J or T | 600 | 100 | - | - |
| A4220 | Class J or T | 600 | 100 | - | - |
| A4300 | Class J or T | 600 | 200 | - | - |
| A4370 | Class J or T | 600 | 200 | - | - |
| A4450 | Class J or T | 600 | 200 | - | - |
| A4550 | Class J or T | 600 | 250 | - | - |
| B4750 | Class J or T | 600 | 300 | - | - |
| B4900 | Class J or T | 600 | 400 | - | - |
| B411K | Class J or T | 600 | 500 | - | - |
| B413K | Class J or T | 600 | 500 | - | - |

2-3-12 Korean Radio Regulation (KC)

사용자안내문

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

Guide for Users

This equipment has been evaluated for conformity in a commercial environment.

When used in a residential environment, it may cause radio interference.

2-3-13 Reference Manual for Options

The following describes outlines of option and peripheral devices and reference manual.

Regenerating Braking Unit (3G3AX-RBU □□□)

When you desire to reduce the motor's deceleration time, use this unit in combination with braking resistor

| Name | Instruction Manual number |
|--|---------------------------|
| Regenerative Braking Unit 3G3AX-RBU □□ User's Manual | I563-E1 |

PG Option Unit (3G3AX-RX2-PG01)

A High accuracy operation which suppresses velocity fluctuation and positional control by pulse train position command input is achieved by feedback after detecting the rotation velocity of the encoder-equipped motor.

| Name | Manual number |
|---|---------------|
| High-function General-purpose Inverter RX2 Series User's Manual | I620-E1 |

CX-Drive

This is a tool which enables you to edit inverter's parameter and monitor the inverter status.

| Name | Manual number |
|---------------------------|---------------|
| CX-Drive Operation Manual | W453-E1 |

DriveProgramming

You can implement an easy sequence control by a single inverter.

| Name | Manual number |
|--------------------------------|---------------|
| DriveProgramming User's Manual | I620-E1 |

3

Operation

This section describes the LCD Operator and the support tool “CX-Drive”.

| | |
|--|-------------|
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| | |
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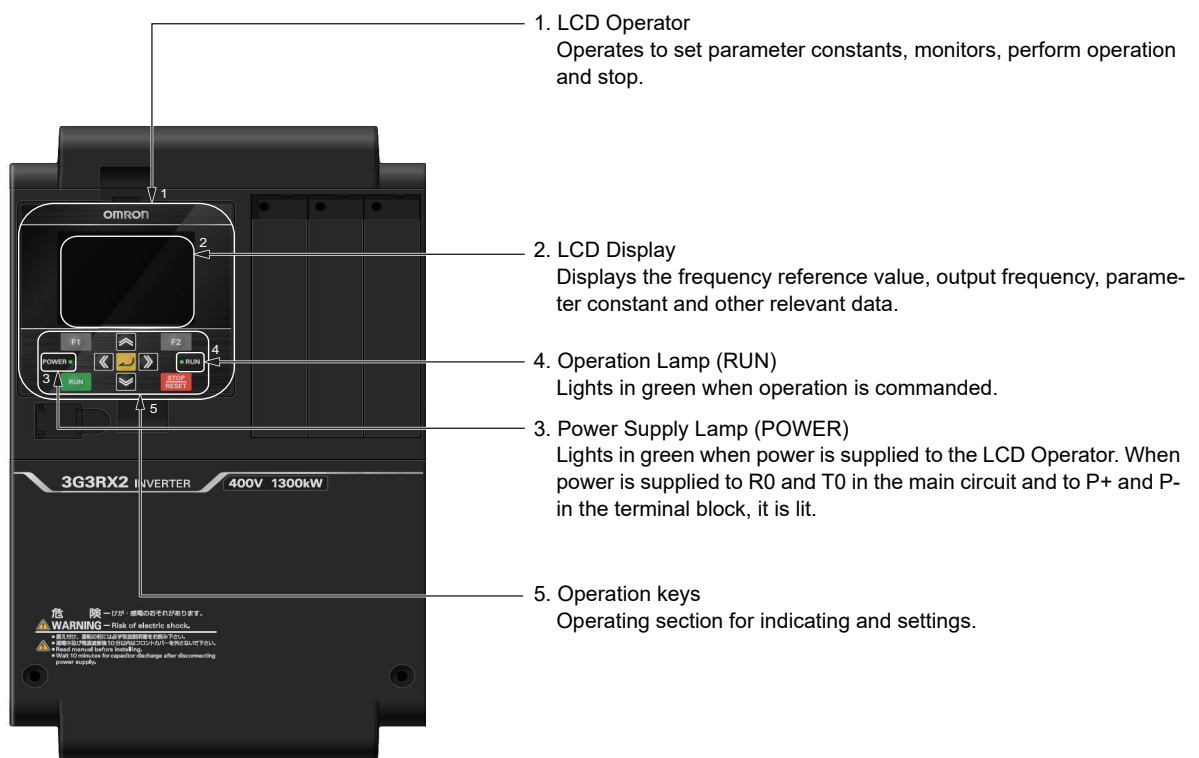
3-1 Overview of LCD Operator

Overview of LCD Operator is described.

This section describes the overview in the state that date and time are displayed in trip history and in retry history. In purchasing, the date and the time are not displayed. Instead, “-” is displayed. If you desire to display them, refer to section 3-1-5 *How to Set Battery and the Time Setting* on page 3-12, and set optional batteries (CR2032, 3V) to the LCD operator in order to operate clock function.

3-1-1 Part Names and Descriptions

Name and function of each part of the LCD Operator is described below.



3-1-2 Names of Operation Keys



| No | Image of the key | Name | Function |
|----|------------------|----------------|--|
| 1 | | F1 key | Displays functions such as navigation to the home screen and cancellation at the bottom left of the screen. |
| 2 | | F2 key | Displays functions such as data storage at the bottom right of the screen. |
| 3 | | RUN key | The device runs when this key is enabled. |
| 4 | | STOP/RESET key | Performs deceleration stop and trip reset. |
| 5 | | Enter key | Proceeds to the display on the lower layer. When it is changing the parameter, it returns to the original display after confirming and documenting the values. |
| 6 | | Increment key | Moves the cursor upward and increases parameter numbers or parameter data. |
| 7 | | Decrement key | Moves the cursor downward and decreases parameter numbers or parameter data. |
| 8 | | Left key | Moves the cursor leftward. Return to the previous mode when the display indicates navigation level. |
| 9 | | Right key | Moves the cursor rightward. Proceed to the next mode when the display indicates navigation level. |

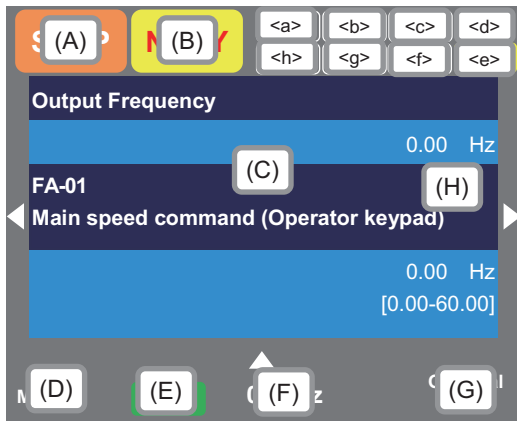


Precautions for Safe Use

Establish an emergency stop button separately from the stop button at this operator because this button is only available when function is set.

3-1-3 LCD Display








Outline of Display Screen










| Number | Description |
|--------|---|
| (A) | Displays the operational status |
| (B) | Displays the warning status |
| (C) | Displays data/parameters |
| (D) | Displays details of the function assigned to the F1 key. |
| (E) | Displays the operation of RUN key on the LCD operator. |
| (F) | Displays frequency command, torque command, inverter name, clock, etc. The function to be displayed in this section can be selected using the F2 key (option) on the main screen. |
| (G) | Displays details of the function assigned to the F2 key. |
| (H) | When soft-lock function is enabled, the [LKS] mark is displayed. |

| Number | Name | Description |
|--------|-------------------|--|
| <a> | Power status | Displays the type of input power supply. |
| | SET function | SET terminal function: Displays the first setting or second setting |
| <c> | Parameter | Displays the status of display restriction mode. |
| <d> | Screen No. | Displays the screen number. |
| <e> | STO function | Displays the STO command. |
| <f> | Control mode | Displays the command control mode. |
| <g> | Drive Programming | Displays the program operation of DriveProgramming. |
| <h> | Special status | Displays the operation of special function. |





Display (A): Operation Status Display

| No. | Indication | Description |
|-----|---|--|
| A1 |  | Displayed during normal rotation operation. There is a parameter that cannot be changed during operation. |
| A2 |  | Displayed during reverse rotation operation. There is a parameter that cannot be changed during operation. |
| A3 |  | Output is in process by 0Hz command. This is also displayed by DB, FOC, and SON functions. There is a parameter that cannot be changed during operation. |
| A4 |  | Displayed during trip after the occurrence of error. For errors that cannot be canceled, perform reset operation to cancel. |
| A5 |  | Displayed when setting inconsistency occurs. Resolve the inconsistency. |
| A6 |  | <p>This is displayed when the device is forcibly stopped by a function although an operation command is issued.</p> <ul style="list-style-type: none"> • The operation command is issued with frequency command at 0Hz. • When the operation command is issued from a source other than the LCD Operator, the device is stopped by the STOP key on the LCD Operator. • When the operation command is issued from a source other than the LCD Operator, the device is stopped by the breaking terminal function [RS], [FRS], etc. • The device is stopped by the instantaneous power failure non-stop function. <p>At this time, the RUN lamp blinks.</p> |
| A7 |  | <p>The operation is suspended due to lack of operation command.</p> <p>If the operation command is issued from the LCD operator, the operation is stopped when the breaking function is enabled.</p> |

Display (B): Warning Status Display

| No. | Indication | Description |
|-----|---|--|
| B1 |  | This is displayed by the following functions. <ul style="list-style-type: none"> • Under overload limit • Under torque limit • Under overcurrent suppression • Under overvoltage suppression • Under upper/lower limit operation • Under jump frequency operation • Under minimum frequency limit |
| B2 |  | This is displayed by the following functions. <ul style="list-style-type: none"> • Overload advance notice • Motor thermal advance notice • Inverter thermal advance notice • Motor heating advance notice |
| B3 |  | Displayed during retry standby or restart standby. |
| B4 |  | Operation is not started even if the operation command is issued. <ul style="list-style-type: none"> • Under insufficient voltage of the main power • Under operation only by the 24V power supply • Under reset operation • Off when the [REN] terminal function is enabled |
| B5 |  | Displayed upon the fan life advance notice. |
| B6 |  | Displayed upon the capacitor life advance notice on the circuit board. |
| B7 |  | Displayed upon the fan life advance notice and capacitor life advance notice on the circuit board. |
| B8 | (None) | A status other than above |

Display (E): Display of RUN Key Function on the LCD Operator

| No. | Indication | Description |
|-----|---|---|
| E1 |  | Normal rotation by the RUN key on the LCD operator |
| E2 |  | Reverse rotation by the RUN key on the LCD operator |
| E3 |  | The RUN key is enabled by the [F-OP] terminal or LCD operator. (Normal rotation) |
| E4 |  | The RUN key is enabled by the [F-OP] terminal or LCD operator. (Reverse rotation) |
| E5 | (None) | The command other than the RUN key is selected |

Display <a>: Power Status Display

| No. | Indication | Description |
|-----|------------|---|
| a1 | (None) | There is input to the main power supply/control power supply. |
| a2 | CTRL | There is input to the control power supply. |
| a3 | 24V | The device runs with 24V input to P+/P-. |

Display : Display of SET Function Operation Status

| No. | Indication | Description |
|-----|------------|---|
| b1 | M1 | The [SET] terminal is not selected or the [SET] terminal is selected but the function is disabled. (common setting and first setting are enabled) |
| b2 | M2 | The [SET] terminal is selected and the function is enabled. (common setting and second setting are enabled) |

Display <c>: Selection of Parameter Display

| No. | Indication | Description |
|-----|------------|-----------------------------------|
| c1 | (None) | All-parameter display mode. |
| c2 | UTL | Individual-function display mode. |
| c3 | USR | User-setting display mode. |
| c4 | CMP | Data-comparison display mode. |
| c5 | MON | Monitor display mode. |

Display <d>: List of Monitor Screen Numbers

Monitor screen numbers are listed below:

| No. | Name | Screen number |
|-----|---|---------------|
| 1 | Three-line monitor screen | H01 |
| 2 | Setting screen for rotating direction of LCD operator | H02 |
| 3 | Setting screen | H03 |
| 4 | Monitor with large characters | H04 |
| 5 | Selection screen for parameter code | H05 |
| 6 | Trip history | H06 |
| 7 | Trip currently occurring | H07 |
| 8 | Detailed trip history screen | H08 |
| 9 | Retry history | H09 |
| 10 | Detailed retry history screen | H10 |
| 11 | Detailed screen for limitation status icon | H11 |
| 12 | Home screen option | o01 |
| 13 | Inverter name setting | o02 |
| 14 | Selection of data displayed at the bottom center | o03 |
| 15 | Menu screen | M01 |
| 16 | R/W function screen | R01 |
| 17 | Screen for selecting data uploaded using the R/W function | R02 |
| 18 | Screen for selecting saving location for data uploaded using the R/W function | R03 |
| 19 | Screen for displaying progress status of uploading using the R/W function | R04 |
| 20 | Screen for selecting data downloaded using the R/W function | R05 |

| No. | Name | Screen number |
|-----|--|---------------|
| 21 | Screen for selecting the location for reading data that is downloaded using the R/W function | R06 |
| 22 | Screen for displaying progress status of downloading using the R/W function | R07 |
| 23 | System settings screen | S01 |
| 24 | Language selection screen | S02 |
| 25 | Dimming setting screen | S03 |
| 26 | Setting screen for automatic light off time | S04 |
| 27 | Setting screen for dimming at light off | S05 |
| 28 | Setting screen for automatic home transition time | S06 |
| 29 | Monitor screen for basic inverter information | S07 |
| 30 | Selection screen for operator initialization | S08 |
| 31 | Operator version display screen | S09 |
| 32 | Date and time screen | S11 |
| 33 | Date and time setting screen | S12 |
| 34 | Selection screen for date and time display format | S13 |
| 35 | Setting screen for battery level warning | S14 |
| 36 | Inverter model selection screen | S19 |
| 37 | Read lock selection screen | S21 |
| 38 | Selection screen for blinking at the time of trip | S22 |
| 39 | Color setting screen | S23 |
| 40 | Selection screen for self-check mode | S25 to S35 |
| 41 | Setting screen for automatic home screen | S36 |
| 42 | Remote mode switching screen | S38 |
| 43 | Scroll menu | L01 |
| 44 | Scroll screen | L02 |
| 45 | Message screen | *1 |

*1. If a message is displayed, see 12-3-3 *Checking Message* on page 12-30.

Display <e>: STO Function Display

| No. | Display | Description |
|-----|---------|--|
| e1 | (None) | Operation of ST1 and ST2 are both enabled (contact point ON), the inverter's output motion is also enabled. |
| e2 | P-1A | From the status that the operation of ST1 and ST2 are both enabled (contact point ON), only ST2 transitions to STO (contact point OFF) and later ST1 is kept operation-enabled (contact point ON) for the STO switching allowable time [bd-02]. |
| e3 | P-2A | From the status that the operation of ST1 and ST2 are both enabled (contact point ON), only ST1 transitions to STO (contact point OFF) and later ST2 is kept operation-enabled (contact point ON) for the STO switching allowable time [bd-02]. |
| e4 | P-1b | (1) The status of P-1A or P-1b continued for the STO switching allowable time [bd-02]. (2) At the status that the operation of ST1 and ST2 were both enabled (contact point ON), only ST2 transitioned to STO (contact point OFF) and later the operation was allowed (contact point ON). |
| e5 | P-2b | (1) The status of P-2A or P-2b continued for the STO switching allowable time [bd-02]. (2) At the status that the operation of ST1 and ST2 were both enabled (contact point ON), only ST1 transitioned to STO (contact point OFF) and later the operation was allowed (contact point ON). |
| e6 | P-1C | From the status that the operation of ST1 and ST2 are both STO (contact point OFF), ST2 transitions to be operation-allowed (contact point ON), and later ST1 is kept STO (contact point OFF) for the STO switching allowable time [bd-02]. |

| No. | Display | Description |
|-----|---------|---|
| e7 | P-2C | From the status that the operation of ST1 and ST2 are both STO (contact point OFF), ST1 transitions to be operation-allowed (contact point ON), and later ST2 is kept STO (contact point OFF) for the STO switching allowable time [bd-02]. |
| e8 | STO | ST1 and ST2 are both in the STO status (contact point OFF). |

Display <f>: Control Command Mode Display

| No. | Indication | Description |
|-----|------------|----------------------------|
| f1 | (None) | The speed control mode. |
| f2 | TRQ | The torque control mode. |
| f3 | POS | The position control mode. |

Display <g>: DriveProgramming Operation Mode Display

| No. | Indication | Description |
|-----|------------|-----------------------------------|
| g1 | (None) | DriveProgramming is not selected. |
| g2 | Ez_S | DriveProgramming is stopped |
| g3 | Ez_R | DriveProgramming is working |

LCD Display Backlight

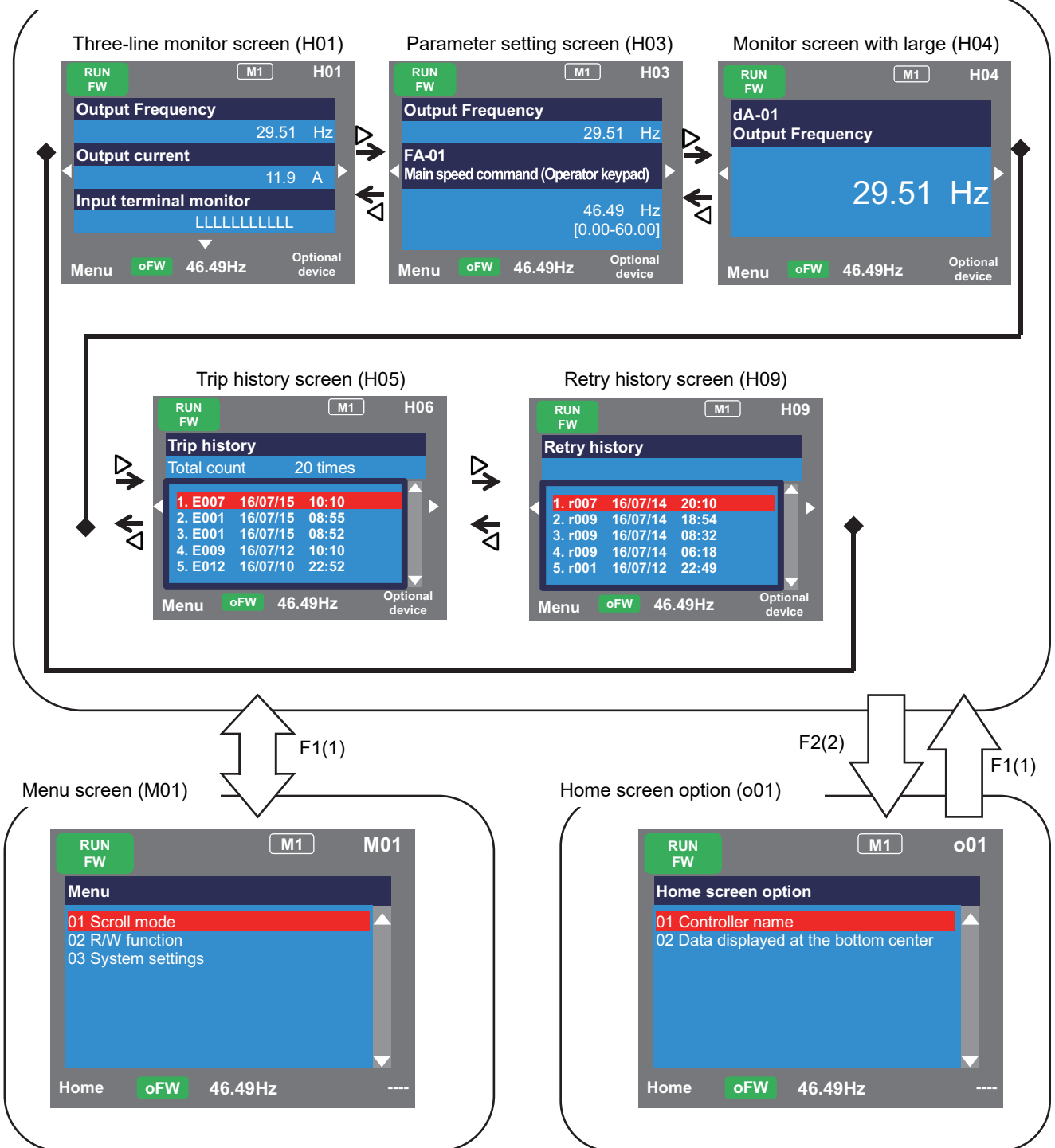
For LCD display backlight, two colors are provided: white and orange.

Colors varying depending on the inverter's status are shown in the table below:

| Backlight color | Status |
|---|---|
| White | Normal (not related to inverter's operation and stop) |
| Orange | Warning (parameter discrepancy) |
| White and orange (blinking alternatively at one-second interval) | Trip (equivalent to alarm LED) |

3-1-4 Transition of Screen Display

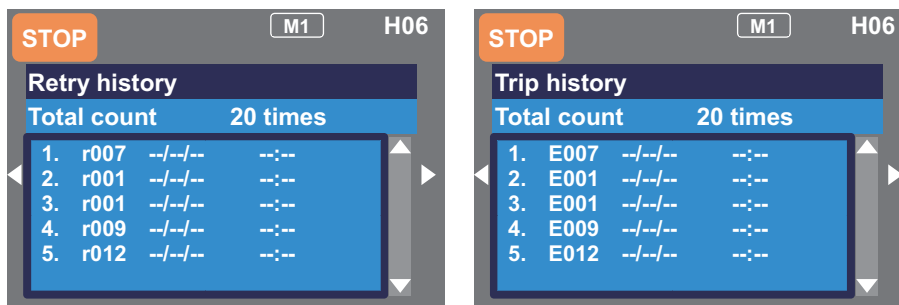
Main monitor screen





Precautions for Correct Use

- To display time in retry history and trip history, you need to configure clock settings.
- To use the clock function, you need an optional battery that is separately sold (CR2032, 3V).
- When the clock function is not used with being retained, the display of error history and trip history are shown below.

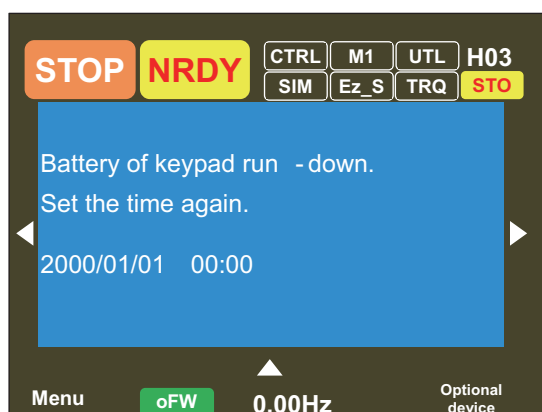


3-1-5 How to Set Battery and the Time Setting

The clock function of LCD operator can display the date and the time of trip/retry history. To use this function, prepare an optional battery (CR2032, 3V) for the LCD operator.

The procedure to set the clock function and insert a battery is as follows:

- 1** Show a system setting screen of LCD operator.
Select "10: battery level warning."
Then select "01: valid."
- 2** Power-off the inverter.
Make sure that the power light of LCD operator is off.
- 3** Remove the LCD operator from the inverter.
- 4** Open the lid on the back side of LCD operator and insert a battery.
Make sure the positive side of the battery can be seen.
- 5** Close the lid and set the LCD operator to the inverter.
- 6** Power-on the inverter.
- 7** Make sure that the following screen comes up. Set the date and time.



8 Make sure that the battery is inserted properly.

Turn OFF the inverter and turn it ON again.

When the battery is properly inserted, the inverter starts without errors.

If the same screen (procedure.7) comes up again, the battery is not set properly. Please try the setting procedure from the beginning.

You can set the time by "09: Date and time" of the system setting screen. However, remember that you should insert battery and set the time/date to activate the clock function. Also do not forget to switch the battery level warning to "valid" for the battery charge detection.



Precautions for Safe Use

- When disposing of LCD operators and wasted batteries, follow the applicable ordinances of your local government. When disposing of the battery, insulate it using tape.



廢電池請回收

The following display must be indicated when products using lithium primary batteries (with more than 6 ppb of perchlorate) are transport to or through the State of California, USA.

Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate

Label or mark the above display on the exterior of all outer shipping packages of your products when exporting your products which the lithium primary batteries (with more than 6 ppb of perchlorate) are installed to the State of California, USA.

- Do not short + and – , charge, disassemble, heat, put into the fire, or apply strong impact on the battery. The battery may leak, explode, produce heat or fire. Never use the battery which was applied strong impact due to such as fall on the floor, it may leak.
- UL standards establish that the battery shall be replaced by an expert engineer. The expert engineer must be in charge of the replacement and also replace the battery according to the method described in this manual.



Additional Information

- Even without battery, parameters saved in LCD operator and programs for DriveProgramming are retained
- If you cannot see what is displayed on the LCD operator because the service life is near its end, replace the LCD operator.

3-2 Parameter Settings

Two procedures are provided for parameter settings:

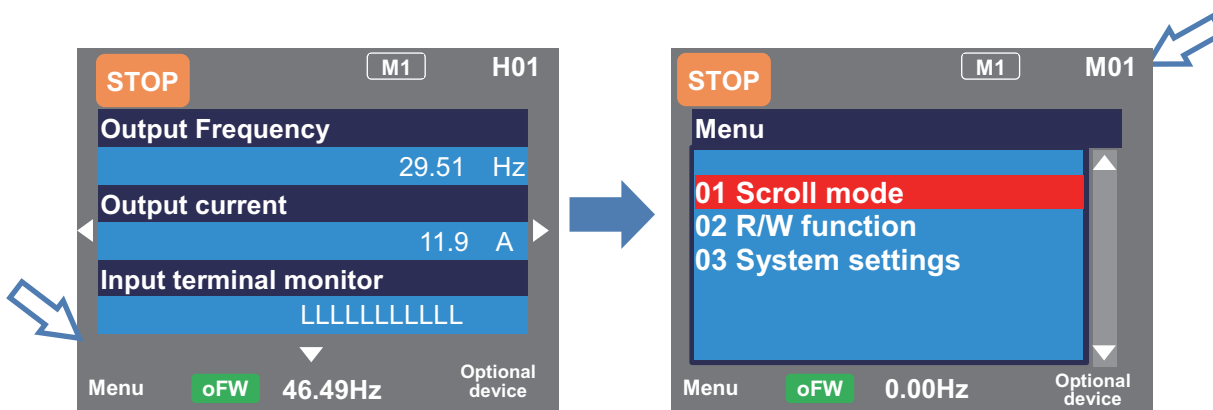
- “scroll mode” in which you can check list of setting data of parameters
- “concurrent monitor mode” you can change parameters while watching the monitor under operation.

3-2-1 Scroll Mode

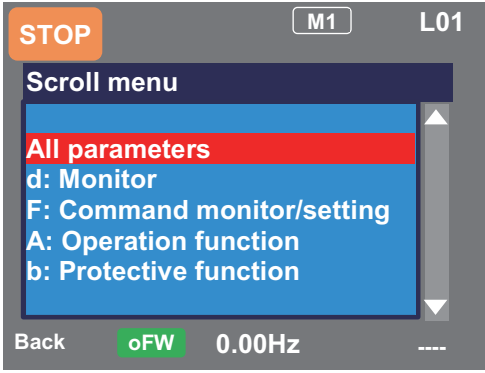
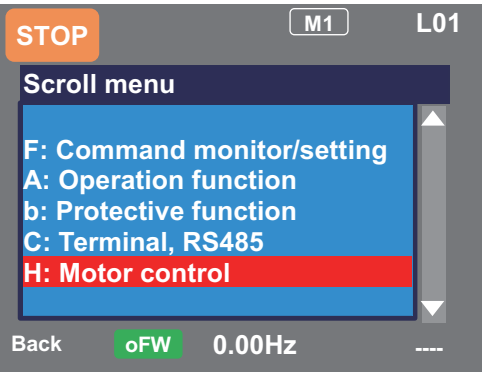


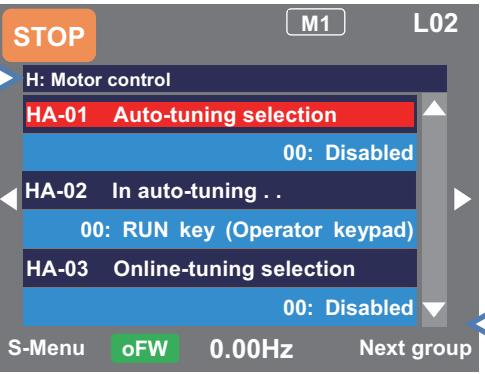


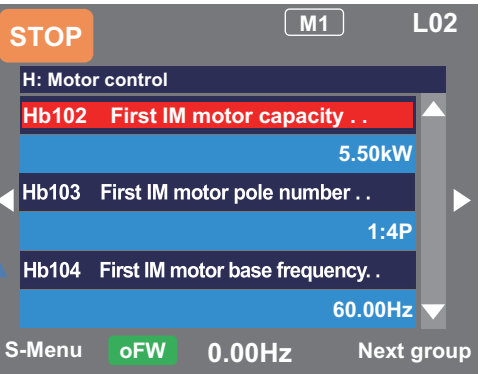


When configuring basic settings of motor, base frequency, rated voltage of motor, input and output of terminals, as well as when configuring individual functions, change parameters in the scroll mode.

You can check list of setting data of parameters in the scroll mode, therefore, it is also useful when checking the settings.

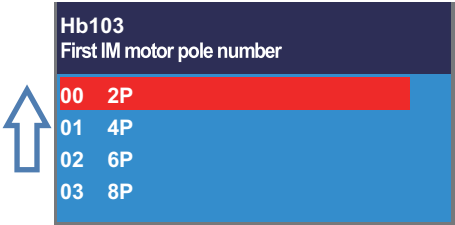


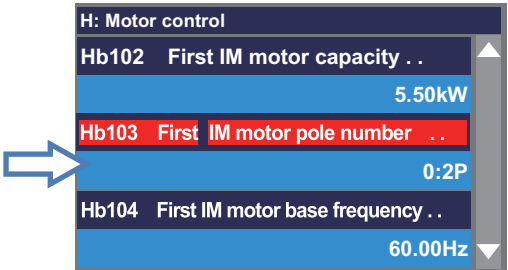
Press F1 (Menu) key on the screen that is displayed upon power-on (Multi-monitor in the example below) to move to the system settings screen (M01).



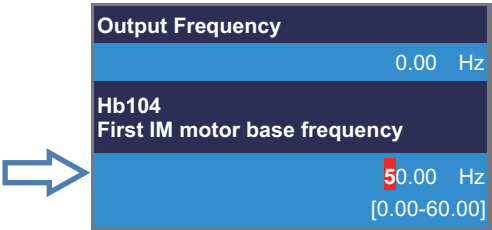




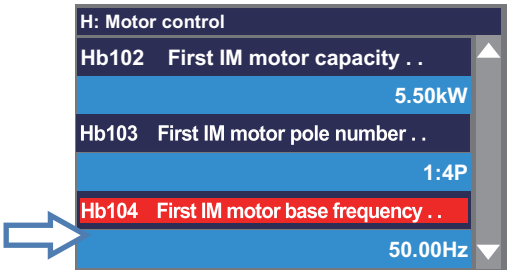
Scroll menu - Parameter selection screen



| Set-up procedure | Action |
|---|---|
|  | <p>Choose the scroll mode on the system settings screen (M01) and press the Enter key to show the scroll menu (L01).</p> |
|  | <p>Choose a group you want to browse using the up and down ( ) keys, and then press the Enter key to move to the parameter list display. For example, select “H: Motor control”.</p> <p>Example: In the example shown below, the Hb group, which is a basic parameter of induction motor, is checked, and a parameter is changed.</p> |
|  | <p>Parameters of “H: Motor control” are displayed.</p> <p>Using the up and down ( ) keys, you can check parameters. Pressing the F2(2) key jumps to the top [Hb102] of the next group of [HA].</p> <p>(Tips)</p> <p>You can jump to the top parameter of the sub-group in the group ([HA], [Hb], etc. in the case of group H) using the F2(2) key (transition is performed in one direction).</p> <p>Example of group H: ...->HA->Hb->HC->Hd->HA->...</p> |
|  | <p>Using the up and down ( ) keys, you can check parameters. Choose the parameter to change, and then press the Enter key.</p> <p>Example1) [Hb103] The parameter to change the first IM motor pole number.</p> <p>Example2) [Hb104] The parameter to change the first IM motor base frequency.</p> |

Example1) Change [Hb103] First IM motor pole number

| Set-up procedure | Action |
|---|--|
|  | <p>If the number of motor poles is 2, using the up and down ( ) keys, adjust it to "00 2P", and then press the F2(Save) key.</p> <p>Data is saved when the F2(2) key is pressed. It is still saved even after the device is turned off. When configuring an item, the entire screen changes to the screen for setting the item. When not saving the setting after changing it, press the F1(Back) key. The screen returns to the parameter list display.</p> |
|  | <p>To confirm if the data is correctly changed, check the lower section of the parameter display. Press the F1(1) key three times to return to the monitor.</p> |

Example2) Change [Hb104] First IM motor base frequency.

| Set-up procedure | Action |
|---|---|
|  | <p>You can change the right-most digit of data area. Change the value using the arrow (   ) keys, and then press the F2(2) key. To 3.9.</p> <p>(Tips)</p> <p>In the figure on the left, base frequency is changed to 50.00Hz. Data is saved when the F2(2) key is pressed. It is still saved even after the device is turned off. You can make adjustments while performing monitoring. The monitor on the upper area shows the parameter selected in the monitor of the capital letters.</p> |
|  | <p>To confirm if the data is correctly changed, check the lower section of the parameter display. Press the F1(1) key three times to return to the monitor.</p> |

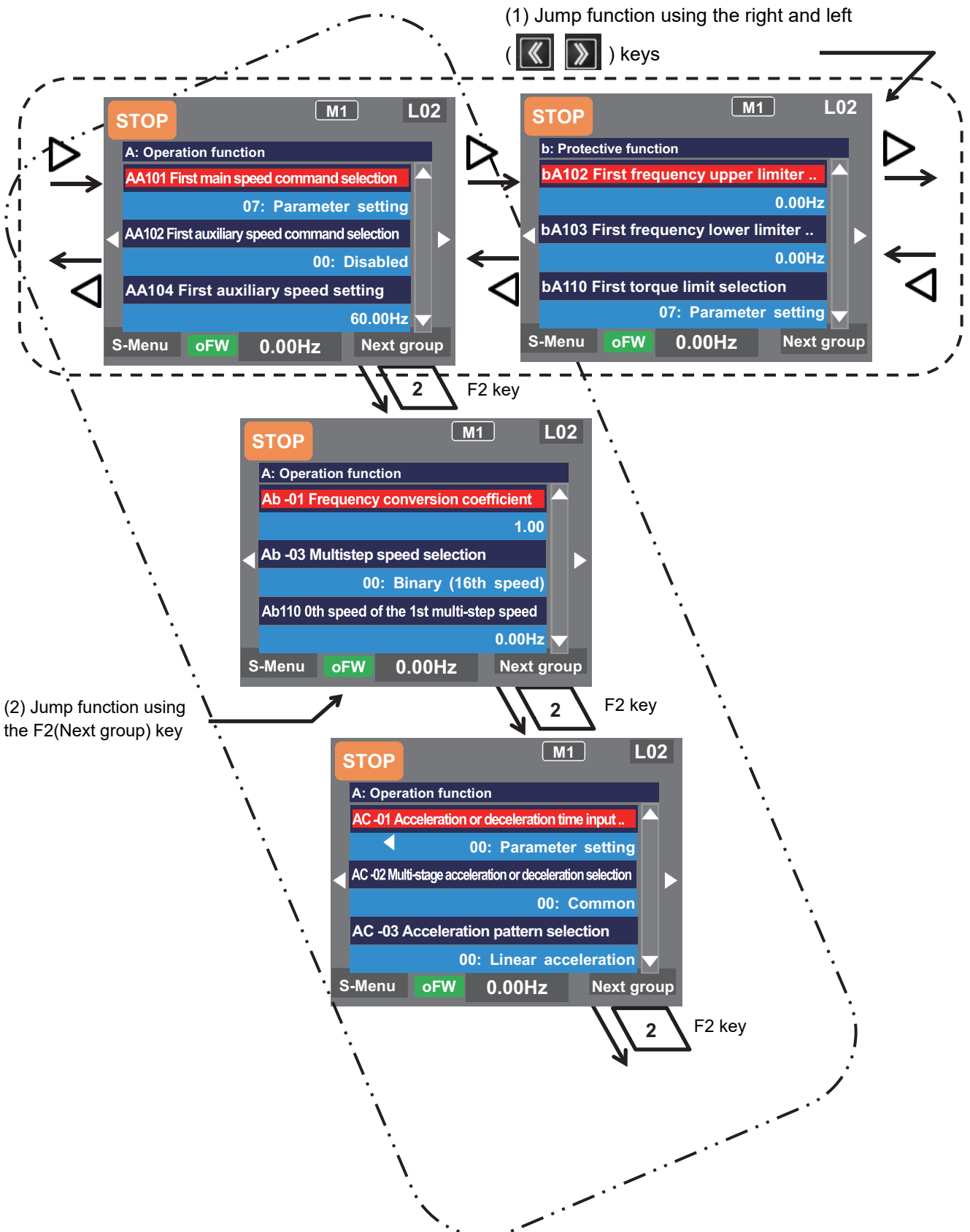
In the scroll mode screen (L02), (1) you can jump to the parameter at the top of each group by using the right and left ( ) keys or (2) jump to the parameter at the top of the sub-group (AA, Ab etc.) of the group by using F2 (Next group) key.

(1) You can jump to the top parameter of each group by using the right and left ( ) keys.

(...<->All parameters<->d: monitor<->F: Command monitor/setting<->...<->U: Initial setting, PDN <->All parameters<->...)


(2) You can jump to the top parameter of the sub-group in the group (AA, Ab, etc.) using the F2 (Next group) key (transition is performed in one direction (see below)).

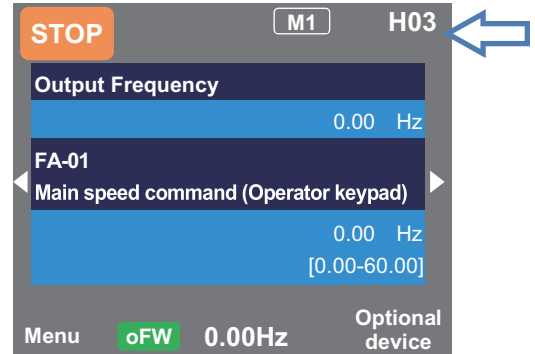
Example of group A: ...->AA->Ab->AC->...AJ->AA->...



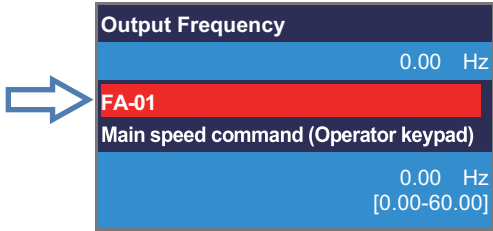


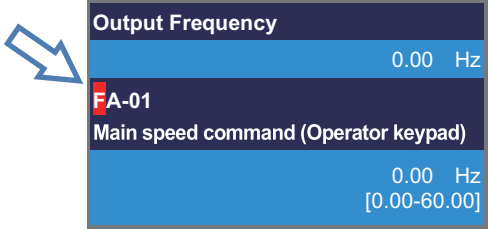
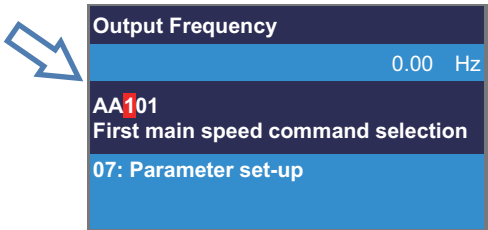




3-2-2 Concurrent Monitor Mode

When configuring settings such as frequency command and acceleration/deceleration time while watching the monitor during operation, you can change the settings on this monitor screen.

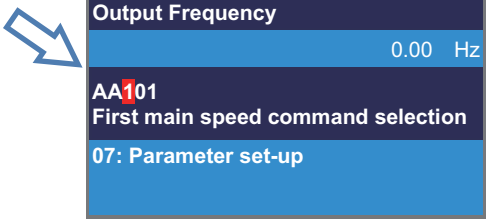
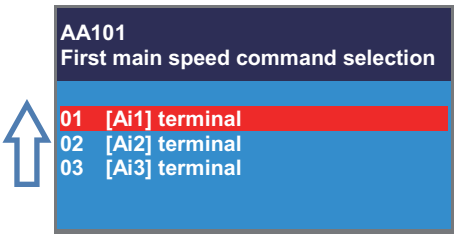


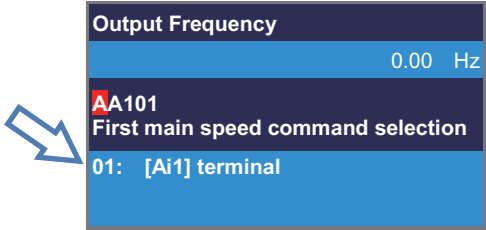
On the screen that is displayed upon power-on, using the right and left ( ) keys, navigate to a setting screen “Concurrent monitor” (H03).



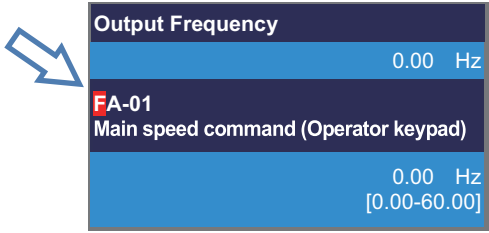
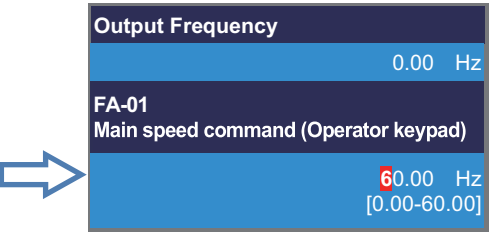




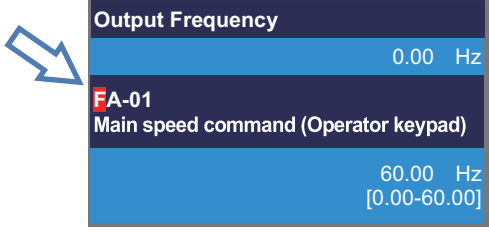
Monitor screen - Parameter selection screen

| Set-up procedure | Action |
|---|--|
|  | <p>Press the Enter key to change the color of parameter field. (Tips)</p> <p>Using the up and down ( ) keys, you can choose to change the parameter or change the monitor.</p> |
|  | <p>When the Enter key is pressed again, the left-most letter of the parameter can be changed.</p> |
|  | <p>Using the arrow (   ) keys to change the parameter number that you want to change, and then press the Enter key.</p> <p>Example1) When the frequency command destination [AA101] First speed command selection is changed.</p> <p>Example2) When the frequency command value is controlled in [FA-01] while the frequency command destination is set to 07: Parameter setting.</p> |

Example1) Change the [AA101] First main speed command selection to [Ai1] terminal.
 The [Ai1] terminal is an analog input terminal (voltage/current).

| Set-up procedure | Action |
|--|--|
|  | <p>Press the Enter key while [AA101] is displayed. (Tips) The information currently selected is shown in the lower section. "07: Parameter setting" is currently selected.</p> |
|  | <p>Using the up and down ( ) keys, select "01 [Ai1] terminal", and then press the F2(2) key. (Tips) Data is saved when the F2(2) key is pressed. It is still saved even after the device is turned off. When configuring an item, the entire screen changes to the screen for setting the item.</p> |
|  | <p>To confirm if the data is correctly changed, check the lower section. Press the F1(1) key to return to the monitor. (Tips) The information currently selected is shown in the lower section. "01 [Ai1] terminal" is currently selected.</p> |



Example2) Change frequency command in [FA-01].
 (If the frequency command selection is "07: Parameter setting")

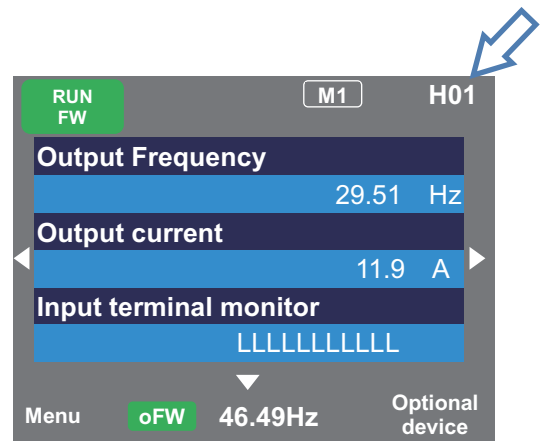
| Set-up procedure | Action |
|--|--|
|  | <p>Press the Enter key while [FA-01] is displayed. (Tips) In [FA-01], the set value can be changed if the string inside () of main speed command indicates the operator keypad or multi-step speed. In other cases, it is set to the command monitor.</p> |
|  | <p>You can change the right-most digit of data. Change the value using the arrow (   ) keys, and then press the F2(2) key. (Tips) In the figure on the left, base frequency is changed to 60.00Hz. Data is saved when the F2(2) key is pressed. It is still saved even after the device is turned off.</p> |
|  | <p>You can make adjustments while performing monitoring. To confirm if the data is correctly changed, check the lower section. Press the F1(1) key to return to the monitor. (Tips) The current frequency command is shown in the lower section. Currently, 60.00Hz is input as the command.</p> |

3-3 Monitor Function

3-3-1 Three-line Monitor Screen

In the three-line monitor screen, you can monitor three types of information at the same time. You can change and save the monitored data.

On the screen that is displayed upon power-on, using the right and left ( ) keys, navigate to "H01".



Example) Change the output current monitor to the input power monitor.

| Set-up procedure | Action |
|---|--|
|  | Press the Enter key to change the color of the field in upper section. Using the up and down ( ) keys, navigate to the second line. |
|  | When the Enter key is pressed, the left-most letter of the parameter can be changed. |
|  | Using the arrow (   ) keys, change [dA-02] to [dA-30]. |
|  | Press the Enter key to confirm the monitoring target. Press the F1(1) key to return to the monitor. |



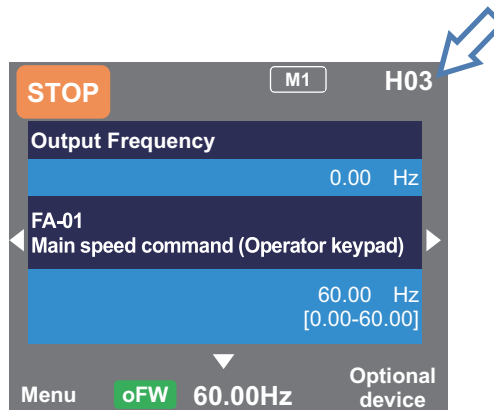
Precautions for Correct Use

What is displayed on the first line of the three-line monitor screen (H01) is the same as that displayed on the upper area of the setting screen (H03) and the screen with large character (H04).

3-3-2 Setting Screen “Concurrent Monitor”

On the setting screen, you can control parameter data while performing monitoring. To change the selected data, the screen changes to the setting screen that shows options.

On the screen that is displayed upon power-on, using the right and left () keys, navigate to “H03”.



Example) Change the output frequency monitor to the PID1 output monitor.

| Set-up procedure | Action |
|------------------|---|
| | Press the Enter key to change the color of parameter field. Using the up and down () keys to select and navigate to the detail of monitoring. |
| | When the Enter key is pressed, the left-most letter of the parameter can be changed. |
| | Using the arrow () keys, change [dA-01] to [db-50]. |

| Set-up procedure | Action |
|------------------|--|
| | <p>Press the Enter key to confirm the monitoring target, which is then displayed in the upper section.</p> <p>Press the F1(1) key to return to the monitor.</p> <p>You can also configure parameters using the up and down () keys.</p> |

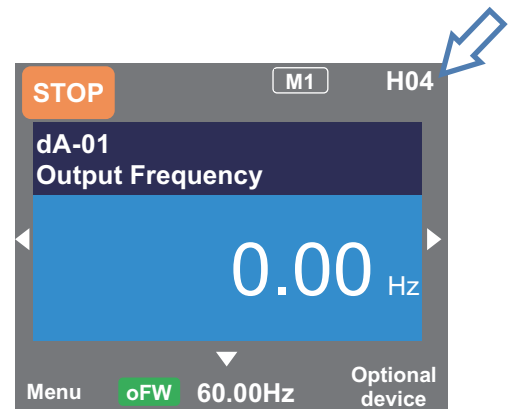
Precautions for Correct Use

What is displayed on the upper monitor of the setting screen “Concurrent monitor” (H03) is the Same as that displayed on the first line of three-line monitor screen (H01) and the screen with large characters(H04).

3-3-3 Monitor with Large Characters

In the monitor screen with large characters, you can display a parameter in bigger size.

On the screen that is displayed upon power-on using the right and left () keys, navigate to “H04”.
And later operate the device in the following procedures.



Example) Change the output frequency monitor to the integrated input power monitor.

| Set-up procedure | Action |
|------------------|---|
| | <p>When the Enter key is pressed, the left-most letter of the parameter can be changed.</p> |
| | <p>Using the arrow () keys, change [dA-01] to [dA-32]. Press the Enter key to confirm and return to the monitor.</p> |

Precautions for Correct Use



What is monitored on the screen with large characters (H04) is the same as the upper monitor of the setting screen (H03) and the first line of three-line monitor screen (H01).

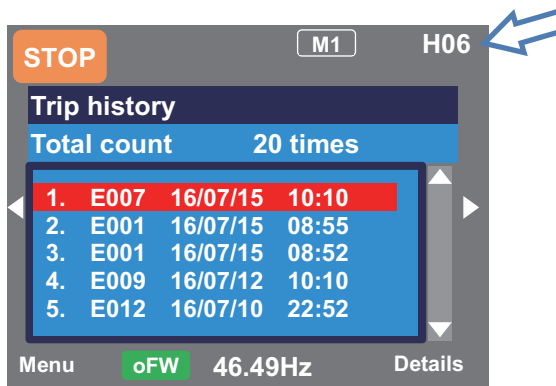
3-4 Error History Display

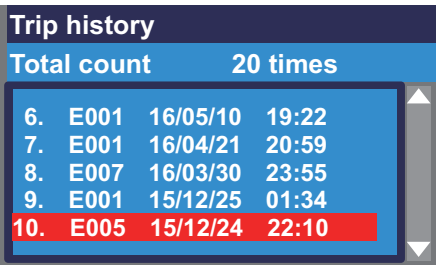


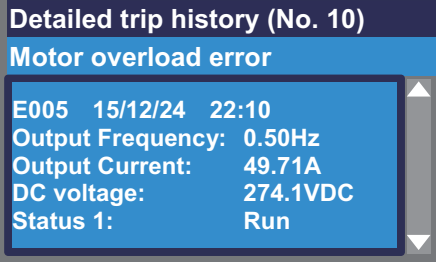
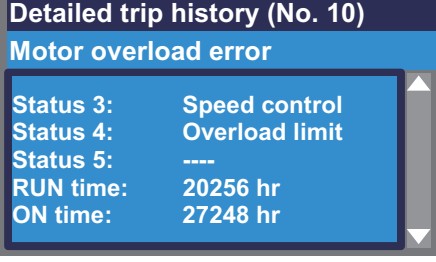


3-4-1 Trip History

The trip history screen shows details of the errors that have occurred and the total number of times trip occurred.

For details of errors, refer to 12-1 Checking Alarm Display on page 12-2.

On the screen that is displayed upon power-on, using the right and left ( ) keys, navigate to "H06". And later operate the device in the following procedures.

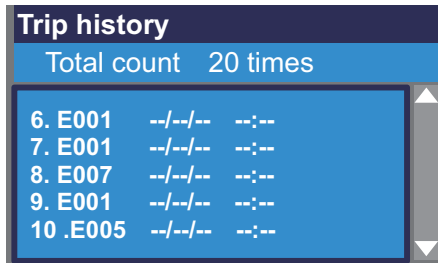


| Set-up procedure | Action |
|---|---|
|  | Using the up and down ( ) keys, select history information you want to check. |
|  | Press the Enter key to show details of the selected history information. |
|  | Using the up and down ( ) keys, you can check details. Press the F1(1) key to return to the monitor. |



Precautions for Correct Use

- To display time in trip history, you need to configure clock settings.
- To use the clock function, you need an optional battery that is separately sold (CR2032, 3V).
- When the clock function is not used with being retained, the display of error history is shown below.



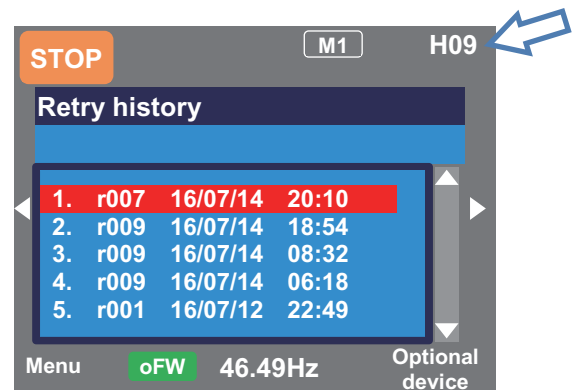
3-4-2 Retry History

The retry history screen shows details of the errors that have occurred and the total number of times retry was performed.

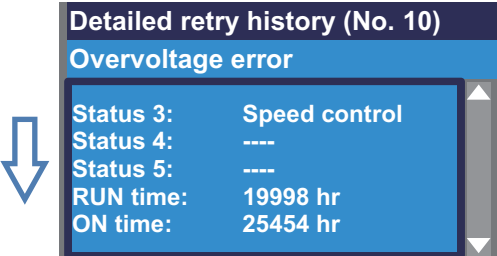


For details of error, refer to 12-1 Checking Alarm Display on page 12-2.

On the screen that is displayed upon power-on, using the right and left () keys, navigate to retry history screen "H09".

And then operate the device in the following procedures.



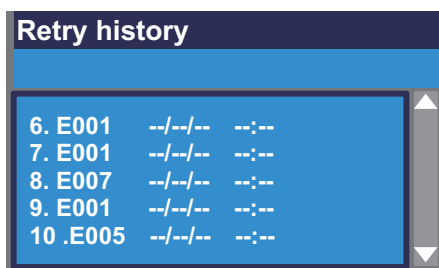
| Set-up procedure | Action |
|------------------|---|
| | Using the up and down () keys, select history information you want to check. |
| | Press the Enter key to show details of the selected history information. |

| Set-up procedure | Action |
|---|--|
|  | <p>Using the up and down ( ) keys, you can check details.</p> <p>Press the F1(1) key to return to the monitor.</p> |



Precautions for Correct Use

- To display time in retry history, you need to configure clock settings.
- To use the clock function, you need an optional battery that is separately sold (CR2032, 3V).
- When the clock function is not used with being retained, the display of error history is shown below.



3-5 Data Copy Function

With R/W function, you can copy the data at Inverter and transfer to LCD operator or write the copied data to the inverter.

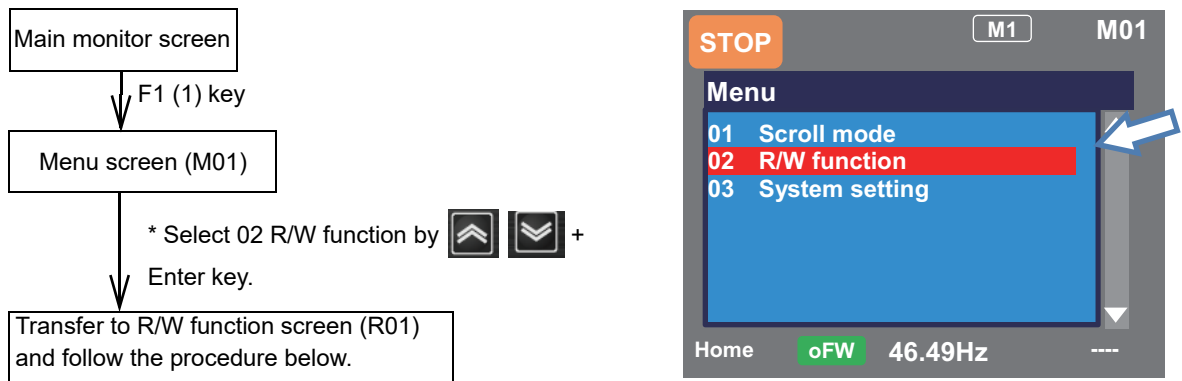
In case you rewrite a backup data to the inverter or to copy data at other inverters, this function is available.

Only a set of data can be saved.

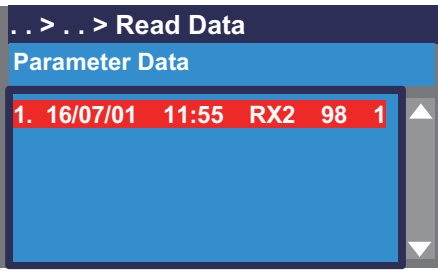
3-5-1 Read Function

Copy the data at Inverter and transfer to LCD operator.

On the screen that is displayed upon power-on, press the F1 (1) key to navigate to the menu screen "M01". Then, select the R/W function by pressing the Enter key.



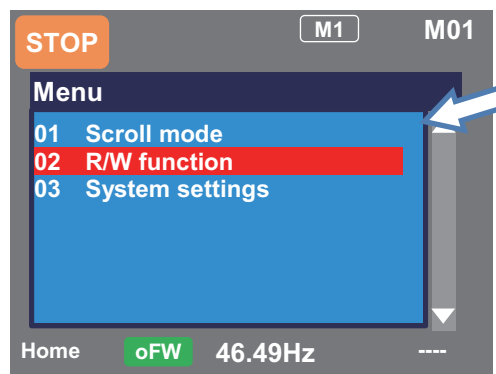
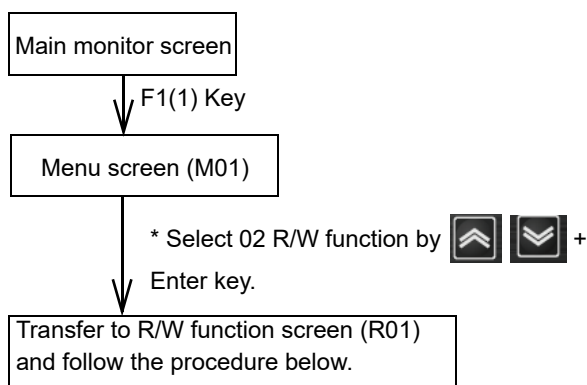
| Set-up procedure | Action |
|------------------|--|
| | Press the Enter key to confirm the READ function. |
| | Select data to be read by using the up and down () keys. Then, confirm the function by pressing the Enter key. |

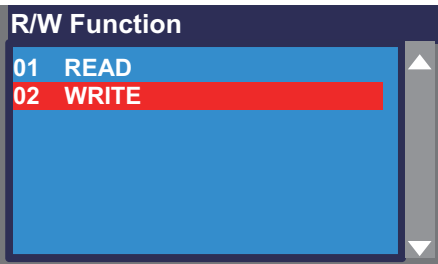


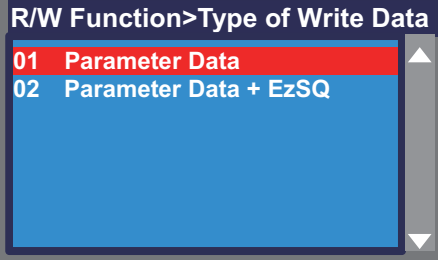


| Set-up procedure | Action |
|---|---|
|  | <p>In accordance with the instruction shown on the screen, specify the location of data you desire to save, and press the F2(2) key to navigate to the confirmation screen. Then, press the F2(2) key to start reading the data. When the completion screen appears, the procedure is complete.</p> <p>Display description: No. Date Time Inverter name: No. Data type * Inverter name: No. is unique to each inverter. * Data type is 1: Only parameters or 2: Parameters+EzSQ. * To display date and time, you need to configure clock settings from System settings.</p> |

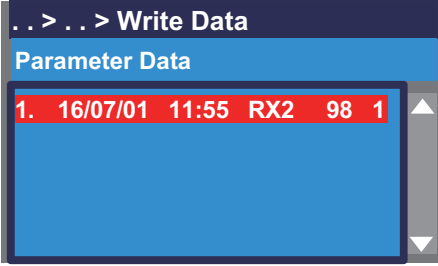
3-5-2 Write Function

Write the data pasted to LCD operator to the inverter.

On the screen that is displayed upon power-on, press the F1 (1) key to navigate to the menu screen "M01". Then, select the R/W function by pressing the Enter key.

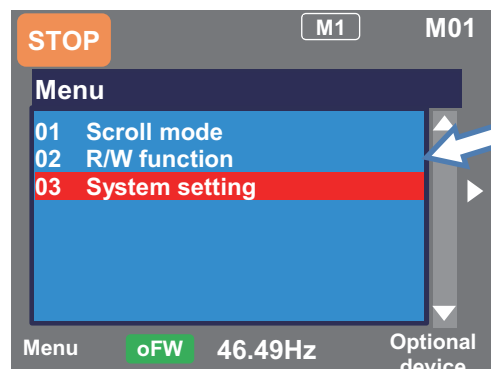
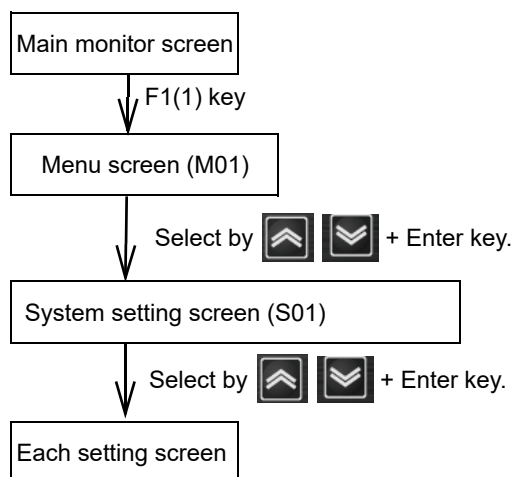



| Set-up procedure | Action |
|---|---|
|  | <p>Select the write function by using the up and down ( ) keys. Then, confirm by pressing the Enter key.</p> |
|  | <p>Select data to be written by using the up and down ( ) keys. Then, confirm the function by pressing the Enter key.</p> |

| Set-up procedure | Action |
|---|---|
|  | <p>In accordance with the instruction shown on the screen, select data to be written to the inverter, and press the F2(2) key to start writing. When the completion screen appears, the procedure is complete.</p> <p>Display description: No. Date Time Inverter name: No. Data type</p> <ul style="list-style-type: none"> * Inverter name: No. is unique to each inverter. * Data type is 1: Only parameters or 2: Parameters+EzSQ. * To display date and time, you need to configure clock settings from System settings. |

3-6 System Settings

On the System settings screen, you can use extended functions.



On the screen that is displayed upon power-on, press the F1 (1) key to navigate to the menu screen “M01”. Then, select the R/W function by pressing the Enter key or right () key.

| No. | Name | Description |
|-----|--|--|
| 01 | Language selection | Changes the language setting. |
| 02 | Dimming | Controls the brightness of LCD operator screen. |
| 03 | Automatic light off time ^{*1} | Controls the time to automatically light off the screen. |
| 04 | Dimming at light off ^{*1} | Controls the brightness when the screen is automatically lit off. |
| 05 | Automatic home transition time | Sets the time to automatically return to the home screen. |
| 06 | Initial home screen selection | Sets the screen that is displayed upon power-on and automatic return to the home screen. |
| 07 | Read lock | Limits the reading of data |
| 08 | Blinking during trip | Sets whether blinking is performed or not during trip. |
| 09 | Date and time ^{*2} | Configures settings of time, display format, and battery level warning. |
| 10 | Battery level warning | Displays a warning message when the battery runs out. |
| 11 | Color setting | Sets the background color. |
| 12 | Basic inverter information monitor | Checks information of the main unit. |
| 13 | Selection of connected model | Sets RX2. |
| 14 | LCD operator version | Displays the version of the LCD operator. |
| 15 | Initialization of LCD operator | Initializes the LCD operator. |
| 16 | Self-check mode | Operates self-check mode. |
| 17 | Remote mode switching | If this setting is enabled, when the F1 key on the home screen is pressed for 1 second or more, you can switch the frequency command and operation command to commands issued from the LCD operator. |
| 18 | Reserve | Do not change the setting from OFF. |

*1. The light off function is disabled until trip is canceled after the occurrence of trip.

*2. To use the clock function, you need an optional battery that is separately sold. (CR2032, 3V)
If no electricity is supplied to the inverter, battery replacement is required every two years.



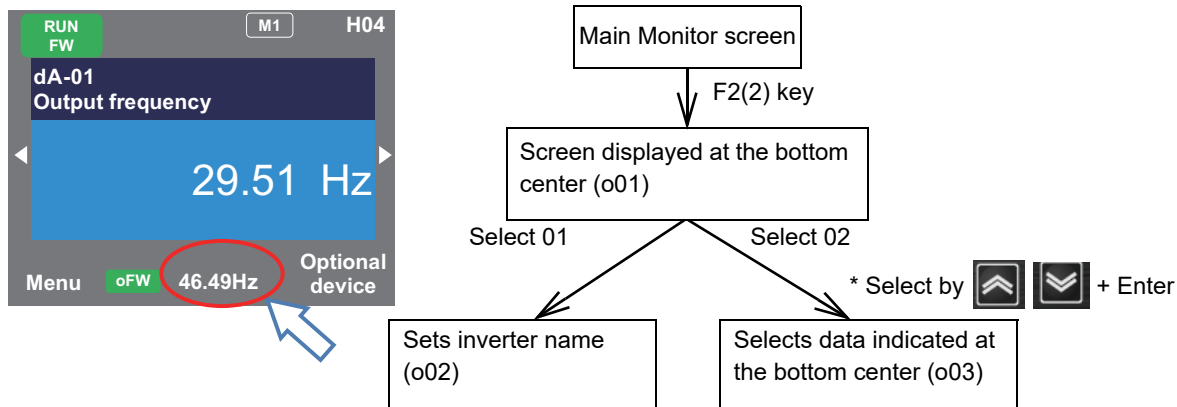
Precautions for Correct Use

If there is an error in the memory area in the LCD operator, an error message is displayed on the LCD operator. In such a case, initialize the LCD operator from the System settings, and confirm the settings. If the error on the LCD operator is not solved, the internal memory may be damaged. You need to replace the LCD operator.

3-7 Changing the Data Indicated at the Bottom Center

You can change the data contents indicated.

Instead of the preset indication, you can set a controller's (inverter) name to indicate.



On the screen that is displayed upon power-on, press the F2(2) key to navigate to the option screen “o01”. Then, select data that is shown at the bottom center by pressing the Enter key. After selecting data, save it by pressing the F2(2) key.

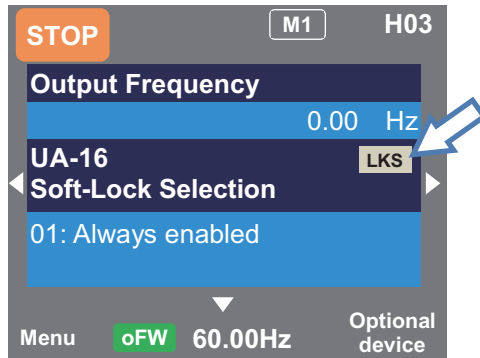
Sets the indicating item as following table.

| Option | Description | |
|--|---|--|
| 01 Controller (inverter) name (o02) | You can specify 8-digit string from alphanumeric letters and symbols. | |
| 02 Data displayed at the bottom center (o03) | 00 Frequency command | The current frequency command is displayed. |
| | 01 Torque command | The current torque command is displayed during torque control. |
| | 02 Time | The current time is displayed. |
| | 03 Controller name | The specified controller (inverter) name is displayed. |

3-8 Parameter Function

3-8-1 Parameter Preservation Function

By configuring the soft-lock function you can prevent parameters from being changed.



By configuring the soft-lock function [UA-16] and [UA-17], you can prevent parameters from being changed.

While soft-lock function is enabled, the LKS mark (Lock State mark) **LKS** is shown on the right of parameters.

● Parameters

| Item | Parameter | Data | Description |
|----------------------------|--------------------|------|---|
| Soft-lock selection | [UA-16] | 00 | Normal state. Only when the soft-lock terminal [SFT] is on, data set to [UA-17] other than [UA-16] are locked. |
| | | 01 | After the setting is performed, the data set to [UA-17] other than [UA-16] are locked. |
| Soft-lock target selection | [UA-17] | 00 | All data other than [UA-16] cannot be changed |
| | | 01 | Data other than [UA-16] and set frequency cannot be changed |
| Input terminal selection | [CA-01] to [CA-11] | 036 | [SFT]: Used when the soft-lock function is used on terminals. |

3-8-2 Limiting Displayed Parameters

You can change the content of display on the LCD operator according to your purpose.

To know which parameters are changed, you can check by setting [UA-10] to 03.

If you do not want to display parameters for functions not in use, you can reduce them by setting [UA-10] to 01.

Related Parameter

| Item | Parameter | Data | Description |
|---------------------------------------|--------------------|-------|---|
| Display restriction selection | [UA-10] | 00 | All parameters are displayed. |
| | | 01 | Parameters are displayed by function. Disabled functions are not displayed with some exceptions. |
| | | 02 | Display is performed in accordance with the settings configured by the user. Parameters set to [UA-31] to [UA-62] are displayed with some exceptions. |
| | | 03 | Parameters that have been changed from the factory default settings and some other parameters are displayed. |
| | | 04 | Monitor parameters and some other parameters are displayed. |
| 2nd-motor parameter display selection | [UA-21] | 00 | Hides parameters of second setting [**2**]. |
| | | 01 | Displays parameters of second setting [**2**]. |
| Option parameter display selection | [UA-22] | 00 | Hides parameters that start with o. |
| | | 01 | Displays parameters that start with o. |
| User parameter selection | [UA-31] to [UA-62] | no | No assignment |
| | | ***** | Choose the code you want to display. (all codes are subjected) |

If you are not using the input terminal function [SET] for switching to the second setting, by setting [UA-21] to 00, you can reduce a great number of displayed items.

If you are not using option unit, by setting [UA-22] to 00, you can reduce indications for option unit.

[UA-10]=01: Function-specific Display

If a function is not selected, parameters related to the function are hidden.

For more information about the display condition, see the table below.

The * mark in the table is replaced by 1 or 2. (1 represents first and 2 represents second.)

(a) IM control parameters

Display condition: AA121 ≤ 10 or AA221 ≤ 10

| Parameter | Name |
|-----------|---|
| Hb*02 | * selection of the IM motor capacity |
| Hb*03 | * selection of the IM motor pole number |
| Hb*04 | * IM base frequency |
| Hb*05 | * IM maximum frequency |
| Hb*06 | * IM motor rated voltage |
| Hb*08 | * IM motor rated current |
| Hb*10 | * IM motor constant R1 |
| Hb*12 | * IM motor constant R2 |
| Hb*14 | * IM motor constant L |
| Hb*16 | * IM motor constant lo |
| Hb*18 | * IM motor constant J |
| Hb*30 | * minimum frequency |
| Hb*31 | * reduced voltage start time |
| Hb*40 | * selection of operation mode for manual torque boost |
| Hb*41 | * volume of manual torque boost |
| Hb*42 | * break point of manual torque boost |
| Hb*45 | * selection of energy-saving operation |
| Hb*46 | * energy-saving response/accuracy adjustment |
| Hb*50 | * free V/f frequency 1 |
| Hb*51 | * free V/f voltage 1 |
| Hb*52 | * free V/f frequency 2 |
| Hb*53 | * free V/f voltage 2 |
| Hb*54 | * free V/f frequency 3 |
| Hb*55 | * free V/f voltage 3 |
| Hb*56 | * free V/f frequency 4 |
| Hb*57 | * free V/f voltage 4 |
| Hb*58 | * free V/f frequency 5 |
| Hb*59 | * free V/f voltage 5 |
| Hb*60 | * free V/f frequency 6 |
| Hb*61 | * free V/f voltage 6 |
| Hb*62 | * free V/f frequency 7 |
| Hb*63 | * free V/f voltage 7 |
| Hb*70 | * slip compensation P gain with sensor |
| Hb*71 | * slip compensation I gain with sensor |
| Hb*80 | * output voltage gain |
| HC*01 | * voltage compensation gain of automatic torque boost |
| HC*02 | * slip compensation gain of automatic torque boost |
| HC*10 | * 0th speed range limiter (IM-0Hz-SLV) |
| HC*11 | * amount of boost at the start (IM-SLV, IM-CLV) |
| HC*12 | * amount of boost at the start (IM-0Hz-SLV) |
| HC*13 | * selection of whether a secondary-resistance correction is to be conducted (IM-SLV, IM-0Hz-SLV,IM-CLV) |
| HC*14 | * selection of reversal prevention (IM-SLV, IM-0Hz-SLV, IM-CLV) |

| Parameter | Name |
|-----------|---|
| HC*20 | * time constant for torque current command filter |
| HC*21 | * speed feed forward compensation adjustment gain |

(b) SM (PMM) control parameter

Display condition: AA121 > 10 or AA221 > 10

| Parameter | Name |
|-----------|---|
| Hd*02 | * SM(PMM) motor capacity selection |
| Hd*03 | * SM(PMM) motor poles selection |
| Hd*04 | * SM(PMM) base frequency |
| Hd*05 | * SM(PMM) maximum frequency |
| Hd*06 | * SM(PMM) motor rated voltage |
| Hd*08 | * SM(PMM) motor rated voltage |
| Hd*10 | * SM(PMM) motor constant R |
| Hd*12 | * SM(PMM) motor constant Ld |
| Hd*14 | * SM(PMM) motor constant Lq |
| Hd*16 | * SM(PMM) motor constant Ke |
| Hd*18 | * SM(PMM) motor constant J |
| Hd*30 | * SM(PMM) lowest frequency (switch) (SM-SLV, SM-IVMS) |
| Hd*31 | * SM no-load current (SM-SLV, SM-IVMS) |
| Hd*32 | * SM start method selection (SM-SLV, SM-IVMS, SM-CLV) |
| Hd*33 | * SM initial position estimation Zero-V stand-by times (SM-SLV, SM-IVMS, SM-CLV) |
| Hd*34 | * SM initial position estimation Detection stand-by times (SM-SLV, SM-IVMS, SM-CLV) |
| Hd*35 | * SM initial position estimation Detection times (SM-SLV, SM-IVMS, SM-CLV) |
| Hd*36 | * SM initial position estimation Voltage gain (SM-SLV, SM-IVMS, SM-CLV) |
| Hd*37 | * SM initial position estimation Magnetic-pole position offset |
| Hd-41 | IVMS carrier frequency |
| Hd-42 | Filter gain of IVMS detection current |
| Hd-43 | Open-phase voltage detection gain selection SM(PMM)-IVMS |
| Hd-44 | Selection of open-phase switch threshold correction SM(PMM)-IVMS |
| Hd-45 | Speed control P gain SM(PMM)-IVMS |
| Hd-46 | Speed control I gain SM(PMM)-IVMS |
| Hd-47 | Waiting time for open-phase switching SM(PMM)-IVMS |
| Hd-48 | Restriction on the rotation-direction determination SM(PMM)-IVMS |
| Hd-49 | Timing adjustment for open-phase voltage detection SM(PMM)-IVMS |
| Hd-50 | Minimum pulse range adjustment SM(PMM)-IVMS |
| Hd-51 | Current limit of IVMS threshold |
| Hd-52 | IVMS threshold gain |
| Hd-58 | IVMS carrier-frequency switching start/finish point |

(c) Position control parameter

Display condition: AA123 ≠ 00 or AA223 ≠ 00

| Parameter | Name |
|-----------|---|
| AE-01 | Electronic gear installation position selection |
| AE-02 | Numerator of electronic gear ratio |
| AE-03 | Denominator of electronic gear ratio |
| AE-04 | Positioning completion range setting |
| AE-05 | Positioning completion delay time setting |
| AE-06 | Positioning control feed forward |
| AE-07 | Position loop gain |

(d) Orientation

Display condition: AA123 = 01 or AA223 = 01

| Parameter | Name |
|-----------|---|
| AE-08 | Position bias volume |
| AE-10 | Orientation stop position for input destination selection |
| AE-11 | Orientation stop position |
| AE-12 | Orientation speed setting |
| AE-13 | Orientation direction setting |

(e) Absolute position control

Display condition: AA123 > 01 or AA223 > 01

| Parameter | Name |
|-------------|---|
| AE-20 to 50 | Position command 0-15 |
| AE-52 | Position range designation (forward rotation) |
| AE-54 | Position range designation (reverse rotation) |
| AE-56 | Positioning mode selection |
| AE-60 | Teaching selection |
| AE-61 | Memorization of current position at power-off |
| AE-62 | Preset position data |
| AE-64 | Gain for calculating the deceleration stop distance |
| AE-65 | Bias for calculating the deceleration stop distance |
| AE-66 | APR control speed limit |
| AE-67 | APR start speed |
| AE-70 | Zero return mode selection |
| AE-71 | Zero return direction selection |
| AE-72 | Low speed zero return speed |
| AE-73 | High speed zero return speed |

(f) Normal acceleration/deceleration speed

Display condition: AC - 02 = 00

| Parameter | Name |
|-----------|---|
| AC*15 | * 2-stage acceleration/deceleration selection |
| AC*16 | * 2-stage acceleration frequency |
| AC*17 | * 2-stage deceleration frequency |
| AC*20 | * acceleration time 1 |
| AC*22 | * deceleration time 1 |
| AC*24 | * acceleration time 2 |
| AC*26 | * deceleration time 2 |

(g) Multi-stage acceleration/deceleration

Display condition: AC - 02 = 01

| Parameter | Name |
|-----------|---|
| AC-30 | Acceleration time for multi-speed 1st speed |
| AC-32 | Deceleration time for multi-speed 1st speed |
| AC-34 | Acceleration time for multi-speed 2nd speed |
| AC-36 | Deceleration time for multi-speed 2nd speed |
| AC-38 | Acceleration time for multi-speed 3rd speed |
| AC-40 | Deceleration time for multi-speed 3rd speed |
| AC-42 | Acceleration time for multi-speed 4th speed |

| Parameter | Name |
|-----------|--|
| AC-44 | Deceleration time for multi-speed 4th speed |
| AC-46 | Acceleration time for multi-speed 5th speed |
| AC-48 | Deceleration time for multi-speed 5th speed |
| AC-50 | Acceleration time for multi-speed 6th speed |
| AC-52 | Deceleration time for multi-speed 6th speed |
| AC-54 | Acceleration time for multi-speed 7th speed |
| AC-56 | Deceleration time for multi-speed 7th speed |
| AC-58 | Acceleration time for multi-speed 8th speed |
| AC-60 | Deceleration time for multi-speed 8th speed |
| AC-62 | Acceleration time for multi-speed 9th speed |
| AC-64 | Deceleration time for multi-speed 9th speed |
| AC-66 | Acceleration time for multi-speed 10th speed |
| AC-68 | Deceleration time for multi-speed 10th speed |
| AC-70 | Acceleration time for multi-speed 11th speed |
| AC-72 | Deceleration time for multi-speed 11th speed |
| AC-74 | Acceleration time for multi-speed 12th speed |
| AC-76 | Deceleration time for multi-speed 12th speed |
| AC-78 | Acceleration time for multi-speed 13th speed |
| AC-80 | Deceleration time for multi-speed 13th speed |
| AC-82 | Acceleration time for multi-speed 14th speed |
| AC-84 | Deceleration time for multi-speed 14th speed |
| AC-86 | Acceleration time for multi-speed 15th speed |
| AC-88 | Deceleration time for multi-speed 15th speed |

(h) Internal direct current braking

Display condition: AF*01 = 01, 02

| Parameter | Name |
|-----------|--|
| AF*02 | * braking mode |
| AF*03 | * DC braking frequency |
| AF*04 | * DC braking delay time |
| AF*05 | * DC braking force at the time of the stop |
| AF*06 | * DC braking time at the time of the stop |
| AF*07 | * DC current braking trigger selection |
| AF*08 | * DC braking force at the start |
| AF*09 | * DC braking time at the start |

(i) Brake control 1 (common for forward/reverse)

Display condition: AF*30 = 01, 02

| Parameter | Name |
|-----------|--|
| AF*31 | * brake release establishment waiting time |
| AF*32 | * acceleration waiting time |
| AF*33 | * stop waiting time |
| AF*34 | * brake check waiting time |
| AF*35 | * brake release frequency |
| AF*36 | * brake release current |
| AF*37 | * brake apply frequency |

(j) Brake control 1 (Forward/reverse set individually)

Display condition: AF*30 = 02

| Parameter | Name |
|-----------|---|
| AF*38 | * brake release establishment waiting time (reverse rotation) |
| AF*39 | * acceleration waiting time (reverse rotation) |
| AF*40 | * stop waiting time (reverse rotation) |
| AF*41 | * brake check waiting time (reverse rotation) |
| AF*42 | * brake release frequency (reverse rotation) |
| AF*43 | * brake release current (reverse rotation) |
| AF*44 | * brake apply frequency (reverse rotation) |

(k) Brake control 2

Display condition: AF*30 = 03

| Parameter | Name |
|-----------|----------------------------|
| AF*50 | * brake release delay time |
| AF*51 | * brake apply delay time |
| AF*52 | * brake check time |
| AF*53 | * servo lock time at start |
| AF*54 | * servo lock time at stop |

(l) Free electronic thermal

Display condition: bc*11 = 02

| Parameter | Name |
|-----------|---------------------------------------|
| bC*20 | * free electronic thermal frequency 1 |
| bC*21 | * free electronic thermal current 1 |
| bC*22 | * free electronic thermal frequency 2 |
| bC*23 | * free electronic thermal current 2 |
| bC*24 | * free electronic thermal frequency 3 |
| bC*25 | * free electronic thermal current 3 |

(m) Gain mapping 1

Display condition: HA*20 = 00

| Parameter | Name |
|-----------|-----------------------------------|
| HA*21 | * gain switch time |
| HA*27 | * gain mapping P control P gain 1 |
| HA*30 | * gain mapping P control P gain 2 |

(n) Gain mapping 2

Display condition: HA*20 = 01

| Parameter | Name |
|-----------|------------------------------------|
| HA*22 | * gain switch intermediate speed 1 |
| HA*23 | * gain switch intermediate speed 2 |
| HA*24 | * gain mapping maximum speed |
| HA*31 | * gain mapping P gain 3 |
| HA*32 | * gain mapping I gain 3 |
| HA*33 | * gain mapping P gain 4 |
| HA*34 | * gain mapping I gain 4 |

(o) Instantaneous power failure non-stop

Display condition: bA – 30 ≠ 00

| Parameter | Name |
|-----------|---|
| bA-31 | Instantaneous power failure non-stop Function triggering voltage |
| bA-32 | Instantaneous power failure non-stop Target level |
| bA-34 | Instantaneous power failure non-stop Deceleration time |
| bA-36 | Instantaneous power failure non-stop Deceleration start range |
| bA-37 | Instantaneous power failure non-stop Constant DC voltage control P gain |
| bA-38 | Instantaneous power failure non-stop Constant DC voltage control I gain |

(p) Overvoltage suppression

Display condition: bA*40 ≠ 00

| Parameter | Name |
|-----------|--|
| bA*41 | * overvoltage suppression level setting |
| bA*42 | * overvoltage suppression operating time |
| bA*44 | * constant DC voltage control P gain |
| bA*45 | * constant DC current control I gain |

(q) Overexcitation deceleration

Display condition: bA*46 ≠ 00

| Parameter | Name |
|-----------|--|
| bA*47 | * overexcitation output filter time constant |
| bA*48 | * overexcitation voltage gain |
| bA*49 | * overexcitation suppression level setting |

(r) PID 1

Display condition: AH – 01 = 01, 02

| Parameter | Name |
|-----------|--|
| db-30 | PID1 feedback data 1 monitor |
| db-32 | PID1 feedback data 2 monitor |
| db-34 | PID1 feedback data 3 monitor |
| db-42 | PID1 target value monitor (after calculation) |
| db-44 | PID1 feedback data monitor (after calculation) |
| db-50 | PID1 output monitor |
| db-51 | PID1 deviation monitor |
| db-52 | PID1 deviation 1 monitor |
| db-53 | PID1 deviation 2 monitor |
| db-54 | PID1 deviation 3 monitor |
| db-61 | PID current P gain monitor |
| db-62 | PID current I gain monitor |
| db-63 | PID current D gain monitor |
| db-64 | PID feed forward monitor |
| FA-30 | PID1 target value 1 (monitor + setting) |
| FA-32 | PID1 target value 2 (monitor + setting) |
| FA-34 | PID1 target value 3 (monitor + setting) |
| AH-02 | PID1 deviation minus |
| AH-03 | PID1 unit selection (PID1) |
| AH-04 | PID1 scale adjustment (0%) |
| AH-05 | PID1 scale adjustment (100%) |

| Parameter | Name |
|-----------|---|
| AH-06 | PID1 scale adjustment (decimal point) |
| AH-07 | PID1 target value 1 Input destination selection |
| AH-10 | PID1 target value 1 Set value |
| AH-12 | PID1 multistage target value 1 |
| AH-14 | PID1 multistage target value 2 |
| AH-16 | PID1 multistage target value 3 |
| AH-18 | PID1 multistage target value 4 |
| AH-20 | PID1 multistage target value 5 |
| AH-22 | PID1 multistage target value 6 |
| AH-24 | PID1 multistage target value 7 |
| AH-26 | PID1 multistage target value 8 |
| AH-28 | PID1 multistage target value 9 |
| AH-30 | PID1 multistage target value 10 |
| AH-32 | PID1 multistage target value 11 |
| AH-34 | PID1 multistage target value 12 |
| AH-36 | PID1 multistage target value 13 |
| AH-38 | PID1 multistage target value 14 |
| AH-40 | PID1 multistage target value 15 |
| AH-42 | PID1 target value 2 Input destination selection |
| AH-44 | PID1 target value 2 Set value |
| AH-46 | PID1 target value 3 Input destination 2 selection |
| AH-48 | PID1 target value 3 Set value |
| AH-50 | PID1 target value 1 Operator selection |
| AH-51 | PID1 feedback data 1 Input destination selection |
| AH-52 | PID1 feedback data 2 Input destination selection |
| AH-53 | PID1 feedback data 3 Input destination selection |
| AH-54 | PID1 feedback data Operator selection |
| AH-60 | PID1 gain switch method selection |
| AH-61 | PID1 proportional gain 1 |
| AH-62 | PID1 integral gain 1 |
| AH-63 | PID1 differential gain 1 |
| AH-64 | PID1 proportional gain 2 |
| AH-65 | PID1 integral gain 2 |
| AH-66 | PID1 differential gain 2 |
| AH-67 | PID1 gain switch time |
| AH-70 | PID feed forward selection |
| AH-71 | PID1 changeable range |
| AH-72 | PID2 excessive deviation level |
| AH-73 | PID1 feedback comparison signal OFF level |
| AH-74 | PID1 feedback comparison signal ON level |

(s) PID 2

Display condition: AJ – 01 = 01, 02

| Parameter | Name |
|-----------|---------------------------------------|
| db-36 | PID2 feedback data monitor |
| db-55 | PID2 output monitor |
| db-56 | PID2 deviation monitor |
| FA-36 | PID2 target value (monitor + setting) |
| AJ-02 | PID2 deviation minus |
| AJ-03 | PID2 unit selection (PID2) |
| AJ-04 | PID2 scale adjustment (0%) |
| AJ-05 | PID2 scale adjustment (100%) |

| Parameter | Name |
|-----------|--|
| AJ-06 | PID2 scale adjustment (decimal point) |
| AJ-07 | PID2 target value Input destination selection |
| AJ-10 | PID2 target value Set value |
| AJ-12 | PID2 feedback data Input destination selection |
| AJ-13 | PID2 proportional gain |
| AJ-14 | PID2 integral gain |
| AJ-15 | PID2 differential gain |
| AJ-16 | PID2 changeable range |
| AJ-17 | PID2 excessive deviation level |
| AJ-18 | PID2 feedback comparison signal OFF level |
| AJ-19 | PID2 feedback comparison signal ON level |

(t) PID 3

Display condition: AJ – 21 = 01, 02

| Parameter | Name |
|-----------|--|
| db-38 | PID3 feedback data monitor |
| db-57 | PID3 output monitor |
| db-58 | PID3 deviation monitor |
| FA-38 | PID3 target value (monitor + setting) |
| AJ-22 | PID3 deviation minus |
| AJ-23 | PID3 unit selection (PID3) |
| AJ-24 | PID3 scale adjustment (0%) |
| AJ-25 | PID3 scale adjustment (100%) |
| AJ-26 | PID3 scale adjustment (decimal point) |
| AJ-27 | PID3 target value Input destination selection |
| AJ-30 | PID3 target value setting |
| AJ-32 | PID3 feedback data Input destination selection |
| AJ-33 | PID3 proportional gain |
| AJ-34 | PID3 integral gain |
| AJ-35 | PID3 differential gain |
| AJ-36 | PID3 changeable range |
| AJ-37 | PID3 excessive deviation level |
| AJ-38 | PID3 feedback comparison signal OFF level |
| AJ-39 | PID3 feedback comparison signal ON level |

(u) PID 4

Display condition: AJ – 41 = 01, 02

| Parameter | Name |
|-----------|--|
| db-40 | PID4 feedback data monitor |
| db-59 | PID4 output monitor |
| db-60 | PID4 deviation monitor |
| FA-40 | PID4 target value (monitor + setting) |
| AJ-42 | PID4 deviation minus |
| AJ-43 | PID4 unit selection (PID4) |
| AJ-44 | PID4 scale adjustment (0%) |
| AJ-45 | PID4 scale adjustment (100%) |
| AJ-46 | PID4 scale adjustment (decimal point) |
| AJ-47 | PID4 target value Input destination selection |
| AJ-50 | PID4 target value setting |
| AJ-52 | PID4 feedback data Input destination selection |
| AJ-53 | PID4 proportional gain |

| Parameter | Name |
|-----------|---|
| AJ-54 | PID4 integral gain |
| AJ-55 | PID4 differential gain |
| AJ-56 | PID4 changeable range |
| AJ-57 | PID4 excessive deviation level |
| AJ-58 | PID4 feedback comparison signal OFF level |
| AJ-59 | PID4 feedback comparison signal ON level |

(v) PID in general

Display condition: AH – 01 = 01, 02 or AJ – 01 = 01, 02 or AJ – 21 = 01, 02 or AJ – 41 = 01, 02

| Parameter | Name |
|-----------|---|
| AH-75 | PID selection of soft-start function |
| AH-76 | PID soft-start target level |
| AH-78 | PID acceleration time for soft-start |
| AH-80 | PID soft-start time |
| AH-81 | PID start abnormal judgment implement selection |
| AH-82 | PID start abnormal judgment level |
| AH-85 | PID sleep condition selection |
| AH-86 | PID sleep start level |
| AH-87 | PID sleep operation time |
| AH-88 | PID selection of boost before sleep |
| AH-89 | PID boost time before sleep |
| AH-90 | PID boost volume before sleep |
| AH-91 | PID minimum operating time before sleep |
| AH-92 | PID minimum retention time of sleep state |
| AH-93 | PID wake condition selection |
| AH-94 | PID wake start level |
| AH-95 | PID wake operation time |
| AH-96 | PID wake start deviation amount |

(w) simulation mode

Display condition: PA – 20 = 01

| Parameter | Name |
|-----------|--|
| PA-21 | Selection of error code for alarm test |
| PA-22 | Output current monitor optional output selection |
| PA-23 | Output current monitor optional setting value |
| PA-24 | P-N voltage monitor optional output selection |
| PA-25 | P-N voltage monitor optional setting value |
| PA-26 | Output voltage monitor optional output selection |
| PA-27 | Output voltage monitor optional setting value |
| PA-28 | Output torque monitor optional output selection |
| PA-29 | Output torque monitor optional setting value |
| PA-30 | Frequency adjustment optional output selection |
| PA-31 | Frequency matching optional setting value |

(x) DriveProgramming

Display condition: UE – 02 ≠ 00

| Parameter | Name |
|----------------|--|
| db-01 | Program download monitor |
| db-02 | Program number monitor |
| db-03 to db-07 | Program counter (Task1-5) |
| db-08 to db-16 | User monitor 0-4 |
| db-18 to db-23 | Analog output monitor YA0-YA5 |
| UE-01 | DriveProgramming execution interval |
| UE-10 to UE-73 | Driveprogramming user parameter U (00)-U(63) |
| UF-02 to UF-33 | DriveProgramming user parameter UL(00)-U(15) |

User Setting: [UA-10]=02

Parameters set to the user setting functions [UA-31] to [UA-62], main speed command [FA-01], output frequency monitor [dA-01], and display selection [UA-10] are displayed.

Data-comparison Display: [UA-10]=03

- Only parameters that have been changed from the factory default settings are displayed.
- All monitor displays [d****] and [F****], display selection [UA-10], and the password for display [UA-01] are always shown.



Precautions for Correct Use

- The initial value used for comparison is determined by the inverter model and the following settings.
Initialize Data selection [Ub-02]
Load type selection [Ub-03]
- If you changes the base frequency, the value of the motor constant IO is changed, so the data-comparison displays the changes in parameter.

Monitor Display: [UA-10]=04

All monitor displays [d****] and [F****] and display selection [UA-10] are shown.

3-8-3 Saving Automatically Changed Parameters

Changed parameters can be saved.

When selection of user parameter automatic setting [UA-30] is set to 01, parameters whose data has been changed are automatically saved in [UA-31] to [UA-62].

Also, when you desire to retrieve history of parameter changes, set selection of user parameter automatic setting [UA-30] to 01.

Up to 32 changed parameters can be saved.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|-------|--|
| User parameter automatic setting selection | [UA-30] | 00 | Disable |
| | | 01 | When a parameter is changed, the parameter is automatically set to [UA-31] to [UA-62]. |
| User parameter selection | [UA-31] to [UA-62] | no | No assignment |
| | | ***** | When this function is enabled, automatically recorded parameters are displayed. (all codes are subjected) |



Precautions for Correct Use

- [UA-31] is the newest data, and [UA-62] is the oldest data.
- Only one value is saved for a parameter.
- If more than 32 parameters are changed, the oldest data of [UA-62] is deleted, and values are shifted by one parameter. Then, new data is saved in [UA-31].

3-8-4 Protecting Parameters by Password

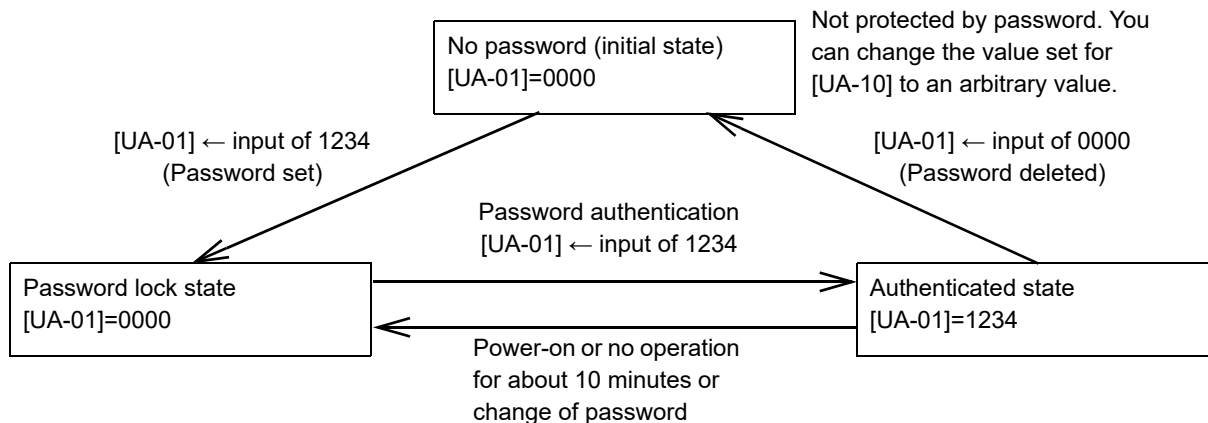
You can protect the parameters you changed by password.

By setting a password to the display selection function [UA-10] and soft-lock function [UA-16], you can prevent parameters from being displayed or changed.

● Parameter

| Item | Parameter | Data | Description |
|--------------------------|--------------------|--------------|---|
| Password for display | [UA-01] | 0000 to FFFF | Lock/unlock the display selection function [UA-10]. |
| Soft-lock password | [UA-02] | 0000 to FFFF | Lock/unlock the soft-lock function [UA-16]. |
| Display selection | [UA-10] | 00 | All parameters are displayed. |
| | | 01 | Parameters are displayed by functions. Disabled functions are not displayed with some exceptions. |
| | | 02 | Display is performed in accordance with the settings configured by the user. Parameters set to [UA-31] to [UA-62] are displayed with some exceptions. |
| | | 03 | Parameters that have been changed from the factory default settings and some other parameters are displayed. |
| | | 04 | Monitor parameters and some other parameters are displayed. |
| Soft-lock selection | [UA-16] | 00 | When the soft-lock terminal [SFT] is on, changes of data set to [UA-17] other than [UA-16] are locked. |
| | | 01 | After the setting is performed, changes of data set to [UA-17] other than [UA-16] are locked. |
| Input terminal selection | [CA-01] to [CA-11] | 036 | [SFT]: Used when the soft-lock function is used on terminals. |

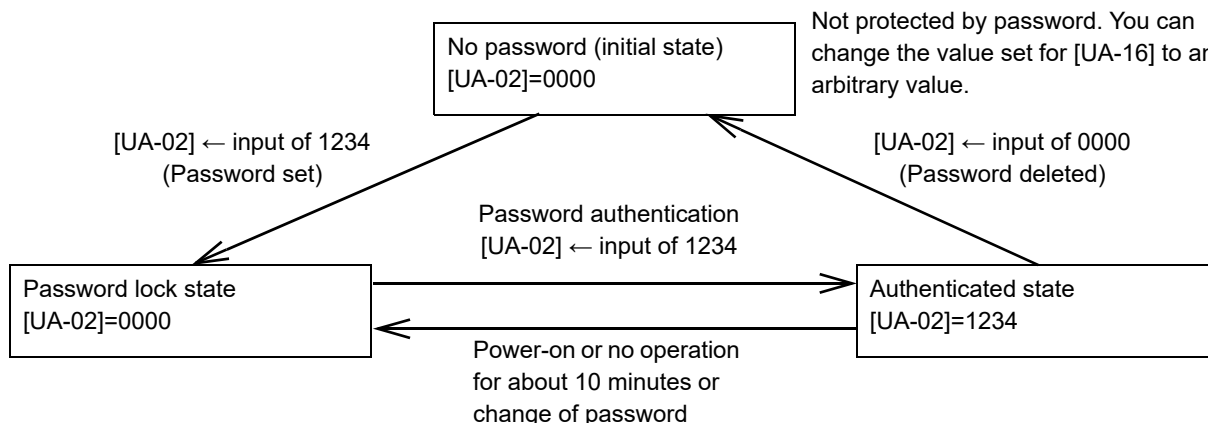
Example of Password for Limiting Display



Protected by password. You cannot change the value set for [UA-10].
The LKP icon is displayed in the parameter section.

After password authentication, although the password setting information is not deleted, you can change the value set for [UA-10]. If power is turned on again or 10 minutes pass without any operation, the password is automatically locked again.

Example of a Soft-lock Password



Protected by password. You cannot change the value set for [UA-16]. The LKP icon is displayed in the parameter section.

After password authentication, although the password setting information is not deleted, you can change the value set for [UA-16]. If power is turned on again or 10 minutes pass without any operation, the password is automatically locked again.



Precautions for Correct Use

If you forget the set password, there is no way to unlock the password lock. Also, the password cannot be investigated by our plant or service station, therefore, care must be taken when setting a password.

3-9 Display Fixation Function

You can fix the display by DISP terminal.

When the [DISP] function of the input terminal function is on, display of the LCD operator is fixed on the monitor screen (the home screen selected in LCD operator).

When the [DISP] function of the input terminal function is on, keys other than the RUN key and STOP/RESET keys are disabled.

To disable the RUN key, set [AA111] to a value other than 02.

The following shows operations when the [DISP] terminal is on.

- When STOP key selection [AA-13] is 01, even if [AA111] is other than 02, you can stop the inverter or reset inverter trip by using the STOP/RESET key.
- When STOP key selection [AA-13] is 02, even if [AA111] is other than 02, you can reset inverter trip by using the STOP/RESET key.
- When STOP key selection [AA-13] is 00, if [AA111] is other than 02, the STOP/RESET key is also disabled, thus disabling all keys.

● Parameter

| Item | Parameter | Data | Description |
|------------------------------|--------------------|------|--|
| Selecting the input terminal | [CA-01] to [CA-11] | 102 | [DISP]: Used when the screen fixation function is used on terminals. |
| Operation command selection | [AA111] | 00 | [FW]/[RV] terminals |
| | | 01 | 3 wire |
| | | 02 | RUN key on the LCD Operator |
| | | 03 | RS485 setting |
| | | 04 | Option 1 |
| | | 05 | Option 2 |
| | | 06 | Option 3 |
| STOP key selection | [AA-13] | 00 | Disable |
| | | 01 | Enable |
| | | 02 | Enable only reset |

3-10 Error Operation on the LCD Operator

3-10-1 Selection of Operation at Disconnection of LCD Operator

You can configure operation when the LCD operator is disconnected.

When about 5 seconds have passed after communication with the LCD operator is disconnected, it is determined that disconnection occurred.

For operation at disconnection, see the parameter table shown below.

● Parameter

| Item | Parameter | Data | Description |
|---|-----------|------|---|
| Selection of operation at disconnection of LCD operator | [UA-20] | 00 | When disconnection occurs, the inverter trips due to [E040] LCD operator communication error. |
| | | 01 | When disconnection occurs, the inverter trips due to [E040] LCD operator communication error after deceleration stop. |
| | | 02 | Ignores detection of disconnection. |
| | | 03 | Performs the free-run stop when disconnection occurs. No error occurs. |
| | | 04 | Performs the deceleration stop when disconnection occurs. No error occurs. |

3-10-2 Display of Battery Level Warning

You are informed with battery run-out, when the battery is run out. And then you can trip the inverter.

The LCD operator is monitored on a regular basis, and when it is determined the time setting of LCD operator returns to the initial state, it is determined to be error.

When [UA-19] is set to 01 and it is determined that abnormality occurs, the output terminal function 080 [LBK] is turned on. When time is configured on LCD operator, [LBK] is turned off.

When [UA-19] is set to 02, when it is determined that abnormality occurs, an error is generated, and the inverter trips due to [E042] RTC error. The output terminal function 080 [LBK] is turned on at the same time the error occurs. When time on LCD Operator is configured, [LBK] is turned

● Parameter

| Item | Parameter | Data | Description |
|---------------------------------|-----------|------|---|
| Battery level warning selection | [UA-19] | 00 | Disable |
| | | 01 | The output terminal function 080 [LBK] is turned on as a warning. |
| | | 02 | Generates the [E042] RTC error and the inverter trips. Turns on the output terminal function 080 [LBK]. |



Precautions for Correct Use

- You can cancel trip of [E042] RTC error by performing the reset operation, however, if time is not configured, the error occurs again. In this case, the output terminal function 080 [LBK] is on.
- If [UA-19] is set to a value other than 00, insert the battery in the LCD operator, and set [UA-19] after configuring time.

3-11 Preventing Read and Write of Unnecessary Data

You can configure the prohibition of data reading and writing via LCD operator.

By setting [UA-18] Data R/W selection to 01, Read/Write access from LCD operator is disabled, and read and write of unnecessary data can be prevented.

After the parameter is confirmed, if it is set to 01 after data is read for backup, unnecessary read and write can be prevented.

● Parameter

| Item | Parameter | Data | Description |
|--------------------|-----------|------|--|
| Data R/W selection | [UA-18] | 00 | R/W enabled. Read and write are possible. |
| | | 01 | R/W disabled. Read and write are prohibited. |

3-12 Inverter Initialization

When the initialization target [Ub-01] is chosen and [Ub-05] Start Initialization is set to 01, the designated data can be initialized to the factory setting.

Only the trip history can be cleared without initialization of the stored parameter values.



Precautions for Correct Use

- Duty type selection (Ub-03) is not initialized.
- The initialization sets the parameters to initial values. If the data before the initialization are necessary, read the data using the R/W function (Read) on the operator keypad or use PC software to save the data on a PC.
- The parameter for initialization is not displayed, depending on the setting of Display Restriction Selection (UA-10). Set the initial values to 00 (Full display) to complete the initialization.
- The initialization cannot be achieved when a change of the parameter setting values is banned on the setting of Soft Lock Selection (UA-16). Be sure to perform the initialization after the banned change of the parameter setting values is reset.
- Take a caution that the initialization starts when you set data of Initialize Enable (Ub-05) to 01 (Start initialization) and press F2 key. The previous data cannot be returned.

● Parameter

| Item | Parameter | Data | Description |
|---------------------------|-----------|------|---|
| Initialize Mode selection | [Ub-01] | 00 | The initialization is disabled. |
| | | 01 | The trip history and retry history are cleared. |
| | | 02 | All the parameters are all initialized. |
| | | 03 | The trip history, retry history, and all parameters are initialized. |
| | | 04 | The trip history, retry history, all parameters, and program data for DriveProgramming are initialized. |
| | | 05 | Parameters other than those of I/O terminal function are initialized. |
| | | 06 | Parameters other than the communication function parameters are initialized. |
| | | 07 | Parameters other than those of I/O terminal function and communication function are initialized. |
| | | 08 | Only the program data for DriveProgramming are initialized. |
| Initialize Data selection | [Ub-02] | 01 | Mode 1 (the factory setting) |
| Initialize Enable | [Ub-05] | 00 | Function disabled |
| | | 01 | Initialization start |

● [Ub-01] Parameters Chosen for Initialization

Initialization targets are indicated by ■.

| [Ub-01] | (1) History data | (2) Setting of I/O terminal | (3) Communication function | (4) Other than parameters (2) and (3) | (5) DriveProgramming |
|---------|---------------------|-----------------------------------|----------------------------------|--|-------------------------|
| 00 | | | | | |
| 01 | ■ | | | | |
| 02 | | ■ | ■ | ■ | |
| 03 | ■ | ■ | ■ | ■ | |
| 04 | ■ | ■ | ■ | ■ | ■ |
| 05 | | | ■ | ■ | |
| 06 | | ■ | | ■ | |
| 07 | | | | ■ | |
| 08 | | | | | ■ |

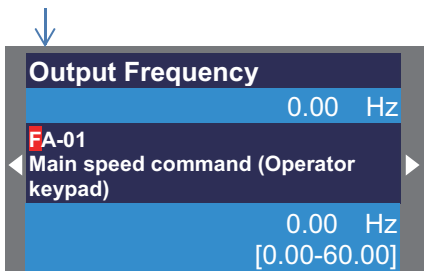
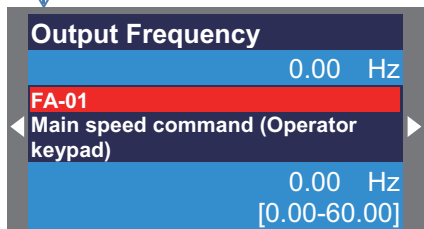
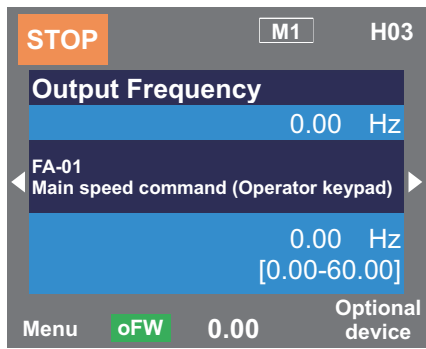
| Item | Parameter range | Description |
|-------------------------|--------------------|--------------------------------|
| Input terminal setting | [CA-01] to [CA-11] | Input terminal selection |
| | [CA-21] to [CA-31] | a/b contact selection |
| | [CA-41] to [CA-51] | Input terminal response |
| | [Cb-40] | Thermistor selection |
| | [CC-01] to [CC-07] | Output terminal selection |
| | [CC-11] to [CC-17] | a/b contact selection |
| | [CC-20] to [CC-33] | Output delay |
| | [CC-40] to [CC-60] | Logical operation function |
| Communication functions | [CF-01] to [CF-10] | Setting of RS485 communication |
| | [CF-20] to [CF-38] | Setting of EzCOM communication |

Example of initialization of the trip history, all the parameters, and the program data for DriveProgramming

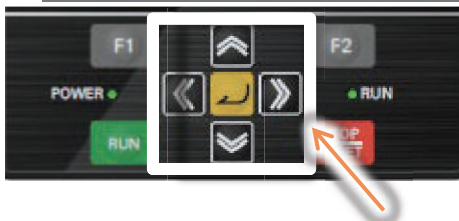
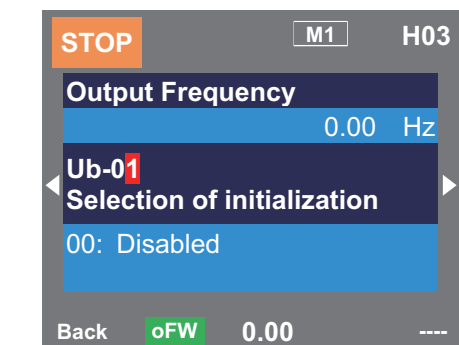
- 1 Press right (▶) key on LCD operator.



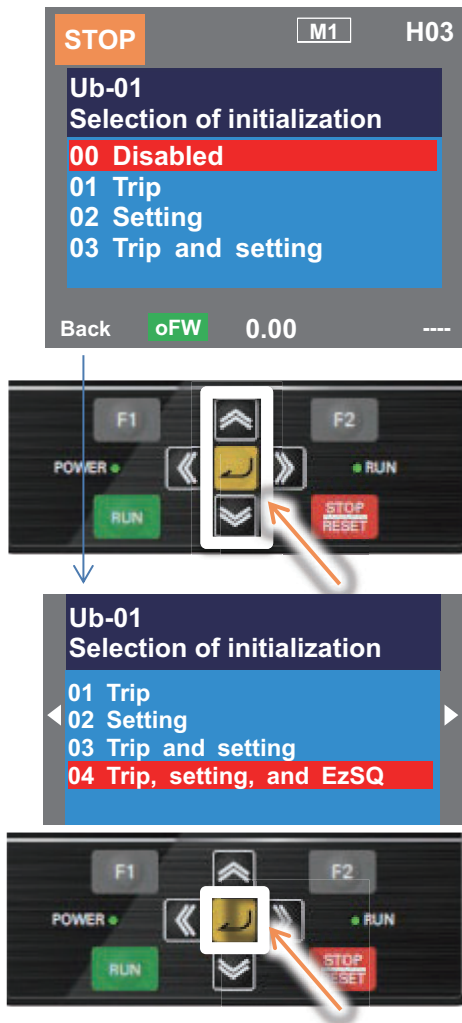
2 Press Enter key twice on the keypad and the parameter area begins blinking.



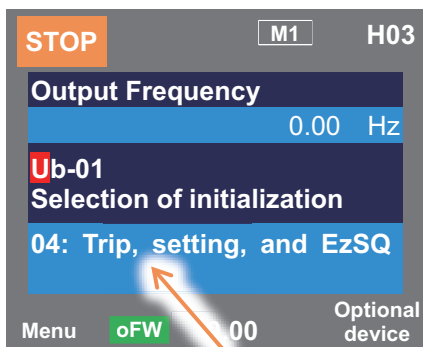
3 Use up, down, right, and left keys to choose a parameter and Enter key to set it.



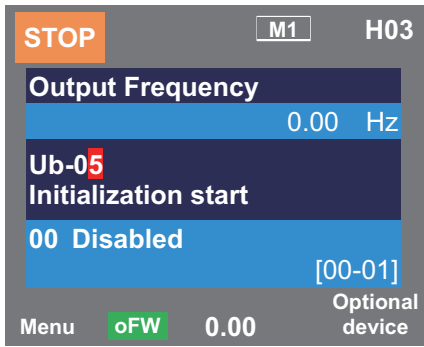
4 Use up and down keys to choose a mode and Enter key to set it.



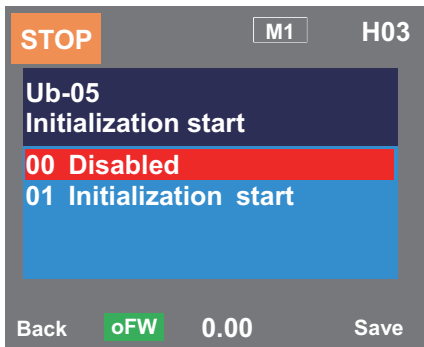
5 Check the content on the previous screen.
The initialization is not done yet.



6 Use up, down, right, and left keys to choose [Ub-05] and Enter key to set it.



7 Choose Enabled and press Enter key and initialization begins.



8 Initialization is on-going.



9 Initialization completed is displayed.

3-13 Connection and Functions of CX-Drive

The inverter/Servo support tool CX-Drive is support software to edit the inverter parameter settings. Installing the OMRON CX-One software on your PC also installs the CX-Drive simultaneously. The 3G3RX2 Series Inverter is supported in the following or higher versions of the CX-Drive product:

- CX-One: Ver. 4 or later
- CX-Drive: Ver. 3.0

This section describes how to connect the CX-Drive to an inverter and provides an overview of its functions.

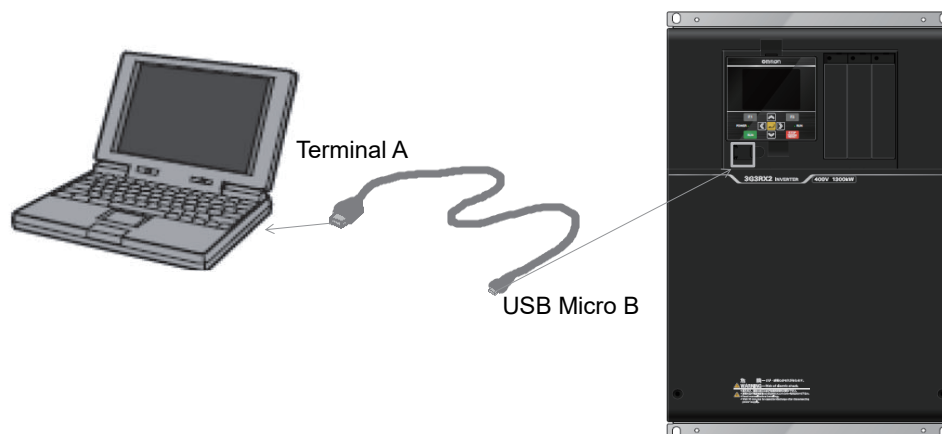
For details on the functions of the CX-Drive, refer to the *CX-Drive Operation Manual (Cat. No. W453-E1)*.

3-13-1 CX-Drive Connection Method

The following figure shows how to connect the 3G3RX2 Series with the inverter/Servo support tool CX-Drive.

Direct Connection via Serial Communications

Connect the CX-Drive directly to the serial communications port of the inverter.



CX-Drive Connection Procedures

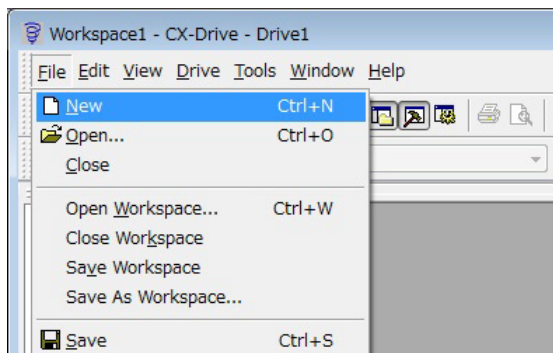
This section describes how to connect CX-Drive with an inverter.

● Connecting by Registering Inverter Connection Method Beforehand

Create a new inverter project, set the connecting method, and connect with the inverter.

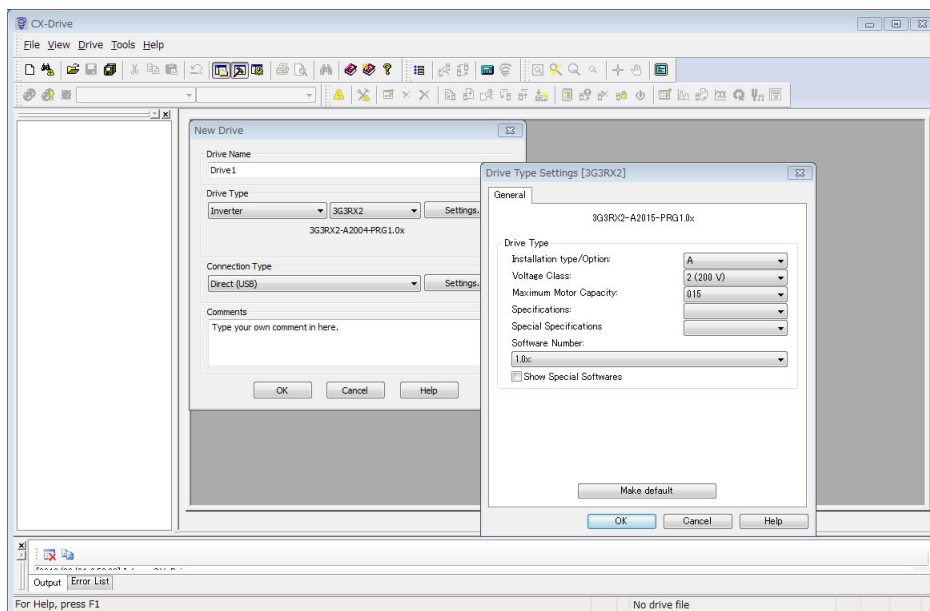
Follow the steps below.

- 1 Start the CX-Drive and, from the [File] menu, select [New].

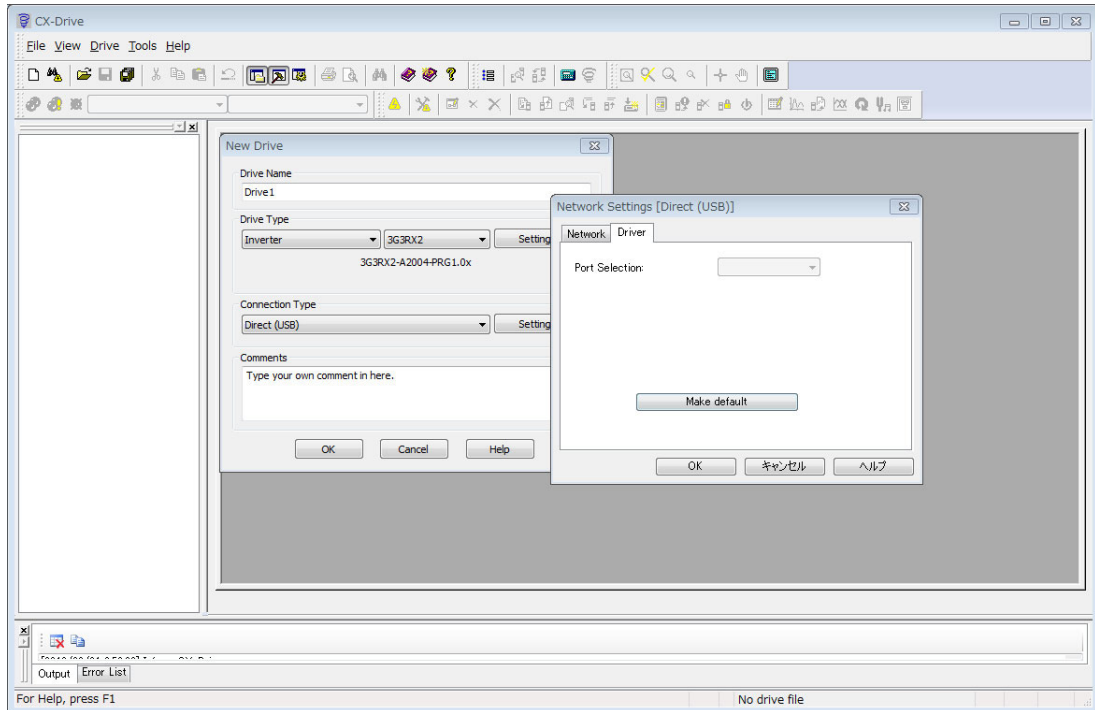


- 2 In the [New Drive] window, set the drive type of the target inverter.


Select "3G3RX2" on [Drive Type]. After that, click the [Settings] button to the right. Set the Inverter Protective Structure, Voltage Class and Maximum Motor Capacity on the [Drive Type Settings] window. After these settings, click the [OK] button to close the [Drive Type Settings] window.



- 3** In the [New Drive] window, set the type of connection to the inverter.
Under [Connection Type], select [Direct] and click the [Settings] button to the right.
On the [Driver] tab, set the Port Selection to the port name of the computer on which the CX-Drive is installed.



- 4** After setting these items, click the [OK] button and close all windows.
The new project is registered in the workspace.

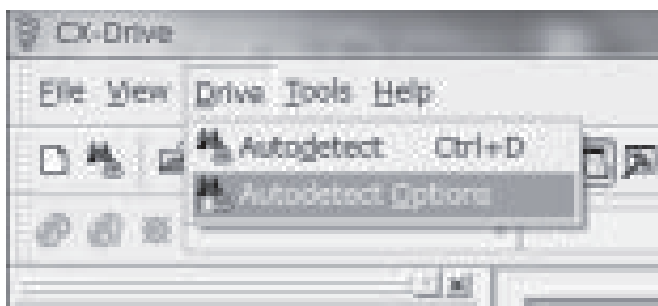
Click the [] (Work Online) icon to connect to the inverter.

● Automatically Detecting the Connected Inverter

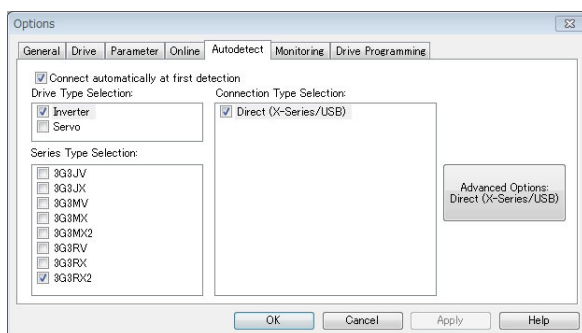
Set the [Autodetect Options] in the CX-Drive and use the Autodetect function to automatically connect to the inverter.

Follow the steps below.

- 1** Start the CX-Drive and, from the [Drive] menu, select [Autodetect Options] to open the Options window.



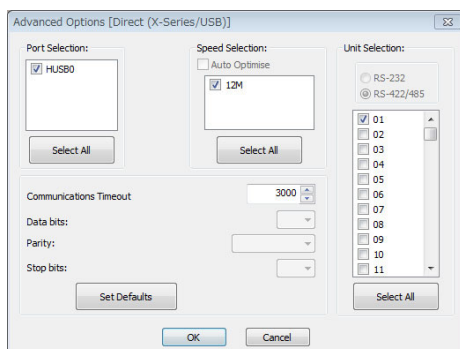
- 2** On the [Autodetect] tab, under [Drive Type Selection], check the [Inverter] box. Then, under [Connection Type Selection], check the [Direct] box and click the [Advanced Options: Direct] button to the right.



Additional Information

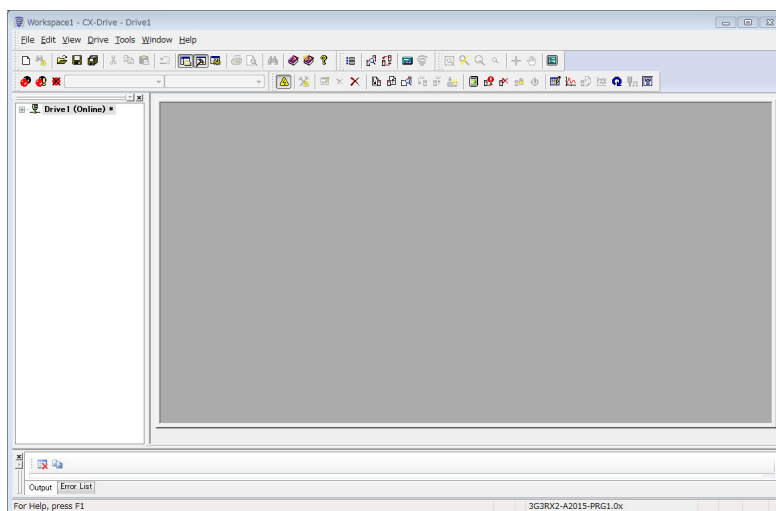
For the reduction of the automatic search time, deselect unnecessary check boxes to narrow down the scope of autodetection.

- 3** In the [Advanced Options [Direct (X-Series)]] window, set communications options.



- 4** After setting communications options, click the [OK] button and close all windows. Then, click [Autodetect].

The Autodetect function starts to create new drive projects automatically.



3-13-2 Outline of CX-Drive

The Inverter/Servo support tool CX-Drive enables you to edit inverter parameters and monitor the inverter status.

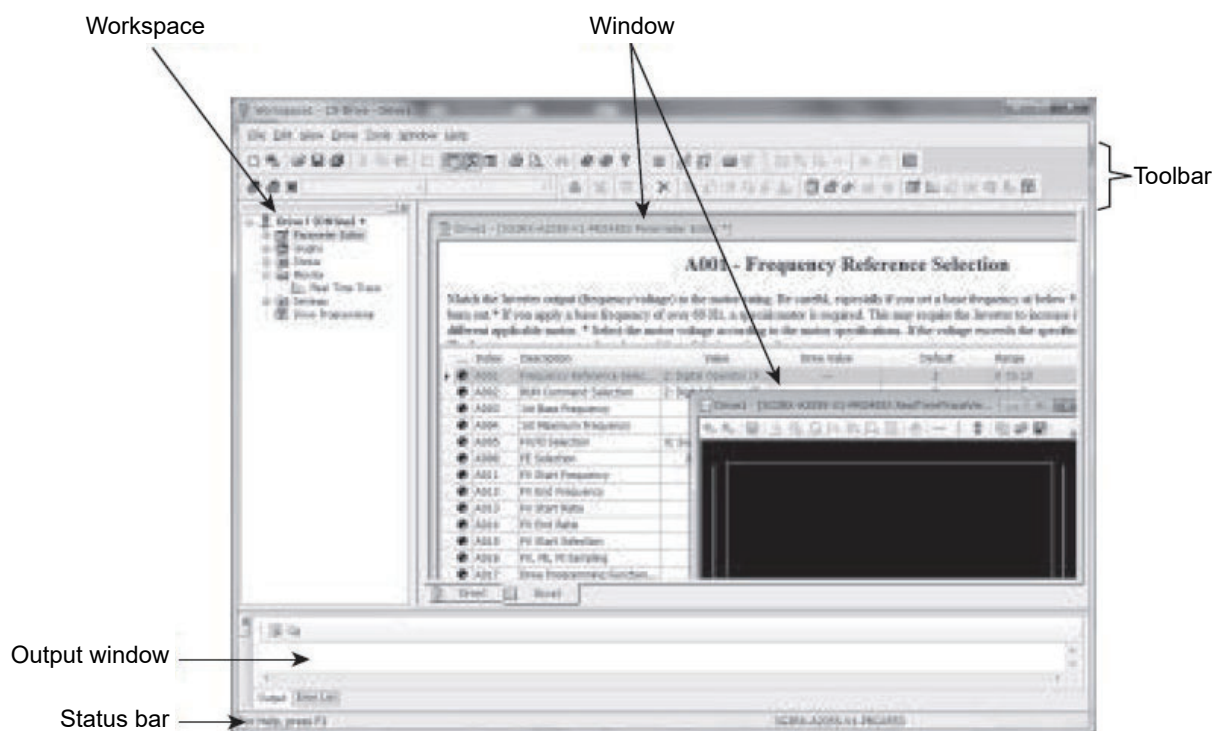
This section provides a functional outline of CX-Drive.

Screen Structure of CX-Drive

The screen structure of the CX-Drive is as shown below.

The workspace shows a list of registered drive projects. Double-clicking a project displays the functions contained in it.

Then, double-clicking each function opens a window corresponding to that function.



Precautions for Correct Use

CX-Drive, by default, does not allow connection to the inverter unless the software versions match.

- Software number of the inverter set in the CX-Drive project
- Software number of the inverter actually connected

If you cannot connect to the inverter due to a software number mismatch, select [Tools] - [Options] in the menu bar and, in the [Online] tab, deselect the [Check Drive Software Compatibility] check box. This allows CX-Drive to connect to the inverter operate normally, although a warning display appears.

To match the software numbers, right-click the project, select [Properties], and click the [Settings] button in the [Drive Type] section. In the Drive Type Settings window, set the Software Number that matches that of the inverter. If you cannot find the applicable software number in the CX-Drive's Software Number list, please upgrade the CX-Drive version.

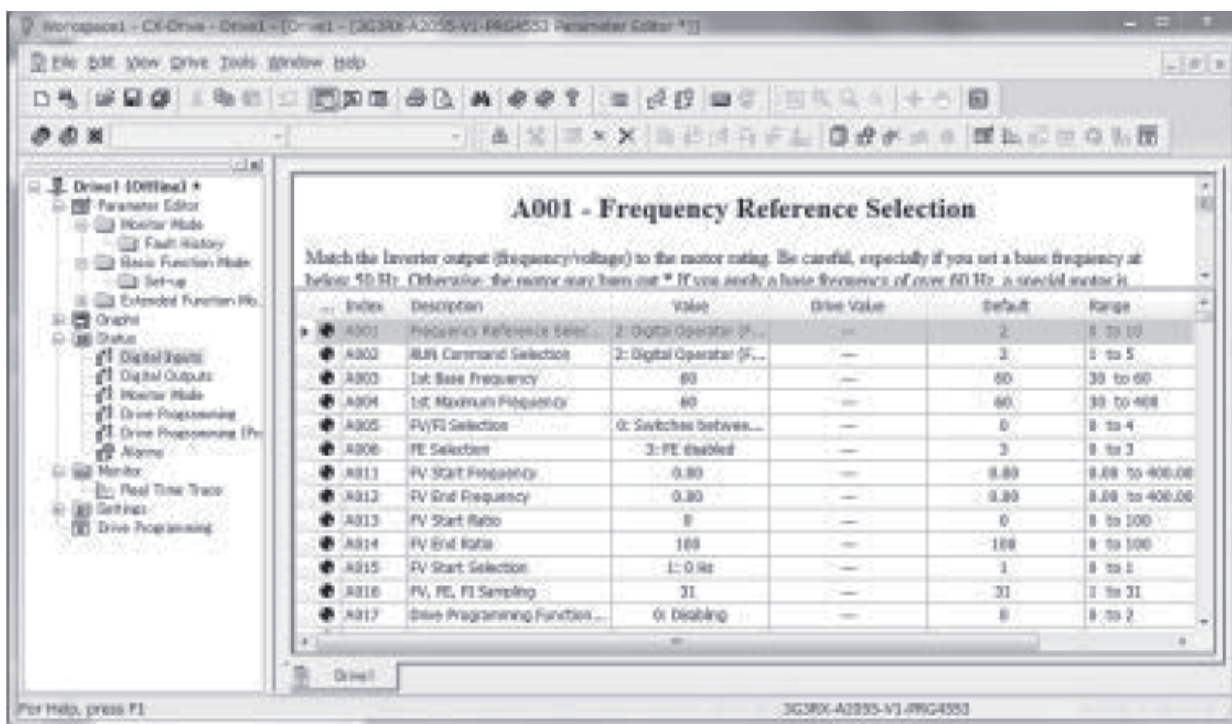
Editing Device Parameters Using CX-Drive

Double-clicking [Parameter Editor] in the project opens a window in which all inverter parameters are listed (in ascending order).

You can edit inverter parameters in this window.

To upload/download inverter parameters, use the [Transfer] buttons in the toolbar.

- Double-click one of the folders under Parameter Editor to narrow down the parameter list to only those parameters associated with it.
- Edit the value set for each parameter in the Value field of the parameter list.
- When a parameter is selected, the explanation of that parameter is displayed in the upper area.
- At the left end of the list, icons that represent the status of parameter data are displayed: Not default, Not default and different from the inverter, or Invalid. You can display only parameters with the same icon.
- You can select specific parameters and transfer data for only those selected parameters to the inverter.

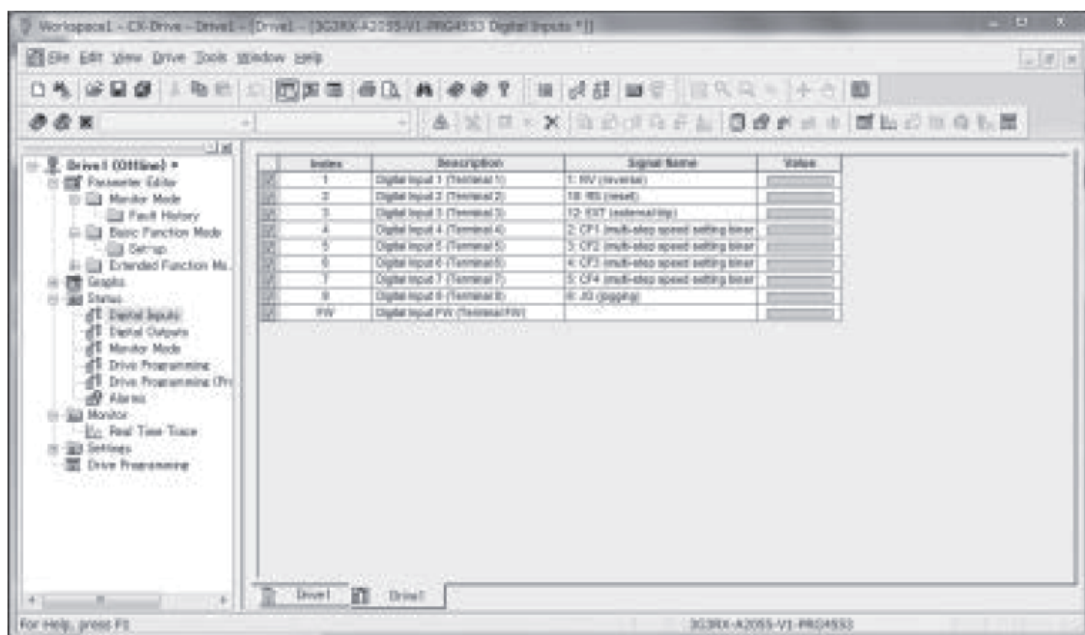


Status Function of CX-Drive

Open the Status folder in the project and double-click the status information.

The window corresponding to the selected status information opens.

| Status icon category | Description |
|----------------------|---|
| [Digital Inputs] | Displays the current ON/OFF status information, including the input function settings for the selected inverter. |
| [Digital Outputs] | Displays the current ON/OFF status information, including the output function settings for the selected inverter. |
| [Monitor Mode] | Displays the internal status values of the inverter. These status values are similar to those displayed in the monitor mode (dxxx) of the inverter. |
| [Alarms] | Displays an alarm history of the current and past alarms. |

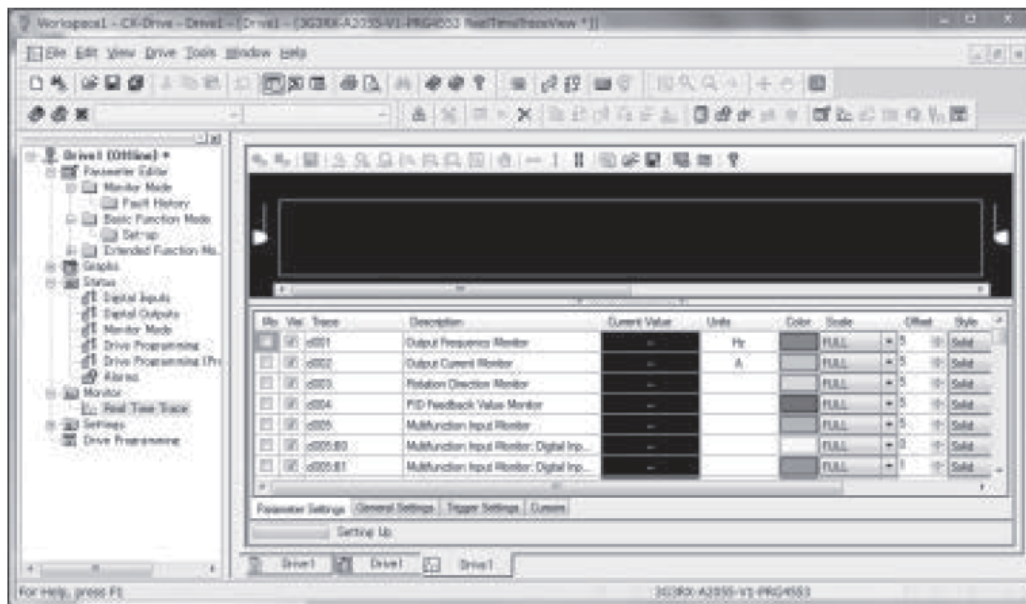


Monitor Function of CX-Drive

Open the Monitor folder in the project and double-click Real Time Trace.

The Real Time Trace window opens, in which you can monitor the operation status of the inverter.

- Up to 8 signals can be traced.
- Triggers can be set to the ON/OFF timing of the inverter's internal status, or numerically.



4

Test Run

This chapter provides an operational flow to do a test run.

| | | |
|-----|---|------|
| 4-1 | Test Run Method | 4-2 |
| 4-2 | Settings and Commands Required for Running the Inverter | 4-3 |
| 4-3 | Operation only with LCD Operator | 4-5 |
| 4-4 | Conduct a Test Run with Analog Input | 4-7 |
| 4-5 | Simulation Mode | 4-10 |


4-1 Test Run Method

To perform a test run, follow the procedures shown below.

Carefully read and understand *Safety Precautions* on page 8 and the relevant instructions in the following chart before starting works.

Operation with the host device can be checked before connecting a load and motor.

● Procedure

| Procedure ▶ | Check Items ▶ | For more details, |
|---|---|--|
| 1. Safety check  | See the precautions required for handling the inverter. | See <i>Safety Precautions</i> on page 8. |
| 2. Checking the inverter | Confirm that there is no abnormality in items included in the package of inverter and the appearance of the inverter. | See <i>Checking the Accessories</i> on page 19. |
| 3. Installation of the inverter | Confirm that the inverter is installed in a proper environment and in a proper setting. | See <i>1-3-4 External Dimensions</i> on page 1-13. |
| 4. Wiring requirements | Confirm that wires are properly connected to the inverter. | See <i>2-3 Wiring</i> on page 2-20. |
| 5. Setting up the operation method | Check how to operate the LCD operator. | See <i>Section 3 Operation</i> . |
| 6. Setting up the running method | Set up the inverter running method. | See <i>6-3 Operation Command Settings</i> on page 6-19. |
| 7. Selecting a control mode and protective function according to a load | Set up the inverter control method. | See <i>7-1 Overview of Motor Control Methods</i> on page 7-3 for descriptions of required items. The items required for running the inverter are provided in the following article. |
| Completed | | |

4-2 Settings and Commands Required for Running the Inverter

To turn the motor, configure the following settings.



Precautions for Correct Use

This article explains the settings for operation. Carefully read Safety Instructions before handling the inverter.

1 Basic setting for motor

Set the following parameters in accordance with the plate of motor. Set the data indicating the basic characteristics of motor.

| Item | Parameter | |
|--|-----------|---------|
| | IM | SM(PMM) |
| Async.Motor capacity setting, 1st-motor | [Hb102] | [Hd102] |
| Async.Motor poles setting, 1st-motor | [Hb103] | [Hd103] |
| Async.Motor Base frequency setting, 1st-motor | [Hb104] | [Hd104] |
| Async.Motor Maximum frequency setting, 1st-motor | [Hb105] | [Hd105] |
| Async.Motor rated voltage, 1st-motor | [Hb106] | [Hd106] |
| Async.Motor rated current, 1st-motor | [Hb108] | [Hd108] |

Note See 6-2-1 *Motor Basic Settings* on page 6-8 for details.

2 Setting for protection of motor

The motor may be burned if a large current keeps on flowing in the motor; the setting therefore must be performed appropriately.

| Item | Parameter |
|--|-----------|
| Electronic thermal level setting, 1st-motor | [bC110] |
| Electronic thermal characteristic selection, 1st-motor | [bC111] |

Note See 6-6 *Thermal Protection of Motor (Electronic Thermal)* on page 6-48 for details.

3 Setting for activating the motor

The voltage output of the inverter requires not only an operation command but also a frequency command. In the initial state, a main speed command is used as a frequency command.

| Item | Parameter |
|---|-----------|
| Main speed input source selection, 1st-motor | [AA101] |
| Run-command input source selection, 1st-motor | [AA111] |
| Main Speed reference monitor | [FA-01] |

Note For details, see 6-3 *Operation Command Settings* on page 6-19 and 6-4 *Frequency Command Settings* on page 6-25.

4 Settings for motor control

- Set the motor control method.
- For changing to the mode of driving an SM (PMM), you need to change the control method.

| Item | Parameter |
|-----------------------------------|-----------|
| Control mode selection, 1st-motor | [AA121] |

Note For details, see *7-1 Overview of Motor Control Methods* on page 7-3.

- When driving an SM (PMM) or using vector control, you need to set up the following motor constants:
- For induction motor IM

| Item | Parameter |
|------------------------------------|-----------|
| Async.Motor constant R1, 1st-motor | [Hb110] |
| Async.Motor constant R2, 1st-motor | [Hb112] |
| Async.Motor constant L, 1st-motor | [Hb114] |
| Async.Motor constant lo, 1st-motor | [Hb116] |
| Async.Motor constant J, 1st-motor | [Hb118] |

- For synchronous motor (permanent magnetic motor) (SM (PMM))

| Item | Parameter |
|-----------------------------------|-----------|
| Sync.Motor constant R, 1st-motor | [Hd110] |
| Sync.Motor constant Ld, 1st-motor | [Hd112] |
| Sync.Motor constant Lq, 1st-motor | [Hd114] |
| Sync.Motor constant Ke, 1st-motor | [Hd116] |
| Sync.Motor constant J, 1st-motor | [Hd118] |

4-3 Operation only with LCD Operator

This section describes how to conduct a test run with LCD operator.

To perform a test run only with the LCD operator, check the following parameters, or set the following parameters from the initial value.

- (a) Frequency command source selection [AA101]
- (b) Main speed command [FA-01]
- (c) Operation command source selection [AA111]
- (d) Setting the electronic thermal level of motor [bC110]

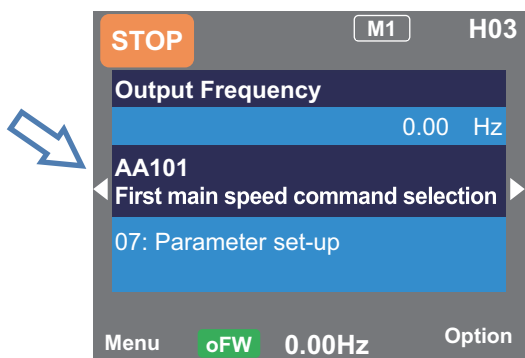
A test run can be performed with the LCD operator.

● Procedure

- From the initial screen displayed at power-on, move to “H03” with the LEFT/RIGHT (◀▶) keys.
- For procedure of changing parameters, see 3-2-1 *Scroll Mode* on page 3-14.

1 Frequency command source selection [AA101]

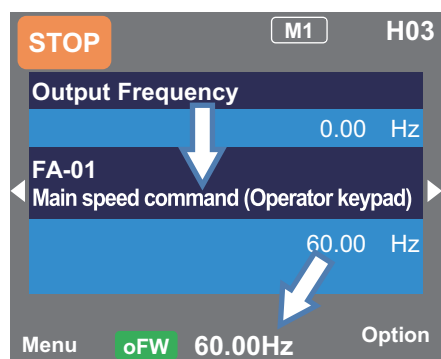
Set the frequency command destination to “07: Parameter set-up”.



2 Main speed command [FA-01]

When the frequency command source is set to “07: Parameter set-up”, “Main speed command (Operator keypad)” will be shown.

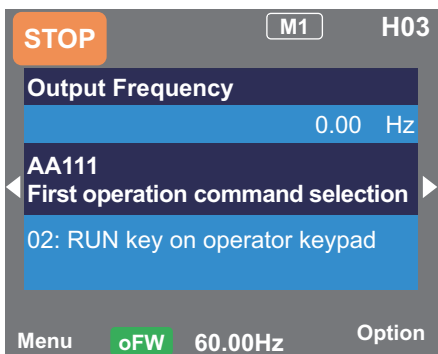
If a frequency command is set in this state, the value will be shown at the bottom command monitor area.



3 Operation command source selection [AA111]

When the operation command source is set to "02: LCD operator", "oFW" will be shown on the LCD operator at the bottom in the area for displaying function of RUN key.

Note When the operation command source is set to reverse, "oRN" is displayed.



4 Setting the electronic thermal level of motor [bC110]

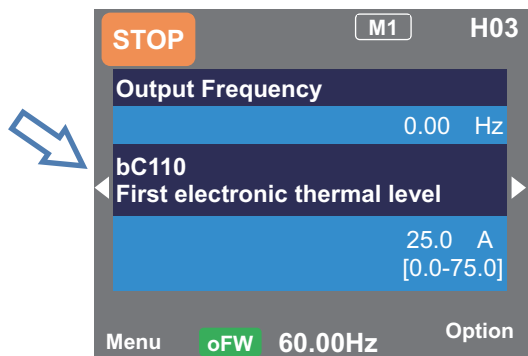
Set the level so that it does not exceed the rated current of motor.



Precautions for Correct Use

Note that the motor may be burned if the electronic thermal level is not appropriately set.

Note The electronic thermal for protecting the inverter works automatically.



4-4 Conduct a Test Run with Analog Input

This section describes how to conduct a test run, using variable resistance knobs into terminal block [FW] input and analog input H, Ai1 and L.

To perform a test run using analog input Ai1, set the following parameters from the initial value, or check the following parameters.

- (a) Frequency command source selection [AA101]
- (b) Main speed command [FA-01]
- (c) Operation command source selection [AA111]
- (d) Setting the electronic thermal level of motor [bC110]

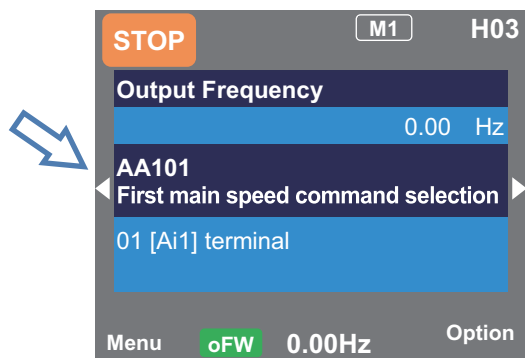
A test run can be performed using a variable resistor.

A test run can be performed with 10 V voltage input.

● Procedure

- From the initial screen displayed at power-on, move to “H03” with the LEFT/RIGHT arrow (◀ ▶) keys.
- For procedure of changing parameters, see 3-2-1 *Scroll Mode* on page 3-14.

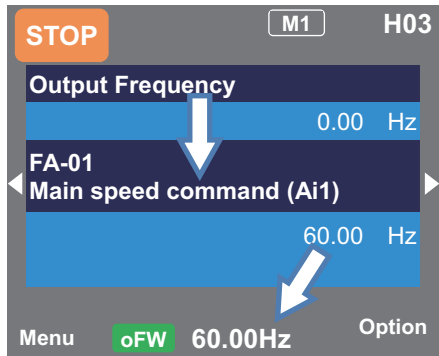
- 1 Frequency command source selection [AA101]
Set the frequency command source to “01: Ai1 input”.



2 Checking the main speed command [FA-01]

When the operation command source is set to "01: Ai1 input", "Main speed command (Ai1)" will be shown.

If a frequency command is set in this state, the value will be shown at the bottom command monitor area.



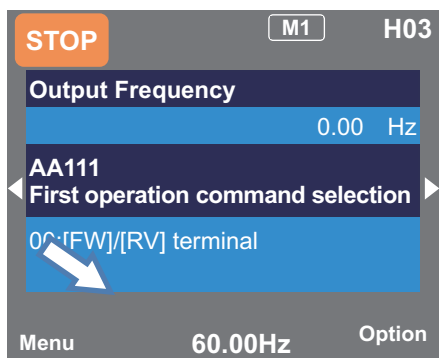
Precautions for Correct Use

- To connect a cable between Ai1 and L, or between Ai2 and L, make sure to check that a desired input (voltage or current) is provided to the corresponding positions of DIP switch SW1 and SW2.
- A damage may be caused by inputting a wrong voltage or current due to wrong selection of switches, input beyond the specified range (P24 terminal of 24 V is used instead of H terminal of 10 V), and wrong wiring (voltage/current being input reversely due to wrong wire connection or a cable between H and L is short-circuited at 0 Ω during wiring of a tab and so on).

3 Operation command source selection [AA111]

When the operation command source is set to "00:[FW]/[RV] terminal", the display will disappear from the area for displaying function of RUN key on LCD operator at the bottom.

Note Normal/reverse rotation can be set at [FW]/[RV] terminal.

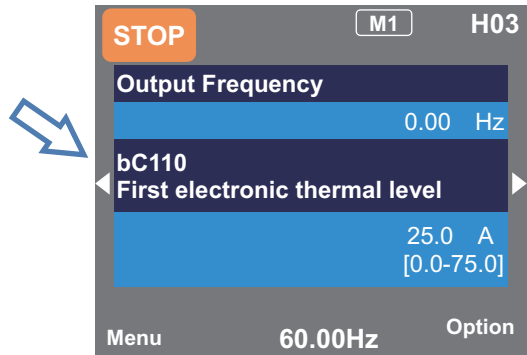


- 4** Setting the electronic thermal level of motor [bC110]
Set the level so that it does not exceed the rated current of motor.

Precautions for Correct Use

Note that the motor may be burned if the electronic thermal level is not appropriately set.

Note The electronic thermal for protecting the inverter works automatically.



Precautions for Correct Use

- Check the setting of the motor capacity, the number of motor poles, frequency, voltage, and current in order to conduct motor control.
- IM: Induction motor

| General motor items | Code | Setting range (unit) |
|-----------------------|---------|----------------------|
| Capacity | [Hb102] | 0.01 to 160.00 (kW) |
| Number of motor poles | [Hb103] | 2 to 48 (poles) |
| Frequency | [Hb104] | 10.00 to 590.00 (Hz) |
| | [Hb105] | 10.00 to 590.00 (Hz) |
| Voltage | [Hb106] | 1 to 1000 (V) |
| Current | [Hb108] | 0.01 to 10000.00 (A) |

- SM (PMM): Synchronous (permanent magnet) motor

| General motor items | Code | Setting range (unit) |
|-----------------------|---------|----------------------|
| Capacity | [Hd102] | 0.01 to 160.00 (kW) |
| Number of motor poles | [Hd103] | 2 to 48 (poles) |
| Frequency | [Hd104] | 10.00 to 590.00 (Hz) |
| | [Hd105] | 10.00 to 590.00 (Hz) |
| Voltage | [Hd106] | 1 to 1000 (V) |
| Current | [Hd108] | 0.01 to 10000.00 (A) |

- See 6-2 *Parameter Setting for Motor Related* on page 6-8 for details.
- In the initial state, the motor is in the V/f control mode, in which voltage is output proportional to the frequency for induction motor control.

For control modes, see 7-1 *Overview of Motor Control Methods* on page 7-3.

4-5 Simulation Mode

If the simulation mode [PA-20] is set to 01 and the power is turned on again, the inverter enters the simulation mode and does not output to the motor.

To cancel the simulation mode, set [PA-20] to 00 and then turn on the power again.

Because the inverter behaves just like a normal operation except that it cannot output to the motor, you can check terminals and communication operations.

It will be possible to change the internal data on a real-time basis by assigning a parameter or analog input to the internal data.

Operation checks can be performed in the condition that the control power supply is input or 24-V power supply is used.

If the error code selection [PA-21] is set during the simulation mode, a trip is issued as soon as the setting is made. To cancel a trip, reset the inverter (turn ON the [RS] terminal or press RESET key) as usual. When the inverter is reset, [PA-21] is automatically set to 00.

Terminal checks can be performed without inverter output.



Precautions for Correct Use

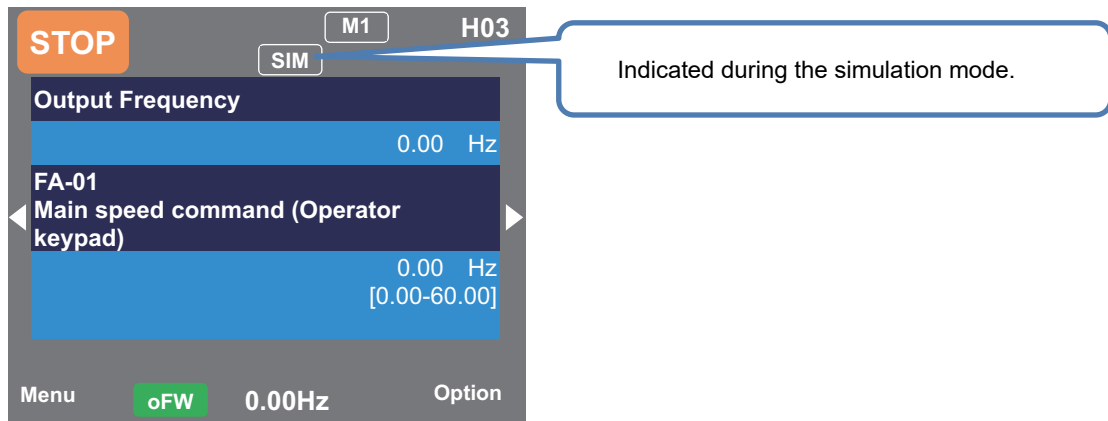
- The motor cannot be driven in the simulation mode.
 - To check the actual motor behavior, set the simulation mode [PA-20] to “00: Disable” and then turn on the power again.
 - To activate the simulation mode, activate it in the condition that 24-V power supply is input for 24-V power supply; that control power supply is input for control power supply terminals (R0, T0) inputs; and that R, S, and T terminals are input for main power supply inputs R, S, and T. Then turn off the power to end the simulation mode.
 - Because the simulation mode is for simulating terminals' behaviors, the function activated by a motor control operation does not work.
 - In the simulation mode, if an error not listed in the selection of error code for alarm test [PA-21] is entered, the error will not be generated.
 - In the simulation mode, if a serious fault error is entered to the selection of error code for alarm test [PA-21], the power needs to be turned on again.
(Serious fault errors: E008, E010, E011, E014, E019, E020)
-

● [Procedure] Entering the simulation mode

- 1** Set the simulation mode [PA-20] to 01.
- 2** Turn off the power, and then turn it on again.
- 3** The simulation mode becomes active.

● [Procedure] Canceling the simulation mode

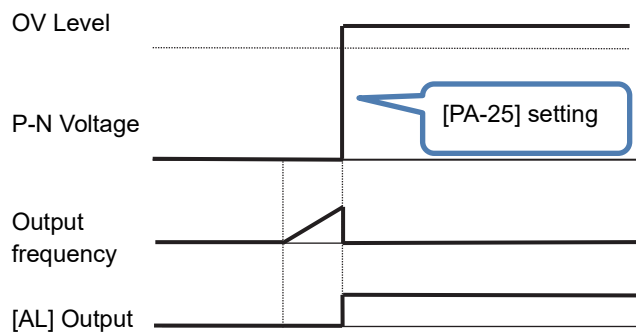
- 1** Set the simulation mode [PA-20] to 00.
- 2** Turn off the power, and then turn it on again.
- 3** The simulation mode is canceled.



(Example: usage 1)

[AL] Checking the behavior while the alarm [AL] is on.

- The operation was started.
- DC-bus voltage monitor optional output enable [PA-24] was set to 01, and DC-bus voltage monitor optional value output [PA-25] was set to the maximum value.

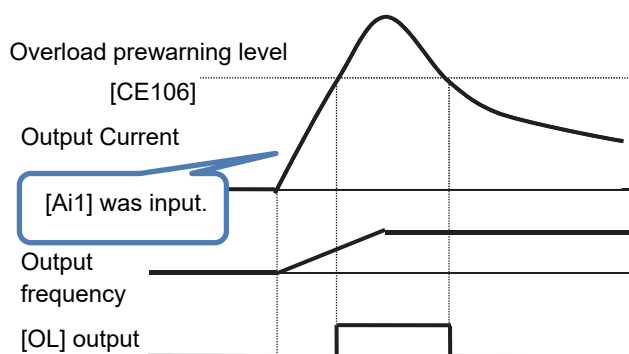


- An overvoltage error [E007] occurred and [AL] was ON.

(Example: usage 2)

Checking the signal output of overload prewarning level [OL].

- The over current detection level 1, 1st motor [CE106] was set, and the operation was started.
- Output current monitor optional output selection [PA-22] was set to 02, and [Ai1] was increased and decreased.



- [OL] was turned ON because the output current exceeded the over current detection level 1, 1st motor [CE106].

● Parameter

| Item | Parameter | Data | Description |
|---|---|--|--|
| Simulation mode enable | [PA-20] | 00 | Disable |
| | | 01 | Enable |
| Error code selection for Alarm test | [PA-21] | 000 to 255 | Issues a set error. Errors not listed in the selection do not occur. |
| Output current monitor optional output enable | [PA-22] [PA-24] [PA-26] [PA-28] [PA-30] | 00 | Disable |
| DC-bus voltage monitor optional output enable | | 01 | Enable (Parameter setting) |
| Output voltage monitor optional output enable | | 02 | Enable (Setting by [Ai1]) |
| Output torque monitor optional output enable | | 03 | Enable (Setting by [Ai2]) |
| Start with frequency matching optional Setting enable | | 04 | Enable (Setting by [Ai3]) |
| | | 05 | (Reserved) |
| | | 06 | (Reserved) |
| | 07 | (Reserved) | |
| Output current monitor optional output value setting | [PA-23] | 0.0 to 3.0 × Inverter rated current (A) ^{*1} | Treats the set values as internal output values. |
| DC-bus voltage monitor optional value output | [PA-25] | 200V class: 0.0 to 450.0 (Vdc) 400V class: 0.0 to 900.0 (Vdc) | Treats the set values as internal output values. |
| Output voltage monitor optional output value setting | [PA-27] | 200V class: 0.0-300.0(V) 400V class: 0.0-600.0(V) | Treats the set values as internal output values. |
| Output torque monitor optional output value setting | [PA-29] | -500.0 to 500.0(%) | Treats the set values as internal output values. |
| Start with frequency matching optional value setting | [PA-31] | 0.00 to 590.00(Hz) | Treats the set values as internal output values. |

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
- 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- 3) Drive programming: 0.01% (Rated ratio)

5

Monitor

This section describes monitor functions installed with an inverter.

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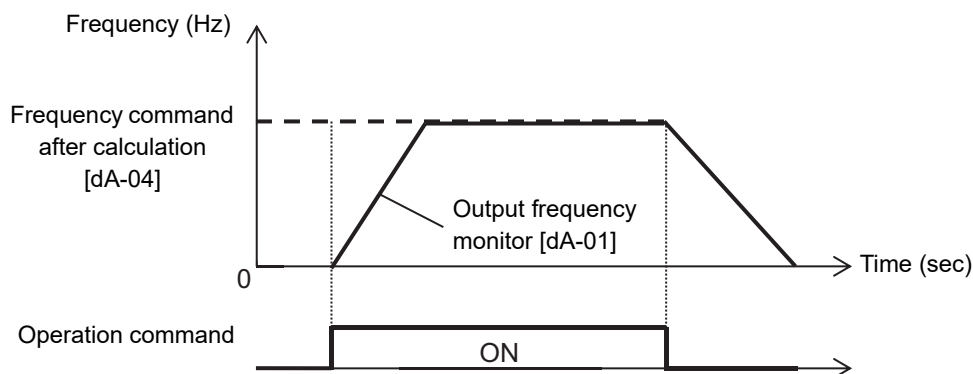
| | |
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5-1 Frequency Monitor

5-1-1 Output Frequency Monitor

Displays the output frequency of an inverter.

Output frequency monitor adjusts frequency command according to the setting of the acceleration/deceleration time after the inverter starts operation.



● Parameter

| Item | Parameter | Data | Description |
|--------------------------------------|-----------|------------------------|--|
| Output frequency monitor | [dA-01] | 0.00 to 590.00 (Hz) | Displays output frequency. |
| Output frequency monitor (with sign) | [dA-12] | -590.00 to 590.00 (Hz) | Displays output frequency with sign. A forward revolution is indicated with + sign, and a reverse revolution with -. |

5-1-2 Frequency Command Monitor

Frequency command after calculation [dA-04] monitors the state of command which is input ultimately at the moment.

As for the Main Speed reference monitor [FA-01], frequency command setting value can be changed by using UP/DOWN keys on the monitor, if the Main speed input source selection, 1st-motor [AA101] is set to 07 (Parameter setting).

As for the Sub Speed reference monitor [FA-02], frequency command setting value can be changed by using UP/DOWN keys on the monitor, if the Sub frequency input source selection, 1st-motor [AA102] is set to 07 (Parameter setting).



Precautions for Correct Use

- If the frequency command monitor does not change when frequency command is changed, a command destination not intended by the frequency command may have taken a priority.
- The frequency command is influenced by the following functions:
 - Main speed input source selection, 1st-motor [AA101]
 - Sub frequency input source selection, 1st-motor [AA102]
 - Jogging command [JG]
 - Multi-speed command [CF/SF]
 - Operation switching [SCHG]
 - Calculation symbol selection for Speed reference, 1st-motor [AA105]
 - Forced operation [F-OP]
 - Addition [ADD]
- See 6-4 *Frequency Command Settings* on page 6-25 for details.

● Parameter

| Item | Parameter | Data | Description |
|------------------------------|-----------|---|--|
| Frequency command | [dA-04] | -590.00 to 590.00 (Hz) | Displays frequency command. Displays a result of function such as jogging, multi speed, and forced operation [F-OP]. |
| Main Speed reference monitor | [FA-01] | 0.00 to 590.00 (Hz) | Displays the command frequency selected for the main speed input source selection, 1st-motor [AA101]. |
| Sub Speed reference monitor | [FA-02] | Monitor: 0.00 to 590.00 (Hz) Setting: -590.00 to 590.00 (Hz) | Displays the command frequency selected for the Sub frequency input source selection, 1st-motor [AA102]. |

5-1-3 Frequency Conversion Monitor

The frequency conversion monitor displays the value obtained by multiplying the frequency command (Hz) by coefficient which is set in the Frequency conversion gain [Ab-01]. Use this method when you want to change the displayed value of data such as motor rotation speed, etc.

Example of conversion of displayed frequency

“Output frequency conversion monitor [dA-06]” = “Frequency command (Hz)” x “Frequency conversion gain [Ab-01]”

(Example) Displaying the motor rotation speed

The relationship of rotation speed and frequency is as shown below:

$$\text{Rotation speed } N \text{ (min}^{-1}\text{)} = (120 \times f \text{ (Hz)})/P \text{ (poles)}$$

When the motor frequency is 60Hz and the number of poles is 4, the coefficient is 30; hence at 60Hz, where [Ab-01]=30.00, “60×30.0=1800 (min⁻¹)” will be displayed on the monitor.

Table of sample conversions

| Motor frequency (Hz) | Number of motor poles (P) | Coefficient [Ab-01] | Synchronous rotation [min-1] |
|----------------------|---------------------------|---------------------|------------------------------|
| 50 | 2 | 60 | 3000 |
| 50 | 4 | 30 | 1500 |
| 50 | 6 | 15 | 750 |
| 50 | 8 | 7.5 | 375 |
| 60 | 2 | 60 | 3600 |
| 60 | 4 | 30 | 1800 |
| 60 | 6 | 15 | 900 |
| 60 | 8 | 7.5 | 450 |



Precautions for Correct Use

In this monitor, gain is applied to the output frequency monitor [dA-01].

● Parameter

| Item | Parameter | Data | Description |
|-------------------------------------|-----------|-----------------------|---|
| Output frequency conversion monitor | [dA-06] | 0.00 to 59000.00 (Hz) | Converted output frequency is displayed. |
| Frequency conversion gain | [Ab-01] | 0.01 to 100.00 | Set the gain of frequency conversion monitor. |

5-1-4 Speed Detection Value Monitor

If the motor is controlled with the PG Option Unit, the feed back rotation speed data can be shown as frequency.



Precautions for Correct Use

- Frequency will not be displayed if the feedback function is not used.
- Frequency will not be correctly displayed if the number of pulses of encoder and the number of motor poles are not set accurately.

● Parameter

| Item | Parameter | Data | Description |
|--|-----------|------------------------|---|
| Speed detection value monitor | [dA-08] | -590.00 to 590.00 (Hz) | Displays the feed back speed detection value. |
| Encoder constant setting | [CA-81] | 32 to 65535 (pls) | Enabled when the "pulse train input (inverter) detection target [CA-90]" is set to 02. |
| Pulse train detection object selection | [CA-90] | 00 | Disabled |
| | | 01 | Pulse train input frequency command is enabled. |
| | | 02 | Speed feedback |
| | | 03 | Pulse count |
| Encoder constant setting | [ob-01] | 32 to 65535 (pls) | Set the number of pulses of encoder which is input from PG Option Unit. It is enabled when [CA-90] is set to except for 02. |
| Async.Motor poles setting, 1st-motor | [Hb103] | 2 to 48 (poles) | Set the number of motor poles. |

5-2 Acceleration/Deceleration Time Monitor

The time of acceleration or deceleration currently underway can be shown, when, with 2-step acceleration/deceleration function or multi-speed function, the acceleration or deceleration time is switched or when you are using the inverter while changing the acceleration/deceleration time setting.

The time that it takes to rise from 0 Hz to the maximum frequency will be displayed as the acceleration time.

The time that it takes to fall from the maximum frequency to 0 Hz will be displayed as the deceleration time.



Precautions for Correct Use

- The acceleration time and deceleration time monitors are affected by the following functions:
 - Acceleration/deceleration function
 - 2-step acceleration/deceleration function
 - Multi-speed function
 - PID soft-start function
 - Acceleration/deceleration cancellation [LAC] function
 - Second setting [SET] function
- The acceleration time and deceleration time monitors are enabled only under the frequency control. A correct value may not be displayed when the acceleration or deceleration time fluctuates depending on the torque under the torque control.
- When the frequency is accelerated or decelerated after the acceleration or deceleration pattern is changed, the time to change between 0 Hz and maximum value will be displayed.

● Parameter

| Item | Parameter | Data | Description |
|---------------------------|-----------|---------------------|---|
| Acceleration time monitor | [FA-10] | 0.00 to 3600.00 (s) | Displays the enabled acceleration time. |
| Deceleration time monitor | [FA-12] | 0.00 to 3600.00 (s) | Displays the enabled deceleration time. |

5-3 Operation Direction Monitor

The operation direction monitor displays conditions of the operation commands and the rotation direction.

The rotation direction is determined by methods of operation command and signs of frequency command.



Precautions for Correct Use

- In the zero-speed output mode, it is likely that the converter is outputting under 0Hz command due to the direct current function, forcing function, or 0Hz range sensorless vector control, etc.
- The inverter is stopped when an output is not made.

● Parameter

| Item | Parameter | Data | Description |
|-----------------------------|-----------|-------------------------------------|---|
| Operation direction monitor | [dA-03] | 00: o (Stopped) | Inverter is stopped. |
| | | 01: d (0Hz output) | Inverter is outputting 0 Hz. |
| | | 02: F (Normal rotation in process) | Inverter is running under forward rotation command. |
| | | 03: r (Reverse rotation in process) | Inverter is running under reverse rotation command. |

5-4 I/O Terminal Monitor

5-4-1 Input Terminal Monitor

The input terminal monitor displays the physical ON (H)/OFF (L) status of terminals.

The input terminal monitor shows the slow reaction according to the input terminal response time.

The input terminal monitor is not affected by setting of a/b contact.

(Example) The state where terminals 4 and 8 are ON.

| Monitor | L L L H L L L H L L L |
|--------------|-----------------------------------|
| Terminal No. | (B)(A)(9)(8)(7)(6)(5)(4)(3)(2)(1) |



Precautions for Correct Use

- If the monitor status doesn't change when a terminal is turned ON and OFF, the input wires may be disconnected.
- When the [RS] terminal is turned ON, the inverter enters a reset mode; hence the state of input terminal cannot be checked on the input terminal monitor. However, from the fact the inverter enters the reset mode, you know that the terminal is working.

● Parameter

| Item | Parameter | Data | Description |
|------------------------|-----------|----------------------------|--|
| Input terminal monitor | [dA-51] | LLLLLLLLLLL to HHHHHHHHHHH | Displays the ON/OFF status of input terminals (H: ON; L: OFF). |

5-4-2 Output Terminal Monitor

The output terminal monitor displays the state of internal functions.

The output terminal monitor behaves as set for on-delay/off-delay of output terminals.

(Example) The state where terminals 15 and AL are ON.

| Monitor | H L H L L L L |
|--------------|------------------------------------|
| Terminal No. | (AL) (16) (15) (14) (13) (12) (11) |



Precautions for Correct Use

- If the output terminal status doesn't change when the monitor status changes, the output wires may be disconnected.
- The output terminal monitor is not affected by setting of a/b contact.

● Parameter

| Item | Parameter | Data | Description |
|-------------------------|-----------|--------------------|---|
| Output terminal monitor | [dA-54] | LLLLLLL to HHHHHHH | Displays the ON/OFF status of output terminals (H: ON; L: OFF). |

5-4-3 Output Current Monitor

Displays the output current flowing in the motor.



Precautions for Correct Use

The lower the carrier frequency, the more the value of current of monitor may fluctuate, depending on the PWM output system of the inverter.

● Parameter

| Item | Parameter | Data | Description |
|------------------------|-----------|--------------------|--|
| Output current monitor | [dA-02] | 0.00 to 655.35 (A) | Displays the effective value of output current flowing in the motor. |

5-4-4 Output Voltage Monitor

Displays the output voltage which is output to the motor.



Precautions for Correct Use

A correct value may not be displayed when the input voltage is low.

● Parameter

| Item | Parameter | Data | Description |
|------------------------|-----------|------------------|--|
| Output voltage monitor | [dA-18] | 0.0 to 800.0 (V) | Displays the voltage which is output to the motor. |

5-5 P-N Voltage Monitor

Displays P-N voltage charged in the main circuit capacitor of an inverter.



Precautions for Correct Use

P-N voltage is DC voltage. The overvoltage error [E007] is generated in the following cases:

- When P-N voltage is over around 405 VDC in the class of 200 V inverter.
- When P-N voltage is over around 810 VDC in the class of 400 V inverter.

● Parameter

| Item | Parameter | Data | Description |
|--------------------|-----------|-------------------|---------------------------------------|
| DC voltage monitor | [dA-40] | 0.0 to 1000.0 (V) | Displays the P-N voltage of inverter. |

5-6 Operation Time and Count Monitor

5-6-1 Cumulative operating hours monitor during RUN

The cumulative operating hours monitor during RUN displays the duration of the time when an inverter provides output after it receives an operation command.



Precautions for Correct Use

The cumulative operating hours monitor during RUN cannot be cleared by initialization or the similar method.

● Parameter

| Item | Parameter | Data | Description |
|---|-----------|------------------|--|
| Cumulative operating hours monitor during RUN | [dC-22] | 0 to 100000 [hr] | Stores and displays the duration of the time when an inverter provides output. |

5-6-2 Cumulative Power-on Time Monitor

The cumulative power-on time monitor displays the duration of the time when the inverter was turned ON.



Precautions for Correct Use

The cumulative power-on time monitor cannot be cleared by initialization or the like.

● Parameter

| Item | Parameter | Data | Description |
|----------------------------------|-----------|------------------|--|
| Cumulative power-on time monitor | [dC-24] | 0 to 100000 [hr] | Data of period that the inverter is ON is stored for monitoring. |

5-6-3 Total Start-up Count Monitor

The total start-up count monitor displays the number of times when the inverter starts outputs from the power-off condition.



Precautions for Correct Use

Total start-up count monitor cannot be cleared by initialization or the like.

● Parameter

| Item | Parameter | Data | Description |
|------------------------------|-----------|---------------------|---|
| Total start-up count monitor | [dC-20] | 0 to 65535 (Counts) | Checks the number of times the inverter entered an operation condition from an power-off condition. |

5-6-4 Cumulative Power-on Count Monitor

The cumulative power-on count monitor displays the number of the times when the inverter was turned ON.



Precautions for Correct Use

- Power-on count monitor cannot be cleared by initialization or the like.
- Retry restarts due to instantaneous power failures are not counted.

● Parameter

| Item | Parameter | Data | Description |
|----------------|-----------|---------------------|--|
| Power-on count | [dC-21] | 0 to 65535 (Counts) | Displays numbers of the times when the power supply for control circuit was turned ON. |

5-7 Cooling Fin Temperature Monitor

The cooling fin temperature monitor displays the temperature of the inverter's fin.



Precautions for Correct Use

The temperature error [E021] is generated when the cooling fin temperature exceeds 120°C.

● Parameter

| Item | Parameter | Data | Description |
|---------------------------------|-----------|---------------------|--------------------------------------|
| Cooling fin temperature monitor | [dC-15] | -20.0 to 200.0 (°C) | Displays the cooling fin temperature |

5-8 Power Monitor

5-8-1 Input Power Monitor

The input power monitor [dA-30] displays the current power input to the inverter.

The integrated input power monitor [dA-32] displays the integrated data of the power input to the inverter.



Additional Information

- Display gain for Accumulation input power monitor [UA-13] mode, the displayed contents can be converted with gain.
[dA-32]= "Calculated input power value (kWh)"/[UA-13]
([UA-13] can be set from 1. to 1000. by an unit.)
- Accumulation input power monitor clear [UA-12] to "01" and then determining it, you can clear an integrated input power value.
- Also, if 039 [KHC] (clearing of integrated input power) has been assigned to one of the input terminals, integrated input power value can be cleared via that terminal.

● Parameter

| Item | Parameter | Data | Description |
|---|--------------------|-----------------------|---|
| Input power monitor | [dA-30] | 0.00 to 600.00 (kW) | Displays the input power. Changes according to input power factors. |
| Integrated input power monitor | [dA-32] | 0.0 to 100000.0 (kWh) | Displays the integrated value of input power. Changes according to input power factors. |
| Accumulation input power monitor clear | [UA-12] | 00 | Disable |
| | | 01 | Clear |
| Display gain for Accumulation input power monitor | [UA-13] | 1 to 1000 | Displays a value obtained by multiplying by gain. |
| Input terminal function | [CA-01] to [CA-11] | 039 | [KHC] Clearing of integrated input power terminal |

5-8-2 Output Power Monitor

The output power monitor [dA-34] displays the current power output to the inverter.

The integrated output power monitor [dA-36] displays the integrated data of the power output to the inverter.



Additional Information

- Display gain for Accumulation output power monitor [UA-15] mode, the displayed contents can be converted with gain.
Value indicated on [dA-36] = "Calculated output power value (kWh)"/[UA-15]
([UA-15] can be set from 1. to 1000. by an unit.)
- Accumulation output power monitor clear [UA-14] to "01" and then determining it, you can clear an integrated output power value.
- Also, if 40 (OKHC: clearing of integrated output power) has been assigned to one of the input terminals, integrated input power value can be cleared via that terminal.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|-----------------------|---|
| Output power monitor | [dA-34] | 0.00 to 600.00 (kW) | Displays the output power. |
| Integrated output power monitor | [dA-36] | 0.0 to 100000.0 (kWh) | Displays the integrated value of output power. |
| Accumulation output power monitor clear | [UA-14] | 00 | Disable |
| | | 01 | Clear |
| Display gain for Accumulation output power monitor | [UA-15] | 1 to 1000 | Displays a value obtained by multiplying by gain. |
| Input terminal function | [CA-01] to [CA-11] | 040 | [OKHC] Clearing of integrated output power terminal |

5-9 Life Monitor

5-9-1 Life Diagnostic Monitor

The life diagnostic monitor displays the following conditions:

- The lives of capacitors on the main circuit board
- The cooling fan life

As for signals, a capacitor life prewarning signal (029 [WAC]) and a fan life advance notice signal (030 [WAF]) can be output.



Precautions for Correct Use

- The lives of capacitors are calculated once a ten minutes. If the power supply is repeatedly turned ON and OFF faster than this cycle, the inverter will be incapable of diagnosing the lives of capacitors normally.
- If the selection of the cooling fan operation is set to other than 00, the fan will stop automatically depending on the condition. The life diagnosis isn't carried out while the fan is in the automatic stop mode.

● Parameter

| Item | Parameter | Data | Description |
|--------------------------------------|--------------------|----------|--|
| Life diagnostic monitor | [dC-16] | LL to HH | The monitors shows H at the end of the life spans. The monitor on the right indicates the lives of the capacitors on the circuit board, whereas that on the left indicates the life of the cooling fan. |
| Capacitor life advance notice | [CC-01] to [CC-07] | 029 | [WAC]: This signal is output when the lives of the capacitors on the circuit board are neared. |
| Fan life advance notice | [CC-01] to [CC-07] | 030 | [WAF]: This signal is output when the cooling fan rotation speed is decreased. |
| Cooling FAN control method selection | [bA-70] | 00 | Always ON |
| | | 01 | The fan is turned ON during operation and continues rotating after the operation is stopped. |
| | | 02 | Running depending on the temperature. The fan runs as the fin temperature rises. |

For operation of cooling fan, see 8-5 *Cooling Fan Control* on page 8-122.

5-9-2 Monitor of Cumulative Operating Time of Cooling Fan

The cumulative operating time of cooling fan displays the time when the cooling fan run.

The cumulative cooling fan operating time monitor can be used as a guide for a replacement of the cooling fan.



Precautions for Correct Use

The Cumulative Operating Time of Cooling Fan can be cleared by setting the parameter.

● Parameter

| Item | Parameter | Data | Description |
|---|-----------|-------------------|--|
| Cumulative operating time of cooling fan | [dC-26] | 0 to 1000000 (hr) | Measures and displays the duration of time that the cooling fan has been operated. |
| Cooling FAN accumulation running time clear selection | [bA-71] | 00 | Not carries out. |
| | | 01 | Carries out clearance at the set time. |

5-10 Electronic Thermal Load Ratio Monitor

5-10-1 Electronic Thermal Load Ratio Monitor of Motor

Display the electric thermal load ratio of the motor. The overload protection error [E005] is generated when the displayed thermal load ratio is about to exceed 100%.



Precautions for Correct Use

Appropriately perform the basic settings of motor and electric thermal function settings.

● Parameter

| Item | Parameter | Data | Description |
|---|-----------|--------------------|---|
| Electronic thermal duty ratio monitor MTR | [dA-42] | 0.00 to 100.00 (%) | Displays the thermal load ratio of the motor. |

5-10-2 Electronic Thermal Load Ratio Monitor of Inverter

The monitor displays electronic thermal load ratio of the inverter. The controller overload protection error [E039] is generated when the displayed thermal load ratio exceeds 100%.



Precautions for Correct Use

The heat characteristics of the inverter has been predetermined.

● Parameter

| Item | Parameter | Data | Description |
|---|-----------|--------------------|--|
| Electronic thermal duty ratio monitor CTL | [dA-43] | 0.00 to 100.00 (%) | Displays the thermal load ratio of the inverter. |

5-11 Inverter Rated Monitor

5-11-1 Load Rated Monitor

Displays the load rating of the inverter.



Precautions for Correct Use

You should also check the rated current and current derating characteristics because they vary depending on load type selections.

● Parameter

| Item | Parameter | Data | Description |
|--------------------------------------|-----------|------|--------------------|
| Inverter load type selection monitor | [dC-01] | 00 | VLD: Very low duty |
| | | 01 | LD: Low duty |
| | | 02 | ND: Normal duty |

5-11-2 Rated Current Monitor

Displays the rated current of the inverter.



Precautions for Correct Use

You should also check the rated current and current derating characteristics because they vary depending on load type selections.

● Parameter

| Item | Parameter | Data | Description |
|-----------------------|-----------|-------------------|---|
| Rated current monitor | [dC-02] | 0.0 to 6553.5 [A] | Displays the rated current adopted to the inverter. |

5-12 Braking Resistor Load Ratio Monitor

Display the use rate of braking resistor circuit (BRD).



Precautions for Correct Use

- A setting is required for a braking resistor circuit (BRD) to operate. For details, see 8-2-5 *Regenerative Braking Function* on page 8-50.
- The braking resistor overload error [E006] is generated when the displayed rate exceeds the Dynamic brake usage rate [bA-60].

● Parameter

| Item | Parameter | Data | Description |
|--------------------------|-----------|--------------------|--|
| BRD load factor monitor | [dA-41] | 0.00 to 100.00 (%) | Displays the load ratio of braking resistor. |
| Dynamic brake usage rate | [bA-60] | 0.0 to 100.0 (%) | Sets the maximum use rate of braking resistor. |

5-13 Inverter Status Monitor

Displays the current conditions of inverter.



Precautions for Correct Use

Command destinations vary according to the state of terminal functions as well as to the settings. Commands not input from the currently enabled command destinations will be ignored.

● Parameter

| Item | Parameter | Data | Description |
|-----------------------------------|-----------|----------|---|
| Detailed monitor for icon 2 LIM | [dC-37] | 00 to 06 | Refer to 3-1-3 LCD Display on page 3-5. |
| Detailed monitor for icon 2 ALT | [dC-38] | 00 to 04 | |
| Detailed monitor for icon 2 RETRY | [dC-39] | 00 to 02 | |
| Detailed monitor for icon 2 NRDY | [dC-40] | 00 to 05 | |

● Detailed Monitor for Icon 2 LIM [dC-37]

| Data | Status | Description |
|------|---|--|
| 01 | The overcurrent suppression function is applied due to increased current. | Under overcurrent suppression. |
| 02 | The overload limiting function is applied due to increased current. | Under overload limit. |
| 03 | The overvoltage suppression function is applied due to increased P-N voltage. | Under overvoltage suppression. |
| 04 | The torque limiting function is applied due to increased current. | Under torque limit. |
| 05 | The frequency is within the upper/lower limit or jump frequency limit. | Within upper limit. Within lower limit. Within jump frequency limit. |
| 06 | The frequency command at below the minimum frequency has been given. | Under minimum frequency limit. |
| 00 | A state other than those above. | A state other than those above. |

● Detailed Monitor for Icon 2 ALT [dC-38]

| Data | Status | Description |
|------|---|--|
| 01 | Current is increased. | Overload advance notice in effect. |
| 02 | The motor thermal load is increased. | Motor thermal advance notice in effect. |
| 03 | The inverter thermal load is increased. | Inverter thermal advance notice in effect. |
| 04 | Motor temperature is rising. | Motor heating advance notice in effect. |
| 00 | A state other than those above. | A state other than those above. |

● **Detailed Monitor for Icon 2 RETRY [dC-39]**

| Data | Status | Description |
|------|---------------------------------|---------------------------------|
| 01 | Waiting to retry after a trip. | Retry Standby. |
| 02 | Waiting to restart. | Waiting to restart. |
| 00 | A state other than those above. | A state other than those above. |

● **Detailed Monitor for Icon 2 NRDY [dC-40]**

| Data | Status | Description |
|------|---------------------------------|---|
| 01 | Tripped. | A trip has occurred. |
| 02 | Power supply abnormality. | Power failure or undervoltage state. |
| 03 | Being reset. | Being reset or waiting to cancel reset. |
| 04 | STO | STO is enabled. |
| 05 | Waiting. | Waiting for inverter's internal circuit or internal condition to be stable. |
| 06 | Data inconsistency. | A setting inconsistency exists (warning). |
| 07 | Sequence abnormality. | Abnormality during a sequence operation. |
| 08 | Free-run. | Free-run is enabled (free-run operation). |
| 09 | Forced stop state. | Operation command isn't permitted. Or forced stop is being issued. (Deceleration stop behavior) |
| 00 | A state other than those above. | A state other than those above. |

5-14 Analog Input Value Monitor

Displays the input values for Ai1, Ai2 and Ai3 that are currently input to the terminal block of the inverter.

● Parameter

| Item | Parameter | Data | Description |
|----------------------------|-----------|-----------------------|--|
| Analog input [Ai1] monitor | [dA-61] | 0.00 to 100.00 (%) | Monitors analog input values. [Ai1][Ai2]: 0 to 10V/0 to 20mA [Ai3]: Equivalent to -10 to 10V |
| Analog input [Ai2] monitor | [dA-62] | 0.00 to 100.00 (%) | |
| Analog input [Ai3] monitor | [dA-63] | -100.00 to 100.00 (%) | |

5-15 Analog Terminal Setting Monitor

Displays the state of analog input/output changeover switch.



Precautions for Correct Use

- Note that the data cannot be obtained appropriately if the analog input switch selection differs from the actual input, which results in a damage.
- The data cannot be output appropriately if an analog output switch selection differs from the actual output.
- If the data on analog switch monitor does not switch after the switch is switched, check the switch because the switch may not be fully switched or may be damaged.

● Parameter

| Item | Parameter | Data | Description |
|------------------------------|-----------|-------------------------|--|
| Analog I/O selection monitor | [dA-60] | VVVVVVVV to AAAAAAAA | Displays whether an analog input/output terminal is a voltage input/output terminal or a current input/output terminal. [Left side] (Reserved) (Reserved) (Reserved) (terminal Ai3 (Ii3/Vi3)) (terminal Ao2) (terminal Ao1) (terminal Ai2) (terminal Ai1) [Right side] V: voltage/A: current |

5-16 Terminal Block Type Monitor

Displays options for a terminal block that is equipped with inverter.

● Parameter

| Item | Parameter | Data | Description |
|--------------------------------------|-----------|---------------|---------------------------------------|
| Terminal block option mounted status | [dA-50] | 00 (standard) | Displays terminal block option types. |

5-17 Operation Command/Frequency Command Sources Monitor

Displays the operation command sources and the frequency command sources that are currently enabled.



Precautions for Correct Use

Command sources vary according to the state of terminal functions as well as to the settings. Commands not input from the currently enabled command sources will be ignored.

● Parameter

| Item | Parameter | Data | Description |
|---|-----------|--------------------|--|
| Speed command destination monitor (main) | [dC-07] | 01 to 07, 09 to 34 | 00 (disabled), 01 (Ai1), 02 (Ai2), 03 (Ai3), 07 (Multistage speed 0[Ab110]/[Ab210]), 08 (auxiliary speed[AA104]/[AA204]), |
| Speed command destination monitor (auxiliary) | [dC-08] | 00 to 34 | 09 (Multistage speed 1[Ab-11]), 10 (Multistage speed 2[Ab-12]), 11 (Multistage speed 3[Ab-13]), 12 (Multistage speed 4[Ab-14]), 13 (Multistage speed 5[Ab-15]), 14 (Multistage speed 6[Ab-16]), 15 (Multistage speed 7[Ab-17]), 16 (Multistage speed 8[Ab-18]), 17 (Multistage speed 9[Ab-19]), 18 (Multistage speed 10[Ab-20]), 19 (Multistage speed 11[Ab-21]), 20 (Multistage speed 12[Ab-22]), 21 (Multistage speed 13[Ab-23]), 22 (Multistage speed 14[Ab-24]), 23 (Multistage speed 15[Ab-25]), 24 (JG[AG-20]), 25 (RS485), 29 (Pulse array (inverter)), 30 (Pulse array (Option)), 31 (Drive Programming), 32 (PID), 34 (AHD retention speed) |
| Operation command destination monitor | [dC-10] | 00 to 06 | 00 ([FW]/[RV] terminal)/01 (3 wire)/02 (RUN key on LCD operator)/03 (RS485 setting)/04 (Option 1)/05 (Option 2)/06 (Option 3) |

5-18 Options Monitor

Displays which option unit is equipped and where it is equipped.



Precautions for Correct Use

- Recognition of an optional unit is performed in the condition the power supply of the optional unit has been established.
- If the optional unit is poorly connected or damaged, it is regarded as in unconnected state.

● Parameter

| Item | Parameter | Data | Description |
|-----------------------------|-----------|-----------|--|
| Option slot 1 mounted state | [dA-81] | Option ID | Displays the ID of optional Unit mounted in the option slot 1. |
| Option slot 2 mounted state | [dA-82] | Option ID | Displays the ID of optional Unit mounted in the option slot 2. |
| Option slot 3 mounted state | [dA-83] | Option ID | Displays the ID of optional Unit mounted in the option slot 3. |

Option ID

| ID | Optional Unit type | Description |
|----|--------------------|----------------|
| 00 | No | |
| 33 | RX2-PG | PG Option Unit |

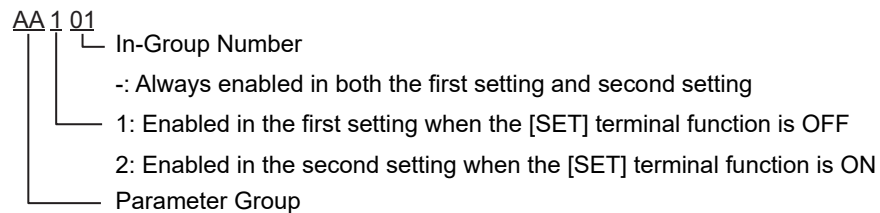
6

Basic Parameter Settings

This chapter explains the basic parameter settings.

The parameter number structure is indicated below.

This chapter explains how to set the first setting. For the second setting, follow the same procedure. The setting value and operation are common.



The function assigned to In/Output terminals is indicated as a combination of three digits numbers and alphabets, like "023[F-OP]." For more details of the functions, refer to the <List of input terminal functions> on page C-44 and the <List of output terminal functions> on page C-49.

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6-1 Basic Parameter Settings

6-1-1 Inverter Load Rating Settings

The duty rating mode of the inverter can be chosen from Normal Duty (ND), Low Duty (LD), and Very Low Duty (VLD).

The rated current, excess duty endurance, and rated temperature of the inverter vary depending on the duty rating mode.

A change of the inverter duty rating mode is reflected immediately after the Load type selection [Ub-03] is changed.



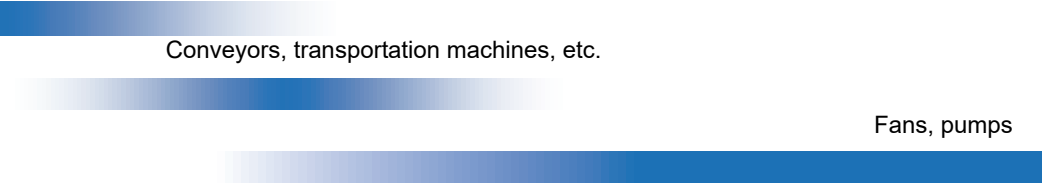
Precautions for Correct Use

- When [Ub-03] is changed, the parameter set for the electric current is automatically adjusted at the ratio of the changed rated current and the set value is changed accordingly.
- Another check is necessary if the electric current is set by using the excess duty limit function, direct current control function, electronic thermal function, excess duty warning function, or low current detection function.
- When VLD is selected and the control mode is selected out of the Control mode selection, 1st-motor [AA121], the control mode is automatically set to the V/f control. Another check is necessary when the control type setting is changed.

● Parameters

| Item | Parameters | Data | Description | Default data |
|---------------------|------------|------|---------------------|--------------|
| Load type selection | [Ub-03] | 00 | VLD (Very Low Duty) | 02 |
| | | 01 | LD (Low Duty) | |
| | | 02 | ND (Normal Duty) | |

For details about the load rating mode that you can set in selecting load specifications, see the following tables.

| Duty rating | ND (Normal Duty) | LD (Low Duty) | VLD (Very Low Duty) |
|--|---|---|---|
| Excess duty endurance | 150% (1 min.) 200% (3 sec.) | 120% (1 min.) 150% (3 sec.) | 110% (1 min.) 120% (3 sec.) |
| Temperature characteristics | 50°C (with derating) | 45°C (with derating) | 40°C (with derating) |
| Corresponding control type^{*1} | Induction motor IM <ul style="list-style-type: none"> • V/f control • V/f control with sensor • SLV (sensorless vector) control • 0 Hz-range SLV control • Vector control with sensor Synchronous motor SM <ul style="list-style-type: none"> • SLV control • IVMS start type sensorless vector control (SM/PMM) | Induction motor IM <ul style="list-style-type: none"> • V/f control • V/f control with sensor • SLV (sensorless vector) control Synchronous motor SM <ul style="list-style-type: none"> • SLV control • IVMS start type sensorless vector control (SM/PMM) | Induction motor IM <ul style="list-style-type: none"> • V/f control • V/f control with sensor • SLV (sensorless vector) control Synchronous motor SM <ul style="list-style-type: none"> • SLV control |
| Major applications | Lifts, cranes, etc.  Conveyors, transportation machines, etc. Fans, pumps | | |

*1. PG option unit of the optional unit is necessary for the vector control with sensor.

6-1-2 Inverter Initialization

When the Initialize Mode selection [Ub-01] is chosen and [Ub-05] Initialize Enable is set to 01, the designated data can be initialized to the default data.

When you use an inverter of 3G3RX2 at the first time or you newly set the inverter, set Initialize Mode selection [Ub-01] to 04 (Trip history + parameters + DriveProgramming) in order to complete the initialization.

Only the trip history can be cleared without initialization of the stored parameter values.

Initial values to be stored after the initialization can be changed by changing the initial value selection [Ub-02].



Precautions for Correct Use

- The following data cannot be initialized: DriveProgramming user parameter U00 to U63 (UE-10 to UE-73) setting value, cumulative operating hours monitor during RUN (dC-22), cumulative power-ON time (dC-24), initialized data selection (Ub-02), duty type selection (Ub-03), analog adjustment (Cb-30 to Cb-35), thermistor adjustment (Cb-41).
- The initialization sets the parameters to initial values. When the data before the initialization is required, read out it with R/W function (Read) in LCD operator, or use CX-Drive to store it in PC.
- The initialized parameters are not displayed, depends on Display restriction selection (UA-10). Change the data to 00: total view to complete the initialization.
- When the soft lock selection (UA-16) setting bans on a change of parameter values, data can not be initialized. Be sure to reset the ban on a change of parameter values to carry out the initialization.
- When you select the data 01 in Initialize Enable (Ub-05) and press F2 key, the initialization starts. Take a caution you can not undo the data once the initialization starts.
- Initialization cannot be initialized in the following states:
 - During operation
 - When the trip occurs
 - During soft lock
- Even when the operation command is input during initialization, the inverter ignores the command. Input the operation command again after the initialization is finished.

● Parameters

| Item | Parameters | Data | Description | Default data |
|---------------------------|------------|------|--|--------------|
| Initialize Mode selection | [Ub-01] | 00 | The initialization is disabled. | 00 |
| | | 01 | The trip history and retry history are cleared. | |
| | | 02 | Parameters all initialized | |
| | | 03 | The trip history, retry history, and all parameters are initialized. | |
| | | 04 | The trip history, retry history, all parameters, and program data for EzSQ are initialized. | |
| | | 05 | Parameters other than those of I/O terminal function are initialized. | |
| | | 06 | Parameters other than the communication function parameters are initialized. | |
| | | 07 | Parameters other than those of I/O terminal function and communication function are initialized. | |
| | | 08 | Only the program data for DriveProgramming are initialized. | |
| Initialize Data selection | [Ub-02] | 00 | Mode 0 | 01 |
| | | 01 | Mode 1 (Factory setting) | |
| | | 02 | Mode 2 | |
| | | 03 | Mode 3 | |
| Initialize Enable | [Ub-05] | 00 | Function disabled | 00 |
| | | 01 | Initialization start | |

● Parameters Chosen for Initialization [Ub-01]

| Item | Parameter range | Description |
|---|--------------------|--------------------------------|
| Classification of I/O terminal functions | [CA-01] to [CA-11] | Input terminal selection |
| | [CA-21] to [CA-31] | a/b contact selection |
| | [CA-41] to [CA-51] | Input terminal response |
| | [Cb-40] | Thermistor selection |
| | [CC-01] to [CC-07] | Output terminal selection |
| | [CC-11] to [CC-17] | a/b contact selection |
| | [CC-20] to [CC-33] | Output delay |
| | [CC-40] to [CC-60] | Logical operation function |
| Classification of communication functions | [CF-01] to [CF-10] | Setting of RS485 communication |
| | [CF-20] to [CF-38] | Setting of EzCOM communication |

● Table of Initialization Targets

[Ub-01] Selection of initialization:

Initialization targets are indicated by ■.

| [Ub-01] | (1) History data | (2) Setting of I/O terminal | (3) Communica- tion function | (4) Other than parameters (2) and (3) | (5) DriveProgram- ming |
|---------|---------------------|-----------------------------------|------------------------------------|--|------------------------------|
| 00 | | | | | |
| 01 | ■ | | | | |
| 02 | | ■ | ■ | ■ | |
| 03 | ■ | ■ | ■ | ■ | |
| 04 | ■ | ■ | ■ | ■ | ■ |
| 05 | | | ■ | ■ | |
| 06 | | ■ | | ■ | |
| 07 | | | | ■ | |
| 08 | | | | | ■ |

● Initialize Data selection [Ub-02]

The data is initialized in the following manners, depending on the selected mode. The default data is common in other parameters.

Set the default data during shipment to 01 (Mode 1).

| Code | Function Name | Mode 0 | Mode 1 (Default data during shipment) | Mode 2 | Mode 3 |
|-------|--|---------------------------------------|---|--------------------------------------|--------------------------------------|
| AA101 | Main speed input source selection, 1st-motor | 07 (Parameter setting) | 01 (Ai1 terminal input) | 01 (Ai1 terminal input) | 01 (Ai1 terminal input) |
| AA111 | Run-command input source selection, 1st-motor | 02 (RUN key on operator LCD Operator) | 00 ([FW]/[RV] terminal) | 00 ([FW]/[RV] terminal) | 00 ([FW]/[RV] terminal) |
| AA201 | Main speed input source selection, 2nd-motor | 07 (Parameter setting) | 01 (Ai1 terminal input) | 01 (Ai1 terminal input) | 01 (Ai1 terminal input) |
| AA211 | Run-command input source selection, 2nd-motor | 02 (RUN key on operator LCD Operator) | 00 ([FW]/[RV] terminal) | 00 ([FW]/[RV] terminal) | 00 ([FW]/[RV] terminal) |
| bC111 | Electronic thermal characteristic selection, 1st-motor | 00 (Reduction characteristics) | 01 (Constant torque characteristics) | 01 (Constant torque characteristics) | 01 (Constant torque characteristics) |
| bC211 | Electronic thermal characteristic selection, 2nd-motor | 00 (Reduction characteristics) | 01 (Constant torque characteristics) | 01 (Constant torque characteristics) | 01 (Constant torque characteristics) |
| Hb104 | Async.Motor Base frequency setting, 1st-motor | 60.00 | 50.00 | 60.00 | 50.00 |
| Hb105 | Async.Motor Maximum frequency setting, 1st-motor | 60.00 | 50.00 | 60.00 | 50.00 |
| Hb106 | Async.Motor rated voltage, 1st-motor | 200 V class: 200 400 V class: 400 | 200 V class: 230 400 V class: 400 | 200 V class: 230 400 V class: 460 | 200 V class: 230 400 V class: 400 |
| Hb204 | Async.Motor Base frequency setting, 2nd-motor | 60.00 | 50.00 | 60.00 | 50.00 |
| Hb205 | Async.Motor Maximum frequency setting, 2nd-motor | 60.00 | 50.00 | 60.00 | 50.00 |
| Hb206 | Async.Motor rated voltage, 2nd-motor | 200 V class: 200 400 V class: 400 | 200 V class: 230 400 V class: 400 | 200 V class: 230 400 V class: 460 | 200 V class: 230 400 V class: 400 |

6-2 Parameter Setting for Motor Related

6-2-1 Motor Basic Settings

Basic parameters to control and protect the motor are set.

The following basic parameters need to be set for any control type regardless of controlling method.

The motor operation could be stabilized if the motor items are set to the inverter.

The induction motor (IM) and synchronous motor (SM) / permanent magnet motor (PMM) are set separately.

Induction Motor (IM) Parameter

| Items of Induction motor | Parameters of inverter | | Setting range (unit) | Description | Default data |
|--------------------------|------------------------|--|----------------------|-----------------------------------|--|
| Capacity | [Hb102] | Async.Motor capacity setting, 1st-motor | 0.01 to 160.00 (kW) | Sets the motor capacity. | Varies depending on inverter models and settings of duty rating. |
| Number of motor poles | [Hb103] | Async.Motor poles setting, 1st-motor | 2 to 48 (poles) | Sets the number of motor poles. | 4 |
| Frequency | [Hb104] | Async.Motor Base frequency setting, 1st-motor | 10.00 to 590.00 (Hz) | Sets the base frequency of motor. | 50* ¹ |
| | [Hb105] | Async.Motor Maximum frequency setting, 1st-motor | 10.00 to 590.00 (Hz) | Sets the max. frequency of motor. | 50* ¹ |
| Voltage | [Hb106] | Async.Motor rated voltage, 1st-motor | 1 to 1000 (V) | Sets the rated voltage of motor. | 200 V: 230* ¹ 400 V: 400* ¹ |
| Current | [Hb108] | Async.Motor rated current, 1st-motor | 0.01 to 10000.00 (A) | Sets the rated current of motor. | Varies depending on inverter models and settings of duty rating. |

*1. Default data when default data selection (UB-02) is set to 01.

Parameters for Synchronous Motor (SM)/ Permanent Magnetic Motor (PMM)

| Items of SM and PMM motor | Parameters of inverter | | Setting range (unit) | Description | Default data |
|---------------------------|------------------------|--|----------------------|-----------------------------------|--|
| Capacity | [Hd102] | Async.Motor capacity setting, 1st-motor | 0.01 to 160.00 (kW) | Sets the motor capacity. | Varies depending on inverter models and settings of duty rating. |
| Number of poles | [Hd103] | Async.Motor poles setting, 1st-motor | 2 to 48 (poles) | Sets the number of poles. | Varies depending on inverter models and settings of duty rating. |
| Frequency | [Hd104] | Async.Motor Base frequency setting, 1st-motor | 10.00 to 590.00 (Hz) | Sets the base frequency of motor. | Varies depending on inverter models and settings of duty rating. |
| | [Hd105] | Async.Motor Maximum frequency setting, 1st-motor | 10.00 to 590.00 (Hz) | Sets the max. frequency of motor. | Varies depending on inverter models and settings of duty rating. |
| Voltage | [Hd106] | Async.Motor rated voltage, 1st-motor | 1 to 1000 (V) | Sets the rated voltage of motor. | 200 V: 230 ^{*1} 400 V: 400 ^{*1} |
| Current | [Hd108] | Async.Motor rated current, 1st-motor | 0.01 to 10000.00 (A) | Sets the rated current of motor. | Varies depending on inverter models and settings of duty rating. |



Precautions for Correct Use

- The motor could burn if the base frequency is set lower than the motor frequency. (Lower than 50 Hz in case of standard induction motor)
- For setting the maximum frequency higher than 60 Hz, make sure the motor's maximum allowable frequency.
- The motor could burn if the maximum frequency and rated voltage are set to exceed the specified range of rated voltage.
- After initialization, the motor protection function needs to be configured again. Otherwise, the motor could burn.

Capacity and Number of Poles

The inverter reads out preset standard motor data if the capacity and number of poles are changed.

The motor disturbance could be suppressed and the motor operation could be stabilized if the capacity and number of poles are correctly set.

Base Frequency

Set the base frequency according to the motor specifications.



Precautions for Correct Use

The induction motor should be regarded as a special one if used at higher than 60 Hz. In this case, the inverter capacity may need to be made larger as the maximum capacity of the inverter motor is incorrect.

Maximum Frequency

Sets the maximum frequency of motor to use.

Rated Voltage

Set the rated voltage of motor according to the motor specifications.



Precautions for Correct Use

- Expected characteristics may not be obtained if the motor rated voltage is set higher than receiving voltage or inverter rated voltage.
- Set the rated voltage of motor in the following way if the inverter is switched from 3G3RX-V1 Series.

[Hb106]=A082×A045/100

Rated Current

Set the rated current of motor to the parameter according to the motor specifications. Inappropriate configuration may disable the motor protecting function or make motor control unstable.

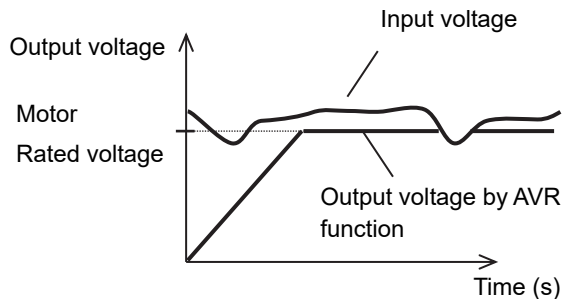


Precautions for Correct Use

Expected characteristics may not be obtained if the motor rated current is set higher than the inverter rated current. In some cases, the inverter protection works first.

Automatic Voltage Regulation Function (AVR Function)

The inverter automatically operates the automatic voltage regulation function (AVR function). This function outputs voltage to the motor correctly regardless of input voltage fluctuation supplied to the inverter. Output of a voltage higher than the input voltage is not possible even using this function.



In case you set AVR function to OFF, configure the parameter [bA146] Over magnetization deceleration function selection, 1st_motor.

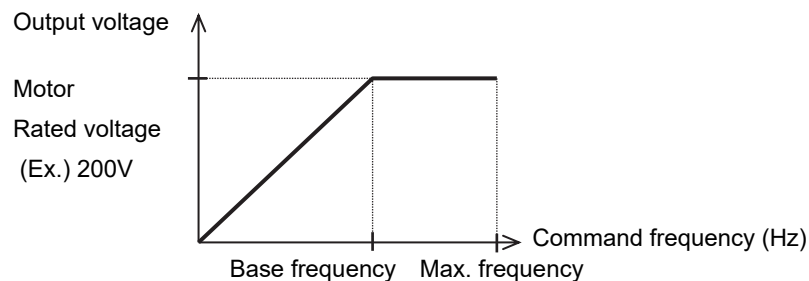
[bA146]=02 for AVR OFF during deceleration.

[bA146]=01 for AVR OFF all time.

Relation between Frequency and Voltage under General V/f Control (IM)

General V/f control command is given in the following with the base frequency and rated voltage being set.

The output voltage from the base to maximum frequency cannot exceed the rated voltage.



Control of General Synchronous Motor



Precautions for Correct Use

Basically the synchronous motor needs current calculation control and the motor parameters need to be set. The parameters in this item and motor constants in the next item need to be set.

6-2-2 Motor Constant Setting

The motor operation could be stabilized if the motor constants are set.

In particular, the motor constants need to be set according to the motor specifications when the automatic boost function, automatic boost function with sensor, sensorless vector control function, 0 Hz-range sensorless vector control function, or vector control function with sensor is used.

The motor constants of standard motor are automatically set to the followings when the motor capacity or number of motor poles is changed.

Some of the motor constants in the following tables are automatically set to acquired constant data when the auto-tuning function is used. For details, see the next section.

The motor constants can be chosen from the motor constant selection or manually changed or adjusted.

The standard motor constants are used as initial values of the induction motor (IM) constants.



Precautions for Correct Use

- Note that the motor constants will be overwritten if any of the following actions are taken.

In case of induction motor (IM):

- The motor capacity or number of motor poles is changed.
- The auto-tuning is performed.
- The initialization is performed.

In case of synchronous motor (SM) and permanent magnet motor (PMM):

- The motor capacity is changed.
- The auto-tuning is performed.
- The initialization is performed.

- Please be advised to save the constants using the R/W function on the LCD operator.
 - For details of adjustment, see *7-1 Overview of Motor Control Methods* on page 7-3.
-

IM Motor Constant Parameters

| Item | Parameters | Data | Description | Default data |
|---|------------|-------------------------------------|---|--|
| Async.Motor constant R1, 1st-motor | [Hb110] | 0.000001 to 1000.000000(Ω) | Sets the primary resistance of IM. | Varies depending on inverter models and settings of duty rating. |
| Async.Motor constant R2, 1st-motor | [Hb112] | 0.000001 to 1000.000000(Ω) | Sets the secondary resistance of IM. | |
| Async.Motor constant L, 1st-motor | [Hb114] | 0.000001 to 1000.000000(mH) | Sets the leakage inductance of IM. | |
| Async.Motor constant I ₀ , 1st-motor | [Hb116] | 0.01 to 10000.00(A) | Sets the no-load current of IM. | |
| Async.Motor constant J, 1st-motor | [Hb118] | 0.00001 to 10000.00000(kg m^2) | Sets the moment of inertia of the system. | |



Precautions for Correct Use

- Set the motor constant I₀ in the following way if it is switched from 3G3RX-V1 Series.
[Hb116]=(50Hz/A003) \times H023 (or H033)
- When the base frequency is changed, the reference value of the motor constant I₀ is changed and the change is recognized (the set value is kept). To obtain a correct value with the auto-tuning or call the initial value of induction motor (IM), set another value in the selection of number of motor poles [Hb103], for example, set to 2 poles from 4 and then to 4 poles again. This results in setting data corresponding to the base frequency after the change in the Async.Motor constant I₀, 1st-motor [Hb116].

SM/PMM Motor Constant Parameters

| Item | Parameters | Data | Description | Default data |
|---|------------|-------------------------------------|---|--|
| Async.Motor constant R1, 1st-motor | [Hd110] | 0.000001 to 1000.000000(Ω) | Sets the resistance of SM/PMM. | Varies depending on inverter models and settings of duty rating. |
| Async.Motor constant R2, 1st-motor | [Hd112] | 0.000001 to 1000.000000(mH) | Sets the d-axis inductance of SM/PMM. | |
| Async.Motor constant L, 1st-motor | [Hd114] | 0.000001 to 1000.000000(mH) | Sets the q-axis inductance of SM/PMM. | |
| Async.Motor constant I ₀ , 1st-motor | [Hd116] | 0.1 to 100000.0(mVs/rad) | Sets the calculated value of induced voltage of SM/PMM. | |
| Async.Motor constant J, 1st-motor | [Hd118] | 0.00001 to 10000.00000(kg m^2) | Sets the moment of inertia of the system. | |



Additional Information

- The base (maximum) frequency can be calculated from the rated number of revolutions of the motor (min^{-1}) and the number of poles in the following formula.
Base (maximum) frequency (Hz) = rated number of revolutions (min^{-1}) \times number of poles (pole)/120
- The motor constant K_e is the peak value of the phase induced voltage (mV) per electrical angular speed (rad/s).

6-2-3 Auto-tuning of Motor

The auto-tuning is a function that measures and automatically sets the motor constants necessary for the motor control.

There are two types of auto-tuning functions: Offline auto-tuning where the auto-tuning function finishes after a single measurement and online auto-tuning where the auto-tuning function measures a change in the constants due to motor temperature increase every time the motor is started or stopped.

Use the offline auto-tuning to measure the motor constants if you use a motor whose constants are unknown.

The online auto-tuning can stabilize the motor behavior by correcting the temperature increase of the motor during operation.



Precautions for Correct Use

- When 02 (revolving) is chosen in the auto-tuning selection [HA-01], the motor automatically begins rotating when the tuning starts.
Make sure of the followings.
 - No problem shall occur even with the rotation at a frequency close to 80% of the base frequency.
 - The motor shall not be driven from external.
 - The braking shall be in the open state.
 - The torque is not high enough during the auto-tuning. Lift or other machine could have unexpected slipping. Remove the motor from the loading machine and perform the auto-tuning to the independent motor. (In this case, the moment of inertia J is that of the independent motor and hence the moment of inertia of the loading machine should be converted to the value about the motor axis and added to J .)
 - For a machine with limited motor axis rotation (lift, ball screw, etc.), 01 (non-revolving) should be chosen in [HA-01] since rotation higher than the allowed one could occur causing a damage to the machine.
-

● Parameters

| Item | Parameters | Data | Description | Default data |
|--------------------------------------|------------|------|--|--------------|
| Auto-tuning selection | [HA-01] | 00 | Function disabled | 00 |
| | | 01 | Non-revolving auto-tuning is performed. After this parameter is set, an operation command starts the tuning. | |
| | | 02 | Revolving auto-tuning is performed. After this parameter is set, an operation command starts the tuning. | |
| | | 03 | The tuning for the IVMS control type is performed. After this parameter is set, an operation command starts the tuning. | |
| RUN command selection at Auto-tuning | [HA-02] | 00 | RUN key on the operator keypad | 00 |
| | | 01 | Command is sent from the designated operation commander. | |
| Online auto-tuning selection | [HA-03] | 00 | Function disabled | 00 |
| | | 01 | The online tuning is performed. The online tuning is automatically performed after the deceleration stops in ordinary operations. | |



Precautions for Correct Use

- The constants of standard induction motor (IE3 motor) are used as default in the factory setting. If you use standard induction motor, expected characteristics will be achieved without offline auto-tuning in most cases.
- Smooth tuning could be done if the offline auto-tuning is first performed for the factory-set parameters.
- If you use a synchronous motor SM (or permanent magnet motor PMM), perform the Control mode selection, 1st-motor [AA121] is set to 11 (SM/PMM: Synchronous activation) or 12 (SM/PMM: IVMS activation).
- If expected characteristics cannot be achieved, adjust the parameters and motor constants.
- Perform the offline auto-tuning before using the online auto-tuning function.
- The motor constants are for a single phase of Y-connection.
- The offline auto-tuning is performed only when the operation can be made.
- If no-load current is not known, check the current in the operation at the base frequency with the V/f control by using an electric current monitor and enter the value to [Hb116] before the auto-tuning.
- Even if 01 (non-revolving) is chosen for [HA-01], the motor could make a half-turn at the maximum.
- The offline auto-tuning automatically overwrites the parameters with acquired data. The online auto-tuning does not overwrite the parameters with the data as it corrects internal data.

Parameter Data Overwritten in the Offline Auto-tuning

| Selection of IM/SM | Parameters to be overwritten | |
|--|--|---|
| | Non-revolving tuning [HA-01]=01 | Revolving tuning [HA-01]=02 |
| Induction motor (IM) control [AA121]=00 to 10 | [Hb110] Motor constant R1 [Hb112] Motor constant R2 [Hb114] Motor constant L | [Hb110] Motor constant R1 [Hb112] Motor constant R2 [Hb114] Motor constant L [Hb116] Motor constant I0 [Hb118] Motor constant J |
| Control of synchronous motor (per- manent magnetic motor) (SM (PMM)) [AA121]=11 to 12 | [Hd110] Motor constant R [Hd112] Motor constant Ld [Hd114] Motor constant Lq | - |

Note The above table shows the case where [SET] terminal is OFF or not selected. If [SET] terminal is made ON and the secondary setting is used, the parameters of [H*21*] ([Hb210], [Hd210], etc.) are effective and overwritten according to the selection of the control type [AA221].

Offline Auto-tuning

- 1** Check the control type [AA121].
For the induction motor (IM), make sure that the control type [AA121] is set to the one for IM. For the synchronous motor (SM) or permanent magnetic motor (PMM), make sure that the control type [AA121] is set to the one for PMM.
- 2** Set the auto-tuning selection [HA-01].
In the auto-tuning selection [HA-01], 01: Non-revolving or 02: Revolving is set. The tuning does not begin at this stage. Only “non-revolving” can be chosen for synchronous motor (SM) / permanent magnetic motor (PMM).
- 3** Set a start command for tuning.
Pressing OPERATION button on the LCD operator starts the tuning, Pressing STOP button terminates the tuning, However tuning data are not saved.
- 4** The inverter automatically operates.
Output of a preset pattern is given to the motor. If the auto-tuning selection [HA-01] is set to 01: Non-revolving, non-revolving output of three different patterns is given.
If the auto-tuning selection [HA-01] is set to 02: Revolving, acceleration and deceleration are repeated twice in addition to the above output. The frequency increases up to 80% of the base frequency.
After the above operation finishes, the output with no revolution is checked as final check.
- 5** The tuning finished.
When the tuning End display appears, the tuning finishes. Use STOP key to cancel the End display.

Online Auto-tuning

- 1** Perform the offline auto-tuning.
The online auto-tuning works with the designated motor constants and the offline auto-tuning described above is performed.
- 2** The Online auto-tuning selection [HA-03] is set.
Set the Online auto-tuning selection [HA-03] to 01: Enabled.
- 3** Check the online auto-tuning.
The online tuning operates for up to 5 s when every operation stops. Use the online tuning after making sure that the operation and stop can be made correctly by your operation command.



Precautions for Correct Use

- In case of termination due to trip or erroneous tuning, correct data cannot be acquired. See the following table.
- The result of the online tuning is automatically reflected in up to 5 seconds after the stop. It is not reflected if the operation is restarted during the tuning.
- In the factory setting, the offline auto-tuning can be started by the RUN Key on the LCD operator. It can be changed to a designated operation command by changing the operation command [HA-02] of the auto-tuning.
- When the following settings are enabled, the Online auto-tuning is not performed:
 - DC braking force setting
 - Servo ON [SON], Forcing [FOC]
 - Brake Control 2

● How to Reset Failures of Auto-tuning

| Expected causes | Examples of measures |
|---|--|
| The control type is not suitable for the motor. | Since the tuning type changes depending on the Control mode selection, 1st-motor [AA121], IM control or SM/PMM control, set the type in accordance with the motor. |
| The base frequency, motor rated voltage, or motor rated current is not suitable for the motor specifications. | Since wrong basic parameters of the motor could cause excess current or trip, check the basic parameters and set them appropriately. |
| STOP key was pressed. | Pressing the STOP key on the LCD operator interrupts the auto-tuning. Check the setting of the auto-tuning again before starting the tuning. |
| External factors such as braking caused a trip. | Factors that cause the trip need to be removed. |
| The input terminal function worked. | The tuning could be disturbed if the input terminal function works during the auto-tuning. |
| The motor capacity is too small compared to the one set for the inverter. | If the tuning does not finish correctly, the motor constants need to be set manually. |



Precautions for Correct Use

In case of failure of the auto-tuning, the motor constant data are not updated and the motor works in the untuned state.

IVMS Auto-tuning

Use IVMS control when a high torque is required for activation while you use SM/PMM motors.



Precautions for Correct Use

- If a high torque is necessary for activation, original IVMS control is used. If 03 is chosen for the auto-tuning selection [HA-01], it can be detected whether the target motor can be driven with the IVMS control, although combination check should be made in advance.
 - The tuning with the IVMS control should be performed on an independent motor with the Control mode selection, 1st-motor [AA121] set to 12 (SM/PMM: IVMS activation).
 - In case of failure of the auto-tuning with the IVMS control, data necessary for the IVMS control cannot be obtained from the motor and the Control mode selection, 1st-motor [AA121] should be set to 11 (SM/PMM: Synchronous activation) to drive the motor.
-

6-3 Operation Command Settings

6-3-1 Types of Operation Commands

The operation command (operation modes) selected in a function is enabled.

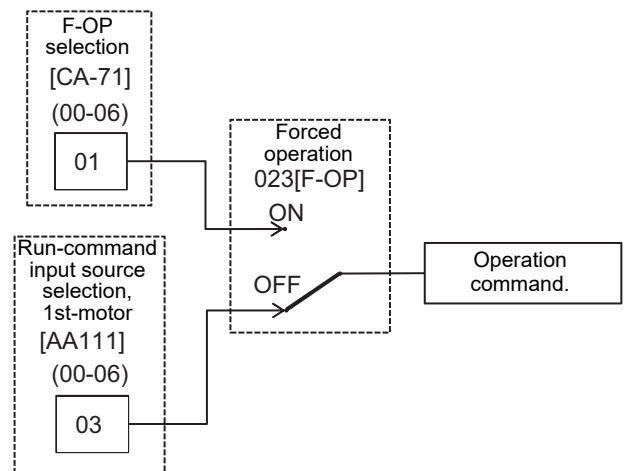
For details, see the description in the next and subsequent sections.



Precautions for Correct Use

The operation of the inverter requires not only an operation command but also a frequency command.

| parameter | setting data |
|----------------|-----------------------------|
| CA-71 AA111 | 00: [FW]/[RV] terminal |
| | 01: 3 wire |
| | 02: RUN key on LCD Operator |
| | 03: RS485 |
| | 04: Option 1 |
| | 05: Option 2 |
| | 06: Option 3 |



Precautions for Correct Use

- The above shows an example of operation with [AA111]=02 (RUN key on the LCD operator).
- Functions not assigned to the input terminal functions [CA-01]-[CA-11] become OFF.

6-3-2 Operation with LCD Operator

The LCD operator is used to give a frequency command.

Use "RUN Key" and "STOP/RESET Key" for operation and stop respectively.

For operation using the LCD operator, the operation direction can be changed by setting RUN-key Direction of LCD operator, 1st-motor [AA-12].



Precautions for Correct Use

- The output of the inverter requires not only an operation command but also a frequency command.
- If the forced operation 023 [F-OP] of the terminal function is enabled, the command destination specified in the [F-OP] function becomes effective irrespective of the present setting.

● Parameter

| Item | Parameters | Data | Description | Default data |
|---|--------------------|------|--|--------------|
| Run-command input source selection, 1st-motor | [AA111] | 02 | Operation command from "Operation key"/"Stop key" on the LCD operator. | 00*1 |
| RUN-key Direction of LCD operator, 1st-motor | [AA-12] | 00 | Forward rotation command from the LCD operator. | 00 |
| | | 01 | Reverse rotation command from the LCD operator. | |
| Output terminal function | [CC-01] to [CC-07] | 011 | [REF] ON when an operation command can be given from the LCD operator. | - |

*1. Default data when default data selection (UB-02) is set to 01.

6-3-3 Operation with Forward/Reverse Rotation Terminal

Forward and reverse rotation command from the inverter control circuit terminal enable the inverter operation.

A forward rotation command can be given from [FW] terminal and a reverse one from [RV] terminal.

In the factory setting, the [FW] and [RV] terminals are assigned to the terminal No. 9 and 8, respectively. This assignment can be changed by setting [CA-01]-[CA-11] in the input terminal setting selection.

a/b contact of each terminal can be switched by changing the corresponding setting item of [CA-21]-[CA-31].

Simultaneous input of a forward and reverse rotation commands is equivalent to stop command.

The relation between [FW] and [RV] terminals is given below.

| FW terminal | RV terminal | Operation command. |
|-------------|-------------|---------------------------|
| OFF | OFF | Stop command |
| ON | OFF | Forward rotation command. |
| OFF | ON | Reverse rotation command. |
| ON | ON | Stop command |

Commands can be given by [FW]/[RV] command of the DriveProgramming function.



Precautions for Correct Use

- The output of the inverter requires not only an operation command but also a frequency command.
- In case the input terminal function 023 [F-OP] is enabled, the command destination specified in the [F-OP] function becomes effective irrespective of the present setting.

● Parameter

| Item | Parameters | Data | Description | Default data |
|---|--------------------|------|--|------------------|
| Run-command input source selection, 1st-motor | [AA111] | 00 | Run/Stop from the control circuit terminal block. ([FW], [RV] terminals) | 00 ^{*1} |
| Input terminal function selection | [CA-01] to [CA-11] | 01 | [FW] terminal function | - |
| | | 02 | [RV] terminal function | |
| Input terminal a/b (NO/NC) selection | [CA-21] to [CA-31] | 00 | a contact (NO) | - |
| | | 01 | b contact (NC) | |

*1. Default data when default data selection (UB-02) is set to 01.

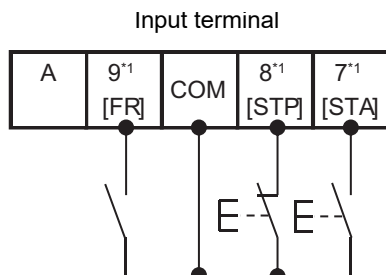
6-3-4 Operation with 3 Wire Function of Terminal Block

For 3-wire terminal commands, there are start, stop and forward/reverse operations. They are used to start and stop the inverter via an automatic reset contact such as a pushbutton switch.

Operation start command can be given from [STA] terminal and stop command from [STP] terminal.

To use the 3 wire function, the setting of the Run-command input source selection, 1st-motor [AA111] and the input terminal setting selection [CA-01]-[CA-11] needs to be changed.

Select [AA111]=01 3 wire function. In this example, the 3 wire function is assigned to the input terminal function in the following way.

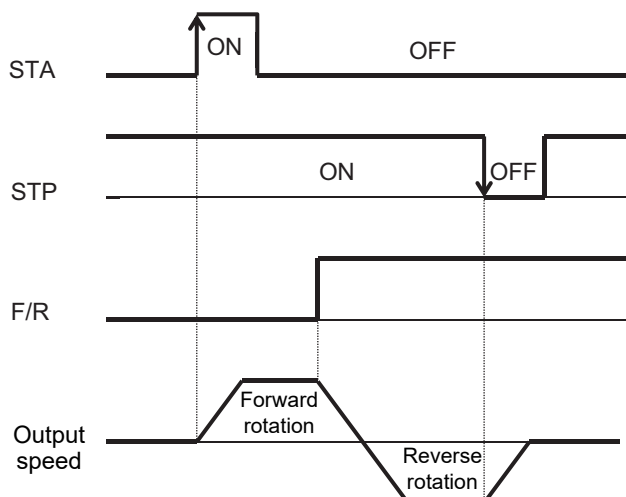


*1. Set the terminals as the terminal No. 7 [CA-07]=016, No. 8 [CA-08]=017, No. 9 [CA-09]=018.

Operation can be started/stopped by making the 016 [STA]/017 [STP] terminal function ON/OFF on the control circuit terminal block of the inverter.

018 [F/R] terminal function switches forward and reverse rotations by the contact.

The terminal action is made in the following way.



**Precautions for Correct Use**

- The output of the inverter requires not only an operation command but also a frequency command.
- In case the terminal 023 [F-OP] is enabled, the command destination specified in the [F-OP] function becomes effective irrespective of the present setting.

● **Parameter**

| Item | Parameters | Data | Description | Default data |
|---|--------------------|------|-------------------------|--------------|
| Run-command input source selection, 1st-motor | [AA111] | 01 | 3 wire | 00*1 |
| Input terminal function selection | [CA-01] to [CA-11] | 016 | [STA] terminal function | - |
| | | 017 | [STP] terminal function | |
| | | 018 | [F/R] terminal function | |

*1. Default data when default data selection (UB-02) is set to 01.

6-3-5 Operation with RS485 Communication

RS485 coil is used to give an operation start/stop command.

**Precautions for Correct Use**

- The output of the inverter requires not only an operation command but also a frequency command.
- The terminal 023 [F-OP] is enabled, the command destination specified in the [F-OP] function becomes effective irrespective of the present setting.

● **Parameter**

| Item | Parameters | Data | Description | Default data |
|---|------------|------|--|--------------|
| Run-command input source selection, 1st-motor | [AA111] | 03 | Start/Stop by RS485 communication command. | 00*1 |

*1. Default data when default data selection (UB-02) is set to 01.

6-3-6 Operation from Optional Unit

An operation start/stop command is given from an optional board.

**Precautions for Correct Use**

- The output of the inverter requires not only an operation command but also a frequency command.
- The terminal 023 [F-OP] is enabled, the command destination specified in the [F-OP] function becomes effective irrespective of the present setting.

● Parameter

| Item | Parameters | Data | Description | Default data |
|---|------------|------|--|--------------|
| Run-command input source selection, 1st-motor | [AA111] | 04 | Operation command from option 1 enabled. | 00*1 |
| | | 05 | Operation command from option 2 enabled. | |
| | | 06 | Operation command from option 3 enabled. | |

*1. Default data when default data selection (UB-02) is set to 01.

6-3-7 Disabling the Keys on LCD Operator

When a terminal command or communication command is given, the operation cannot be stopped from the LCD operator by setting [AA-13]=01.

Set [AA-13]=02 to disable the Stop key and use the resetting function in case of a trip.

When 102 [DISP] terminal function is ON, the operator keypad screen is fixed to home screen.



Precautions for Correct Use

- Set [AA-13] to 00: Disabled if a stop command is given from the LCD operator of the inverter in case of emergency.
- Usually, operation under an operation command from other than the LCD operator can be stopped by using the Stop/Reset key on the LCD operator.
- When the operation under an external command is stopped from the LCD operator, the operation stops for safety. To restart the operation, turn off the external command and on it again.

● Parameter

| Item | Parameters | Data | Description | Default data |
|---|--------------------|------|--|--------------|
| Run-command input source selection, 1st-motor | [AA111] | 00 | Run/Stop from the control circuit terminal block. ([FW], [RV] terminals) | 00*1 |
| | | 01 | 3 wire | |
| | | 02 | Start/Stop by RS485 communication command. | |
| STOP-key enable at RUN-command from terminal, 1st-motor | [AA-13] | 00 | Function disabled Always recognizes stop/reset key operation. | 01 |
| | | 01 | Function enabled The stop/reset key no longer works. | |
| | | 02 | Only inverter trips can be reset by the stop/reset key. | |
| Input terminal function selection | [CA-01] to [CA-11] | 102 | [DISP] terminal function | - |

*1. Default data when default data selection (UB-02) is set to 01.



Precautions for Correct Use

- [AA-13] STOP-key enable at RUN-command from terminal, 1st-motor is enabled when the Run-command input source selection, 1st-motor [AA111] is set to a value other than the value of the LCD operator (02).
- Unlike 3G3RX-V1 Series, the communication function on 3G3RX2 Series continues communication even during resetting and therefore no idling time is necessary for the resetting.

6-3-8 Temporary Change of Operation Command Destination

The operation command destination can be temporarily changed with [F-OP] terminal.

When 023 [F-OP] terminal is ON, the command destination of [CA-71] is employed in a priority to the operation command destination given in [AA111].



Precautions for Correct Use

- When 023 [F-OP] terminal is ON, the frequency command destination also employs the frequency command selection designated in [CA-70].
- If [AA111] and [CA-71] are set differently from each other, the operation is interrupted when the [F-OP] terminal is made ON or OFF. The selected operation command is enabled when it is made OFF and then ON.

● Parameter

| Item | Parameters | Data | Description | Default data |
|--|--------------------|----------|--|--------------|
| Input terminal function selection | [CA-01] to [CA-11] | 023 | [F-OP]: Gives a forced command. | - |
| Speed reference source selection at [F-OP] is active | [CA-70] | 01 to 15 | 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: parameter setting, 08: RS485 communication, 09: option 1, 10: option 2, 11: option 3, 12: pulse string input (main body), 13: pulse string input (optional), 14: program function, 15: PID arithmetic | 01 |
| RUN command source selection at [F-OP] is active | [CA-71] | 00 to 06 | 00: [FW]/[RV] terminal, 01: 3 wire, 02: RUN key on LCD operator, 03: RS485 communication, 04: option 1, 05: option 2, 06: option 3 | 00 |

6-4 Frequency Command Settings

6-4-1 Frequency Command Selection

The frequency command selected in each function is enabled.

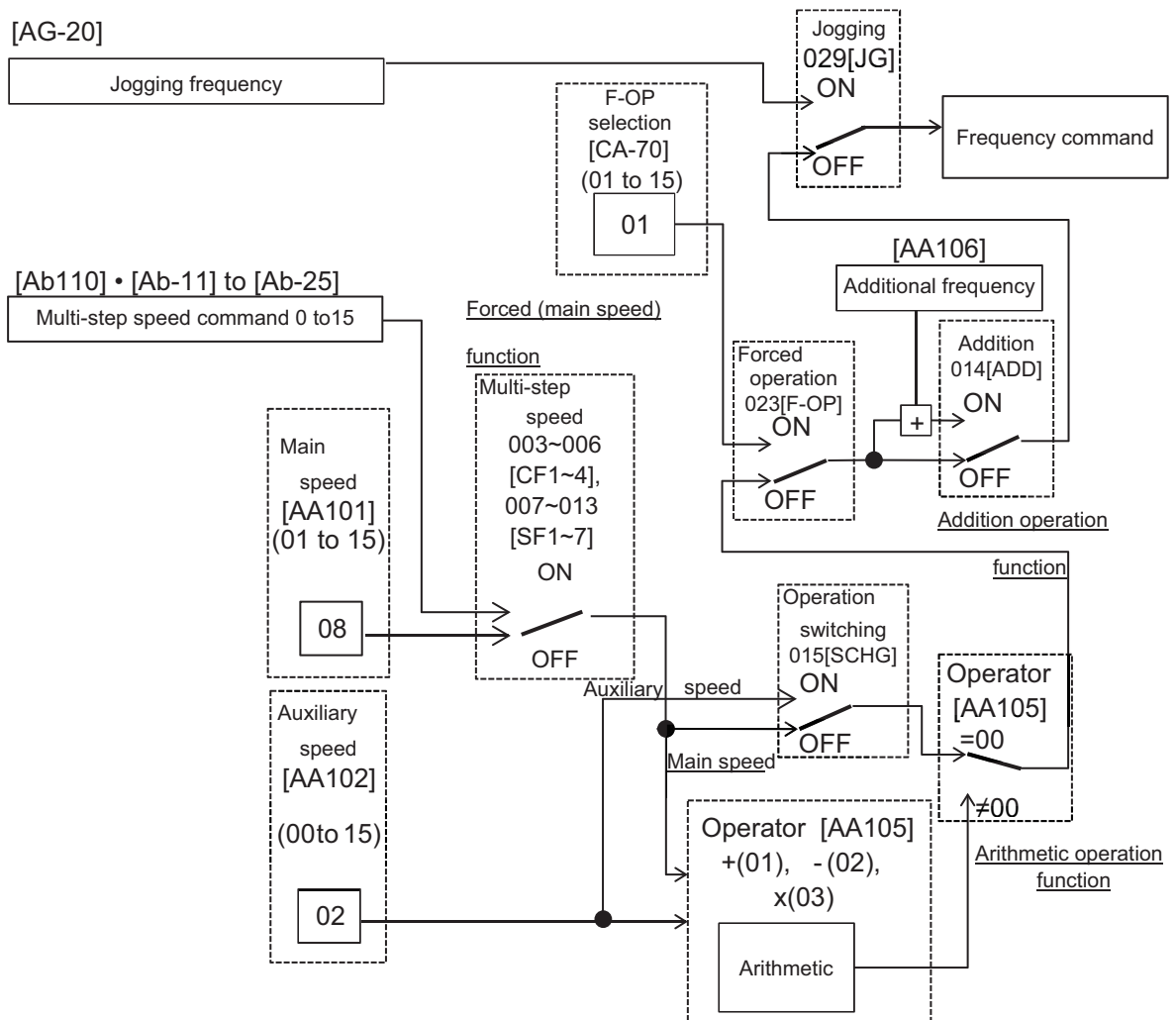
For details, see the next and subsequent sections.

The value of the enabled frequency command is shown in [FA-01].



Precautions for Correct Use

- The operation of the inverter requires not only a frequency command but also an operation command.
- To use the second setting switching [SET] of the input terminal function, replace 1 of the third digit of the parameter with 2. Ex.: [AA101]->[AA201]. If the third digit is "-", the parameter is shared for the first and second settings.



| Parameter | Setting data |
|-----------|----------------------------------|
| | 00: Disabled |
| | 01: Ai1 terminal input |
| | 02: Ai2 terminal input |
| | 03: Ai3 terminal input |
| | 07: Parameter setting |
| CA-70 | 08: RS 485 |
| AA101 | 09: Option 1 |
| AA102 | 10: Option 2 |
| | 11: Option 3 |
| | 12: Pulse string input: Inverter |
| | 13: Pulse string input: Option |
| | 14: Program function |
| | 15: PID calculation |



Precautions for Correct Use

- In the above example, [AA101]=08(RS 485) is enabled. For details, see the following explanation.
- Other command destinations can be chosen even when RS485 (Modbus communication, EzCOM function) and program function (Drive Programming) are being used.
- If an operation command is given from the operation screen of PC software CX-Drive, [AA101]=07 and [AA111]=03 are forcedly overwritten when the operation screen opens. Set [AA101]=07 and [AA111]=03.

6-4-2 Case where Command Is Given with LCD Operator

The LCD operator is used to give a frequency command.

For operation using the LCD operator, the operation direction can be changed by setting RUN-key Direction of LCD operator, 1st-motor [AA-12].



Precautions for Correct Use

- The output of the inverter (operation of the motor) requires not only a frequency command but also an operation command.
- The main and auxiliary speeds can be selected and calculated by using the input terminal function [SCHG] and the operator selection. For details, see *6-4-8 Case where Command Is Given with Main Speed Command and Auxiliary Speed Command* on page 6-35.
- If not using the LCD operator, you need to make FW/RV direction switching from each command.

● Parameter

| Item | Parameters | Data | Description | Default data |
|---|--------------------|--------------------|---|--------------|
| Main speed input source selection, 1st-motor | [AA101] | 07 | The frequency set from the LCD operator is for main speed In this case the setting is made for [Ab110]. | 01*1 |
| Sub frequency input source selection, 1st-motor | [AA102] | 07 | Auxiliary speed to use switching and arithmetic functions is set from the LCD operator. For auxiliary speed, the setting is made for [AA104]. | |
| Multispeed-0 setting, 1st-motor | [Ab110] | 0.00 to 590.00(Hz) | Frequency setting of the main speed on the LCD operator. Shared for the 0th speed of the multi-step speed function. | 00 |
| Sub speed setting, 1st-motor | [AA104] | 0.00 to 590.00(Hz) | Frequency setting of the auxiliary speed on the LCD operator. | 0.00 |
| RUN-key Direction of LCD operator, 1st-motor | [AA-12] | 00 | Forward rotation operation | 00 |
| | | 01 | Reverse rotation operation | |
| Output terminal function | [CC-01] to [CC-07] | 010 | [FREF] ON when a frequency command can be given from the LCD operator. | - |

*1. Default data when default data selection (UB-02) is set to 01.

6-4-3 Case where Command Is Given from Terminal Block Analog Signals

A frequency command is given by input from the terminal block.

The inverter has three kinds of external analog input terminals.

| Terminal connection | Input range | Switching method |
|---------------------|---------------------------------|-------------------------------|
| Ai1-L | 0 to 10 V/0 to 20 mA switchable | SW1 on the board is switched. |
| Ai2-L | 0 to 10 V/0 to 20 mA switchable | SW2 on the board is switched. |
| Ai3-L | -10 to 10 V | - |

For each input, relation between the input signal and the frequency command can be set independently.

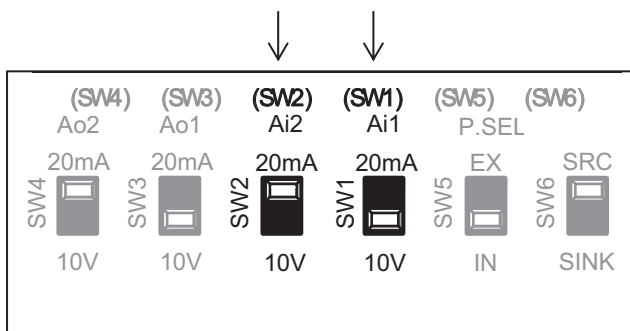
To add/subtract a command, the sub frequency input source selection, 1st-motor [AA102] and Calculation symbol selection for Speed reference, 1st-motor [AA105] should also be set. [Ai3] can be added to [Ai1] and [Ai2] without choosing an operator in the [Cb-22][Ai3] terminal selection. For details, see 8-10-5 *Analog Input* on page 8-163.



Precautions for Correct Use

- The output of the inverter requires not only a frequency command but also an operation command.
- Note that the voltage input and the current input are switched from each other by the terminal block switch.
- For adjustment of the analog input, see 8-10 *Input Terminal Function* on page 8-154.

First, the voltage SW and current SW are switched when the wiring is made.



Next, a command destination for the parameter [AA101] is set.

● Parameter

| Item | Parameters | Data | Description | Default data |
|--|------------|------|----------------------------------|--------------|
| Main speed input source selection, 1st-motor | [AA101] | 01 | Input between Ai1 and L enabled. | 01*1 |
| | | 02 | Input between Ai2 and L enabled. | |
| | | 03 | Input between Ai3 and L enabled. | |
| | | 04 | Reserved | |
| | | 05 | Reserved | |
| | | 06 | Reserved | |

*1. Default data when default data selection (UB-02) is set to 01.

6-4-4 Case where Command Is Given through RS485 Communications

RS485 communication is used to give a frequency command.



Precautions for Correct Use

For details, see 9-1 Communication Specifications on page 9-2

● Parameter

| Item | Parameters | Data | Description | Default data |
|--|------------|------|----------------------------------|--------------|
| Main speed input source selection, 1st-motor | [AA101] | 08 | Command from RS485 communication | 01*1 |

*1. Default data when default data selection (UB-02) is set to 01.

6-4-5 Case where Command Is Given through Input of Pulse String

Frequency command is given with a pulse string input.

Note To give a pulse string input, there are two methods. One is to use the main body's terminals and the other is to use the PG option unit.

Case where Command Is Given from Input Terminals [A] and [B]

To use the input terminals [A] and [B] of the main body as a pulse string input frequency command, set [CA-90] to 01: command.

A pulse string given as input to the input terminals [A] and [B] can be used as a frequency command / PID feedback value in each control mode.

Set an input pulse frequency that corresponds to the maximum frequency to the pulse string frequency scale [CA-92].

The pulse string input values to the input terminals [A] and [B] can be monitored with [dA-70].



Precautions for Correct Use

- Start/End function of analog input cannot be used. To limit the pulse string input frequency, use the pulse string frequency bias size [CA-94], the pulse string frequency upper detection limit [CA-95], and the pulse string frequency lower detection limit [CA-96]
- When the pulse input frequency is below the pulse string frequency lower detection limit [CA-96], it is regarded as 0 Hz in the processing.
- Slow start if the pulse string frequency lower detection limit [CA-96] is set to a high value.

● Parameter (Main body)

| Item | Parameters | Data | Description | Default data |
|--|------------|---------------------|--|--------------|
| Main speed input source selection, 1st-motor | [AA101] | 12 | Frequency command from pulse string input (input terminals [A] and [B]) | 01*1 |
| Input terminal [A] function | CA-10 | 103 | pulse train input A | - |
| Input terminal [B] function | CA-11 | 104 | pulse train input B | |
| Pulse train detection object selection | [CA-90] | 01 | Used for frequency command | 00 |
| Mode selection of pulse train input | [CA-91] | 00 | Mode 0: 90° phase difference pulse string | 00 |
| | | 01 | Mode 1: Forward/Reverse rotation command and rotation direction | |
| | | 02 | Mode 2: Forward rotation pulse string and reverse rotation pulse string | |
| Pulse train frequency Scale | [CA-92] | 0.05 to 32.00 (kHz) | Input a pulse string frequency that corresponds to the maximum frequency. | 25.00 |
| Pulse train frequency Filter time constant | [CA-93] | 0.01 to 2.00 (sec) | A filter is applied to the input of the pulse string frequency. | 0.10 |
| Pulse train frequency Bias value | [CA-94] | -100.0 to 100.0(%) | A bias is applied to the input of the pulse string frequency. | 0.0 |
| Pulse train frequency High Limit | [CA-95] | 0.0 to 100.0 (%) | The output of the pulse string frequency input is limited. | 100.00 |
| Pulse train frequency detection low level | [CA-96] | 0.0 to 100.0 (%) | In outputting the pulse string frequency input, pulses with the frequency lower than the limit is set to 0.0%. | 0.0 |

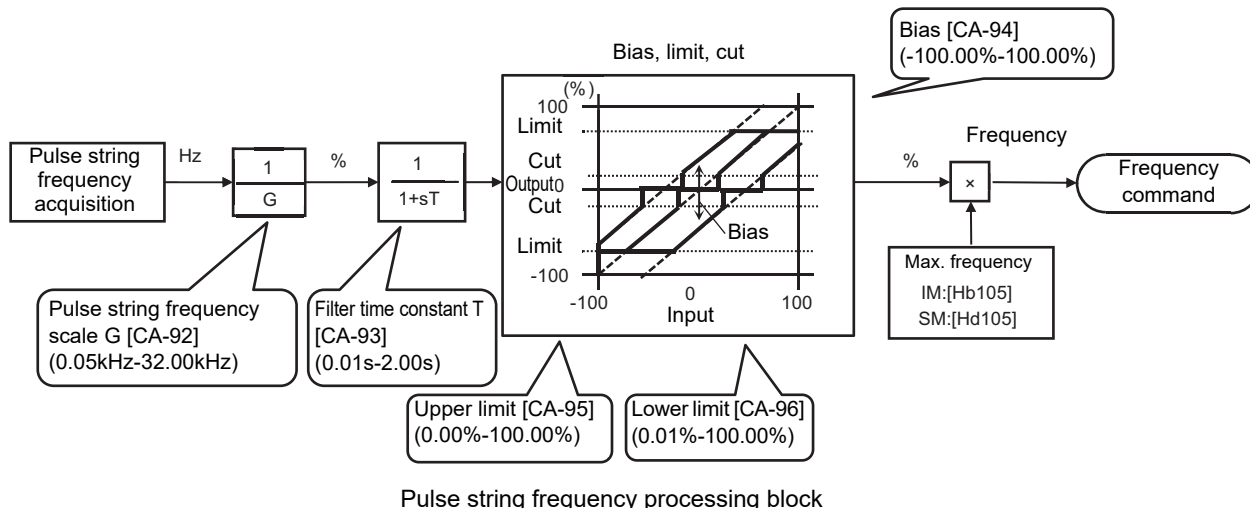
*1. Default data when default data selection (UB-02) is set to 01.

● Monitor (Main Body)

| Item | Parameters | Data | Description |
|--|------------|---------------------|---|
| Pulse string input monitor (main body) | [dA-70] | -100.0 to 100.00(%) | The frequency command from the pulse string input (input terminals A/B) is displayed. |

● Internal Arithmetic Block Diagram

Internal processing is schematically drawn.

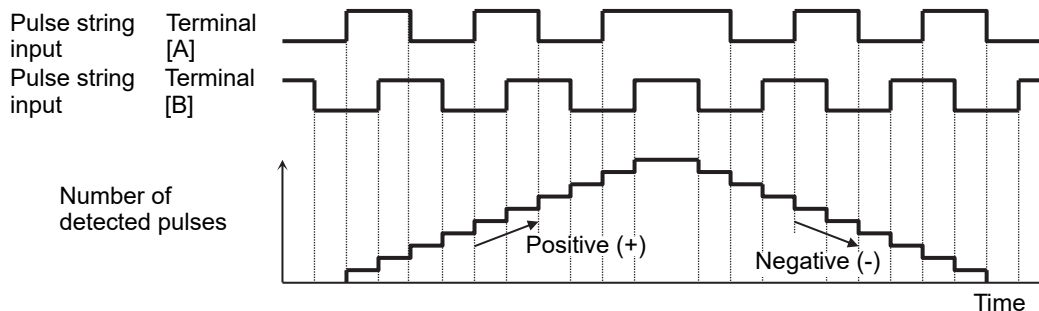


● Details about Pulse String Input Mode

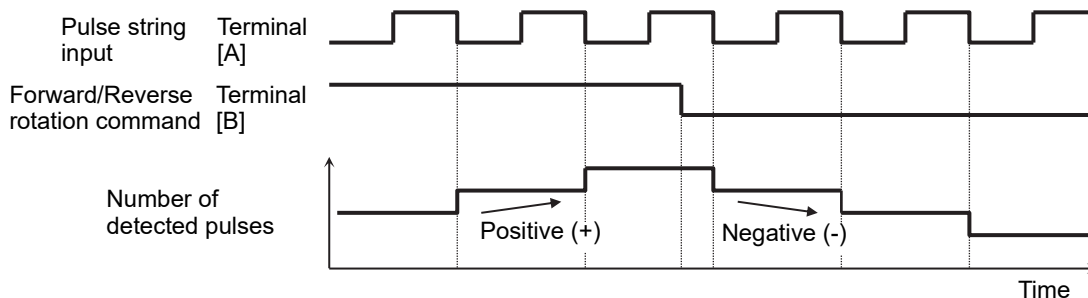
Command frequency is determined by the frequency of the pulse string input.

The sign of the command frequency is determined in the following way.

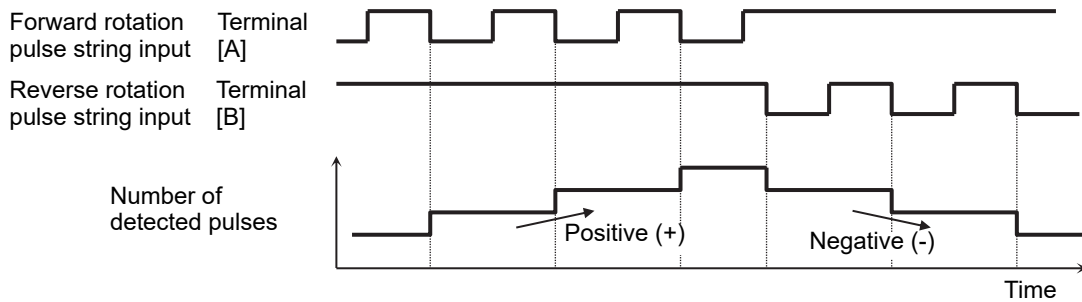
a) Mode 0: [CA-91]=00 90° phase difference pulse string



b) Mode 1: [CA-91]=01 forward and reverse rotation commands + pulse string



c) Mode 2: [CA-91]=02 Forward rotation pulse string + reverse rotation pulse string



Precautions for Correct Use

Your setting must be in accordance with the pulse string input to use. Make sure to set the proper pulse string input (the inverter) mode selection: [CA-91]. If your setting is incorrect, the motor could make reverse rotations or other unintended movements.

Case where Command Is Given with PG Option Unit

When you use the pulse string that is input in [SAP][SBP][SAN][SBN] of PG option unit as a frequency command, set main speed input source selection, 1st-motor [AA101] to 13 (Pulse string input: Option) and set Pulse train detection object selection [ob-10] to 00 (Pulse train detection object selection).

A pulse string given as input to PG option unit can be used as a frequency command / PID feedback value in each control mode.

Set an input pulse frequency that corresponds to the maximum frequency to the pulse string frequency scale [ob-12].

The pulse string input values to PG option unit can be monitored with [dA-71].



Precautions for Correct Use

- Start/End function of analog input cannot be used. To limit the pulse string input frequency, use the pulse string frequency bias size [ob-14], the pulse string frequency upper detection limit [ob-15], and the pulse string frequency lower detection limit [ob-16]
- When the pulse input frequency is below the pulse string frequency lower detection limit [ob-16], it is regarded as 0 Hz in the processing.
- Slow start if the pulse string frequency lower detection limit [ob-16] is set to a high value.

● Parameter (Main Body)

| Item | Parameters | Data | Description | Default data |
|--|------------|---------------------|--|--------------|
| Main speed input source selection, 1st-motor | [AA101] | 13 | Frequency command from PG option unit enabled. | 01*1 |
| Pulse train detection object selection | [ob-10] | 00 | Used for frequency command | 00 |
| Mode selection of pulse train input | [ob-11] | 00 | Mode 0: 90° phase difference pulse string | 01 |
| | | 01 | Mode 1: Forward/Reverse rotation command and rotation direction | |
| | | 02 | Mode 2: Forward rotation pulse string and reverse rotation pulse string | |
| Pulse train frequency Scale | [ob-12] | 0.05 to 200.0 (kHz) | A pulse string frequency equivalent to the maximum frequency is given. | 25 |
| Pulse train frequency Filter time constant | [ob-13] | 0.01 to 2.00 (sec) | A filter is applied to the input of the pulse string frequency. | 0.1 |
| Pulse train frequency Bias value | [ob-14] | -100.0 to 100.0(%) | A bias is applied to the input of the pulse string frequency. | 0.0 |
| Pulse train frequency High Limit | [ob-15] | 0.0 to 100.0 (%) | The output of the pulse string frequency input is limited. | 100.0 |
| Pulse train frequency detection low level | [ob-16] | 0.0 to 100.0 (%) | In outputting the pulse string frequency input, pulses with the frequency lower than the limit is set to 0.0%. | 0.0 |

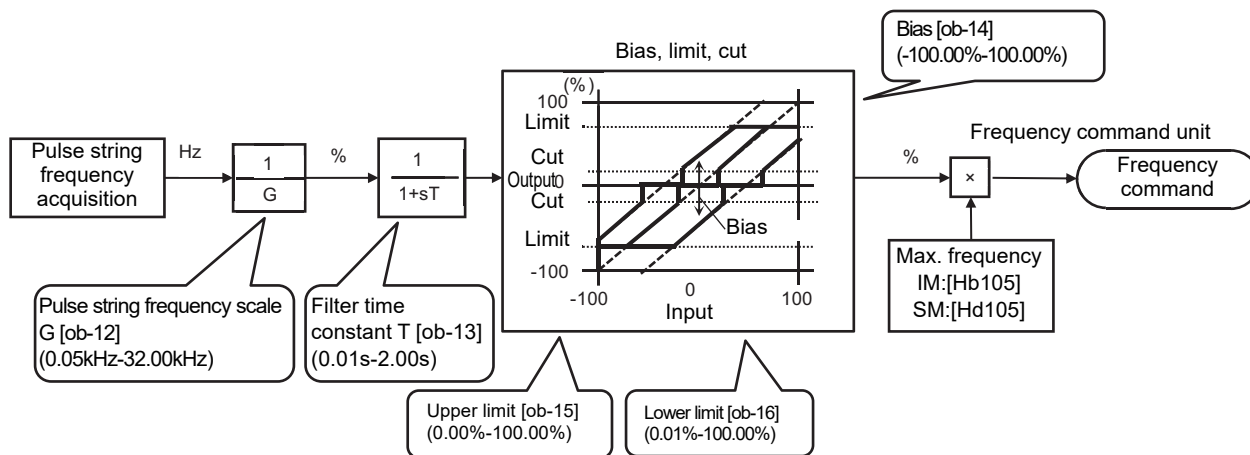
*1. Default data when default data selection (UB-02) is set to 01.

● Monitor (Main Body)

| Item | Parameters | Data | Description |
|-------------------------------------|------------|----------------------|--|
| Pulse string input monitor (option) | [dA-71] | -100.00 to 100.00(%) | Frequency command from pulse string input (option input A phase / B phase) |

● Internal Arithmetic Block Diagram

Internal processing is schematically drawn.



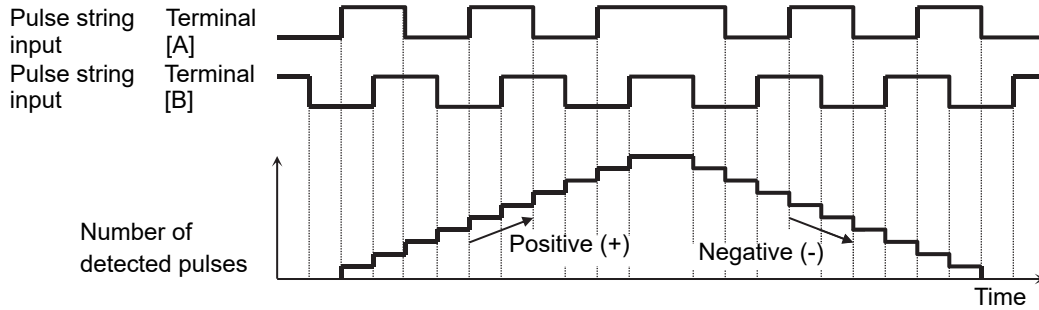
Pulse string frequency processing block

● **Details about Pulse String Input Mode**

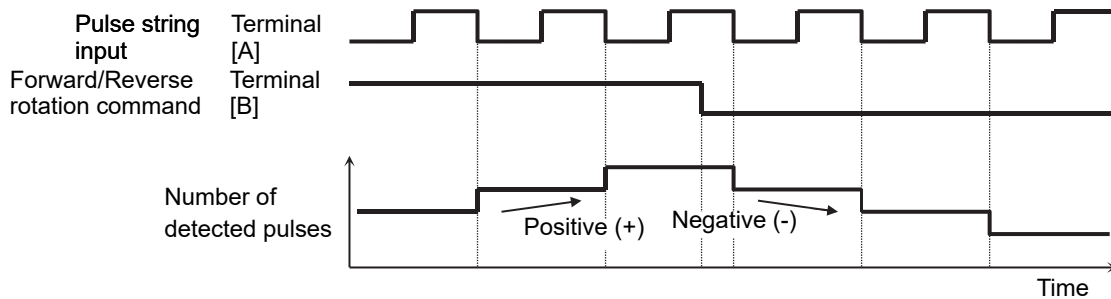
Command frequency is determined by the frequency of the pulse string input.

The sign of the command frequency is determined in the following way.

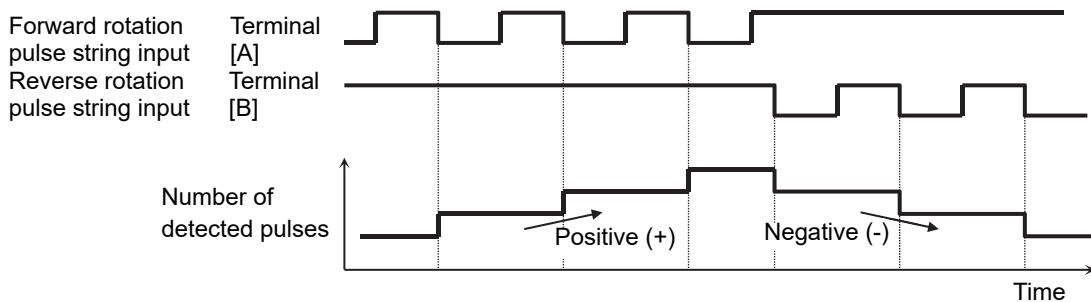
a) Mode 0: [ob-11]=00 90° phase difference pulse string



b) Mode 1: [ob-11]=01 Forward and reverse commands + pulse string



c) Mode 2: [ob-11]=02 Forward rotation pulse string + reverse rotation pulse string



Precautions for Correct Use

Your setting must be in accordance with the pulse string input to use. Make sure to set the proper pulse string input (option) mode selection: [ob-11]. If your setting is incorrect, the motor could make reverse rotations or other unintended movements.

6-4-6 Case where Command Is Given through DriveProgramming

Frequency command is given via DriveProgramming.

A frequency command can be given through the DriveProgramming when Set-Freq command is used in the program for DriveProgramming.



Precautions for Correct Use

- A program created on PC needs to be downloaded from the PC to the inverter.
- Downloaded program begins working when the program action of the DriveProgramming function is enabled.
- For the details, see the instruction manual of DriveProgramming SBCE-440.

● Parameter

| Item | Parameters | Data | Description | Default data |
|--|------------|------|---|------------------|
| Main speed input source selection, 1st-motor | [AA101] | 14 | Frequency command from the program function is enabled. | 01 ^{*1} |
| EzSQ function enable | [UE-02] | 00 | Actions of the downloaded programs disabled. | 01 |
| | | 01 | The program starts when [PRG] terminal is made ON. | |
| | | 02 | The program starts after the setting or power activation. | |

*1. Default data when default data selection (UB-02) is set to 01.

6-4-7 Case where Command Is Given with PID Control

Frequency command is given with PID control.

To use the PID control for motor control, PID arithmetic is set in the frequency command selection after the PID function is set.



Precautions for Correct Use

To give a command from the PID control, parameters of the PID control function need to be set. For details, see 8-1 PID Control on page 8-4.

● Parameter

| Item | Parameters | Data | Description | Default data |
|--|------------|------|--|------------------|
| Main speed input source selection, 1st-motor | [AA101] | 15 | An arithmetic result of the PID control is output. | 01 ^{*1} |

*1. Default data when default data selection (UB-02) is set to 01.

6-4-8 Case where Command Is Given with Main Speed Command and Auxiliary Speed Command

By selecting an operator, you can either switch between main speed and auxiliary speed ([SCHG] switching with [AA105]=00) or make a command (arithmetic frequency) ([AA105] not equal to 00) on the basis of addition, subtraction, or multiplication of the two speeds.

● Parameter

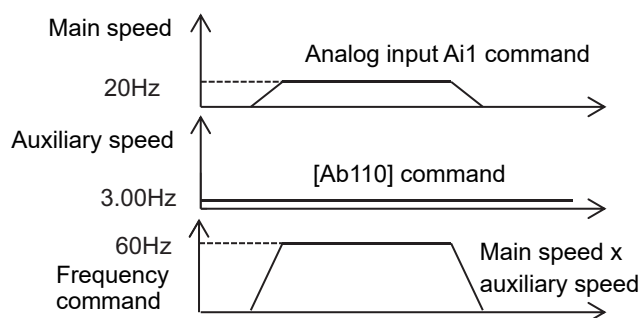
| Item | Parameters | Data | Description | Default data |
|---|--------------------|----------|--|------------------|
| Main speed input source selection, 1st-motor | [AA101] | 01 to 15 | 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 07: parameter setting, 08: RS485 communication, 12: pulse string input (main body), 13: Pulse string input: Option, 14: program function, 15: PID arithmetic, 00: disabled (only for auxiliary speed) | 01 ^{*1} |
| Sub frequency input source selection, 1st-motor | [AA102] | | | 00 |
| Calculation symbol selection for Speed reference, 1st-motor | [AA105] | 00 | The arithmetic function is disabled and can be switched by using the [SCHG] terminal. | 00 |
| | | 01 | (Main speed) + (auxiliary speed) is used for the command. | |
| | | 02 | (Main speed) - (auxiliary speed) is used for the command. | |
| | | 03 | (Main speed) x (auxiliary speed) is used for the command. | |
| Input terminal function | [CA-01] to [CA-11] | 015 | [SCHG] Main speed and auxiliary speed are switched from each other for the operation. OFF: Main speed is effective, ON: Auxiliary speed is effective. Note The operator needs to be [AA105]=00. | - |

*1. Default data when default data selection (UB-02) is set to 01.

Calculation with Two Commands

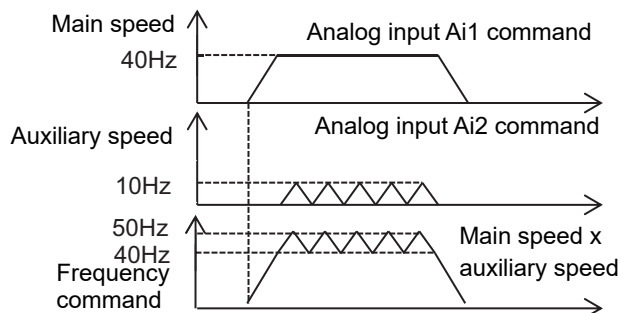
(Ex.1) Gain is multiplied.

[AA101]=01 ([Ai1] command)/[AA102]=07 (set [Ab110])/[AA105]=03 (multiplication)/[Ab110]=3.00(Hz)



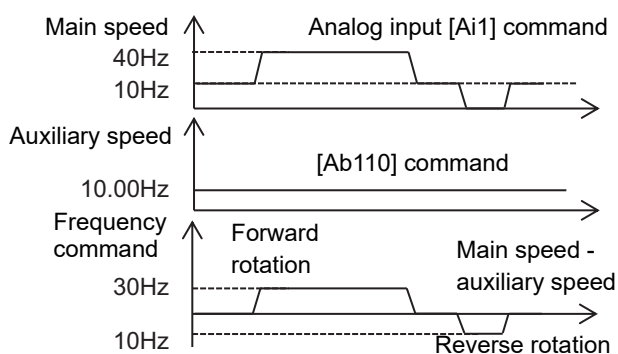
(Ex.2) Command by addition

[AA101]=01([Ai1] command)/[AA102]=02([Ai2] command)/[AA105]=01(addition)



(Ex.3) Forward rotation at a high speed and reverse rotation at a low speed are made by a command.

[AA101]=01 ([Ai1] command)/[AA102]=07 (set [Ab110])/[AA105]=02 (subtraction)/[Ab110]=10.00(Hz)

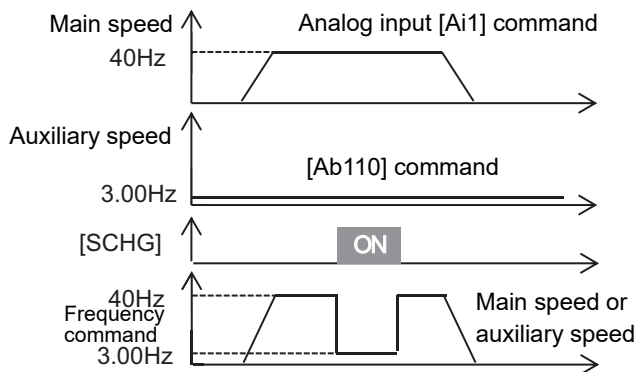


Precautions for Correct Use

- The same setting can be used for both [AA101] and [AA102], Square can be calculated multiplication.
- The input terminal [FUP]/[FDN] functions are effective for commands where the main speed can be set (with the LCD operator setting, multi-speed setting, and analog holding function [AHD]).

Switching with Two Commands

[AA101]=01 ([Ai1] command)/[AA102]=07 (set [Ab110])/[AA105]=00 (disabled)/[Ab110]=3.00(Hz)



Precautions for Correct Use

The output frequency of the inverter accelerates/decelerates toward the frequency command, following the setting of the acceleration/deceleration time.

6-4-9 Case where Command Is Given with Multi-Step Speed

A frequency command is controlled with a signal pattern by setting multiple command frequencies in advance.

In the multi-step speed command, one can either give a binary combination of 0 (OFF) and 1 (ON) or give a priority on certain terminals (bit operation).

In the binary operation, a frequency at maximum 16th speed with four terminals can be set. In the bit operation, a frequency at maximum 8th speed with seven terminals can be set.



Precautions for Correct Use

- If the LCD operator [AA101]=07 is chosen in the frequency command selection, rewriting of the main speed command [FA-01] automatically rewrites [Ab110], frequency setting of the 0th speed.
- The frequency setting for the 1st to 15th speeds should be made in the 1st-15th speeds of the multi-step speed function ([Ab-11]-[Ab-25]).
- With the multi-step speed function, one can set the acceleration/deceleration time individually for the frequency switching in the multi-step speed command. For details, see 6-7-3 *Switching of Acceleration or Deceleration Time with Multi-Speed Step* on page 6-61.
- The multi-step speed function is effective only for the main speed command. Not applied to the auxiliary speed command
- If [SET] terminal is made ON and the secondary setting function is used, [Ab210] instead of [Ab110] becomes effective.

● Parameter

| Item | Parameters | Data | Description | Default data |
|-------------------------------------|--------------------|---|--|--------------|
| Main Speed reference monitor | [FA-01] | Data change depending on the frequency command selection. | The frequency command value is shown. | - |
| Multispeed operation selection | [Ab-03] | 00 | Binary operation, max. 16 speed modes | 00 |
| | | 01 | Bit operation, max. 8 speed modes | |
| Multispeed-0 setting, 1st-motor | [Ab110] | 0.00/Min. frequency -max. frequency (Hz) | 0th speed of the multi-step speed | 0.00 |
| Multispeed-1to15 setting | [Ab-11] to [Ab-25] | 0.00/Min. frequency -max. frequency (Hz) | 1st-15th speeds of the multi-step speed | 0.00 |
| Multistage input determination time | [CA-55] | 0 to 2000(ms) | This is the time to fix the frequency in switching the multi-step speed. | 0 |

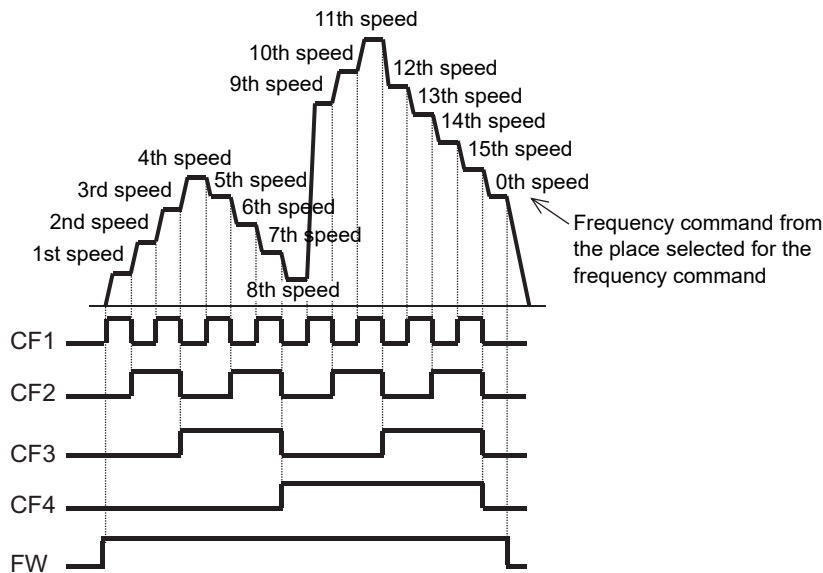
Binary Operation (Maximum 16-speed Command: [Ab-03]=00)

Multi-step speeds of 0th to 15th speeds can be chosen by assigning 003-006 ([CF1]-[CF4]) to the input terminals 1-9, A, and B [CA-01]-[CA-11].

● Action Table

| Multi-step speed | CF4 | CF3 | CF2 | CF1 | Parameters |
|------------------|-----|-----|-----|-----|------------|
| 0th speed | OFF | OFF | OFF | OFF | Ab110 |
| 1st speed | OFF | OFF | OFF | ON | Ab-11 |
| 2nd speed | OFF | OFF | ON | OFF | Ab-12 |
| 3rd speed | OFF | OFF | ON | ON | Ab-13 |
| 4th speed | OFF | ON | OFF | OFF | Ab-14 |
| 5th speed | OFF | ON | OFF | ON | Ab-15 |
| 6th speed | OFF | ON | ON | OFF | Ab-16 |
| 7th speed | OFF | ON | ON | ON | Ab-17 |
| 8th speed | ON | OFF | OFF | OFF | Ab-18 |
| 9th speed | ON | OFF | OFF | ON | Ab-19 |
| 10th speed | ON | OFF | ON | OFF | Ab-20 |
| 11th speed | ON | OFF | ON | ON | Ab-21 |
| 12th speed | ON | ON | OFF | OFF | Ab-22 |
| 13th speed | ON | ON | OFF | ON | Ab-23 |
| 14th speed | ON | ON | ON | OFF | Ab-24 |
| 15th speed | ON | ON | ON | ON | Ab-25 |

● Action Chart





Precautions for Correct Use

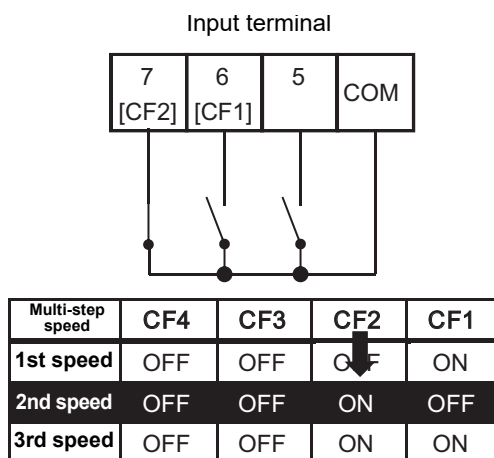
- For the binary operation, idling time to wait for a terminal input to be given can be set in the Multistage input determination time [CA-55]. This can prevent transition during terminal switching.
- Data are fixed after the time specified in [CA-55] passes with no change in the input. Input response would be slow if the determination time is set to be large.
- For the command frequency of the 0th speed, the command designated in the Main speed input source selection, 1st-motor [AA101] is used. The above table is for [AA101]=07.

Ex.) 2nd speed is effective.

In this case we have [CA-06]=003 (CF1) and [CA-07]=004 (CF2).

No assignment is made for 005 (CF3) and 006 (CF4).

Only the input terminal No. 7 (CF2) is ON.



Bit Operation (Maximum 8-speed Command: [Ab-03]=01)

Multi-step speeds of 0th to 7th speeds can be chosen by assigning 007-013 ([SF1]-[SF7]) to the input terminals selection 1-9, A, and B [CA-01]-[CA-11].

The frequency setting of [SF1]-[SF7] should be made to the multi-step speeds of 1st to 7th speeds ([Ab-11]-[Ab-17]).



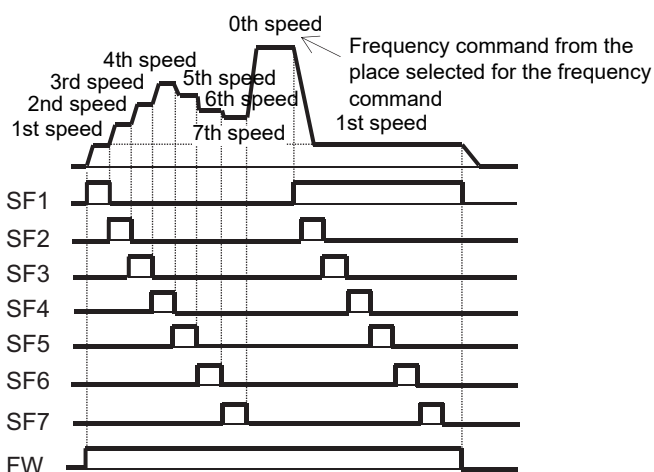
Precautions for Correct Use

- If multiple terminals are made ON simultaneously, the one with smaller number has priority. "-" in the table indicates that a frequency is chosen independently from ON/OFF state of the terminals.
- For the command frequency of the 0th speed, the command designated in the main speed selection [AA101] is used. The following table is for [AA101]=07.

● Action Table

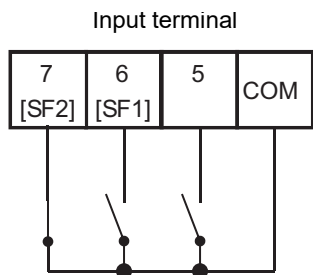
| Multi-step speed | SF7 | SF6 | SF5 | SF4 | SF3 | SF2 | SF1 | Parameters |
|------------------|-----|-----|-----|-----|-----|-----|-----|------------|
| 0th speed | OFF | OFF | OFF | OFF | OFF | OFF | OFF | Ab110 |
| 1st speed | - | - | - | - | - | - | ON | Ab-11 |
| 2nd speed | - | - | - | - | - | ON | OFF | Ab-12 |
| 3rd speed | - | - | - | - | ON | OFF | OFF | Ab-13 |
| 4th speed | - | - | - | ON | OFF | OFF | OFF | Ab-14 |
| 5th speed | - | - | ON | OFF | OFF | OFF | OFF | Ab-15 |
| 6th speed | - | ON | OFF | OFF | OFF | OFF | OFF | Ab-16 |
| 7th speed | ON | OFF | OFF | OFF | OFF | OFF | OFF | Ab-17 |

● Action Chart



Ex.) 2nd speed is effective.

In this case we have [CA-06]=007 (SF1) and [CA-07]=008 (SF2).
 No assignment is made for 009 (SF3) and 013 (SF7).
 Only the input terminal No. 7 (SF2) is ON.



| Multi-step speed | SF4 | SF3 | SF2 | SF1 |
|------------------|-----|-----|-----|-----|
| 1st speed | - | - | ↓ | ON |
| 2nd speed | - | - | ON | OFF |
| 3rd speed | - | ON | OFF | OFF |

If SF1 becomes ON in this state, the 1st speed becomes effective.

6-4-10 Temporal Addition of Frequency Command

The frequency command can be changed temporally when the frequency is added by turning [ADD] terminal ON.

The frequency command can be subtracted when the sign of the frequency command changes (+) to (-).



Precautions for Correct Use

- The frequency addition of the input terminal function 014 [ADD] is made within the limited frequency range. If the frequency is not within the range between the upper and lower limits or exceeds the maximum frequency, the frequency command is restricted.
- If the sign of the frequency command changes ((-) to (+) or (+) to (-)) as a result of the arithmetic, the rotation direction is reversed.
- This function is also effective for PID target value.

● Parameter

| Item | Parameters | Data | Description | Default data |
|----------------------------------|--------------------|-----------------------|--|--------------|
| Add frequency setting, 1st-motor | [AA106] | -590.00 to 590.00(Hz) | Sets the frequency to add. | 0.00 |
| Input terminal selection | [CA-01] to [CA-11] | 014 | [ADD] The designated frequency is added. | - |

6-4-11 Up/Down Function (FUP, FDN)

The frequency command of the inverter can be changed by a signal input if 020 [FUP terminal and 021 [FDN] terminal are assigned in the input terminal function.

This function works for the selected frequency command when the frequency command selection [AA101] is 07 (parameter effective) or when a multi-step speed command is given.

While [FUP] terminal is turned ON, the frequency command increases.

While [FDN] terminal is turned ON, the frequency command decreases.

Acceleration/Deceleration follows Acceleration time setting for FUP/FDN function [CA-64]/Deceleration time setting for FUP/FDN function [CA-66].

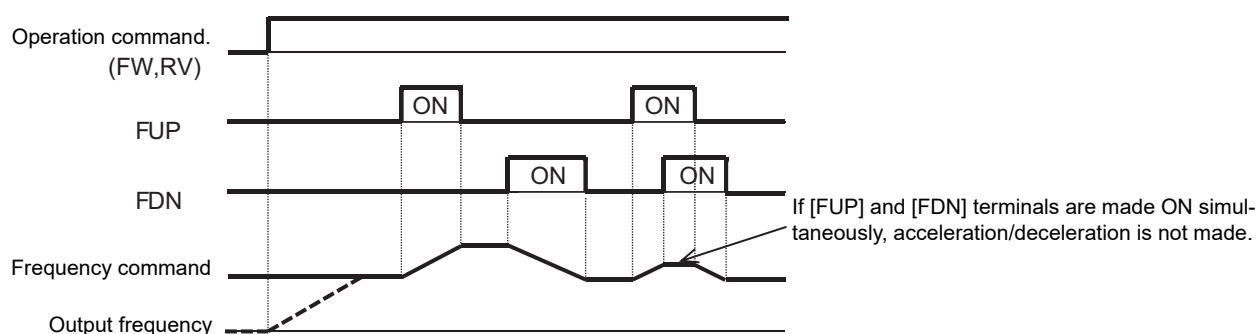
If 01 (save) is chosen in [CA-61], frequency command data changed with [FUP] terminal and [FDN] terminal can be saved when the power supply is cut off. The operation of an inverter can be resumed with the saved frequency command even after the power supply is cycled. To clear the saved frequency value, assign 022[UDC] to the input terminal and change the [UDC] terminal from ON to OFF. Clearance by [UDC] follows the designated value of [CA-62].



Precautions for Correct Use

- When 020 [FUP] terminal / 021 [FDN] terminal is made ON/OFF immediately after the power shutdown, data may not be able to be correctly saved.
- Cannot be used to set the frequency of the input terminal function 029 [JG] jogging operation.

An example of operation on [FUP] and [FDN] terminals is shown as follow:



● Parameter

| Item | Parameters | Data | Description | Default data |
|--|--------------------|--------------------|---|------------------|
| Main speed input source selection, 1st-motor | [AA101] | 01 to 15 | 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 07: parameter setting, 08: RS485 communication, 12: pulse string input (main body), 14: program function, 15: PID arithmetic | 01 ^{*1} |
| Input terminal function selection | [CA-01] to [CA-11] | 020 | FUP: Acceleration through remote operation | - |
| | | 021 | FDN: Deceleration through remote operation | |
| | | 022 | UDC: Clearing of remote operation data | |
| FUP/FDN overwriting target selection | [CA-60] | 00 | Overwrites the frequency command. | 00 |
| | | 01 | PID target value is overwritten. | |
| FUP/FDN data save enable | [CA-61] | 00 | The command is not saved in case of power shutdown. | 00 |
| | | 01 | The command is saved in case of power shutdown. | |
| FUP/FDN UDC selection | [CA-62] | 00 | Cleared to 0 Hz. | 00 |
| | | 01 | Cleared to the saved command. | |
| Acceleration time setting for FUP/FDN function | [CA-64] | 0.00 to 3600.00(s) | Sets acceleration time for FUP/FDN functions. | 30.00 |
| Deceleration time setting for FUP/FDN function | [CA-66] | 0.00 to 3600.00(s) | Sets deceleration time for FUP/FDN functions. | 30.00 |

*1. Default data when default data selection (UB-02) is set to 01.

6-4-12 Analog Command Hold Function (AHD)

The input terminal 019 [AHD] analog command holding holds the command of the analog input when the input terminal becomes ON. When the input terminal becomes OFF, the command returns to the analog command.

If the main speed command [AA101] is an analog input command (01-03), this function is effective even when data are held by the analog command holding [AHD] function.

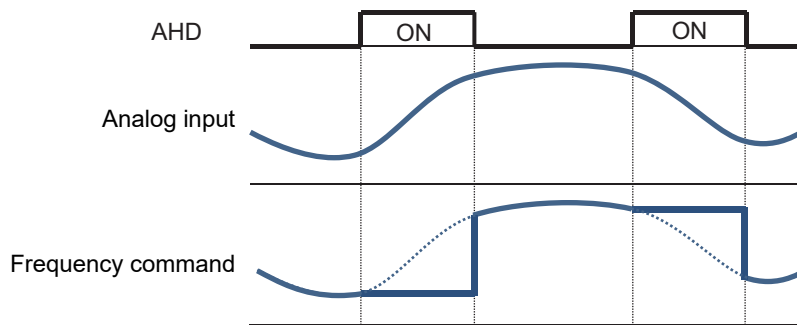
If 019[AHD] function is effective, the held data can be moved up/down by using [FUP]/[FDN] function.



Precautions for Correct Use

Data changes with the [FUP]/[FDN] function are not saved.

A frequency command uses [AHD] in the analog input.



● Parameter

| Item | Parameters | Data | Description |
|-----------------------------------|--------------------|----------|---|
| Main speed command selection | [AA101] | 01 to 15 | 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input |
| Input terminal function selection | [CA-01] to [CA-11] | 019 | AHD: Analog command holding |

6-4-13 Temporal Change of Frequency Command Destinations

When [F-OP] terminal is ON, the frequency destination can be changed temporally.

When 023 [F-OP] terminal is ON, the command destination of [CA-70] is employed in a priority to the frequency command destination given in [AA101].



Precautions for Correct Use

When 023 [F-OP] terminal is ON, the operation command destination also employs the operation command selection designated in [CA-71].

● Parameter

| Item | Parameters | Data | Description | Default data |
|--|--------------------|----------|--|--------------|
| Input terminal function selection | [CA-01] to [CA-11] | 023 | [F-OP]: Gives a forced command. | - |
| Speed reference source selection at [F-OP] is active | [CA-70] | 01 to 15 | 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: parameter setting, 08: RS485 communication, 09: option 1, 10: option 2, 11: option 3, 12: pulse string input (main body), 13: pulse string input (option), 14: program function, 15: PID arithmetic | 01 |
| RUN command source selection at [F-OP] is active | [CA-71] | 00 to 06 | 00: [FW]/[RV] terminal, 01: 3 wire, 02: RUN key on LCD operator, 03: RS485 communication, 04: option 1, 05: option 2, 06: option 3 | 00 |

6-5 Limit Frequency and Operation Commands

6-5-1 Limit Frequency and Operation Commands

A limiter of the upper and lower limits of the frequency command can be set. The upper limiter can be set from analog input by setting [bA101].

This function limits a frequency command even if a frequency command value outside the range between the upper and lower limiters is set.



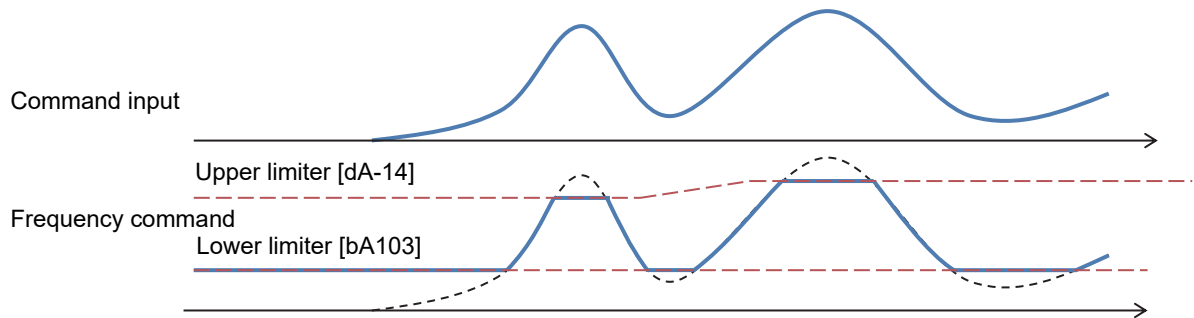
Precautions for Correct Use

- The upper and lower limiters should be set lower than the maximum frequency. Otherwise, warning of the inconsistency will arise.
- To set the limiters, set the upper limiter [bA102] first. Make sure that it is larger than the lower limiter value [bA103].
- Under the restriction by the upper and lower limiters and the minimum frequency, a LIM icon appears.
- To enable Upper Frequency limit [bA102], set [bA101] = 07: Parameter setting.

● Parameter

| Item | Parameters | Data | Description | Default data |
|---|--|--|--|--------------|
| Max. frequency | For IM [Hb105] For SM (PMM) [Hd105] | 10.00 to 590.00(Hz) | Sets the max. frequency. IM: Induction motor [AA121]=00-10 SM(PMM): Synchronous motor (permanent magnet motor) [AA121]=11, 12 | 50*1 |
| Minimum frequency adjustment, 1st-motor | [Hb130] | 0.00 to 10.00(Hz) | Sets the min. frequency to start output. Disabled when [AA121]=09, 10. | 0.50 |
| Frequency limit selection, 1st-motor | [bA101] | 00 to 13 | 00 (disabling)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/ 04 (Reserved)/ 05 (Reserved)/06 (Reserved)/ 07 (parameter setting)/08 (RS485)/ 09 (option 1)/ 10 (option 2)/11 (option 3)/ 12 (pulse string input (main body))/ 13 (pulse string input (Option)) | 00 |
| Upper Frequency limit, 1st-motor | [bA102] | 0.00, lower limiter of frequency -max. frequency (Hz) | Sets the upper limit of the frequency command. | 0.00 |
| Lower Frequency limit, 1st-motor | [bA103] | 0.00, start frequency -upper limiter of frequency (Hz) | Sets the lower limit of the frequency command. Disabled when 0.00 is set. | 0.00 |
| Frequency upper limit monitor | [dA-14] | 0.00 to 590.00(Hz) | The employed upper limit of the frequency is shown. | - |

*1. Default data when default data selection (UB-02) is set to 01.



6-5-2 Limit Operation Command Direction

Output in the allowed rotation direction can be obtained by setting the RUN-direction restriction, 1st-motor [AA114] to limit the direction of the operation.

Set the operation direction limit selection if reverse operation output could adversely affect connected machines.

The reverse rotation direction command due to a negative value of the frequency is also restricted.

Output stops when the direction is being limited.



Precautions for Correct Use

- Even if this function works, you may have output of reverse operation as a result of the control other than V/f control. In this case, enable the reverse operation prevention function. See 6-5-3 *Limit Output Direction* on page 6-45.
- Even if this function is used, the motor may rotate in the reverse direction under an external force applied in that direction. If you use this function to limit the operation direction, use the function for a system that does not receive an external force applied in the reverse direction.

● Parameter

| Item | Parameters | Data | Description | Default data |
|--------------------------------------|------------|------|--|--------------|
| RUN-direction restriction, 1st-motor | [AA114] | 00 | Both forward and reverse rotations enabled | 00 |
| | | 01 | Only forward rotation enabled | |
| | | 02 | Only reverse rotation enabled | |

6-5-3 Limit Output Direction

Under some control, output at a low speed in the direction opposite to the one specified in the operation command may occur. The output can be restricted in the direction specified in the operation command if the reverse rotation prevention function selection [HC114] is used.

Enable the reverse rotation prevention function selection if the reverse rotation of the motor could give damage to the connected machine.



Precautions for Correct Use

- This function is enabled when the control method [AA121] is set to 08 (sensorless vector control), 09 (sensorless vector control in zero speed range), or 10 (vector control with sensor).
- Even if this function is used, the motor may rotate in the reverse direction under a high-load external force applied in that direction. If you use this function to limit the operation direction, make sure that the motor would not make reverse rotation.

| Item | Parameters | Data | Description | Default data |
|---|------------|------|---|--------------|
| Control mode selection, 1st-motor | [AA121] | 08 | Sensorless vector control | 00 |
| | | 09 | Sensorless vector control in zero speed range*1 | |
| | | 10 | Vector control with sensor*1 | |
| Counter direction run protection selection, 1st-motor | [HC114] | 00 | Disabled | 00 |
| | | 01 | Enabled | |

*1. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 02 (VLD).

6-5-4 Operation Permission

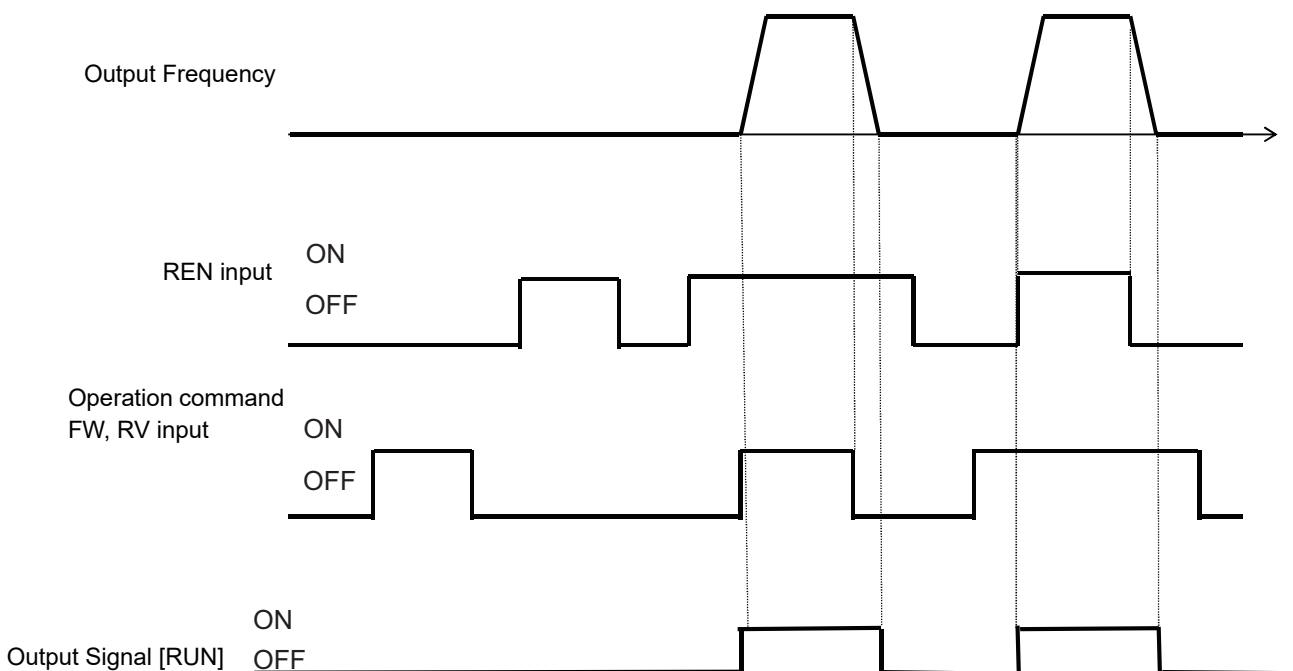
The system is configured in such a way that the operation can be stopped for safety irrespective of the operation command until the system allows the operation.

This function becomes enabled when 101[REN] is set to any of the input terminal selections [CA-01]-[CA-11].



Precautions for Correct Use

The operation does not start if [REN] is set to OFF. To make output from the inverter based on an operation command in a trial operation, [REN] needs to be set to 000[no] temporarily.



● Parameter

| Item | Parameters | Data | Description |
|-------------------------|-----------------------|------|---|
| Input terminal function | [CA-01] to [CA-11] | 101 | [REN]; Controls Permitted/Not permitted using operation permission signal. ON: Allowed OFF: Not allowed |

6-6 Thermal Protection of Motor (Electronic Thermal)

6-6-1 Electronic Thermal Setting

Electronic thermal setting enables a motor to be protected from thermals.

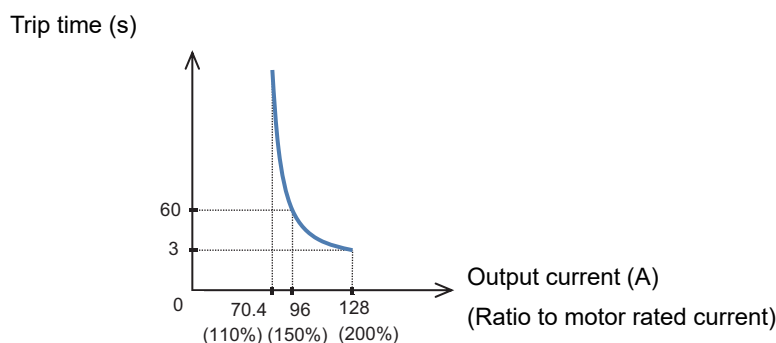
Change of Electronic Thermal Level

Setting in accordance with the motor rated current protects the motor from continuous current flows. To make the protection earlier, the protection level should be set lower than the motor rated current.

(Ex.1) Motor rated current 64A ([bC110]=64.0A)

Setting range:12.8A(20%) to 204.0A(300%)

When driven at a base frequency



Precautions for Correct Use

- Make the setting correctly as this is necessary to protect the motor.
- When the thermal protection begins, [E005] motor electronic thermal error occurs.
- Irrespective of the thermal setting of the motor, the inverter electronic thermal protection works independently to protect the inverter.
- When the current grows rapidly, [E001] excessive current error could occur before [E005] motor electronic thermal error.
- Even electronic thermal level is set high, electronic thermal for the inverter works separately and it may be reduced from 5 Hz while the reduction ratio may be $\times 0.8$ at 0 Hz.

The electronic thermal time-limited characteristics is shown in (Ex.1) when the electronic thermal level setting, 1st-motor [bC110] is 64A

Example 1 shows the case of reduction ratio x1. (For example, the case of the motor driven at a base frequency for [bC111]=01.)

The magnification ratio and hence the time to a trip could change depending on the choice of the electronic thermal characteristic.

A trip occurs in 60 seconds when an electric current of 150% of the electronic thermal level x1 flows continuously.

● Parameter

| Item | Parameters | Data | Description | Default data |
|--|------------|--|--|-------------------------------|
| First electronic thermal level | [bC110] | In range of 20 to 300% of the inverter rated current (unit: A) ^{*1} | Sets the protection current of motor. | 1.00 × Inverter rated current |
| Electronic thermal characteristic selection, 1st-motor | [bC111] | 00 | Reduced torque characteristics: Pattern for cooling function deterioration at a low speed | 01 ^{*2} |
| | | 01 | Constant torque characteristics: Pattern for constant output | |
| | | 02 | Free setting: Multiple patterns are available according to the motor characteristics. | |

*1. The inverter rated current is switched by the load type selection [Ub-03]. Even if [bC110] is set to be high, [E001] excessive current error occurs when the current exceeds the excess current level.

*2. Default data when default data selection (UB-02) is set to 01.

Change of Electronic Thermal Characteristics

Optimal protection characteristics can be achieved with the deterioration of the cooling ability of the motor at a low speed taken account of. ([bC111]=00)

Frequency-dependent characteristics can be set in the selection of the electronic thermal characteristics. ([bC111]=02)



Precautions for Correct Use

- Autocooling motor needs to be used with reduced load (current) since the cooling function of the autocooling fan becomes less effective when the motor rotation frequency decreases.
- The reduced torque characteristics are in accordance with the heat generation of the autocooling motor.

● Parameter

| Item | Parameters | Data | Description | Default data |
|--|------------|------|--|------------------|
| Electronic thermal characteristic selection, 1st-motor | [bC111] | 00 | Reduced torque characteristics: Pattern for cooling function deterioration at a low speed | 01 ^{*1} |
| | | 01 | Constant torque characteristics: Pattern for constant output | |
| | | 02 | Free setting: Multiple patterns are available according to the motor characteristics. | |

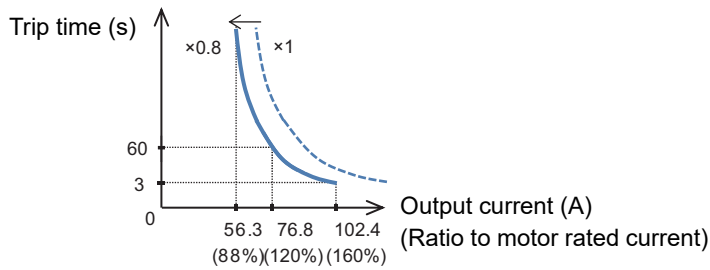
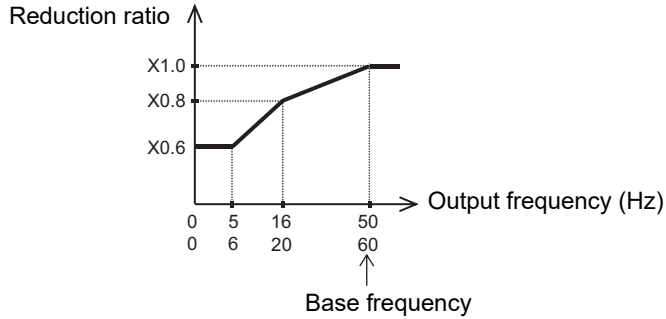
*1. Default data when default data selection (UB-02) is set to 01.

● **Reduced Torque Characteristics [bC111]=00**

Can be used for load reduction in accordance with the cooling performance at a low speed.

(Ex.2) Induction motor rated current 64A, [bC110]=64 (A)

For base frequency [Hb104]=60 Hz, output frequency=20 Hz



When the first electronic thermal level [bC110] is 64 A, the reduction ratio is $\times 0.8$ for operations at a base frequency of 60 Hz and output frequency of 20 Hz and the electronic thermal time-limited characteristics are given in the lower part of Example 2.

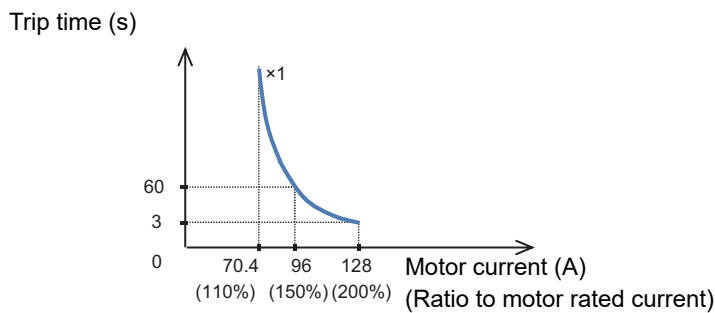
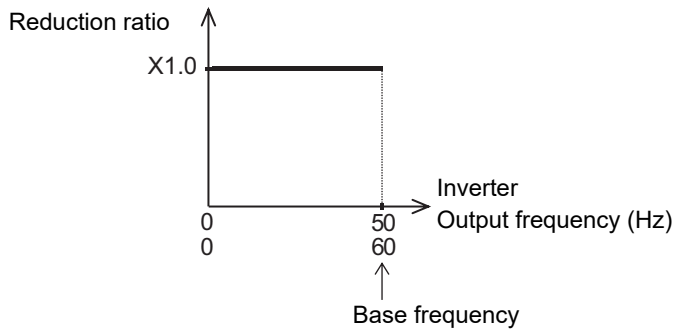
Since Example 1 shows the case of the reduction ratio $\times 1$, a trip occurs in 60 seconds when an electric current of 150% $\times 1$ of the motor rated current flows continuously. However in Example 2, a trip occurs in 60 seconds when an electric current of 150% $\times 0.8=120\%$ of the motor rated current flows continuously.

● Constant Torque Characteristics [bC111]=01

Use this setting to use the constant-torque motor

(Ex.3) For induction motor rated current: 64A, [bC110]=64(A)

Base frequency [Hb104]=50 Hz, output frequency =5 Hz



When the first electronic thermal level [bC110] is 64 A, the reduction ratio is $\times 1.0$ for operations at a base frequency of 50 Hz and output frequency of 5 Hz and the electronic thermal time-limited characteristics are given in the lower part of Example 3.

Since Example 1 shows the case of the reduction ratio $\times 1$, a trip occurs in 60 seconds when an electric current of 150% $\times 1$ of the motor rated current flows continuously. The performance in the example 3 is the same as the one in the example 1.

● Free Settings [bC111]=02

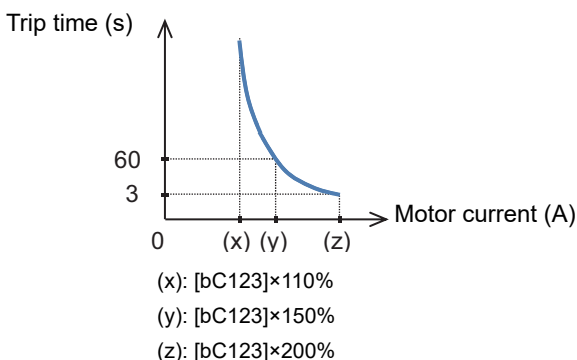
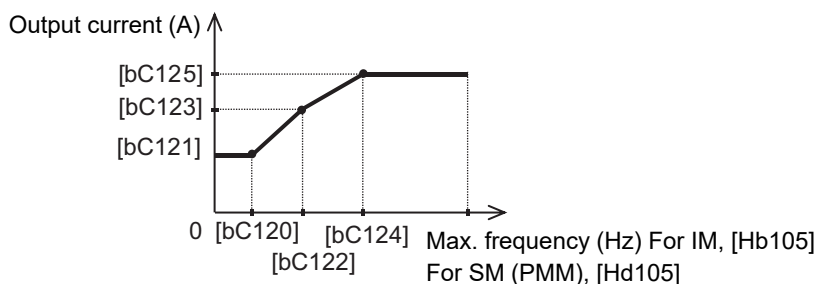
To protect the motor, the electronic thermal characteristics can be freely set in accordance with the load.

● Parameter

| Item | Parameters | Data | Description | Default data |
|-------------------------------------|------------|--|--|--------------|
| Free electronic thermal frequency 1 | [bC120] | 0.00 to [bC122](Hz) | Frequency corresponding to free electronic thermal current 1 | 0.00 |
| Free electronic thermal current 1 | [bC121] | Inverter rated current x 0 to 300% (A) ^{*1} | Current corresponding to free electronic thermal frequency 1 | 0.0 |
| Free electronic thermal frequency 2 | [bC122] | [bC120] to [bC124](Hz) | Frequency corresponding to free electronic thermal current 2 | 0.00 |
| Free electronic thermal current 2 | [bC123] | Inverter rated current x 0 to 300% (A) ^{*1} | Current corresponding to free electronic thermal frequency 2 | 0.0 |
| Free electronic thermal frequency 3 | [bC124] | [bC122] to 590.00(Hz) | Frequency corresponding to free electronic thermal current 3 | 0.00 |
| Free electronic thermal current 3 | [bC125] | Inverter rated current x 0 to 300% (A) ^{*1} | Current corresponding to free electronic thermal frequency 3 | 0.0 |

*1. The inverter rated current is switched by the load type selection [Ub-03].

(Ex.4) For output frequency of [bC122]



When the output frequency coincides with the free electronic thermal frequency-2, 1st-motor [bC122], the electronic thermal time-limited characteristics are given in the lower part of Example 4.

In Example 4, a trip occurs in 60 seconds when an electric current of 150% of the free electronic thermal current-2, 1st-motor [bC123] flows continuously.



Precautions for Correct Use

- When [bC121][bC123][bC125] are set as default (0.00) and [bC111] electronic thermal is set as 02, E005 is generated.
- Set the free electronic thermal frequency in the order of [bC125], [bC123] and [bC121]. At that time, set in the following manner: [bC125]≥[bC123]≥[bC121].

Change of Heat Emission Characteristics of Electronic Thermal

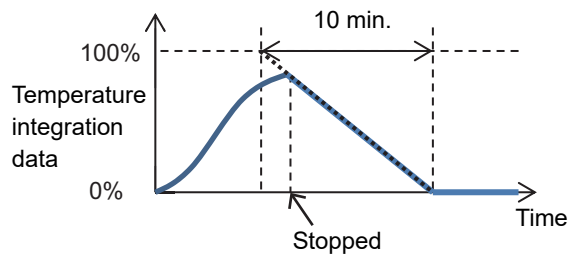
When you set Electronic thermal Subtraction function enable, 1st-motor [bC112] to 01 (Enabled) when the current is below the electronic thermal level, the temperature integration data can be reduced according to the heat emission from the motor.



Precautions for Correct Use

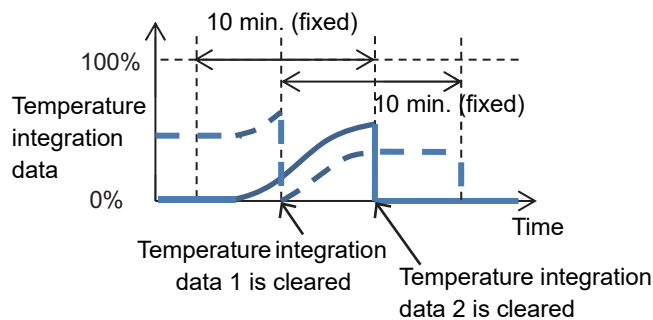
- The electronic thermal of the inverter works independently even when the electronic thermal subtraction time is made shorter.
- Appropriate setting should be made for the motor that you use.
- In case of [bC112]=00, resetting cannot be made in 10 seconds after occurrence of an error.
- [bC112]=00 to be set to be equivalent to 3G3RX-V1 Series.

Ex.1) Subtraction mode ([bC112]=01, for [bC113]=600 s (10 min.))



Ex.2) Constant period mode ([bC112]=00)

In the constant period mode, a motor overload error [E005] and a trip occurs when either of the duplicated counters reaches 100%. In the constant period mode, the thermal subtraction data are cleared every 10 minutes (fixed).



Note In the constant period mode, a trip occurs when either of the duplicated counters reaches 100%. In the constant period mode, data are cleared every 10 minutes.

● Parameter

| Item | Parameters | Data | Description | Default data |
|---|------------|------|---|--------------|
| Electronic thermal Subtraction function enable, 1st-motor | [bC112] | 00 | Invalid: constant period mode The temperature integration data are cleared every 10 minutes. | 01 |
| | | 01 | Valid: Subtraction mode The temperature integration data are subtracted in accordance with the heat emission of the motor. | |

| Item | Parameters | Data | Description | Default data |
|--|------------|-------------|--|--------------|
| Electronic thermal Subtraction time, 1st-motor | [bC113] | 1s to 1000s | Should be set in accordance with the heat emission time of the motor. Sets the time for the integration data to change form 100% to 0%. | 600 |

When the Power Supply Is Shut off or Reset, Electronic Thermal Data Is Held

The temperature integration data of the motor are saved even after power termination or inverter trip resetting. When the motor current increases again when the power is made on or the system is reset, the system is restarted with the saved temperature integration data.



Precautions for Correct Use

When the data-holding function is used, the integration data are held even if the inverter is powered off for a long period of time, and a risk of occurrence of an error would increase. After it is powered on, a short-time operation could cause an error.

The temperature integration data of an inverter is reset when the power supply is shut-off.

| Item | Parameters | Data | Description | Default data |
|--|------------|------|---|--------------|
| Electronic thermal counter memory selection at Power-off | [bC-14] | 00 | Not holding: The temperature integration data are cleared by the power shut-off and resetting. | 01 |
| | | 01 | Holding: The temperature integration data are not cleared and subtracted only in the subtraction mode. | |

Electronic Thermal State Monitor

The integration state can be monitored from [dA-42] electronic thermal load rate monitor (motor).

If you want a warning signal when the electronic thermal exceeds a certain level, set the output signal function 026 [THM] and [CE-30] electronic thermal warning level (motor). For details, see 8-6-8 *Motor Thermal Warning Signal (THM)* on page 8-133.

The integration state can be monitored from [dA-43] electronic thermal load rate monitor (controller).

If you want a warning signal when the electronic thermal exceeds a certain level, set the output signal function 027 [THC] and [CE-31] electronic thermal warning level (controller). For details, see 8-6-9 *Inverter Thermal Warning Signal (THC)* on page 8-134.

6-6-2 Monitoring of Motor Temperature

The temperature protection of an external device can be made by connecting a thermistor installed in the motor or other external device to the inverter and setting the function of the thermistor.

The external thermistor should be wired between the control terminals TH+ and TH-.

Set the thermistor selection [Cb-40] and the resistance value at error occurrence [bb-70] in accordance with the thermistor's specifications.

[E035] thermistor error occurs when the thermistor resistance reaches the thermistor error level [bb-70] depending on the motor temperature.

When [Cb-40] is set to 02, [dA-38] motor temperature monitor indicates the detected temperature of the motor.



Precautions for Correct Use

- When an external thermistor is not connected, a trip occurs if the thermistor selection [Cb-40] is set to 01.
- To use this function, the wiring distance between the motor and the inverter has to be 20 m or shorter. Since the current flowing in the thermistor is very weak, a measure such as wiring separation should be taken to prevent noise from the motor current.
- When [Cb-40] is set to a value other than 02, [dA-38] motor temperature monitor indicates 0 °C.

● Parameter

| Item | Parameters | Data | Description | Default data |
|----------------------------|------------|--------------------|---|--------------|
| Thermistor error level | [bb-70] | 0 to 10000.(Ω) | Set the resistance for the temperature at which a trip occurs in accordance with the thermistor resistance specifications. Effective when [Cb-40]=01, 02 | 3000 |
| Thermistor selection | [Cb-40] | 00 | Disabled | 00 |
| | | 01 | Enabled Positive temperature coefficient resistor (PTC) | |
| | | 02 | Enabled Negative temperature coefficient resistor (NTC) | |
| Thermistor gain adjustment | [Cb-41] | 0.0 to 1000. | Use as gain adjustment. | 100.0 |
| Motor temperature monitor | [dA-38] | -20.0 to 200.0(C°) | Indicates the detected motor temperature. | - |

6-7 Acceleration/Deceleration Settings

6-7-1 Change Acceleration Time and Deceleration Time

Set up the acceleration time and the deceleration time of the motor. Set a longer time for slower acceleration or deceleration; set a shorter time for faster acceleration or deceleration.

As for the acceleration time, set the time that it takes to rise from 0 Hz to the maximum frequency; as for the deceleration time, set the time that it takes to fall from the maximum frequency to 0 Hz.

In the initial state, the acceleration time setting 1, 1st-motor [AC120] and the deceleration time setting 1, 1st-motor [AC122] are enabled.

The currently enabled acceleration time and deceleration time can be monitored with [FA-10] and [FA-12], respectively; In the initial state, [FA-10] = [AC120] acceleration time 1 and [FA-12] = [AC122] deceleration time 1



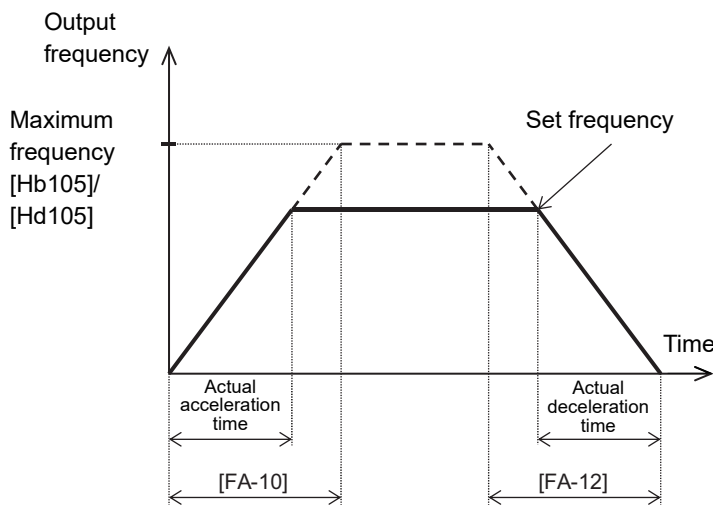
Precautions for Correct Use

- When the function of acceleration or deceleration action cancellation 071 [LAC] is selected as the Input terminal function and the signal is turned ON, the set acceleration or deceleration time will be reset to 0 seconds and the output frequency will be made instantaneously to follow the frequency command.
- The target of command for the acceleration or deceleration time can be selected with [AC-01].
 - Employ the internally-set acceleration or deceleration time.
 - Employ the acceleration or deceleration time of the program function Drive Programming.
- The acceleration or deceleration time may be changed in response to the command given by the multi-speed function. For details, see *6-4-9 Case where Command Is Given with Multi-Step Speed* on page 6-37.

● Parameter

| Item | Parameters | Data | Description | Default data |
|---|---|------------------------|--|--------------|
| Maximum frequency | For IM, [Hb105] For SM (PMM), [Hd105] | 10.00 to 590.00(Hz) | Set the maximum value for the frequency. | 50*1 |
| Acceleration time setting 1, 1st-motor | [AC120] | 0.00 to 3600.00(s) | Set, as the acceleration time, the time that it takes to rise from 0 Hz to the maximum frequency. | 30.00 |
| Deceleration time setting 1, 1st-motor | [AC122] | 0.00 to 3600.00(s) | Set, as the deceleration time, the time that it takes to fall from the maximum frequency to 0 Hz. | 30.00 |
| Acceleration/ Deceleration Time input selection | [AC-01] | 00 to 04 | 00: Parameter set-up 04: Program function DriveProgramming | 00 |
| Input terminal selection | [CA-01] to [CA-11] | 071 | Acceleration or deceleration cancellation function [LAC] OFF: Function disabled. ON: Ignore the acceleration or deceleration time, and follow the command. | - |
| Acceleration time (Monitor + Setting) | [FA-10] | 0.00 to 3600.00(s) | Display the currently-enabled acceleration time. | - |
| Deceleration time (Monitor + Setting) | [FA-12] | 0.00 to 3600.00(s) | Display the currently-enabled deceleration time. | - |

*1. Default data when default data selection (UB-02) is set to 01.



Acceleration time t_s

$$t_s = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_s - T_L)}$$

Deceleration time t_B

$$t_B = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_B + T_L)}$$

J_L : Moment of inertia J ($\text{kg} \cdot \text{m}^2$) of the load converted into that of the motor shaft.

J_M : Moment of inertia J ($\text{kg} \cdot \text{m}^2$) of the motor.

N_M : Revolution speed of the motor (r/min)

T_s : Maximum acceleration torque (N·m) of the motor driven by the inverter.

T_B : Maximum deceleration torque (N·m) of the motor driven by the inverter.

T_L : required operating torque (N·m)



Precautions for Correct Use

However short the acceleration or deceleration time is set, the actual acceleration or deceleration of the motor cannot be shorter than the minimum acceleration or deceleration time that is determined by the moment of inertia J of the mechanical system and the motor torque. An act of acceleration or deceleration in a shorter time than the minimum acceleration or deceleration time may cause an over current or over voltage trip to happen.

6-7-2 Switch Acceleration Time and Deceleration Time in Two Stages

Setting this function allows you to change the acceleration or deceleration time while driving in response to the terminal command, the frequency command, or the direction command.

When [AC115] = 00, setting 031 [2CH] in any of the [CA-01] to [CA-11] and turning OFF/ON the target Input terminal allows you to switch the acceleration or deceleration time. ⇒ (Example 1)

When [AC115] = 01, the frequency command and the relationship between the set values [AC116] and [AC117] can be used to switch the acceleration or deceleration time.

⇒ (Example 2)

When you set Select method to switch to Accel2/Decel2 Profile, 1st-motor [AC115] to 02 (Switching normal/reverse rotation), the acceleration time and deceleration time can be configured by setting forward or backward rotation.

⇒ (Example 3)



Precautions for Correct Use

When the input terminal is used for switching, operation should be performed by assigning 031 [2CH] to any of [CA-01] to [CA-11].

● Parameter

| Item | Parameters | Data | Description | Default data |
|---|---|------------------------|--|------------------|
| Maximum frequency | For IM, [Hb105] For SM (PMM), [Hd105] | 10.00 to 590.00(Hz) | Set the maximum value for the frequency. | 50 ^{*1} |
| Acceleration time setting 1, 1st-motor | [AC120] | 0.00 to 3600.00(s) | Set, as the acceleration time, the time that it takes to rise from 0 Hz to the maximum frequency. | 30.00 |
| Deceleration time setting 1, 1st-motor | [AC122] | 0.00 to 3600.00(s) | Set, as the deceleration time, the time that it takes to fall from the maximum frequency to 0 Hz. | 30.00 |
| Acceleration time setting 2, 1st-motor | [AC124] | 0.00 to 3600.00(s) | Set, as the acceleration time, the time that it takes to rise from 0 Hz to the maximum frequency. | 15.00 |
| Deceleration time setting 2, 1st-motor | [AC126] | 0.00 to 3600.00(s) | Set, as the deceleration time, the time that it takes to fall from the maximum frequency to 0 Hz. | 15.00 |
| Select method to switch to Accel2/Decel2 Profile, 1st-motor | [AC115] | 00 | Switching by [2CH] terminal (Example 1) | 00 |
| | | 01 | Switching by 2-stage acceleration or deceleration frequency (Example 2) | |
| | | 02 | Enabled only when the revolution is switched between the forward and the backward directions (Example 3) | |
| Accel1 to Accel2 Frequency transition point, 1st-motor | [AC116] | 0.00 to 590.00(Hz) | Enabled when 2-stage acceleration or deceleration selection [AC115] is 01. | 0.00 |
| Decel1 to Decel2 Frequency transition point, 1st-motor | [AC117] | 0.00 to 590.00(Hz) | Enabled when 2-stage acceleration or deceleration selection [AC115] is 01. | 0.00 |

| Item | Parameters | Data | Description | Default data |
|---|--------------------|------|---|--------------|
| Acceleration/ Deceleration Time input selection | [AC-01] | 00 | Use the "Setting" of the operator keypad to input the type. | 00 |
| Input terminal function selection | [CA-01] to [CA-11] | 031 | 2-stage acceleration or deceleration function [2CH]. When [AC115] = 00, OFF: The set acceleration or deceleration command is enabled. ON: [AC124]/[AC126] is forcefully enabled. | - |

*1. Default data when default data selection (UB-02) is set to 01.



Precautions for Correct Use

Set, as the acceleration time, the time that it takes to rise from 0 Hz to the maximum frequency; and set as the deceleration time, the time that it takes to fall from the maximum frequency to 0 Hz. Each of the set times is the corresponding one of the following values.

Acceleration time 1: Calculated value from [AC120];

Deceleration time 1: Calculated value from [AC122];

Acceleration time 2: Calculated value from [AC124]; and

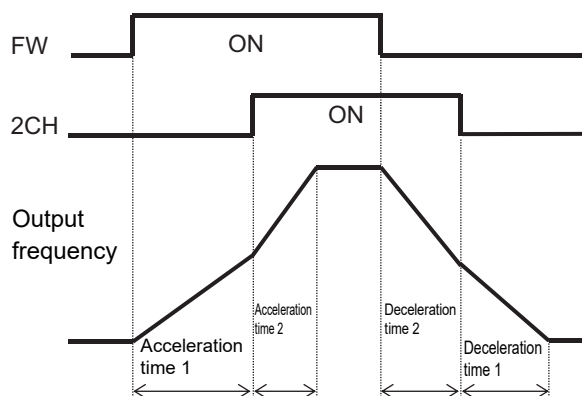
Deceleration time 2: Calculated value from [AC126].

You can use [AC115] to select one of the following three methods of switching the acceleration or deceleration time:

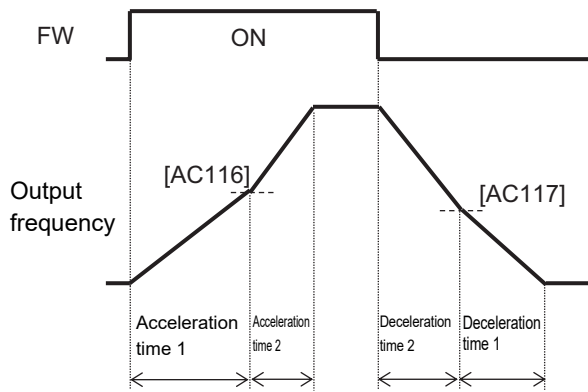
- Switching by the Input terminal function [2CH];
- Automatically switching by any given frequency; and
- Automatically switching only at the time of switching between the forward revolution and the backward revolution.

Described below is an exemplar case of switching between the acceleration or deceleration time 1 and the acceleration or deceleration time 2.

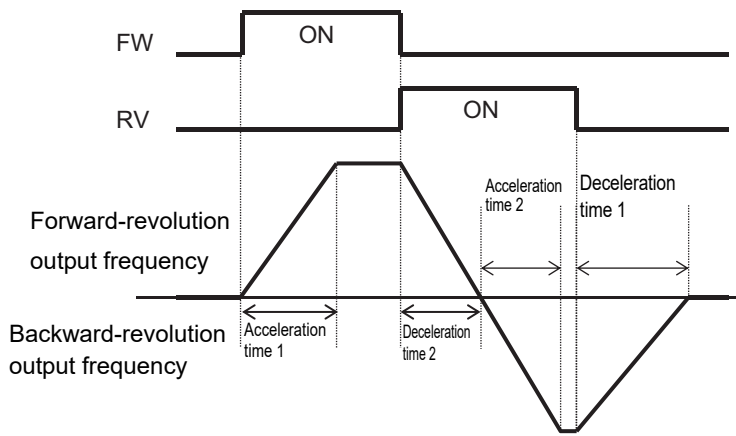
(Example 1) In the case of setting [AC115] = 00



(Example 2) In the case of setting [AC115] = 01



(Example 3) In the case of setting [AC115] = 02



6-7-3 Switching of Acceleration or Deceleration Time with Multi-Speed Step

Setting up this function allows the acceleration or deceleration time to be changed in response to the multi-speed command.

Also this function changes several settings of acceleration/deceleration times while the motor is being accelerated to reach the fixed frequency.



Precautions for Correct Use

- When using the input terminal function to switch the multiple speeds, operation should be performed by assigning 003 [CF1] to 006 [CF4] or 007 [SF1] to 013 [SF7] to any of [CA-01] to [CA-11].
- When [AC-02] Acceleration/ Deceleration Selection is 01, the 2-stage acceleration or deceleration function is disabled.

● Parameter

| Item | Parameters | Data | Description | Default data |
|---|---|---------------------------|---|--------------|
| Acceleration/ Deceleration Selection | [AC-02] | 00 | The acceleration or deceleration time follows [AC120]/[AC122] or [AC124]/[AC126] (when 2-stage acceleration or deceleration function is enabled). | 00 |
| | | 01 | The acceleration or deceleration time will be switched in accordance with the multi-speed command. | |
| Multi-speed command | [Ab-11] to [Ab-25] | 0.00 to 590.00(Hz) | Set the multi-speed command with 1st speed [Ab-11] to 15th speed [Ab-25]. | 0.00 |
| Acceleration time set-up for the multi-speed 1st to 15th speeds | [AC-30], [AC-34], [AC-38], [AC-42], [AC-46], [AC-50], [AC-54], [AC-58], [AC-62], [AC-66], [AC-70], [AC-74], [AC-78], [AC-82], [AC-86] | 0.00 to 3600.00(s) | Set an acceleration time ranging from 0 Hz to the maximum frequency for each of the multi-speed commands. | 0.00 |
| Deceleration time set-up for the multi-speed 1st to 15th speeds | [AC-32], [AC-36], [AC-40], [AC-44], [AC-48], [AC-52], [AC-56], [AC-60], [AC-64], [AC-68], [AC-72], [AC-76], [AC-80], [AC-84], [AC-88] | 0.00 to 3600.00(s) | Set a deceleration time ranging from the maximum frequency to 0 Hz for each of the multi-speed commands. | 0.00 |
| Multispeed operation selection | [Ab-03] | 00 | Corresponding to 16-speed binary operation. 003[CF1] to 006[CF4] | 00 |
| | | 01 | Corresponding to 8-speed bit operation. 007[SF1] to 013[SF7] | |
| Input terminal function selection | [CA-01] to [CA-11] | 003 to 006/ 007 to 013 | Implementing the multi-speed command. 003[CF1] to 006[CF4]/007[SF1] to 013[SF7] | - |

Shown below are the multi-speed table for binary operation (when [Ab-03] = 00) and that for bit operation (when [Ab-03] = 01).

Table for Binary Operation

[Ab-03]=00.

Input terminal function 003 [CF1] to 006 [CF4]

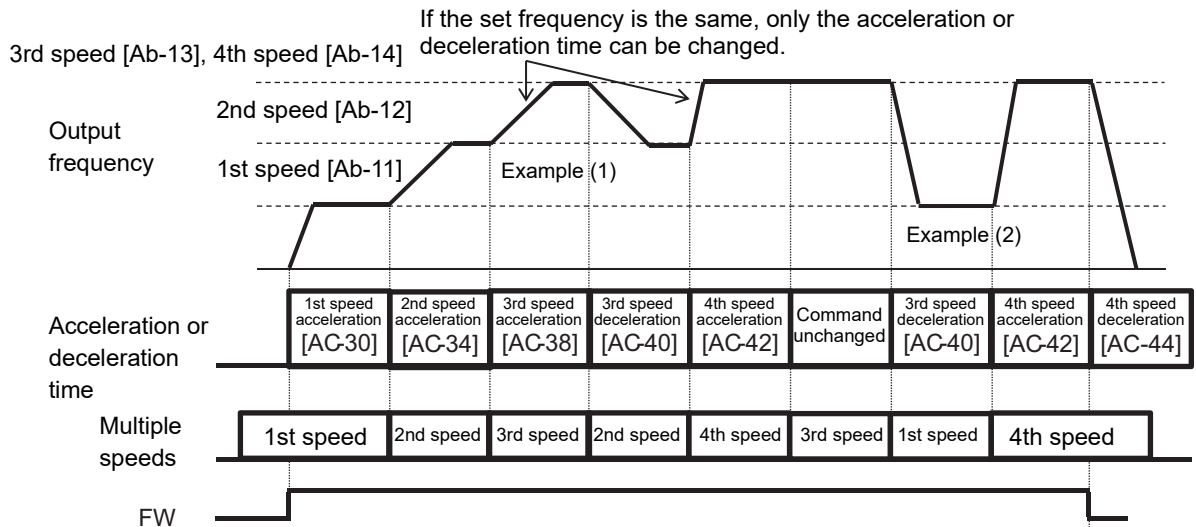
| Multiple speeds | CF4 | CF3 | CF2 | CF1 |
|-----------------|-----|-----|-----|-----|
| 0th speed | OFF | OFF | OFF | OFF |
| 1st speed | OFF | OFF | OFF | ON |
| 2nd speed | OFF | OFF | ON | OFF |
| 3rd speed | OFF | OFF | ON | ON |
| 4th speed | OFF | ON | OFF | OFF |
| 5th speed | OFF | ON | OFF | ON |
| 6th speed | OFF | ON | ON | OFF |
| 7th speed | OFF | ON | ON | ON |
| 8th speed | ON | OFF | OFF | OFF |
| 9th speed | ON | OFF | OFF | ON |
| 10th speed | ON | OFF | ON | OFF |
| 11th speed | ON | OFF | ON | ON |
| 12th speed | ON | ON | OFF | OFF |
| 13th speed | ON | ON | OFF | ON |
| 14th speed | ON | ON | ON | OFF |
| 15th speed | ON | ON | ON | ON |

Table for Bit Operation

[Ab-03] = 01; Input terminal function 007 [SF1] to 013 [SF7]

| Multiple speeds | SF7 | SF6 | SF5 | SF4 | SF3 | SF2 | SF1 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|
| 0th speed | OFF | OFF | OFF | OFF | OFF | OFF | OFF |
| 1st speed | - | - | - | - | - | - | ON |
| 2nd speed | - | - | - | - | - | ON | OFF |
| 3rd speed | - | - | - | - | ON | OFF | OFF |
| 4th speed | - | - | - | ON | OFF | OFF | OFF |
| 5th speed | - | - | ON | OFF | OFF | OFF | OFF |
| 6th speed | - | ON | OFF | OFF | OFF | OFF | OFF |
| 7th speed | ON | OFF | OFF | OFF | OFF | OFF | OFF |

Exemplar Operation

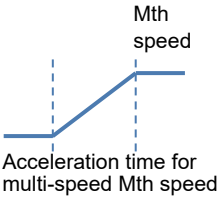


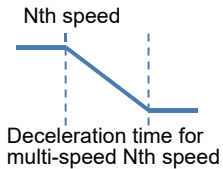
Example (1) If the multi-speed 3rd speed is engaged and the revolution is accelerating, the enabled acceleration time is the acceleration time setting for Multispeed-3 [AC-38].

Example (2) If the multi-speed 1st speed is engaged and the revolution is decelerating, the enabled deceleration time is the deceleration time setting for Multispeed-3 [AC-40] for the multi-speed 3rd speed that has been engaged until the multi-speed 1st speed is engaged.

Acceleration or Deceleration Time Table

The following table shows the multi-speed commands and their corresponding acceleration or deceleration times.

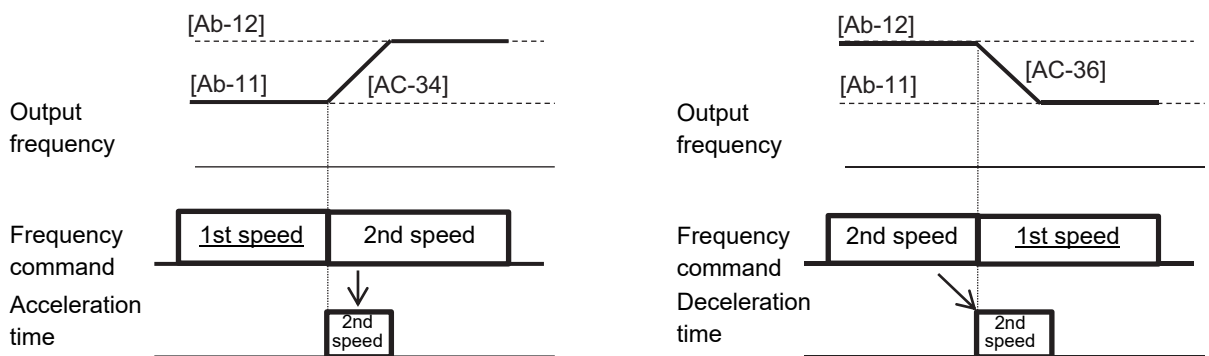
| Setting state | Multi-speed command | Command state | Acceleration or deceleration time to be used |
|---|---------------------|--|--|
| <p>The frequency after a speed is ON will be higher than the speed before that.</p> <p>To the accelerating state</p>  | 1st speed ON | Multi-speed 1st speed [Ab-11] > Frequency before 1st speed is ON | Acceleration time for multi-speed 1st speed [AC-30] |
| | 2nd speed ON | Multi-speed 2nd speed [Ab-12] > Frequency before 2nd speed is ON | Acceleration time for multi-speed 2nd speed [AC-34] |
| | 3rd speed ON | Multi-speed 3rd speed [Ab-13] > Frequency before 3rd speed is ON | Acceleration time for multi-speed 3rd speed [AC-38] |
| | 4th speed ON | Multi-speed 4th speed [Ab-14] > Frequency before 4th speed is ON | Acceleration time for multi-speed 4th speed [AC-42] |
| | 5th speed ON | Multi-speed 5th speed [Ab-15] > Frequency before 5th speed is ON | Acceleration time for multi-speed 5th speed [AC-46] |
| | 6th speed ON | Multi-speed 6th speed [Ab-16] > Frequency before 6th speed is ON | Acceleration time for multi-speed 6th speed [AC-50] |
| | 7th speed ON | Multi-speed 7th speed [Ab-17] > Frequency before 7th speed is ON | Acceleration time for multi-speed 7th speed [AC-54] |
| | 8th speed ON | Multi-speed 8th speed [Ab-18] > Frequency before 8th speed is ON | Acceleration time for multi-speed 8th speed [AC-58] |
| | 9th speed ON | Multi-speed 9th speed [Ab-19] > Frequency before 9th speed is ON | Acceleration time for multi-speed 9th speed [AC-62] |
| | 10th speed ON | Multi-speed 10th speed [Ab-20] > Frequency before 10th speed is ON | Acceleration time for multi-speed 10th speed [AC-66] |
| | 11th speed ON | Multi-speed 11th speed [Ab-21] > Frequency before 11th speed is ON | Acceleration time for multi-speed 11th speed [AC-70] |
| | 12th speed ON | Multi-speed 12th speed [Ab-22] > Frequency before 12th speed is ON | Acceleration time for multi-speed 12th speed [AC-74] |
| | 13th speed ON | Multi-speed 13th speed [Ab-23] > Frequency before 13th speed is ON | Acceleration time for multi-speed 13th speed [AC-78] |
| | 14th speed ON | Multi-speed 14th speed [Ab-24] > Frequency before 14th speed is ON | Acceleration time for multi-speed 14th speed [AC-82] |
| | 15th speed ON | Multi-speed 15th speed [Ab-25] > Frequency before 15th speed is ON | Acceleration time for multi-speed 15th speed [AC-86] |
| | No multi-speed | Other than those above | Acceleration time [AC120] |

| Setting state | Multi-speed command | Command state | Acceleration or deceleration time to be used |
|--|---------------------|--|--|
| <p>The frequency after a speed is OFF will be lower than the speed before that.</p> <p>To the decelerating state</p>  | 1st speed OFF | Multi-speed 1st speed [Ab-11] > Frequency after 1st speed is OFF | Deceleration time for multi-speed 1st speed [AC-32] |
| | 2nd speed OFF | Multi-speed 2nd speed [Ab-12] > Frequency after 2nd speed is OFF | Deceleration time for multi-speed 2nd speed [AC-36] |
| | 3rd speed OFF | Multi-speed 3rd speed [Ab-13] > Frequency after 3rd speed is OFF | Deceleration time for multi-speed 3rd speed [AC-40] |
| | 4th speed OFF | Multi-speed 4th speed [Ab-14] > Frequency after 4th speed is OFF | Deceleration time for multi-speed 4th speed [AC-44] |
| | 5th speed OFF | Multi-speed 5th speed [Ab-15] > Frequency after 5th speed is OFF | Deceleration time for multi-speed 5th speed [AC-48] |
| | 6th speed OFF | Multi-speed 6th speed [Ab-16] > Frequency after 6th speed is OFF | Deceleration time for multi-speed 6th speed [AC-52] |
| | 7th speed OFF | Multi-speed 7th speed [Ab-17] > Frequency after 7th speed is OFF | Deceleration time for multi-speed 7th speed [AC-56] |
| | 8th speed OFF | Multi-speed 8th speed [Ab-18] > Frequency after 8th speed is OFF | Deceleration time for multi-speed 8th speed [AC-60] |
| | 9th speed OFF | Multi-speed 9th speed [Ab-19] > Frequency after 9th speed is OFF | Deceleration time for multi-speed 9th speed [AC-64] |
| | 10th speed OFF | Multi-speed 10th speed [Ab-20] > Frequency after 10th speed is OFF | Deceleration time for multi-speed 10th speed [AC-68] |
| | 11th speed OFF | Multi-speed 11th speed [Ab-21] > Frequency after 11th speed is OFF | Deceleration time for multi-speed 11th speed [AC-72] |
| | 12th speed OFF | Multi-speed 12th speed [Ab-22] > Frequency after 12th speed is OFF | Deceleration time for multi-speed 12th speed [AC-76] |
| | 13th speed OFF | Multi-speed 13th speed [Ab-23] > Frequency after 13th speed is OFF | Deceleration time for multi-speed 13th speed [AC-80] |
| | 14th speed OFF | Multi-speed 14th speed [Ab-24] > Frequency after 14th speed is OFF | Deceleration time for multi-speed 14th speed [AC-84] |
| | 15th speed OFF | Multi-speed 15th speed [Ab-25] > Frequency after 15th speed is OFF | Deceleration time for multi-speed 15th speed [AC-88] |
| | No multi-speed | Other than those above | Deceleration time [AC122] |



Precautions for Correct Use

The switching timing of frequency command by multi-speed terminal command is different from that of the deceleration time.



6-7-4 Holding Function of Acceleration/Deceleration

The holding function of the acceleration or deceleration is enabled when a mechanical moment of inertia is large.

The acceleration-hold function is to withhold further acceleration until the motor that is starting its revolution achieves a small enough slip. Use this function when an over current trip happens at the start of the motor revolution.

The deceleration-hold function is to withhold further deceleration until the motor achieves a small enough slip. Use this function when an over voltage trip happens during deceleration.

There are two methods of stopping the acceleration or deceleration, and they can be used together.

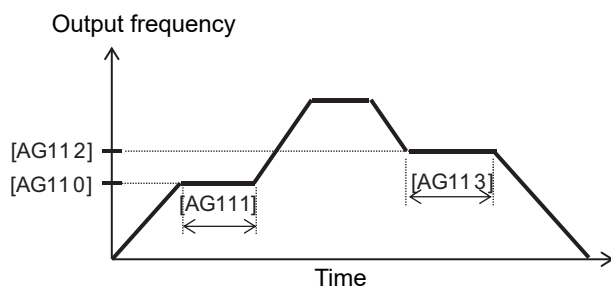
- Holding automatically at any frequency for any length of hold time.
- Holding by means of the Input terminal function.



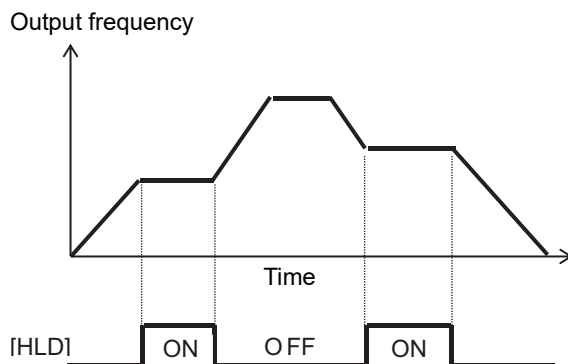
Precautions for Correct Use

- The working of this function depends on none of the content of the acceleration curve selection [AC-03] and that of the deceleration curve selection [AC-04]. This function works for all the patterns.
- When the acceleration (deceleration) command is switched to deceleration (acceleration) command while acceleration (deceleration)-hold function is withholding, halt the function and follow the changed command.

Case where Setting Time is held with Any Frequency



Case where Frequency is held with Input Terminal 100 [HLD] Terminal Function



● Parameter

| Item | Parameters | Data | Description | Default data |
|--|--------------------|--------------------|---|--------------|
| Acceleration stop frequency setting, 1st-motor | [AG110] | 0.00 to 590.00(Hz) | Setting the frequency at which the acceleration is withheld. A setting of 0.00 is not valid. | 0.00 |
| Acceleration stop time setting, 1st-motor | [AG111] | 0.00 to 60.00(s) | Setting the length of time for which the acceleration is withheld. | 0 |
| Deceleration stop frequency setting, 1st-motor | [AG112] | 0.00 to 590.00(Hz) | Setting the frequency at which the deceleration is withheld. A setting of 0.00 is not valid. | 0.00 |
| Deceleration stop time setting, 1st-motor | [AG113] | 0.00 to 60.00(s) | Setting the length of time for which the deceleration is withheld. | 0 |
| Input terminal function selection | [CA-01] to [CA-11] | 100 | Using the acceleration- or deceleration-hold [HLD] function. | - |

6-7-5 Change the Acceleration or Deceleration Pattern

Setting an acceleration or deceleration pattern is possible that suit each system.

Setting the acceleration pattern selection and the deceleration pattern selection can be done independently by [AC-03] and [AC-04], respectively.

To use an acceleration or deceleration pattern other than the linear one (00), a stable operation can be achieved by an command that can fix the target of the frequency command by means of the LCD operator command and/or the multi-speed command.

Even if an acceleration or deceleration pattern is set, the acceleration time should be set at the time that it takes to rise from 0 Hz to the maximum frequency and the deceleration time should be set at the time it takes to fall from the maximum frequency to 0 Hz.

Calculation of the acceleration or deceleration pattern is performed from the minimum frequency (the command frequency) to the command frequency (the minimum frequency) when an inverter is started or stopped. In control mode in which the minimum frequency is disable, the calculation that ignores the minimum frequency is performed.

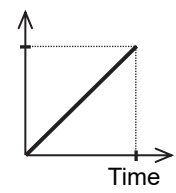
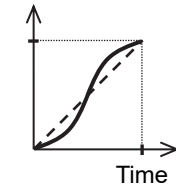
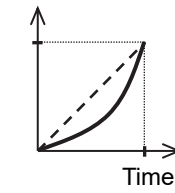
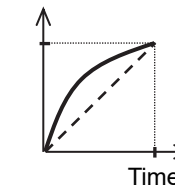
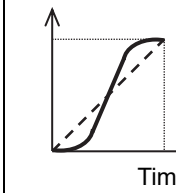
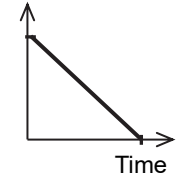
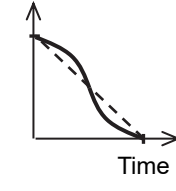
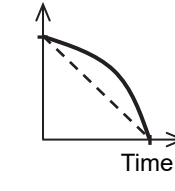
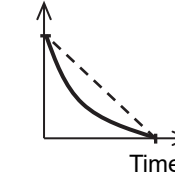
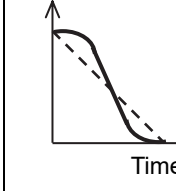


Precautions for Correct Use

- Changing the acceleration or deceleration pattern from one to another will create a sector with a(n) acceleration or deceleration time having a steep gradient. If the occurrence of an over current/over voltage is predicted, the acceleration or deceleration time has to be adjusted to prevent such an occurrence.
- When any other acceleration or deceleration pattern than the linear one (00) is set, a change of command value during the acceleration or deceleration may cause a recalculation of the acceleration or deceleration pattern, which may result in a shock.
- When any other acceleration or deceleration pattern than the linear one (00) is set, use any other command than the analog input one. An unsteady command value may cause a recalculation of the acceleration or deceleration pattern, which may prolong the actual acceleration or deceleration time.

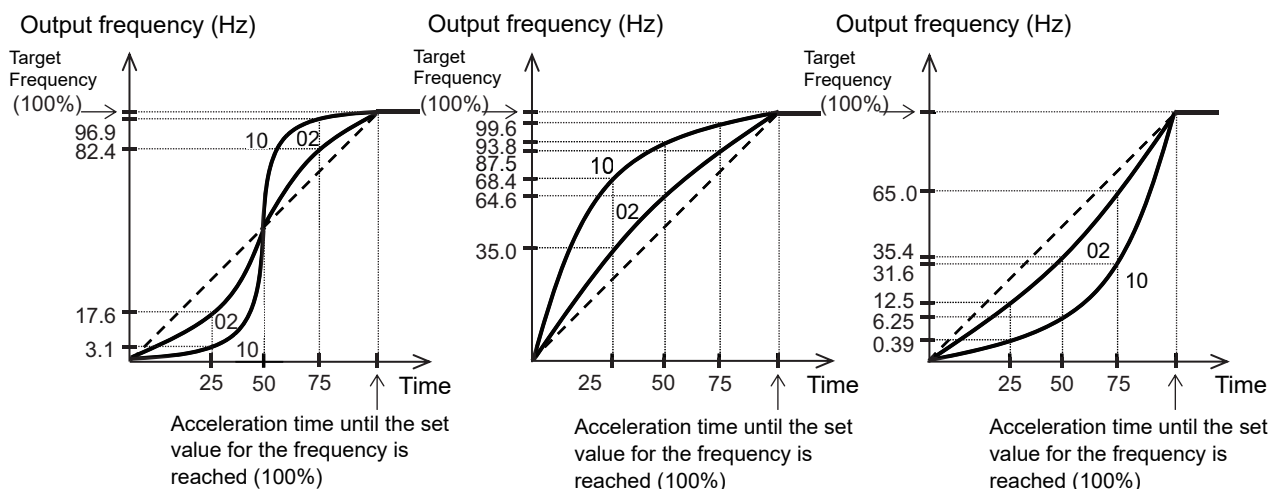
Pattern Selection

Select a pattern for each of the acceleration and the deceleration patterns by referring to the following table.

| Set value | 00 | 01 | 02 | 03 | 04 |
|---------------------------|---|---|--|---|--|
| Curve | Linear | S-shaped | U-shaped | Inverse-U-shaped | EL-S-shaped |
| [AC-03] (Acceleration) | Output frequency  | Output frequency  | Output frequency  | Output frequency  | Output frequency  |
| [AC-04] (Deceleration) | Output frequency  | Output frequency  | Output frequency  | Output frequency  | Output frequency  |
| Description | Providing a linear acceleration up or deceleration down to the set frequency value. | Effective in the prevention of load collapse in lifts or on conveyors, for example. | Effective when a winder or the like needs to control of the tension and/or prevent the object to be wound from being cut. Usable for 1-shot winding/feeding. | | Providing a shockless start/stop as in the case of the S-shaped curve, but providing a linear middle sector. |

Curve Constant (Degree of Bulging) of Pattern

Determine the bulging degree by referring to the following figure.



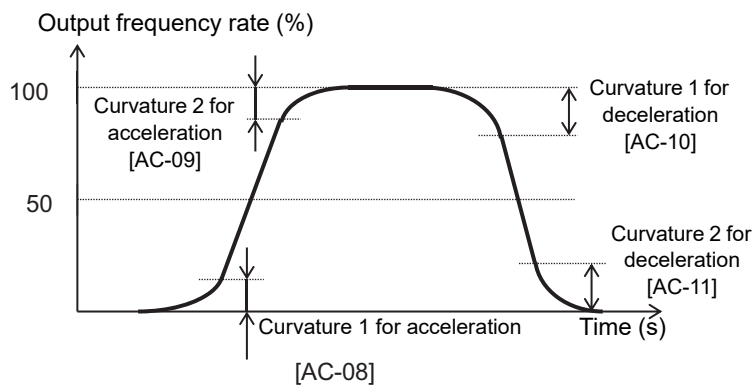
EL-S-shaped Curve's Curvature

Use of an EL-S-shaped curve allows the curvature settings [AC-08] to [AC-11] for acceleration/deceleration.

Setting all the curvatures at 50 (%) makes the EL-S-shaped curve equivalent to an S-shaped curve.

When setting the pair of [AC-08] and [AC-09] or that of [AC-10] and [AC-11], divide 100(%) into 2 segments, and assign one of which to the former of the pair and the other to the latter thereof (i.e., the two segments, if summed up, render a value up to 100%).

A setting where [AC-08] = 100 and [AC-09] = 0 makes the acceleration curve a U-shaped acceleration curve.



● Parameter

| Item | Parameters | Data | Description | Default data |
|---|------------|-------------|--|--------------|
| Acceleration curve selection | [AC-03] | 00 | Linear acceleration/deceleration | 00 |
| Deceleration curve selection | [AC-04] | 01 | S-shaped acceleration/deceleration | |
| | | 02 | U-shaped acceleration/deceleration | |
| | | 03 | Inverse-U-shaped acceleration/deceleration | |
| | | 04 | EL-S-shaped acceleration/deceleration | |
| Acceleration curve constant setting | [AC-05] | 1 to 10 | 1 (small bulging) | 2 |
| Deceleration curve constant setting | [AC-06] | | ↓ 10 (large bulging) | |
| EL-S-curve ratio @start of acceleration | [AC-08] | 0 to 100(%) | Designate the curvature of the curved sector when an EL-S-shaped pattern is used. (For acceleration) | 25 |
| EL-S-curve ratio @end of acceleration | [AC-09] | | | |
| EL-S-curve ratio @start of deceleration | [AC-10] | 0 to 100(%) | Designate the curvature of the curved sector when an EL-S-shaped pattern is used. (For deceleration) | 25 |
| EL-S-curve ratio @end of deceleration | [AC-11] | | | |

6-7-6 Following Frequency Command

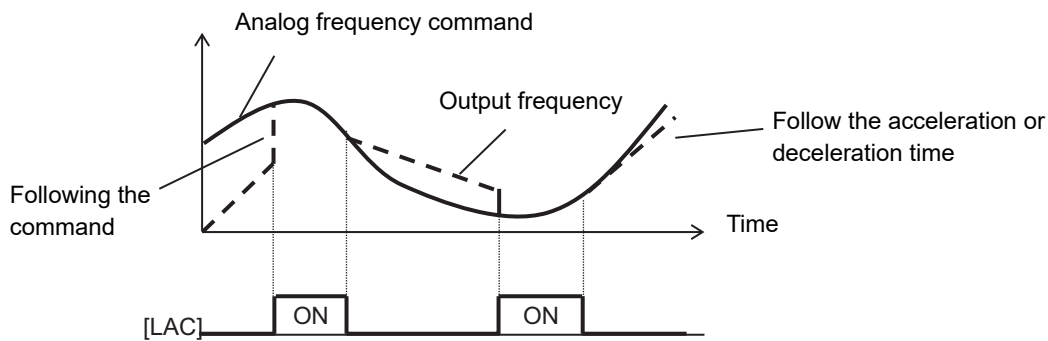
If the acceleration or deceleration cancel [LAC] function is selected as the input terminal function selection and the signal is turned ON, the acceleration or deceleration time becomes ignored and the output frequency is made instantaneously to follow the set frequency.



Precautions for Correct Use

- As the use of the acceleration or deceleration cancellation function makes the output follow the command, a large amount of increase/decrease in the frequency demanded by the command may cause a trip.
- [LAC] function is valid for any frequency command such as one from parameter set-up, one from the communication, and so on.

| Item | Parameters | Data | Description |
|-----------------------------------|--------------------|------|--|
| Input terminal function selection | [CA-01] to [CA-11] | 071 | Acceleration or deceleration cancellation function [LAC] is selected. Canceling the acceleration or deceleration and making the output follow the command |



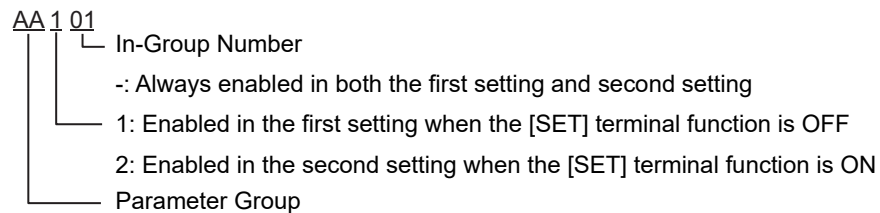


Advanced Settings

This chapter explains the advanced settings of the motor control.

The parameter number structure is indicated below.

This chapter explains how to set the first setting. For the second setting, follow the same procedure. The setting value and operation are common.



The function assigned to In/Output terminals is indicated as a combination of three digits numbers and alphabets, like "023[F-OP]." For more details of the functions, refer to the <List of input terminal functions> on page C-44 and the <List of output terminal functions> on page C-49.

| | |
|--|-------------|
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| | | |
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7-1 Overview of Motor Control Methods

Select an appropriate motor control mode for the motor to be driven and the control method.

When you drive an induction motor (IM), set [AA121]=00 to 10.

Set [AA121] = 11 or 12 to drive a synchronous motor (SM)/permanent magnet motor (PMM).

The characteristics of the control operation may be improved by automatic tuning.

Whether the currently-selected mode is the control mode for induction motors or that for synchronous motors (SMs)/permanent magnet motors (PMMs) can be checked by [dC-45] IM/SM(PMM) monitor.



Precautions for Correct Use

- As improper settings for a given motor result in performance below its potential characteristics, be sure to set up appropriately.
- See 6-2 *Parameter Setting for Motor Related* on page 6-8 for checking.
- To drive multiple induction motors (IMs) by a single inverter, it is recommendable to use it with V/f control's constant torque characteristics.
- An exemplar selection of control mode will be shown in the following section. Some of your systems may have more suitable modes than what is selected as the example.

● Parameter

| Item | Parameter | Data | Description | Default data |
|-----------------------------------|-----------|------|---|--------------|
| Control mode selection, 1st-motor | [AA121] | 00 | V/f control-constant torque characteristics (IM) | 00 |
| | | 01 | V/f control-reducing torque characteristics (IM) | |
| | | 02 | V/f control-free V/f (IM) | |
| | | 03 | Automatic torque boost (IM) | |
| | | 04 | V/f control-constant torque characteristics (IM) with sensor | |
| | | 05 | V/f control-reducing torque characteristics (IM) with sensor | |
| | | 06 | V/f control with sensor-free V/f (IM) | |
| | | 07 | Automatic torque boost (IM) with sensor | |
| | | 08 | Sensorless vector control (IM) | |
| | | 09 | Zero-Hz range sensorless vector control (IM) ^{*1} | |
| | | 10 | Vector control (IM) with sensor ^{*1} | |
| | | 11 | Synchronous-start type sensorless vector control (SM/PMM) | |
| | | 12 | IVMS-start type sensorless vector control (SM/PMM) ^{*2} | |
| IM/SM monitor | [dC-45] | 00 | Induction motor IM being selected. | - |
| | | 01 | Synchronous motor SM (permanent magnet motor PMM) being selected. | |

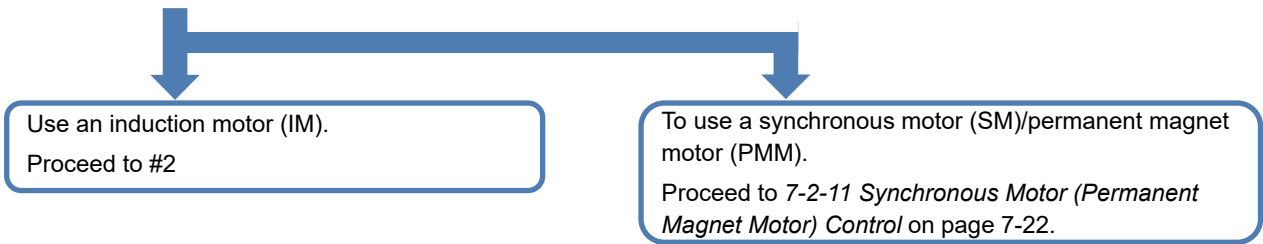
*1. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 00 (VLD).

*2. Cannot be selected if [Ub-03] duty spec selection is 00 (VLD).

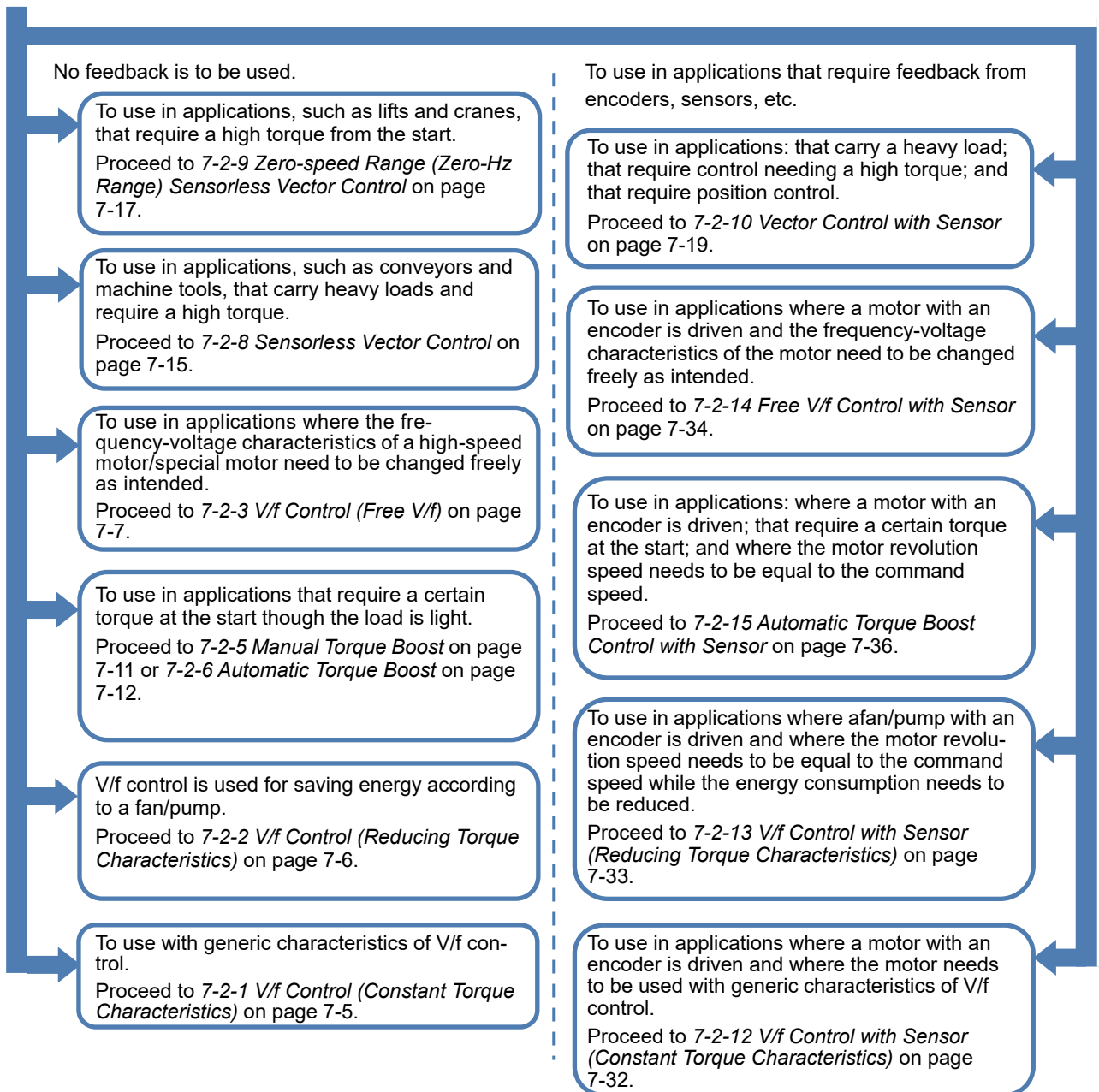
Note IM: Induction motor

SM (PMM): Synchronous motor (permanent magnet motor)

1 Check the motor type.



2 Select a control mode.



Precautions for Correct Use

To conduct encoder feedback, see also 7-2-16 *Encoder Feedback Control* on page 7-37.

7-2 Selection of Motor Control Methods

7-2-1 V/f Control (Constant Torque Characteristics)

It is suitable when constant torque is required regardless of the rotation speed of bogies, conveyor and crane, etc.

With constant torque characteristics, the output voltage is outputted proportionally to a given command frequency along the straight line drawn from the point 0 Hz/0 V to the intersection of the base frequency and the rated voltage.

The output voltage corresponding to a frequency range from 0 Hz to the base frequency is determined proportionally to the given frequency, but the output voltage corresponding to a frequency range from the base frequency to the maximum frequency is constant irrespective of the frequency.

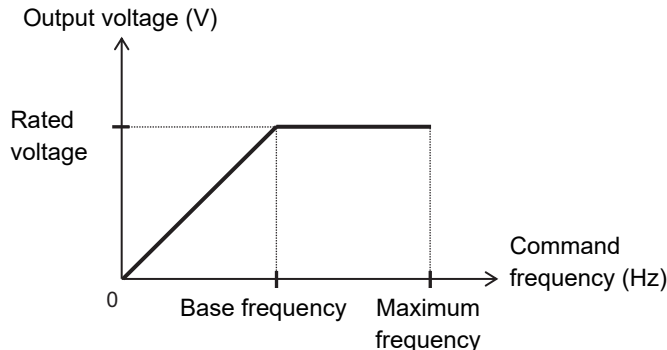
Use of the manual boost function renders the output voltage higher than that on the basic proportional line by the boost voltage.

The manual boost function is effective in the cases of low speeds and insufficient torque.



Additional Information

- When a motor is hunting and vibrating, an adjustment of the stabilization constant, 1st-motor [HA110] may improve the state of the motor.
- When a single inverter runs multiple motors and the motors are vibrating, a downward adjustment of the stabilization constant, 1st-motor [HA110] may stabilize the state of the motors.



● Parameter

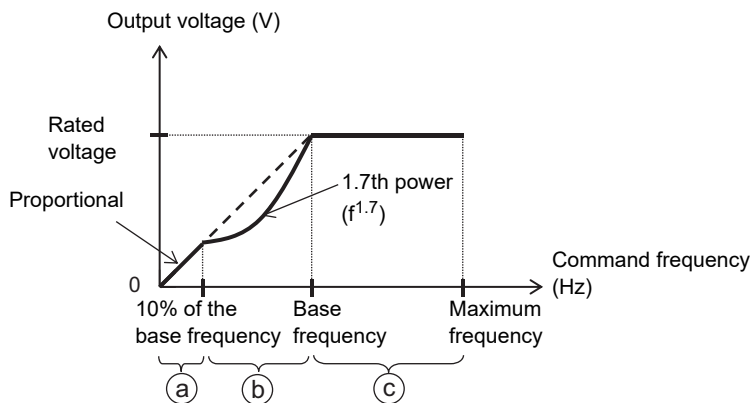
| Item | Parameter | Data | Description | Default data |
|--|-----------|-------------------------------------|---|--|
| Control mode selection, 1st-motor | [AA121] | 00 | To be used with the V/f control and the constant torque characteristics (IM). | 00 |
| Stabilization constant, 1st-motor | [HA110] | 0 to 1000(%) | To adjust the control for reducing the hunting of motors. | 100 |
| Async.Motor Base frequency setting, 1st-motor | [Hb104] | 10.00 to the maximum frequency (Hz) | To set the base frequency of motors. | 50 ^{*1} |
| Async.Motor Maximum frequency setting, 1st-motor | [Hb105] | Base frequency to 590.00 (Hz) | To set the maximum frequency of motors. | 50 ^{*1} |
| Async.Motor rated voltage, 1st-motor | [Hb106] | 1 to 1000 (V) | Set the rated voltage of motors. | 200V: 230 ^{*1} 400V: 400 ^{*1} |

*1. Default data when default data selection (UB-02) is set to 01.

7-2-2 V/f Control (Reducing Torque Characteristics)

Suitable for applications, such as a fan/pump, that require no large torque at a low-speed range.

As the output voltage is low at a low-speed range, improved efficiency, lower noise, and less vibration can be expected.



Period a: Constant torque characteristics are employed for a period from 0 Hz to the frequency that is 10% of the base frequency. (e.g.) A 60-Hz base frequency yields constant torque characteristics for a range from 0 to 6 Hz.

Period b: Reducing torque characteristics are employed for a period from the frequency that is 10% of the base frequency to the base frequency. For a given frequency, the voltage on the curve of the 1.7th power to the given frequency is outputted.

Period c: The voltage has constant-output characteristics for a range from the base frequency to the maximum frequency.



Precautions for Correct Use

When a motor is hunting and vibrating, an adjustment of the stabilization constant, 1st-motor [HA110] may improve the state of the motor.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|-------------------------------------|---|--|
| Control mode selection, 1st-motor | [AA121] | 01 | To be used with the V/f control and the reducing torque characteristics (IM). | 00 |
| Stabilization constant, 1st-motor | [HA110] | 0 to 1000(%) | To adjust the control for reducing the hunting of motors. | 100 |
| Async.Motor Base frequency setting, 1st-motor | [Hb104] | 10.00 to the maximum frequency (Hz) | To set the base frequency of motors. | 50 ^{*1} |
| Async.Motor Maximum frequency setting, 1st-motor | [Hb105] | Base frequency to 590.00 (Hz) | To set the maximum frequency of motors. | 50 ^{*1} |
| Async.Motor rated voltage, 1st-motor | [Hb106] | 1 to 1000 (V) | Set the rated voltage of motors. | 200V: 230 ^{*1} 400V: 400 ^{*1} |

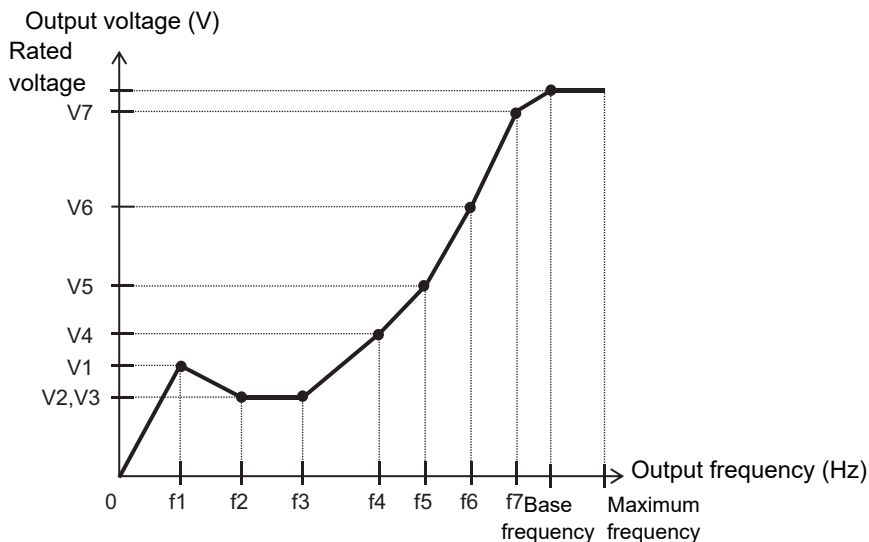
*1. Default data when default data selection (UB-02) is set to 01.

7-2-3 V/f Control (Free V/f)

It is suitable for an application in which load varies considerably in rotation speed.

In the free V/f set-up, any intended V/f characteristics can be set by setting the voltage and the frequency at 7 points.

Output voltage of an inverter can be adjusted according to applications. For example, when you use applications on which loads drastically vary in a rotation speed (output frequency), set frequency that makes the load heavier and adjust the output voltage. In such way, a motor can be controlled with the output torque according to loads.





Precautions for Correct Use

- When a motor is hunting and vibrating, an adjustment of the stabilization constant, 1st-motor [HA110] may improve the state of the motor.
 - The frequencies set by free V/f set-up have to always meet the following requirement: $f1 \leq f2 \leq f3 \leq f4 \leq f5 \leq f6 \leq f7 \leq$ base frequency. The initial value for each of the frequencies set by the free V/f set-up is 0 Hz. Set the maximum frequency and the base frequency first, and then set the frequencies f7, f6, f5, f4, f3, f2, and f1 in this order by the free V/f set-up.
 - Setting the [AA121] at 02 (free V/f set-up) disables the manual torque boost operational mode selection, 1st-motor [Hb140].
 - Default data of frequency for Free V/f setting is 0Hz. Even when you set Control mode selection, 1st-motor [AA121] to 02 ([V/f] Free V/f (IM)), you can not operate an inverter. Be sure to set the frequency for Free V/f setting.
-

● Parameter

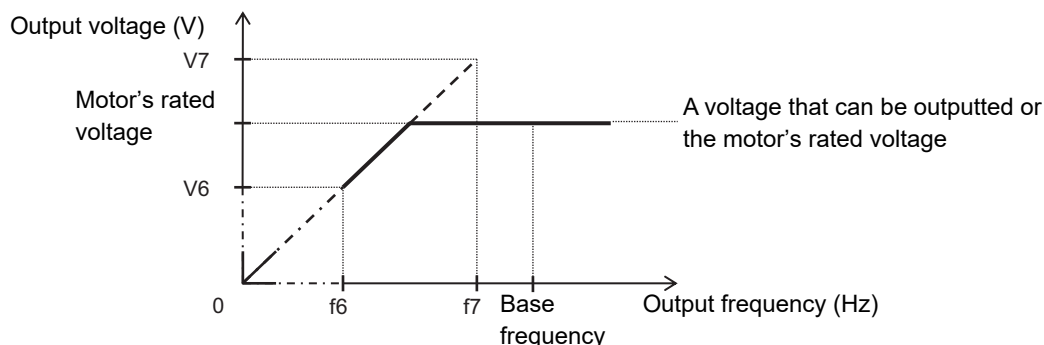
| Item | Parameter | Data | Description | Default data |
|--|-----------|-------------------------------------|---|--|
| Control mode selection, 1st-motor | [AA121] | 02: Free V/f (IM) | To use the free V/f (IM) | 00 |
| Stabilization constant, 1st-motor | [HA110] | 0 to 1000(%) | To adjust the control for reducing the hunting of motors. | 100 |
| Async.Motor Base frequency setting, 1st-motor | [Hb104] | 10.00 to the maximum frequency (Hz) | To set the base frequency of motors. | 50 ^{*1} |
| Async.Motor Maximum frequency setting, 1st-motor | [Hb105] | Base frequency to 590.00 (Hz) | To set the maximum frequency of motors. | 50 ^{*1} |
| Async.Motor rated voltage, 1st-motor | [Hb106] | 1 to 1000 (V) | Set the rated voltage of motors. | 200V: 230 ^{*1} 400V: 400 ^{*1} |
| Free-V/f frequency 7 setting, 1st-motor | [Hb162] | [Hb160] to the base frequency (Hz) | Set the frequency at each break point. | 0.00 |
| Free-V/f frequency 6 setting, 1st-motor | [Hb160] | [Hb158] to [Hb162] (Hz) | | |
| Free-V/f frequency 5 setting, 1st-motor | [Hb158] | [Hb156] to [Hb160] (Hz) | | |
| Free-V/f frequency 4 setting, 1st-motor | [Hb156] | [Hb154] to [Hb158] (Hz) | | |
| Free-V/f frequency 3 setting, 1st-motor | [Hb154] | [Hb152] to [Hb156] (Hz) | | |
| Free-V/f frequency 2 setting, 1st-motor | [Hb152] | [Hb150] to [Hb154] (Hz) | | |
| Free-V/f frequency 1 setting, 1st-motor | [Hb150] | 0.00 to [H152](Hz) | | |
| Free-V/f Voltage 7 setting, 1st-motor | [Hb163] | 0.0 to 1000.0(V) | | |
| Free-V/f Voltage 6 setting, 1st-motor | [Hb161] | | | |
| Free-V/f Voltage 5 setting, 1st-motor | [Hb159] | | | |
| Free-V/f Voltage 4 setting, 1st-motor | [Hb157] | | | |
| Free-V/f Voltage 3 setting, 1st-motor | [Hb155] | | | |
| Free-V/f Voltage 2 setting, 1st-motor | [Hb153] | | | |
| Free-V/f Voltage 1 setting, 1st-motor | [Hb151] | | | |

*1. Default data when default data selection (UB-02) is set to 01.



Precautions for Correct Use

- Even the setting of 1000 V for all of the free V/f voltages 1 to 7 will not enable the inverter to output a voltage that is higher than the input voltage or the motor’s voltage selection.
- Set the characteristics very carefully because inappropriately set characteristics may cause over current to happen during the acceleration or deceleration and/or may cause machine vibration.



7-2-4 Energy-Saving Mode

Adjust automatically so as to achieve the minimum output power of the inverter during constant-speed operation. Suitable for the load corresponding to the reducing torque characteristics of a fan/pump.

Running with this function needs a setting of 01 for the eco drive enable, 1st-motor [Hb145]. The response and the accuracy can be adjusted by the eco drive response adjustment, 1st-motor [Hb146].



Precautions for Correct Use

- Because this function is implemented by relatively slow control, a rapid change in load, such as an impact load, may stall the motor and cause an over current trip
- This function acts when either the V/f control (constant torque characteristics) or the V/f control (reducing torque characteristics) is selected.

● **Parameter**

| Item | Parameter | Data | Description | | | Default data |
|--|-----------|------------------------------|---|-------------------|------------------|--------------|
| Eco drive enable, 1st-motor | [Hb145] | 00: disabled; 01: enabled | Select whether or not to conduct the energy-saving operation. | | | 00 |
| Eco drive response adjustment, 1st-motor | [Hb146] | 0 to 100(%) | Setting | Response | Accuracy | 50 |
| | | | 0 ↓ 100 | Slow ↓ Fast | High ↓ Low | |

7-2-5 Manual Torque Boost

Raise the output voltage by adding an extra voltage in order to achieve a higher torque at low speeds than otherwise.

In the V/f control, no special correction is conducted to control the motor. Accordingly, at low output voltages, the resistance component and/or the wiring in the motor will cause the voltage drop, which in turn lowers the voltage applied to the motor. Manual boost corrects the voltage and thereby improves the lowering of the torque at the low-speed range.

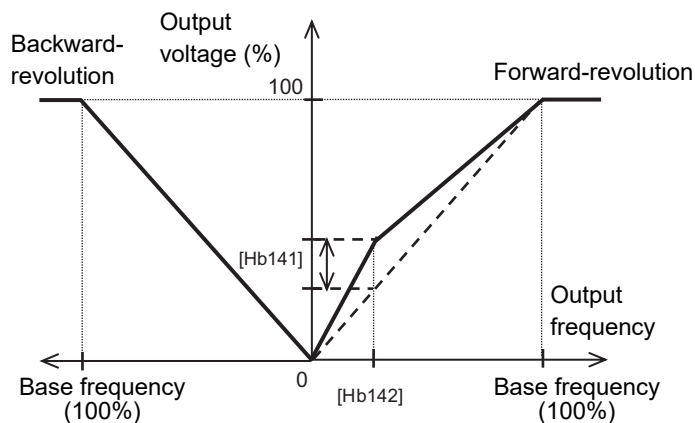
Confirm and adjust so that the output voltage of an inverter is within 150% level of the rated currents of a motor.

As the manual torque boost value, 1st-motor [Hb141], set the proportion thereof to the async.Motor rated voltage, 1st-motor [Hb106] (= 100 %). The set value is the maximum amount to be added at manual torque boost Peak speed, 1st-motor [Hb142].

As the manual torque boost Peak speed, 1st-motor [Hb142], set the proportion of the frequency at that point to the async.Motor Base frequency setting, 1st-motor [Hb104] (= 100%).

When an automatic torque boost is activated, you do not need to use the manual torque boost. Set the manual torque boost when you do not use an automatic torque boost or a motor goes into a stall while the deceleration.

e.g.) When [Hb140] = 02, the boost works only for the forward revolution of the motor.



Precautions for Correct Use

- Be sure not to cause an over excitation of the motor when raising the set value for the manual torque boost. Boosting increases the flow of the current, which may burn the motor.
- The target of the torque boost is the V/f control of induction motors. (except the free V/f)

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|----------------|--|--------------|
| Manual torque boost operational mode selection, 1st-motor | [Hb140] | 00 | Disabled | 01*1 |
| | | 01 | Always enabled | |
| | | 02 | Enabled only for forward revolution | |
| | | 03 | Enabled only for backward revolution | |
| Manual torque boost value, 1st-motor | [Hb141] | 0.0 to 20.0(%) | Setting the maximum amount of torque boost for the motor's rated voltage [Hb106] at the time of setting the manual torque boost break point. | 0.0 |
| Manual torque boost Peak speed, 1st-motor | [Hb142] | 0.0 to 50.0(%) | Set, as the break point, the proportion of the boost amount to the base frequency [Hb104] | 0.0 |

*1. Default data when default data selection (UB-02) is set to 01.

7-2-6 Automatic Torque Boost

Automatically adjust the frequency and the output voltage so as to achieve a higher torque.

The automatic boost corrects the frequency and the output in order to control the motor. Accordingly, it requires the acquisition of the motor constant by means of auto-tuning or the like.



Precautions for Correct Use

- When a motor is hunting and vibrating, an adjustment of the stabilization constant, 1st-motor [HA110] may improve the state of the motor.
- In the automatic torque boost, set appropriately the motor capacity, the number of motor poles, the base frequency, the rated voltage, and the rated current in order to conduct motor control.
- When a trip caused by overcurrent is generated while the deceleration, set a over magnetization deceleration function selection, 1st-motor (bA146) to 00: Enabled.
- When the motor performs below its potential characteristics, conduct the auto-tuning and make adjustment by referring to the next section.

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|-------------------------------------|--|--|
| Control mode | [AA121] | 03 | To use the automatic torque boost (IM). | 00 |
| Stability constant | [HA110] | 0 to 1000(%) | To adjust the control for reducing the hunting of motors. | 100 |
| Async.Motor Base frequency setting, 1st-motor | [Hb104] | 10.00 to the maximum frequency (Hz) | To set the base frequency of motors. | 50 ^{*1} |
| Async.Motor Maximum frequency setting, 1st-motor | [Hb105] | Base frequency to 590.00 (Hz) | To set the maximum frequency of motors. | 50 ^{*1} |
| Async.Motor rated voltage, 1st-motor | [Hb106] | 1 to 1000 (V) | Set the rated voltage of motors. | 200V: 230 ^{*1} 400V: 400 ^{*1} |
| Automatic torque boost voltage compensation gain, 1st-motor | [HC101] | 0 to 255 | To adjust the amount of the voltage added by the automatic torque boost. | 100 |
| Automatic torque boost slip compensation gain, 1st-motor | [HC102] | 0 to 255 | To adjust the amount of the frequency added by the automatic torque boost. | 100 |

*1. Default data when default data selection (UB-02) is set to 01.

| Phenomenon | Estimated cause(s) | Exemplar measures to be taken |
|---|---|--|
| Slower motor revolution at low speeds than what is expected | Insufficient output voltage, which in turn renders the torque insufficient | Make an adjustment by incrementing the automatic torque boost voltage compensation gain [HC101] by approximately 5% each time. |
| | Insufficient frequency correction, which in turn renders the torque insufficient. | Make an adjustment by incrementing the automatic torque boost slip compensation gain [HC102] by approximately 5% each time |
| A heavy load lowers the revolution frequency of the motor. | Insufficient frequency correction, which in turn renders the torque insufficient. | Make an adjustment by incrementing the automatic torque boost slip compensation gain [HC102] by approximately 5% each time |
| A heavy load raises the revolution frequency of the motor. | An excessive frequency correction raises the frequency. | Make an adjustment by decrementing the automatic torque boost slip compensation gain [HC102] by approximately 5% each time |
| With a heavy load, an acceleration causes an over current. | An excessive voltage correction increases the current. | Make an adjustment by decrementing the automatic torque boost voltage compensation gain [HC101] by approximately 5% each time. |
| | An excessive frequency correction raises the frequency. | Make an adjustment by decrementing the automatic torque boost slip compensation gain [HC102] by approximately 5% each time |

**Precautions for Correct Use**

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
 - If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.
-

7-2-7 Stabilization of Motor Rotation

This function is used to adjust a motor that is hunting and vibrating. It searches a set range for a point where the hunting stops and makes an adjustment.

When a single inverter drives multiple motors, setting the stability constant at 0 may improve the state.

When a load with large inertia such as a fan is rotated, decrementing the stabilization constant, 1st-motor [HA110] by 10% each time may improve the state.

When the motor capacity is smaller than the rated capacity of the inverter, incrementing the set value by 10% each time may improve the state. In contrast, when the motor capacity is larger than the rated capacity of the inverter, decrementing the set value by 10% each time may improve the state.

**Precautions for Correct Use**

- If the motor is hunting and vibrating, check if appropriate settings are provided for the motor capacity, the number of motor poles, the base frequency, the rated voltage, and the rated current.
 - Then conduct the auto-tuning to check if the hunting ends, and adjust the stability constant.
 - Exemplar methods of reducing the hunting include the following methods:
 1. Adjust the carrier speed setting, 1st-motor [bb101] by gradually decrementing it down to 2 kHz.
 2. Adjust the output voltage gain, 1st-motor [Hb180] by gradually decrementing it down to 80%.
 If no effect can be observed, restore the original values.
-

**Precautions for Correct Use**

Do not conduct a steady operation with a setting for the output voltage gain, 1st-motor [Hb180] that exceeds 100%.
The motor may be burned.

● Parameter

| Item | Parameter | Data | Description | Default data |
|-----------------------------------|-----------|---------------------|---|--------------|
| Stabilization constant, 1st-motor | [HA110] | 0 to 1000(%) | To adjust the control for reducing the hunting of motors. | 100 |
| Output voltage gain, 1st-motor | [Hb180] | 0 to 255(%) | Decrease it if the motor is hunting. A lower setting decreases the output voltage. | 100 |
| Carrier speed setting, 1st-motor | [bb101] | 0.5 to 16.0(kHz) *1 | Change the carrier frequency of the PWM output. If the motor is hunting, lower the setting. | 2.0 |

*1. Some settings may limit the carrier frequency. For details, see *7-4 Reduction of Motor Noise, Noise and Inverter Heat Generation* on page 7-59.

7-2-8 Sensorless Vector Control

This application is used on such as conveyors and machine tools, that carry heavy loads and require a high torque.

Automatically adjust the frequency and the output voltage so as to achieve responsively a higher torque even at slow speeds.

In the sensorless vector control, to control the motor, the frequency and the output voltage are corrected and the response is adjusted with respect to the load inertia.

A motor constant and the load inertia must be set with auto-tuning, etc.

In the sensorless vector control, adjustment of the response is possible. The sensorless vector control can be used in applications that require a better follow-up performance of the frequency to the command.

When a motor is hunting and vibrating, an adjustment of the speed response [HA115] may improve the state of the motor.

To limit the output direction by enabling the reversal prevention function [HC114].

To correct the slip change caused by temperature changes by enabling the selection of the secondary resistance correction [HC113]. Connection is needed between a thermistor for measuring the temperature of the motor and the TH terminal.



Precautions for Correct Use

- In the sensorless vector control, set appropriately the motor capacity, the number of motor poles, the base frequency, the rated voltage, and the rated current in order to conduct motor control.
- When the motor performs below its potential characteristics, conduct the auto-tuning and make adjustment by referring to the next section.
- In the cases of a long wiring (approximately longer than 20 m) and in the cases of controlling motors other than out company's, the performance may be below what are expected from the characteristics.
- As the capacity becomes farther away from the maximum applicable motor capacity, sufficient operation characteristics becomes more difficult to get.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|--------------|---|--------------|
| Control mode selection, 1st-motor | [AA121] | 08 | To use the sensorless vector control (IM). | 00 |
| Speed response for Async.M, 1st-motor | [HA115] | 0 to 1000(%) | To adjust the responsiveness of the control. A larger value enhances the responsiveness. | 100 |
| Boost value at start for Async.M-SLV/IM-C LV, 1st-motor | [HC111] | 0 to 50(%) | To adjust the current command at the start when the starting torque is not sufficient. | 0 |
| Secondary resistance correction, 1st-motor | [HC113] | 00 | Disabled | 00 |
| | | 01 | Enabled Requiring a temperature thermistor. | |
| Counter direction run protection selection, 1st-motor | [HC114] | 00 | Disabled | 00 |
| | | 01 | Enabled Limit the output to prevent the output in the reverse direction. | |
| Torque current reference filter time constant, 1st-motor | [HC120] | 0 to 100(ms) | To adjust the filter for the torque current. | 2 |
| Speed feedforward compensation gain, 1st-motor | [HC121] | 0 to 1000(%) | To adjust the feed forward control of the speed controller. | 0 |

| Phenomenon | Estimated cause(s) | Exemplar measures to be taken |
|---|---|---|
| Socks occur during the revolutions at the start. | The control system has a speed response that is too high. | <ul style="list-style-type: none"> Make an adjustment by decrementing the response adjustment [HA115] by 5% each time. Make an adjustment by decrementing the IM motor constant J [Hb118] by 5% each time. Make an adjustment by decrementing the boost amount at the start [HC111] by 5% each time. |
| Unsteady revolutions at low speeds, resulting in fluctuating revolutions. | The control system has a speed response that is too low. | <ul style="list-style-type: none"> Make an adjustment by incrementing the response adjustment [HA115] by 5% each time. Make an adjustment by incrementing the IM motor constant J [Hb118] by 5% each time. |
| The motor is hunting. | The control system has a speed response that is too low. | <ul style="list-style-type: none"> Make an adjustment by decrementing the response adjustment [HA115] by 5% each time. Make an adjustment by decrementing the IM motor constant J [Hb118] by 5% each time. |
| When a load in the motor-stopping direction is applied to the motor, the revolution frequency becomes lower. | The motor constant R2 is set at too small a value. | Make an adjustment by incrementing the IM motor constant R2 [Hb112] by 5% of the current value each time. |
| When a load in the motor-stopping direction is applied to the motor, the revolution frequency becomes higher. | The motor constant R2 is set at too large a value. | Make an adjustment by decrementing the IM motor constant R2 [Hb112] by 5% of the current value each time. |
| When a load in the motor-stopping direction is applied to the motor, the revolution frequency becomes higher. | Insufficient regenerative torque at low speeds. | <ul style="list-style-type: none"> Make an adjustment by incrementing the IM motor constant R1 [Hb110] by 5% of the current value each time. Make an adjustment by incrementing the IM motor constant I0 [Hb116] by 5% of the current value each time. |

| Phenomenon | Estimated cause(s) | Exemplar measures to be taken |
|--|--|---|
| Revolution in the opposite direction to the command direction occurs for an instant. | A command demanding the revolution in the opposite direction is dispatched over the control system for an instant. | Enable the reversal prevention selection [HC114]. |



Precautions for Correct Use

- Set the carrier speed setting, 1st-motor [bb101] at a value of 2.0 kHz or higher. A set frequency of 1.9 kHz or lower may cause hunting.
- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-9 Zero-speed Range (Zero-Hz Range) Sensorless Vector Control

This application is used on such as lifts and cranes, that require a high torque from the start.

Automatically adjust the frequency and the output voltage so as to achieve responsively a higher torque even at slow speeds.

In the zero-speed range sensorless vector control, the sensorless vector control is supplemented with an output that can achieve an intended torque from at extremely low speeds such as those in the zero-speed range.

A motor constant and the load inertia must be set with auto-tuning, etc.

As in the case of the sensorless vector control, acquire the motor constant by means of auto-tuning or the like.

In the zero-speed range sensorless vector control, as in the case of the sensorless vector control, adjustment of the response is possible. In addition to the adjustment of the response, it is possible to set the torque boost for the current at the start.

When a motor is hunting and vibrating, an adjustment of the speed response for Async.M, 1st-motor [HA115] may improve the state of the motor.

The zero-speed range sensorless vector control cannot be used at the light load mode or the extra light load. When you select a load type selection (Ub-03), use the mode as 02: ND (Standard).



Precautions for Correct Use

- In the zero-speed range sensorless vector control, as in the case of the sensorless vector control, set appropriately the motor capacity, the number of motor poles, the base frequency, the rated voltage, and the rated current in order to conduct motor control.
- When the motor performs below its potential characteristics, conduct the auto-tuning and make adjustment by referring to the next section.
- In the case that a length of a wire is over 20 m, the motor's characteristic may be below what are expected.
- As the capacity becomes farther away from the maximum applicable motor capacity, sufficient operation characteristics becomes more difficult to get.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|------------------|--|--------------|
| Control mode selection, 1st-motor | [AA121] | 09 ^{*1} | To use the zero-speed range sensorless vector control (IM) function. | 00 |
| Speed response for Async.M, 1st-motor | [HA115] | 0 to 1000(%) | To adjust the responsiveness of the control. A larger value enhances the responsiveness. | 100 |
| Zero speed area limit for Async.M-OSLV, 1st-motor | [HC110] | 0 to 100(%) | To limit the current at the start so as not to allow the rising of the current to rise too high. | 80 |
| Boost value at start for Async.M-OSLV, 1st-motor | [HC112] | 0 to 50(%) | To adjust the current command at the start when the starting torque is not sufficient. | 10 |
| Secondary resistance correction, 1st-motor | [HC113] | 00 | Disabled | 00 |
| | | 01 | Enabled Requiring a temperature thermistor. | |
| Counter direction run protection selection, 1st-motor | [HC114] | 00 | Disabled | 00 |
| | | 01 | Enabled Limit the output to prevent the output in the reverse direction. | |
| Torque current reference filter time constant, 1st-motor | [HC120] | 0 to 100(ms) | To adjust the filter for the torque current. | 2 |
| Speed feedforward compensation gain, 1st-motor | [HC121] | 0 to 1000(%) | To adjust the feed forward control of the speed controller. | 0 |

*1. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 00 (VLD).

In addition to the adjustment of the sensorless vector control, refer to the following description.

| Phenomenon | Estimated cause(s) | Exemplar measures to be taken |
|--|----------------------------|---|
| Socks occur during the revolutions at the start. | Boost amount is too large. | <ul style="list-style-type: none"> Make an adjustment by decrementing the zero-speed range limiter [HC110] by 5% each time. Make an adjustment by decrementing the zero-speed range boost at the start [HC112] by 5% each time. |
| Over current occurs at the start | | |
| The motor cannot provide enough torque for the load is too high for the motor to at the start. | Boost amount is too small. | Make an adjustment by incrementing the zero-speed range boost at the start [HC112] by 5% each time. |
| Acceleration is not possible. | | |



Precautions for Correct Use

- Set the carrier speed setting, 1st-motor [bb101] at a value of 2.0 kHz or higher. A set frequency of 1.9 kHz or lower may cause hunting.
- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-10 Vector Control with Sensor

This application is used in the following cases: It carries a heavy load; that require control needing a high torque; and that require position control.

The feedback of the encoder signal from the motor allows highly accurate frequency control from the low-speed range.

In the vector control with sensor, to control the motor, the frequency and the output voltage are corrected and the response is adjusted with respect to the load inertia.

Accordingly, it requires the acquisition of the motor constant and the load inertia by means of auto-tuning or the like.

In the vector control with sensor, adjustment of the response is possible. The vector control with sensor can be used in applications that require a better follow-up performance of the speed to the command.

In the vector control with sensor, the position control mode can be used.

A motor constant and the load inertia must be set with auto-tuning, etc.

When a motor is hunting and vibrating, an adjustment of the speed response [HA115] and [HC120] may improve the state of the motor.



Precautions for Correct Use

- Conducting the vector control with sensor requires the encoder feedback from the motor.
- When [CA-90] = 02, Input terminals [A] and [B] are switched to the terminals for feedback control. When [CA-90] ≠ 02, terminals [EAP], [EBP], [EAN], and [EBN] of the PG option unit are enabled.
- See 7-2-16 *Encoder Feedback Control* on page 7-37.
- In the vector control with sensor, set appropriately the motor capacity, the number of motor poles, the base frequency, the rated voltage, and the rated current in order to conduct motor control.
- As the motor's frame number becomes smaller and smaller from the one of the maximum applicable motor, sufficient operation characteristics becomes more difficult to get.
- In the case that a length of a wire is over 20 m, the motor's characteristic may be below what are expected.
- Once [HC114] Counter direction run protection selection, 1st-motor is enabled, output directions are limited.
- Once [HC113] Secondary resistance correction, 1st-motor is enabled, a slip change of motor rotation according to temperature change is corrected. Connect a thermistor, which measures the motor temperature, to TH terminals.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|------------------|--|--------------|
| Control mode selection, 1st-motor | [AA121] | 10 ^{*1} | To use the vector control with sensor (IM). | 00 |
| Speed response for Async.M, 1st-motor | [HA115] | 0 to 1000(%) | To adjust the responsiveness of the control. A larger value enhances the responsiveness. | 100 |
| Vector control mode selection, 1st-motor | [AA123] | 00 | Operation is possible by switching between the speed control and the torque control. | 00 |
| | | 01 | Activate the pulse train position control mode. | |
| | | 02 | Activate the absolute position control mode. | |
| | | 03 | Activate the high-resolution absolute position control mode. | |
| Boost value at start for Async.M-SLV/IM-C LV, 1st-motor | [HC111] | 0 to 50 (%) | To adjust the current command at the start when the starting torque is not sufficient. | 0 |
| Secondary resistance correction, 1st-motor | [HC113] | 00 | Disabled | 00 |
| | | 01 | Enabled Requiring a temperature thermistor. | |
| Counter direction run protection selection, 1st-motor | [HC114] | 00 | Disabled | 00 |
| | | 01 | Enabled Limit the output to prevent the output in the reverse direction. | |
| Torque current reference filter time constant, 1st-motor | [HC120] | 0 to 100 (ms) | To adjust the filter for the torque current. | 2 |
| Speed feedforward compensation gain, 1st-motor | [HC121] | 0 to 1000 (%) | To adjust the feed forward control of the speed controller. | 0 |

*1. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 00 (VLD).

| Phenomenon | Estimated cause(s) | Exemplar measures to be taken |
|---|---|--|
| The performance is not sufficient for what the motor control characteristics predict. | An improper motor constant is being used. | The performance may be improved by automatic tuning. Check 6-2-3 <i>Auto-tuning of Motor</i> on page 6-14. |
| Socks occur during the revolutions at the start. | The control system has a frequency response that is too high. | <ul style="list-style-type: none"> • Make an adjustment by decrementing the response adjustment [HA115] by 5% each time. • Make an adjustment by decrementing the IM motor constant J [Hb118] by 5% each time. |
| The motor is hunting. | | |
| Unsteady revolutions at low speeds, resulting in fluctuating revolutions. | The control system has a frequency response that is too low. | <ul style="list-style-type: none"> • Make an adjustment by incrementing the response adjustment [HA115] by 5% each time. • Make an adjustment by incrementing the IM motor constant J [Hb118] by 5% each time. |
| Normal acceleration is impossible and the protection against the over load works. | An improper motor constant is being used. | The performance may be improved by automatic tuning. Check 6-2-3 <i>Auto-tuning of Motor</i> on page 6-14. |
| | An improper phase sequence is being used. | Set V/f control (00) in [AA121], and check the frequency detection value monitor [dA-08]. The wiring is correct if the forward operation [FW] has a positive (+) value and if the reversal operation [RV] has a negative (-) value. If the forward and negative operations have incorrect values, rearrange the phase sequence in the encoder or check again, 7-2-16 <i>Encoder Feedback Control</i> on page 7-37. |



Precautions for Correct Use

- Set the Carrier speed setting, 1st-motor [bb101] at a value of 2.0 kHz or higher. A set frequency of 1.9 kHz or lower may cause an incorrect operation.
- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-11 Synchronous Motor (Permanent Magnet Motor) Control

Controlling a synchronous motor (permanent magnet motor) requires the setting-up of the motor constant. See, 6-2 *Parameter Setting for Motor Related* on page 6-8 The motor constant is data corresponding to one phase of Y-connection (including wiring).



Precautions for Correct Use

- Set an appropriate over current level of the inverter [bb160]. Do not drive a motor whose maximum current (demagnetization level) is below the 150% of [bb160].
- Be aware of the root-mean-square value and the peak value. The rated output current listed in the specification table is the root-mean-square value.
- This is the control mode for the reducing torque applications where the motor that has the same frame number as the inverter's rating needs a torque at the start that is 50% or smaller.
- This mode can be used neither in applications that require a constant torque from low speeds nor in applications that involve rapid acceleration or deceleration and that require a large torque from low speeds. Never use this mode for applications involving a gravity load, such as lifts.
- Synchronous motors (permanent magnet motors) cannot be operated by a direct input from the commercial power supply.
- Multiple synchronous motors (permanent magnet motors) cannot be driven by a single inverter.
- Synchronous motors (permanent magnet motors) are more likely to cause over voltage errors than non-synchronous motors (induction motors). If the rapid deceleration and/or the direct-current braking function need to be used, consider the possible use of an optional braking resistor, a regenerative braking unit.
- When a hold brake is used, release the brake before the motor starts operation. Otherwise, the motor may lose its synchronism.
- The motor may move in the reverse direction at the start of its revolution. When a malfunction is caused by the reverse revolution, use the starting Method for Sync.M, 1st-motor [Hd132].
- Set the carrier speed setting, 1st-motor [bb101] at a value of 8.0kHz or higher. Some low carrier frequencies may make the motor generate a lot of heat.
- The tolerable load moment of inertia is 50 times as large as the motor's moment of inertia or smaller. Some applications whose loads moment of inertia exceed the above mentioned range may result in a performance that is below the desired one.
- If the wiring length between the motor and the inverter is about 20m or longer, the motor could not exhibit the full properties.
- In some cases of a long wiring (approximately longer than 20 m), frequency-synchronized re-start may cause an over current error.
- Driving a motor whose sync.Motor rated current, 1st-motor [Hd108] exceeds the inverter's rated current or a motor whose frame number is smaller than the maximum applicable motor by 2 or more may result in a performance that is below the desirable one.
- Set not only the sync.Motor rated current, 1st-motor [Hd108] but also the electronic thermal level setting, 1st-motor [bC110].
- If the initial position estimation is enabled in the starting Method for Sync.M, 1st-motor [Hd132], a shrill sound caused by the position detection action may be heard, but this sound has nothing to do with any abnormality.
- If the initial position estimation is enabled in the Carrier speed setting, 1st-motor [Hd132], start the operation from the state in which the motor stopped. Failure to acquire the correct position may occur, which may result in unintended revolution, over current, or loss of synchronization.

Disabled Functions

The following functions cannot be used when the synchronous motor (permanent magnet motor) control is conducted.

Even when they are enabled by parameters of setting, they are actually disabled.

In the following table, only the common settings (parameter center “-”) and the first settings (parameter center “1”) are listed, but it is not possible either to use the second settings (parameter center “2”) that correspond to the first settings in the following table.

| Item | Parameter | Description |
|--|---|---|
| Functions associated with torque control | [FA-15], [FA-16], [dA-15], and [dA-16] | Torque command monitoring function |
| | [Ad-01] to [Ad-04], and [Ad-40] to [Ad-43], Input terminal 067 [ATR] | Torque controlling function |
| | [Ad-11] to [Ad-14], Input terminal 068 [TBS] | Torque biasing function |
| | [bA110] to [bA116], and [bA210] to [bA216], Input terminals 060 [TL], 061 [TRQ1], and 062 [TRQ2] Output terminal 022 [TRQ] | Torque limiting function |
| | [CE120] to [CE123], Output terminal 019 [OTQ] | Over torque signal |
| Over current restraining function | [bA120] and [bA121] | Over current restraining function |
| Functions associated with induction motor control | [HA110] | Stabilization adjustment gain |
| | [Hb130], [Hb131], [Hb140] to [Hb142], [Hb145], [Hb146], [Hb150] to [Hb163], [Hb170], [Hb171], and [Hb180] | Functions associated with V/f control |
| | [HC101] and [HC102] | Functions associated with automatic boost |
| | [HC110] to [HC114], [HC120], and [HC121] | Sensorless vector control, Zero-speed range sensorless vector control |
| Part of gain mapping function | [HA126],[HA129] | Constant for I control |
| Part of auto-tuning | [HA-01]=02 | Rotating system tuning |
| | [HA-03] | Online auto-tuning |
| Commercial power supply switching function | Input terminal 035 [CS] | Switching to commercial power supply |
| Acceleration or deceleration cancellation function | Input terminal 071 [LAC] | Acceleration or deceleration cancellation function |
| Jogging operation | [AG-20], [AG-21], input terminal 029 [JG] | Jogging operation function |

Synchronous-start Type Sensorless Vector Control (SM/PMM)

In this control mode, operations of magnetic-pole position estimation, synchronous start control, and sensorless vector control are started in this order.

In the magnetic-pole position estimation, it is possible to select whether the motor is started after the motor's magnetic-pole positions are estimated by use of the initial-position estimation function or the magnetic-pole positions are synchronized by use of the DC braking function.

In the case of starting after the magnetic-pole position estimation, estimation operation is conducted at the start by setting the Starting Method for Sync.M, 1st-motor [Hd132] at 01.

In the case of the Starting Method for Sync.M, 1st-motor [Hd132] being set at 00, the motor is started as its magnetic poles are synchronized with the output phases. In the cases where the magnetic poles and the output phases are unsynchronized by a great amount, or in the cases that require a certain starting torque, use the starting-time DB to synchronize the magnetic-pole positions and the output phases before the acceleration.

Use [AF108] to adjust the current during a synchronous starting. Adjustment is possible even when [AF101] = 00. When a larger torque is needed than what is needed in the synchronous starting mode, use of IVMS start mode may improve the situation.

The minimum Frequency for Sync.M-SLV, 1st-motor [Hd130] at which the synchronous start control is switched to the sensorless vector control is adjusted at the lowest frequency (switching).

When a motor is hunting and vibrating, an adjustment of the speed response for Async.M, 1st-motor [HA115] and/or the no-Load current for Sync.M-SLV, 1st-motor [Hd131] may improve the state of the motor.

When the starting-time DB function is used at the start, see 7-5-2 *Startup DC Injection Braking* on page 7-64.

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|--------------|---|--------------|
| Control mode selection, 1st-motor | [AA121] | 11 | To use synchronous-start type sensorless vector control (SM/PMM) | 00 |
| Speed response for Async.M, 1st-motor | [HA115] | 0 to 1000(%) | To adjust the responsiveness of the control. A larger value enhances the responsiveness. | 100 |
| Minimum Frequency for Sync.M-SLV, 1st-motor | [Hd130] | 0 to 50(%) | The frequency at which the sensorless vector control is started. Set the ratio to the base frequency [Hd104]. | 8 |
| No-Load current for Sync.M-SLV, 1st-motor | [Hd131] | 0 to 100(%) | Set the ratio of the no-load current to the rated current during the sensorless vector control. | 10 |
| Starting Method for Sync.M, 1st-motor | [Hd132] | 00 | Initial position estimation is disabled. | 00 |
| | | 01 | Initial position estimation is enabled. | |
| IMPE 0V wait number for Sync.M, 1st-motor | [Hd133] | 0 to 255 | This is a stand-by adjustment value to stabilize the reference value for the initial position estimation detection. | 10 |
| IMPE detect wait number for Sync.M, 1st-motor | [Hd134] | 0 to 255 | This is an adjustment value to stabilize the current rise of the initial position estimation operation. | 10 |
| IMPE detect number for Sync.M, 1st-motor | [Hd135] | 0 to 255 | This is a detection-operation adjustment value of the initial position estimation operation. | 30 |
| IMPE voltage gain for Sync.M, 1st-motor | [Hd136] | 0 to 200(%) | This is a output-voltage adjustment gain of the initial position estimation operation. | 100 |

| Item | Parameter | Data | Description | Default data |
|--|-----------|--|---|---------------------------------|
| IMPE Mg-pole position offset, 1st-motor | [Hd137] | 0 to 359° | To conduct corrections in a case where the initial position estimation operation has a certain error. | 0 |
| DC braking selection, 1st-motor | [AF101] | 01 | Internal DC braking: enabled | 00 |
| DC braking force at start, 1st-motor | [AF108] | 0 to 100(%) | To adjust the DC braking force. Setting of 100% will provide maximum braking force. | 30 |
| DC braking active time at start, 1st-motor | [AF109] | 0.00 to 60.00 (s) | Enabled during the internal DC braking. When the operation command is turned ON, DC braking is started. | 0.00 |
| Over current detection level, 1st-motor | [bb160] | Inverter ND rated current × (0.2 to 2.2) | To Set the level at which the over current is detected. | 2.2 × Inverter ND rated current |

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

- Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
- Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- Drive programming: 0.01% (Rated ratio)

| Phenomenon | Estimated cause(s) | Exemplar measures to be taken |
|--|---|--|
| At the start, rotating temporarily in the opposite direction to the intended one. | Misalignment of the output phases and the motor's magnetic-pole positions | Enable the initial-position estimation function. [Hd132]=01 In the cases of a slight opposite-direction movement even in the initial-position estimation function, make an adjustment by incrementing [Hd137] by 5° at a time. |
| Over current occurs at the start | • Insufficient starting torque | • Enable the initial-position estimation function. [Hd132]=01 • Set the DC braking at the start [AF101] = 01, and after the start, the time needed for the motor to be stabilized is set in [AF109]. In addition, make an adjustment by incrementing the braking force at the start [AF108] by 5% each time. |
| At the start, the motor loses synchronization and no acceleration is observed. | • Misalignment of the output phases and the motor's magnetic-pole positions | |
| A long starting time is required. | A long phase-synchronization time is required. | When the magnetic-pole positions are synchronized in the DC braking at the starting, enable the initial-position estimation function instead of the DC braking at the start. [Hd132]=01 |
| Fluctuating revolutions occur at low speeds (at the lowest frequency (switch) or even lower) | Insufficient starting torque | Make an adjustment by incrementing the braking force at the start [AF108] by 5% each time. |
| Hunting occurs at low speeds (at the lowest frequency (switch) or even lower) | There is a motor constant error. | Decrement the motor constant R [Hd110] little by little until it reaches a value = set value × 0.7. Increment little by little each of the motor constant Ld [Hd112] and the motor constant Lq [Hd112] until they reach their respective values = set values × 1.4. Note, however that Ld ≤ Lq. |
| Shock or over current occurs at about the lowest frequency (switch). | The speed response is too low. | Make an adjustment by incrementing the speed response [HA115] by 5% each time. |
| | Load fluctuation occurs at around the switch. | Adjust the lowest frequency (switch) [Hd130]. |

| Phenomenon | Estimated cause(s) | Exemplar measures to be taken |
|--|--|--|
| Hunting occurs at higher speeds (at the lowest frequency (switch) or higher). | Unsynchronized speed response. | Make an adjustment by incrementing/decrementing the speed response [HA115] by 5% each time. |
| | Distorted wave form of the radio wave. | Make an adjustment by incrementing the no-load current [Hd131] by 5% each time. |
| A long initial position estimation time is required. | Set value for the estimation is too large. | Lower the values [Hd133] to [Hd135] by the same ratio. Note Too low a value may result in an operation in the opposite direction. |
| A movement in the opposite direction occurs while the initial position estimation is being used. | The estimation is improperly conducted. | Raise the values [Hd133] to [Hd135] by the same ratio, or raise the voltage gain [Hd136] by 5% each time. |
| While the initial position estimation is being used, over current errors may occur. | Voltage gain is too high. | Decrement the voltage gain [Hd136] by 5% each time. |
| Frequency-synchronized re-start may cause errors. | Too high revolution speeds and too large offset of the phases. | Make an adjustment by incrementing the speed response [HA115] by 5% each time. Waiting a longer time for the re-start may improve the situation. |



Precautions for Correct Use

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current, loss of synchronization, or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

IVMS Start Sensorless Vector Control (SM/PMM)

In this control mode, operations of magnetic-pole position estimation, IVMS start control, and sensorless vector control are started in this order.

In this control mode, only the parameters set by the first set-up are enabled. Terminal [SET] cannot be used.

In the magnetic-pole position estimation, it is possible to select whether the motor is started after the motor's magnetic-pole positions are estimated by use of the initial-position estimation function or the magnetic-pole positions are synchronized by use of the DC braking function.

In the case of starting after the magnetic-pole position estimation, estimation operation is conducted at the start by setting the Starting Method for Sync.M, 1st-motor [Hd132] at 01.

In the case of the Starting Method for Sync.M, 1st-motor [Hd132] being set at 00, the magnetic poles are positioned to the output phases at the start. As a large offset between the magnetic poles and the output phases may fail the starting, use the starting-time DB to synchronize the magnetic-pole positions and the output phases before the starting.

IVMS start mode is a start mode where larger torque is provided than in the synchronous starting mode.

When the synchronous starting mode provides an insufficient torque, use of the IVMS start mode may improve the performance.

Use of the IVMS start mode requires an SM(PMM) constant that is set by the sensorless vector control and an adjustment dedicated for IVMS start mode.

Before the motor drive, conduct an IVMS auto-tuning and a test run with the load removed.



Precautions for Correct Use

- Some SM (PMM) may be unable to start in the IVMS start mode.
- For IVMS control mode, you are required to make a precise adjustment. By using the auto-tuning selection[AH-01]=03, check that the target motor can be operated by IVMS control. If the auto-tuning result is NG, you need to find other control modes because the target motor cannot be operated by IVMS control.
- IVMS start mode requires a re-adjustment when the inverter is replaced. When a malfunctioning inverter needs to be restored immediately by replacing the malfunctioning inverter with a new one, the synchronous starting mode should be used.
- As the IVMS start mode is a very special control, which may make a unique operation sound as the starting sound.

● Parameters for IVMS Start Mode

| Item | Parameter | Data | Description | Default data |
|--|-----------|------------------|---|--------------|
| Carrier frequency at IVMS | [Hd-41] | 0.5 to 16.0(kHz) | Set the carrier frequency during the IVMS drive. Usually, the value does not require to change. | 2.00 |
| Filter gain of current detection at IVMS | [Hd-42] | 0 to 1000 | The filter adjustment gain applied to the detection current during the IVMS drive. | 100 |
| Open phase voltage detection gain | [Hd-43] | 00 to 04 | The adjustment gain applied to the detection voltage during the IVMS drive. | 00 |
| Open phase switching threshold compensation | [Hd-44] | 00 | IVMS correction: Disabled (no correction) | 01 |
| | | 01 | IVMS correction: Enabled (correction to be conducted) | |
| P-Gain for speed control, SM(PMM)-IVMS | [Hd-45] | 0 to 1000 | Speed control P gain during the IVMS drive A larger value enhances the responsiveness of the speed control. | 100 |
| I-Gain for speed control, SM(PMM)-IVMS | [Hd-46] | 0 to 10000 | Speed control I gain during the IVMS drive A larger value enhances the responsiveness of the speed control. | 100 |
| Wait time for open phase switching, SM(PMM)-IVMS | [Hd-47] | 0 to 1000 | Waiting time for the open-phase switching during the IVMS drive. A larger value enhances the stability. | 15 |
| Limitation of decision about the drive direction, SM(PMM)-IVMS | [Hd-48] | 00 | Rotation-direction determination: Disabled (no restriction) | 01 |
| | | 01 | Rotation-direction determination: Enabled (restricted to the operation-command direction) | |
| Open phase voltage detection timing adjustment, SM(PMM)-IVMS | [Hd-49] | 0 to 1000 | Adjustment value of the IVMS detection timing. Usually, the value does not require to change. | 10 |
| Minimum pulse width adjustment, SM(PMM)-IVMS | [Hd-50] | 0 to 1000 | To adjust the width of the voltage pulse during the IVMS drive. A larger value renders the pulse width wider. | 100 |
| IVMS Current Limit for threshold | [Hd-51] | 0 to 255 | Set a limit on each of the upper and the lower limits of the detection current during the IVMS drive. Enabled when [Hd-44] = 01 (enabled). | 100 |
| IVMS Threshold Gain | [Hd-52] | 0 to 255 | To adjust the IVMS auto-tuning value. | 100 |
| IVMS Carrier frequency start/end point | [Hd-58] | 0 to 50(%) | To adjust the point where the carrier frequency is switched in the IVMS start mode. Usually, the value does not require to change. | 5 |

● Parameters Common to This Mode and the Synchronous Starting Mode

| Item | Parameter | Data | Description | Default data |
|---|-----------|--|---|----------------------------------|
| Control mode selection, 1st-motor | [AA121] | 12 ^{*1} | To use IVMS-start type sensorless vector control (SM/PMM) | 00 |
| Speed response for Async.M, 1st-motor | [HA115] | 0 to 1000(%) | To adjust the responsiveness of the control. A larger value enhances the responsiveness. | 100 |
| Minimum Frequency for Sync.M-SLV, 1st-motor | [Hd130] | 0 to 50(%) | The frequency at which the sensorless vector control is started. Set the ratio to the base frequency [Hd104]. | 8 |
| No-Load current for Sync.M-SLV, 1st-motor | [Hd131] | 0 to 100(%) | Set the ratio of the no-load current to the rated current during the sensorless vector control. | 10 |
| Starting Method for Sync.M, 1st-motor | [Hd132] | 00 | Initial position estimation is disabled. | 00 |
| | | 01 | Initial position estimation is enabled. | |
| IMPE 0V wait number for Sync.M, 1st-motor | [Hd133] | 0 to 255 | This is a stand-by adjustment value to stabilize the reference value for the initial position estimation detection. | 10 |
| IMPE detect wait number for Sync.M, 1st-motor | [Hd134] | 0 to 255 | This is an adjustment value to stabilize the current rise of the initial position estimation operation. | 10 |
| IMPE detect number for Sync.M, 1st-motor | [Hd135] | 0 to 255 | This is a detection-operation adjustment value of the initial position estimation operation. | 30 |
| IMPE voltage gain for Sync.M, 1st-motor | [Hd136] | 0 to 200(%) | This is a output-voltage adjustment gain of the initial position estimation operation. | 100 |
| IMPE Mg-pole position offset, 1st-motor | [Hd137] | 0 to 359(°) | To conduct corrections in a case where the initial position estimation operation has a certain error. | 0 |
| DC braking selection, 1st-motor | [AF101] | 01 | Internal DC braking: enabled | 00 |
| DC braking force at start, 1st-motor | [AF108] | 0 to 100(%) | To adjust the DC braking force. Setting of 100% will provide maximum braking force. | 30 |
| DC braking active time at start, 1st-motor | [AF109] | 0.0 to 60.0(s) | Enabled during the internal DC braking. When the operation command is turned ON, DC braking is started. | 0.00 |
| Over current detection level, 1st-motor | [bb160] | Inverter ND rated current × (0.20 to 2.20) | To Set the level at which the over current is detected. | 2.20 × Inverter ND rated current |

*1. Cannot be selected if [Ub-03] duty spec selection is 00 (VLD).

● Set-up Procedures of IVMS Start Mode

- 1 Set the protection for the PM motor.
 - Setting the over current detection level [bb160]
 - Setting the electronic thermal level [bc110]



Precautions for Correct Use

- The over-current detection level should be set appropriately by taking into account the maximum current (demagnetization level) of the PM motor to be used. Set the over-current detection level so that the SM (PMM)'s maximum current (demagnetization level) is not below 150% of the over-current detection level.
 - See also 6-6-1 *Electronic Thermal Setting* on page 6-48 and set it appropriately.
-

- 2 Set the PM motor's Plate Data.
 - Setting the capacitance [Hd102]
 - Setting the number of poles [Hd103]
 - Setting the base frequency [Hd104]
 - Setting the maximum frequency [Hd105]
 - Setting the rated voltage [Hd106]
 - Setting the rated current [Hd108]



Precautions for Correct Use

See also 6-2-1 *Motor Basic Settings* on page 6-8 and set them appropriately.

- 3 Set the PM motor constants.
 - Setting the motor constant R [Hd110].
 - Setting the motor constant Ld [Hd112].
 - Setting the motor constant Lq [Hd114].
 - Setting the motor constant Ke [Hd116].
 - Setting the motor constant J [Hd118].



Precautions for Correct Use

See also 6-2-2 *Motor Constant Setting* on page 6-12 and set them appropriately.

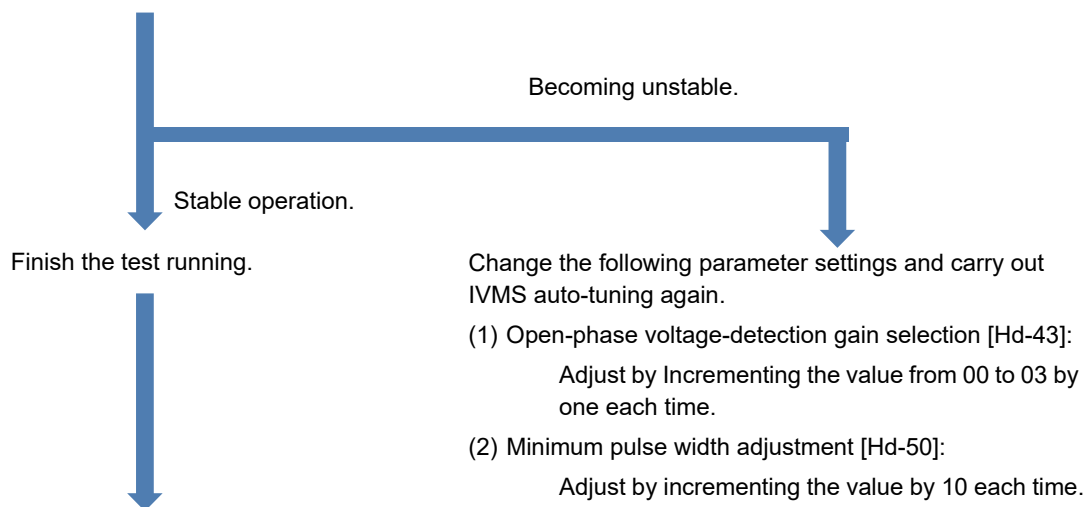
- 4 Conduct the IVMS auto-tuning
 - Set the control mode [AA121] at 12 (SM-IVMS).
 - Set the auto-tuning selection [HA-01] at 03 (IVMS).
 - Input the command for starting the auto-tuning (operation command).
 - The inverter is in an automatic operation.
 - Tuning is finished.

**Precautions for Correct Use**

- For the procedures from the auto-tuning start to the auto-tuning finish, check 6-2-3 *Auto-tuning of Motor* on page 6-14 and follow the procedures.
- In the IVMS auto-tuning, the tuning should be done as the motor shaft is being rotated little by little. When the motor shaft is locked, or when the load is heavy, even a normal finish of the auto-tuning may result in a adjustment failure. Conduct the IVMS auto-tuning with nothing attached to the motor shaft.
- When an over current occurs during the automatic operation of the IVMS auto-tuning, check the following items.
 - (1) Motor lock caused by braking and/or foreign objects.
 - (2) Setting over-current detection level [bb160]
 Check these items, and when there is no problem, conduct the IVMS auto-tuning by incrementing the minimum pulse width adjustment [Hd-50] by 10 each time.
- It may take approximately 5 minute to conduct the IVMS auto-tuning.

5 Run test running

- Set the main-speed command [FA-01] at a value that is smaller than the lowest frequency (switch) [Hd130], and check that stable drive can be provided for the forward revolutions, the backward revolutions, the acceleration, and the deceleration.
- Then, Set the main-speed command [FA-01] at a value that is larger than the lowest frequency (switch) [Hd130], and check that stable drive can be provided for the forward revolutions, the backward revolutions, the acceleration, and the deceleration.

**Precautions for Correct Use**

When the adjustment has been conducted repeatedly but no trial operation can be conducted, it may be due to the unavailability of IVMS start mode for use. Use the synchronous starting mode.

6 Conduct real operation

- Combine the target motor with a load device that you want to drive actually and then start the operation, and then check whether the motor can provide a stable drive. The drive performance may be improved by conducting a parameter adjustment. For more details, see the following.
- For the adjustment of the high-speed (lowest frequency (switch) or higher), see also the descriptions of the synchronous starting mode.



Precautions for Correct Use

During the operation, do not change the following set parameters. The operation may go into destabilization.

- Open phase voltage detection gain [Hd-43]
- Minimum pulse width adjustment, SM(PMM)-IVMS [Hd-50]

| Phenomenon | Estimated cause(s) | Exemplar measures to be taken |
|--|---|--|
| Over current occurs at the start | <ul style="list-style-type: none"> • Insufficient starting torque • Misalignment of the output phases and the motor's magnetic-pole positions | <ul style="list-style-type: none"> • Enable the selection of open-phase switch threshold correction [Hd-44]. • Adjust each of the speed control P gain [Hd-45] and the speed control I gain [Hd-46] by 10 each time. The adjustment should be conducted so that $[Hd-45] \leq [Hd-46]$. Some motor characteristics require an adjustment by raising and lowering the settings. • Adjust the waiting time for open-phase switching [Hd-47] by incrementing it by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings. |
| At the start, the motor loses synchronization and no acceleration is observed. | | |
| Loss of synchronization, hunting, and/or over current occur at low speeds (at the lowest frequency(switch) or even lower). | <ul style="list-style-type: none"> • Insufficient torque • Misalignment of the output phases and the motor's magnetic-pole positions | <ul style="list-style-type: none"> • Enable the selection of open-phase switch threshold correction [Hd-44]. • Adjust each of the speed control P gain [Hd-45] and the speed control I gain [Hd-46] by 10 each time. The adjustment should be conducted so that $[Hd-45] \leq [Hd-46]$. Some motor characteristics require an adjustment by raising and lowering the settings. • Adjust the waiting time for open-phase switching [Hd-47] by incrementing it by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings. • Adjust by decrementing the current limit of IVMS threshold [Hd-51] by 5 each time. Some motor characteristics may provide instability with excessively small settings. • Adjust by decrementing the IVMS threshold gain [Hd-52] by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings. |
| Loss of synchronization, hunting, and/or over current occur at low speeds (at the lowest frequency(switch) or even lower) and with a heavy load. | | |
| The drive becomes unstable at low speeds (at the lowest frequency(switch) or even lower) | Misalignment of the output phases and the motor's magnetic-pole positions | <ul style="list-style-type: none"> • Adjust by decrementing the IVMS detection current filter gain [Hd-42] by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings. • Adjust the waiting time for open-phase switching [Hd-47] by incrementing it by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings. |

7-2-12 V/f Control with Sensor (Constant Torque Characteristics)

A motor with an encoder can be used with general-purpose characteristics of V/f control.

The feedback of the encoder signal from the motor allows highly accurate frequency control.

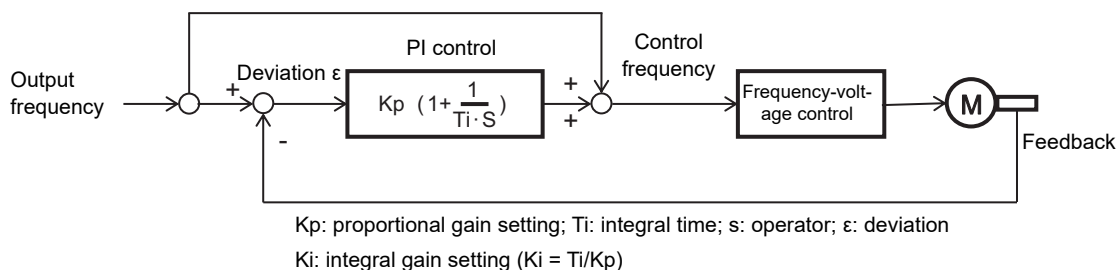
For the adjustment of V/f control (constant torque characteristics), see 7-2-1 V/f Control (Constant Torque Characteristics) on page 7-5.

In the V/f control with feedback (FB), a correction of PI control is conducted on the command frequency for the fed-back frequency to control the motor.



Precautions for Correct Use

- When [CA-90] = 02, Input terminals [A] and [B] are switched to the terminals for feedback control. When [CA-90] ≠ 02, terminals [EA] and [EB] of the PG option unit are enabled.
- See 7-2-16 Encoder Feedback Control on page 7-37.



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|--------------|--|--------------|
| Control mode selection, 1st-motor | [AA121] | 04 | To use V/f control with sensor (constant torque characteristics). | 00 |
| Slip Compensation P-gain with encoder, 1st-motor | [Hb170] | 0 to 1000(%) | This is the P gain for the slip compensation of control with sensor. | 100 |
| Slip Compensation I-gain with encoder, 1st-motor | [Hb171] | 0 to 1000(%) | This is the I gain for the slip compensation of control with sensor. | 100 |

| Phenomenon | Estimated cause(s) | Exemplar measures to be taken |
|--|--|--|
| The motor speed follows the command slowly. | Response of the output is slow and the change in the fed-back value is slow. | Increment the proportional (P) gain [Hb170]. |
| The motor operates unstably. Overshoot and/or hunting occur. | Response to the fed-back value is too quick. | Decrement the proportional (P) gain [Hb170]. |
| The motor speed oscillates gently. Stabilization of the operation requires a long time. | Response to the integral operation is slow. | Increment the integral (I) gain [Hb171]. |
| It takes time for the command value and the motor speed to be equal to each other. | Response of the output is slow and the change in the fed-back value is slow. | Decrement the integral (I) gain [Hb171]. |



Precautions for Correct Use

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current, or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-13 V/f Control with Sensor (Reducing Torque Characteristics)

V/F control is used to adjust the numbers of motor rotation to the command velocity while saving energy when a fan/pump with encoder is driven.

The feedback of the encoder signal from the motor allows highly accurate frequency control.

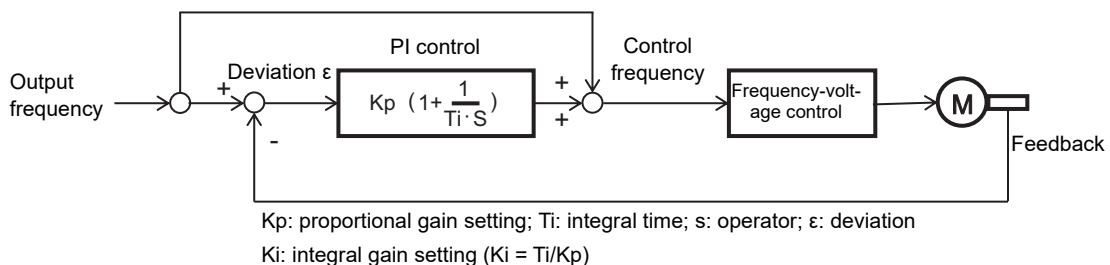
For the adjustment of V/f control (reducing torque characteristics), see 7-2-2 V/f Control (Reducing Torque Characteristics) on page 7-6.

In the V/f control with feedback (FB), a correction of PI control is conducted on the command frequency for the fed-back frequency to control the motor.



Precautions for Correct Use

- When [CA-90] = 02, Input terminals [A] and [B] are switched to the terminals for feedback control. When [CA-90] ≠ 02, terminals [EA] and [EB] of the PG option unit are enabled.
- See 7-2-16 Encoder Feedback Control on page 7-37.



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|--------------|--|--------------|
| Control mode selection, 1st-motor | [AA121] | 05 | To use V/f control with sensor (reducing torque characteristics). | 00 |
| Slip Compensation P-gain with encoder, 1st-motor | [Hb170] | 0 to 1000(%) | This is the P gain for the slip compensation of control with sensor. | 100 |
| Slip Compensation I-gain with encoder, 1st-motor | [Hb171] | 0 to 1000(%) | This is the I gain for the slip compensation of control with sensor. | 100 |

| Phenomenon | Estimated cause(s) | Exemplar measures to be taken |
|--|--|--|
| The motor speed follows the command slowly. | Response of the output is slow and the change in the fed-back value is slow. | Increment the proportional (P) gain [Hb170]. |
| The motor operates unstably. Overshoot and/or hunting occur. | Response to the fed-back value is too quick. | Decrement the proportional (P) gain [Hb170]. |
| The motor speed oscillates gently. Stabilization of the operation requires a long time. | Response to the integral operation is slow. | Increment the integral (I) gain [Hb171]. |
| It takes time for the command value and the motor speed to be equal to each other. | Response of the output is slow and the change in the fed-back value is slow. | Decrement the integral (I) gain [Hb171]. |



Precautions for Correct Use

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current, or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-14 Free V/f Control with Sensor

Free V/f control with sensor is used to change the frequency and voltage characteristics when a motor with an encoder is driven.

The feedback of the encoder signal from the motor allows highly accurate frequency control.

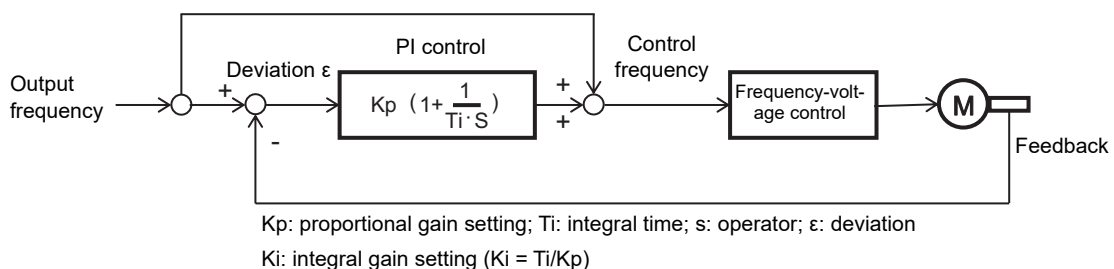
For the adjustment of V/f control (free V/f), see 7-2-3 V/f Control (Free V/f) on page 7-7.

In the V/f control with feedback (FB), a correction of PI control is conducted on the command frequency for the fed-back frequency to control the motor.



Precautions for Correct Use

- When [CA-90] = 02, Input terminals [A] and [B] are switched to the terminals for feedback control. When [CA-90] ≠ 02, terminals [EA] and [EB] of the PG option unit are enabled.
- See 7-2-16 Encoder Feedback Control on page 7-37.



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|--------------|--|--------------|
| Control mode selection, 1st-motor | [AA121] | 06 | To use V/f control with sensor (free V/f). | 00 |
| Slip Compensation P-gain with encoder, 1st-motor | [Hb170] | 0 to 1000(%) | This is the P gain for the slip compensation of control with sensor. | 100 |
| Slip Compensation I-gain with encoder, 1st-motor | [Hb171] | 0 to 1000(%) | This is the I gain for the slip compensation of control with sensor. | 100 |

| Phenomenon | Estimated cause(s) | Exemplar measures to be taken |
|--|--|--|
| The motor speed follows the command slowly. | Response of the output is slow and the change in the fed-back value is slow. | Increment the proportional (P) gain [Hb170]. |
| The motor operates unstably. Overshoot and/or hunting occur. | Response to the fed-back value is too quick. | Decrement the proportional (P) gain [Hb170]. |
| The motor speed oscillates gently. Stabilization of the operation requires a long time. | Response to the integral operation is slow. | Increment the integral (I) gain [Hb171]. |
| It takes time for the command value and the motor speed to be equal to each other. | Response of the output is slow and the change in the fed-back value is slow. | Decrement the integral (I) gain [Hb171]. |



Precautions for Correct Use

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current, or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-15 Automatic Torque Boost Control with Sensor

Automatic torque boost control is used when a motor with an encoder is driven; that require a certain torque at the start; and when the motor revolution speed needs to be equal to the command speed.

The feedback of the encoder signal from the motor allows highly accurate frequency control.

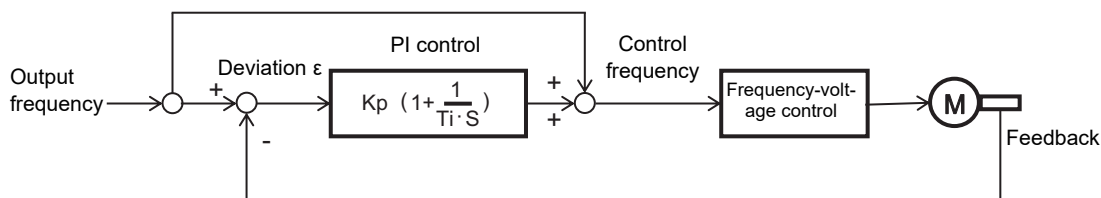
As for adjustment of the automatic torque boost control, refer to 7-2-6 Automatic Torque Boost on page 7-12.

In the V/f control with feedback (FB), a correction of PI control is conducted on the command frequency for the fed-back frequency to control the motor.



Precautions for Correct Use

- When [CA-90] = 02, Input terminals [A] and [B] are switched to the terminals for feedback control. When [CA-90] ≠ 02, terminals [EA] and [EB] of the feedback option RX2-PG01 are enabled.
- See 7-2-16 Encoder Feedback Control on page 7-37.



Kp: proportional gain setting; Ti: integral time; s: operator; ε: deviation
 Ki: integral gain setting (Ki = Ti/Kp)

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|--------------|--|--------------|
| Control mode selection, 1st-motor | [AA121] | 07 | To use the automatic torque boost with sensor. | 00 |
| Slip Compensation P-gain with encoder, 1st-motor | [Hb170] | 0 to 1000(%) | This is the P gain for the slip compensation of control with sensor. | 100 |
| Slip Compensation I-gain with encoder, 1st-motor | [Hb171] | 0 to 1000(%) | This is the I gain for the slip compensation of control with sensor. | 100 |

| Phenomenon | Estimated cause(s) | Estimated cause(s) Exemplar measures to be taken |
|--|--|--|
| The motor speed follows the command slowly. | Response of the output is slow and the change in the fed-back value is slow. | Increment the proportional (P) gain [Hb170]. |
| The motor operates unstably. Overshoot and/or hunting occur. | Response to the fed-back value is too quick. | Decrement the proportional (P) gain [Hb170]. |
| The motor speed oscillates gently. Stabilization of the operation requires a long time. | Response to the integral operation is slow. | Increment the integral (I) gain [Hb171]. |
| It takes time for the command value and the motor speed to be equal to each other. | Response of the output is slow and the change in the fed-back value is slow. | Decrement the integral (I) gain [Hb171]. |



Precautions for Correct Use

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current, or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-16 Encoder Feedback Control

In 3G3RX2 series, input of feedback from a motor into a control circuit terminal block of the main body or into a PG option unit allows the control with sensor and the absolute position control.



Precautions for Correct Use

- When [CA-90] ≠ 00, Input terminals [A] and [B] of the main body are switched to the terminals for feedback control.
- When [CA-90] = 02, the control with sensor and the absolute position control are possible with Input terminals [A] and [B].
- When [CA-90] ≠ 02, the control with sensor and the absolute position control are possible with terminals [EAP], [EBP], [EAN], and [EBN] of the PG option unit.
- To conduct the pulse train position control, terminals [SAP], [SBP], [SAN], and [SBN] of the PG option unit are used.
- When the PG option unit was once set in a slot and was removed later, a trip occurs with a feedback option connection error [E112].
- Trips are triggered by an encoder disconnection error [E100] by setting switches on the PG option unit. For more details, see 2-3-6 *Wiring for PG Option Unit* on page 2-63.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|-----------------|--|--------------|
| Encoder constant setting | [CA-81] | 0 to 65535(pls) | Setting the encoder constant | 1024 |
| Encoder position selection | [CA-82] | 00 | Phase-A is leading. | 00 |
| | | 01 | Phase-B is leading. | |
| Motor gear ratio Numerator | [CA-83] | 1 to 10000 | Setting the numerator of the gear ratio of a motor. | 1 |
| Motor gear ratio Denominator | [CA-84] | 1 to 10000 | Setting the denominator of the gear ratio of a motor. | 1 |
| Pulse train detection object selection | [CA-90] | 00 | PCNT function | 00 |
| | | 01 | Command | |
| | | 02 | Control with speed feedback | |
| | | 03 | Pulse count | |
| Mode selection of pulse train input | [CA-91] | 00 | MD0: 90-degree phase difference pulse train | 00 |
| | | 01 | MD1: Forward-backward rotation command + pulse train | |
| | | 02 | MD2: Forward-rotation pulse train + backward-rotation pulse train. | |
| Encoder constant setting | [ob-01] | 0 to 65535(pls) | Setting the encoder constant | 1024 |
| Encoder position selection | [ob-02] | 00 | Phase-A is leading. | 00 |
| | | 01 | Phase-B is leading. | |
| Motor gear ratio Numerator | [ob-03] | 1 to 10000 | Setting the numerator of the gear ratio of a motor. | 1 |
| Motor gear ratio Denominator | [ob-04] | 1 to 10000 | Setting the denominator of the gear ratio of a motor. | 1 |
| Pulse train detection object selection | [ob-10] | 00 | Command | 00 |
| | | 01 | Pulse train position command | |
| Mode selection of pulse train input | [ob-11] | 00 | MD0: 90-degree phase difference pulse train | 01 |
| | | 01 | MD1: Forward-backward rotation command + pulse train | |
| | | 02 | MD2: Forward-rotation pulse train + backward-rotation pulse train. | |

Encoder's Setting Table

| | Setting description | Terminals [A] and [B] of main body | Terminals [EAP], [EBP], [EAN], and [EBN] of PG Option Unit |
|-----|------------------------------|------------------------------------|--|
| (1) | Encoder constant setting | [CA-81] | [ob-01] |
| (2) | Encoder position selection | [CA-82] | [ob-02] |
| (3) | Motor gear ratio Numerator | [CA-83] | [ob-03] |
| (4) | Motor gear ratio Denominator | [CA-84] | [ob-04] |

Table (1)Encoder constant-setup sets up the actual number of pulses of the encoder based on the terminals to be used.

Table (2) encoder phase sequence selection is set up in accordance with the encoder's phase sequence.

When [CA-90] = 02, the main-body speed feedback is enabled while [CA-90] ≠ 02, PG option unit speed feedback is enabled.



Precautions for Correct Use

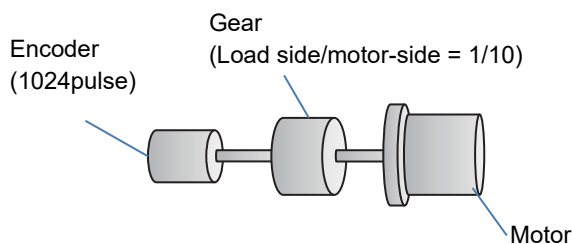
- When either [CA-82] or [ob-02] = 00, meaning that phase-A is leading, and when the operation is of forward rotation, the phase of the phase-A advances 90-degrees more than that of the phase-B in a normal case.
- When either [CA-82] or [ob-02] = 01, meaning that phase-B is leading, and when the operation is of forward rotation, the phase of the phase-B advances 90-degrees more than that of the phase-A in a normal case.
- To check if the encoder input into the main body or into PG option unit is correct, set [AA121] = 00 to 03, meaning V/f control (00), and check the monitor for the [dA-08] frequency detection values. The wiring is correct if the forward operation [FW] has a positive (+) value and if the reversal operation [RV] has a negative (-) value. If it is incorrect, either revising the wiring or switching the Encoder position selection [CA-82] or [ob-02].

Adjustment in Cases Where a Gear Exists between the Motor and the Encoder

When the encoder and the motor shaft are connected to each other by means of a gear, for Tables (3) and (4) conversion is made possible by setting up (3) Encoder gear-ratio's numerator/(4) encoder gear-ratio's denominator.

Set the values ((3)/(4)) so as to be within a range between (1/50) to (20).

An exemplar case where a gear is attached there.



When the encoder's rotating rate for the motor's standard encoder becomes 1/10 for 1024 pulses,

Table (1) Encoder constant set-up: 1024 pulses

Table (3): Encoder's gear ratio's numerator: 1.

Table (4): Encoder's gear ratio's denominator: 10

Set up as above.

Encoder's Speed Detection

To acquire the frequency that was input through the encoder, the following settings are necessary.

- Set-up of Tables (1), (3), and (4)
- Set-up of the number of motor poles

Note When the selected control mode [AA121] is the induction motor control ([AA121] = 00 to 10), async.Motor poles setting, 1st-motor [Hb103] is set as the number of motor poles.

Set-up of Functions of the Encoder Feedback

1 Check the encoder's set-up from the encoder's specifications.

(1) Check the encoder's or the pulse trains' input specs.

(2) Open collector input

Control using main body's terminals [A] and [B]
→ Set [CA-90] = 02.

(3) Line driver input

Control using PG option unit [EAP], [EAN], [EBP],
and [EBN]
→ Check that [CA-90] ≠ 02.

2 Set up the control method.

(1) Check whether the speed control or the position control is to be conducted with the control with sensor.

(2) Conduct the speed control with sensor.

In accordance with the mode to be used, select one of the following three controls:

- V/f control with sensor ([AA121] = 04 to 06)
- Automatic boost with sensor ([AA121] = 07)
- Vector control with sensor ([AA121] = 10)

(see, 7-1 Overview of Motor Control Methods on page 7-3)

Note When [AA121] = 10, the vector control mode selection [AA123] = 00.

(3) Conduct the absolute position control.

Select the vector control with sensor ([AA121] = 10), and set as the vector control mode selection [AA123] either

- 02: Absolute position control; or
- 03: High-resolution absolute position control
(See, 8-4-9 Absolute Position Control on page 8-108)

Check Pulse Train Input Setting

This section describes a procedure for check of pulse train input setting shown in the following table.

The following table lists a function where a function of inputting the related pulse train into the main body's terminals [A] and [B], and into the PG option unit terminals: [EAP], [EAN], [EBP], [EBN], [SAP], [SAN], [SBP], and [SBN].

| Function to be used | Setting check | For pulse-train input |
|----------------------------------|---|--|
| Speed control with sensor | <p>Necessary settings</p> <ul style="list-style-type: none"> Control with sensor ([AA121] = 04 to 07) or Vector control with sensor ([AA121] = 10 and [AA123] = 00) Selection of target for pulse train input detection ([CA-90], See the right-hand side.) <p>Related section 7-1 Overview of Motor Control Methods on page 7-3</p> | |
| Speed-torque control with sensor | <p>Necessary settings</p> <ul style="list-style-type: none"> Vector control with sensor ([AA121] = 10 and [AA123] = 00) Selection of target for pulse train input detection ([CA-90], See the right-hand side.) <p>Related section 7-2-10 Vector Control with Sensor on page 7-19 7-3 Torque Control on page 7-43</p> | <ul style="list-style-type: none"> Input into main body's terminals [A] and [B] ([CA-90] = 02) Input into PG option unit terminals [EAP], [EAN], [EBP], and [EBN] ([CA-90] ≠ 02). |
| Absolute position control | <p>Necessary settings</p> <ul style="list-style-type: none"> Vector control with sensor ([AA121] = 10 and [AA123] = 02, or [AA121] = 10 and [AA123] = 03) Selection of target for pulse train input detection ([CA-90], See the right-hand side.) <p>Related section 7-2-10 Vector Control with Sensor on page 7-19 8-4-9 Absolute Position Control on page 8-108</p> | |
| Pulse train position control | <p>Necessary settings</p> <ul style="list-style-type: none"> Vector control with sensor ([AA121] = 10 and [AA123] = 01) Pulse train input SA/SB ([ob-10] = 01) <p>Related section 8-4-7 Pulse Train Position Control on page 8-99</p> | <ul style="list-style-type: none"> To input PG option unit terminals [SAP], [SAN], [SBP], and [SBN]. The following items can be used for the motor's vector control. Input into main body's terminals [A] and [B] ([CA-90] = 02) Input into PG option unit terminals [EAP], [EAN], [EBP], and [EBN] ([CA-90] ≠ 02). |

| Function to be used | Setting check | For pulse-train input |
|--|--|---|
| Pulse train frequency command (main body) | Necessary settings <ul style="list-style-type: none"> • Frequency command ([AA101] = 12) • Selection of target for pulse train input detection ([CA-90] = 01) Related section <i>6-4-5 Case where Command Is Given through Input of Pulse String on page 6-28</i> | Input into main body's terminals [A] and [B]. |
| Pulse train frequency command (PG Option Unit) | Necessary settings <ul style="list-style-type: none"> • Frequency command ([AA101] = 13) • Pulse train input SA/SB ([ob-10] = 00) Related section <i>6-4-5 Case where Command Is Given through Input of Pulse String on page 6-28</i> | To input PG option unit terminals [SAP], [SAN], [SBP], and [SBN]. |
| Pulse count | Necessary settings Selection of target for pulse train input detection ([CA-90] = 03) Related section <i>8-10-6 Pulse Count Function on page 8-167</i> | Input into main body's terminals [A] and [B]. |

7-3 Torque Control

7-3-1 Speed Control and Torque Control

The followings show methods to control the motor's torque.

- Speed control: A method of output control by having the motor speed follow a certain frequency command and sending torque at a certain speed, and
- A method of output control with change of speed so that output torque follows a certain command torque.

In the case of controlling by torque command, 08: Sensorless vector control and 10: Sensor vector control need to be selected in the [AA121] control method.

The torque limit function in speed control can be used for 08: Sensorless vector control and 09: Sensorless vector control in the zero speed area and 10: Sensor vector control in the [AA121] control method. In the zero speed area of 09: Sensorless vector control in the zero speed area, however, control to send torque is prioritized.

| Item | Speed control | Torque control |
|----------------|---|--|
| Control target | Control is done to maintain the motor speed per frequency command. | Control is done to output the motor torque per torque command. |
| Operation | Output will be controlled to maintain the speed when loading is changed. If loading becomes bigger, control will be done to send a larger torque. When loading becomes smaller, control will be done to send a smaller torque. | When loading is changed, output will be controlled to maintain the torque. If loading becomes bigger, control will be done to maintain the torque by raising the speed, etc. If loading becomes smaller, control will be done to maintain the torque by slowing the speed, etc. |

7-3-2 Control Gain Switching Function

Control gain switching function is used when the motor's response is changed and when the gain is switched according to speed.

In the control gain switch function, two types of PI gains are switched and applied by turning ON and OFF the input terminal function [CAS].

In the gain mapping function to be switched by setting, setting multiple control gains corresponding to the speed can change the gain with the speed change.

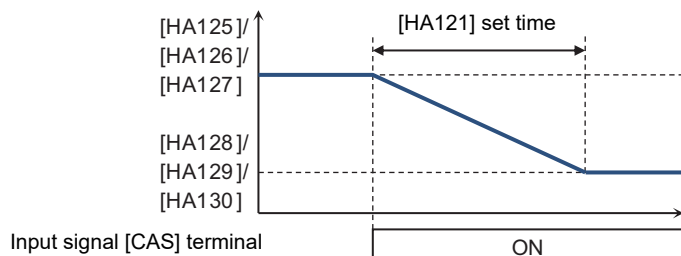


Precautions for Correct Use

- If switching is done by the [PPI] terminal when the control gain mapping function is used, [HA130] of gain mapping P control P gain 2 will be applied.
- In the case of using this function, sensorless vector control, sensorless vector control in the zero speed area, and sensor vector control need to be selected in the [AA121] control method.
- In the case of using this function in SM (PMM) control, P gain is adopted.

Control gain switching function [HA120] = 00

You can switch gains from/to [HA125][HA126] to/from [HA128][HA129] by selecting 063[CAS] Switching of control gain to the input terminal function and turning OFF/ON the signal.

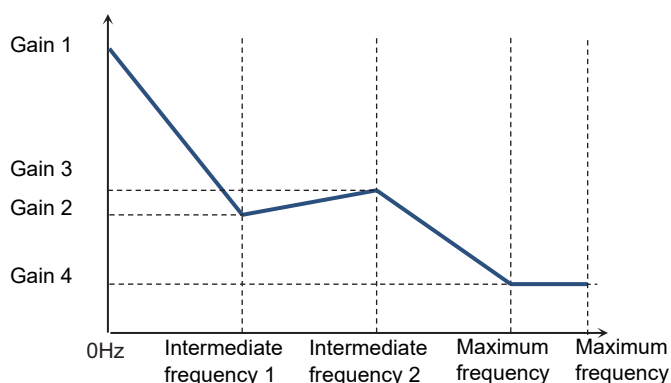


The gains to be applied by switching of the [CAS] terminal are as follows.

| Terminal function | [PPI]OFF | [PPI]ON |
|-------------------|--|----------------------------|
| [CAS]OFF | PI control P gain 1 [HA125] PI control I gain 1 [HA126] | P control P gain 1 [HA127] |
| [CAS]ON | PI control P gain 2 [HA128] PI control P gain 2 [HA129] | P control P gain 2 [HA130] |

Gain mapping function [HA120] = 01

This function switches gains to the arranged settings according to the speed.



The gains to be applied by switching of the control gain mapping function are as follows.

| Speed | Applied gain | [PPI] Off | [PPI] On |
|--------------------------|--------------|--|----------------------------|
| Zero Hz | Gain 1 | PI control P gain 1 [HA125] PI control I gain 1 [HA126] | P control P gain 1 [HA127] |
| Intermediate frequency 1 | Gain 2 | PI control P gain 2 [HA128] PI control P gain 2 [HA129] | P control P gain 2 [HA130] |
| Intermediate frequency 2 | Gain 3 | PI control P gain 3 [HA131] PI control I gain 3 [HA132] | |
| Maximum frequency | Gain 4 | PI control P gain 4 [HA133] PI control I gain 4 [HA134] | |

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|--------------------|--------------------|---|--------------|
| ASR gain switching mode selection, 1st-motor | [HA120] | 00 | Switches gain 1 and 2 by the [CAS] terminal. | 00 |
| | | 01 | Switches by speed based on the setting. | |
| ASR gain switching time setting, 1st-motor | [HA121] | 0 to 10000(ms) | Switches the gain over the set time when [CAS] gain is switched. | 100 |
| ASR gain mapping intermediate speed 1, 1st-motor | [HA122] | 0.00 to 590.00(Hz) | Is a frequency for which the control gain 2 of the gain mapping function is applied. | 0.00 |
| ASR gain mapping intermediate speed 2, 1st-motor | [HA123] | 0.00 to 590.00(Hz) | Is a frequency for which the control gain 3 of the gain mapping function is applied. | 0.00 |
| ASR gain mapping Maximum speed, 1st-motor | [HA124] | 0.00 to 590.00(Hz) | Is a frequency for the control gain 4 of the gain mapping function. | 0.00 |
| ASR gain mapping P-gain 1, 1st-motor | [HA125] | 0.0 to 1000.0(%) | Sets the P gain of PI control when the [CAS] terminal is OFF or the gain mapping is at zero speed. | 100.0 |
| ASR gain mapping I-gain 1, 1st-motor | [HA126] | 0.0 to 1000.0(%) | Sets the I gain of PI control when the [CAS] terminal is OFF or the gain mapping is at zero speed. | 100.0 |
| ASR gain mapping P-gain 1 at P-control, 1st-motor | [HA127] | 0.0 to 1000.0(%) | Sets the P gain of P control when the [CAS] terminal is OFF or the gain mapping is at zero speed. | 100.0 |
| ASR gain mapping P-gain 2, 1st-motor | [HA128] | 0.0 to 1000.0(%) | Sets the P gain of PI control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1. | 100.0 |
| ASR gain mapping I-gain 2, 1st-motor | [HA129] | 0.0 to 1000.0(%) | Sets the I gain of PI control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1. | 100.0 |
| ASR gain mapping P-gain 2 at P-control, 1st-motor | [HA130] | 0.0 to 1000.0(%) | Sets the P gain of P control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1. | 100.0 |
| ASR gain mapping P-gain 3, 1st-motor | [HA131] | 0.0 to 1000.0(%) | Sets the P gain of PI control when the gain mapping intermediate speed is at 2. | 100.0 |
| ASR gain mapping I-gain 3, 1st-motor | [HA132] | 0.0 to 1000.0(%) | Sets the I gain of PI control when the gain mapping intermediate speed is at 2. | 100.0 |
| ASR gain mapping P-gain 4, 1st-motor | [HA133] | 0.0 to 1000.0(%) | Sets the P gain of PI control at the gain mapping maximum speed. | 100.0 |
| ASR gain mapping I-gain 4, 1st-motor | [HA134] | 0.0 to 1000.0(%) | Sets the I gain of PI control at the gain mapping maximum speed. | 100.0 |
| Control gain switch | [CA-01] to [CA-11] | 064 | Switches gains by the [CAS] terminal. | - |
| PPI control switch | | 063 | Switches PI control and P control by the [CAS] terminal. | |

7-3-3 P/PI Switching Function

This switches the control gain (ASR gain) of motor control from Proportional Integral (PI) control to Proportionality (P) control.

When the motor control is switched from Proportional Integral (PI) Control to Proportionality (P) Control, the whole gain of a speed control loop lowers. That may control vibration, etc.

You can switch from/to PI control to/from P control by selecting 062[PPI] Switching of PPI control and turning OFF/ON the signal.

Use the following formula when calculating P control P gain.

$$(P \text{ control P gain}) = \frac{10}{(\text{Speed fluctuation ratio})} (\%)$$

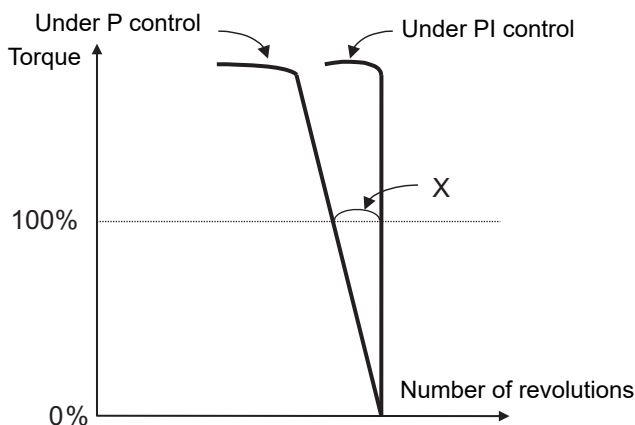
The relationship between speed fluctuation ratio and speed tolerance is calculated based on the following schematic formula.

$$(\text{Speed fluctuation ratio}) = \frac{\text{Speed tolerance at the rated torque } X(\text{min}^{-1})}{\text{Synchronous rotation at the base speed } (\text{min}^{-1})} \times 100\%$$



Precautions for Correct Use

In the case of using this function, [AA121] control method, sensorless vector control, sensorless vector control in the zero speed area, and sensor vector control need to be selected.



Control gain switching function [HA120] = 00

| Terminal function | [PPI]OFF | [PPI]ON |
|-------------------|--|----------------------------|
| [CAS]OFF | PI control P gain 1 [HA125] PI control I gain 1 [HA126] | P control P gain 1 [HA127] |
| [CAS]ON | PI control P gain 2 [HA128] PI control P gain 2 [HA129] | P control P gain 2 [HA130] |

Control gain switching function [HA120] = 01

| Speed | Applied gain | [PPI] Off | [PPI] On |
|--------------------------|--------------|--|----------------------------|
| 0Hz | Gain 1 | PI control P gain 1 [HA125] PI control I gain 1 [HA126] | P control P gain 1 [HA127] |
| Intermediate frequency 1 | Gain 2 | PI control P gain 2 [HA128] PI control P gain 2 [HA129] | P control P gain 2 [HA130] |
| Intermediate frequency 2 | Gain 3 | PI control P gain 3 [HA131] PI control I gain 3 [HA132] | |
| Maximum frequency | Gain 4 | PI control P gain 4 [HA133] PI control I gain 4 [HA134] | |

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|--------------------|---|--------------|
| ASR gain switching mode selection, 1st-motor | [HA120] | 00 | Switches gain 1 and 2 by the [CAS] terminal. | 00 |
| | | 01 | Switches by speed based on the setting. | |
| ASR gain switching time setting, 1st-motor | [HA121] | 0 to 10000(ms) | Switches the gain over the set time when [CAS] gain is switched. | 100 |
| ASR gain mapping intermediate speed 1, 1st-motor | [HA122] | 0.00 to 590.00(Hz) | Is speed for which the control gain 2 of the gain mapping function is applied. | 0.00 |
| ASR gain mapping intermediate speed 2, 1st-motor | [HA123] | 0.00 to 590.00(Hz) | Is speed for which the control gain 3 of the gain mapping function is applied. | 0.00 |
| ASR gain mapping Maximum speed, 1st-motor | [HA124] | 0.00 to 590.00(Hz) | Is speed for which the control gain 4 of the gain mapping function is applied. | 0.00 |
| ASR gain mapping P-gain 1, 1st-motor | [HA125] | 0.0 to 1000.0(%) | Sets the P gain of PI control when the [CAS] terminal is OFF or the gain mapping is at zero speed. | 100.0 |
| ASR gain mapping I-gain 1, 1st-motor | [HA126] | 0.0 to 1000.0(%) | Sets the I gain of PI control when the [CAS] terminal is OFF or the gain mapping is at zero speed. | 100.0 |
| ASR gain mapping P-gain 1 at P-control, 1st-motor | [HA127] | 0.0 to 1000.0(%) | Sets the P gain of P control when the [CAS] terminal is OFF or the gain mapping is at zero speed. | 100.0 |
| ASR gain mapping P-gain 2, 1st-motor | [HA128] | 0.0 to 1000.0(%) | Sets the P gain of PI control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1. | 100.0 |
| ASR gain mapping I-gain 2, 1st-motor | [HA129] | 0.0 to 1000.0(%) | Sets the I gain of PI control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1. | 100.0 |
| ASR gain mapping P-gain 2 at P-control, 1st-motor | [HA130] | 0.0 to 1000.0(%) | Sets the P gain of P control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1. | 100.0 |
| ASR gain mapping P-gain 3, 1st-motor | [HA131] | 0.0 to 1000.0(%) | Sets the P gain of PI control when the gain mapping intermediate speed is at 2. | 100.0 |
| ASR gain mapping I-gain 3, 1st-motor | [HA132] | 0.0 to 1000.0(%) | Sets the I gain of PI control when the gain mapping intermediate speed is at 2. | 100.0 |
| ASR gain mapping P-gain 4, 1st-motor | [HA133] | 0.0 to 1000.0(%) | Sets the P gain of PI control at the gain mapping maximum speed. | 100.0 |
| ASR gain mapping I-gain 4, 1st-motor | [HA134] | 0.0 to 1000.0(%) | Sets the I gain of PI control at the gain mapping maximum speed. | 100.0 |

| Item | Parameter | Data | Description | Default data |
|---------------------|--------------------|------|--|--------------|
| Control gain switch | [CA-01] to [CA-11] | 064 | Switches gains by the [CAS] terminal. | - |
| PPI control switch | | 063 | Switches PI control and P control by the [CAS] terminal. | |

7-3-4 Torque Limit Function

This limits torque when the speed is controlled. Contact positioning control, etc. can limit the torque increase.

In the case of using [AA121] control method, sensorless vector control, sensorless vector control in the zero speed area, and sensor vector control, this limits output torque of the motor. However, when Zero-Hz range sensorless vector control is used, the control to output the torque is prioritized within a Zero-Hz range.

Speed control/position control/torque control are enabled.

The torque limit function is set in [bA110].

When a torque limiting signal is selected in output selection, the output terminal 022 [TRQ] torque limiting signal will be turned ON once the torque limit function above starts operation.



Precautions for Correct Use

- If the torque limiting function [TL] is set to an input terminal, the torque limit function set to [bA110] will be enabled, only when [TL] is turned ON. When it is OFF, the torque limit setting will be disabled and the torque limit value will be the maximum value.
- If the torque limiting function [TL] is not set to an input terminal, the torque limit function set to the torque limit selection [bA110] will be enabled constantly.
- To calculate the motor rated torque (100%) in this function, use the following formula.

Motor rated torque = $79.58 \times \text{Motor capacity} \times \text{Number of poles} / \text{Base frequency}$

Example: Motor rated torque = $79.58 \times 5.5 \text{ (kW)} \times 4 \text{ (P)} / 50 \text{ (Hz)} \approx 35 \text{ Nm}$

Therefore, the output torque varies depending on the combined motor. Note that it is not the absolute value of torque.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--|------------------|--|--------------|
| Torque limit selection, 1st-motor | [bA110] | 00 to 11 | 00 (Disable/01)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3) | 07 |
| Torque limit parameter mode selection, 1st-motor | [bA111] | 00 | Four Quadrant specific | 00 |
| | | 01 | [TRQ] terminal switch | |
| Torque limit 1 Torque limit 2 Torque limit 3 Torque limit 4 | [bA112] [bA113] [bA114] [bA115] | 0.0 to 500.00(%) | The torque limit function will operate when output torque exceeds this set value. | 150.0 |

● Input Terminal Function [CA-01] to [CA-11]

| Item | Terminal name | Data | Description |
|----------------------------|---------------|------|---|
| Validation of torque limit | [TL] | 060 | Switches enable/disable of the torque limit function. |
| Torque limit switchover 1 | [TRQ1] | 061 | Is the torque limit command switch terminal 1. |
| Torque limit switchover 2 | [TRQ2] | 062 | Is the torque limit command switch terminal 2. |

● Output Terminal [CC-01] to [CC-07]

| Item | Terminal name | Data | Description |
|--------------------------|---------------|------|--|
| During torque limitation | [TRQ] | 022 | Signal turns ON when the torque limit function is enabled. |

(a) Analog input mode

It is a mode to set a torque limit value in all operation states by applied voltage/current by setting the Ai1/Ai2/Ai3 terminal on the control terminal block in the torque limit selection [bA110].

In the case of setting torque bias, values corresponding to analog input are as follows.

- Input to Ai1/Ai2 Terminal

0 to 10 (V)/0 to 20 (mA) corresponding value

Torque command addition 0.0 to 500.0(%)

- Input to Ai3 Terminal

-10 to 10 (V) corresponding value

Torque command addition -500.0 to 500.0(%)

The setting of the ratio above can be changed by adjusting the analog input start end function. See 8-10-5 *Analog Input* on page 8-163.

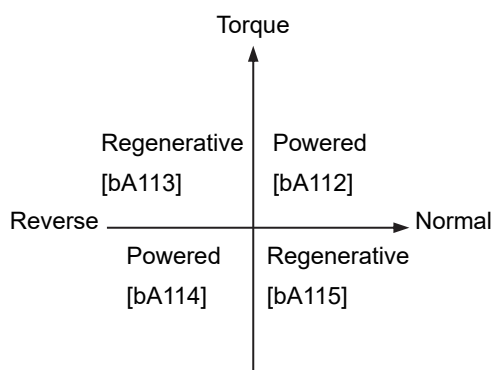
(e.g.) In the case of setting 0.0 to 50.0% to the torque command addition value for 0-10 (V)/0-20 (mA) input as [Ai1], set 10.0% for [Cb-04] to make it 50.0% against maximum 500.0%. ([Cb-03]=0.0,[Cb-04]=10.0,[Cb-05]=0.0,[Cb-06]=100.0)

(b) 4 Quadrant specific setting mode

It is a mode to set respective torque limits 1 to 4 ([bA112] to [bA115]) in the four quadrants of normal powered, normal regenerative, reverse powered, and reverse regenerative.

It will be enabled when torque limit selection [bA110] = 07 (parameter setting) and torque limit mode selection [bA111] = 00 (by each quadrant).

The relationship of four quadrants and torque limits is shown in the figure below.

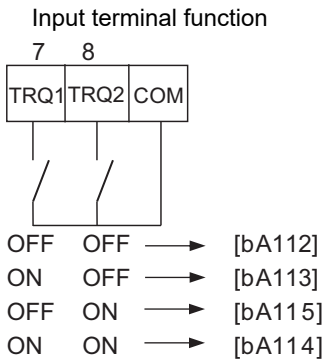


(c) Terminal switch mode

Set values of torque limits 1 to 4 ([bA112] to [bA115]) in all operation states are enabled by the combination of torque limit switch terminals 1 and 2 (TRQ1, TRQ2) set to the input terminal.

When torque limit selection [bA110] = 07 (parameter setting) or torque limit mode selection [bA111] = 01 ([TRQ] terminal switch) is selected, torque limit 1 to 4 that can be switched by switching the torque limit switch 1/2 assigned to the input terminal will be set as shown in the figure on the right.

(e.g.) When the 061 [TRQ1] torque limit switch 1 is assigned to the input terminal 7 and the 062 [TRQ2] torque limit switch 2 to the input terminal 8



Torque LAD Stop Function

This function is used to stop the limit acceleration/deceleration function (LAD) temporarily when the torque limit function is operated.

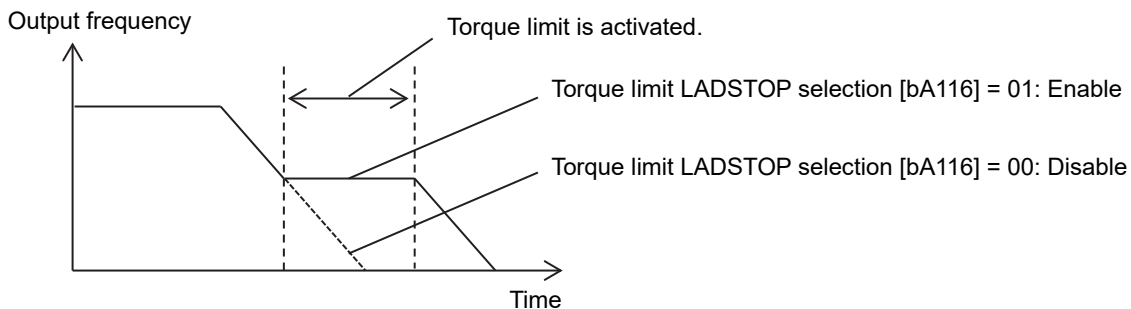
When the torque limit is operated, the frequency command is temporarily held. On the other hand, when the torque limit is reset, the held frequency command is resumed.

To stabilize the motor operation after torque limit is reset, set this function enabled.

This function operates only during the deceleration on the speed control.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|------|--|--------------|
| Torque limit LAD-STOP selection, 1st-motor | [bA116] | 00 | Disable | 00 |
| | | 01 | Enable: retains frequency information when the torque limit is switched. (at the time of deceleration operation) | |



Over Torque Signal Output

The output terminal 019 [OTQ] over torque signal will be turned ON when the output torque monitor [dA-17] exceeds [CE120] to [CE123].

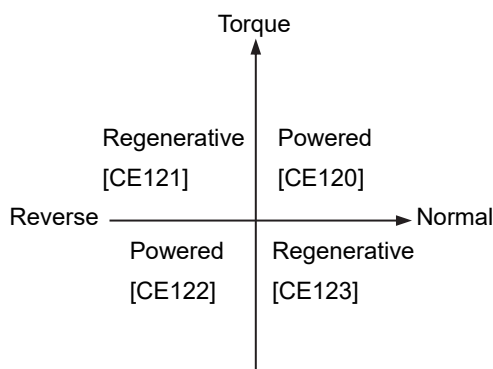
In the case of using as an under torque signal, output will be feasible when the output terminal a/b [NO/NC] setting [CC-11] to [CC-17] corresponding to the output terminal function [CC-01] to [CC-07] assigned with 019 [OTQ] is switched from 00 to 01.

To calculate the motor rated torque (100%) in this function, use the following formula.

Motor rated torque = $79.58 \times \text{Motor capacity} \times \text{Number of poles/Base frequency}$

Example: Motor rated torque = $79.58 \times 5.5 \text{ (kW)} \times 4 \text{ (P)}/50 \text{ (Hz)} \approx 35 \text{ Nm}$

This level is used when you detect lift excessive high load.



● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|-----------------|---|--------------|
| Over torque level (Forward driving), 1st motor | [CE120] | 0.0 to 500.0(%) | Turns On the [OTQ] output terminal function when the output torque exceeds respective levels. | 100.0 |
| Over torque level (Reverse regenerative), 1st motor | [CE121] | | | |
| Over torque level (Reverse driving), 1st motor | [CE122] | | | |
| Over torque level (Forward regenerative), 1st motor | [CE123] | | | |

● Output Terminal [CC-01] to [CC-07]

| Item | Terminal name | Data | Description |
|------------------|---------------|------|--|
| Excessive torque | [OTQ] | 019 | A signal turns ON when it exceeds the over torque level. |

Torque Limit Value Monitor

You can check the torque limit value switched by selection on the [dA-16] torque limit monitor.

● Parameter

| Item | Parameter | Data | Description | Default data |
|-----------------------|-----------|----------------------|--|--------------|
| Torque limit monitor | [dA-16] | 0 to 500.0(%) | Displays the limit value of the torque limit function. | - |
| Output torque monitor | [dA-17] | -1000.0 to 1000.0(%) | Displays the output torque. | - |



Precautions for Correct Use

Torque limit monitor cannot operate the monitoring function in the following cases:

- When setting bA110 to 00 (Disabled)
- With TL allocation, TL=OFF (deactivate by TL terminals)
- When setting bA110 to 07 (Parameter setting) and bA111 to 00 (Four quadrant specific)

7-3-5 High-torque Multi-operation Control

When high-torque multi-operation is carried out, connect an inverter to two motors with the same specification to complete sensorless vector control (IM). That enables an output of high torque.

Motor constant needs to be set as follows.



Precautions for Correct Use

- In the case of operating different loads on two motors, the load fluctuation on one motor may influence the operation status of the other and cause inappropriate control. Make sure to operate them with a load that can be considered as one load.
- See 7-1 Overview of Motor Control Methods on page 7-3 for adjustment method.

● Motor Base Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|---------------------|---|--|
| Async.Motor capacity setting, 1st-motor | [Hb102] | 0.01 to 160.00 (kW) | Sets a 2-fold capacity of a motor in high torque multi-operation. | Varies depending on inverter models and settings of duty rating. |
| Async.Motor poles setting, 1st-motor | [Hb103] | 2 to 48 (poles) | Sets the number of poles per motor. | 4 |
| Async.Motor Base frequency setting, 1st-motor | [Hb104] | 1.00 to 590.00 (Hz) | Sets the base frequency per motor. | 50.00 ^{*1} |
| Async.Motor Maximum frequency setting, 1st-motor | [Hb105] | 1.00 to 590.00 (Hz) | Sets the maximum frequency per motor. | 50.00 |
| Async.Motor rated voltage, 1st-motor | [Hb106] | 1 to 1000 (V) | Sets the rated voltage per motor. | 200V: 230 ^{*1} 400V: 400 ^{*1} |

| Item | Parameter | Data | Description | Default data |
|--------------------------------------|-----------|---------------------|--|--|
| Async.Motor rated current, 1st-motor | [Hb108] | 0.01 to 10000.00(A) | Sets a 2-fold rated current of a motor in high torque multi-operation. | Varies depending on inverter models and settings of duty rating. |

*1. Default data when default data selection (UB-02) is set to 01.

● IM Motor Constant Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|--|---|--|
| Async.Motor constant R1, 1st-motor | [Hb110] | 0.000001 to 1000.000000 (Ω) | Sets half of primary resistance of a motor in high torque multi-operation. | Varies depending on inverter models and settings of duty rating. |
| Async.Motor constant R2, 1st-motor | [Hb112] | 0.000001 to 1000.000000 (Ω) | Sets half of secondary resistance of a motor in high torque multi-operation. | |
| Async.Motor constant L, 1st-motor | [Hb114] | 0.000001 to 1000.000000 (mH) | Sets half of leaked inductance value of a motor in high torque multi-operation. | |
| Async.Motor constant I ₀ , 1st-motor | [Hb116] | 0.01 to 10000.00(A) | Sets a 2-fold non-load current value of a motor in high torque multi-operation. | |
| Async.Motor constant J, 1st-motor | [Hb118] | 0.00001 to 10000.00000 (kgm ²) | Sets a 2-fold system inertia moment of a motor in high torque multi-operation. | |

● Parameter

| Item | Parameter | Data | Description | Default data |
|-----------------------------------|-----------|---|--|--------------|
| Control mode selection, 1st-motor | [AA121] | 08: Sensorless vector control (IM) 09: Sensorless vector control in zero speed area (IM) ^{*1} | Uses the sensorless vector control function or sensorless vector control in the zero speed area. | 00 |

*1. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 00 (VLD).

7-3-6 Torque Bias Function

This function is used when torque command values are increased during the operation start and the lifting.

The torque bias function operates by enabling torque bias mode selection at the time of speed control.

The torque bias function will be enabled when the [AA121] control method is set to the sensorless vector control, sensorless vector control in the zero speed area, and sensor vector control.

The torque bias function operates in either speed control or torque control.

When the 068 [TBS] torque bias enable function is set to the input terminal, the torque bias function will be enabled, only when [TBS] is turned ON. When it is OFF, the torque bias setting will be disabled and the torque addition will be 0.

In the torque bias function, switching forward/reverse can switch the adding direction.

(a) When it is per the sign $[\pm]$ of [Ad-14] = 00

Regardless of the operation direction, torque will be added to the forward direction, when the torque bias value is (+), and to the reverse direction, when the torque bias is (-).

(b) When it is dependent on the operation direction [Ad-14] = 01

The sign of torque bias value and the direction of action of torque bias change based on the direction of operation command.

Forward command: Adds torque in the same direction as the torque bias value.

Reverse command: Adds torque in the reverse direction as the torque bias value.



Precautions for Correct Use

- The torque bias function increases the current because torque command is added.
- In the case of setting torque bias, values corresponding to analog inputs are as follows.
 - Input to Ai1/Ai2 Terminal

0 to 10 (V)/0 to 20 (mA) corresponding value

Torque command addition 0.0 to 500.0(%)

- Input to Ai3 Terminal

-10 to 10 (V) corresponding value

Torque command addition -500.0 to 500.0(%)

- The setting of the ratio above can be changed by adjusting the analog input start end function.

See 8-10-5 *Analog Input* on page 8-163.

(e.g.) In the case of setting 0.0 to 50.0% to the torque command addition value for 0-10 (V)/0-20 (mA) input as [Ai1], set 10.0% for [Cb-04] to make it 50.0% against maximum 500.0%. ([Cb-03]=0.0,[Cb-04]=10.0,[Cb-05]=0.0,[Cb-06]=100.0)

Torque Bias Command Value Monitor

Commanded torque bias value can be monitored on the [FA-16] torque bias monitor.

In the case of [Ad-11] = 07, the setting can be changed on the [FA-16] monitor.

The torque command monitor (after calculation) [dA-15] displays the value with torque bias added to the current torque command.

To calculate the motor rated torque (100%) in this function, use the following formula.

Motor rated torque = $79.58 \times \text{Motor capacity} \times \text{Number of poles} / \text{Base frequency}$

Example: Motor rated torque = $79.58 \times 5.5 \text{ (kW)} \times 4 \text{ (P)} / 50 \text{ (Hz)} \approx 35 \text{ Nm}$

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|--------------------------------------|---|--------------|
| Torque bias input source selection | [Ad-11] | 00 to 13,15 | 00 (Disable)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/ 11 (Option 3)/ 12 (Pulse train input: main unit)/ 13 (Pulse train input: Option)/ 15 (PID calculation) | 00 |
| Torque bias value setting | [Ad-12] | -500.0 to 500.0(%) | Adds a torque addition amount. | 0.0 |
| Polarity selection for torque bias | [Ad-13] | 00 (Per sign) | Regardless of the operation direction, torque will be added to the forward direction, when the value is (+), and to the reverse direction, when the the value is (-). | 00 |
| | | 01 (Follow the revolution direction) | Torque bias [Ad-12] is applied to the operation direction when (+), and applied to the reverse direction when (-). | |
| Terminal [TBS] active | [Ad-14] | 00 | Disable | 00 |
| | | 01 | Enable | |
| Torque bias monitor | [FA-16] | -500.00 to 500.00(%) | Is the torque bias set monitor. | - |
| Torque command monitor after calculation | [dA-15] | -500.00 to 500.00(%) | Is the torque command monitor calculated set value and bias value. | - |
| Input terminal function | [CA-01] to [CA-11] | 068 | [TBS]: Can switch enable/disable of bias by the terminal ON/OFF switch when [TBS] is assigned and [Ad-11] = 01. ON: Enable/OFF: Disable | - |

7-3-7 Switching Function of Torque Control/Speed Control (ATR)

This function is used so that speed control and torque control are switched with contact positioning control, etc.

When turning on the input terminal function 067 [ATR] terminal, the motor is controlled by torque, and when turning off, the motor is controlled by speed.



Precautions for Correct Use

If the torque command changes in a step manner when switching from speed control to torque control, the current may rise instantaneously.

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|---------------|---|--------------|
| Switching time of Speed control to Torque control | [Ad-04] | 0 to 1000(ms) | This function is used to switch the speed control to the torque control moderately in accordance with the set time. | 100 |

Input Terminal Function

| Item | Parameter | Data | Description |
|---|--------------------|------|--------------------------------------|
| Input terminal 1 to 9, A or B selection | [CA-01] to [CA-11] | 067 | [ATR]: Torque command input approval |

7-3-8 Torque Command

In the case of using [AA121] control method in sensorless vector control, and sensor vector control, this drives the motor based on torque command.

This function can be used not only in speed control/pulse train position control but also in torque control. It can also be applied to a winding machine.

Using the torque bias function at the time of torque control adds a torque bias amount to torque command.

In the case of operating by torque control, assign 067 [ATR] to any of the input terminals. Turning ON the [ATR] terminal switches from speed control to torque control.

Torque command handles the input value selected in the torque command setting [Ad-01] as a command.

To calculate the motor rated torque (100%) in this function, use the following formula.

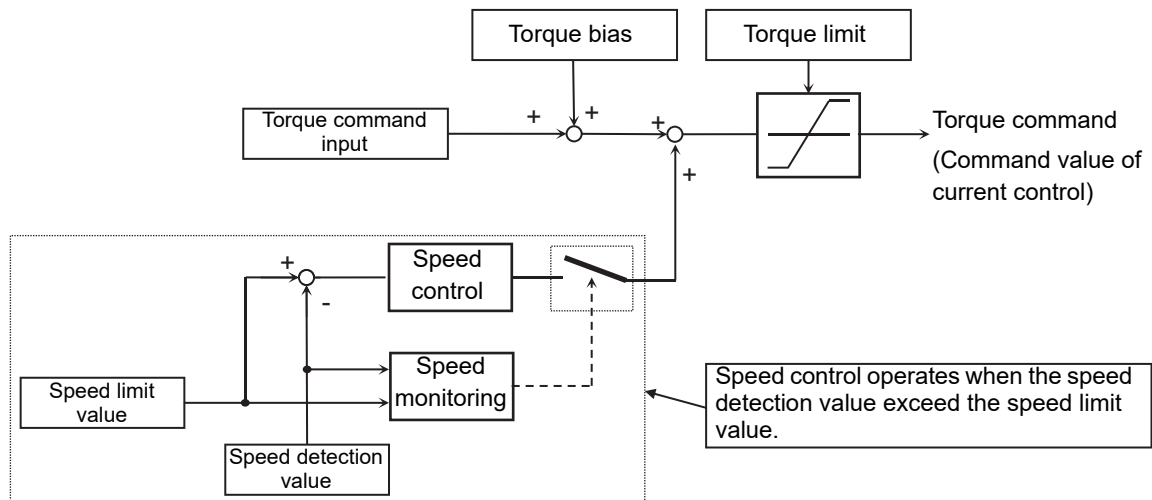
Motor rated torque = $79.58 \times \text{Motor capacity} \times \text{Number of poles} / \text{Base frequency}$

Example: Motor rated torque = $79.58 \times 5.5 \text{ (kW)} \times 4 \text{ (P)} / 50 \text{ (Hz)} \approx 35 \text{ Nm}$



Precautions for Correct Use

Because the speed under torque control is decided by the balance with load, set [Ad-40] torque control speed limit value input selection for prevention of runaway. In the case of 07: Parameter setting, set the speed limit value setting [Ad-41]/[Ad-42].



● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|--------------------|--|--------------|
| Switching time of Speed control to Torque control | [Ad-04] | 0 to 1000(ms) | It is a time to switch from torque command to speed control. When an error occurs while the control is switched, set the time longer than the set time. | 100 |
| Input selection for speed limit at torque control | [Ad-40] | 01 to 13 | 01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/ 11 (Option 3)/12 (Pulse train input: main unit)/13 (Pulse train input: Option) | 07 |
| Speed limit at torque control (at Forward rotation) | [Ad-41] | 0.00 to 590.00(Hz) | Sets frequency to limit in the normal rotation during torque control. | 0.00 |
| Speed limit at torque control (at Reverse rotation) | [Ad-42] | 0.00 to 590.00(Hz) | Sets frequency to limit in the reverse rotation during torque control. | 0.00 |

Monitor Torque Command and Output Torque

The torque command monitor [FA-15] displays a current command value that has been commanded.

In the case of [Ad-01] = 07, the torque command set value can be changed on the [FA-15] monitor.

To calculate the motor rated torque (100%) in this function, use the following formula.

Motor rated torque = $79.58 \times \text{Motor capacity} \times \text{Number of poles} / \text{Base frequency}$

Example: Motor rated torque = $79.58 \times 5.5 \text{ (kW)} \times 4 \text{ (P)} / 50 \text{ (Hz)} \approx 35 \text{ Nm}$

The torque command monitor (after calculation) [dA-15] displays the value with torque bias added to the current torque command.

Current output torque can be monitored on the Output torque monitor [dA-17].

To calculate the motor rated torque (100%) in this function, use the following formula.

Motor rated torque = $79.58 \times \text{Motor capacity} \times \text{Number of poles} / \text{Base frequency}$

Example: Motor rated torque = $79.58 \times 5.5 \text{ (kW)} \times 4 \text{ (P)} / 50 \text{ (Hz)} \approx 35 \text{ Nm}$

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|--------------------------------------|--|--------------|
| Torque reference input source selection | [Ad-01] | 01 to 13,15 | 01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse train input: main unit)/13 (Pulse train input: Option)/15 (PID calculation) | 07 |
| Torque reference value setting | [Ad-02] | -500.0 to 500.0(%) | Adds a torque addition amount. | 0.0 |
| Polarity selection for torque reference | [Ad-03] | 00 (Per sign) | Regardless of the operation direction, torque will be added to the forward direction, when the value is (+), and to the reverse direction, when the the value is (-). | 00 |
| | | 01 (Follow the revolution direction) | Changes the sign of value and the direction of torque bias action based on the operation command direction. | |
| Torque command monitor (after calculation) | [dA-15] | -500.00 to 500.00(%) | Is the torque command monitor calculated set value and bias value. | - |
| Output torque monitor | [dA-17] | -500.00 to 500.00(%) | Displays the output torque. | - |
| Torque reference monitor | [FA-15] | -500.00 to 500.00(%) | Is the torque command set monitor. | - |

Input Terminal Function

| Item | Parameter | Data | Description |
|---|--------------------|------|-------------------------------------|
| Input terminal 1 to 9, A or B selection | [CA-01] to [CA-11] | 067 | Torque command input approval [ATR] |

7-4 Reduction of Motor Noise, Noise and Inverter Heat Generation

7-4-1 Carrier Frequency

The electromagnetic noise from the motor, noise from the inverter and the heat generation in the inverter can be reduced/suppressed when you change the carrier frequency.

The carrier frequency is the frequency at which the element that controls the inverter output changes.

The carrier frequency can be changed using the [bb101] setting.

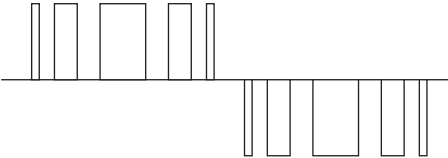
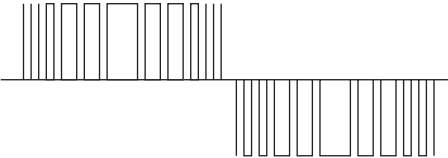
It is also effective in avoiding resonance of mechanical systems and motors.



Precautions for Correct Use

- With the selection using [Ub-03] Load specifications, the carrier frequency setting will be automatically restrained.
- In accordance with the figures of *Derating of Rated Output Current* on page 2-10, operate the inverter within the proper current range.
- If the [AA121] control method selection when driven by induction motor (IM) is automatic torque boost (03), sensorless vector control (08), or zero speed area sensorless vector control (09), set the carrier frequency to 2.0 kHz or higher.
- If the [AA121] control method selection is the synchronous motor/permanent magnet motor (SM/PMM) sensorless vector control (11), set the carrier frequency to 8.0 kHz or higher.
- The carrier frequency should be set to 10 times or higher of the [Hb105] IM highest frequency or [Hd105] SM (PMM) highest frequency.
(Ex.) When [Hb105] = 60 Hz, [bb101] = 0.6 kHz (600 Hz) or higher
- When using the carrier frequency of 2.1 kHz or higher, see 2-1-3 *Installation Environment* on page 2-7.

Carrier Frequency and Its Extent of the Effect

| Carrier frequency | Low | High |
|---|---|--|
| Motor electromagnetic noise | Loud | Quiet |
| Noise | Quiet | Loud |
| Inverter heat generation | Little | Great |
| Leakage current | Low | High |
| Inverter output voltage waveform example (PWM output) | Carrier frequency: Low  | Carrier frequency: High  |

● Parameter

| Item | Parameter | Data | Description | Default data |
|----------------------------------|-----------|---------------------|--------------------------------|--------------|
| Carrier speed setting, 1st-motor | [bb101] | 0.5 to 16.0(kHz) *1 | Changes the carrier frequency. | 2.0 |

*1. The following constraints will be applied internally.
Maximum 12.0 kHz at rated LD, maximum 10.0 kHz at rated VLD

7-4-2 Automatic Carrier Reduction

It automatically lowers the carrier frequency according to increase of output current values and temperature rise in inverter.

The automatic carrier frequency reduction selection can be changed using the [bb103] setting.

The higher the inverter carrier frequency is, the more the temperature inside the inverter tends to increase.

The Automatic carrier frequency reduction function reduces life degradation of the elements by automatically lowering the carrier frequency according to the output current or temperature.



Precautions for Correct Use

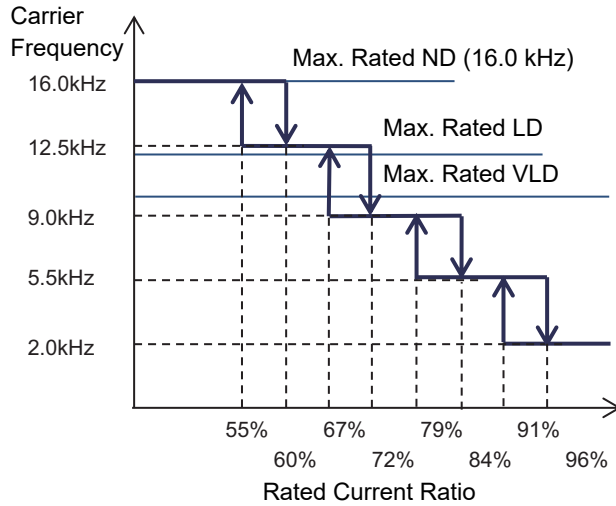
- When the automatic carrier frequency reduction function is activated, the electromagnetic noise of the motor changes.
- If the carrier frequency [bb101] is 2.0 kHz or lower, this function will not be activated.
- The operation rate when the carrier frequency was changed during operation will be 2 kHz in 1 second.
- When the automatic carrier frequency reduction function is activated, the electromagnetic noise generated by the motor changes slowly.
- The [bb102] setting is not necessary when synchronous motor and permanent magnet motor are used.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|------|---|--------------|
| Automatic-carrier reduction selection, 1st-motor | [bb103] | 00 | [bb101] Follows the carrier frequency. | 00 |
| | | 01 | Reduces the carrier frequency according to the inverter output current. | |
| | | 02 | Reduces the carrier frequency according to the inverter temperature. | |

Output Current-dependent ([bb103] = 01)

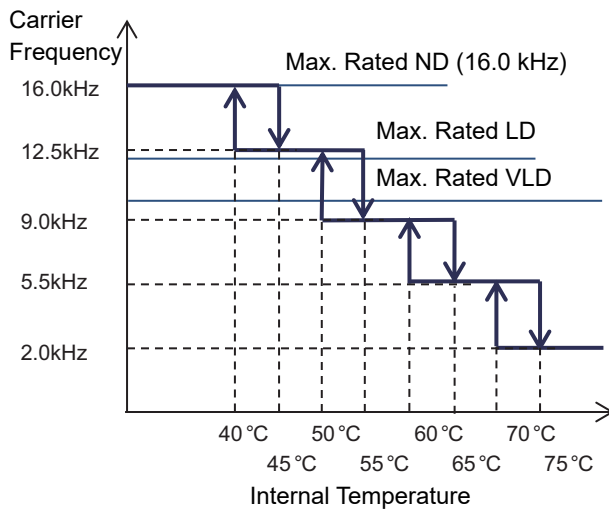
Carrier frequency reduction starts once the current exceeds a certain value to the rated current. When the current decreases, the carrier frequency is automatically regained.



Cooling Fin Temperature-dependent ([bb103] = 02)

Carrier frequency reduction starts once the temperature of the internal output element exceeds a certain value.

When the temperature lowers, the carrier frequency is automatically regained.



7-4-3 Lowering Electromagnetic Noise from Motor

Changing the sprinkle carrier pattern selection cuts the electromagnetic noise of a certain area and changes the electromagnetic noise of the motor.

Sprinkle carrier pattern selection can be changed using the [bb102] setting.

The inverter carrier frequency is about the same as when output at 3 kHz.

Default data



Precautions for Correct Use

The [bb102] setting is not necessary when synchronous motor and permanent magnet motor (SM/PMM) are used.

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|------|--|--------------|
| Sprinkle carrier pattern selection, 1st-motor | [bb102] | 00 | Disabled (Follows other carrier frequency setting) | 00 |
| | | 01 | Pattern 01 | |
| | | 02 | Pattern 02 | |
| | | 03 | Pattern 03 | |

7-5 Start Conditions

7-5-1 Selection of Reduced Voltage Startup

This function allows you to make the inverter increase the voltage gradually when starting the motor while outputting the minimum frequency.

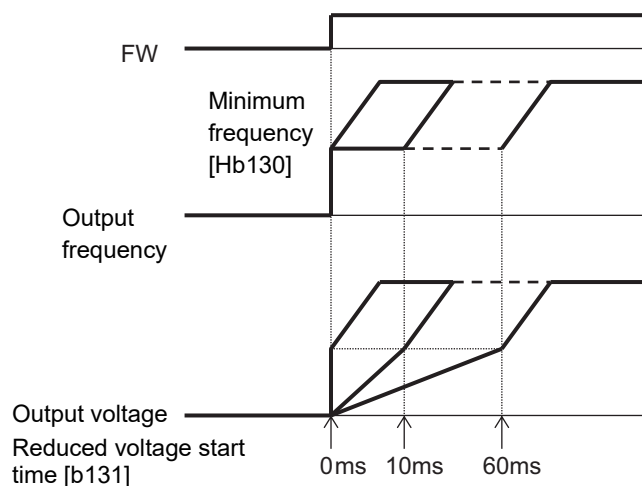
The time to reach the output voltage for the reduced voltage start can be set with [Hb131].



Precautions for Correct Use

- Set a small value for the reduced voltage start selection [Hb131] if you intend to increase the start torque. On the other hand, setting a small value will cause the inverter to perform full-voltage starting and to easily trip because of overcurrent.
- This function is effective only when V/f control (constant torque characteristics, reduced torque characteristics, or free V/f control) is selected for the control method [AA121].

| Item | Parameter | Data | Description | Default data |
|---|-----------|-------------------|--|--------------|
| Minimum frequency adjustment, 1st-motor | [Hb130] | 0.00 to 10.00(Hz) | This is the start frequency. | 0.50 |
| Reduced voltage start time setting, 1st-motor | [Hb131] | 0 to 2000(ms) | Increases the output voltage over the set time, from the operation start to the voltage command equivalent to the minimum frequency. | 36 |



7-5-2 Startup DC Injection Braking

Before outputting the frequency to the motor, apply DC braking to stop the motor rotating. And then, start operation.

To use DC braking for starting, the following settings are required:

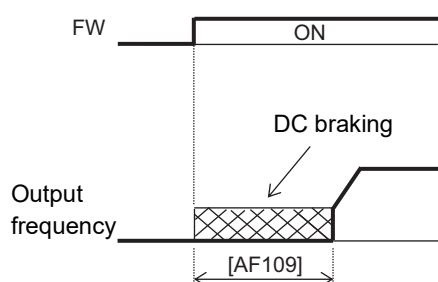
- Set [AF101] DC braking selection to 01
- Set [AF102] Braking mode selection to 00
- Set [AF109] DC braking time for starting to other than 0.00

DC braking for starting, DC braking is performed, after the operation command is given, for the period of time set for the DC braking time for starting [AF109].



Precautions for Correct Use

- Depending on the set braking force, the carrier frequency may automatically go down to protect the inverter.
- When setting or operating [AF108] DC braking force for starting and [AF109] DC braking time for starting, pay attention to heat generation on the motor.
- The motor could make a half-turn at the maximum.



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|------------------|---|--------------|
| DC braking selection, 1st-motor | [AF101] | 00 | Internal DC braking: Disabled | 00 |
| | | 01 | Internal DC braking: Enabled | |
| | | 02 | Internal DC braking: Enabled (operable only at the set frequency) | |
| Braking type selection, 1st-motor | [AF102] | 00 | Enables the DC braking. | 00 |
| DC braking force at start, 1st-motor | [AF108] | 0 to 100(%) | Adjusts the DC braking force. The maximum braking force is achieved when set to 100%. | 30 |
| DC braking active time at start, 1st-motor | [AF109] | 0.00 to 60.00(s) | Valid when the internal DC braking is enabled. Starts the DC braking when the operation command is turned on. | 0.00 |



Precautions for Correct Use

- If [AF101] DC braking selection is set to 02, DC braking will be started when both the frequency command and the output frequency become equal to or lower than [AF103] DC braking frequency setting, regardless of whether the motor is running or stopped. See 7-6-2 *DC Injection Braking Stop* on page 7-83 for details.
- If [AF102] Braking mode selection is set to other than 00, see 7-5-9 *Startup DC Injection Braking (Servo Lock Control)* on page 7-80.

7-5-3 Frequency Matching Start

Frequency matching start is activated if you set the function that an inverter runs by picking up frequency while a motor is idling due to a trip or terminal function.

Obtain the cycle of the motor residual voltage to start operation.

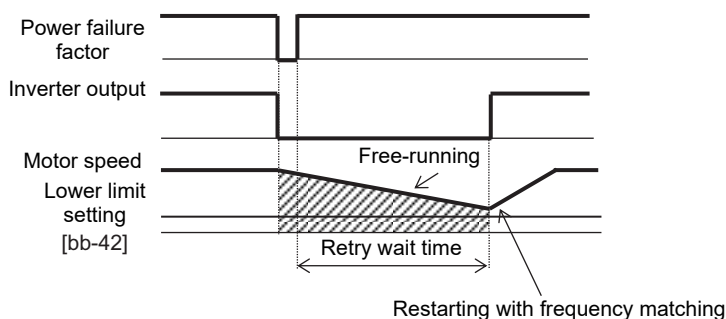
Frequency matching lower limit setting [bb-42] is the parameter common to frequency matching functions.



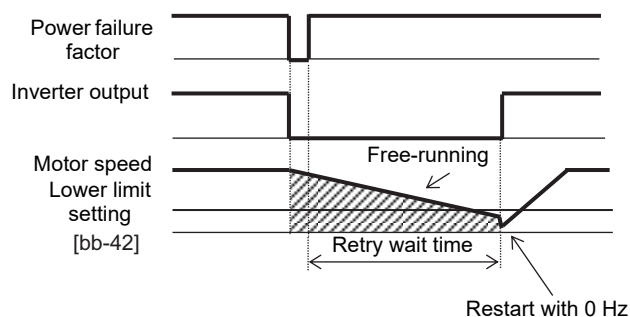
Precautions for Correct Use

- Even if frequency matching restart is selected, the inverter may restart with 0 Hz if:
 1. the output frequency is equal to or lower than 1/2 of the base frequency,
 2. the voltage induced on the induction motor quickly attenuates, or
 3. the frequency matching lower limit setting [bb-42] is set and the inverter detects a frequency equal to or lower than that.
- If the restart after free-run stop or the restart after reset is performed, the inverter will restart after the retry wait time after instantaneous power failure/under-voltage has elapsed.
- The restart after free-run stop and the restart after reset will be performed if the operation command is continuously input via a terminal command or other ways.
- If the frequency matching restart does not go well because the residual voltage rapidly decreases or for other reasons, it may go well by using the frequency pull-in restart. See 7-5-4 *Frequency Pull-in Start* on page 7-69.

(Ex.1) The motor speed is equal to or more than the frequency matching lower limit setting.



(Ex.2) The motor speed is equal to or lower than the frequency matching lower limit setting



● Parameter

| Item | Parameter | Data | Description | Default data |
|-----------------------------|-----------|--------------------|---|--------------|
| Restart frequency threshold | [bb-42] | 0.00 to 590.00(Hz) | When the detected value is equal to or lower than the set value, the inverter restarts with 0 Hz. | 0.00 |

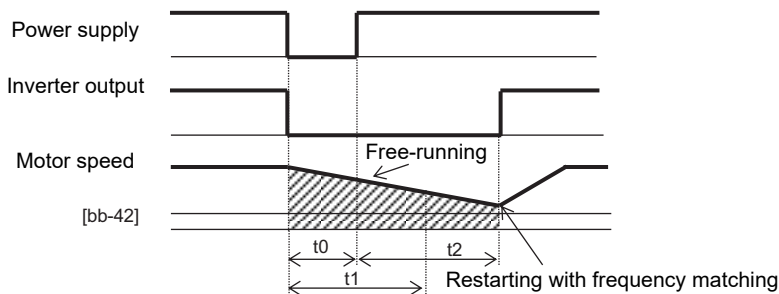


Precautions for Correct Use

For the retry function, see 8-2 *Tripless Functions* on page 8-40 as well.

When Instantaneous Power Failure/Under-voltage Occurs [bb-24]=01

(Ex.1) Power recovery within Allowable instantaneous power failure time [bb-25]

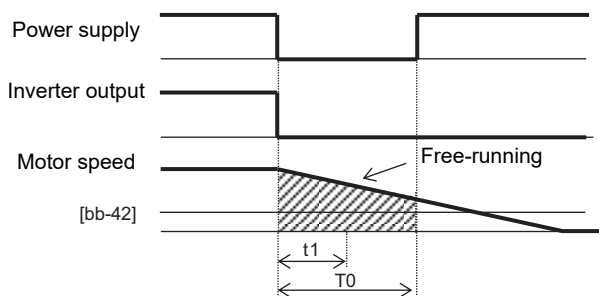


t0: Instantaneous power failure time

t1: Allowable instantaneous power failure time [bb-25]

t2: Retry wait time [bb-26]

(Ex.2) Power recovery after Allowable instantaneous power failure time [bb-25]



| Item | Parameter | Data | Description | Default data |
|--|-----------|-----------------|--|--------------|
| Selection of restart mode @Instantaneous power failure/ under-voltage trip | [bb-24] | 01 | Performs frequency matching restart. | 01 |
| Allowable under-voltage power failure time | [bb-25] | 0.3 to 25.0(s) | Restarts the motor if it is within the allowable time. | 1.0 |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Sets the wait time after the power recovery. | 0.3 |

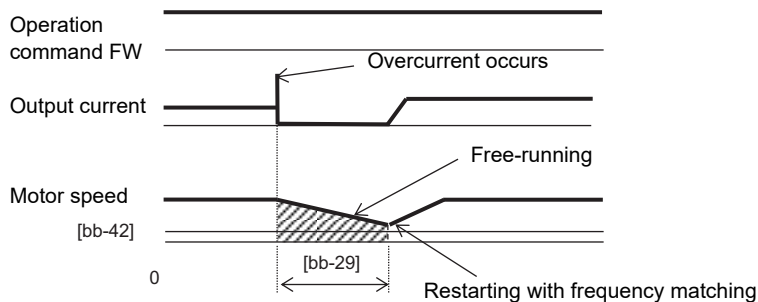


Precautions for Correct Use

- If a power failure has occurred so that the power to the inverter's control power supply terminals (R0, T0) is lost, and then the inverter is restarted, it is considered as power-on and the inverter will operate in accordance with the restart after reset [bb-41].
- Even if the power to control power supply terminals (R0, T0) is lost, it will take time until the internal power supply is completely lost.
- Trip after instantaneous power failure/under-voltage can be switched between "enabled" and "disabled" by using [bb-27] Selection of instantaneous power failure/under-voltage trip during stopping. This will prevent the occurrence of an error during stopping. If the error is prevented, the output terminal [AL] will not turn on.
- In a system where the power to control power supply terminals (R0, T0) gradually decreases, it is possible to cause a trip when Allowable instantaneous power failure time has elapsed.
- To make the power to control power supply terminals (R0, T0) last as much as possible by the inverter alone during an instantaneous power failure, remove the J51 connector cables from terminals R0 and T0, and connect a cable from P on the main circuit terminal block to R0, and N on the main circuit terminal block to T0. Use 0.75 mm² or heavier wires for the connections.

Retry on Overcurrent [bb-28]=01

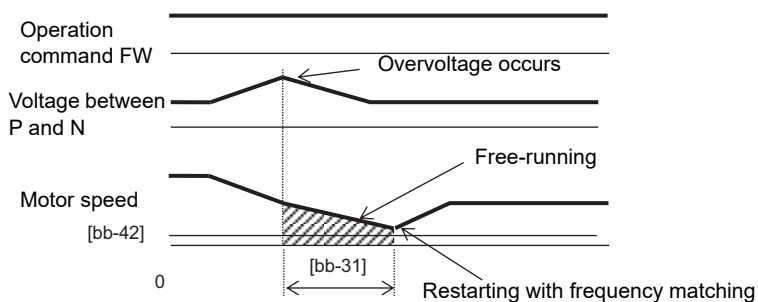
(Ex.) Retry operation on overcurrent



| Item | Parameter | Data | Description | Default data |
|---|-----------|-----------------|--|--------------|
| Selection of restart mode @over-current | [bb-28] | 01 | Performs frequency matching restart. | 01 |
| Wait time of restart @over-current | [bb-29] | 0.3 to 100.0(s) | Sets the wait time after the retry operation on overcurrent. | 0.3 |

Retry on Overvoltage [bb-30]=01

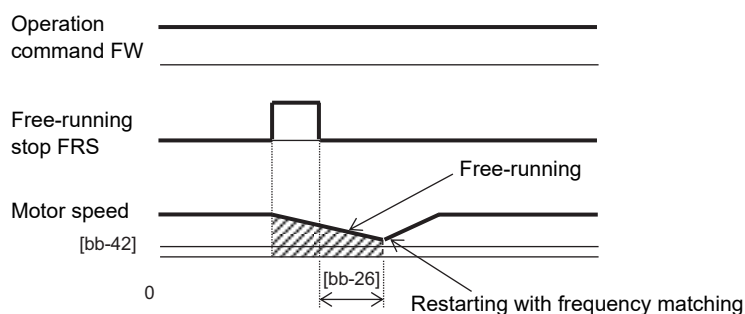
(Ex.) Retry operation on overvoltage



| Item | Parameter | Data | Description | Default data |
|---|-----------|-----------------|--|--------------|
| Selection of restart mode @over-voltage | [bb-30] | 01 | Performs frequency matching restart. | 01 |
| Wait time of restart @over-voltage | [bb-31] | 0.3 to 100.0(s) | Sets the wait time after the retry operation on overvoltage. | 0.3 |

Frequency Matching after Free-run Stop [FRS] Release [bb-40]=01

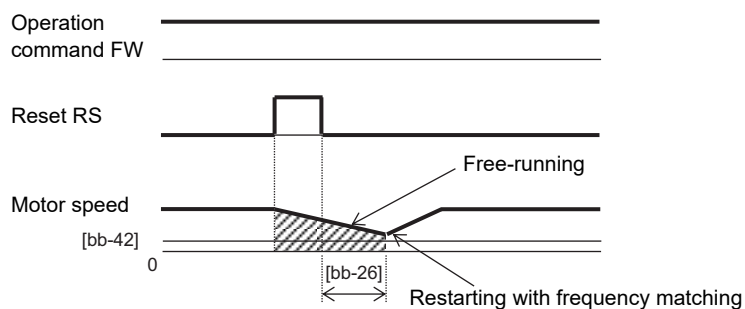
(Ex.) Frequency matching operation after free-run stop [FRS]



| Item | Parameter | Data | Description | Default data |
|--------------------------------------|-----------|-----------------|---|--------------|
| Restart mode after FRS release | [bb-40] | 01 | Performs frequency matching restart. | 00 |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Sets the wait time after the free-run stop release. | 0.3 |

Frequency Matching After Reset [RS] [bb-41]=01

(Ex.) Frequency matching operation after reset [RS]



| Item | Parameter | Data | Description | Default data |
|--------------------------------------|-----------|-----------------|---|--------------|
| Restart mode after RS release | [bb-41] | 01 | Performs frequency matching restart. | 00 |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Sets the wait time after the reset release. | 0.3 |

Note If the frequency matching after reset has been set, starting after power-on will also occur with frequency matching.

7-5-4 Frequency Pull-in Start

To achieve these goals when the motor is idling due to a trip or terminal function, enable the frequency pull-in function so that the inverter is started with the output frequency specified to each function.

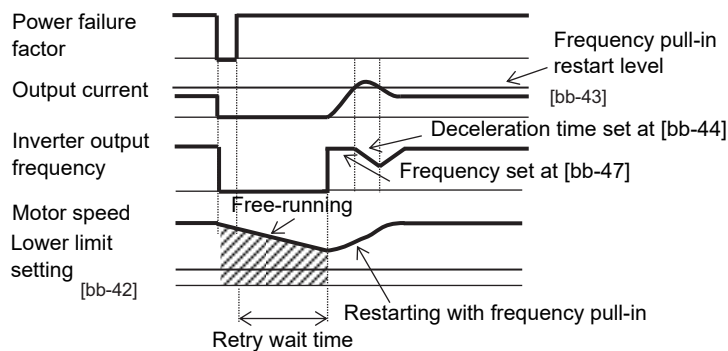
Even if a motor residual voltage is lost, the inverter will restart at the frequency selected in [bb-47] Start frequency selection for frequency pull-in restart.

When frequency pull-in with the V/f control is selected, the inverter starts with a suppressed output voltage during the time set for [bb-45] Frequency pull-in operation time (voltage). When sensorless vector control, zero-speed range sensorless vector control, or vector control with sensor is selected, the frequency is automatically pulled in while controlling the current.

If the current increases during frequency pull-in to exceed [bb-43] Restart level, the motor will decelerate over the time set for [bb-44] Frequency pull-in operation time (frequency).

If the current rapidly increases during frequency pull-in to exceed [bb-46] Overcurrent suppression level for frequency pull-in restart, the overcurrent suppression function will automatically set in.

(Ex.) How the frequency pull-in works



Precautions for Correct Use

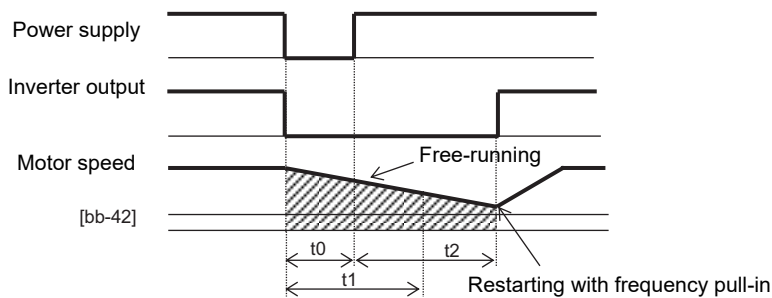
- If the restart after free-run stop or the restart after reset is performed, the inverter will restart after the retry wait time after instantaneous power failure/under-voltage has elapsed.
- The restart after free-run stop and the restart after reset will be performed when the operation command is given.
- The frequency pull-in restart function can be used only for induced motor drive. In addition, if [AA121] Control mode is set to other than the V/f control, restart may become unstable. In this case, see 7-5-3 *Frequency Matching Start* on page 7-65.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|--------------------------------------|---|------------------------------|
| Restart frequency threshold | [bb-42] | 0.00 to 590.00(Hz) | When the detected value is equal to or lower than the set value, the inverter restarts with 0 Hz. | 0.00 |
| Restart level of Active frequency matching | [bb-43] | Inverterrated current × (0.2 to 2.0) | Determines whether or not the current has increased at restart. | 1.0 × Inverter rated current |
| Restart constant(speed) of Active frequency matching | [bb-44] | 0.10 to 30.00(s) | Sets the deceleration time for an increase in the current. | 0.50 |
| Restart constant(Voltage) of Active frequency matching | [bb-45] | 0.10 to 30.00(s) | Sets the time to start with reduced output voltage. | 0.50 |
| OC-supress level of Active frequency matching | [bb-46] | Inverterrated current × (0.0 to 2.0) | Sets the level of the current at which a sudden current increase at restarting is prevented. | 1.0 × Inverter rated current |
| Restart speed selection of Active frequency matching | [bb-47] | 00 | Starts at the frequency at the previous shutoff. | 00 |
| | | 01 | Starts at the maximum frequency. | |
| | | 02 | Starts at the current frequency command. | |

When Instantaneous Power Failure/Under-voltage Occurs [bb-24]=02

(Ex.1) Power recovery within Allowable instantaneous power failure time [bb-25]

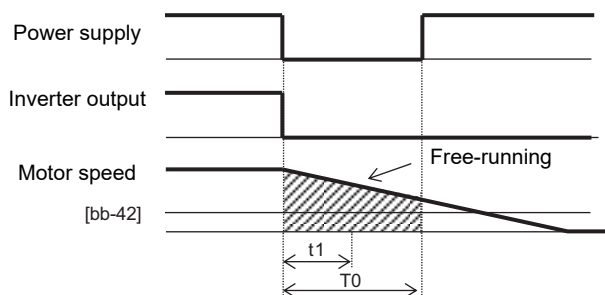


t0: Instantaneous power failure time

t1: Allowable instantaneous power failure time [bb-25]

t2: Retry wait time [bb-26]

(Ex.2) Power recovery after Allowable instantaneous power failure time [bb-25]



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|-----------------|--|--------------|
| Selection of restart mode @Instantaneous power failure/ under-voltage trip | [bb-24] | 02 | Performs frequency pull-in restart. | 01 |
| Allowable under-voltage power failure time | [bb-25] | 0.3 to 25.0(s) | Restarts the motor if it is within the allowable time. | 1.0 |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Sets the wait time after the operation command. | 0.3 |

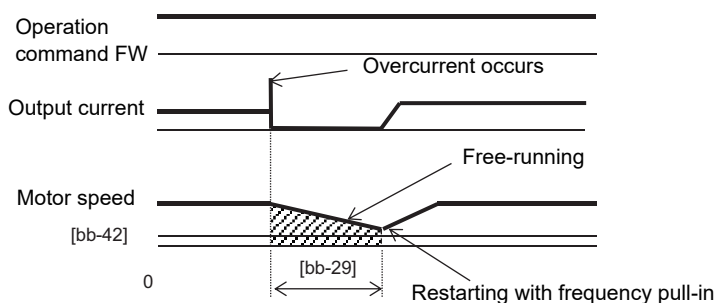


Precautions for Correct Use

- If a power failure has occurred so that the power to the inverter's control power supply terminals (R0,T0) is lost, and then the inverter is restarted, it is considered as power-on and the inverter will operate in accordance with the restart after reset [bb-41].
- Even if the power to control power supply terminals (R0, T0) is lost, it will take time until the internal power supply is completely lost.
- Trip after instantaneous power failure/under-voltage can be switched between "enabled" and "disabled" by using [bb-27] Selection of instantaneous power failure/under-voltage trip during stopping. This will prevent the occurrence of an error during stopping. If the error is prevented, the output terminal [AL] will not turn on.
- In a system where the power to control power supply terminals (R0, T0) gradually decreases, it is possible to cause a trip when Allowable instantaneous power failure time has elapsed.
- To make the power to control power supply terminals (R0, T0) last as much as possible by the inverter alone when an instantaneous power failure occurs, remove the J51 connector cables from terminals R0 and T0, connect the main circuit terminals P and R0 to each other, and connect the main terminals N and T0 to each other. Use 0.75 mm² or heavier wires for the connections.

Retry on Overcurrent [bb-28]=02

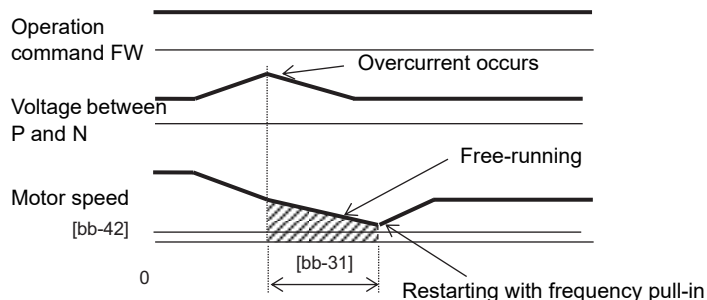
(Ex.) Retry operation on overcurrent



| Item | Parameter | Data | Description | Default data |
|---|-----------|-----------------|---|--------------|
| Selection of restart mode @over-current | [bb-28] | 02 | Performs frequency pull-in restart. | 01 |
| Wait time of restart @over-current | [bb-29] | 0.3 to 100.0(s) | Sets the wait time after the operation command. | 0.3 |

Retry on Overvoltage [bb-30]=01

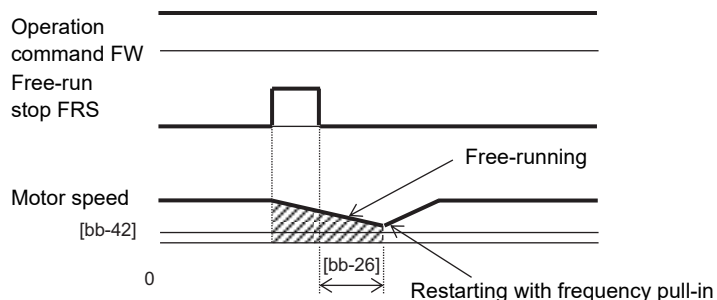
(Ex.) Retry operation on overvoltage



| Item | Parameter | Data | Description | Default data |
|---|-----------|-----------------|---|--------------|
| Selection of restart mode @over-voltage | [bb-30] | 02 | Performs frequency pull-in restart. | 01 |
| Wait time of restart @over-voltage | [bb-31] | 0.3 to 100.0(s) | Sets the wait time after the operation command. | 0.3 |

Frequency Matching After Free-run Stop [FRS] [bb-40]=02

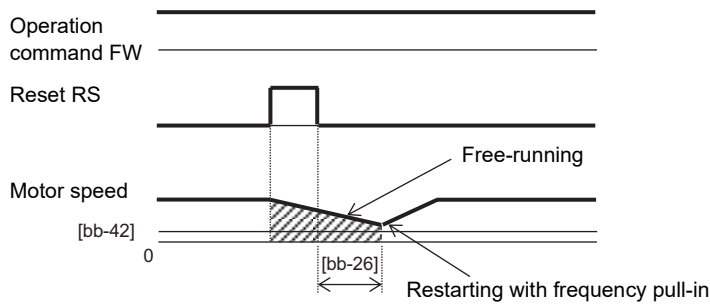
(Ex.) Frequency matching operation after free-run stop [FRS]



| Item | Parameter | Data | Description | Default data |
|--------------------------------------|-----------|-----------------|---|--------------|
| Restart mode after FRS release | [bb-40] | 02 | Performs frequency pull-in restart. | 00 |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Sets the wait time after the operation command. | 0.3 |

Frequency Matching After Reset [RS] [bb-41]=02

(Ex.) Frequency matching operation after reset [RS]



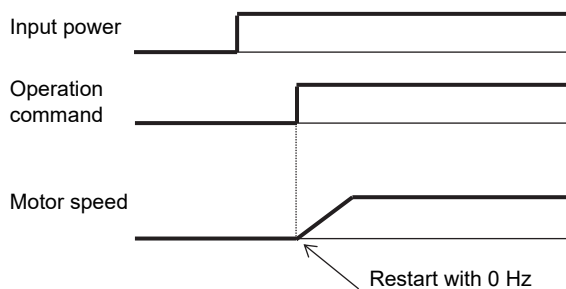
| Item | Parameter | Data | Description | Default data |
|--------------------------------------|-----------|-----------------|---|--------------|
| Restart mode after RS release | [bb-41] | 02 | Performs frequency pull-in restart. | 00 |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Sets the wait time after the operation command. | 0.3 |

Note If the frequency matching after reset has been set, starting after power-on will also occur with frequency matching.

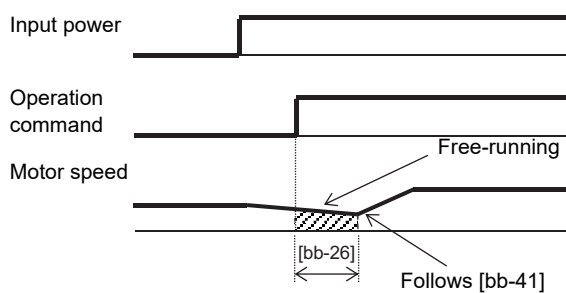
7-5-5 Starting after Power-on

Sets the start mode at power-on.

(Ex.1) Restart operation with 0 Hz: [bb-41]=00



(Ex.2) Frequency pull-in operation [bb-41]=01 to 03





Precautions for Correct Use

- The operation at power-on is the same as that of the restart after reset stop which occurs when the inverter recovers from reset.
- If the frequency pull-in restart is used, the rotational direction of the output frequency is the same as that of the frequency command.
- If a power failure lasts long and the inverter’s internal power supply is lost, recovery will take place by the restart after reset instead of the restart after instantaneous power failure/under-voltage.
- In the case of [bb-41]=01, if the residual voltage generated by the motor cannot be detected, the 0 Hz restart may take place.

● **Parameter**

| Item | Parameter | Data | Description | Default data |
|--------------------------------------|-----------|-----------------|---|--------------|
| Restart mode after RS release | [bb-41] | 00 | Performs the 0 Hz restart. | 00 |
| | | 01 | Performs frequency matching restart.*1 | |
| | | 02 | Performs frequency pull-in restart.*2 | |
| | | 03 | Restarts from the speed received from Input terminal A and B or the PG option unit. | |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Sets the wait time after the operation command. | 0.3 |

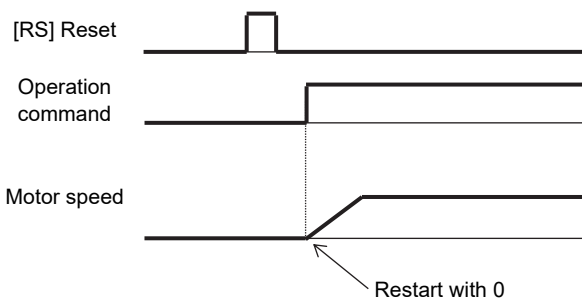
*1. See 7-5-3 Frequency Matching Start on page 7-65.

*2. See 7-5-4 Frequency Pull-in Start on page 7-69.

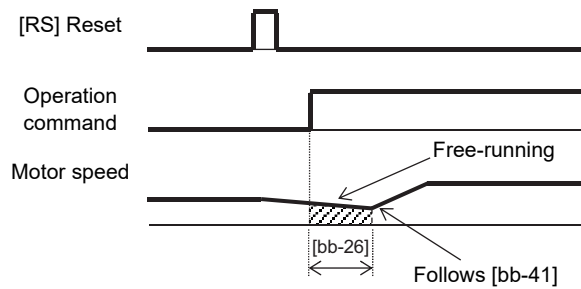
7-5-6 Restart after Releasing Reset

Set the start mode after a trip reset or a reset input via the [RS] terminal (input terminal function 028).

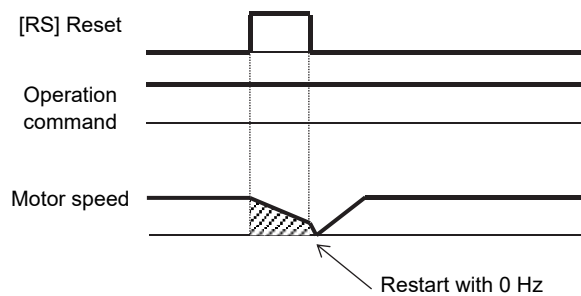
(Ex.1) Restart operation with 0 Hz: [bb-41]=00



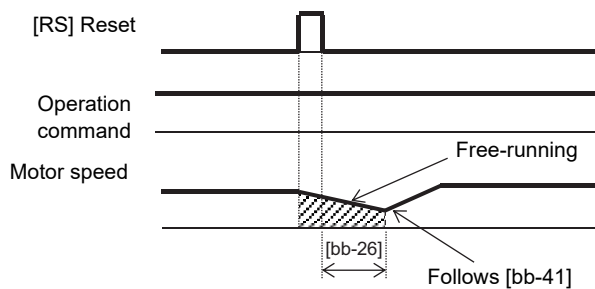
(Ex.2) Frequency pull-in [bb-41]=01 to 03



(Ex.3) Restart with 0 Hz: [bb-41]=00



(Ex.4) Frequency pull-in [bb-41]=01 to 03



Precautions for Correct Use

- The restart after reset, which occurs when the inverter recovers from a reset, is the same as the mode at power-on.
- If the frequency pull-in restart is used, the rotational direction of the output frequency is the same as the command direction at shut-off.
- If a power failure lasts long and the inverter's internal power supply is lost, recovery will take place by the restart after reset instead of the restart after instantaneous power failure/under-voltage.
- In case of the 0 Hz restart, there is no wait time.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--------------------------------------|-----------|-----------------|---|--------------|
| Restart mode after RS release | [bb-41] | 00 | Performs the 0 Hz restart. | 00 |
| | | 01 | Performs frequency matching restart.*1 | |
| | | 02 | Performs frequency pull-in restart.*2 | |
| | | 03 | Restarts at the speed received from Input terminal A and B or the PG option unit. | |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Sets the wait time after the operation command. | 0.3 |

*1. See 7-5-3 Frequency Matching Start on page 7-65.

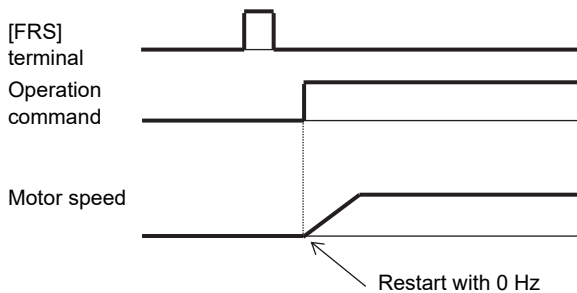
*2. See 7-5-4 Frequency Pull-in Start on page 7-69.

7-5-7 Starting after Free-run Stop

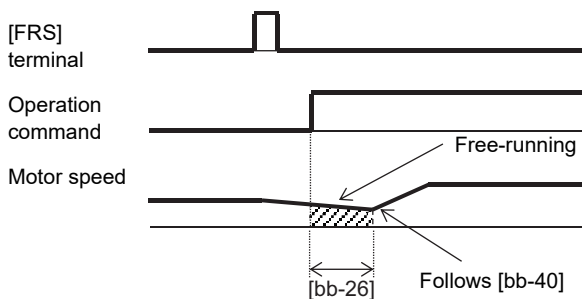
Set the start mode after free-run stop command is input via the [FRS] terminal (input terminal function 032), (Ex.1) to (Ex.4), or start mode after stop when FRS (free run to stop) is specified for [AA115] Stop mode selection, (Ex.5) and (Ex.6).

(Ex.1) to (Ex.4) below are examples where a free-run stop command is input using the [FRS] terminal.

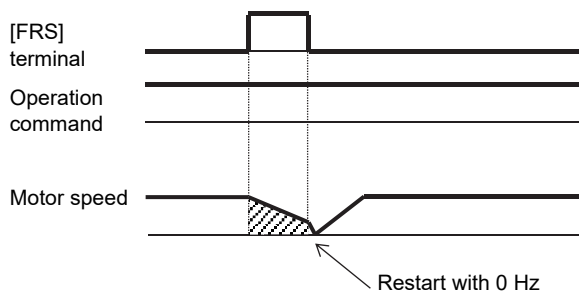
(Ex.1) Restart with 0 Hz: [bb-40]=00



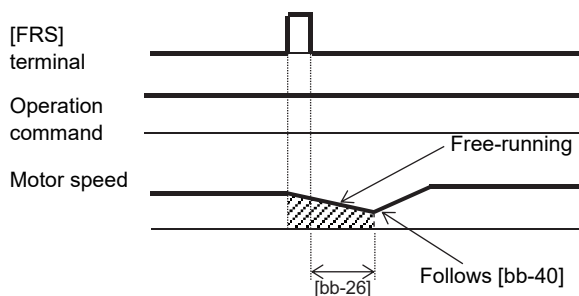
(Ex.2) Frequency pull-in [bb-40]=01 to 03



(Ex.3) Restart with 0 Hz: [bb-40]=00



(Ex.4) Frequency pull-in [bb-40]=01 to 03

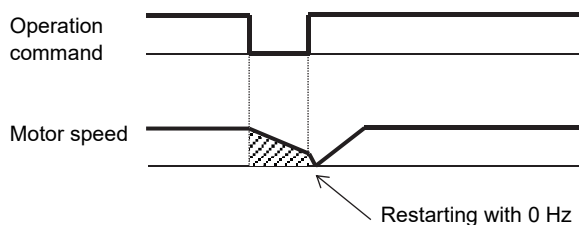


Precautions for Correct Use

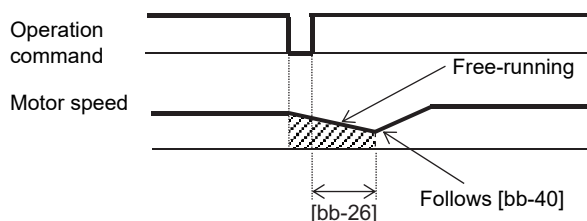
- The restart after reset, which occurs when the inverter recovers from a reset, is the same as the mode at power-on.
- If the frequency pull-in restart is used, the rotational direction of the output frequency is the same as that of the frequency command.
- If a power failure lasts long and the inverter's internal power supply is lost, recovery will take place by the restart after reset instead of the restart after instantaneous power failure/under-voltage.
- At power-on, the inverter will start operation with 0 Hz.
- In case of the 0 Hz restart, there is no wait time.

(Ex.5) and (Ex.6) below show cases where the free-run stop is performed via the operation command. The free-run stop at stopping is used when an overvoltage error occurs at stopping, for example. However, the motor continues rotating through inertia.

(Ex.5) Restarting with 0 Hz: [bb-40]=00



(Ex.6) Frequency pull-in [bb-40]=01 to 03



● Parameter

| Item | Parameter | Data | Description | Default data |
|--------------------------------------|-----------|-----------------|---|--------------|
| Restart mode after FRS release | [bb-40] | 00 | Performs the 0 Hz restart. | 00 |
| | | 01 | Performs frequency matching restart.*1 | |
| | | 02 | Performs frequency pull-in restart.*2 | |
| | | 03 | Re-starts at the speed received from the Input terminal A/B or from the PG Option Unit. | |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Sets the wait time after the power recovery. | 0.3 |
| STOP mode selection, 1st-motor | [AA115] | 01 | Performs the free-run stop when the operation command is off. | 00 |

*1. See 7-5-3 Frequency Matching Start on page 7-65.

*2. See 7-5-4 Frequency Pull-in Start on page 7-69.

7-5-8 Forcing Function

This function is to preliminarily establish magnetic flux by applying an excitation current via the forcing terminal [FOC] command.

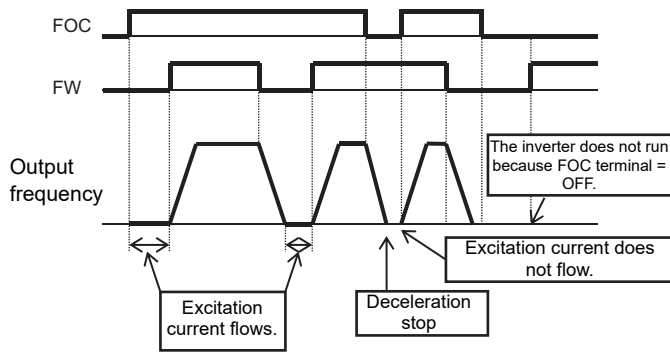
This function operates if the input terminal function 066 [FOC] is assigned.



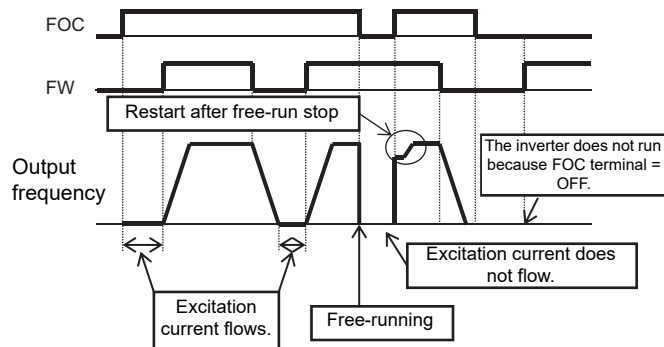
Precautions for Correct Use

- This function is effective when the IM sensorless vector control, IM zero-speed range sensorless vector control, or IM vector control with sensor is selected for the control mode [AA121].
- If [FOC] is assigned to the input terminal function, operation will not be accepted unless [FOC] is turned on.
- If [FOC] is turned off during operation, the inverter will be operated according to [AA115] Stop mode selection. If a free run occurs, restart will take place according to the setting for the restart after free-run stop.

- When [AA115] Stop mode selection is set to 00: Deceleration stop



- When [AA115] Stop mode selection is set to 01: Free run stop



● Parameter

| Item | Parameter | Data | Description | Default data |
|--------------------------------------|--------------------|-----------------|---|--------------|
| Input terminal function | [CA-01] to [CA-11] | 066 | Forcing function [FOC] | - |
| STOP mode selection, 1st-motor | [AA115] | 00 | Performs the deceleration stop when the operation command is off. | 00 |
| | | 01 | Performs the free-run when the operation command is off. | |
| Restart mode after FRS release | [bb-40] | 00 | Performs the 0 Hz restart. | 00 |
| | | 01 | Performs frequency matching restart.*1 | |
| | | 02 | Performs frequency pull-in restart.*2 | |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Sets the wait time after the operation command. | 0.3 |

*1. See 7-5-3 Frequency Matching Start on page 7-65.

*2. See 7-5-4 Frequency Pull-in Start on page 7-69.



Precautions for Correct Use

- If torque at starting is insufficient, it may improve by adjusting the boost amount at starting [HC111], [HC112] or the speed response [HA115].
- See 7-1 Overview of Motor Control Methods on page 7-3.
- If torque at starting is insufficient, it may improve by using the torque bias function. See 7-3-6 Torque Bias Function on page 7-54.

7-5-9 Startup DC Injection Braking (Servo Lock Control)

Before outputting the frequency to the motor, perform the servo-lock to stop the motor rotating. And then, start operation.

To apply DC braking for starting (servo-lock control), the following settings are required:

- [AA121] Control mode (see below)
- Set [AF101] DC braking selection to 01
- Set [AF102] Braking mode selection to 01 or 02.
- Set [AF109] DC braking time for starting to other than 0.0

If the DC braking for starting (servo-lock control) is enabled, DC braking (servo-lock control) will be performed after the operation command is given, for the period of time set as DC braking time for starting [AF109].



Precautions for Correct Use

- Depending on the set braking force, the carrier frequency may automatically go down to protect the inverter.
- To use the servo-lock control, it is necessary to set [AA121] Control mode. If the applicable control mode is not selected, the inverter will operate as if [AF102] has been set to 00: DC braking.

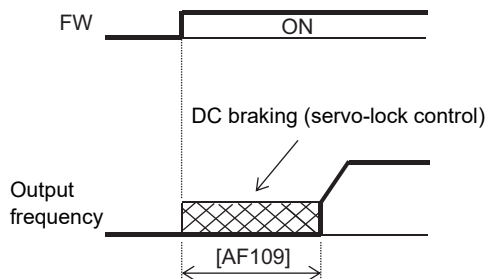
(1)When [AF102] Braking mode selection is set to 01: Speed servo-lock

| No. | [AA121] Control mode |
|-----|--|
| 1 | 09: Zero-speed range sensorless vector control |
| 2 | 10: Vector control with sensor |

(2)When [AF102] Braking mode selection is set to 02: Position servo-lock

| No. | [AA121] Control mode |
|-----|--------------------------------|
| 1 | 10: Vector control with sensor |

- For [AA121] Control mode and [AA123] Vector control mode selection, it is necessary to set . See 7-1 Overview of Motor Control Methods on page 7-3.
- The output of the servo-lock control is automatically calculated according to the selected control mode.



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|----------------|---|--------------|
| DC braking selection, 1st-motor | [AF101] | 00 | Internal DC braking: Disabled | 00 |
| | | 01 | Internal DC braking: Enabled | |
| | | 02 | Internal DC braking: Enabled (The braking operates only with the set braking frequency.) | |
| Braking type selection, 1st-motor | [AF102] | 01 | Enables the speed servo-lock. | 00 |
| | | 02 | Enables the position servo-lock. | |
| DC braking active time at start, 1st-motor | [AF109] | 0.0 to 60.0(s) | Valid when the internal DC braking is enabled. Starts the servo-lock when the operation command is turned on. | 0.3 |
| Control mode selection, 1st-motor | [AA121] | 08 | Sensorless vector control | 00 |
| | | 09 | Zero-speed range sensorless vector control | |
| | | 10 | Vector control with sensor | |

7-6 Stop Conditions

7-6-1 Selection of Stop Operation

Use [AA115] Stop mode selection to select one of the two methods of stopping the motor when the operation command is turned off. One is to stop the motor according to the deceleration time; the other is to immediately cut off the output to shut down.

If a free-run stop is to be input from a terminal, assign 032 [FRS] to an input terminal, and turn on the terminal.

If the free-run stop is selected, the restart when an operation command is given the next time will follow the selection at [bb-40] Restart after free-run stop.



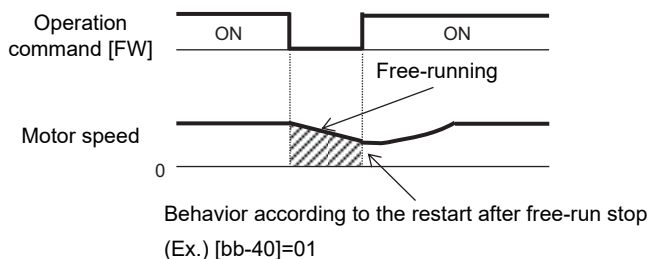
Precautions for Correct Use

If [AA115]=01 free-run stop is selected, the output will be shut off when the operation command is turned off.

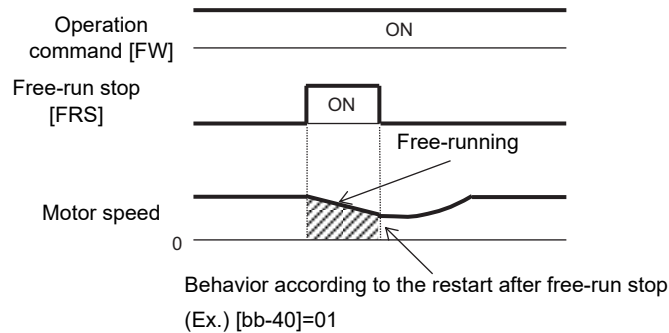
● Parameter

| Item | Parameter | Data | Description | Default data |
|--------------------------------|--------------------|------|--|--------------|
| STOP mode selection, 1st-motor | [AA115] | 00 | Normal stop (deceleration → stop) | 00 |
| | | 01 | Free-run stop | |
| Restart mode after FRS release | [bb-40] | 00 | Restart with 0 Hz | 00 |
| | | 01 | Frequency matching restart | |
| | | 02 | Frequency pull-in restart | |
| Input terminal selection | [CA-01] to [CA-11] | 032 | Uses the Free-run stop function [FRS]. | - |

When Free-run Stop is Selected: [AA115]=01



When the [FRS] Terminal is Used



7-6-2 DC Injection Braking Stop

To use DC braking for stopping, the following settings are required:

- Set [AF101] DC braking selection to 01
- Set [AF102] Braking mode selection to 00
- [AF105] DC braking force
- Set [AF106] DC braking time to other than 0.0

To use DC braking with frequency command, the following settings are required:

- Set [AF101] DC braking selection to 02
 - Set [AF102] Braking mode to 01 or 02.
 - Set [AF103] DC braking frequency setting to other than 0.00
 - [AF105] DC braking force
 - Set [AF106] DC braking time to other than 0.0
- How to stop the motor when a large moment of inertia makes it continue rotating even after deceleration stop



Precautions for Correct Use

- The carrier frequency during DC braking depends on [bb101], but it is limited to at maximum 5 Hz. Depending on the set braking force, the carrier frequency may automatically go down to 2 kHz.
- When the motor is stopped by using [DB] external DC braking function (input terminal function 030), a high output frequency or a high-inertia load may cause an overcurrent error or overvoltage error.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|--------------------|---|--------------|
| DC braking selection, 1st-motor | [AF101] | 00 | Internal DC braking: Disabled | 00 |
| | | 01 | Internal DC braking: Enabled | |
| | | 02 | Internal DC braking: Enabled (The braking operates only with the frequency command.) | |
| Braking type selection, 1st-motor | [AF102] | 00 | Enables the DC braking. | 00 |
| DC braking frequency, 1st-motor | [AF103] | 0.00 to 590.00(Hz) | With internal DC braking enabled, DC braking is started when the output frequency reaches or becomes less than the frequency set for stopping. | 0.50 |
| DC braking delay time, 1st-motor | [AF104] | 0.00 to 5.00(s) | Specifies the delay in starting DC braking while temporarily shutting off the output. | 0.00 |
| DC braking force setting, 1st-motor | [AF105] | 0 to 100(%) | Adjusts the DC braking force. When "0%" is specified, no braking operation will be performed. | 30 |
| DC braking active time at stop, 1st-motor | [AF106] | 0.00 to 60.00(s) | Sets the duration for DC braking. This setting is valid for the [DB] terminal in edge mode or for the internal DC braking. When "0.00 second" is specified, no braking operation will be performed. | 0.00 |
| DC braking operation method selection, 1st-motor | [AF107] | 00 | Edge mode (Examples 1-a to 6-a) | 01 |
| | | 01 | Level mode (Examples 1-b to 6-b) | |
| Input terminal function | [CA-01] to [CA-11] | 030 | DC braking is enabled by using the [DB] terminal. OFF: DC braking is disabled. ON: DC braking is enabled. | - |

DC Braking Force for Stopping

To use the DC braking force for stopping, set [AF101] DC braking selection to 01, [AF102] Braking mode selection to 00, [AF106] DC braking time to other than 0.00 second, and [AF105] DC braking force to any any value. When the frequency output is shut off, DC braking force will be applied.

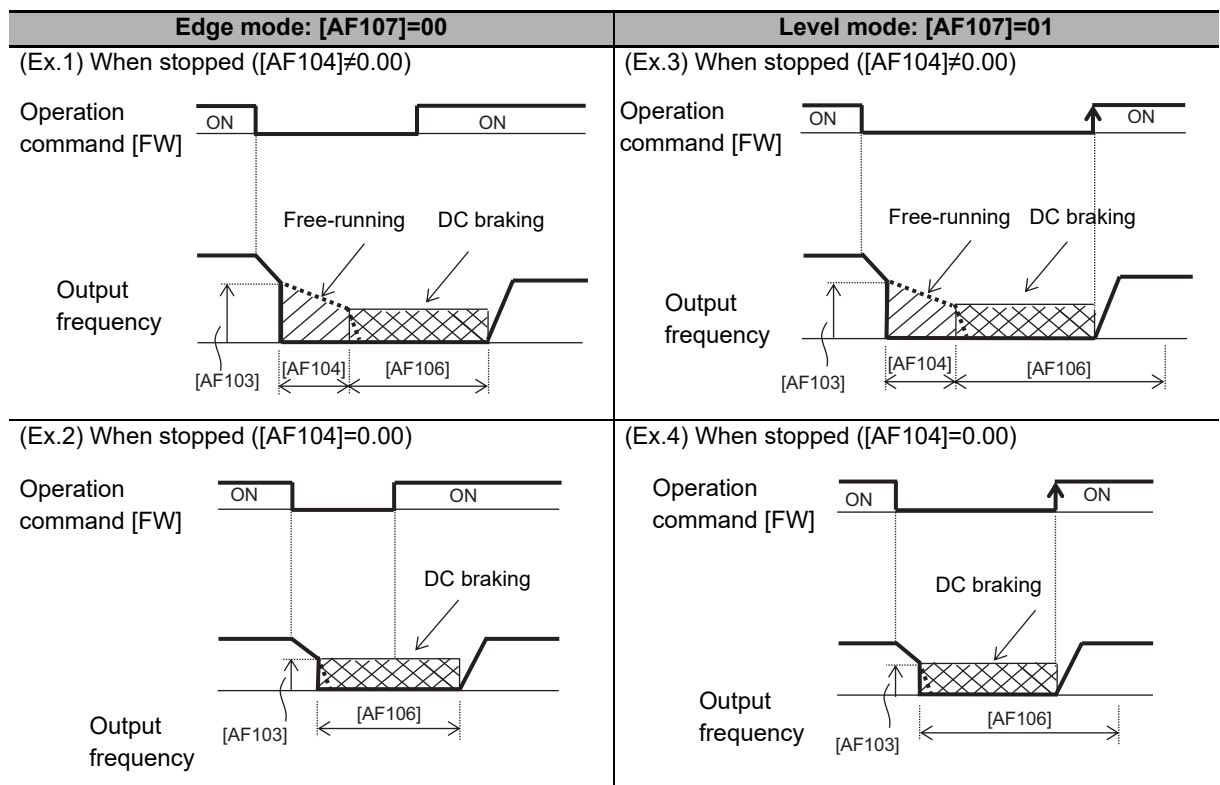
The braking force is adjusted at the [AF105] DC braking force.

When [AF104] DC braking delay time is set, and if the operation command is turned off and the decelerated frequency falls below [AF103] DC braking frequency, the output will be shut off once, and after [AF104] has elapsed, DC braking will be started.



Precautions for Correct Use

- The operation to be performed when the operation command is switched from the stop command to the start command varies depending on the setting of [AF107] DC braking/edge or level selection.
 - When setting [AF105] DC braking force and [AF106] DC braking time, pay attention to the heat generation on the motor.
-
- Edge mode: [AF107]=00
[AF106] DC braking time setting is given priority, and the inverter performs DC braking for the time set for [AF106]. After the operation command is turned off, if the output frequency falls below [AF103] DC braking frequency, DC braking will be applied for the time set for [AF106]. Even if the operation command is turned on during DC braking, DC braking continues until the time set for [AF106] elapses. (Ex.1), (Ex.2)
 - Level mode: [AF107]=01
Operation commands are given priority. The inverter ignores [AF106] DC braking time and transits to the normal operation. If the start command is turned on during DC braking, the inverter ignores the time set for [AF106] and returns to the normal operation. (Ex.3), (Ex.4)



DC Braking with Frequency Command

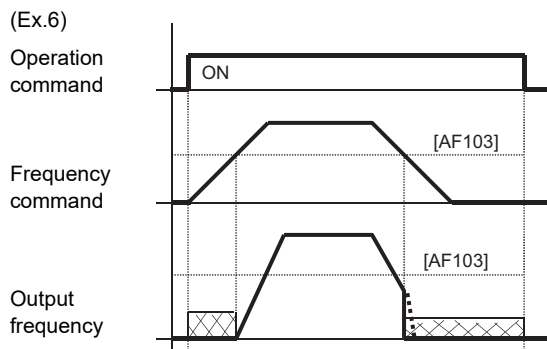
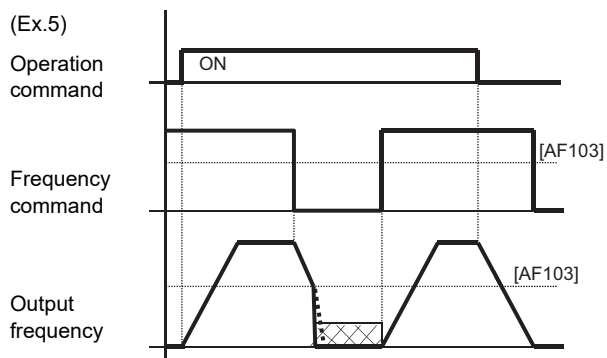
To use the DC braking with frequency command, set [AF101] DC braking selection to 02, and [AF106] DC braking time to other than 0.0 second. DC output can be started by changing the frequency command.

The inverter starts DC braking when both the frequency set by the frequency command and the output frequency fall to [AF103] or below. (Ex.5)

This function operates only when the operation command is on.

If the operation command is turned on after the frequency command has been established (where a value larger than [AF103]+2 Hz is input), the inverter will start operation with the normal output.

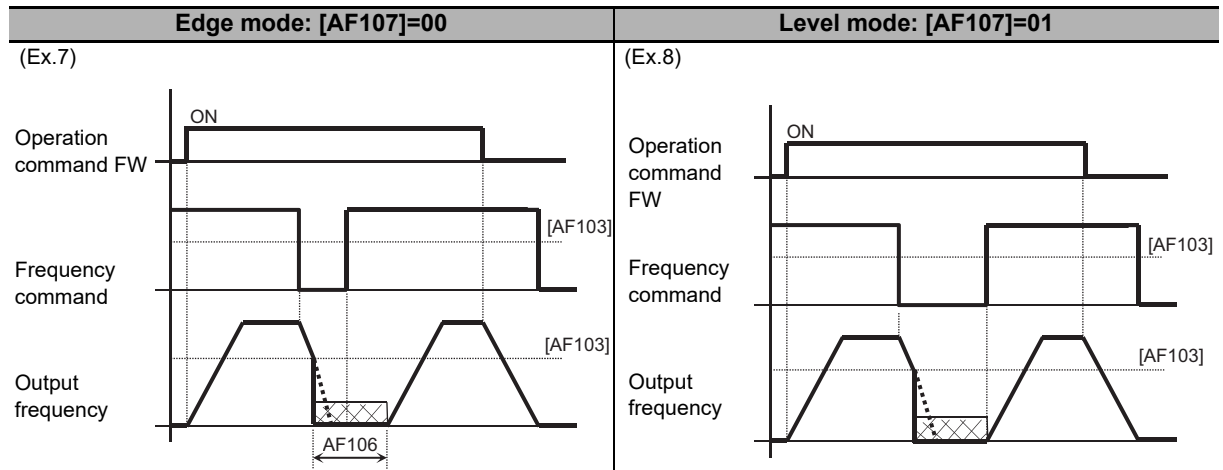
If the frequency command at starting is "0" when the operation command is given via an analog input terminal, the inverter will start operation with DC braking because both the frequency set by the frequency command and current output frequency are "0". (Ex.6)



How the inverter returns to the normal operation varies depending on the setting of the DC braking/edge or level selection [AF107].

When "00" is specified for [AF107], the inverter returns to the normal operation after [AF106] DC braking time has elapsed. (Ex.7)

When [AF107]=01: The inverter starts acceleration when the frequency command exceeds [AF103]+2 Hz. (Ex.8)



Precautions for Correct Use

- If the function of the DC braking with frequency command is enabled, [DB] (input terminal 030) will be disabled.
- If the function of the DC braking with frequency command is enabled, the setting of [AF102] will be disabled and DC braking with [AF102]=00 will operate.

External DC Braking via Terminal Function

Assign 030 [DB] to input terminal functions [CA-01] to [CA-11].

When [AF101]=00 or 01, DC braking will be applied depending on whether the [DB] terminal is on.

Adjust the braking force by adjusting the [AF105] DC braking force.

When you set the [AF104] DC braking delay time, the inverter output will be shut off within the set period of delay, and the motor will run freely during the period. (Ex.11), (Ex.14)

DC braking will be restarted after the set period has elapsed.

Select the braking mode by the DC braking/edge or level selection [AF107], and then make any other necessary settings suitable for your system.

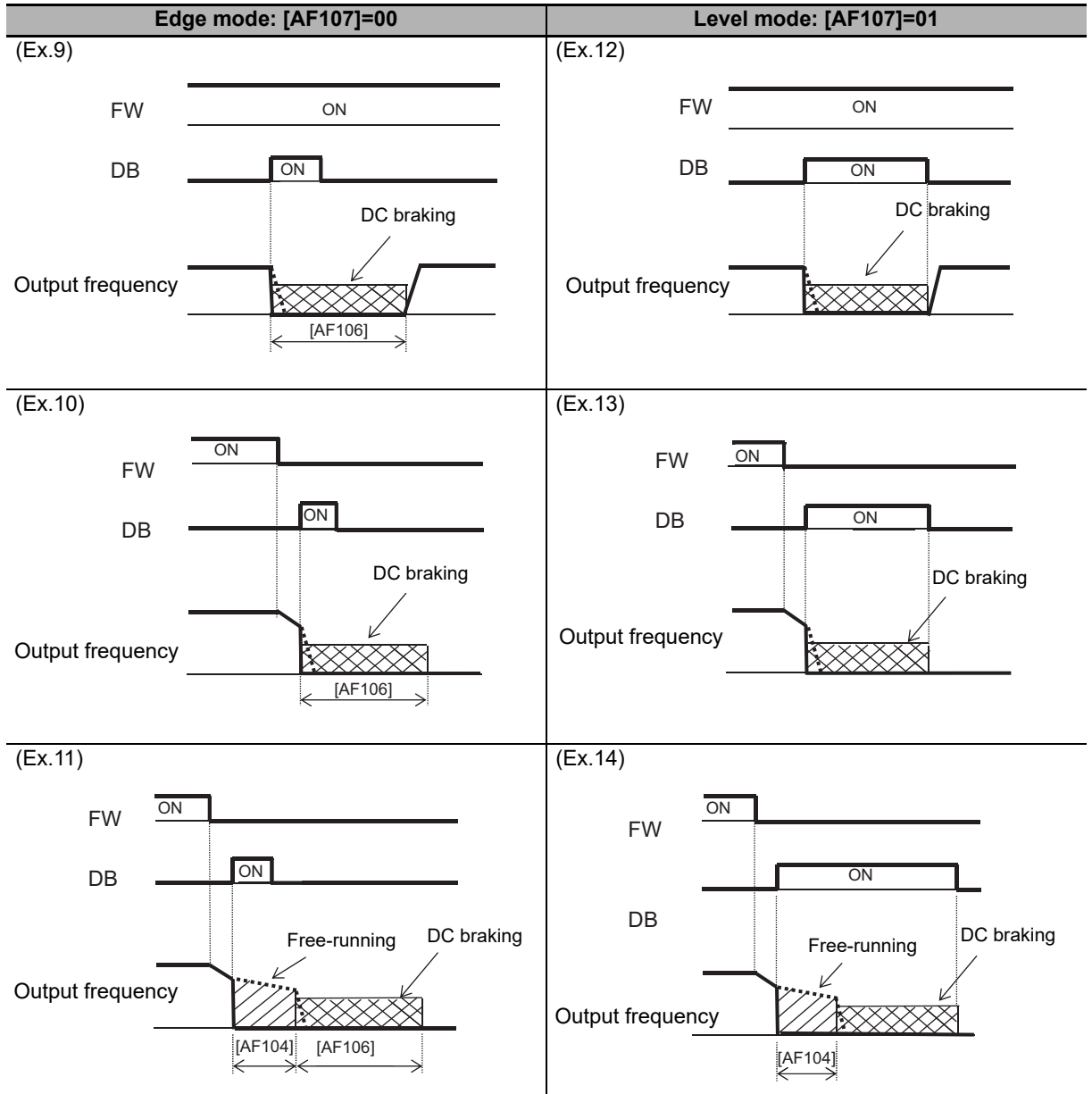
When [AF107]=00: After [DB] is turned on, the inverter performs DC braking for the time set for [AF106] . (Ex.9) to (Ex.11)

When [AF107]=01: The inverter performs DC braking only when [DB] is on. (Ex.12) to (Ex.14)



Precautions for Correct Use

- When setting [AF105] DC braking force, [AF106] DC braking time, or the ON time of the [DB] terminal (input terminal function 030), pay attention to the heat generation on the motor.
 - The setting for the [DB] terminal is given priority over operation commands. (Ex.9), (Ex.12)
 - If the [DB] terminal is turned on when the motor speed is high, an overcurrent error or an overvoltage error may occur.
 - When the [DB] terminal is turned on, DC braking mode that occurs when “00” is specified for [AF102] Braking mode selection is performed regardless of the setting for [AF102].
-



7-6-3 DC Braking for Stopping (Servo Lock Control)

This function is used when a motor does not finish the rotation completely while it is stopping or when the stop position for the motor is fixed.

To use DC braking for stopping (servo-lock control), set [AA121] Control mode and [AF101] DC braking selection to 01, [AF102] Braking mode selection to 01 or 02, and [AF106] DC braking time to other than 0.00 second. DC braking will operate after the frequency output has been shut off.

When [AF104] DC braking delay time is set, and if the operation command is turned off and the decelerated frequency falls below [AF103] DC braking frequency, the output will be shut off once, and after [AF104] has elapsed, DC braking will be started.



Precautions for Correct Use

- The carrier frequency during DC braking depends on [bb101], but it is limited to at maximum 5 Hz. Depending on the set braking force, the carrier frequency may automatically go down to 2 kHz.
- To use the servo-lock control, it is necessary to set [AA121] Control mode. If the applicable control mode is not selected, the inverter will operate as if [AF102] has been set to 00: DC braking.

(1)When [AF102] Braking mode selection is set to 01: Speed servo-lock

| No. | [AA121] Control mode |
|-----|---|
| 1 | 09: 0Hz-range sensorless vector control |
| 2 | 10: Vector control with sensor |

(2)When [AF102] Braking mode selection is set to 02: Position servo-lock

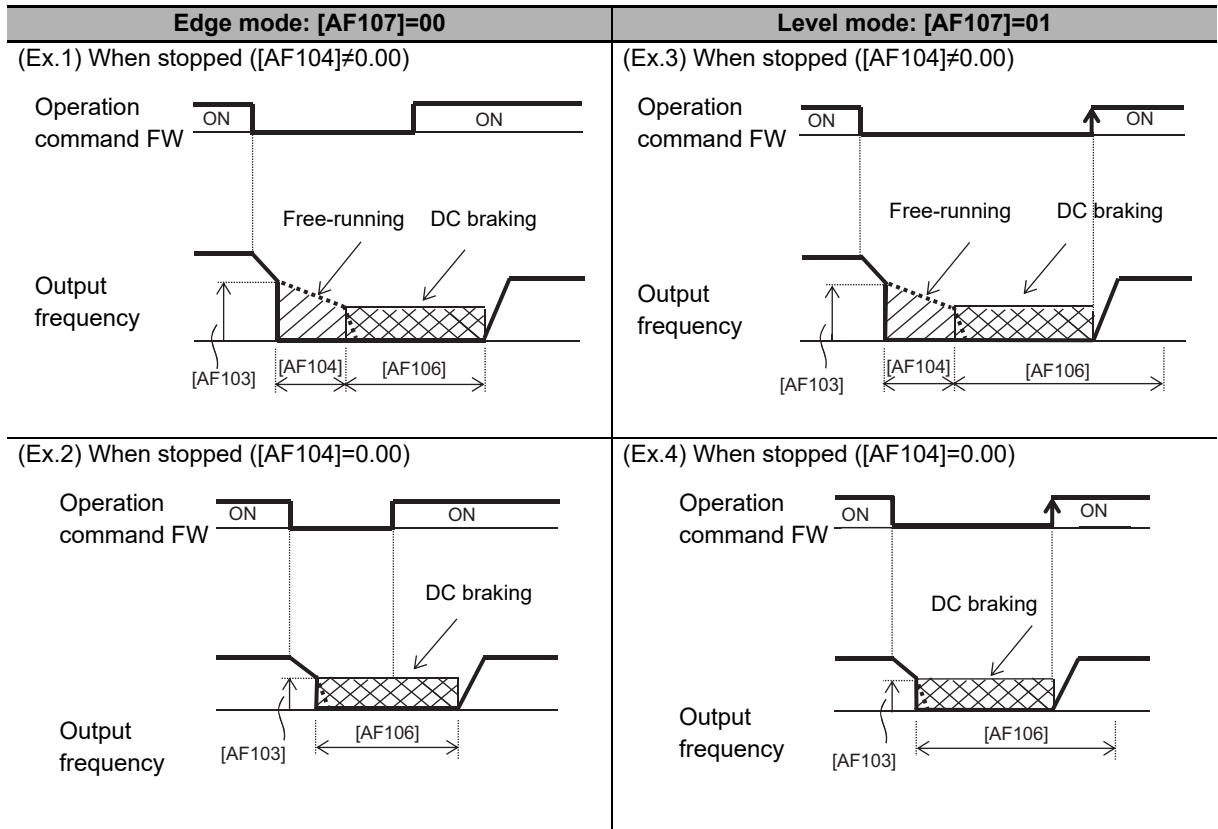
| No. | [AA121] Control mode |
|-----|--------------------------------|
| 1 | 10: Vector control with sensor |

- The operation to be performed when the operation command is switched from the stop command to the start command varies depending on the setting of [AF107] DC braking/edge or level selection.
- When setting [AF106] DC braking time, pay attention to the heat generation on the motor.
- To use the servo-lock control, it is necessary to set [AA121] Control mode. See *7-1 Overview of Motor Control Methods* on page 7-3.
- The output of the servo-lock control is automatically calculated according to the selected control mode.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|--------------------|---|--------------|
| DC braking selection, 1st-motor | [AF101] | 00 | Internal DC braking: Disabled | 00 |
| | | 01 | Internal DC braking: Enabled | |
| | | 02 | Internal DC braking: Enabled (The braking operates only with the set braking frequency.) | |
| Braking type selection, 1st-motor | [AF102] | 01 | Enables the speed servo-lock. | 00 |
| | | 02 | Enables the position servo-lock. | |
| DC braking frequency, 1st-motor | [AF103] | 0.00 to 590.00(Hz) | With internal DC braking enabled, DC braking is started when the output frequency reaches or becomes less than the frequency set for stopping. | 0.50 |
| DC braking delay time, 1st-motor | [AF104] | 0.00 to 5.00(s) | Specifies the delay in starting DC braking while temporarily shutting off the output. | 000 |
| DC braking active time at stop, 1st-motor | [AF106] | 0.00 to 60.00(s) | Sets the duration for DC braking. This setting is valid for the [DB] terminal in edge mode or for the internal DC braking. When "0.00 second" is specified, no braking operation will be performed. | 0.00 |
| DC braking operation method selection, 1st-motor | [AF107] | 00 | Edge mode (Examples 1-a to 6-a) | 01 |
| | | 01 | Level mode (Examples 1-b to 6-b) | |
| Input terminal function | [CA-01] to [CA-11] | 054 | Controls with the servo-on mode using the [SON] terminal. OFF: Servo lock is disabled. ON: Servo lock is enabled. | - |
| Control mode selection, 1st-motor | [AA121] | 08 | Sensorless vector control | 00 |
| | | 09 | Zero-speed range sensorless vector control | |
| | | 10 | Vector control with sensor | |

- Edge mode: [AF107]=00
 [AF106] DC braking time setting is given priority, and the inverter performs DC braking (servo-lock control) for the time set for [AF106]. After the operation command is turned off, if the output frequency falls below [AF103] DC braking frequency, DC braking will be applied for the time set for [AF106]. Even if the operation command is turned on during DC braking, DC braking continues until the time set for [AF106] elapses. (Ex.1), (Ex.2)
- Level mode: [AF107]=01
 Operation commands are given priority. The inverter ignores [AF106] DC braking time and transits to the normal operation. If the start command is turned on during DC braking, the inverter ignores the time set for [AF106] and returns to the normal operation. (Ex.3), (Ex.4)



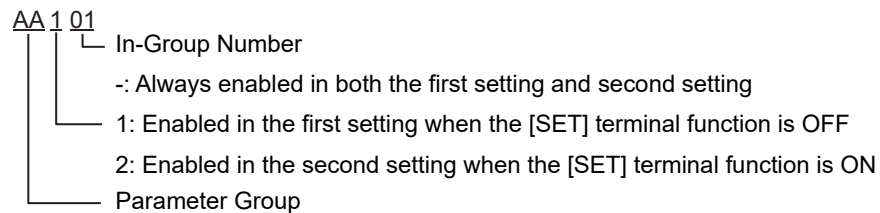
8

Applied Settings

This chapter explains the settings of the applied functions.

The parameter number structure is indicated below.

This chapter explains how to set the first setting. For the second setting, follow the same procedure. The setting value and operation are common.



The function assigned to In/Output terminals is indicated as a combination of three digits numbers and alphabets, like "023[F-OP]." For more details of the functions, refer to the <List of input terminal functions> on page C-44 and the <List of output terminal functions> on page C-49.

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8-1 PID Control

8-1-1 Function Overview

3G3RX2-series is equipped with 4 independent PID functions, and each PID can be set independently.

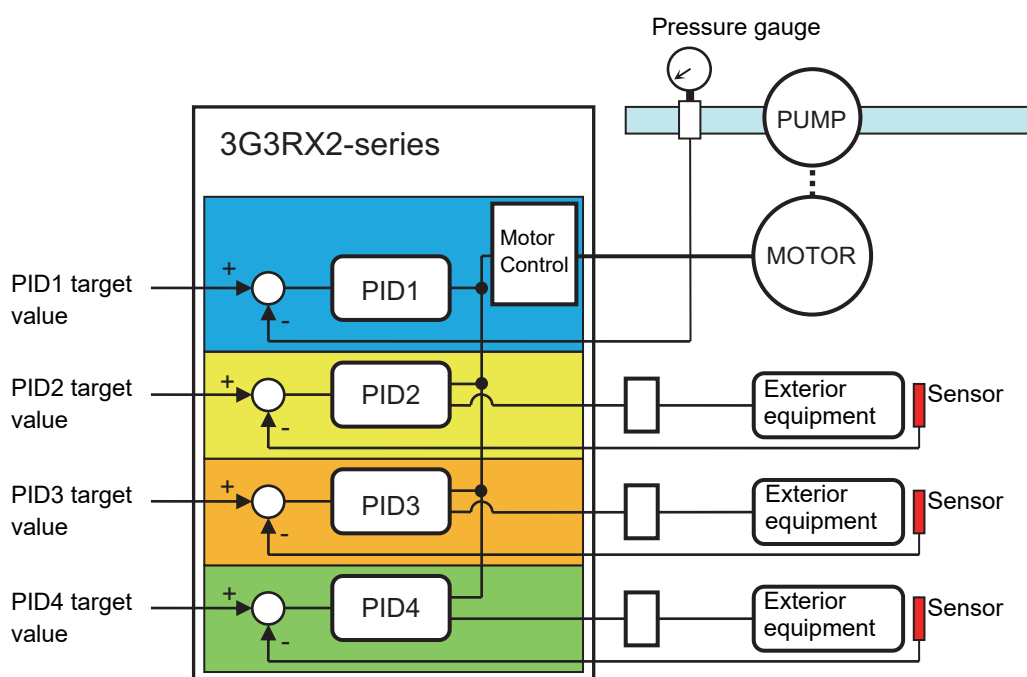
Four PID functions can be used for motor control by switching the [PIO1]/[PIO2] terminals.

PID not used for motor control can be used for operation of exterior PID not related to inverter control freely.

This helps to save space and cost because there is no need to install a separate PID controller.

PID1 can be controlled based on 3 deviations.

Connecting PID1 and PID2 can make 2-layer PID control possible.



For PID control, you can select feed-forward control to attempt stabilizing disturbance in advance, in addition to feedback control to stabilize disturbance.

To control output frequency sent to the motor by the PID function, selection of PID1-4 and setting of frequency command are required.

In the soft-start function, operating normally for a certain period of distance at the start can raise output automatically and then shift to PID control. See *8-1-3 PID Soft-start Function* on page 8-19.

Sleep operation, which is more energy saving, can be set for when the flow rate or air volume is increased. See *8-1-4 PID Sleep Function* on page 8-21.

During PID operation, PID functions are disabled and normal output is performed with the command selected as a target value, while the input terminal function [PID] signal is ON.

Multi-layer command by PID control command is feasible.



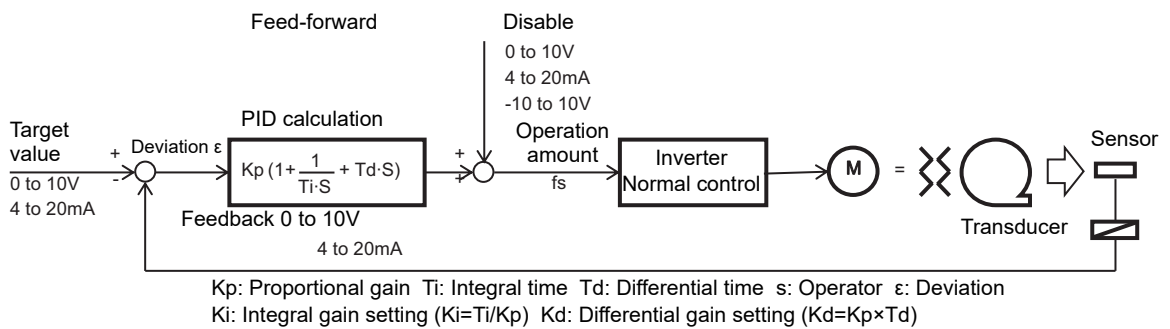
Precautions for Correct Use

- In the case of controlling the motor by PID control, frequency command destination needs to be set to PID output.
- The upper/lower limiter function operates for command frequency by PID output. It does not operate for PID target value.

e.g.) Follow the steps below to perform simple PID control by inputting a target value [Ai1] and a feedback (FB) value [Ai2] from where parameters are default.

1. Set [AH-01] to 01 (enable)
2. Set 15 (PID calculation) to the main speed input source selection, 1st-motor [AA101]
3. Set 01 (Ai1) to the PID1 target value 1 input destination [AH-51]
4. Set 02 (Ai2) to the PID1 FB 1 input destination [AH-07]
5. Set the PID gain of PID1 to [AH-61] to [AH-63]
6. Put the run-command input source selection, 1st-motor [AA111] and start PID control

Basic Composition of PID Control



PID Operation

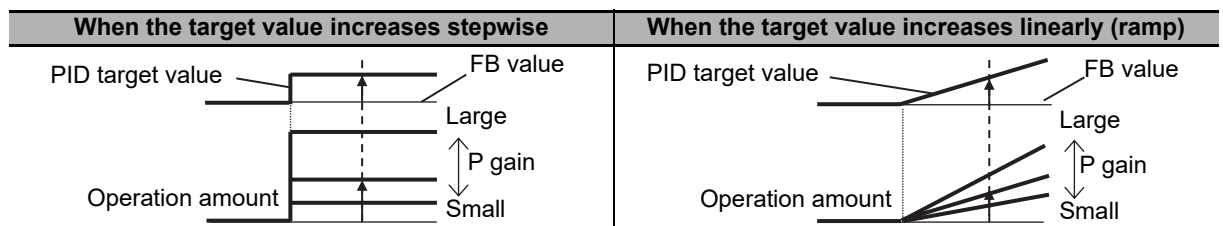
This section explains of a situation when PID target value is constant and feedback (FB) value is changed by using an example.

(a) P operation: P gain K_p

This is an operation that an operation amount of PID command value is proportional to the deviation between PID target value and current feedback (FB) value.

Command operation amount can be adjusted by P gain.

Deviation becomes (PID target value - FB value).



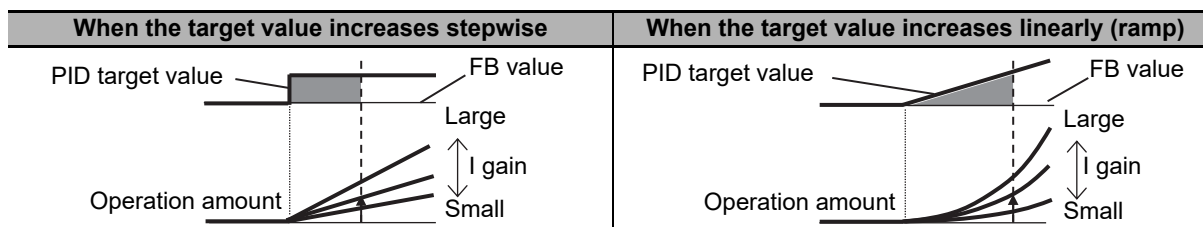
(b) I operation: I gain $K_i (=T_i/K_p)$

This is an operation that an operation amount of PID command value is proportional to the time integral value of the deviation between PID target value and current feedback (FB) value.

Command operation amount can be adjusted by I gain.

Integral value can be cleared by the PIDC terminal function.

Because output change becomes smaller as PID target value and FB value come closer based on an operation amount and it takes time to reach the target value in P operation, it is compensated with I operation.

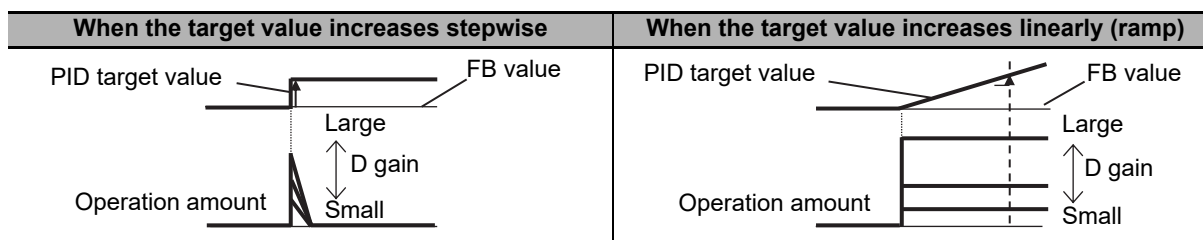


(c) D operation: D gain $K_d (=K_p \times T_d)$

This is an operation that an operation amount of PID command value is proportional to the change of the deviation between PID target value and current feedback (FB) value.

Command operation amount can be adjusted by D gain.

D operation has an effect to compensate the responsiveness of P operation and I operation.



PI operation is an operation with (a) and (b) combined.

PD operation is an operation with (a) and (c) combined.

PID operation is an operation with (a), (b) and (c) combined.

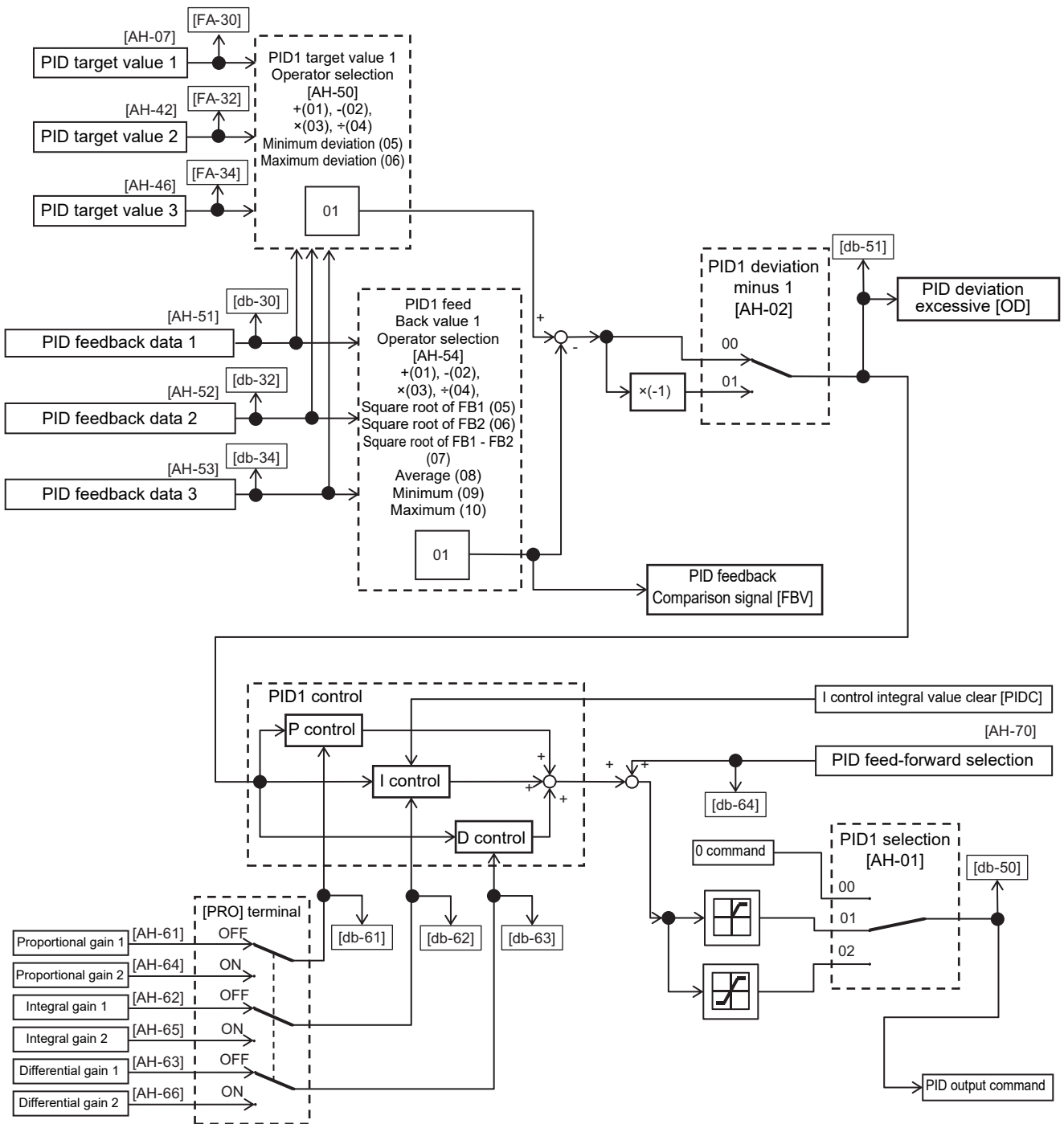
8-1-2 PID Parameter and Block Diagram

PID1 allows three inputs into PID target value and PID feedback data.

PID gain 1 and 2 can be switched by the input terminal function [PRO].

PID1 output can be used as a target value of PID2.

Block Diagram of PID1 Control



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|------------------------------------|--|--------------|
| PID1 enable | [AH-01] | 00 | Disable | 00 |
| | | 01 | Enable (if command becomes negative, it does not output in a reverse direction) | |
| | | 02 | Enable (if command becomes negative, it outputs in a reverse direction) | |
| PID1 deviation inverse | [AH-02] | 00 | Disable | 00 |
| | | 01 | Enable (polarity inversion of deviation) | |
| PID1 deviation inverse | [AH-07] | 00 to 13 | 00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-10] 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 07 |
| Set-point-1 setting for PID1 | [AH-10] | -100.00 to 100.00(%) ^{*1} | This is a set value 1 of PID1 target value 1. | 0.00 |
| Input source selection of Set-point 2 for PID1 | [AH-42] | 00 to 13 | 00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 00 |
| Set-point 2 setting for PID1 | [AH-44] | -100.00 to 100.00(%) ^{*1} | This is a set value of PID1 target value 2. | 0.00 |
| Input source selection of Set-point 3 for PID1 | [AH-46] | 00 to 13 | 00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-48], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 00 |
| Set-point 3 setting for PID1 | [AH-48] | -100.00 to 100.00(%) ^{*1} | This is a set value of PID1 target value 3. | 0.00 |
| Calculation symbol selection of Set-point 1 for PID1 | [AH-50] | 01 | (Target value 1) + (Target value 2) | 01 |
| | | 02 | (Target value 1) - (Target value 2) | |
| | | 03 | (Target value 1) x (Target value 2) | |
| | | 04 | (Target value 1) / (Target value 2) | |
| | | 05 | Minimum deviation among input destinations 1, 2, and 3 | |
| | | 06 | Maximum deviation among input destinations 1, 2, and 3 | |

*1. Data range varies depending on the data from [AH-04] to [AH-06].

| Item | Parameter | Data | Description | Default data |
|---|-----------|-----------------------|---|--------------|
| Input source selection of Process data 1 for PID1 | [AH-51] | 00 to 06, 08 to 13 | 00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 01 |
| Input source selection of Process data 2 for PID1 | [AH-52] | 00 to 06, 08 to 13 | 00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 00 |
| Input source selection of Process data 3 for PID1 | [AH-53] | 00 to 06, 08 to 13 | 00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 00 |
| Calculation symbol selection of Process data for PID1 | [AH-54] | 01 | (FB1)+(FB2) | 01 |
| | | 02 | (FB1)-(FB2) | |
| | | 03 | (FB1)×(FB2) | |
| | | 04 | (FB1)÷(FB2) | |
| | | 05 | Square root of FB1 | |
| | | 06 | Square root of FB2 | |
| | | 07 | Square root of (FB1 - FB2) | |
| | | 08 | Average of FB1/FB2/FB3 | |
| | | 09 | Minimum of FB1/FB2/FB3 | |
| | | 10 | Maximum of FB1/FB2/FB3 | |
| PID1 gain change method selection | [AH-60] | 00 | Disable (gain 1 is used) | 00 |
| | | 01 | Switch by [PRO] terminal | |
| PID1 proportional gain 1 | [AH-61] | 0.0 to 100.0 | Proportional gain | 1.0 |
| PID1 integral time constant 1 | [AH-62] | 0.0 to 3600.0(s) | Integral gain | 1.0 |
| PID1 derivative gain 1 | [AH-63] | 0.00 to 100.00(s) | Differential gain | 0.00 |
| PID proportional gain 2 | [AH-64] | 0.0 to 100.0 | Proportional gain | 0.0 |
| PID integral time constant 2 | [AH-65] | 0.0 to 3600.0(s) | Integral gain | 0.0 |
| PID1 derivative gain 2 | [AH-66] | 0.00 to 100.00(s) | Differential gain | 0.00 |
| PID1 gain change time | [AH-67] | 0 to 10000(ms) | Time for switch by [PRO] terminal operation | 100 |
| PID feed-forward selection | [AH-70] | 00 | Disable | 00 |
| | | 01 | [Ai1] terminal input | |
| | | 02 | [Ai2] terminal input | |
| | | 03 | [Ai3] terminal input | |
| | | 04 | (Reserved) | |
| | | 05 | (Reserved) | |
| | | 06 | (Reserved) | |

● Input Terminal Function

| Item | Terminal name | Data | Description |
|---------------------------------------|---------------|------|--|
| PID disable function | [PID] | 041 | Disables the PID1 function by turning ON the terminal function. When disabled, operation is done by using the command set for target value as command frequency. |
| PID1 I control integral value clear | [PIDC] | 042 | Clears integral value of PID1 control. |
| Multi-layer target command terminal 1 | [SVC1] | 051 | Switches multiple target values. |
| Multi-layer target command terminal 2 | [SVC2] | 052 | |
| Multi-layer target command terminal 3 | [SVC3] | 053 | |
| Multi-layer target command terminal 4 | [SVC4] | 054 | |
| PID gain switch | [PRO] | 055 | Switches PID gain 1 and 2 by terminal. |

● Data Monitor Function

| Item | Parameter | Data | Description |
|---|-----------|------------------------------------|---|
| PID1 target value 1 | [FA-30] | 0.00 to 100.00(%) ^{*1} | Displays PID1 target value. Is changeable when [AH-07] = 07 or multi-layer target value 1-15 is enabled. |
| PID1 target value 2 | [FA-32] | 0.00 to 100.00(%) ^{*1} | Displays PID1 target value 2. Is changeable when [AH-42] = 07. |
| PID1 target value 3 | [FA-34] | 0.00 to 100.00(%) ^{*1} | Displays PID1 target value 3. Is changeable when [AH-46] = 07. |
| PID1 feedback data 1 monitor | [db-30] | -100.00 to 100.00(%) ^{*1} | Displays PID1 feedback value 1. |
| PID1 feedback data 2 monitor | [db-32] | -100.00 to 100.00(%) ^{*1} | Displays PID1 feedback value 2. |
| PID1 feedback data 3 monitor | [db-34] | -100.00 to 100.00(%) ^{*1} | Displays PID1 feedback value 3. |
| PID1 target value monitor after calculation | [db-42] | -100.00 to 100.00(%) ^{*1} | Displays target value after calculation by [AH-50]. |
| PID1 feedback data | [db-44] | -100.00 to 100.00(%) ^{*1} | Displays feedback value after calculation by [AH-54]. |
| PID1 output monitor | [db-50] | -100.00 to 100.00(%) | Displays PID1 output value. |
| PID1 deviation monitor | [db-51] | -200.00 to 200.00(%) | Displays PID1 deviation. |
| PID1 deviation 1 monitor | [db-52] | -200.00 to 200.00(%) | Monitors 3 deviations of PID1 when [AH-50] = 05 or 06. |
| PID1 deviation 2 monitor | [db-53] | -200.00 to 200.00(%) | |
| PID1 deviation 3 monitor | [db-54] | -200.00 to 200.00(%) | |
| PID current P gain monitor | [db-61] | 0.0 to 100.0 | Displays current P gain. |
| PID current I gain monitor | [db-62] | 0.0 to 3600.0(s) | Displays current I gain. |
| PID current D gain monitor | [db-63] | 0.00 to 100.00(s) | Displays current D gain. |
| PID feed-forward monitor | [db-64] | -100.00 to 100.00(%) | Displays feed-forward command value. |

*1. Data range varies depending on the data from [AH-04] to [AH-06].

PID1 Target Value Selection

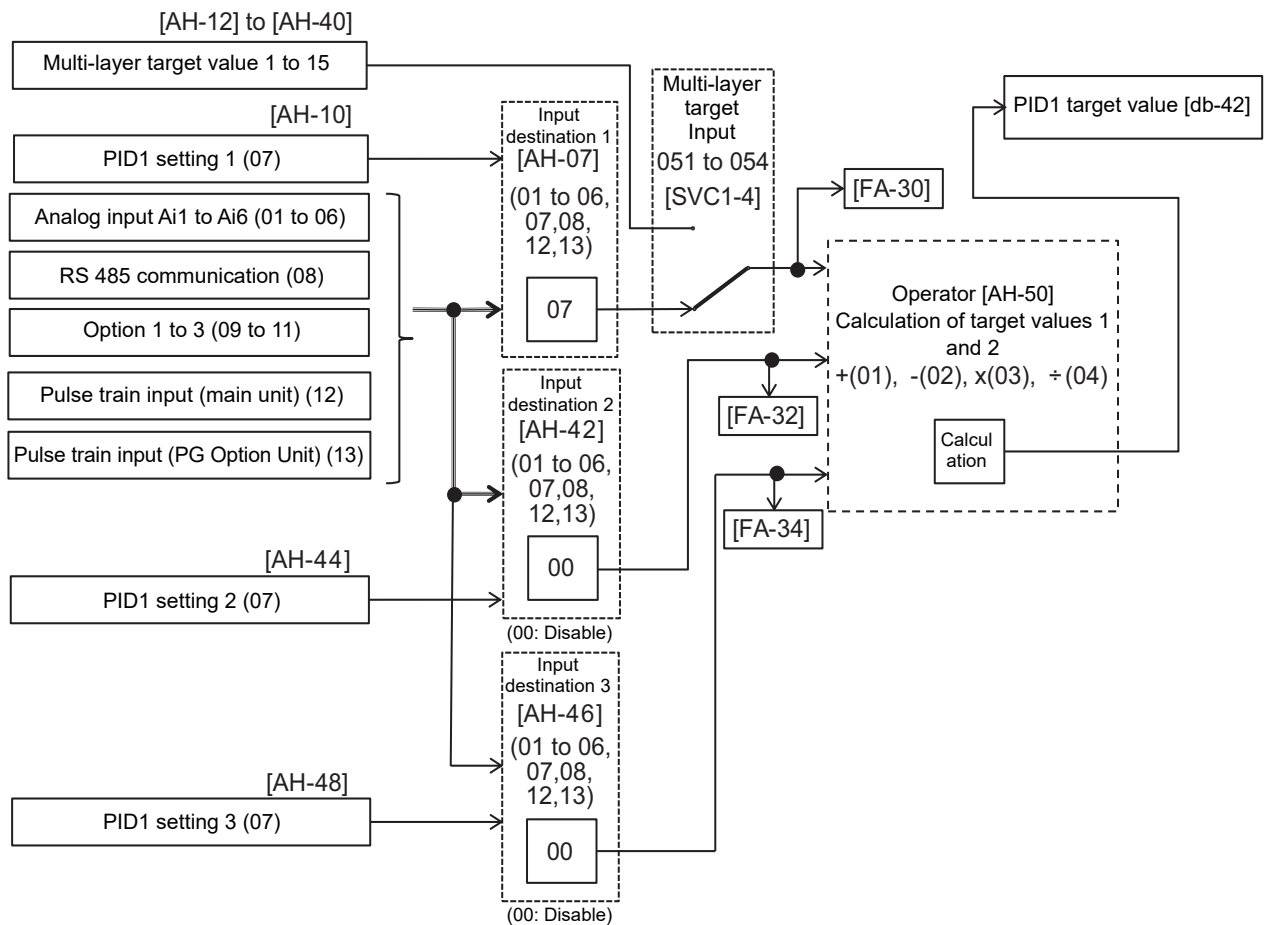
Select PID1 target value.

In the case of setting target value with one input, set 00: None to [AH-42]/[AH-46] and 01: Add to [AH-50] to disable the input destination 2/3.

Calculation result of operator [AH-50] will be restricted in a range of -100.00 to 100.00 (%).

● When Operator [AH-50] is 01 to 04

When 01 to 04 is selected in operator [AH-50], calculation is targeted to target value 1 and target value 2.



● When Operator [AH-50] is 05 or 06

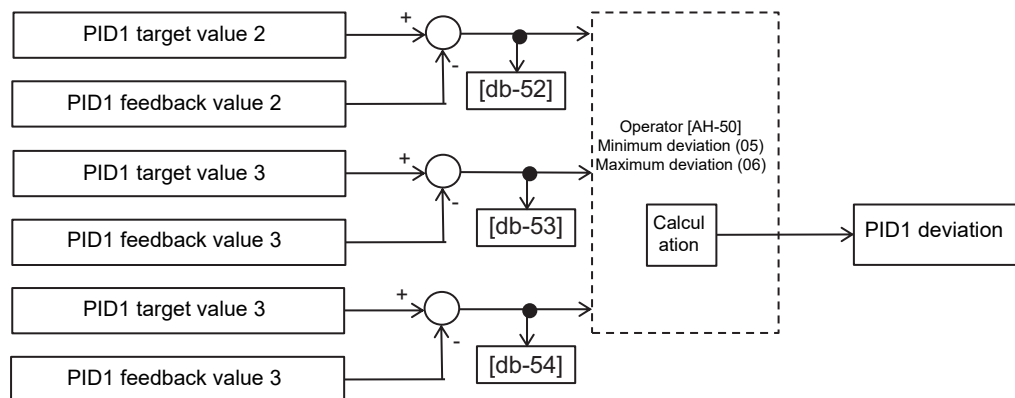
When 05 or 06 is selected in operator [AH-50],

(Target value 1) - (Feedback value 1)

(Target value 2) - (Feedback value 2)

(Target value 3) - (Feedback value 3)

these 3 deviations are compared and PID calculation is performed by using the deviation of minimum (05)/maximum (06).



Precautions for Correct Use

Select 00: Disable for target value and feedback value not in use.

PID Target Value Multi-layer Switch Function

PID1 multi-layer target value (0 to 15 speed) become selectable by assigning 051 to 054 ([SVC1] to [SVC4]) to input terminals 1 to 9, A or B selection [CA-01] to [CA-11].



Precautions for Correct Use

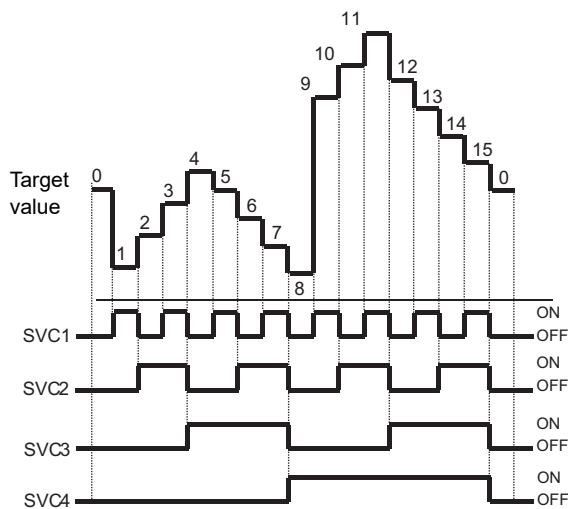
- Stand-by time until terminal input finalization is settable by multi-layer input finalize time [CA-55]. It prevents the transition status of switching terminals from being selected.
- Data is determined after the elapse of a set time for [CA-55] without input change. When you makes the set time longer, input response shows slower.

● Operation Table

| Multi-layer target | SVC4 | SVC3 | SVC2 | SVC1 | Parameter |
|--------------------|------|------|------|------|-----------|
| Target value 0 | OFF | OFF | OFF | OFF | [AH-10]*1 |
| Target value 1 | OFF | OFF | OFF | ON | [AH-12] |
| Target value 2 | OFF | OFF | ON | OFF | [AH-14] |
| Target value 3 | OFF | OFF | ON | ON | [AH-16] |
| Target value 4 | OFF | ON | OFF | OFF | [AH-18] |
| Target value 5 | OFF | ON | OFF | ON | [AH-20] |
| Target value 6 | OFF | ON | ON | OFF | [AH-22] |
| Target value 7 | OFF | ON | ON | ON | [AH-24] |
| Target value 8 | ON | OFF | OFF | OFF | [AH-26] |
| Target value 9 | ON | OFF | OFF | ON | [AH-28] |
| Target value 10 | ON | OFF | ON | OFF | [AH-30] |
| Target value 11 | ON | OFF | ON | ON | [AH-32] |
| Target value 12 | ON | ON | OFF | OFF | [AH-34] |
| Target value 13 | ON | ON | OFF | ON | [AH-36] |
| Target value 14 | ON | ON | ON | OFF | [AH-38] |
| Target value 15 | ON | ON | ON | ON | [AH-40] |

*1. When [AH-07] = 07. Follow the setting of [AH-07].

● Operation Graph



● Input Terminal Function

| Item | Terminal name | Data | Description |
|---------------------------------------|---------------|------|----------------------------------|
| Multi-layer target command terminal 1 | [SVC1] | 051 | Switches multiple target values. |
| Multi-layer target command terminal 2 | [SVC2] | 052 | |
| Multi-layer target command terminal 3 | [SVC3] | 053 | |
| Multi-layer target command terminal 4 | [SVC4] | 054 | |

● PID1 Target Value Selection

| Item | Parameter | Data | Description | Default data |
|--|-----------|---------------------------------|--|--------------|
| Input source selection of Set-point for PID1 | [AH-07] | 00 to 13 | 00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-10], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 07 |
| Set-point-1 setting for PID1 | [AH-10] | 0.00 to 100.00[%] ^{*1} | Is a parameter set value. | 0.00 |
| PID1 Multi stage set-point 1 setting | [AH-12] | | | |
| PID1 Multi stage set-point 2 setting | [AH-14] | | | |
| PID1 Multi stage set-point 3 setting | [AH-16] | | | |
| PID1 Multi stage set-point 4 setting | [AH-18] | | | |
| PID1 Multi stage set-point 5 setting | [AH-20] | | | |
| PID1 Multi stage set-point 6 setting | [AH-22] | | | |
| PID1 Multi stage set-point 7 setting | [AH-24] | | | |
| PID1 Multi stage set-point 8 setting | [AH-26] | | | |
| PID1 Multi stage set-point 9 setting | [AH-28] | | | |
| PID1 Multi stage set-point 10 setting | [AH-30] | | | |
| PID1 Multi stage set-point 11 setting | [AH-32] | | | |
| PID1 Multi stage set-point 12 setting | [AH-34] | | | |
| PID1 Multi stage set-point 13 setting | [AH-36] | | | |
| PID1 Multi stage set-point 14 setting | [AH-38] | | | |
| PID1 Multi stage set-point 15 setting | [AH-40] | | | |
| Input source selection of Set-point 2 for PID1 | [AH-42] | 00 to 13 | 00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 00 |
| Set-point 2 setting for PID1 | [AH-44] | 0.00 to 100.00[%] ^{*1} | Is a parameter set value. | 0.00 |

| Item | Parameter | Data | Description | Default data |
|--|--|---------------------|--|--------------|
| Input source selection of Set-point 3 for PID1 | [AH-46] | 00 to 13 | 00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-48], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 00 |
| Set-point 3 setting for PID1 | [AH-48] | 0.00 to 100.00[%]*1 | Is a parameter set value. | 0.00 |
| Calculation symbol selection of Set-point 1 for PID1 | [AH-50] | 01 | (Target value 1) + (Target value 2) | 01 |
| | | 02 | (Target value 1) - (Target value 2) | |
| | | 03 | (Target value 1) x (Target value 2) | |
| | | 04 | (Target value 1) / (Target value 2) | |
| | | 05 | Minimum of deviation 1 (Target value 1 - FB 1), deviation 2 (Target value 2 - FB 2), and deviation 3 (Target value 3 - FB 1) | |
| 06 | Maximum of deviation 1 (Target value 1 - FB 1), deviation 2 (Target value 2 - FB 2), and deviation 3 (Target value 3 - FB 1) | | | |

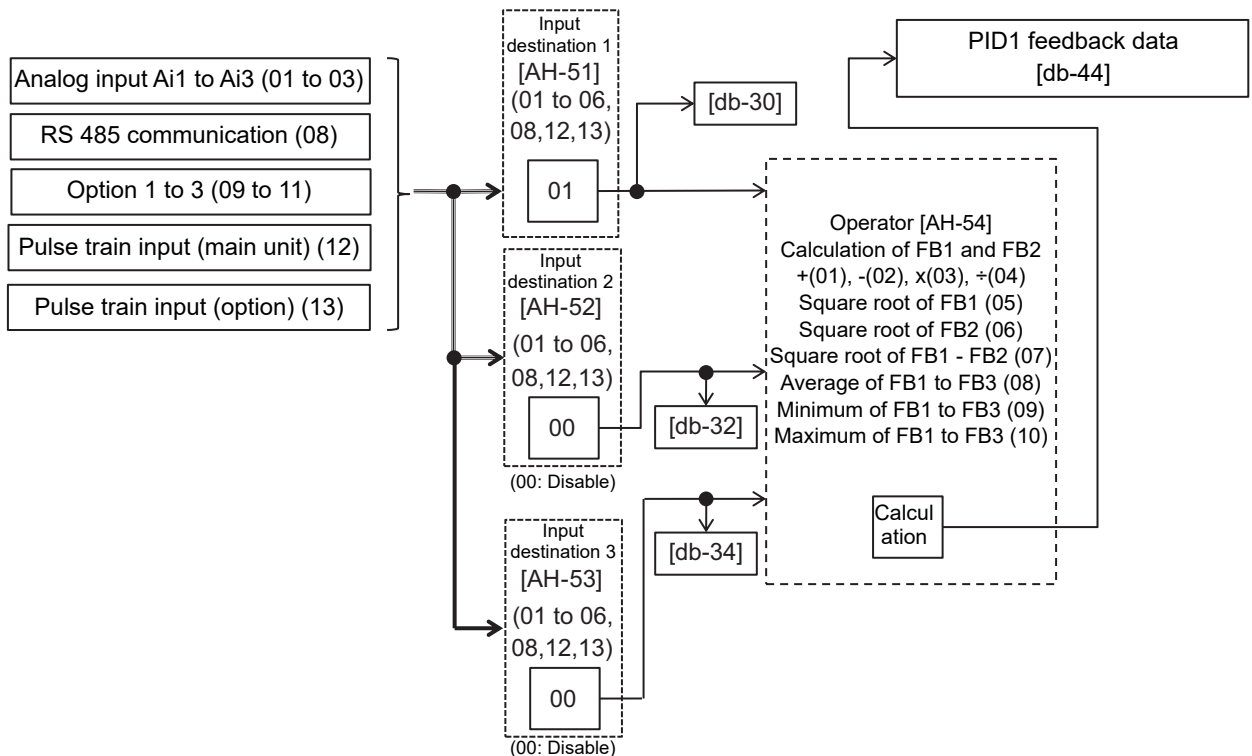
*1. Data range varies depending on the data from [AH-04] to [AH-06].

Selection of PID1 Feedback Data

This selects PID1 feedback data.

In the case of setting feedback data with one input, set 00: None to [AH-52]/[AH-53] and 01: Add to [AH-54] to disable the input destination 2/3.

Calculation result of operator [AH-54] will be restricted in a range of -100.00 to 100.00 (%).



When 01 to 07 is selected in operator [AH-54], calculation will be targeted to feedback data 1 and feedback data 2.

When 08 to 10 is selected in operator [AH-54], calculation will be targeted to feedback data 1 to 3.



Precautions for Correct Use

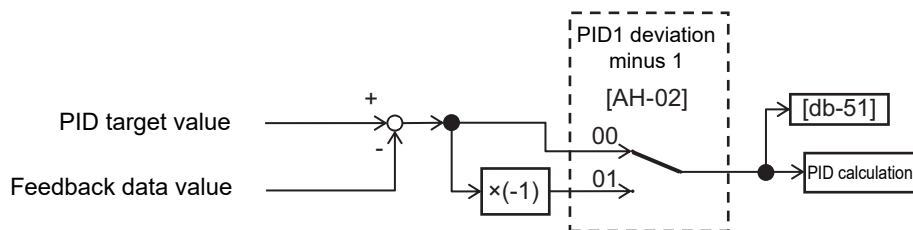
- Select 00: Disable for feedback value not in use.
- Operator [AH-54] will be available to be selected only when 01 to 04 is selected for target value operator [AH-50].

Output of ± Switching PID1 Deviation

Output is feasible by switching ± PID1 deviation.

When PID1 deviation minus [AH-02] is 00, calculation will be performed by (PID target value - FB value). With 01, it will be the same operation as (FB value - PID target value).

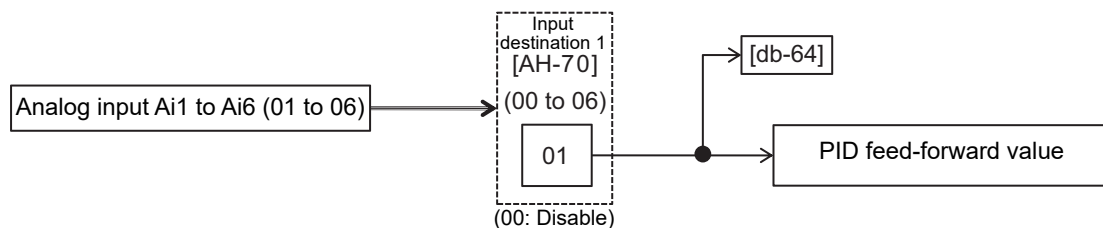
Use this when the polarity of deviation of PID target value and FB value does not much with the command from the inverter due to sensor characteristics, etc.



Selection of PID1 Feed-forward Value

Select PID1-feed forward value.

Feed-forward control operates by setting [AH-70] to anything other than 00 (None).



PID1 Changeable Range Limitation

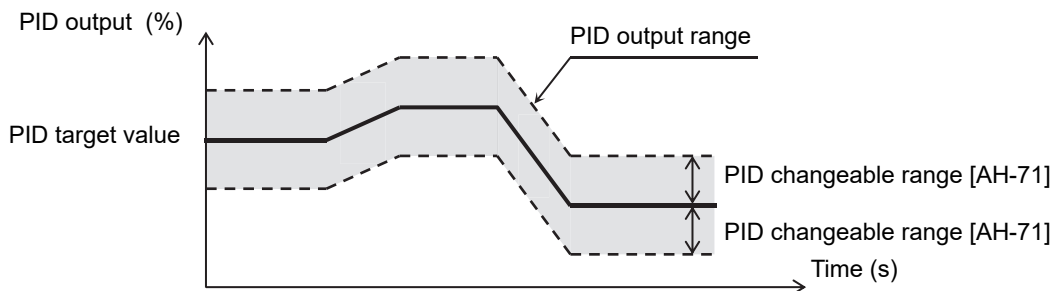
PID output is restricted to a changeable range based on the target value.

When [AH-71] is 0.00, the function will be disabled.



Precautions for Correct Use

In the case of using this function, set PID1 output range [AH-71]. Restriction will be made in a range of PID target value \pm [AH-71] with the maximum speed as 100%.



● Parameter

| Item | Terminal name | Data | Description | Default data |
|-------------------|---------------|-------------------|--|--------------|
| PID1 output range | [AH-71] | 0.00 to 100.00(%) | Changeable range based on the target value | 00 |

PID1 Reverse Output

In normal PID control, the inverter does not output a negative figure for frequency command and limits at 0 Hz, when result of PID calculation was negative. If you select 02 (with reverse output) for PID1 selection [AH-01], frequency command can be output in a reverse direction, when result of PID calculation was negative.



Precautions for Correct Use

When [AH-01] is set to 02 (with reverse output), the PID changeable range limit function [AH-71] will be extended to the negative direction.

PID1 I Control Integral Reset Function [PIDC]

This is a function to clear the integral figure of PID operation.

In the case of turning ON the [PIDC] terminal, do so when PID is not in operation.



Precautions for Correct Use

Turning ON the [PIDC] terminal during PID operation clears the integral value added to the PID output command and changes the PID output command value abruptly, resulting in an over-current error.

PID1 Disable Function [PID]

Turning ON the terminal temporarily disables PID operation and performs output according to frequency command.

The figure input as PID command will be adopted for frequency command.

Adjustment of PID1 Control

When a response is not stabilized in PID function, adjust the control in accordance with the following tables.



Precautions for Correct Use

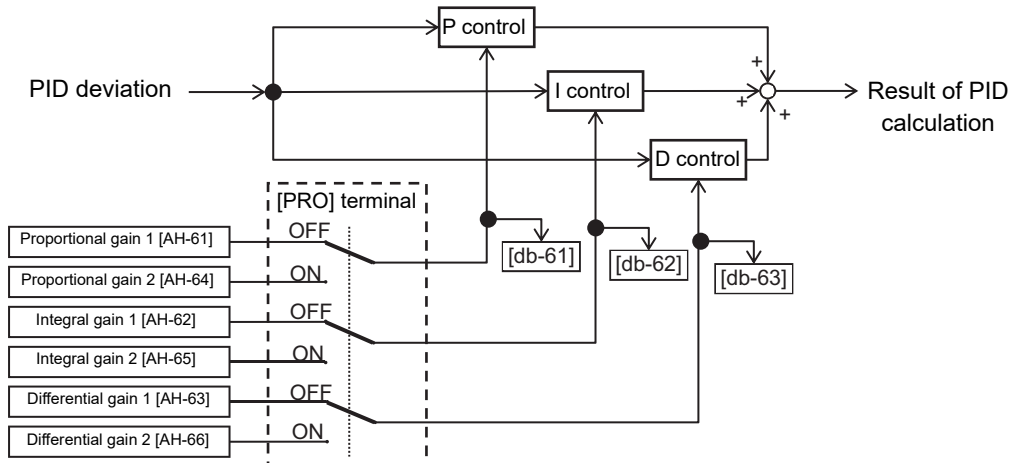
If acceleration/deceleration time is set too long, following of output frequency will be delayed and control may not be successful. In this case, set the acceleration/deceleration time short.

| Phenomenon | Examples of measures |
|--|--|
| Output response is slow and feedback value does not change swiftly even if PID target value was changed. | Increase PID1 proportional (P) gain 1 [AH-61]. |
| <ul style="list-style-type: none"> Feedback value changes swiftly and is not stabilized. Overshooting or hunting occurs. | Decrease PID1 proportional (P) gain 1 [AH-61]. |
| <ul style="list-style-type: none"> Feedback value vibrates mildly. t takes time for operation to be stabilized. | Decrease PID1 integral (I) gain 1 [AH-62]. |
| PID target value and feedback value do not match easily. | Increase PID1 integral (I) gain 1 [AH-62]. |
| <ul style="list-style-type: none"> Response is slow even if proportional gain was increased. Small hunting occurs. | Increase PID1 differential (D) gain 1 [AH-63]. |
| Response due to disturbance is large and it takes time until stabilization. | Decrease PID1 differential (D) gain 1 [AH-63]. |

Switching PID1 Gain

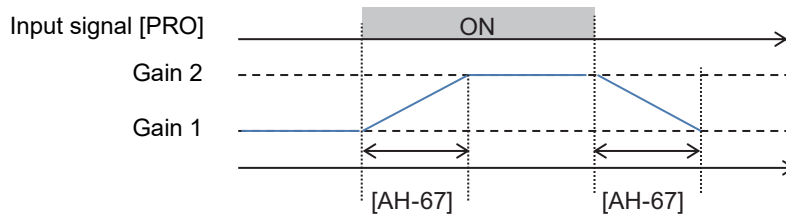
PID gain 1 and 2 can be switched by switching the input terminal function 055 [PRO].

In the case of using the [PRO] terminal, set 01 to PID1 gain switch method selection [AH-60].



PID gain is time for PID1 gain to switch [AH-67] and switches continuously.

Each gain selected for PIDs can be checked by respective monitors [db-61] to [db-63].

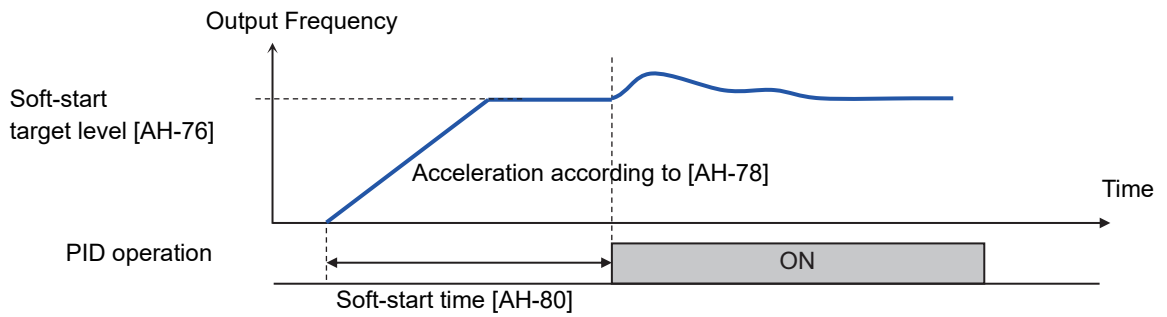


8-1-3 PID Soft-start Function

In the case of using this function, enable PID control and set 01 to the [AH-75] PID soft-start function selection.

It will move to PID control automatically after the elapse of the time set in [AH-80].

It accelerates to soft-start target level [AH-76] after start of soft-start.



● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|--------------------|--|--------------|
| PID soft start function enable | [AH-75] | 00 | Disable | 00 |
| | | 01 | Enable | |
| PID soft start target level | [AH-76] | 0.00 to 100.00(%) | It is a target value of the soft-start range with the maximum frequency as 100%. | 100 |
| Acceleration time setting for PID soft start function | [AH-78] | 0.00 to 3600.00(s) | Sets acceleration time at the time of soft-start. | 30.00 |
| PID soft start time | [AH-80] | 0.00 to 600.00(s) | Is soft-start operation time. | 0.00 |

PID Start Abnormal Judgment

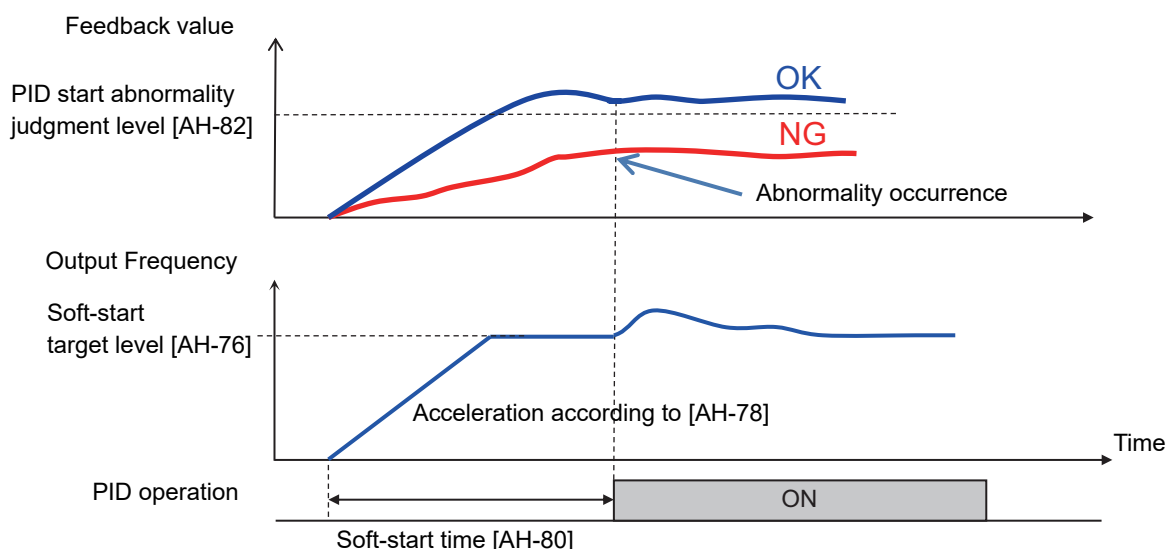
It is a function to detect breakage of pipes such as water leakage.

Abnormality will be judged when PID-FB value is lower than [AH-82] PID start abnormality judgment level after the elapse of [AH-80] soft-start time following PID soft-start.

Abnormal operations vary depending on the setting of [AH-81] PID start abnormality judgment implementation selection at the time of abnormality judgment.

- Nothing will be done when [AH-81] is 00.
- When [AH-81] is 01, it will trip with [E120] PID start abnormality error after the abnormal status elapsed the set time for [AH-80].
- When [AH-81] is 02, the [SSE] terminal will be turned ON after the abnormal status elapsed the set time of [AH-80].

The [SSE] terminal will stay ON until it stops.



● Parameter

| Item | Parameter | Data | Description | Default data |
|---------------------------------------|-----------|-------------------|---|--------------|
| PID soft start error detection enable | [AH-81] | 00 | Disable | 00 |
| | | 01 | Enable It will trip with [E120] PID start abnormality error when start abnormality is judged. | |
| | | 02 | Enable The [SSE] terminal will be turned ON when start abnormality is judged. | |
| PID soft start error detection level | [AH-82] | 0.00 to 100.00(%) | Is a level to judge start abnormality. | 0.00 |

8-1-4 PID Sleep Function

In the case of using this function, set 01 (output low) or 02 (SLEP terminal) to PID sleep condition selection [AH-85].

You can change the start/cancel time and level of the sleep operation depending on the usage.

You can choose cancellation of the PID sleep status from 01 (deviation amount), 02 (feedback low), and 03 (WAKE terminal) of the PID wake condition selection [AH-93].

In the case of canceling the PID sleep status by deviation, cancellation will only be activated when deviation increases in a direction of lower output, even if PID1 deviation [AH-02] was set to 01 and PID deviation \pm was switched.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|--------------------|--|--------------|
| PID sleep trigger selection | [AH-85] | 00 | Disable | 00 |
| | | 01 | Starts sleep operation when output is low | |
| | | 02 | Starts operation at the rising edge of the [SLEP] terminal | |
| PID sleep start level | [AH-86] | 0.00 to 590.00(Hz) | Is a level of making a judgment of sleep operation for the output speed when [AH-85] = 01. | 0.00 |
| PID sleep active time | [AH-87] | 0.00 to 100.00(s) | Is stand-by time before shifting to sleep operation. | 0.00 |
| Setpoint boost before PID sleep enable | [AH-88] | 00 | Disable | 00 |
| | | 01 | Boosts target value before sleep operation. | |
| Setpoint boost time | [AH-89] | 0.00 to 100.00(s) | Is actuation time prior to PID sleep. | 0.00 |
| Setpoint boost value | [AH-90] | 0.00 to 100.00(%) | Sets a boost amount to be added to target value before sleep. | 0.00 |
| Minimum RUN time before PID sleep | [AH-91] | 0.00 to 100.00(s) | Does not start sleep operation until [AH-91] has elapsed from start. | 0.00 |
| Minimum active time of PID sleep | [AH-92] | 0.00 to 100.00(s) | Retains the sleep status until [AH-92] has elapsed, once the sleep operation started. | 0.00 |
| PID sleep trigger selection | [AH-93] | 01 | Cancels the sleep operation when a deviation amount increases in a deceleration direction. | 01 |
| | | 02 | Cancels the sleep operation when feedback value decreases. | |
| | | 03 | Cancels the operation at the rising edge of the [WAKE] terminal | |
| PID wake start level | [AH-94] | 0.00 to 100.00(%) | Cancels the operation when feedback value goes below the set value when [AH-93] is 02. | 0.00 |
| PID wake start time | [AH-95] | 0.00 to 100.00(s) | Is stand-by time for operation cancellation when [AH-93] is 02. | 0.00 |
| PID wake start deviation value | [AH-96] | 0.00 to 100.00(%) | Cancels the operation when a deviation between target value and feedback value increases when [AH-93] is 01. | 0.00 |

● Input Terminal Function

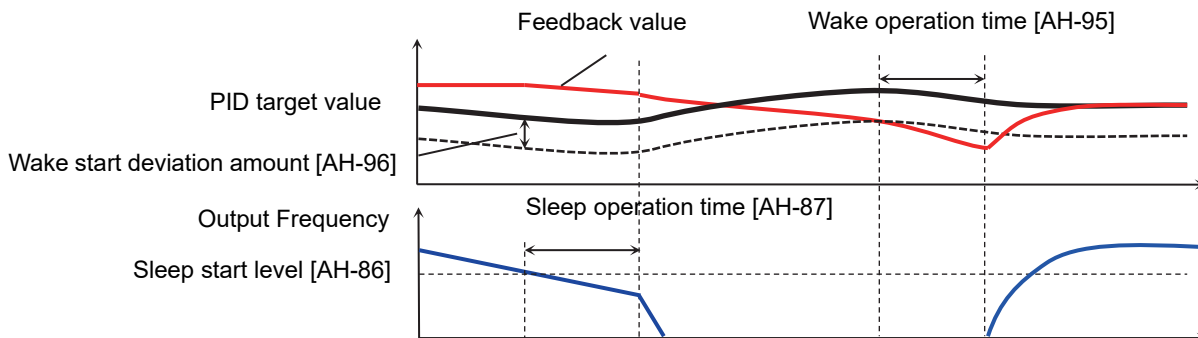
| Item | Terminal name | Data | Description |
|---------------------------|---------------|------|--|
| PID sleep start terminal | [SLEP] | 058 | Starts the sleep function with the terminal when [AH-85] = 02. |
| PID sleep cancel terminal | [WAKE] | 059 | Cancel the sleep function with the terminal when [AH-93] = 03. |

(Ex.1) [AH-85] sleep start: 01 (output low)

Sleep operation starts will start when the output frequency stays below the level of [AH-86] continuously for the set time of [AH-87].

[AH-93] Sleep cancel: 01 (deviation amount)

Cancel operation will start when PID deviation stays over [AH-96] continuously for the set time of [AH-95]. Deviation operates with either figure (\pm).

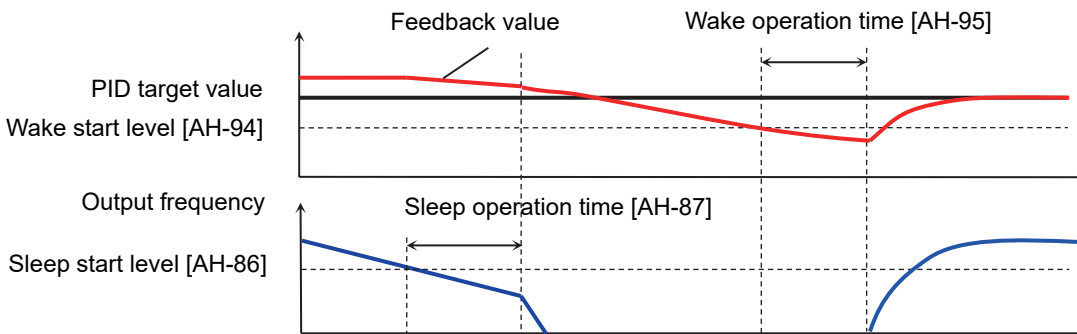


(Ex.2) [AH-85] sleep start: 01 (output low)

Sleep operation will start when the output frequency stays below [AH-86] continuously for the set time of [AH-87].

[AH-93] Sleep cancel: 02 (feedback low)

Cancel operation will start when feedback stays below [AH-94] continuously for the set time of [AH-95].

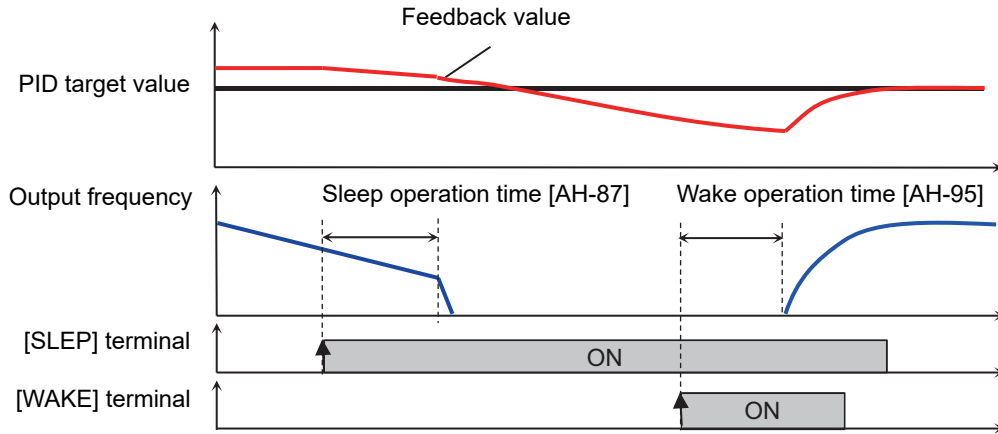


(Ex.3) [AH-85] sleep start: 02 ([SLEP] terminal)

Sleep operation starts after the elapse of [AH-87] from the ON edge of the [SLEP] terminal.

[AH-93] Sleep cancel: 03 ([WAKE] terminal)

Sleep operation will start after the elapse of [AH-95] from the ON edge of the [WAKE] terminal.



Precautions for Correct Use

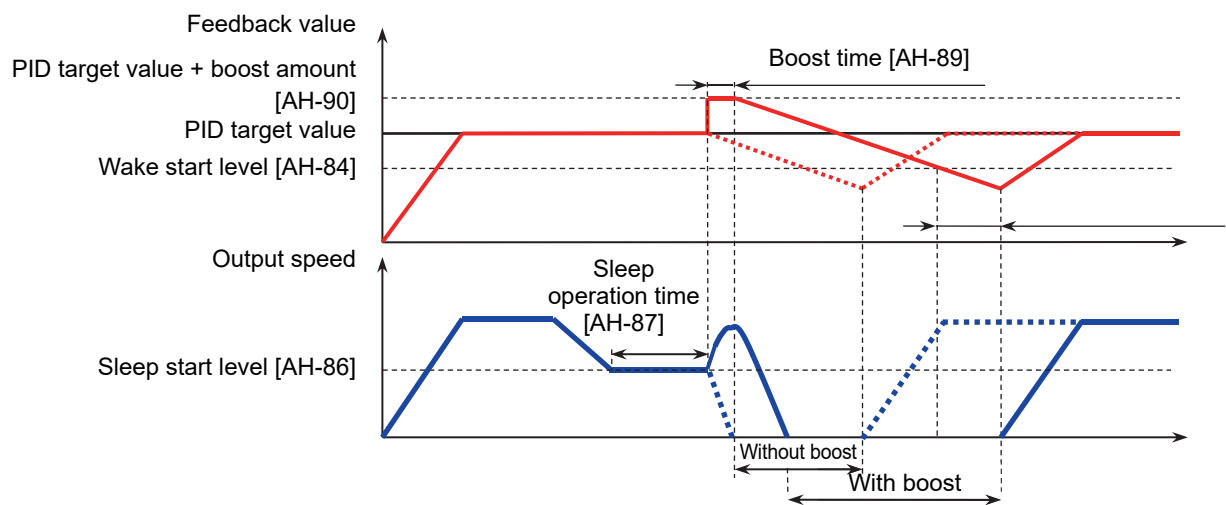
- When you use [SLEP] terminal, turn its terminal ON after wake operation is completed.
- When you use [WAKE] terminal, turn its terminal ON after sleep operation is completed.

Boost Function Prior to Sleep

This raises the PID target value before sleep and increases the feedback amount once. By this, the sleep status can be maintained for a long period of time.

The diagram below is an example when 01 is set to [AH-85] and 02 to [AH-93].

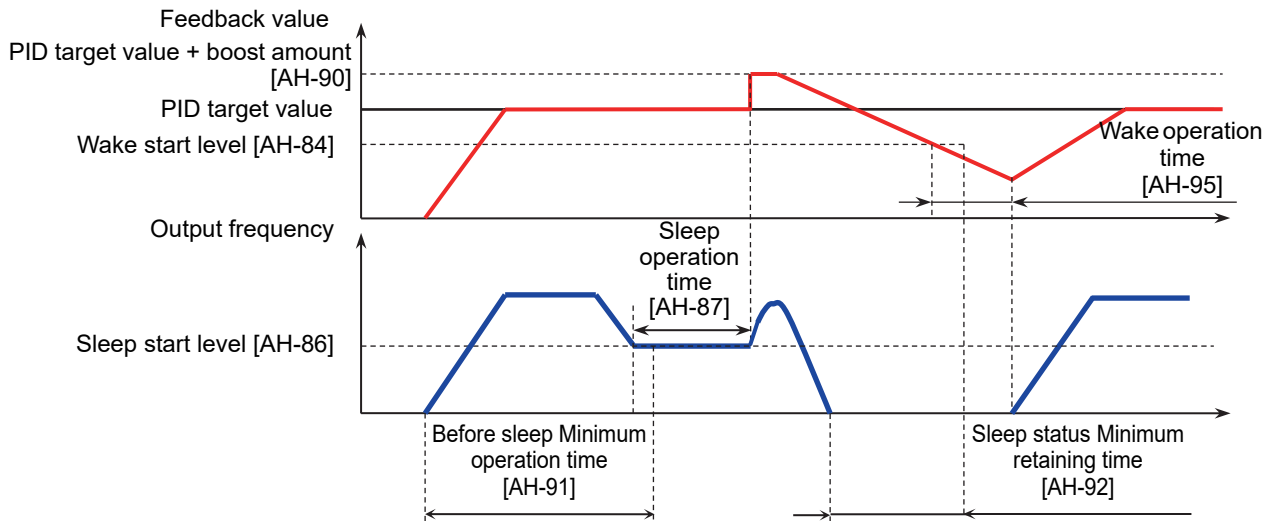
When [AH-85] is 01, the set value of [AH-90] will be added to the PID target value for the set time of [AH-89], if the output frequency stayed below [AH-86] continuously.



Sleep Function Disable Time

Minimum operation time from start to sleep [AH-91] and minimum retaining time of the sleep status [AH-92] can be set.

PID sleep operation can prevent the operation of switching between the sleep status and operation status frequently.



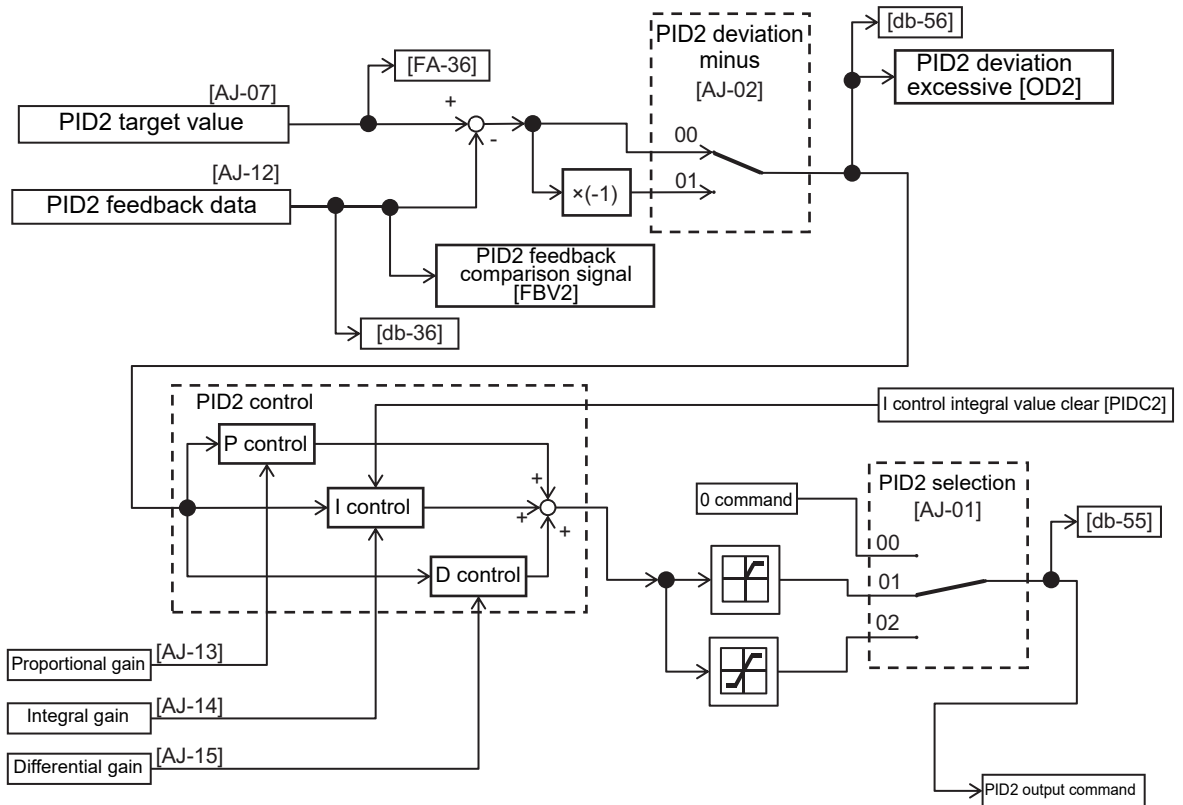
8-1-5 PID2/PID3/PID4 Control

PID1 to PID4 controls operate independently.

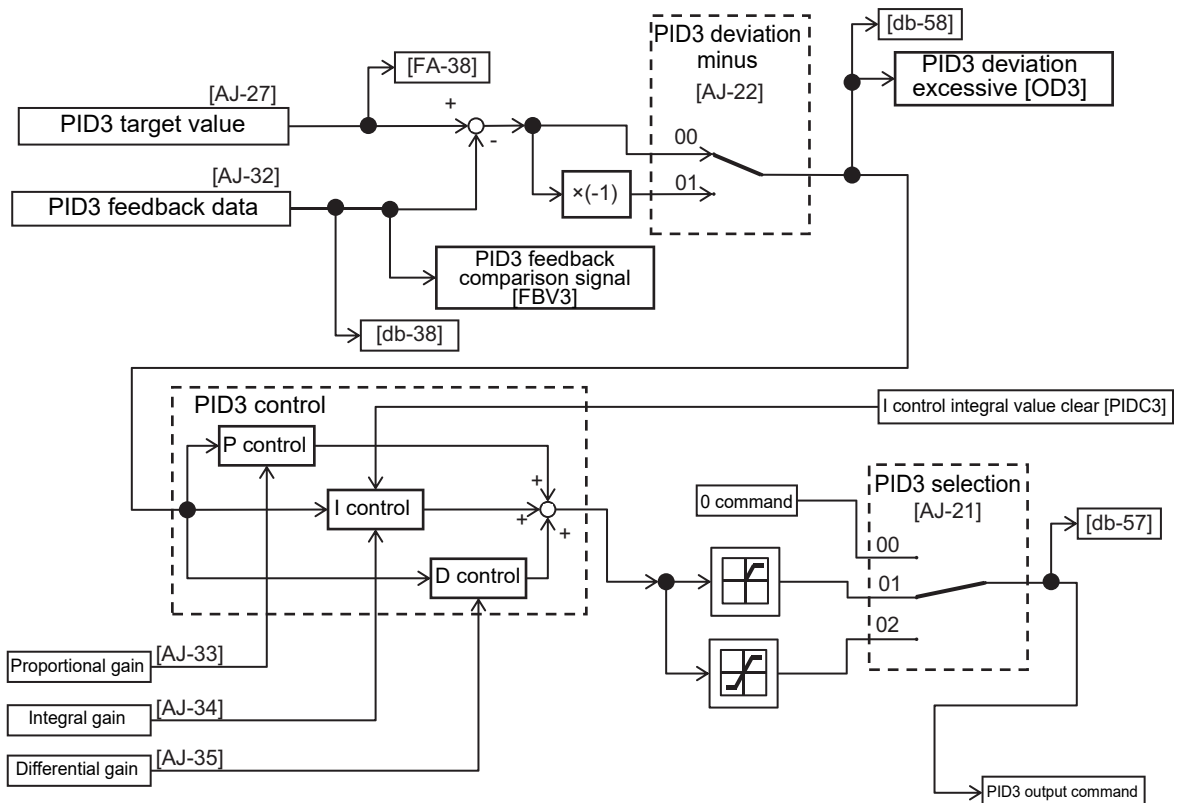
Switching PID1 to 4 by terminal enables the use for switching batch control, etc.

In PID2, selecting PID1 output to target value enables control in consideration of influences from the 2 systems.

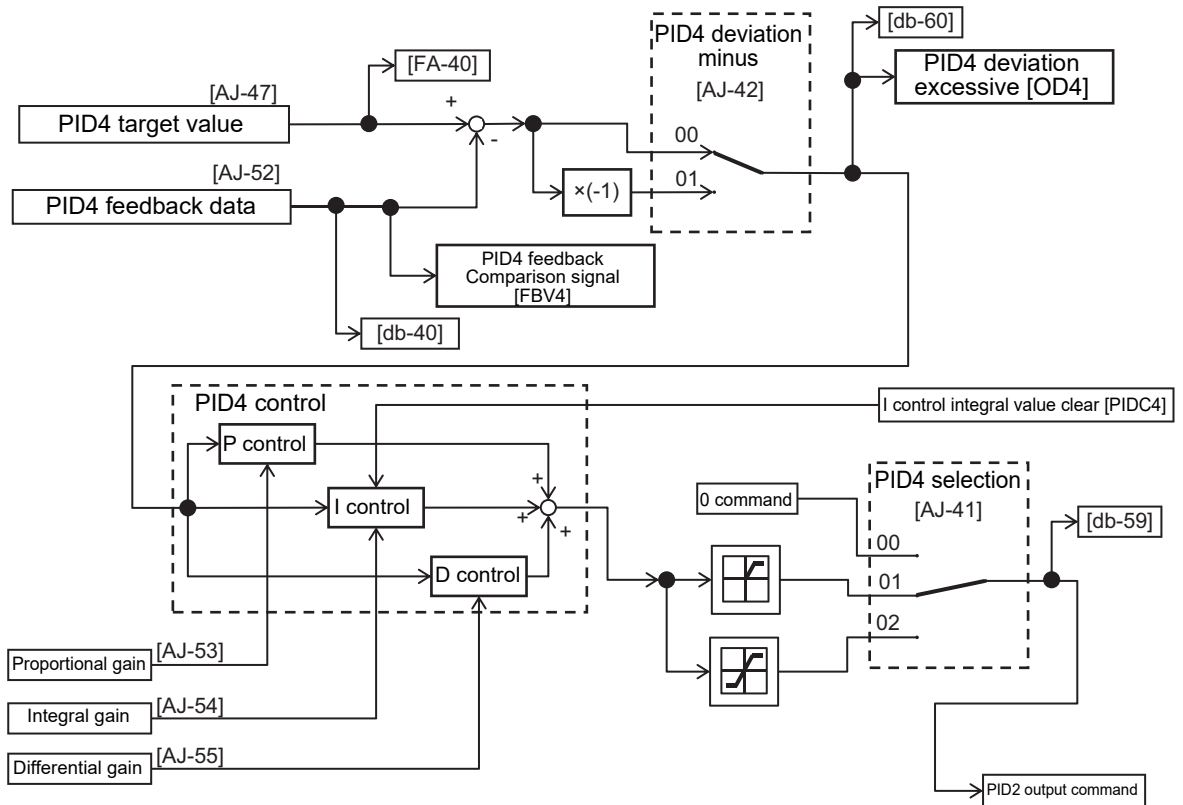
Schematic Diagram of PID2 Control



Schematic Diagram of PID3 Control

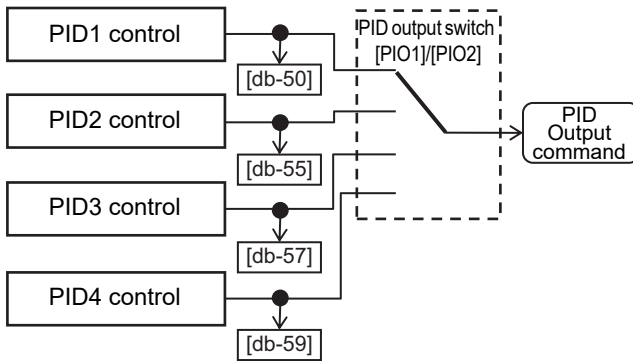


Schematic Diagram of PID4 Control



Switching PID1 to PID4

Switching the input terminal function 056[PIO1]/057[PIO2] enables switching and controlling of PID1 to PID4.



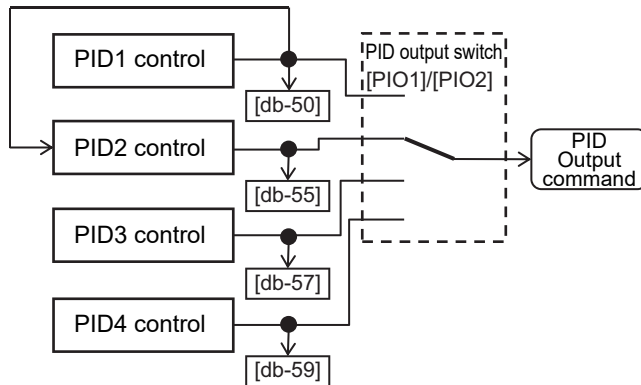
Combination of PIO1/PIO2

| | [PIO2] | [PIO1] |
|-----------------|--------|--------|
| PID1 is enabled | OFF | OFF |
| PID2 is enabled | OFF | ON |
| PID3 is enabled | ON | OFF |
| PID4 is enabled | ON | ON |

Connection of PID1 with PID2

Setting the target value of PID2 to PID1 output ([AJ-07] = 15) enables double-layer control of PID. (PID3/PID4 cannot be selected.)

Enable PID2 output command as follows.



Combination of PIO1/PIO2

| | [PIO2] | [PIO1] |
|-----------------|--------|--------|
| PID2 is enabled | OFF | ON |

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|---------------------------------|---|--------------|
| PID2 enable | [AJ-01] | 00 | Disable | 00 |
| | | 01 | Enable (if command becomes negative, it does not output in a reverse direction) | |
| | | 02 | Enable (if command becomes negative, it outputs in a reverse direction) | |
| PID2 deviation inverse | [AJ-02] | 00 | Disable | 00 |
| | | 01 | Enabled (polarity inversion of deviation) | |
| Input source selection of Set-point for PID2 | [AJ-07] | 00 to 15 | 00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option), 15: PID1 output | 07 |
| Set-point setting for PID2 | [AJ-10] | 0.00 to 100.00(%) ^{*1} | Is a parameter set value. | 0.00 |
| Input source selection of Process data for PID2 | [AJ-12] | 00 to 13 | 00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: P option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 02 |
| PID2 proportional gain | [AJ-13] | 0.0 to 100.0 | Proportional gain | 0.1 |
| PID2 integral time constant | [AJ-14] | 0.0 to 3600.0(s) | Integral gain | 0.1 |

| Item | Parameter | Data | Description | Default data |
|---|-----------|---------------------------------|--|--------------|
| PID2 derivative gain | [AJ-15] | 0.00 to 100.00(s) | Differential gain | 0.00 |
| PID3 enable | [AJ-21] | 00 | Disable | 00 |
| | | 01 | Enable (if command becomes negative, it does not output in a reverse direction) | |
| | | 02 | Enable (if command becomes negative, it outputs in a reverse direction) | |
| PID3 deviation inverse | [AJ-22] | 00 | Disable | 00 |
| | | 01 | Enabled (polarity inversion of deviation) | |
| Input source selection of Set-point for PID3 | [AJ-27] | 00 to 13 | 00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 07 |
| Set-point setting for PID3 | [AJ-30] | 0.00 to 100.00(%) ^{*2} | Is a parameter set value. | 0.00 |
| Input source selection of Process data for PID3 | [AJ-32] | 00 to 13 | 00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option) | 02 |
| PID3 proportional gain | [AJ-33] | 0.0 to 100.0 | Proportional gain | 1.0 |
| PID3 integral time constant | [AJ-34] | 0.0 to 3600.0(s) | Integral gain | 1.0 |
| PID3 derivative gain | [AJ-35] | 0.00 to 100.00(s) | Differential gain | 0.00 |

*1. Data range varies depending on the data from [AJ-04] to [AJ-06].

*2. Data range varies depending on the data from [AJ-24] to [AJ-26].

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|---------------------------------|---|--------------|
| PID4 enable | [AJ-41] | 00 | Disable | 0 |
| | | 01 | Enable (if command becomes negative, it does not output in a reverse direction) | |
| | | 02 | Enable (if command becomes negative, it outputs in a reverse direction) | |
| PID4 deviation inverse | [AJ-42] | 00 | Disable | 0 |
| | | 01 | Enable (polarity inversion of deviation) | |
| Input source selection of Set-point for PID4 | [AJ-47] | 00 to 15 | 00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: Ai4-L input, 05: Ai5-L input, 06: Ai6-L input, 07: Parameter setting [AH-44], 08: RS 485 communication, 09: P option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (PG Option Unit) | 07 |
| Set-point setting for PID4 | [AJ-50] | 0.00 to 100.00(%) ^{*1} | Is a parameter set value. | 0 |
| Input source selection of Process data for PID4 | [AJ-52] | 00 to 13 | 00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: Ai4-L input, 05: Ai5-L input, 06: Ai6-L input, 07: Parameter setting [AH-44], 08: RS 485 communication, 09: P option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (PG Option Unit) | 02 |
| PID4 proportional gain | [AJ-53] | 0.0 to 100.0 | Proportional gain | 1.0 |
| PID4 integral time constant | [AJ-54] | 0.0 to 3600.0(s) | Integral gain | 1.0 |
| PID4 derivative gain | [AJ-55] | 0.00 to 100.00(s) | Differential gain | 0.00 |

*1. Data range varies depending on the data from [AJ-44] to [AJ-46].

● Input Terminal Function

| Item | Terminal name | Data | Description |
|-------------------------------------|---------------|------|---|
| PID2 disable function | [PID2] | 043 | Disables the PID2 function by turning ON the terminal function. Frequency equivalent to the target value of PID2 will be commanded when the terminal is turned ON. |
| PID2 I control integral value clear | [PIDC2] | 044 | Clears the integral value of PID2 control. |
| PID3 disable function | [PID3] | 045 | Disables the PID3 function by turning ON the terminal function. Frequency equivalent to the target value of PID3 will be commanded when the terminal is turned ON. |
| PID3 I control integral value clear | [PIDC3] | 046 | Clears the integral value of PID3 control. |
| PID4 disable function | [PID4] | 047 | Disables the PID4 function by turning ON the terminal function. Frequency equivalent to the target value of PID4 will be commanded when the terminal is turned ON. |
| PID4 I control integral value clear | [PIDC4] | 048 | Clears the integral value of PID4 control. |
| PID output switch 1 | [PIO1] | 056 | Switches PID output by a combination of PIO1 and PIO2. |
| PID output switch 2 | [PIO2] | 057 | |

● Data Monitor Function

| Item | Parameter | Data | Description |
|------------------------|-----------|------------------------------------|---|
| PID2 target value | [FA-36] | -100.00 to 100.00(%) ^{*1} | Displays the target value of PID2. Changeable when [AJ-07] = 09. |
| PID2 feedback monitor | [db-36] | -100.00 to 100.00(%) ^{*1} | Displays the feedback value of PID2. |
| PID2 output monitor | [db-55] | -100.00 to 100.00(%) | Displays the output value of PID2. |
| PID2 deviation monitor | [db-56] | -200.00 to 200.00(%) | Displays the deviation of PID2. |
| PID3 target value | [FA-38] | -100.00 to 100.00(%) ^{*2} | Displays the target value of PID3. Changeable when [AJ-27] = 09. |
| PID3 feedback monitor | [db-38] | -100.00 to 100.00(%) ^{*2} | Displays the feedback value of PID3. |
| PID3 output monitor | [db-57] | -100.00 to 100.00(%) | Displays the output value of PID3. |
| PID3 deviation monitor | [db-58] | -200.00 to 200.00(%) | Displays the deviation of PID3. |
| PID4 target value | [FA-40] | -100.00 to 100.00(%) ^{*3} | Displays the target value of PID4. Changeable when [AJ-47] = 09. |
| PID4 feedback monitor | [db-40] | -100.00 to 100.00(%) ^{*3} | Displays the feedback value of PID4. |
| PID4 output monitor | [db-59] | -100.00 to 100.00(%) | Displays the output value of PID4. |
| PID4 deviation monitor | [db-60] | -200.00 to 200.00(%) | Displays the deviation of PID4. |

*1. Data range varies depending on the data from [AJ-04] to [AJ-06].

*2. Data range varies depending on the data from [AJ-24] to [AJ-26].

*3. Data range varies depending on the data from [AJ-44] to [AJ-46].

Adjust PID2/PID3/PID4 Control

When a response is not stabilized in PID operation, adjust the control in accordance with the following tables.

Adjust respective PID gains for each PID2/PID3/PID4.



Precautions for Correct Use

If acceleration/deceleration time is set too long, following of output frequency will be delayed and control may not be successful.

In this case, set the acceleration/deceleration time short.

| Phenomenon | Examples of measures |
|--|---|
| Output response is slow and feedback value does not change swiftly even if PID target value was changed. | Increase PID proportional gain according to the correspondence table [1]. |
| <ul style="list-style-type: none"> Feedback value changes swiftly and is not stabilized. Overshooting or hunting occurs. | Decrease PID proportional gain according to the correspondence table [1]. |
| <ul style="list-style-type: none"> Feedback value vibrates mildly. It takes time for operation to be stabilized. | Increase PID integral gain according to the correspondence table [2]. |
| PID target value and feedback value do not match easily. | Decrease PID integral gain according to the correspondence table [2]. |
| <ul style="list-style-type: none"> Response is slow even if proportional gain was increased. Small hunting occurs. | Increase PID differential gain according to the correspondence table [3]. |
| Response due to disturbance is large and it takes time until stabilization. | Decrease PID differential gain according to the correspondence table [3]. |

Gain correspondence table

| | [1] Proportional gain | [2] Integral gain | [3] Differential gain |
|------|-----------------------|-------------------|-----------------------|
| PID2 | [AJ-13] | [AJ-14] | [AJ-15] |
| PID3 | [AJ-33] | [AJ-34] | [AJ-35] |
| PID4 | [AJ-53] | [AJ-54] | [AJ-55] |

PID2/PID3/PID4 Changeable Range Limitation

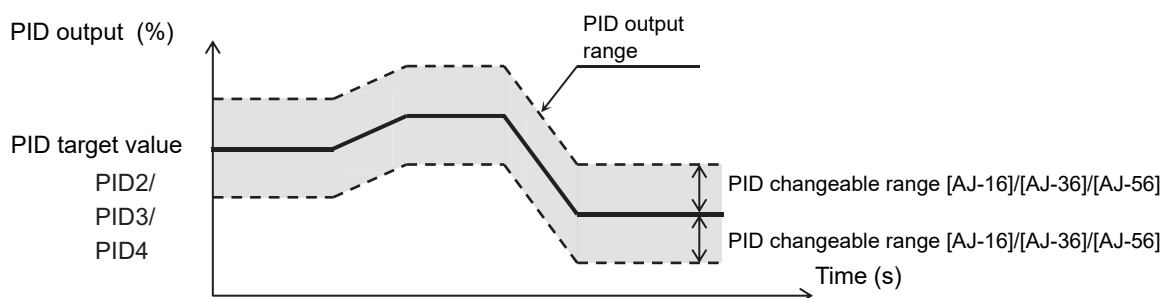
PID output is restricted to a changeable range based on the target value.

The limitation function of PID for which 0.00 was set for the following changeable range will be disabled.



Precautions for Correct Use

In the case of using this function, set the corresponding PID changeable range ([AJ/16]/[AJ-36]/[AJ-56]). Restriction will be set with the maximum speed as 100% (PID target value \pm changeable range).



● Parameter

| Item | Terminal name | Data | Description | Default data |
|-------------------|---------------|-------------------|---|--------------|
| PID2 output range | [AJ-16] | 0.00 to 100.00(%) | Changeable range based on PID2 target value | 0.00 |
| PID3 output range | [AJ-36] | 0.00 to 100.00(%) | Changeable range based on PID3 target value | 0.00 |
| PID4 output range | [AJ-56] | 0.00 to 100.00(%) | Changeable range based on PID4 target value | 0.00 |

PID2/PID3/PID4 Reverse Output

In normal PID control, the inverter does not output a negative figure for frequency command and limits at 0 Hz. If you select 02 (with reverse output) for each selection [AJ-01]/[AJ-21]/[AJ-41] of PID2/PID3/PID4, frequency command can be output in a reverse direction, if the result of the corresponding PID calculation was negative.



Precautions for Correct Use

When [AJ-01]/[AJ-21]/[AJ-41] is set to 02 (with reverse output), the PID changeable range limit function [AJ-16]/[AJ-36]/[AJ-56] will be extended to the negative direction.

● Parameter

| Item | Terminal name | Data | Description | Default data |
|-------------|---------------|------|---|--------------|
| PID2 enable | [AJ-01] | 02 | Enable (if command becomes negative, it outputs in a reverse direction) | 00 |
| PID3 enable | [AJ-21] | | | 00 |
| PID4 enable | [AJ-41] | | | 0 |

PID2/PID3/PID4 I Control Integral Reset Function [PIDC2]/[PIDC3]/[PIDC4]

This is a function to clear an integral figure of the corresponding PID operation.

In the case of turning ON the [PIDC2]/[PIDC3]/[PIDC4] terminal, do so when the corresponding PID is not in operation.



Precautions for Correct Use

Turning ON the [PIDC2]/[PIDC3]/[PIDC4] terminal during PID operation clears the integral value added to the PID output command and changes the PID output command value abruptly, resulting in an over-current error.

PID2/PID3/PID4 Disable Function [PID2]/[PID3]/[PID4]

Turning ON the corresponding terminal disables PID operation temporarily and performs output according to frequency command.

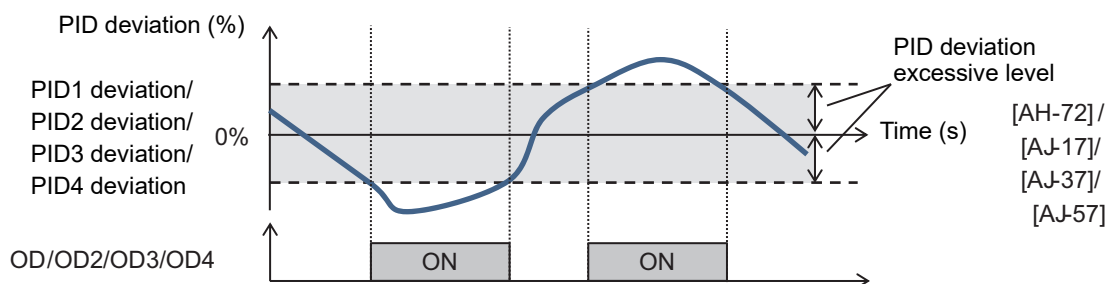
The figure input as PID command will be adopted for frequency command.

8-1-6 PID Signal Output

PID Deviation Excessive Signal (OD)

This outputs a deviation excessive signal in the case of each PID deviation exceeding the set level of the corresponding PID.

Assign output terminal 11 to 15 selection (CC-01 to CC-05) or relay output terminal (16, AL) selection (CC-06/CC-07) to 045 (OD).



● Parameter

| Item | Terminal name | Data | Description | Default data |
|---------------------------|---------------|-------------------|--|--------------|
| PID1 Deviation over level | [AH-72] | 0.00 to 100.00(%) | 045 [OD] signal output judgment level | 3.00 |
| PID2 Deviation over level | [AJ-17] | 0.00 to 100.00(%) | 047 [OD2] signal output judgment level | |
| PID3 Deviation over level | [AJ-37] | 0.00 to 100.00(%) | 089 [OD3] signal output judgment level | |
| PID4 Deviation over level | [AJ-57] | 0.00 to 100.00(%) | 091 [OD4] signal output judgment level | |

● Output Signal Function

| Item | Terminal name | Data | Description |
|---------------------------------|---------------|------|---|
| PID1 deviation excessive signal | OD | 045 | Signal will be turned ON when the difference between PID target value and feedback value exceeds the range of PID1 deviation excessive level. |
| PID2 deviation excessive signal | OD2 | 047 | Signal will be turned ON when the difference between PID target value and feedback value exceeds the range of PID2 deviation excessive level. |
| PID3 deviation excessive signal | OD3 | 089 | Signal will be turned ON when the difference between PID target value and feedback value exceeds the range of PID3 deviation excessive level. |
| PID4 deviation excessive signal | OD4 | 091 | Signal will be turned ON when the difference between PID target value and feedback value exceeds the range of PID4 deviation excessive level. |

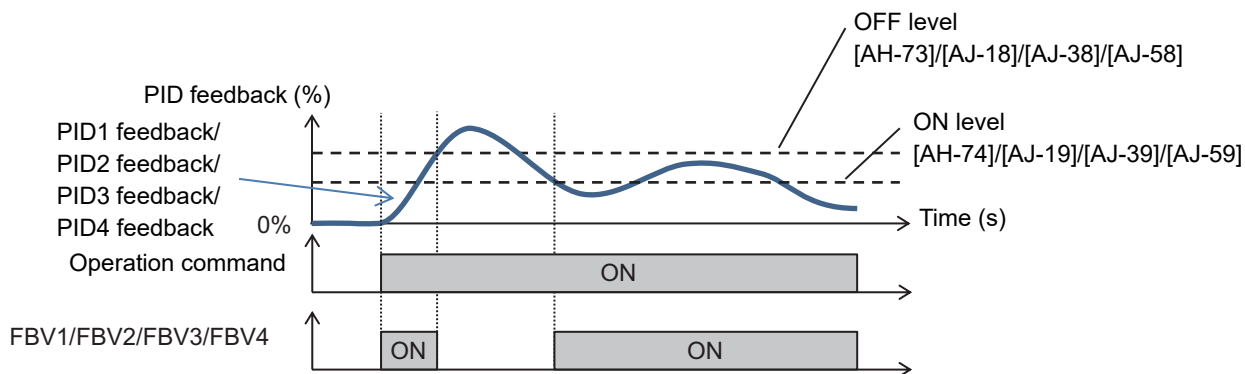
PID Feedback Comparison Signal (FBV)

Output terminal signal will be turned OFF when each PID feedback reaches beyond respective PID set ranges.



Precautions for Correct Use

- Set PID1 feedback to be OFF level \geq ON level. OFF operation will be prioritized when it is set to Off level $<$ ON level.
- Setting ON level/OFF level to be other than 0.00 starts outputting of a feedback comparison signal.



● Parameter

| Item | Terminal name | Data | Description | Default data |
|---|---------------|-------------------|---------------------------------------|--------------|
| PID1 Feedback compare signal turn-off level | [AH-73] | 0.00 to 100.00(%) | FBV1 signal output OFF judgment level | 100.00 |
| PID1 Feedback compare signal turn-on level | [AH-74] | 0.00 to 100.00(%) | FBV1 signal output ON judgment level | 0.00 |
| PID2 Feedback compare signal turn-off level | [AJ-18] | 0.00 to 100.00(%) | FBV2 signal output OFF judgment level | 100.00 |
| PID2 Feedback compare signal turn-on level | [AJ-19] | 0.00 to 100.00(%) | FBV2 signal output ON judgment level | 0.00 |
| PID3 Feedback compare signal turn-off level | [AJ-38] | 0.00 to 100.00(%) | FBV3 signal output OFF judgment level | 100.00 |
| PID3 Feedback compare signal turn-on level | [AJ-39] | 0.00 to 100.00(%) | FBV3 signal output ON judgment level | 0.00 |
| PID4 Feedback compare signal turn-off level | [AJ-58] | 0.00 to 100.00(%) | FBV4 signal output OFF judgment level | 100.00 |
| PID4 Feedback compare signal turn-on level | [AJ-59] | 0.00 to 100.00(%) | FBV4 signal output ON judgment level | 0.00 |

● Feedback Comparison Signal

| Item | Terminal name | Data | Description |
|---------------------------------|---------------|------|---|
| PID1 feedback comparison signal | [FBV1] | 046 | PID1 feedback signal [FBV1] OFF: Exceeded the OFF level. ON: Went below the ON level. |
| PID2 feedback comparison signal | [FBV2] | 048 | PID2 feedback signal [FBV2] OFF: Exceeded the OFF level. ON: Went below the ON level. |
| PID3 feedback comparison signal | [FBV3] | 090 | PID3 feedback signal [FBV3] OFF: Exceeded the OFF level. ON: Went below the ON level. |
| PID4 feedback comparison signal | [FBV4] | 092 | PID4 feedback signal [FBV4] OFF: Exceeded the OFF level. ON: Went below the ON level. |

8-1-7 PID Unit Change

This function enables to change the unit and scale of the following parameters.

In this setting, display descriptions of zero point and maximum point are set.

● PID1 Display Conversion Parameter

| Item | Parameter |
|---|--------------------|
| PID1 Set Value 1 monitor | [FA-30] |
| PID1 Set Value 2 monitor | [FA-32] |
| PID1 Set Value 3 monitor | [FA-34] |
| PID1 feedback data 1 monitor | [db-30] |
| PID1 feedback data 2 monitor | [db-32] |
| PID1 feedback data 3 monitor | [db-34] |
| PID1 target value monitor after calculation | [db-42] |
| PID1 feedback data | [db-44] |
| Set-point-1 setting for PID1 | [AH-10] |
| PID1 Multi stage set-point | [AH-12] to [AH-40] |
| Set-point 2 setting for PID1 | [AH-44] |
| Set-point 3 setting for PID1 | [AH-48] |

● PID2 Display Conversion Parameter

| Item | Parameter |
|----------------------------|-----------|
| PID2 Set Value monitor | [FA-36] |
| PID2 feedback data monitor | [db-36] |
| Set-point setting for PID2 | [AJ-10] |

● PID3 Display Conversion Parameter

| Item | Parameter |
|----------------------------|-----------|
| PID3 Set Value monitor | [FA-38] |
| PID3 feedback data monitor | [db-38] |
| Set-point setting for PID3 | [AJ-30] |

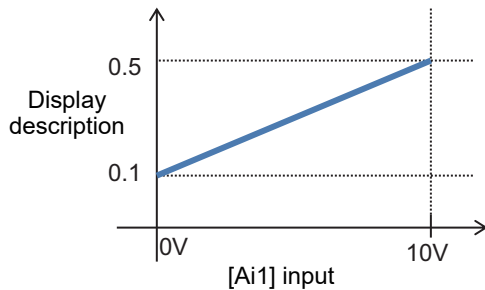
● PID4 Display Conversion Parameter

| Item | Parameter |
|----------------------------|-----------|
| PID4 Set Value monitor | [FA-40] |
| PID4 feedback data monitor | [db-40] |
| Set-point setting for PID4 | [AJ-50] |

● Adjustment Example

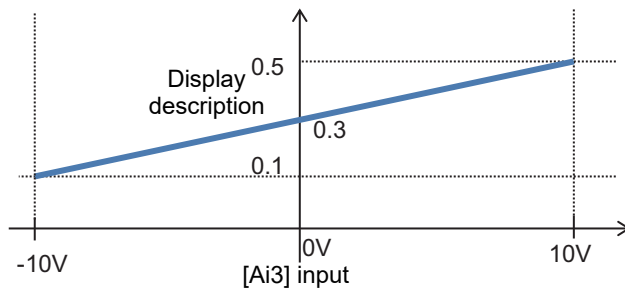
(Adjustment example 1) If you want to display 0 to 10V (0 to 100%) as 0.1 to 0.5kPa in [db-30] when the voltage is feed-backed to the analog input 1 [Ai1]

Unit [AH-03] = 56 (kPa), decimal point position [AH-06] = 02, zero point [AH-04] = 10, end point [AH-05] = 50



(Adjustment example 2) If you want to display -10 to 10V (-100 to 100%) as 0.1 to 0.5kPa in [db-30] when the voltage is feed-backed to the analog input 3 [Ai3]

Unit [AH-03] = 56 (kPa), decimal point position [AH-06] = 02, zero point [AH-04] = 30, end point [AH-05] = 50



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|-----------------|---|--------------|
| PID1 unit selection | [AH-03] | *1 | Sets the unit of PID1 display conversion parameter. | 1 |
| PID1 scale adjustment (0%) | [AH-04] | -10000 to 10000 | Sets the criteria of input 0% of PID1 display conversion parameter. | 0 |
| PID1 scale adjustment (100%) | [AH-05] | -10000 to 10000 | Sets the criteria of input 100% of PID1 display conversion parameter. | 10000 |
| PID1 scale adjustment (point position) | [AH-06] | 00 | 00000. | 02 |
| | | 01 | 0000.0 | |
| | | 02 | 000.00 | |
| | | 03 | 00.000 | |
| | | 04 | 0.0000 | |
| PID2 unit selection | [AJ-03] | *1 | Sets the unit of PID2 display conversion parameter. | 01 |
| PID2 scale adjustment (0%) | [AJ-04] | -10000 to 10000 | Sets the criteria of input 0% of PID2 display conversion parameter. | 0 |
| PID2 scale adjustment (100%) | [AJ-05] | -10000 to 10000 | Sets the criteria of input 100% of PID2 display conversion parameter. | 10000 |
| PID2 scale adjustment (point position) | [AJ-06] | 00 | 00000. | 02 |
| | | 01 | 0000.0 | |
| | | 02 | 000.00 | |
| | | 03 | 00.000 | |
| | | 04 | 0.0000 | |
| PID3 unit selection | [AJ-23] | *1 | Sets the unit of PID3 display conversion parameter. | 01 |
| PID3 scale adjustment (0%) | [AJ-24] | -10000 to 10000 | Sets the criteria of input 0% of PID3 display conversion parameter. | 0 |
| PID3 scale adjustment (100%) | [AJ-25] | -10000 to 10000 | Sets the criteria of input 100% of PID3 display conversion parameter. | 10000 |
| PID3 scale adjustment (point position) | [AJ-26] | 00 | 00000. | 02 |
| | | 01 | 0000.0 | |
| | | 02 | 000.00 | |
| | | 03 | 00.000 | |
| | | 04 | 0.0000 | |
| PID4 unit selection | [AJ-43] | *1 | Sets the unit of PID4 display conversion parameter. | 01 |
| PID4 scale adjustment (0%) | [AJ-44] | -10000 to 10000 | Sets the criteria of input 0% of PID4 display conversion parameter. | 0 |
| PID4 scale adjustment (100%) | [AJ-45] | -10000 to 10000 | Sets the criteria of input 100% of PID4 display conversion parameter. | 10000 |
| PID4 scale adjustment (point position) | [AJ-46] | 00 | 00000. | 02 |
| | | 01 | 0000.0 | |
| | | 02 | 000.00 | |
| | | 03 | 00.000 | |
| | | 04 | 0.0000 | |

*1. Refer to the unit table in the next section.

● Unit Table

| No. | Unit |
|-----|-------------------|
| 00 | non |
| 01 | % |
| 02 | A |
| 03 | Hz |
| 04 | V |
| 05 | kW |
| 06 | W |
| 07 | hr |
| 08 | s |
| 09 | kHz |
| 10 | ohm |
| 11 | mA |
| 12 | ms |
| 13 | P |
| 14 | kgm ² |
| 15 | pls |
| 16 | mH |
| 17 | Vdc |
| 18 | °C |
| 19 | kWh |
| 20 | mF |
| 21 | mVs/rad |
| 22 | Nm |
| 23 | min ⁻¹ |
| 24 | m/s |
| 25 | m/min |
| 26 | m/h |
| 27 | ft/s |
| 28 | ft/min |
| 29 | ft/h |
| 30 | m |

| No. | Unit |
|-----|----------------------|
| 31 | cm |
| 32 | °F |
| 33 | l/s |
| 34 | l/min |
| 35 | l/h |
| 36 | m ³ /s |
| 37 | m ³ /min |
| 38 | m ³ /h |
| 39 | kg/s |
| 40 | kg/min |
| 41 | kg/h |
| 42 | t/min |
| 43 | t/h |
| 44 | gal/s |
| 45 | gal/min |
| 46 | gal/h |
| 47 | ft ³ /s |
| 48 | ft ³ /min |
| 49 | ft ³ /h |
| 50 | lb/s |
| 51 | lb/min |
| 52 | lb/h |
| 53 | mbar |
| 54 | bar |
| 55 | Pa |
| 56 | kPa |
| 57 | PSI |
| 58 | mm |
| | |
| | |
| | |

8-2 Tripless Functions

8-2-1 Overload Limit Level Function

Set [bA122] overload limit function to any value other than 00, and the output frequency automatically lowers according to overload limit time once the output current reaches [bA123] overload limit level.

When [bA122] = 01, the output current is monitored during acceleration or at constant speed. It limits the excess inertial moment during acceleration and overload state caused by sudden acceleration.

When [bA122] = 02, the output current is monitored only at constant speed. It prevents overloading caused by sudden load fluctuation at constant speed without decelerating during acceleration.

When [bA122] = 03, the output current is monitored during acceleration or at constant speed. In addition to the operation with [bA122] = 01, it accelerates to prevent overloading when regenerative load is applied at constant speed.

[bA124] overload limit time is the time to decelerate from the maximum frequency to 0 Hz or to accelerate from 0 Hz to the maximum frequency.

Set overload limit level [bA123/bA127] to 150% of the motor rated current.

Inverter accelerates in the following conditions during regeneration in overload limit level regardless of control methods [AA121/AA221].

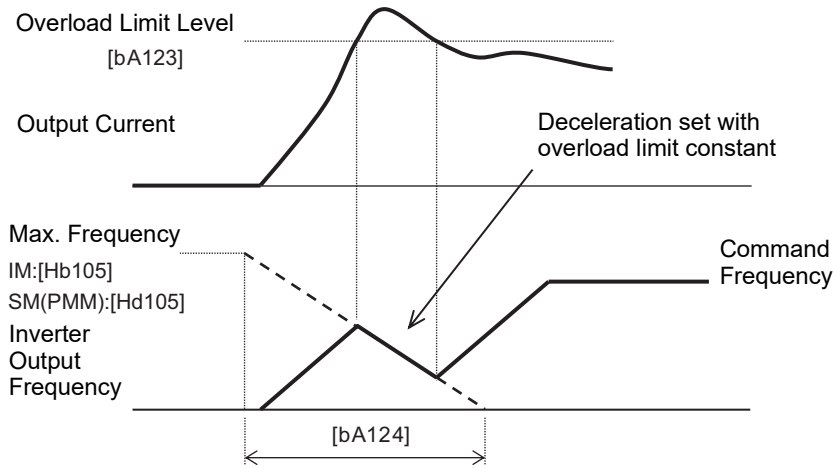
- Overload Limit Selection [bA122/bA126] is set to 03 (Enabled during acceleration/constant speed (Accelerated during regeneration)).
- A current exceeding the overload limit level [bA123/bA127] flows during regenerative operation.

If this function is activated while the inverter is accelerating, the acceleration time will be longer than the set time.



Precautions for Correct Use

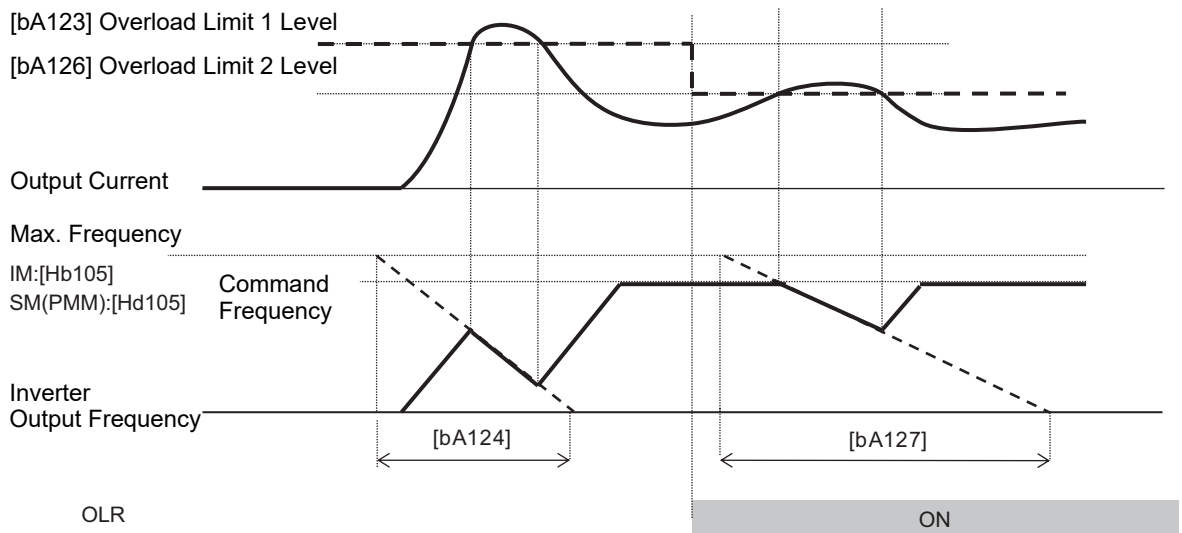
- Setting the overload limit operation time to be too short will cause this function to perform automatic deceleration even during acceleration, which may lead to overvoltage tripping caused by regenerative energy from the motor.
- If this function is activated during acceleration and the frequency does not reach the target frequency, the situation can be improved with the adjustments shown below.
 - Make the acceleration time longer
 - Adjust the torque boost
 - Increase the overload limit level
- Overload limit function is not activated during speed control while it is activated during position/torque control.



Using [bA122] to [bA124] of overload limit 1 and [bA126] to [bA128] of overload limit 2, you can set two types of overload limit functions.

You can switch between overload limit 1 and overload limit 2 with the input terminal function 038[OLR].

Turning on the [OLR] enables the overload limit 2.



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|---|---|--------------------------------|
| Overload restriction 1 mode selection, 1st-motor Overload restriction 2 mode selection, 1st-motor | [bA122] [bA126] | 00 | Disabled | 01 |
| | | 01 | Enabled during acceleration and at constant speed | |
| | | 02 | Enabled at constant speed | |
| | | 03 | Enabled during acceleration and at constant speed (Speed increases during regeneration) | |
| Overload restriction 1 active level, 1st-motor Overload restriction 2 active level, 1st-motor | [bA123] [bA127] | Inverter rated current $\times (0.2 \text{ to } 2.0)^{*1}$ | Overload limit function is activated when the output current exceeds this set value. | 1.5× Inverter rated current |
| Overload restriction 1 action time, 1st-motor Overload restriction 2 Action time, 1st-motor | [bA124] [bA128] | 0.10 to 3600.00(s) | Acceleration/Deceleration time when exceeded the overload limit level. | 1.00 |

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
- 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A detected, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- 3) Drive programming: 0.01% (Rated ratio)

● Input Terminal Function

| Item | Parameter | Data | Description |
|-----------------------------------|--------------------|------|---|
| Input terminal function selection | [CA-01] to [CA-11] | 038 | [OLR] Overload limit switching OFF: Overload limit 1 enabled. ON: Overload limit 2 enabled. |

8-2-2 Overcurrent Suppression Selection

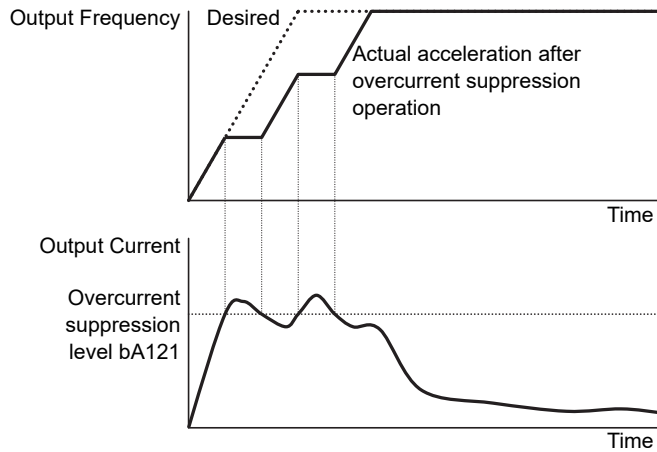
Setting [bA120] overcurrent suppression selection to 01 enables the overcurrent suppression function. This function suppresses the overcurrent caused by steep current increase due to sudden acceleration, etc.

If the overcurrent suppression function is enabled, the overcurrent suppression function will be activated when the motor current exceeds the set value for [bA121] with momentary current increase.



Precautions for Correct Use

- Disable this function when using for elevators, etc. Suppressing the current causes insufficient torque, which may result in sliding down of the panier or anything hanging.
- The overcurrent tripping may take place even if this function is enabled if the current increases sharply due to shock load, etc.
- This function will be automatically enabled during DC braking.
- This function is enabled during position/torque control.
- This function is disabled when synchronous motor (permanent magnet motor) is used.



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|--|---|-------------------------------------|
| Over current suppress enable, 1st-motor | [bA120] | 00 | Disabled | 1 |
| | | 01 | Enabled (Overcurrent suppression is activated.) | |
| Over current suppress Level, 1st-motor | [bA121] | Inverter rated current $\times (0.0 \text{ to } 2.0)^{*1}$ | Sets the operation level of the overcurrent suppression function. | 1.8 \times Inverter rated current |
| OC-suppress level of Active frequency matching | [bb-46] | Inverter rated current $\times (0.0 \text{ to } 2.0)^{*1}$ | Sets the operation level of the overcurrent suppression function when activated with frequency pull-in. ^{*2} | 1.0 \times Inverter rated current |

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
- 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
 When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
 When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- 3) Drive programming: 0.01% (Rated ratio)

*2. See 7-5-4 *Frequency Pull-in Start* on page 7-69 for details.

8-2-3 Overvoltage Suppression Function During Deceleration

This function is used to prevent overvoltage trip caused by the regenerative energy from the motor during deceleration.

[bA140] overvoltage suppression function selection allows you to enable the overvoltage suppression function.

The overvoltage suppression function will be activated when the internal DC voltage of the inverter main circuit capacitor exceeds the value set by [bA141] overvoltage suppression level.

When this function is used, set the Dynamic brake (BRD) usage rate [bA-60] to 0.0 (BDR function is not activated) and the Dynamic brake (BRD) selection [bA-61] to 00 (Disabled).



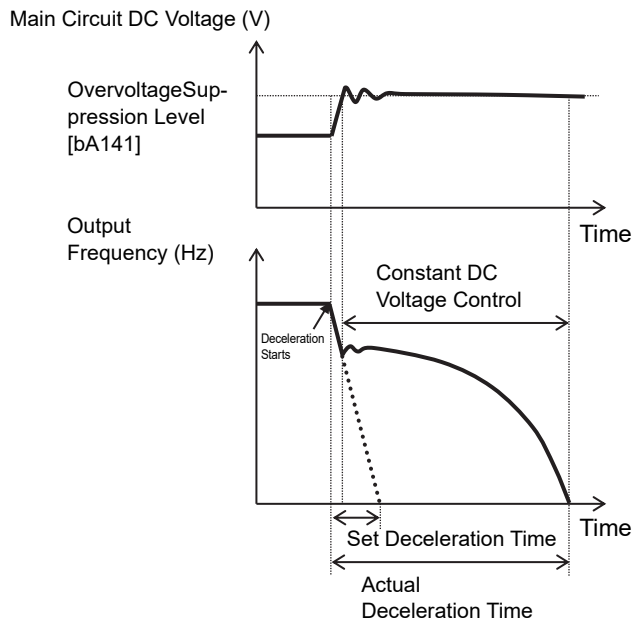
Precautions for Correct Use

- When this function is enabled, the actual deceleration time may get longer than the set value.
- When using this function, it may take long time before the motor stops depending on the motor load moment of inertia.
- Depending on the deceleration rate or load status, the overvoltage tripping may be triggered even if this function is enabled.
- Set [bA141] to be receiving voltage $\times \sqrt{2} \times 1.1$ or higher. Setting a value lower than the P-N voltage in operation may prevent the motor from stopping.
- This function is not activated while the position/torque are controlled.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|--|---|--|
| Over-voltage suppression enable, 1st-motor | [bA140] | 00 | Disabled | 00 |
| | | 01 | Constant DC voltage-controlled deceleration | |
| | | 02 | Function to avoid overvoltage acceleration (only in deceleration) | |
| | | 03 | Function to avoid overvoltage acceleration | |
| Over-voltage suppression active level, 1st-motor | [bA141] | 200 V class: 330.0 to 400.0 (V) 400 V class: 660.0 to 800.0 (V) | Sets the level at which the overvoltage suppression function starts. | (200V class) 380.0 (400V class) 760.0 |
| Over-voltage suppression action time, 1st-motor | [bA142] | 0.00 to 3600.00(s) | Acceleration time when the overvoltage suppression function is activated. | 1.00 |
| DC bus constant control proportional gain, 1st-motor | [bA144] | 0.00 to 5.00 | Proportional gain for PI control in constant DC voltage control. | 0.20 |
| DC bus constant control integral gain, 1st-motor | [bA145] | 0.00 to 150.00 | Integral gain for PI control in constant DC voltage control. | 1.00 |

For Constant DC Voltage Control [bA140] = 01



When [bA140] is 01, PI control is performed so that the internal DC voltage will be constant.

Setting the proportional gain [bA144] to be large will accelerate the response. However, setting it to be too large will dissipate the control, tending to cause tripping.

Setting the integral gain [bA145] to be short will accelerate the response. However, setting it to be too short will tend to cause tripping.

If the internal DC voltage increases when [bA140] is 02 or 03, acceleration control is performed.

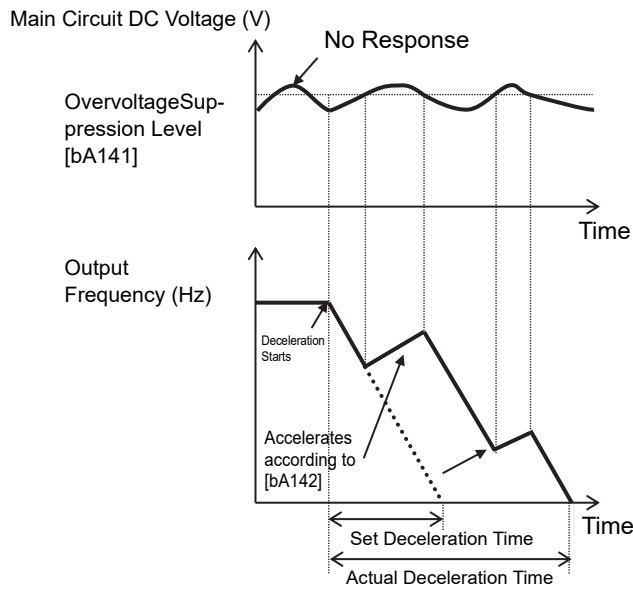
The acceleration control accelerates to the highest frequency setting according to the overvoltage suppression operating time [bA142]. After the acceleration, it decelerates to the target value according to the normal deceleration time.



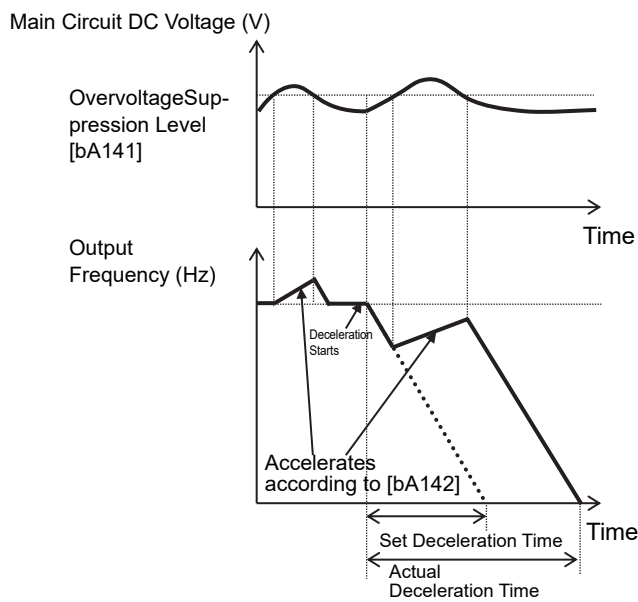
Precautions for Correct Use

If the overvoltage suppression operating time [bA142] is set to be too short, it accelerates more than decelerating and may prevent the motor from stopping. In this case, increase the setting of the overvoltage suppression level setting [bA141].

For Function to Avoid Overvoltage Acceleration (Only in Deceleration) [bA140] = 02



For Function to Avoid Overvoltage Acceleration [bA140] = 03



8-2-4 Overexcitation Function

[bA146] overexcitation function selection allows you to enable the overexcitation function.

The overexcitation function increases the motor loss and reduces energy to be regenerated in order to suppress the overvoltage and prevent tripping.



Precautions for Correct Use

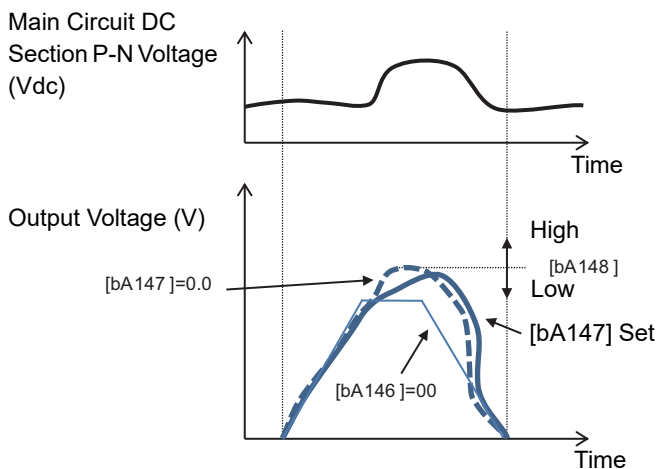
- When this function is enabled, the current may increase as the output voltage increases.
- When using this function, the motor will be overexcited and the heat generated by the motor may increase.
- Depending on the deceleration rate or load status, the overvoltage tripping may be triggered even if this function is enabled.
- The overexcitation function is activated when controlling VC characteristics of V/f control, VP characteristics, and free V/f control.

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|--|--|--|
| Over magnetization deceleration function selection, 1st_motor | [bA146] | 00 | Disabled | 02 |
| | | 01 | Always active | |
| | | 02 | Active only during deceleration | |
| | | 03 | Level operation | |
| | | 04 | Level operation during deceleration | |
| Over magnetization output filter time constant, 1st_motor | [bA147] | 0.00 to 1.00(s) | Filter time constant applied to the overexcitation output. | 0.30 |
| Over magnetization voltage gain, 1st_motor | [bA148] | 50 to 400(%) | Gain for the overexcitation output voltage. | 100 |
| Over magnetization level setting, 1st_motor | [bA149] | 200 V class: 330.0 to 400.0 (V) 400 V class: 660.0 to 800.0 (V) | The level at which the overexcitation function starts its operation. | (200V class) 360.0 (400V class) 720.0 |

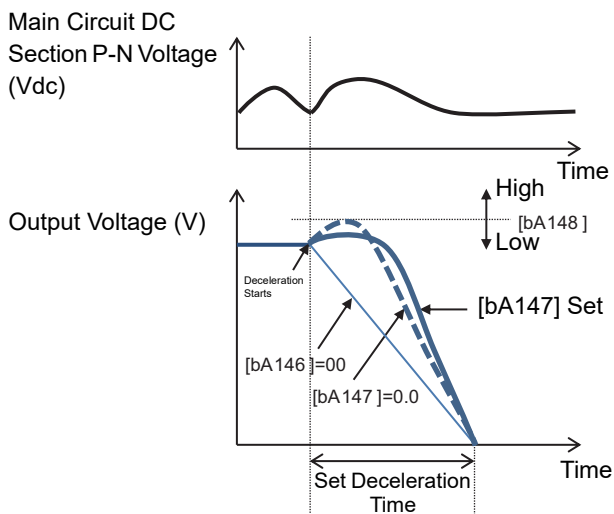
When Always Active [bA146] = 01

Always activated according to the P-N voltage



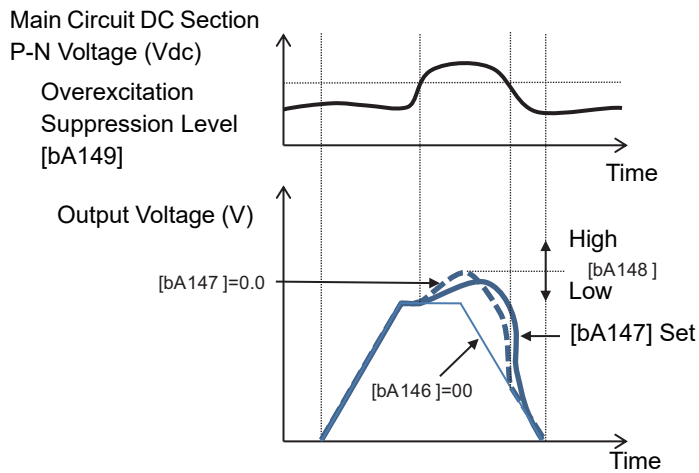
When Activated Only during Deceleration [bA146] = 02

Activated according to the P-N voltage during deceleration



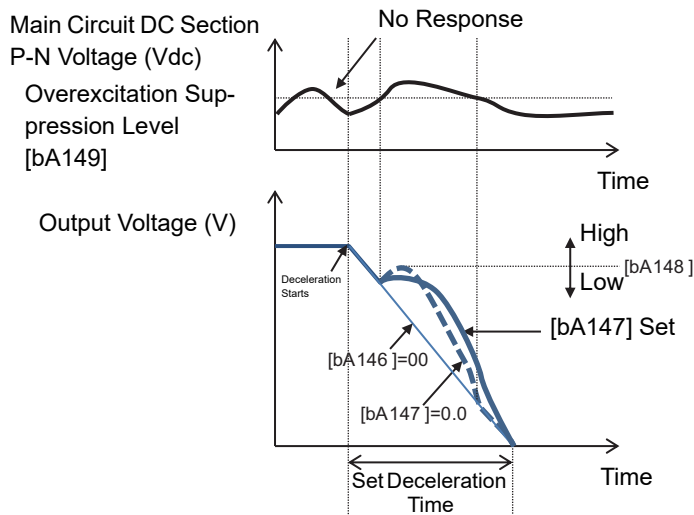
For Level Operation [bA146] = 03

Activated when the P-N voltage exceeds the set level



For Level Operation during Deceleration [bA146] = 04

Activated when the P-N voltage exceeds the set level only during deceleration



8-2-5 Regenerative Braking Function

When decelerating, generating downward movement, or being rotated by an external load (that is, when the output torque direction and the rotation direction are opposite), the motor serves as a generator and the regenerated energy is fed back to the inverter. If the motor load inertia is large, the amount of regeneration may become large, which causes an overvoltage in the inverter during rapid deceleration or when driving an elevating axis.

The regenerative braking function uses the built-in or an external regenerative braking circuit to decrease the internal DC voltage of the inverter by converting the regenerated energy from the motor into heat via external braking resistors.

Connect external braking resistors or external regenerative braking units according to the description of External Braking Resistor Connection Terminal or Regenerative Braking Unit Connection Terminal in *2-3-4 Wiring for Main Circuit Terminals* on page 2-32. The regenerative braking function is enabled only when the inverter is connected with external braking resistors or external regenerative braking units.

The following models have a built-in regenerative braking circuit. Connect external braking resistors only.

[200-V class] 3G3RX2-A2004 (0.4 kW) to 3G3RX2-A2220 (22 kW)

[400-V class] 3G3RX2-A4007 (0.75 kW) to 3G3RX2-A4370 (37 kW)

When using models other than the above or processing a large amount of regenerative energy, you need to use regenerative braking units.

When using the built-in regenerative braking function of the inverter, set BRD selection (bA-61) to Enabled.

Normally, this parameter is set to 01 (Enabled: Disabled during stop). At this time, set the usage condition (%) of the braking resistor in use in the Usage Rate of BRD (bA-60). Note that the regenerative braking function is enabled only when both bA-60 and bA-61 are set.

Be sure to set the resistance values of the connected braking resistor to Dynamic brake (BRD) resistor value [bA-63]. The resistance values are used with Dynamic brake (BRD) usage rate [bA-60] when the regenerative braking function is activated.

For the Regenerative Braking ON Level (b096), you need not change the default data normally. This parameter is used for adjusting the level at which the regenerative braking function according to the input power supply voltage.

External regenerative braking units are processed on the external regenerative braking unit side. Therefore, set the Regenerative Braking Selection (bA-61) to 00 (Disabled). In this case, the bA-60 and bA-62 settings are ignored.

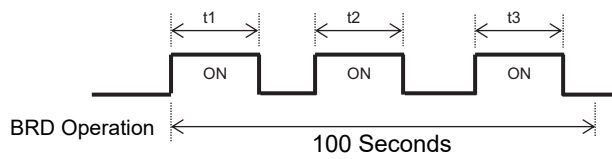
When using this function, set the Overvoltage Suppression Function Selection During Deceleration (bA140) to 00 (Disabled).



Precautions for Correct Use

- You can also use the optional BRD unit instead of using the built-in braking circuit (BRD). If using the BRD unit, no setting needs to be made.
- The BRD ON level is the level setting for the main circuit DC smoothing capacitor inside the inverter. It needs to be set to a value exceeding the input voltage times $\sqrt{2}$.
- See the selection and wiring of regenerative braking resistor for minimum resistance that can be connected and BRD use rate for each model.

The motor will trip when the operation rate exceeds the use rate.



$$\text{Operation Rate (\%)} = \frac{(t1+t2+t3)}{100 \text{ Seconds}} \times 100$$

● Parameter

| Item | Parameter | Data | Description | Default data |
|------------------------------|-----------|--|--|--|
| Dynamic brake usage rate | [bA-60] | 0.0 to 100.0(%) *) The upper limit depends on [bA-63] | If it is set to 0.0, the BRD function will not be activated. If the setting is other than 0.0, the motor will trip when [dA-41] BRD load factor monitor exceeds the BRD use rate. | 10.0 |
| Dynamic brake selection | [bA-61] | 00 | Disabled | 00 |
| | | 01 | Enabled (Disable while being stopped) | |
| | | 02 | Enabled (Enabled while being stopped) | |
| Dynamic brake active level | [bA-62] | 200 V class: 330.0 to 400.0 (V) 400 V class: 660.0 to 800.0 (V) | The ON level at which the BRD is activated. | (200V class) 360.0 (400V class) 720.0 |
| Dynamic brake resistor value | [bA-63] | Minimum resistance to 600 (Ω) | Setting the BRD resistance to be connected automatically sets the maximum value for [bA-60]. | minimum resistance values*1 |

*1. Minimum resistance values vary in inverter model.

● Monitoring

| Item | Parameter | Data | Description |
|-------------------------|-----------|-------------------|--|
| BRD load factor monitor | [dA-41] | 0.00 to 100.00(%) | The value in accordance with the BRD use rate will be displayed. |

8-2-6 Restart during Power Interruption/Undervoltage

Restart Undervoltage

You can select either tripping ([bb-21] = 00) with power supply recovery or retrying restarting ([bb-21] ≠ 00) when the main power (R, S, T) fails.

If the input power supply to the inverter is input separately to main power supply (R, S, T) and control power supply (R0, T0), the operation depends on how the power to the main power supply (R, S, T) drops.

When [bb-27] = 00, you can avoid undervoltage error if the main power supply is to be turned off for saving energy while the inverter output is being stopped.

When [bb-27] = 02, you can avoid undervoltage error caused by power shutdown during deceleration and stop.

When the Power Interruption/Undervoltage Restart Selection (bb-24) is set to one of the restart options, the inverter repeats restart operation for the number of times set in the Power Interruption Restart Count (bb-20) in the event of a power interruption, or for the number of times set in the Undervoltage Restart Count (bb-21) in the event of an undervoltage, and then trips.

When bb-20 or bb-21 is set to No limit, the inverter does not trip.

The Power Interruption/Undervoltage Restart Selection (bb-24) is set to restart condition according to your system.

You can select 0-Hz restart/Frequency matching restart/Frequency pull-in restart/Detection speed (Frequency)/Trip after frequency matching deceleration stop.



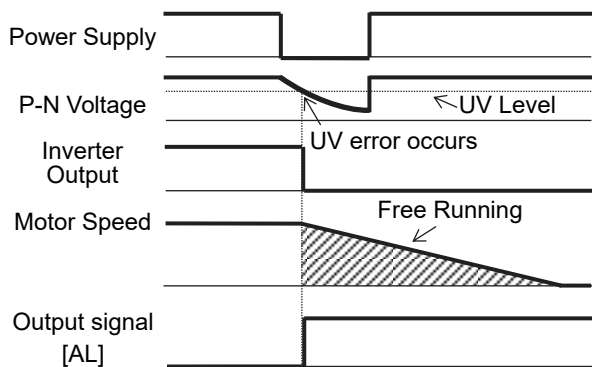
Precautions for Correct Use

- If the input power supply to the inverter is input to the control power supply (R0, T0) via main power supply (R, S, T), instantaneous power failure tripping or instantaneous power failure retry may be triggered first depending on the operating situation.
- If the control power supply has failed completely, the action to be taken is the powering on.
- After 40 seconds with the main power supply (R, S, T) failed, the undervoltage will occur and the motor will trip even if [bb-27] = 00 or 02.
- Inverter internal P-N voltage can be monitored with [dA-40].

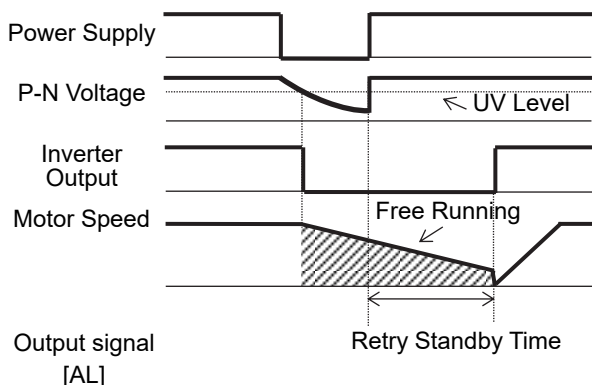
● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|---|---|--------------|
| The number of retries after under voltage | [bb-21] | 00 to 16/ ∞ (255) (Counts) | Sets the undervoltage retry restarting counts. If this is set to 0, the motor will trip upon undervoltage. | 0 |
| Selection of restart mode @Instantaneous power failure/ under-voltage trip | [bb-24] | 00 | Restarts at 0 Hz | 01 |
| | | 01 | Restarts with the frequency matching | |
| | | 02 | Restarts upon frequency pull-in | |
| | | 03 | Detection speed (frequency) <v2.00 or higher> | |
| | | 04 | Trips after decelerating and stopping with the frequency matching | |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Starts after waiting for the set time upon power voltage recovery. | 0.3 |
| Instantaneous power failure/under-voltage trip alarm enable | [bb-27] | 00 | Disabled | 00 |
| | | 01 | Enabled | |
| | | 02 | Disabled during stop and deceleration stop | |

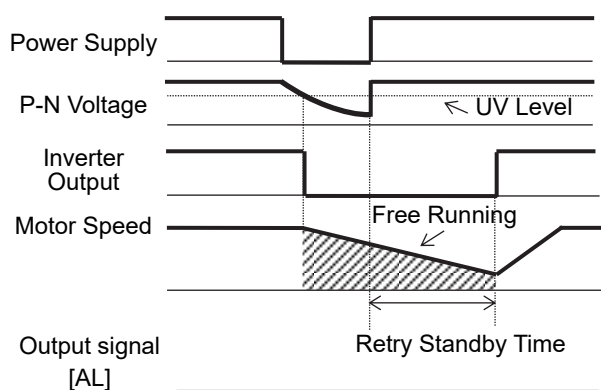
(Ex.1) When [bb-21] = 00, tripping occurs



(Ex.2) When [bb-21] ≠ 00 and [bb-24] = 00, it restarts at 0 Hz.

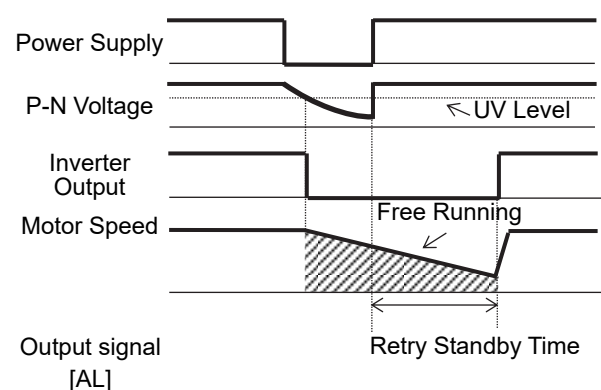


(Ex.3) When [bb-21] ≠ 00 and [bb-24] = 01, it restarts by picking up the frequency.



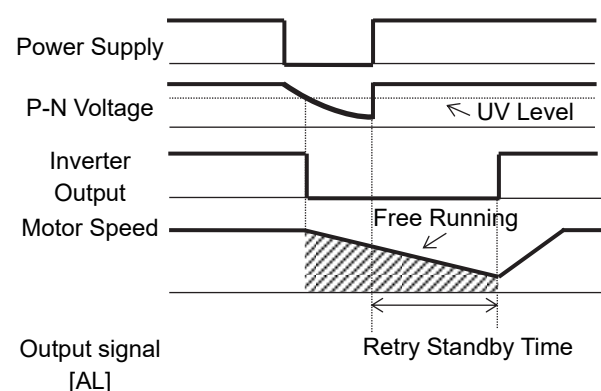
See 7-5-3 Frequency Matching Start on page 7-65 for details.

(Ex.4) When [bb-21] ≠ 00 and [bb-24] = 02, it restarts with frequency pull-in.



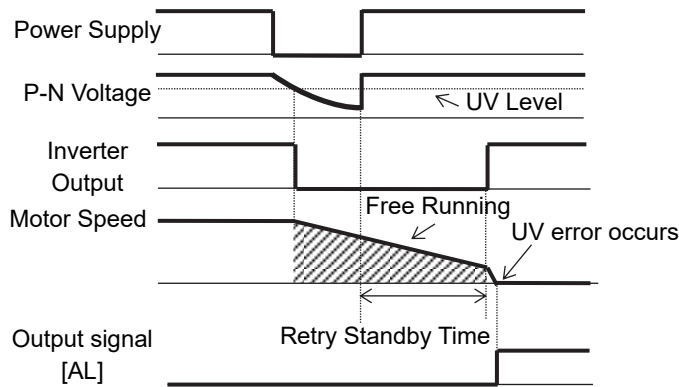
See 7-5-4 Frequency Pull-in Start on page 7-69 for details.

(Ex.5) When [bb-21] ≠ 00 and [bb-24] = 03, it restarts using the motor speed feedback.



For motor speed feedback, the feedback input to the input terminals A and B, or feedback input to the optional cassette PG option unit is required.

(Ex.6) When [bb-21] ≠ 00 and [bb-24] = 04, it restarts by picking up frequency, and then after deceleration according to the setting, the motor trips when stopped.



Restart Power Interruption

When the power supply shows the voltage falling short of the undervoltage level, you can select either tripping ([bb-20] = 00) by recovering the power supply or retrying restarting ([bb-20] ≠ 00).

If the input power supply to the inverter is input separately to main power supply (R, S, T) and control power supply (R0, T0), the instantaneous power failure is detected based on how much the power to the main power supply (R, S, T) drops.

When [bb-27] = 00, you can avoid instantaneous power failure error before the control power supply is turned off for saving energy while the inverter output is being stopped.

When [bb-27] = 02, you can avoid instantaneous power failure error caused by power shutdown during deceleration and stop.



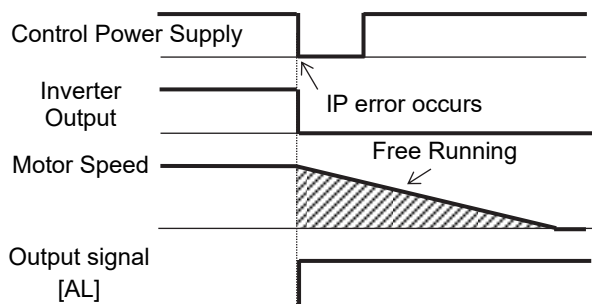
Precautions for Correct Use

- The judgement of instantaneous power failure of the inverter is based on the detection of voltage drop in the main power supply (R, S, T).
- Depending on the fluctuation rate of the main power supply (R, S, T), errors other than instantaneous power failure may occur.
- If the input power supply to the inverter is input to the control power supply (R0, T0) via main power supply (R, S, T), undervoltage tripping or undervoltage retry may be triggered first depending on the operating situation.
- When the power supplied to the control power supply (R0, T0) is shut off, the power will be lost as quick as in about 80 ms. In this case, it will be a power shutdown.

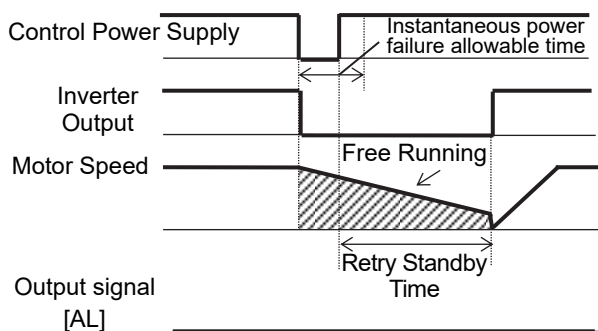
● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|----------------------------|---|--------------|
| The number of retries after instantaneous power failure | [bb-20] | 0 to 16/∞(255) (Counts) | Sets the retry counts in case of instantaneous power failure. If this is set to 0, the motor will trip upon recovery from instantaneous power failure. | 0 |
| Selection of restart mode @Instantaneous power failure/ under-voltage trip | [bb-24] | 00 | Restarts at 0 Hz | 01 |
| | | 01 | Restarts with the frequency matching | |
| | | 02 | Restarts upon frequency pull-in | |
| | | 03 | Detection speed (frequency) <v2.00 or higher> | |
| | | 04 | Trips after decelerating and stopping with the frequency matching | |
| Allowable under-voltage power failure time | [bb-25] | 0.3 to 25.0(s) | Restarts if the instantaneous power failure time is within the set value. | 1.0 |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Starts after waiting for the set time upon power voltage recovery. | 0.3 |
| Instantaneous power failure/under-voltage trip alarm enable | [bb-27] | 00 | Disabled | 00 |
| | | 01 | Enabled | |
| | | 02 | Disabled during stop and deceleration stop | |

(Ex.1) When [bb-20] = 00, tripping occurs

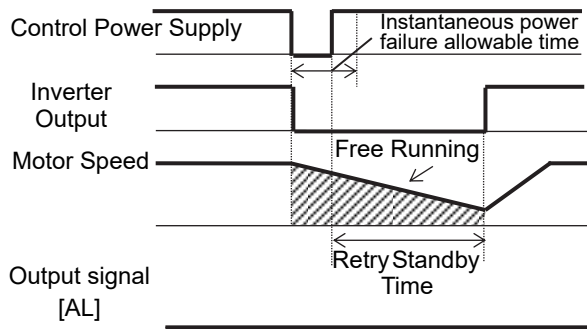


(Ex.2) When [bb-20] ≠ 00 and [bb-24] = 00, it restarts at 0 Hz.



Note The motor will trip after instantaneous power failure allowable time.

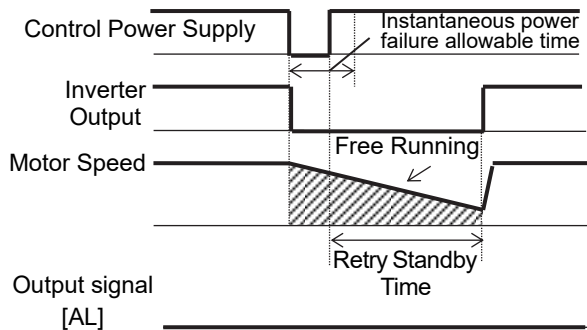
(Ex.3) When [bb-20] ≠ 00 and [bb-24] = 01, it restarts by picking up the frequency.



Note The motor will trip after instantaneous power failure allowable time.

See 7-5-3 *Frequency Matching Start* on page 7-65 for details.

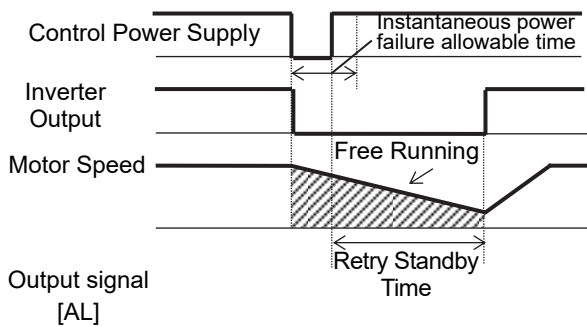
(Ex.4) When [bb-20] ≠ 00 and [bb-24] = 02, it restarts with frequency pull-in.



Note The motor will trip after instantaneous power failure allowable time.

See 7-5-4 *Frequency Pull-in Start* on page 7-69 for details.

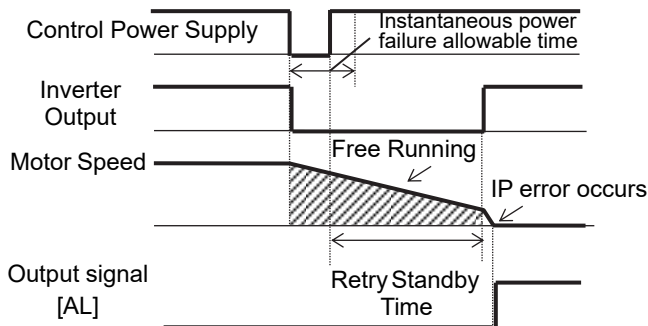
(Ex.5) When [bb-20] ≠ 00 and [bb-24] = 03, it restarts using the motor speed feedback.



Note The motor will trip after instantaneous power failure allowable time.

For motor speed feedback, the feedback input to the input terminals A and B, or feedback input to the optional cassette PG option unit is required.

(Ex.6) When [bb-20] ≠00 and [bb-24] = 04, it restarts by picking up the frequency, and then after deceleration according to the setting, the motor trips when stopped.



Note The motor will trip after instantaneous power failure allowable time.

8-2-7 Restart on Overvoltage/Overcurrent

Restart Overcurrent

In case of overcurrent, you can restart without causing tripping.



Precautions for Correct Use

If overcurrent continues to be observed, there are some possible causes: short acceleration time, heavy load, locked motor, etc.

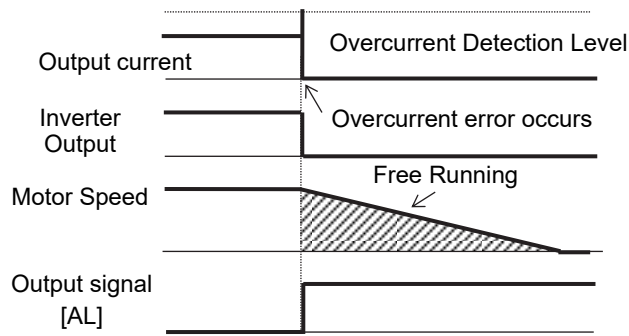
● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|--|--|------------------------|
| Over current detection level, 1st-motor | [bb160] | Inverter ND rated current × (0.2 to 2.2) ^{*1} | Sets the level at which the overcurrent is to be detected. | 2.2 × ND Rated current |
| The number of retries after over current | [bb-22] | 0 to 5 (Counts) | Sets the retry counts in case of overcurrent. If this is set to 0, the motor will trip upon overcurrent. | 0 |
| Selection of restart mode @over-current | [bb-28] | 00 | Restarts at 0 Hz | 01 |
| | | 01 | Restarts with the frequency matching | |
| | | 02 | Restarts upon frequency pull-in | |
| | | 03 | Detection speed (frequency) <v2.00 or higher> | |
| | | 04 | Trips after decelerating and stopping with the frequency matching | |
| Wait time of restart @over-current | [bb-29] | 0.3 to 100.0(s) | Restarts after waiting for the set time upon overcurrent. | 0.3 |

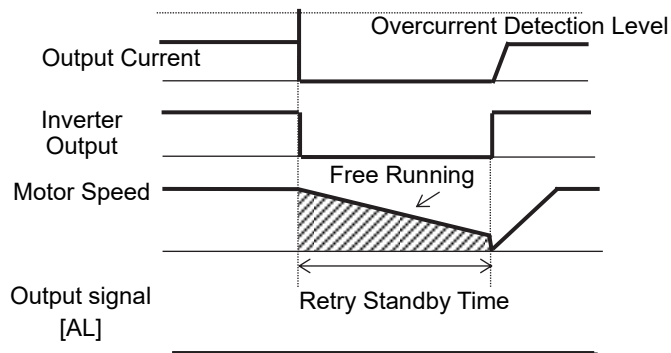
*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
- 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- 3) Drive programming: 0.01% (Rated ratio)

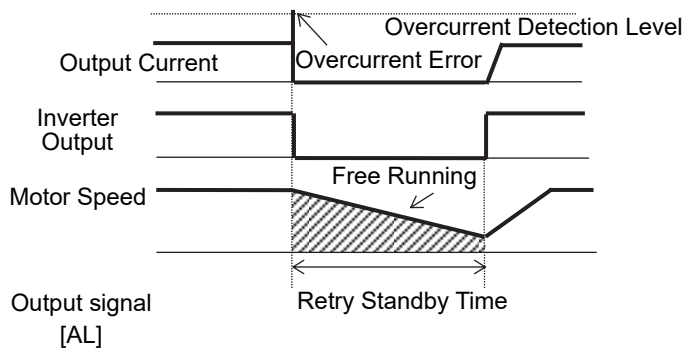
(Ex.1) When [bb-22] = 00, tripping occurs



(Ex.2) When [bb-22] ≠ 00 and [bb-28] = 00, it restarts at 0 Hz.

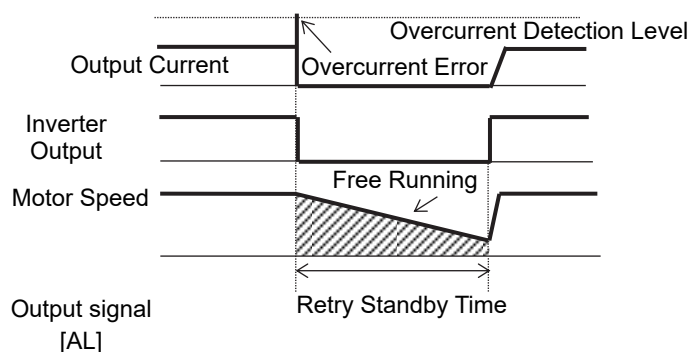


(Ex.3) When [bb-22] ≠ 00 and [bb-28] = 01, it restarts by picking up the frequency.



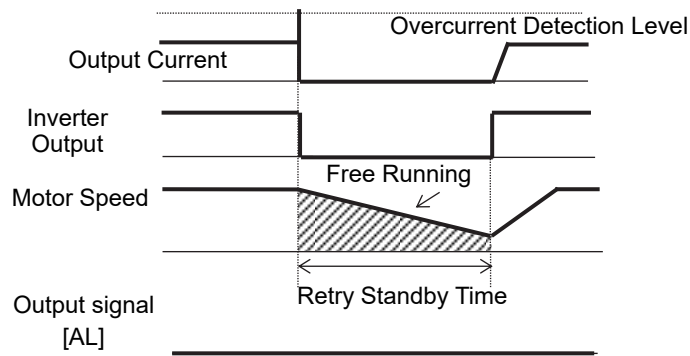
See 7-5-3 *Frequency Matching Start* on page 7-65 for details.

(Ex.4) When [bb-22] ≠ 00 and [bb-28] = 02, it restarts with frequency pull-in.



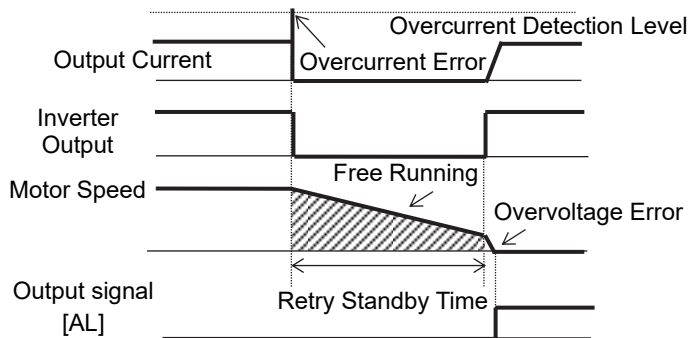
See 7-5-4 *Frequency Pull-in Start* on page 7-69 for details.

(Ex.5) When [bb-22] ≠ 00 and [bb-28] = 03, it restarts using the motor speed feedback.



For motor speed feedback, the feedback input to the input terminals A and B, or feedback input to the optional cassette PG option unit is required.

(Ex.6) When [bb-22] ≠ 00 and [bb-28] = 04, it restarts by picking up the frequency, and then after deceleration according to the setting, the motor trips when stopped.



Restart Overvoltage

In case of overvoltage, you can restart without causing tripping.



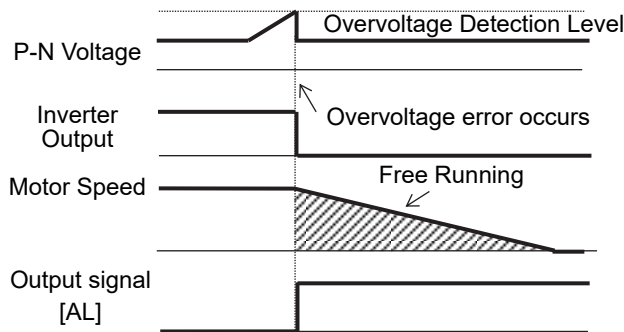
Precautions for Correct Use

If overvoltage continues to be observed, there are some possible causes: short deceleration time, heavy load, motor operated by external force, etc.

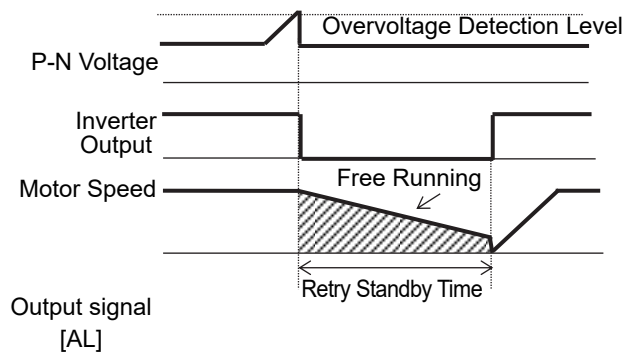
● Parameter

| Item | Parameter | Data | Description | Default data |
|--|-----------|-----------------|--|--------------|
| The number of retries after over voltage | [bb-23] | 0 to 5 (Counts) | Sets the retry counts in case of overvoltage. If this is set to 0, the motor will trip upon overvoltage. | 0 |
| Selection of restart mode @over-voltage | [bb-30] | 00 | Restarts at 0 Hz | 01 |
| | | 01 | Restarts with the frequency matching | |
| | | 02 | Restarts upon frequency pull-in | |
| | | 03 | Detection speed (frequency) <v2.00 or higher> | |
| | | 04 | Trips after decelerating and stopping with the frequency matching | |
| Wait time of restart @over-voltage | [bb-31] | 0.3 to 100.0(s) | Restarts after waiting for the set time upon overvoltage. | 0.3 |

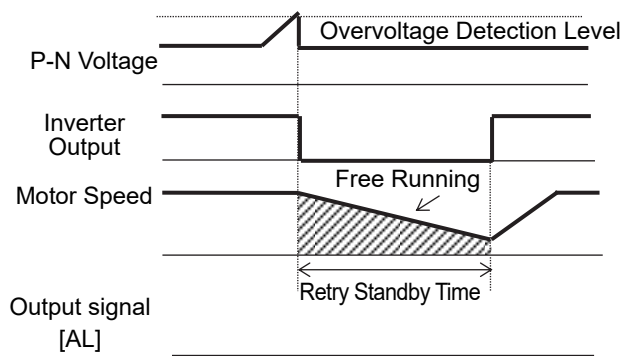
(Ex.1) When [bb-23] = 00, tripping occurs



(Ex.2) When [bb-23] ≠ 00 and [bb-30] = 00, it restarts at 0 Hz.

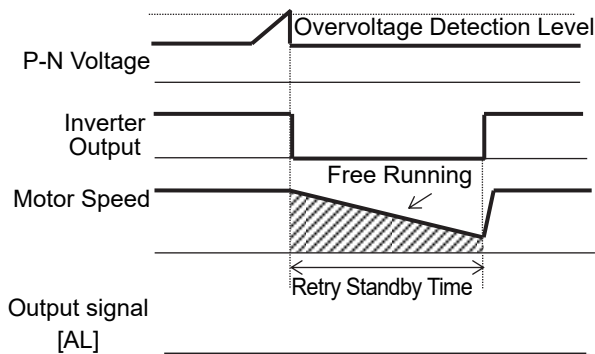


(Ex.3) When [bb-23] ≠00 and [bb-30] = 01, it restarts by picking up the frequency.



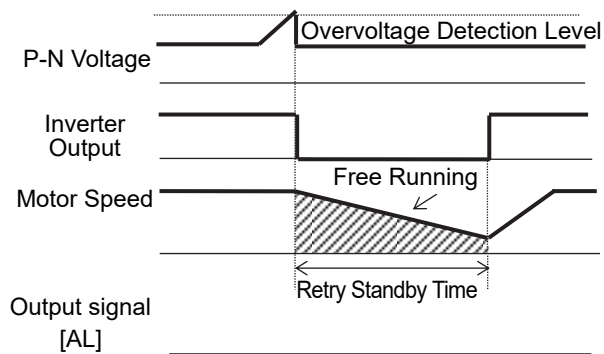
See 7-5-3 Frequency Matching Start on page 7-65 for details.

(Ex.4) When [bb-23] ≠00 and [bb-30] = 02, it restarts with frequency pull-in.



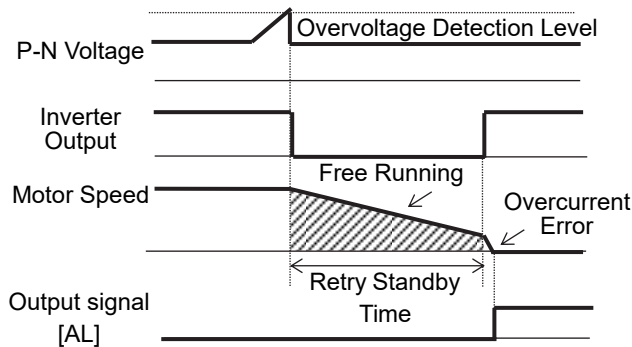
See 7-5-4 Frequency Pull-in Start on page 7-69 for details.

(Ex.5) When [bb-23] ≠00 and [bb-30] = 03, it restarts using the motor speed feedback.



For motor speed feedback, the feedback input to the input terminals A and B, or feedback input to the optional cassette PG option unit is required.

(Ex.6) When [bb-23] ≠ 00 and [bb-30] = 04, it restarts by picking up the frequency, and then after deceleration according to the setting, the motor trips when stopped.



8-2-8 Non-stop on Momentary Power Interruption

This function allows deceleration and stop of the motor while maintaining the voltage under the overvoltage level when the power supply is shut down during operation.

One of the three modes can be selected with [bA-30] instantaneous power failure non-stop selection.



Precautions for Correct Use

- Instantaneous power failure non-stop operation is activated when the input to the main power supply (R, S, T) drops.
- When [bA-30] is 01 or 02, the motor decelerates and stops after the function is activated. You need to turn off the operation command and turn it on again to restart after the stop. Even if the [bA-30] is 03, you still need to turn off the operation command and turn it on again if the motor decelerated and stopped without recovery after the function is activated.
- If the control power supply (R0, T0) is not input separately from main power supply, supply the P-N voltage to the control power supply (R0, T0) to use the instantaneous power failure non-stop function. When using this function, disconnect the J51 connector line connected to the R0 and T0 terminals and connect the wire from main terminal P to R0, and N to T0. Use electrical wire of 0.75mm² or larger.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|--|--|--|
| Deceleration-stop at power failure | [bA-30] | 00 | Disabled | 00 |
| | | 01 | Decelerates and stops, and maintains the stop status. | |
| | | 02 | Decelerates and stops with constant DC voltage control, and maintains the stop status. | |
| | | 03 | Decelerates and stops with constant DC voltage control, and maintains the stop status. If the power supply recovers during the process, the operation continues. | |
| Decel-stop at power failure starting voltage | [bA-31] | (200 V class) 0.0 to 410.0(v) (400 V class) 0.0 to 820.0(v) | This is the voltage level at which the instantaneous power failure non-stop control starts when the internal power supply voltage drops. | (200V class) 220.0 (400V class) 440.0 |
| Decel-stop at power failure control target level | [bA-32] | (200 V class) 0.0 to 410.0(v) (400 V class) 0.0 to 820.0(v) | Switches the deceleration temporarily to constant speed operation when the internal power supply voltage increases due to deceleration. | (200V class) 360.0 (400V class) 720.0 |
| Decel-stop at power failure deceleration time | [bA-34] | 0.01 to 3600.00(s) | Deceleration time setting for instantaneous power failure non-stop deceleration and stop operation. | 1.00 |
| Decel-stop at power failure freq. width at deceleration start | [bA-36] | 0.00 to 10.00(Hz) | The setting for starting deceleration by lowering frequency during instantaneous power failure non-stop deceleration and stop operation. | 0.00 |
| Decel-stop at power failure DC-bus voltage constant control P-gain | [bA-37] | 0.00 to 5.00 | Proportional gain for PI control during constant DC voltage control. | 0.20 |
| Decel-stop at power failure DC-bus voltage constant control I-gain | [bA-38] | 0.00 to 150.00(s) | Integral gain for PI control during constant DC voltage control. | 1.00 |
| Output terminal function | [CC-01] to [CC-07] | 023 | [IPS] Outputs the signal during instantaneous power failure non-stop deceleration. OFF: The function is not active. ON: Instantaneous power failure non-stop deceleration in function. | - |

Instantaneous Power Failure Non-stop Deceleration/Stop ([bA-30] = 01)

This function allows deceleration and stop of the motor while maintaining the voltage under the instantaneous power failure non-stop frequency constant voltage level [bA-32] after the power supply was shut down during operation.

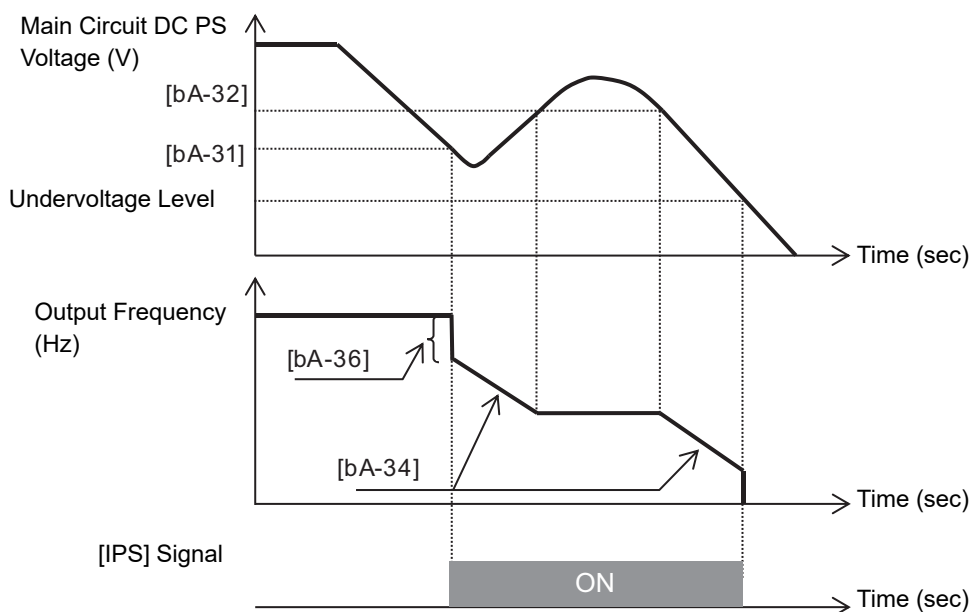
If the power supply was shut down during operation, deceleration starts at the frequency lowered by deceleration starting width [bA-36] when the voltage drops to the instantaneous power failure non-stop function activating voltage [bA-31] or lower, and then decelerates for the instantaneous power failure non-stop deceleration time [bA-34].

In case of regenerative status caused by deceleration torque during deceleration and if the internal power supply voltage reaches the frequency-constant voltage level [bA-32] or higher, the motor will be at constant speed until the internal power supply voltage falls below the overfrequency-constant voltage level [bA-32].



Precautions for Correct Use

- If the frequency-constant voltage level [bA-32] < Function starting voltage [bA-31], it works by taking [bA-32] at the same level as [bA-31]. However, the set values will not be changed.
- If the frequency-constant voltage level [bA-32] is lower than the input voltage multiplied by $\sqrt{2}$, the constant speed state will be maintained and deceleration will not take place if the power recovers while this function is in operation. Power should be shut off and turned on again, or [bA-32] needs to be reset during operation. The [bA-32] must be set to a value greater than the input voltage multiplied by $\sqrt{2}$.
- This function will not be disabled until the operation stop will be completed. To recover power and restart the operation while this function is in operation, input the stop command (operation command OFF) and then input the operation command again after the motor stopped.
- If the instantaneous power failure non-stop deceleration starting range [bA-34] is too large, sudden deceleration will cause overcurrent tripping. • If the value of [bA-36] is too low or the instantaneous power failure non-stop deceleration time [bA-34] is too long, insufficient regenerative force will cause undervoltage tripping.



Instantaneous Power failure Non-stop Constant DC Voltage Control ([bA-30] = 02: No Recovery, [bA-30] = 03: Recovery)

This function maintains the main circuit DC voltage to the value set by [bA-32] instantaneous power failure non-stop level while decelerating if instantaneous power failure occurs or the main circuit DC voltage drops during operation.

The condition to activate this function is when all the conditions below are met.

- [bA-30] is 02 or 03
- In operation
- When the instantaneous power failure occurs at the control power supply or when the main circuit DC voltage drops to [bA-31] instantaneous power failure non stop function starting voltage

If the instantaneous power failure time is short, continuous operation without interrupting output is possible. However, if undervoltage is observed upon instantaneous power failure, the output is interrupted immediately and this function will be terminated. The operation after recovering from the instantaneous power failure depends on the selection of how to restart after instantaneous power failure and undervoltage.

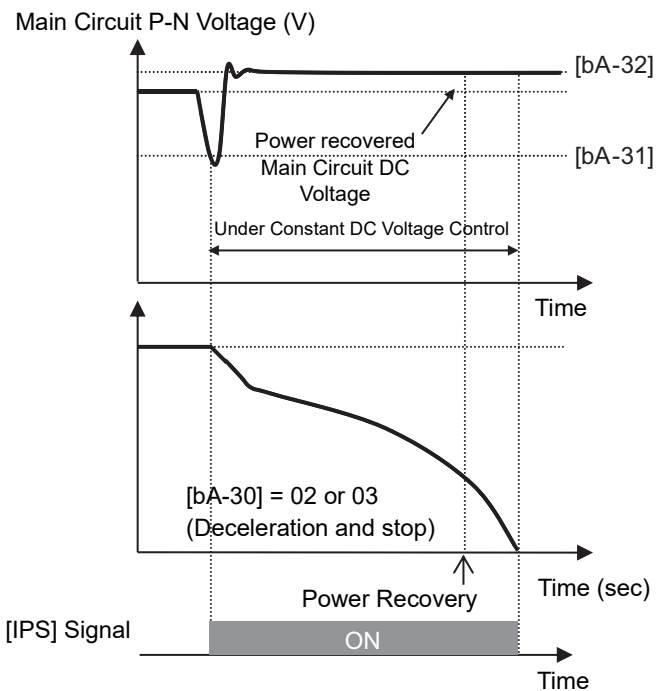
When [bA-30] is 03, the normal operation can be restored if recovered from the instantaneous power failure and the power is received before the output will be interrupted. However, it may decelerate and stop depending on the [bA-31] setting. Details are given below.

| [bA-30] | [bA-31] | Action |
|--------------------|---|--|
| 02 (No recovery) | [bA-32] > Main circuit DC voltage upon power recovery | Deceleration stop (constant DC voltage control) (Ex.1) |
| | [bA-32] < Main circuit DC voltage upon power recovery | Deceleration stops (normal operation) (Ex.2) |
| 03 (With recovery) | [bA-32] > Main circuit DC voltage upon power recovery | Deceleration stop (constant DC voltage control) (Ex.1) |
| | [bA-32] < Main circuit DC voltage upon power recovery | Operation (normal operation) (Ex.2) |

This function is activated if the conditions to start operation mentioned above are met even if the power line for J51 connector connected to R0 and T0 terminals are disconnected to be connected from P of the main terminal to R0 and from N to T0, or even if the control power supply and main circuit power supply are powered independently.

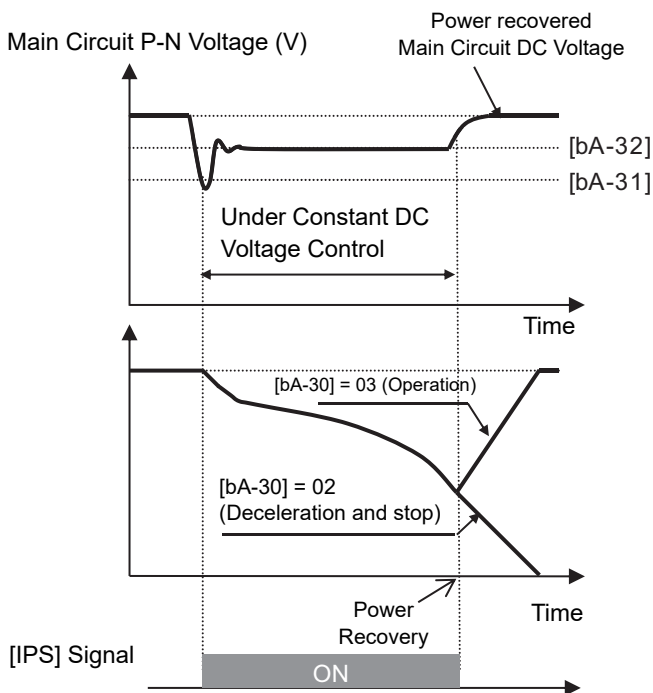
If the motor decelerates and stops as a result of this function activated, it will be forced to stop even if [FW] is ON. Verify that the power is restored before powering on [FW] again when restarting.

(Ex.1)



Note Depending on the proportional gain and integral time settings, the main circuit DC voltage level while the function is being activated may be lower than [bA-32].

(Ex.2)



**Precautions for Correct Use**

- Keep the settings for [bA-31] and [bA-32] to the undervoltage recovery level (P-N voltage 180 V (200 V class), 360 V (400 V class)) or higher. The function will not be activated in case of undervoltage.
 - Make setting so that [bA-31] will be lower than [bA-32]. If the difference between the settings for [bA-31] and [bA-32] is great, setting the proportional gain [bA-37] to be too large may cause sudden acceleration immediately after this function is activated and may cause over-current.
 - When [bA-30] is 02 or 03, PI control is performed so that the internal DC voltage will be constant.
 - Setting the proportional gain [bA-37] to be large will accelerate the response. However, setting it to be too large will dissipate the control, tending to cause tripping.
 - Setting the integral gain [bA-38] to be short will accelerate the response. However, setting it to be too short will also tend to cause tripping.
 - If the proportional gain [bA-37] is small, the motor will trip due to undervoltage because the voltage will drop immediately after the function is activated.
 - If you would like to retry even if the power failure may be relatively long, supply the P-N voltage to R0 and T0.
-

8-3 Protective Functions

8-3-1 Input Power Supply Phase Loss Protection

Enable the input phase loss protection function by using [bb-65] Input phase loss protection selection. When the input phase loss protection function has been enabled, an input phase loss error [E024] will occur if a phase loss state due to disconnection or breakage of the input power cable continues for 1 second or more.

If an input phase loss error [E024] occurs, it is necessary to cut off the power supply to the inverter and check the state of wiring and breakers.



Precautions for Correct Use

- When 3-phase AC is not input to power supply terminals R, S, and T, such as in cases where DC voltage is input to R and T or between P and N of the inverter, this function is disabled regardless of the setting for [bb-65].
- There will be no detection during an instantaneous power failure.

● Parameter

| Item | Parameter | Data | Description | Default data |
|-------------------------|-----------|------|-------------|--------------|
| Input phase loss enable | [bb-65] | 00 | Disabled | 00 |
| | | 01 | Enabled | |

8-3-2 Output Phase Loss Protection Function

Enable the output phase loss protection function by using [bb-66] Output phase loss protection selection.

When the output phase loss protection function has been enabled, an output phase loss error [E034] will occur if a phase loss caused by disconnection or breakage of the motor cable continues.



Precautions for Correct Use

- If the capacity of the drive motor is smaller than that of the inverter, the inverter may erroneously detect an output phase loss. In this case, decrease the value of [bb-67] or set [bb-66] to 00.
- If the carrier frequency [bb101] is low, the inverter may erroneously detect an output phase loss. It may improve by increasing the value of the carrier frequency [bb101].
- This function operates when the output speed is between 5 Hz and 100 Hz.
- Set the value of [bb-67] equal to or lower than the steadily flowing current, with the rated current being 100%.
- A phase loss will lead to the followings, which may result in an inverter malfunction:
 - The ripple current in the main capacitor will increase, which remarkably reduces the life expectancy of the inverter.
 - Under a load condition, the inverter's internal converter may be damaged.

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|----------------------|--|--------------|
| Output phase loss enable | [bb-66] | 00 | Disabled | 00 |
| | | 01 | Enabled | |
| Output phase loss detection sensitivity | [bb-67] | 1 to 100(%) | Adjusts the sensitivity of the output phase loss | 10 |
| Carrier speed setting, 1st-motor | [bb101] | 0.5 to 16.0 (kHz) *1 | Changes the carrier frequency | 2.0 |

*1. The following restriction is applied:
 For LD rated capacity, 12.0 kHz at maximum
 For VLD rated capacity, 10.0 kHz at maximum
 3G3RX2-B4750 to 3G3RX2-B413K shall be as follows.
 [Ub-03]=02: 0.5 to 10.0 (kHz)
 [Ub-03]=00 or 01: 0.5 to 8.0 (kHz)

8-3-3 External Trip (EXT) Function

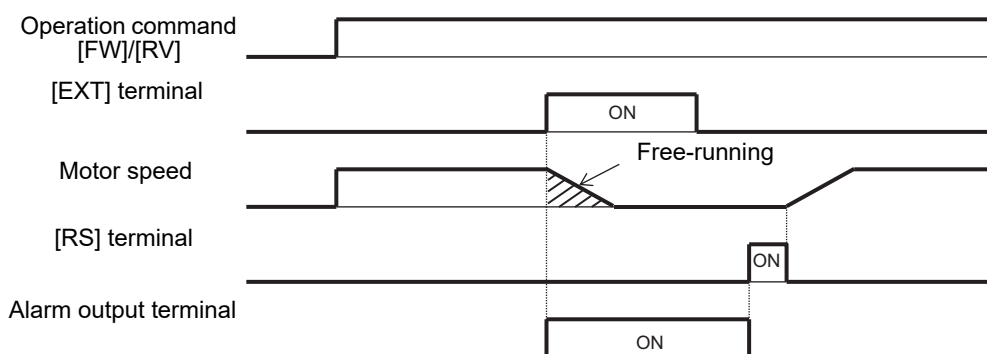
This function is enabled by setting 033 [EXT] as an input terminal function. When a signal connected to the applicable terminal changes, an error [E012] occurs.

Use this function when you want to trip the inverter via an error (trip) signal generated by a peripheral system.



Precautions for Correct Use

- When the inverter trips with error code [E12] displayed, the trip is not reset even if the error signal from the external equipment is reset (EXT terminal is turned off). To reset the trip, Perform the reset operation or turn the power off and on again.
- If you reset the inverter while the terminal [EXT] is turned on, [E012] will occur again.
- After the reset, the inverter follows [bb-41] Restart after reset. See 7-5-6 Restart after Releasing Reset on page 7-74.
- When the terminal [EXT] is turned on, an error will occur even if the inverter output is turned off, and the inverter trips with [E012] displayed.



| Item | Parameter | Data | Description |
|-------------------------|--------------------|------|--|
| Input terminal function | [CA-01] to [CA-11] | 033 | [EXT]: When the terminal corresponding to the assigned position is turned on, an external trip occurs. |

8-3-4 Power Recovery Restart Prevention Function (USP)

This function allows you to make the inverter trip with error code [E13] displayed if the inverter power is turned on when an operation command has been turned on.

You can recover the inverter from tripping by performing the reset operation or turning the operation command off. (Ex.1)

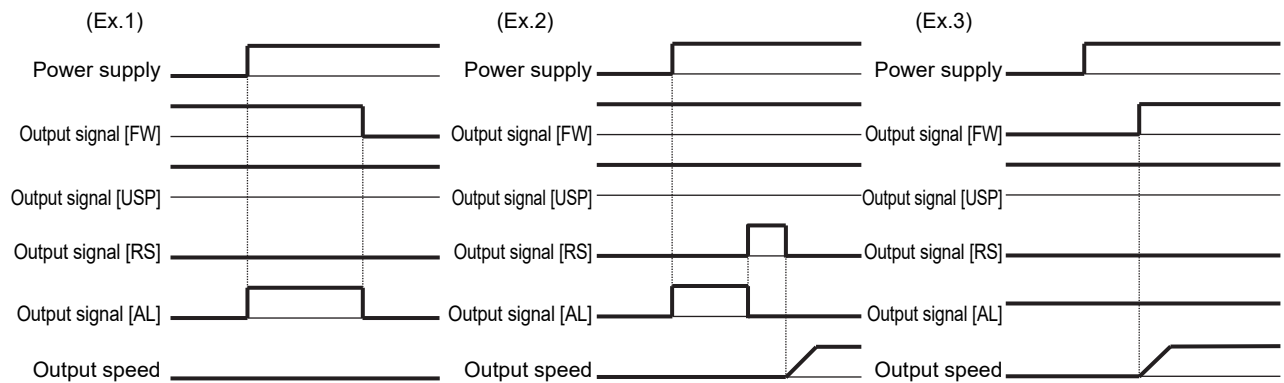
If the inverter is recovered from tripping with the operation command left turned on, the inverter will start operation immediately after recovery. (Ex.2)

The inverter can operate normally when an operation command is turned on after the inverter power is turned on. (Ex.3)



Precautions for Correct Use

- Unlike other types of trip, the USP error [E013] automatically clears when the operation command is turned off.
- The power recovery restart prevention function operates for 2 seconds at maximum after the control power is input.



● Parameter

| Item | Parameter | Data | Description |
|-------------------------|--------------------|------|---|
| Input terminal function | [CA-01] to [CA-11] | 034 | [USP]: If the applicable [USP] terminal assigned to an input terminal has been turned on, the inverter will trip when the power is recovered while an operation command is present. |

8-3-5 Overcurrent Detection

By the setting of the overcurrent detection level [bb160], you can adjust the threshold current value used for detecting the overcurrent error [E001].



Precautions for Correct Use

If the threshold level for overcurrent is lowered, the overcurrent error [E001] is more likely to occur. Therefore, it is necessary to lower the levels for the overload restriction function and the overcurrent suppression function. For details, see 8-2 *Triplless Functions* on page 8-40.

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|--|--|------------------------|
| Over current detection level, 1st-motor | [bb160] | Inverter ND rated current × (0.2 to 2.2)*1 | Sets the threshold level used for detecting overcurrent. | 2.2 × ND Rated current |

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
- 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- 3) Drive programming: 0.01% (Rated ratio)

8-3-6 Instantaneous Power Interruption/Undervoltage Detection

Trip after Instantaneous Power Interruption/Undervoltage

When an instantaneous power failure/undervoltage occurs, the inverter trip can be generated.

| Item | Instantaneous power failure | Under-voltage |
|---|--|--|
| Always making the inverter trip when an instantaneous power failure/under-voltage occurs | Set [bb-20] to 0. [E016] Instantaneous power failure error | Set [bb-21] to 0. [E009] Under-voltage error |
| Always making the inverter retry when an instantaneous power failure/under-voltage occurs | Set [bb-20] to 255. | Set [bb-21] to 255. |
| Making the inverter trip after the specified number of retries are made after an instantaneous power failure/under-voltage has occurred | Set [b-20] to other than 0 or 255. [E016] Instantaneous power failure error | Set [b-21] to other than 0 or 255. [E009] Under-voltage error |
| Outputting the state to an output terminal | Assigns 020 [IP] Instantaneous power failure signal. | Assigns 021 [UV] Under-voltage signal. |
| Selecting whether to make the inverter trip when an instantaneous power failure or under-voltage occurs while the inverter is in a stopped state. | Sets [bb-27]. | |



Precautions for Correct Use

- When selecting a retry function, see *8-2 Tripless Functions* on page 8-40.
- When the control circuit power supply is turn off and the power is lost, the operation mode will be the same as the mode at power-on. For subsequent operations, see the explanation about the restart after reset.
- When direct current (P-N) is supplied to control power supply terminal R0 and T0, the inverter may detect under-voltage at power interruption and then trip. If there is any problem with your system, set [bb-27] to 00 or 02.
- Even if Selection of instantaneous power failure trip [bb-20] is set to other than 0 and Selection of instantaneous power failure/under-voltage trip during stopping [bb-27] is set to “Disabled” (00 or 02), [E016] Instantaneous power failure error will occur when the actual power failure time exceeds the allowable instantaneous power failure time.
- Even during a retry operation, the retry will be interrupted if the instantaneous power failure/under-voltage condition continues for about 40 seconds, and error code [E009] Under-voltage or [E016] Instantaneous power failure will be displayed.
- When connecting separate power supplies to control power supply terminals (R0 and T0), and if an instantaneous power failure occurs at the main power supply terminals (R, S, and T), it will take about 1 second of the detection time before an instantaneous power failure error and under-voltage error occur. When braking is performed by [AL] alarm signal (output terminal function 017), the braking response will be slow, and therefore use the brake control function.

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|------------------|---|--------------|
| The number of retries after instantaneous power failure | [bb-20] | 0 to 16 / 255 | Detects a decrease in the control power supply and restarts the motor when the power supply is recovered. When 0 is specified, the inverter immediately trips when an instantaneous power failure occurs. | 0 |
| The number of retries after under voltage | [bb-21] | 0 to 16 / 255 | Detects a decrease in the main power supply and restarts the motor when the power supply is recovered. When 0 is specified, the inverter immediately trips when an under-voltage condition occurs. | 0 |
| Selection of restart mode @Instantaneous power failure/under-voltage trip | [bb-24] | 00 | Restarts with 0 Hz at retry. | 01 |
| | | 01 | Restarts with speed matching at retry. | |
| | | 02 | Restarts with frequency pull-in at retry. | |
| | | 04 | Restarts with speed matching at retry, and trips after deceleration stop. | |
| Allowable under-voltage power failure time | [bb-25] | 0.3 to 25.0 (s) | Restarts if the instantaneous power failure is within the set time. Trips if the instantaneous power failure exceeds the specified time. | 1.0 |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0 (s) | Sets the time before restarting. | 0.3 |
| Instantaneous power failure/under-voltage trip alarm enable | [bb-27] | 00 | Disabled | 00 |
| | | 01 | Enabled | |
| | | 02 | Disabled during stopping and during deceleration stop after the operation command has been turned off. | |

| Item | Parameter | Data | Description | Default data |
|---------------------------------------|--------------------|------|--|--------------|
| Selection of output terminal function | [CC-01] to [CC-05] | 017 | 017: Outputs [AL] Alarm signal. | - |
| Relay output terminal [16] function | [CC-06] | 020 | 020: Outputs [IP] Instantaneous power failure signal | |
| Relay output terminal [AL] function | [CC-07] | 021 | 021: Outputs [UV] Under-voltage signal. | |

Alarm Output When Instantaneous Power Failure/Under-Voltage occurs during Stopping

Use this function to specify whether to output [AL] Alarm signal (error output) (output terminal function 028) when an instantaneous power failure or under-voltage occurs according to [bb-27] Selection of instantaneous power failure/under-voltage trip during stopping.

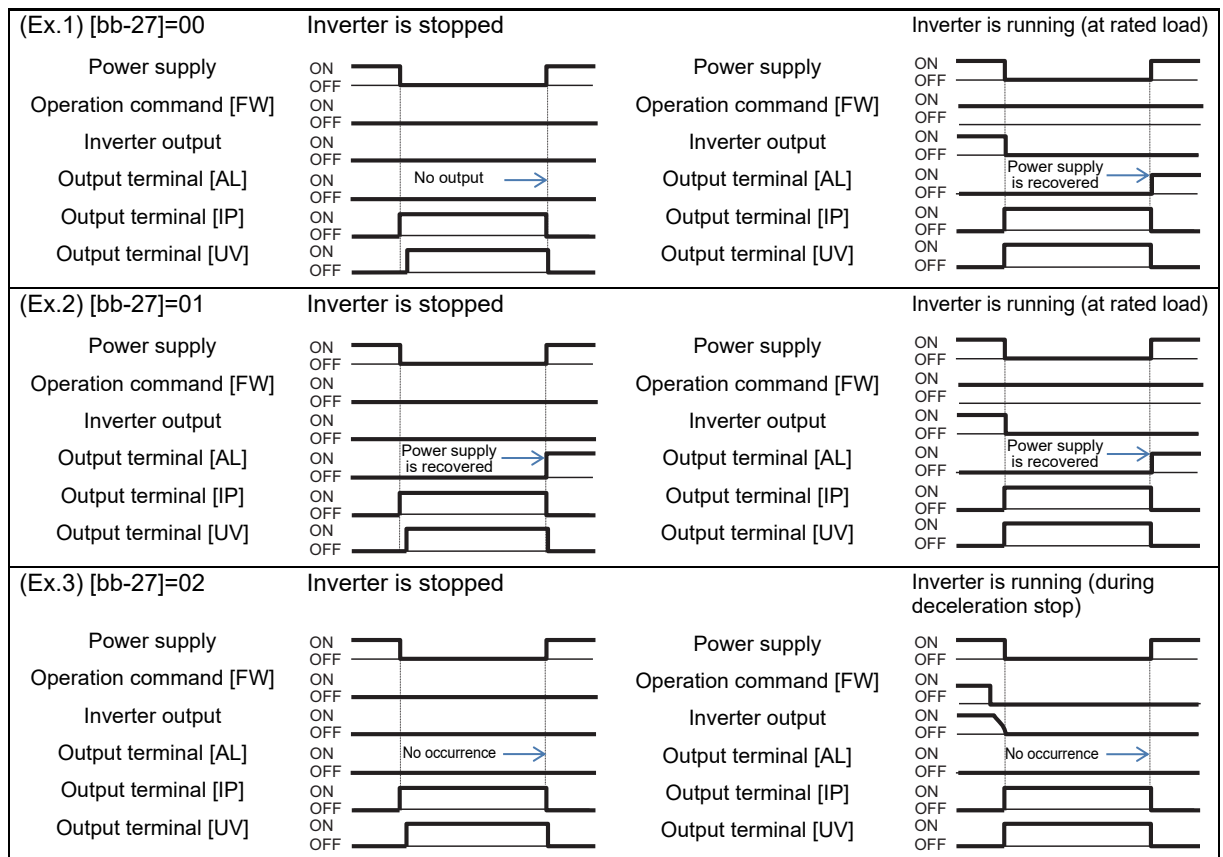
Examples 1 to 6 show cases with no retry.



Precautions for Correct Use

- When the power to control power supply terminals R0 and T0 is supplied from main power supply terminals R, S, and T, and if the control power supply terminals continue to be shut off for 80 ms or more, it is considered as power failure. After the power supply is recovered, the inverter performs power-on operation.
- Depending on the load conditions of the motor driven by the inverter, an under-voltage error [E009], instead of an instantaneous power failure error [E016], may occur.
- The inverter outputs the alarm while the power to control power supply terminals R0 and T0 remains.

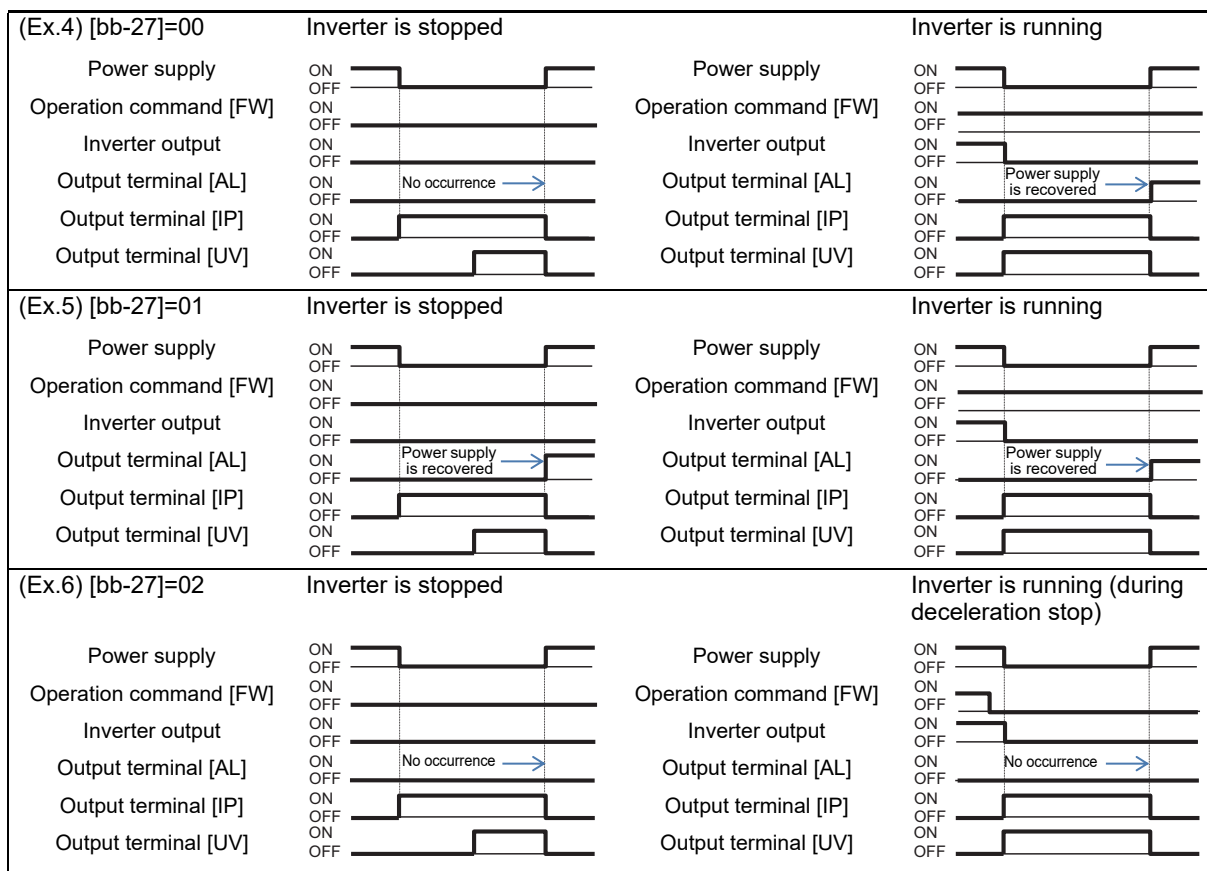
Examples of supplying the power to R0 and T0 from R, S, and T



Precautions for Correct Use

- Depending on the setting for [bb-25] Allowable instantaneous power failure time and the number of retries, the inverter's behavior varies.
- When "0" is specified for the number of retries (Error occurs)
 - Power recovery within [bb-25] Allowable instantaneous power failure time
 - ⇒ An error occurs.
 - Power recovery after [bb-25] Allowable instantaneous power failure time has elapsed
 - ⇒ An error does not occur. The same operation as when the power is turned on.
- When other than "0" is specified for the number of retries (Retry enabled)
 - Power recovery within [bb-25] Allowable instantaneous power failure time
 - ⇒ Retry operation
 - Power recovery after [bb-25] Allowable instantaneous power failure time has elapsed
 - ⇒ An error occurs.

Examples of supplying the power to R0 and T0 from P and N



Precautions for Correct Use

- [IP] signals start to be detected after 3-phase power source has been input to main power supply terminals R, S, and T.
- If direct current is supplied between P and N, [IP] signals will not be output.

8-3-7 Frequency Jump Function

Use the jump frequency function to operate the inverter while avoiding resonance points on the load-machine system.

A jump frequency can be set at 3 points.

When a jump frequency is set, the output frequency is in the upper/lower-limit frequency of the set jump frequency range, avoiding frequencies within that range.

The output frequency within the range of the jump frequency command fluctuates continuously according to normal the acceleration/deceleration time.



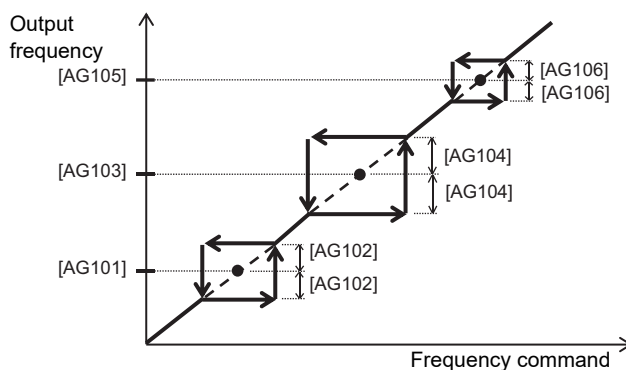
Precautions for Correct Use

The jump frequency function is a function to prevent output within the specified frequency command range. When a frequency command that is within the range of the jump frequency function is input, the output is automatically limited. While the output is limited, the LIM icon will be displayed.

● Parameter

| Item | Parameter | Data | Description | Default data |
|-----------------------------------|-----------|--------------------|---|--------------|
| Jump frequency 1, 1st-motor | [AG101] | 0.00 to 590.00(Hz) | Sets the center of the frequency range at which to execute a jump. If 0.00 Hz is set, the jump frequency function is disabled. | 0.00 |
| Jump frequency 2, 1st-motor | [AG103] | | | |
| Jump frequency 3, 1st-motor | [AG105] | | | |
| Jump frequency width 1, 1st-motor | [AG102] | 0.00 to 10.00(Hz) | Set one-half of the frequency width in which to execute a jump. Frequencies that fall in the range of a jump frequency \pm jump width will be jumped. | 0.00 |
| Jump frequency width 2, 1st-motor | [AG104] | | | |
| Jump frequency width 3, 1st-motor | [AG106] | | | |

Setting Examples



8-3-8 Speed Deviation Error Detection

The speed deviation error detection judges an error when the deviation between the output frequency and the feedback speed becomes large.

This function operates when other than “0.0” is specified for [bb-83] Speed deviation error detection level setting.

The speed deviation is the difference between [dA-12] output frequency monitor and [dA-08] speed detection monitor.

When the absolute value of speed deviation has exceeded [bb-83] Speed deviation error detection level and [bb-84] Speed deviation error detection time has elapsed, it is judged as a speed deviation error.

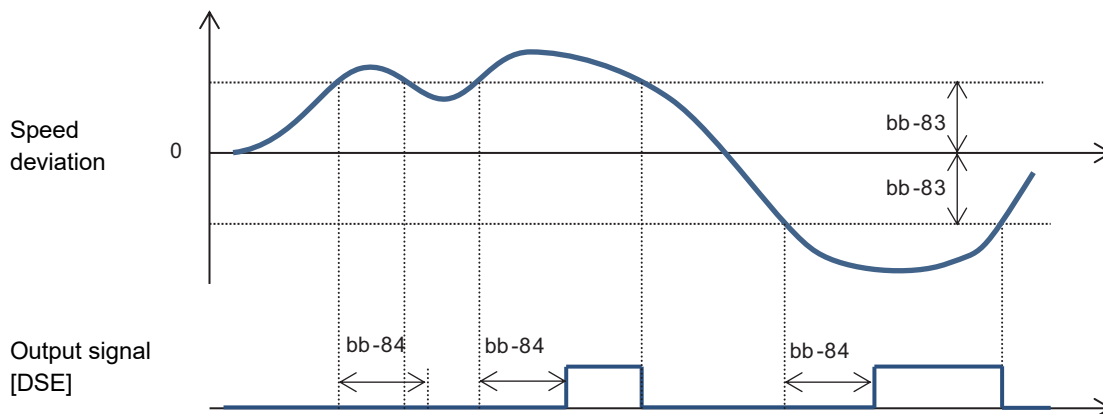
If “00: Warning” is specified for [bb-82] Operation for speed deviation error, the inverter turns on the Output terminal function 041 [DSE] with a speed deviation error.

If “01: Error” is specified for [bb-82] Operation for speed deviation error, the inverter turns on the Output terminal function 041 [DSE] with a speed deviation error, and trips with [E105] Speed deviation excessive error.



Precautions for Correct Use

To use this function, speed feedback by the encoder is required.



● Parameter

| Item | Parameter | Data | Description | Default data |
|---------------------------------------|-----------|-----------------------|---|--------------|
| Speed deviation error mode selection | [bb-82] | 00 | Turns on the output terminal function 041 [DSE]. | 00 |
| | | 01 | Turns on the output terminal function 041 [DSE], and trips with [E105] Speed deviation excessive error. | |
| Speed deviation error detection level | [bb-83] | 0.0 to 100.0(%) | Set the level at 100% to which the maximum frequency is set. | 15.0 |
| Speed deviation error detection time | [bb-84] | 0.0 to 5.0(s) | Sets the time to judge the deviation to be an error after it has excessively increased. | 0.5 |
| Speed Detection Values monitor | [dA-08] | -590.00 to 590.00(Hz) | Displays data obtained through encoder feedback. | - |
| Output frequency monitor | [dA-12] | -590.00 to 590.00(Hz) | Displays the frequency command given by the inverter. | - |

8-3-9 Overspeed Error Detection

The over-speed error detection function judges that the speed is excessive if the feedback speed exceeds the over-speed level.

This function operates when other than "0.0" is specified for [bb-80] Over-speed error detection level.

The overspeed is detected by the feedback frequencies displayed on [dA-08] speed detection monitor.

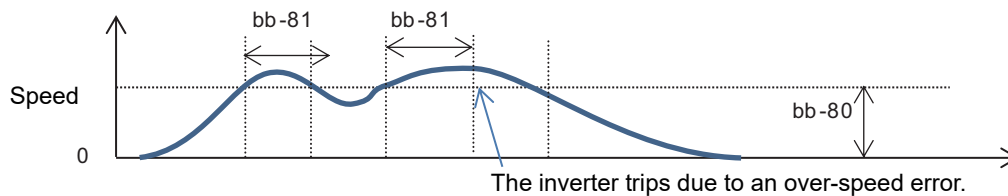
When the speed has exceeded [bb-80] Over-speed error detection level and [bb-81] Over-speed error detection time has elapsed, it is judged as an over-speed error.

When an over-speed error occurs, the inverter trips with [E107] Over-speed error.



Precautions for Correct Use

To use this function, speed feedback by the encoder is required.



● Parameter

| Item | Parameter | Data | Description | Default data |
|-------------------------------|-----------|-----------------------|--|--------------|
| Over speed detection level | [bb-80] | 0.0 to 150.0(%) | Set the overspeed level at 100% to which the maximum frequency is set. | 135.0 |
| Over speed detection time | [bb-81] | 0.0 to 5.0(s) | Sets the time to judge the speed to be an error after it has excessively increased. The inverter trips with [E107] Over-speed error. | 0.5 |
| Speed detection value monitor | [dA-08] | -590.00 to 590.00(Hz) | Displays the data obtained through encoder feedback. | - |

8-4 Control Function

8-4-1 2nd Control (SET)

This function changes the valid parameters by assigning 024[SET] to the input terminal function and turning it on. In conjunction with [SET], the output terminal 012[SETM] is turned on.

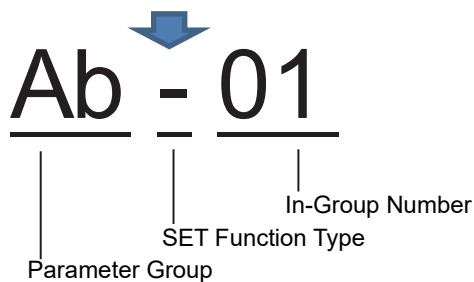
The following is the notation for the parameters that are changed with the [SET] terminal.



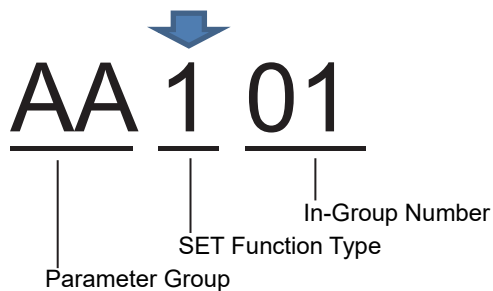
Precautions for Correct Use

- The [SET] terminal can be switched while the output of the inverter is blocked. If it is being switched during the output, it is switched after the output blockage.
- Even if you want to switch the [SET] terminal for immediate operation, take more than 1 second for the switching time.

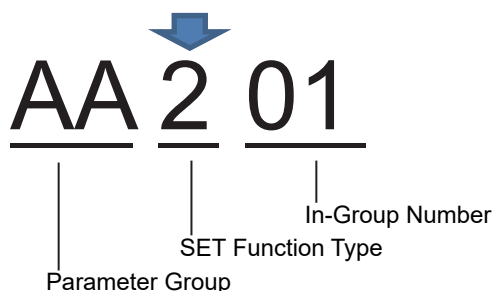
- Example of the Common Settings



- Example of the First Setting



- Example of the Second Setting



| Example | SET Function Type Notation | Description |
|----------------|---|--|
| Common | The third digit of the parameter is "-": [Ab-01], [bA-30], [CC-01], etc. | The parameter is common to the first and second settings regardless of the SET function. Always valid. |
| First setting | The third digit of the parameter is "1": [AA101], [bC112], [Hb102], etc. | If the [SET] terminal is off or the [SET] function is not assigned (off), the first setting is applied. The data for which the third digit of the parameter is "1" are all valid. |
| Second setting | The third digit of the parameter is "2": [AA201], [bC212], [Hb202], etc. | If the [SET] terminal is on, the second setting is applied. The data for which the third digit of the parameter is "2" are all valid. |

● Parameter

| Item | Parameter | Data | Description |
|--------------------------|--------------------|------|--|
| Input terminal function | [CA-01] to [CA-11] | 024 | [SET]: Second setting function OFF: The first setting is valid. ON: The second setting is valid. Note If the parameter does not have 024[SET] assigned, the first setting is valid. |
| Output terminal function | [CC-01] to [CC-07] | 012 | [SETM]: OFF when SET is OFF; ON when SET is ON. |

8-4-2 Commercial Switch (CS)

This function can be used to drive the acceleration/deceleration with the inverter and drive in a constant speed with a commercial power supply for a system where the load inertia moment is large.

If the 035[CS] terminal is turned from on to off with the status where an operation command is sent, the inverter starts with the frequency matched with the motor rotation speed in free-running after the retry waiting time [bb-26]. (Starting the frequency matching.)

When the CS terminal is turned ON with the RUN command input, the inverter cuts off its output. Be sure to maintain the output while the motor sequence is switched.



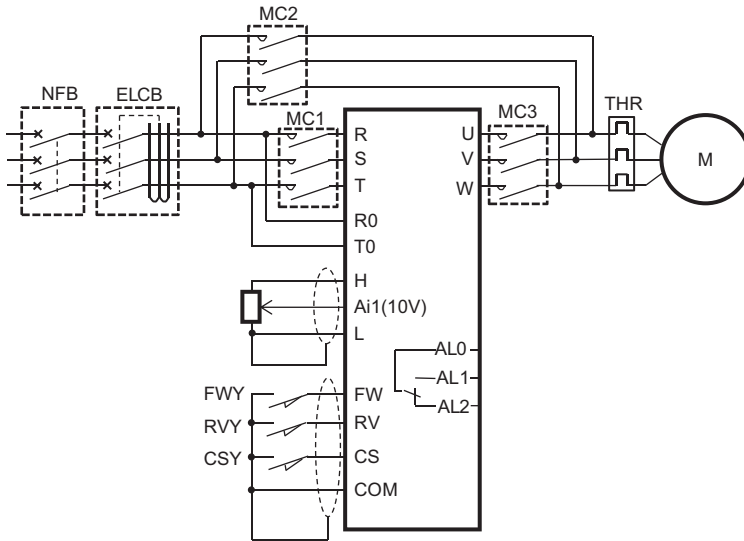
Precautions for Correct Use

- The operation at the [CS] terminal is similar to the case when starting the frequency matching is selected. Starting at 0 Hz may occur when:
 1. The output frequency is equal to or less than one-half of the base frequency.
 2. The induced voltage of the induction motor decays early
 3. The lower limit frequency for the frequency matching [bb-42] is set and a speed not more than the set speed is detected.
- For the frequency matching, extend the retry waiting time [bb-26] when the overcurrent trip occurs.
- The operation can be also restarted automatically when the power is turned on. In this case, the reset restart function is used. For more information, refer to 7-5 Start Conditions on page 7-63.

For the behavior of the commercial switching, refer to the following sample connection diagram for the commercial switching operation and timing.

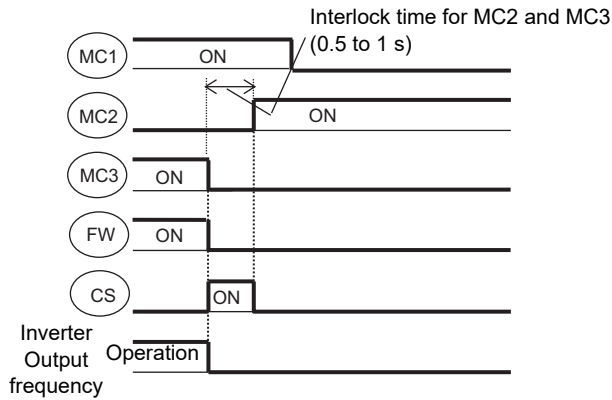
Use light electrical relays for FWY, RVY, and CSY. The following sequence is a reference diagram for timing.

Take a mechanical interlock for MC3 and MC2. Otherwise, you run the risk of damage to the inverter. Since the commercial circuit does not operate either when the earth leakage circuit breaker (ELCB) trips, connect the commercial circuit of another system to MC2 if the backup is required.

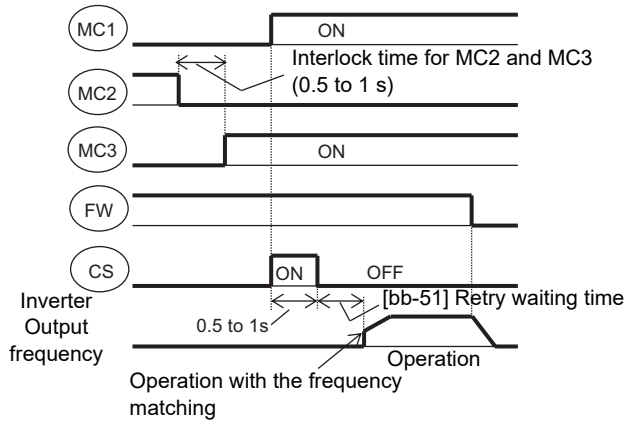


Sample connection diagram for the commercial switching operation and timing

Example of timing from INV to the commercial operation



Example of timing from the commercial operation to INV



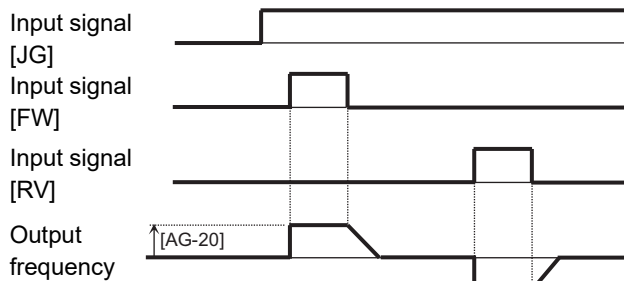
● Parameter

| Item | Parameter | Data | Description | Default data |
|--------------------------------------|--------------------|--------------------|--|--------------|
| Selecting the input terminal | [CA-01] to [CA-11] | 035 | Used for the commercial switching [CS]. | - |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Set the waiting time after an operation command. | 3 |
| Restart frequency threshold | [bb-42] | 0.00 to 590.00(Hz) | Starting at 0 Hz when the detected value is equal to or less than the set value. | 0.00 |

8-4-3 Jogging Operation Function (JG)

This function allows you to fine-tune the position where a motor stops.

The jogging operation starts when frequency commands for the operation is set to [AG-20] the jogging frequency and the [JG] terminal is turned ON.



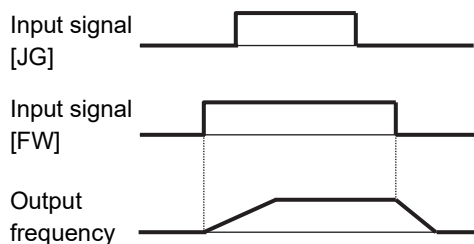
Precautions for Correct Use

- The jogging operation is likely to cause a trip as the frequency command is outputted instantaneously without acceleration time. Adjust the setting value for the jogging frequency [AG-20] to prevent the inverter trip.
- For the jogging operation, set the [AA111] operation command selection to 00, turn on the 029[JG] terminal and then put the [FW]/[RV] terminal. The operation is not allowed with the [JG] terminal alone.
- When [AG-21] = 00, 03 for the free-running at the time of the stop, the operation settings for free-running is required.
- When [AG-21] = 02, 05 for the DC-braking at the time of the stop, the settings for the DC-braking function is required. Refer to 7-6 *Stop Conditions* on page 7-82 respectively.

● Parameter

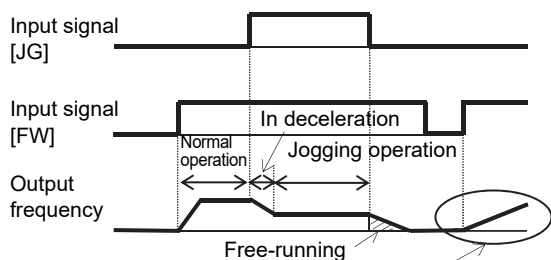
| Item | Parameter | Data | Description | Default data |
|-----------------------------|--------------------|-------------------------------|---|--------------|
| Jogging frequency | [AG-20] | Lowest frequency - 10.00 (Hz) | Frequency command at the time of the jogging operation command. | 6.00 |
| Jogging stop mode selection | [AG-21] | 00 | Invalid while operating Free-running at the time of the stop. | 00 |
| | | 01 | Invalid while operating Decelerating stop at the time of the stop. | |
| | | 02 | Invalid while operating DC braking at the time of the stop. | |
| | | 03 | Valid while operating Free-running at the time of the stop. | |
| | | 04 | Valid while operating Decelerating stop at the time of the stop. | |
| | | 05 | Valid while operating DC braking at the time of the stop. | |
| Input terminal function | [CA-01] to [CA-11] | 029 | When the [JG] terminal function is turned on, the jogging behavior occurs at the time of operation. | - |

(Ex.1)



When the setting for the jogging selection [AG-21] is 00, 01 or 02, the jogging behavior does not occur if the [FW] signal is turned on first.

(Ex.2)



After the free-running is released, acceleration occurs according to the settings for restart [bb-40].

When the setting for [AG-21] is 03, 04 or 05, the jogging behavior occurs if the [FW] signal is turned on first. However, if the [JG] signal is turned off first, the free-running stop occurs.

8-4-4 Brake Control Function (BRK)

Function to control the external brake used in a lifting system, etc. by the inverter. Changing the brake controlling function selection [AF130] enables you to select between two types of control methods.

1. Brake control 1: [AF130] = 01 or 02
Releases and checks the brake while outputting the frequency.
2. Brake control 2: [AF130] = 03
Controls the brake in conjunction with the servo lock control.



Precautions for Correct Use

- For using the brake control function, we recommend using controls that generate high torque when the control system [AA121] is started such as:
Use the following brake control functions.
08: Sensorless vector control,
09: 0 Hz range sensorless vector control or
10: Vector control with sensor.
- When an error occurs in the brake sequence, the inverter trips [E036], the brake control fault signal 038[BER] for the output terminal function is output.

Brake Control 1

Available in those instances where the operations vary for lifting and lowering since different operations can be set for forward and reverse rotations.

The 037[BRK] brake release signal for the output terminal function and the 037[BOK] brake check signal for the input terminal function are available.

For the brake control, a trip occurs in the following cases.

- After the brake release establishment waiting time, the output current was less than the release current.
- When the brake check signal 037[BOK] is used, [BOK] was not turned on within the brake check waiting time at start-up.
- When the brake check signal 037[BOK] is used, [BOK] was not turned off within the brake check waiting time at stop.
- When the brake check signal 037[BOK] is used, the brake release signal 037[BRK] was being output, but [BOK] was turned off.

[AF130] = 01: Brake control 1 common in forward/reverse rotation, the following parameters are valid.

| Item | Valid for both forward and reverse |
|--|------------------------------------|
| Brake release establishment waiting time | [AF131] |
| Acceleration waiting time | [AF132] |
| Stop waiting time | [AF133] |
| Brake check waiting time | [AF134] |
| Brake release frequency | [AF135] |
| Brake release current | [AF136] |
| Brake apply frequency | [AF137] |

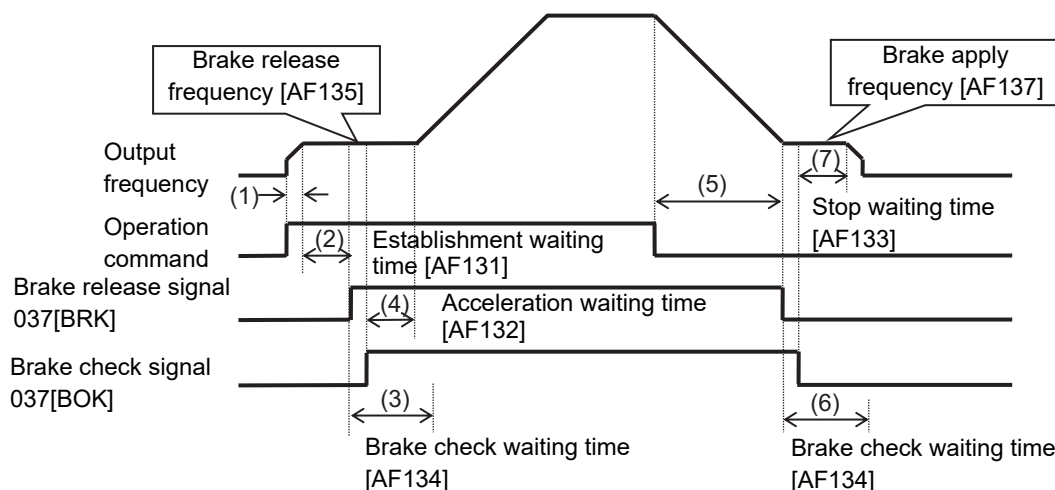
[AF130] = 02: Brake control 1 forward/reverse set individually, the following parameters are valid.

| Item | Forward rotation side | Reverse rotation side |
|--|-----------------------|-----------------------|
| Brake release establishment waiting time | [AF131] | [AF138] |
| Acceleration waiting time | [AF132] | [AF139] |
| Stop waiting time | [AF133] | [AF140] |
| Brake check waiting time | [AF134] | [AF141] |
| Brake release frequency | [AF135] | [AF142] |
| Brake release current | [AF136] | [AF143] |
| Brake apply frequency | [AF137] | [AF144] |



Precautions for Correct Use

- Do not use the brake control 1 function when position/torque controls are performed.
- Do not use the brake control 1 function when the synchronous motor (permanent magnet motor) is used.



Once the inverter receives an operation command, it starts the output and accelerate to the release frequency. (1)

When the brake release establishment waiting time passes after the release frequency is reached, the inverter outputs the brake release signal 037[BRK]. (2)



Precautions for Correct Use

At this time, if the output current is less than the current set for the release current, the brake release signal is not output and the trip occurs with the [E036] brake error outputting the brake fault signal 038[BER].

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function. (3)

| | |
|------------------------------|---|
| With [BOK] setting | The inverter turns on the release signal [BRK] and waits for the input (ON) for the check signal [BOK] without accelerating during the brake check waiting time. If the [BOK] is not turned on during the above time, the inverter trips with the [E036] brake error outputting the fault signal [BER]. |
| Without [BOK] setting | After the release signal [BRK] is turned on, the process goes to the item 4 regardless of the brake check waiting time. |

If the brake check signal [BOK] is not selected, when the brake release signal is output, the inverter starts accelerating again to the set frequency after the acceleration waiting time passes. (4)

Once the operation command is turned off, the inverter decelerates to the brake apply frequency and turns off the brake release signal [BRK]. (5)

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function. (6)

| | |
|------------------------------|--|
| With [BOK] setting | The inverter turns off the release signal [BRK] and waits for the input (OFF) for the check signal [BOK] without decelerating during the brake check waiting time. If the [BOK] is not turned off during the above time, the inverter trips with the [E036] brake error outputting the fault signal [BER]. |
| Without [BOK] setting | After the release signal [BRK] is turned off, the process goes to the item 7 regardless of the brake check waiting time. |

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function. (7)

| | |
|------------------------------|---|
| With [BOK] setting | When the check signal [BOK] is turned off, the inverter decelerates again to 0 Hz after the stop waiting time passes. |
| Without [BOK] setting | When the release signal [BRK] is turned off, the inverter decelerates again to 0 Hz after the stop waiting time passes. |



Precautions for Correct Use

If the operation command is the forward command, the parameters on the side of the forward rotation are adopted; if it is the reverse command, those on the side of the reverse rotation are adopted.

Ex: When FW is turned ON or the output frequency is positive → Forward side parameter
 When FW is turned ON or the output frequency is negative → Reverse side parameter
 When RV is turned ON or the output frequency is positive → Reverse side parameter
 When RV is turned ON or the output frequency is negative → Forward side parameter

● Setting Items Required for the Brake Control 1 Function

| Item | Parameter | Data | Description | Default data |
|--|------------------|---------|--|--------------|
| Brake control function selection | [AF130] | 00 | Disabled | 00 |
| | | 01 | Brake control 1 common in forward/reverse rotation ^{*1} | |
| | | 02 | Brake control 1 forward/reverse set individually | |
| Brake release establishment waiting time | Forward rotation | [AF131] | 0.00 to 5.00(s) | 0.00 |
| | Reverse rotation | [AF138] | | 0.00 |
| Acceleration waiting time | Forward rotation | [AF132] | 0.00 to 5.00(s) | 0.00 |
| | Reverse rotation | [AF139] | | 0.00 |
| Stop waiting time | Forward rotation | [AF133] | 0.00 to 5.00(s) | 0.00 |
| | Reverse rotation | [AF140] | | 0.00 |
| Brake check waiting time | Forward rotation | [AF134] | 0.00 to 5.00(s) | 0.00 |
| | Reverse rotation | [AF141] | | 0.00 |

| Item | Parameter | Data | Description | Default data | |
|--------------------------|------------------|--------------------|--|---|-----------------------------|
| Brake release frequency | Forward rotation | [AF135] | 0.00 to 590.0(Hz) | Setting the frequency to output the brake release signal ^{*2} | 0.00 |
| | Reverse rotation | [AF142] | | | 0.00 |
| Brake release current | Forward rotation | [AF136] | Inverter rated current ×(0.0 to 2.0) ^{*3} | Setting the output current to allow the brake release ^{*4} | 1.0× Inverter rated current |
| | Reverse rotation | [AF143] | | | 1.0× Inverter rated current |
| Brake apply frequency | Forward rotation | [AF137] | 0.00 to 590.0(Hz) | Setting the frequency to close the brake at the time of stop ^{*2} | 0.00 |
| | Reverse rotation | [AF144] | | | 0.00 |
| Input terminal function | | [CA-01] to [CA-11] | 037 | [BOK] Brake check signal OFF: Brake applied ON: Brake released | - |
| Output terminal function | | [CC-01] to [CC-07] | 037 | [BRK] Brake release signal OFF: Brake application command ON: Brake release command | - |
| | | | 038 | [BER] Brake fault signal OFF: Brake sequence is normal ON: Brake sequence is abnormal | |

*1. If [AF130] = 01, the forward rotation settings, [AF131] to [AF137] are valid for both the forward and reverse rotations.

*2. Set the time greater than the value of the minimum speed [Hb130].

*3. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

*4. Note that a low value for the setting may generate sufficient torque when releasing the brake.

Brake Control 2

The brake control by managing time is available.

The 037[BRK] brake release signal for the output terminal function and the 037[BOK] brake check signal for the input terminal function are available.

For the brake control 2, an error occurs with a trip in the following cases.

- When the brake check signal 037[BOK] is used, [BOK] was not turned on within the brake check waiting time at start-up.
- When the brake check signal 037[BOK] is used, [BOK] was not turned off within the brake check waiting time at stop.
- When the brake check signal 037[BOK] is used, the brake release signal 037[BRK] was being output, but [BOK] was turned off.

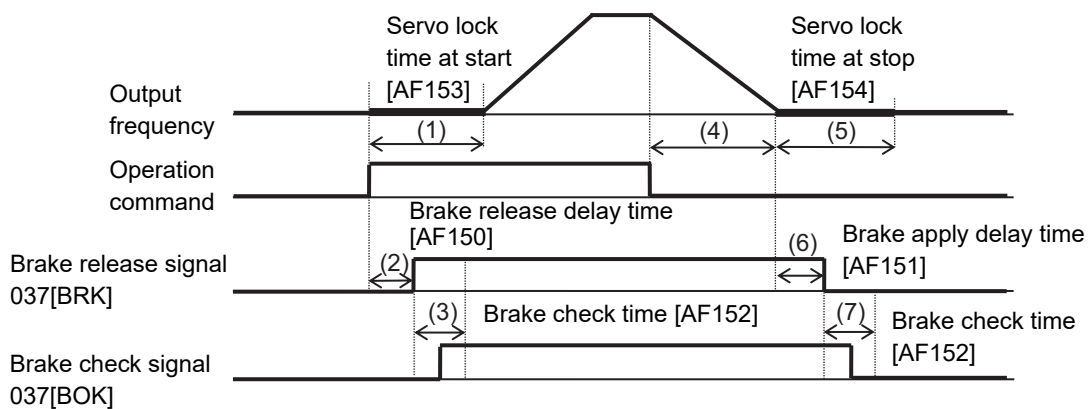
[AF130] = 03: Brake control 2, the following parameters are valid.

| Item | Valid for both forward and reverse |
|--------------------------|------------------------------------|
| Brake release delay time | [AF150] |
| Brake apply delay time | [AF154] |
| Brake check time | [AF152] |
| Servo lock time at start | [AF153] |
| Servo lock time at stop | [AF154] |



Precautions for Correct Use

- Since the brake control 2 generates the servo lock status when the brake is on, use 09: zero speed range sensorless vector control or 10: vector control with sensor for the [AA121] control method.
- Selecting the control methods other than the above will replace the operation part of the servo lock with the DC braking operation. Servo lock time is applied at start/stop operation even when this is a DC injection braking.



The inverter starts the output and performs the servo lock for the servo lock time at start. (If the [AA121] control method is neither 09: zero speed range sensorless vector control nor 10: vector control with sensor, the DC braking is applied.) (1)

After the brake release delay time passes, the brake release signal 037[BRK] is turned on. (2)

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function.

After the servo lock time at start passes, there is an acceleration. (3)

| | |
|------------------------------|--|
| With [BOK] setting | If the 037[BOK] is not turned on during the brake check time, the inverter trips with the [E036] brake error outputting the fault signal 038[BER]. |
| Without [BOK] setting | After the release signal 037[BRK] signal is turned on, there is a waiting for the servo lock time at start to pass. |

Once the operation command is turned off, the inverter decelerates and perform the servo lock. (4)

The servo lock is kept for the servo lock time at stop. (5)

After the brake apply delay waiting time passes, the brake release signal 037[BRK] is turned on. (6)

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function.

There is a waiting for the servo lock time to pass. (7)

| | |
|------------------------------|---|
| With [BOK] setting | The inverter turns off the release signal 037[BOK], and if the 037[BOK] is not turned off during the brake check time, the inverter trips with the [E036] brake error outputting the fault signal 038[BER]. |
| Without [BOK] setting | After the release signal [BRK] signal is turned off, there is a waiting for the servo lock time at stop to pass. |

● Setting Items Required for Brake Control2

| Item | Parameter | Data | Description | Default data |
|---|-----------|------------------|--|--------------|
| Brake Control Enable, 1st-motor | [AF130] | 00 | Disabled | 00 |
| | | 01 | Brake control 1 enabled | |
| | | 02 | Brake control 1 enabled (forward/reverse set individually) | |
| | | 03 | Brake control 2 enabled | |
| Brake open delay time, 1st-motor | [AF150] | 0.00 to 2.00(s) | Set the brake release delay time. | 0.20 |
| Brake close delay time, 1st-motor | [AF151] | 0.00 to 2.00(s) | Set the brake apply delay time. | 0.20 |
| Brake answer back check time, 1st-motor | [AF152] | 0.00 to 5.00(s) | Set the time to check the brake. | 0.10 |
| Servo lock/ DC injection time at start, 1st-motor | [AF153] | 0.00 to 10.00(s) | Set the servo lock time at start. | 0.60 |
| Servo lock/ DC injection time at stop, 1st-motor | [AF154] | 0.00 to 10.00(s) | Set the servo lock time at stop. | 0.60 |
| DC braking force setting, 1st-motor | [AF105] | 0 to 100(%) | If the control method is neither 09: zero speed range sensorless vector control nor 10: vector control with sensor, the DC braking is applied. Set the braking force (at the time of stop). | 30 |
| DC braking force at start, 1st-motor | [AF108] | 0 to 100(%) | If the control method is neither 09: zero speed range sensorless vector control nor 10: vector control with sensor, the DC braking is applied. Set the braking force (at the time of start). | 30 |

8-4-5 Contactor Control (CON)

For performing the contactor operation, set the [AF120] contactor control selection to 01.

The 039[CON] contactor control signal for the output terminal function and the 107[COK] contactor check signal for the input terminal function are available.

For the contactor control, a trip occurs in the following cases.

- When the contactor check signal 107[COK] is used, [COK] is not turned on within the contactor check time at start-up.
- When the contactor check signal 107[COK] is used, [COK] is not turned off within the contactor check time at stop.
- When the contactor check signal 107[COK] is used, [COK] is turned off while the contactor control signal 039[CON] is on



Precautions for Correct Use

- The contactor control requires this function because operating a contactor during the inverter output generates a surge causing damage to the inverter.
- When an error occurs in the contactor sequence, the inverter trips at [E110].

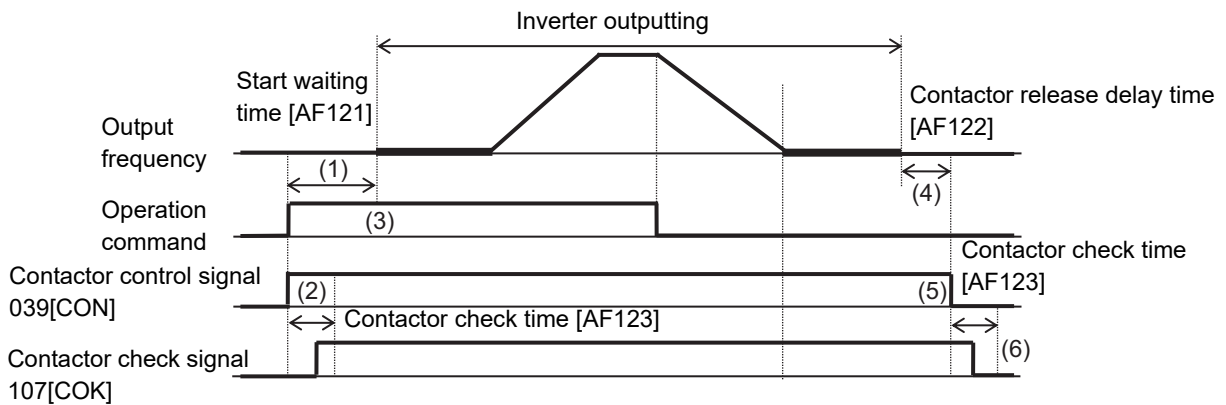
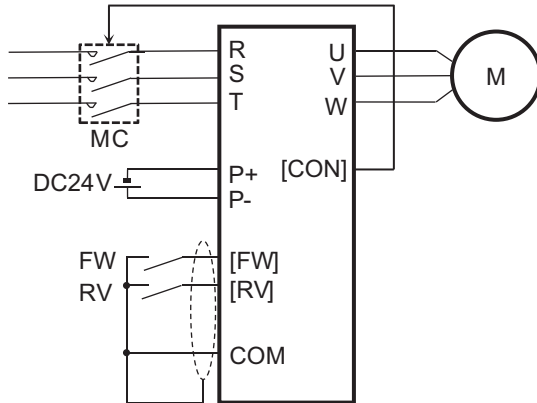
Setting Items Required for the Contactor Control

| Item | Parameter | Data | Description | Default data |
|---|--------------------|-----------------|--|--------------|
| Contactor Control Enable, 1st-motor | [AF120] | 00 | Disabled | 00 |
| | | 01 | Enabled (primary side) Place a contactor on the primary side of the inverter to reduce standby power. | |
| | | 02 | Enabled (secondary side) Place a contactor on the secondary side of the inverter to implement the function as a brake sequence. | |
| Run delay time, 1st-motor | [AF121] | 0.00 to 2.00(s) | Set the waiting time from the input of an operation command to the start of the inverter output. | 0.20 |
| Contactor off delay time, 1st-motor | [AF122] | 0.00 to 2.00(s) | Set the time from the output shutoff of the inverter to the control of the contactor. | 0.10 |
| Contactor answer back check time, 1st-motor | [AF123] | 0.00 to 5.00(s) | Set the time from the operation command to the control of the contactor. | 0.10 |
| Input terminal function | [CA-01] to [CA-11] | 107 | [COK] Contactor check signal OFF: Contactor released ON: Contactor in operation | - |
| Output terminal function | [CC-01] to [CC-07] | 039 | [CON] Contactor control signal OFF: Contactor release command ON: Contactor operation command | - |

Example of Energy Saving on the Primary Side Contactor (AF120 = 01: Enabled (Primary Side))

Reduce standby power in combination with the control power supply DC24V input.

Connecting the auxiliary contact MC for the main circuit power supply to the setting terminal of the output terminal function [CON] shuts off the power input to the inverter main circuit while the inverter output is suspended to implement the operation sequence for energy saving.



The inverter waits for the output until the start waiting time passes. (1)

It turns on the contactor control signal 039[CON] at the same time.

The operation varies depending on whether the contactor check signal 107[COK] is set to the input terminal function. (2)

| | |
|------------------------------|---|
| With [COK] setting | If the 107[COK] is not turned on during the contactor check time, the inverter trips with the [E110] contactor error. |
| Without [COK] setting | After the contactor control signal 039[CON] is turned on, there is a waiting time for the start waiting time to pass. |

After the start waiting time passes, there is an acceleration. (3)

After the inverter stops the output, there is a waiting time for the contactor release delay time to pass. (4)

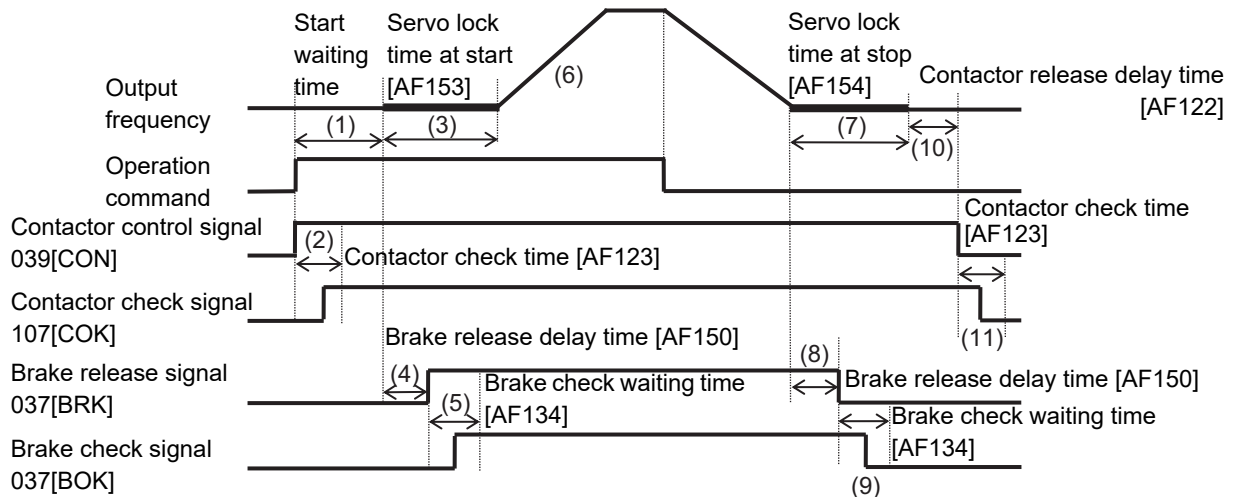
After the contactor release delay time passes, the contactor control signal 039[CON] is turned off. (5)

The operation varies depending on whether the contactor check signal 107[COK] is set to the input terminal function. (6)

| | |
|------------------------------|--|
| With [COK] setting | If the 107[COK] is not turned off during the contactor check time, the inverter trips with the [E110] contactor error. |
| Without [COK] setting | The inverter still does nothing. |

Example of the Control on the Secondary Side (AF120 = 02: Enabled (secondary side))

When Enabled (secondary side) is selected, using in combination with the brake control 2 is available.



Once the operation command is received, the inverter turns on the control signal 039[CON]. (1)

The operation varies depending on whether the contactor check signal 107[COK] is set to the input terminal function. (2)

| | |
|------------------------------|---|
| With [COK] setting | The inverter turns on the control signal 039[CON] and, if the 107[COK] is not turned on during the contactor check time, the inverter trips with the [Er110] contactor error. |
| Without [COK] setting | After the control signal 039[CON] is turned on, there is a waiting time for the start waiting time to pass. |

The inverter starts the output and is in the servo lock status at the present location for the servo lock time at start. (3)

After the brake release delay time passes, the brake release signal 037[BRK] is turned on. (4)

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function. (5)

| | |
|------------------------------|--|
| With [BOK] setting | If the 037[BOK] is not turned on during the brake check waiting time, the inverter trips with the [E036] brake error outputting the fault signal 038[BER]. |
| Without [BOK] setting | After the release signal 037[BRK] signal is turned on, there is a waiting for the servo lock time at start to pass. |

After the servo lock time at start passes, there is an acceleration. (6)

Once the operation command is turned off, the inverter decelerates and is in the position servo lock status for the servo lock time at stop. (7)

After the brake release delay time passes, the brake release signal 037[BRK] is turned off. (8)

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function. (9)

| | |
|------------------------------|---|
| With [BOK] setting | The inverter turns off the release signal 037[BRK], and if the 037[BOK] is not turned off during the brake check time, the inverter trips with the [E036] brake error outputting the fault signal 038[BER]. |
| Without [BOK] setting | After the release signal [BRK] signal is turned off, there is a waiting for the servo lock time at stop to pass. |

The inverter shuts off the output and, after the contactor release delay time passes, the control signal 039[CON] is turned off. (10)

The operation varies depending on whether the contactor check signal 107[COK] is set to the input terminal function. (11)

| | |
|------------------------------|--|
| With [COK] setting | If the 107[COK] is not turned off during the contactor check time, the inverter trips with the [E110] contactor error. |
| Without [COK] setting | The inverter still does nothing. |

8-4-6 Forced Operation

Forced Operation Mode

In this mode, the motor runs at a fixed speed without interrupting the output of the inverter.

Set the [PA-01] forced operation to enabled 01 and turn on the [EMF] emergency forced operation terminal (input terminal: 105) to enter the forced operation mode.

The command for the forced operation mode is set to [PA-02] the forced operation frequency setting and [PA-03] the forced operation rotation direction command.



Precautions for Correct Use

- Once the forced operation mode is turned on, the inverter keeps operating until the power is off.
- When using the forced operation mode, make sure that the system is safe if the operation continues.
- Enabling the overcurrent retry, overvoltage retry, undervoltage retry or instantaneous power failure retry requires a separate setting.
- After the [EMF] emergency forced operation terminal (input terminal: 105) is turned on, the input terminal function except for the following are disabled.
⇒ [COK]: Contactor check signal

● Parameter Setting

| Item | Parameter | Data | Description | Default data |
|--|-----------|--------------------|---|--------------|
| Mode selection for Emergency-force drive | [PA-01] | 00 | Disabled | 00 |
| | | 01 | Enabled | |
| Frequency reference setting at Emergency-force drive | [PA-02] | 0.00 to 590.00(Hz) | Set the frequency command in the forced operation mode. | 0.00 |
| Direction command at Emergency-force drive | [PA-03] | 00 | Forward rotation command | 00 |
| | | 01 | Reverse rotation command | |

● Input Terminal Setting

| Item | Parameter | Data | Description |
|------------------------------|--------------------|------|--|
| Selecting the input terminal | [CA-01] to [CA-11] | 105 | [EMF] emergency forced operation terminal. OFF: Disabled ON: Forced operation mode (when [PA-01] = 01) |

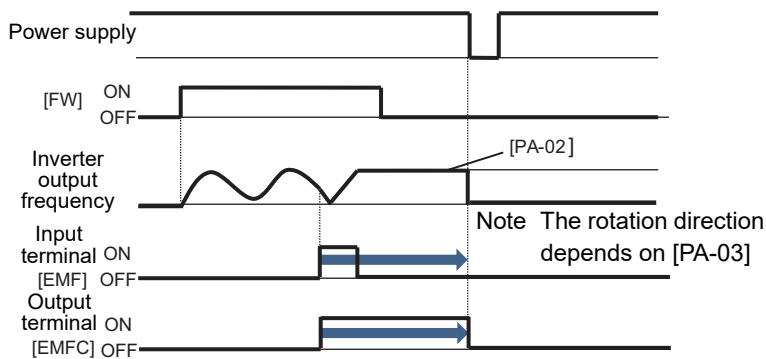
● Output Terminal Setting

| Item | Parameter | Data | Description |
|-------------------------------|--------------------|------|---|
| Selecting the output terminal | [CC-01] to [CC-07] | 076 | [EMFC] Signal in Forced Operation. OFF: Disabled ON: In the forced operation mode |

● Behavior in the Forced Operation

Turn on the [EMF] emergency forced operation terminal (input terminal: 105) to enter the forced operation mode.

The inverter performs the output at the frequency set to the [PA-02] Forced Operation Frequency Setting and rotation direction set to the rotation direction command in the [PA-03] Forced Operation Rotation Direction Command until the power-off.

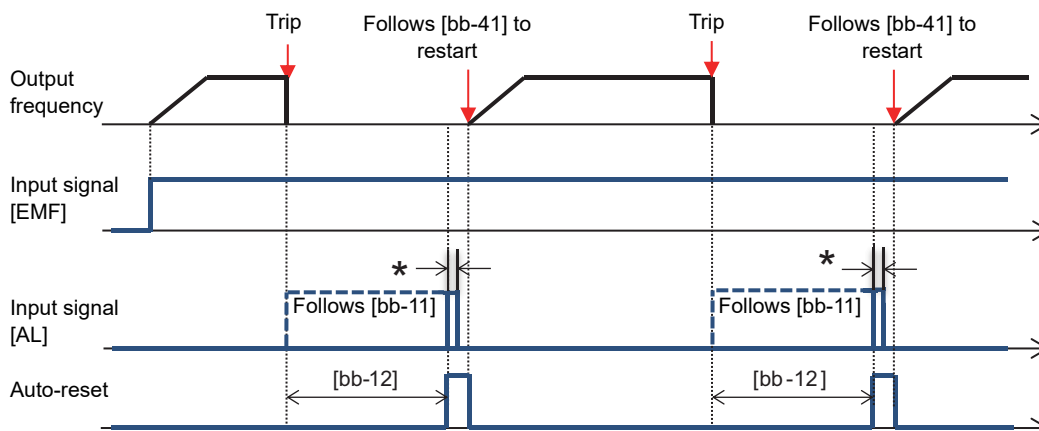


Precautions for Correct Use

- In the forced operation mode, the following functions are operating automatically.
 - (1) Soft lock status (equivalent to [UA-16] = 01) The parameters can be no longer changed. To restore the settings, turn off [EMF], restore the power and then change the parameters.
 - (2) Auto-reset (equivalent to [bb-10] = 02) When a trip that can be released occurs, the reset is performed automatically to restart.
 - (3) STOP key disabled (equivalent to [AA-13] = 00) Disable the STOP/RESET keys on the LCD Operator.
 - (4) Operation enabled during the optional start ([oA-13] = 01, [oA-23] = 01, [oA-33] = 01) The operation is allowed even in the optional start-up.
 - The functions except for the above operate according to the settings.
 - The parameters are changed before forced operation starts.
- Note that some parameters which are not saved returns to the values before forced operation starts when auto-reset is activated.

● **Auto-Reset Behavior in the Forced Operation**

When an error occurs during the forced operation and the inverter trips, the reset equivalent to the one at power-on is performed.



* 000000000For the AL relay terminal, due to the MCU reset (equivalent to Power ON reset), on for a moment no matter what is assigned.

The auto-reset at the forced operation shows the following operation. The parameter isn't changed.

| Item | Equivalent Parameter | At the Forced Behavior | Description | Default data |
|---|----------------------|---|--|--------------|
| Auto-reset selection | - | Reset the entire error with [bb-10] = 02. | Forcibly same behavior as [bb-10] = 02 regardless the settings. (02: Enabled (performed after the [bb-12] setting time)). | - |
| Alarm signal selection at Automatic error reset is active | [bb-11] | Follows the setting for [bb-11] | Parameter setting is enabled. However, due to the system reset, AL is turned on for a moment even if AL is set for the output. | 00 |
| Automatic error reset wait time | [bb-12] | Follows the setting for [bb-12] | Parameter setting is enabled. | 2 |
| Automatic error reset number | [bb-13] | Change to no limit | Forcibly reset an infinite number of times regardless the settings. | 3 |
| Restart mode after RS release | [bb-41] | Follows the setting for [bb-41] | Parameter setting is enabled. For other retry settings ([bb-20] to [bb-31]), the parameter settings are enabled. | 00 |

Commercial Operation Mode (Bypass Mode)

When the [PA-04] bypass function selection is set to 01: Enabled, switching to the commercial operation mode (bypass mode) is allowed if the specified operation mode is not entered during the forced operation.

In the bypass mode, [EMBP] bypass mode signal (output terminal: 076) is turned on and the inverter output is shut off.

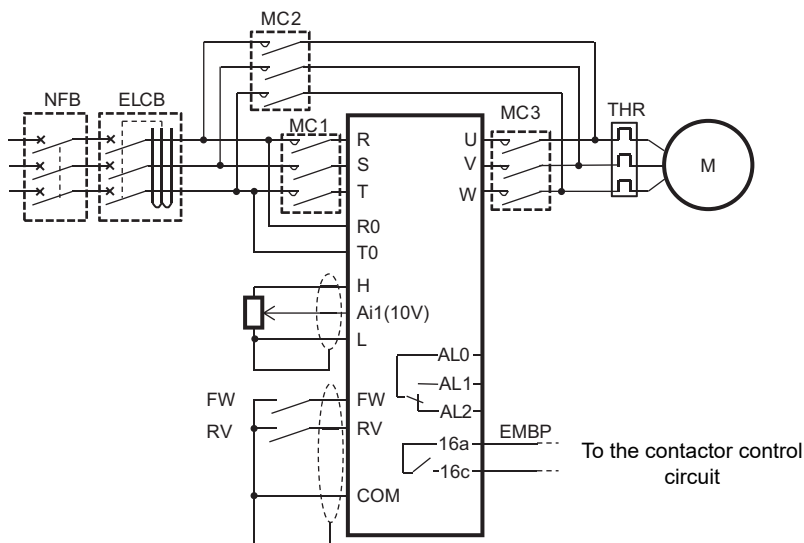
For the behavior in the bypass mode, refer to the following sample connection diagram for the commercial switching operation and timing.

Perform the contactor control based on the [EMBP] bypass mode signal (output terminal: 076).



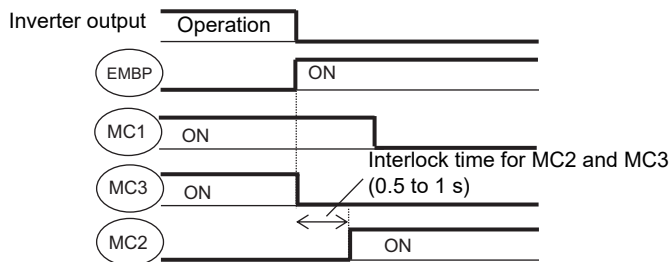
Precautions for Correct Use

- For using the bypass mode, it is necessary to implement a interlock taking into consideration the operation delay of the contactor when shifting to the commercial operation. •Make sure that the system operation is safe in using the mode.
- The timing of the contactor control can be taken using the [EMBP] bypass mode signal (output terminal: 076) as the contactor control signal. Take a interlock between the contactor on the commercial power supply side and that on the inverter output side.
- Since the commercial circuit does not operate either when the earth leakage circuit breaker (ELCB) trips, connect the commercial circuit of another system to MC2 if the backup is required.



Sample connection diagram when shifting to the commercial operation and timing

Example of timing from INV to the commercial operation



● Parameter Setting

| Item | Parameter | Data | Description | Default data |
|---|-----------|------------------|---|--------------|
| Commercial power supply bypass function selection | [PA-04] | 00 | Disabled | 00 |
| | | 01 | Enabled | |
| Delay time of Bypass function | [PA-05] | 0.0 to 1000.0(s) | Set the delay time until the bypass mode operation. | 5.0 |

● Output Terminal Setting

| Item | Parameter | Data | Description |
|-------------------------------|--------------------|------|---|
| Selecting the output terminal | [CC-01] to [CC-07] | 076 | [EMBP] bypass mode signal. OFF: Disabled ON: In the bypass mode |

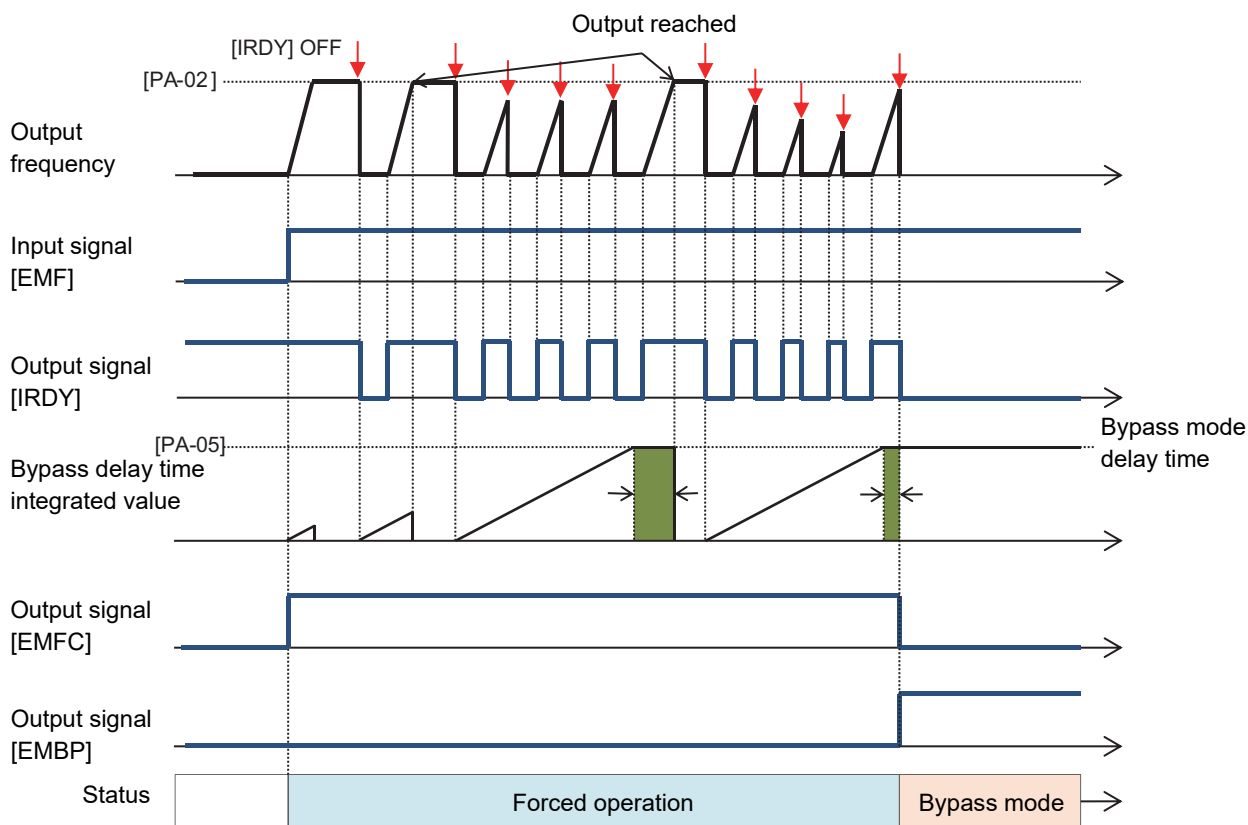
● Decision for Switching to the Bypass Mode

When the [PA-04] bypass function selection is set to 01: Enabled, if the [PA-05] bypass function delay time passes during the forced operation without reaching the forced operation frequency setting [PA-02] and the inverter enters the operation ready incomplete status (output terminal [IRDY] is OFF), it operates in the commercial operation mode (bypass mode).



Precautions for Correct Use

- Once the bypass mode is turned on, the inverter keeps shutting off until the power is off.
- While the inverter is operating immediately after the reset, the output terminal [IRDY] is turned off for about a second, however, the bypass mode is not entered for that period.
- When a value of the Em-Force mode frequency setting [PA-02] cannot be reached while the upper limiter function is in operation, the delay time of the bypass function is integrated.





Precautions for Correct Use

- In the bypass mode, the following functions are operating automatically.
 - (1) Soft lock status (equivalent to [UA-16] = 01)
The parameters can be no longer changed. To restore the settings, turn off [EMF], restore the power and then change the parameters.
 - (2) Auto-reset (equivalent to [bb-10] = 00)
Auto-reset is disabled.
 - (3) STOP key disabled (equivalent to [AA-13] = 00)
Disable the STOP/RESET keys on the LCD operator.
 - (4) Operation enabled during the optional start ([oA-13] = 01, [oA-23] = 01, [oA-33] = 01)
The operation is allowed even in the optional start-up.
- The functions except for the above operate according to the settings.

8-4-7 Pulse Train Position Control

The pulse train can be input to the SA/SB terminal of the PG option unit to perform the position control.

In the pulse train position control mode, the acceleration/deceleration time is disabled.

The inverter output is performed in accordance with the speed command.

The larger the position loop back gain is, the shorter the acceleration/deceleration time becomes.

Start the input of the pulse train by assigning the 073[STAT] pulse train position command input permission to the input terminal and turning on the terminal.

The speed command in the pulse train position control mode is calculated by the following formula.

$$\text{Speed command (Hz)} = \frac{P}{2} \times K_v \times \frac{\Delta P}{4 \times \text{ENC}}$$

P : Number of motor poles

K_v : Position loop gain

ENC : Number of encoder pulses

ΔP : Position deviation

See also 7-2-16 *Encoder Feedback Control* on page 7-37.



Precautions for Correct Use

Using this function requires the following settings.

- [AA121] Control method 10: Vector control with sensor
- [AA123] Vector control mode
01: Pulse train position control mode
- [ob-10] Pulse train input SA/SB (Option) mode selection
01: Pulse train position command
- In the pulse train position control mode, [POK] terminal is not turned ON.
- Only when Ub-03=02 (ND), you can select the vector control with a sensor by AA121/AA221.

● Setting Items for the Pulse Train Position Control

| Item | Parameter | Data | Description | Default data |
|--|--------------------|---------------------------|---|--------------|
| Control mode selection, 1st-motor | [AA121] | 10 | Vector control with sensor | 00 |
| Vector control mode selection, 1st-motor | [AA123] | 01 | Pulse train position control mode | 00 |
| Pulse train detection object selection | [ob-10] | 00 | Pulse train frequency command | 00 |
| | | 01 | Pulse train position command | |
| Mode selection of pulse train input | [ob-11] | 00 | MD0: 90° phase difference pulse train | 01 |
| | | 01 | MD1: Forward/reverse rotation command + pulse train | |
| | | 02 | MD2: Forward rotation pulse train + reverse rotation pulse train | |
| Electronic gear setting point selection | [AE-01] | 00 | FB: Feedback side | 00 |
| | | 01 | REF: Command side | |
| Electronic gear ratio numerator | [AE-02] | 1 to 9999 | Numerator of th electronic gear | 1 |
| Electronic gear ratio denominator | [AE-03] | 1 to 9999 | Denominator of th electronic gear | 1 |
| Position feed-forward gain setting ^{*1} | [AE-06] | 0.00 to 655.35 | Position feed forward gain. | 0.00 |
| Position loop gain setting ^{*2} | [AE-07] | 0.00 to 100.00 | Position loop gain. | 0.50 |
| Position bias setting | [AE-08] | -2048 to 2048 | Set the bias value of the position. | 0 |
| Add frequency setting, 1st-motor | [AA106] | -590.00 to 590.00(Hz) | Frequency added when the [ADD] terminal is turned on. | 0.00 |
| Position deviation error mode selection | [bb-85] | 00 | The excessive position deviation signal [PDD] is output. | 00 |
| | | 01 | The output of the excessive position deviation signal [PDD] and the position deviation error [E106] cause a trip. | |
| Position deviation error detection level | [bb-86] | 0 to 65535 (×100pls) | The level for deciding an abnormal position deviation. | 4096 |
| Position deviation error detection time | [bb-87] | 0.0 to 5.0(s) | Set the time until [PDD] is outputted or an error occurs. | 0.5 |
| Selecting the input terminal | [CA-01] to [CA-11] | 014 | ADD: Set speed addition | - |
| | | 072 | PCLR: Position deviation clear | |
| | | 073 | STAT: Input permission of the pulse train position command | |
| | | 074 | PUP: Adding the position bias | |
| | | 075 | PDN: Subtracting the position bias | |
| Selecting the output terminal | [CC-01] to [CC-07] | 042 | PDD: Excessive position deviation signal | - |
| Pulse train position deviation monitor | [dA-26] | -2147483647 to 2147483647 | Displays the position deviation for the position command and position feedback. | - |

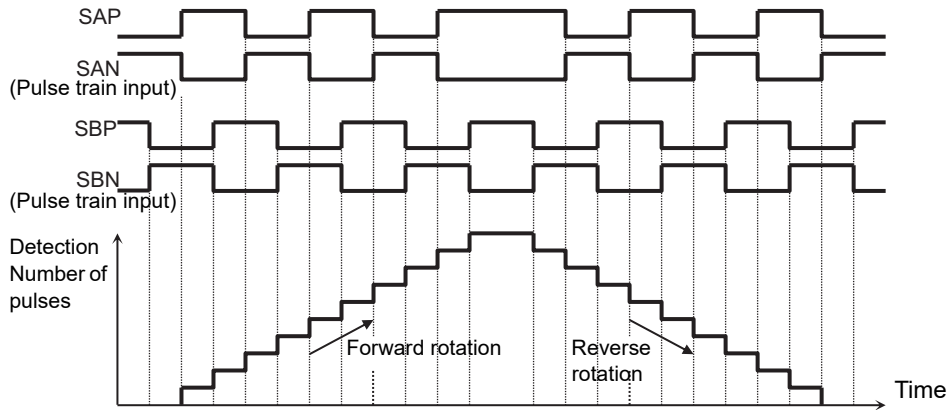
*1. It is recommended to start position control feedforward gain adjustment with AE-06 set to 2.00. To reduce the position deviation between the main and sub motors, increase the feedforward gain. If motor hunting occurs, reduce the feedforward gain.

*2. It is recommended to start position loop gain adjustment with AE-07 set to 2.00. To increase the positioning accuracy and the holding power, increase the position loop gain. If the position loop gain is set too high and causes hunting, decrease the position loop gain.

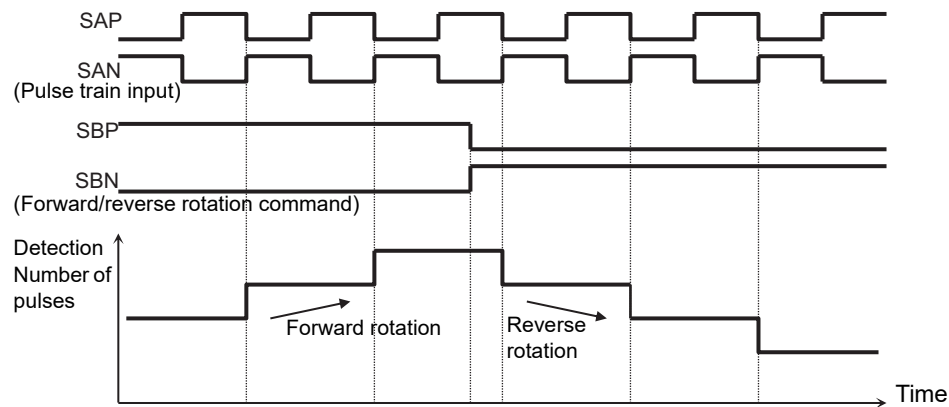
Input Mode for the Pulse Train Position Control

For more information about the pulse train input mode, refer to the following.

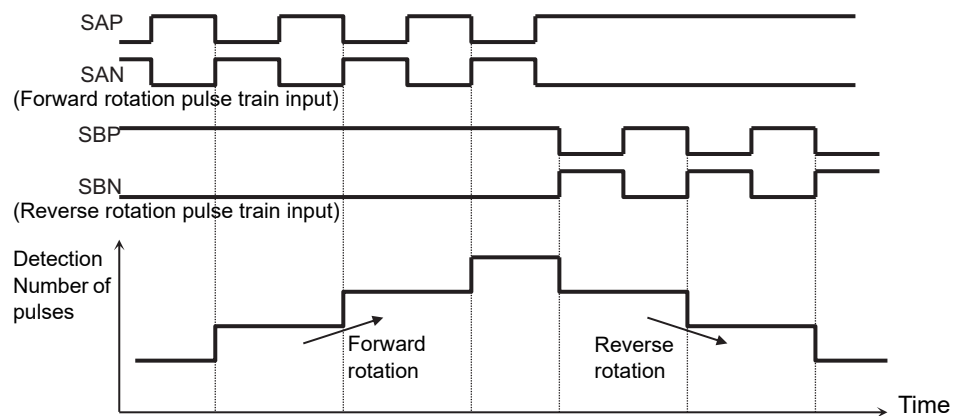
1. MD0: 90° phase difference pulse train



2. MD1: Forward/reverse rotation command + pulse train



3. MD2: Forward rotation pulse train + reverse rotation pulse train



Electronic Gear Function

This function enables you to set the gain for the position command or position feedback to change the rotation ratio of the main and sub motors when performs the synchronous operation.



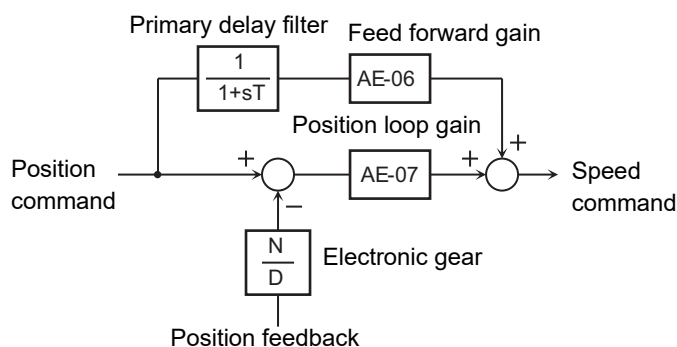
Precautions for Correct Use

Make sure that the setting of N/D is in the range of $1/50 \leq N/D \leq 20$.

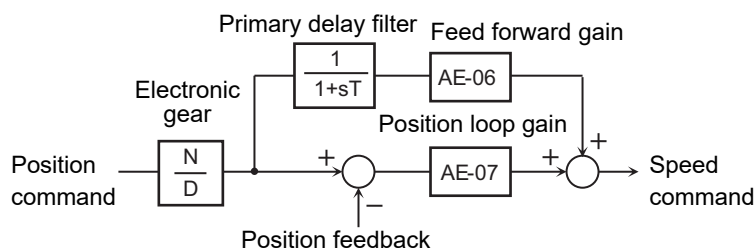
N: [AE-02] Electronic gear ratio numerator

D: [AE-03] Electronic gear ratio denominator

[AE-01] = 00 (feedback side)



[AE-01] = 01 (command side)



The filter time constant of the first-order lag filter is fixed to 10ms.

Synchronous Operation between Master and Slave

The master unit is operable with any control methods ([AA121]).

The slave unit performs the pulse train position control with vector control.

([AA121]=10,[AA123]=01,[ob-10]=01)

Assign the 073[STAT] pulse train position command input permission to an unused input terminal and turn on the terminal.

When the 073[STAT] is off, the pulse train input is not accepted.

<Setting Examples>

- Main motor: Number of encoder pulses is 1024
- Sub motor: Number of encoder pulses is 3000
- Main motor rotation speed : sub motor rotation speed = 2 : 1

For the operation with the above conditions, set the following data to the slave unit.

- [ob-11] Pulse train input mode selection : 00
- [AE-01] Electronic gear installation position : 01 (REF)
- [AE-02] Electronic gear ratio numerator : 3000
- [AE-03] Electronic gear ratio denominator : $1024 \times 2 = 2048$

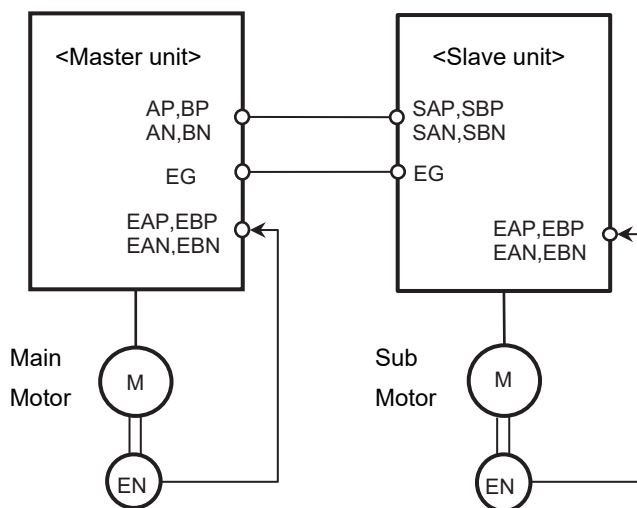
The encoder output [AP][BP][AN][BN] of the main motor is retrieved as the pulse train position command [SAP][SBP][SAN] [SBN] of the slave unit.

When the main motor speed is high, the change amount of the pulse per unit time is getting large and the speed command of the slave unit is also getting large. •When the main motor speed is low, the speed command of the slave unit is also getting small.

This causes the sub motor follows the main motor to operate.

**Precautions for Correct Use**

- It is recommended to start position control feedforward gain adjustment with AE-06 set to 2.00. To reduce the position deviation between the main and sub motors, increase the feed-forward gain. If motor hunting occurs, reduce the feedforward gain.
- It is recommended to start position loop gain adjustment with AE-07 set to 2.00. To increase the positioning accuracy and the holding power, increase the position loop gain. If the position loop gain is set too high and causes hunting, decrease the position loop gain.

**Position Bias Function**

Used to apply a bias to the position command for the pulse train position control.

Add/subtract the set number of pulses to the change amount every 1 ms. Used to adjust the phase of the synchronization point during the synchronous operation, etc.

Set the bias amount to the [AE-08] position bias amount.

Assign either 074(PUP) or 075(PDN) of the input terminal function.

The bias amount is added while the PUP terminal is on and is subtracted while the PDN terminal is on.

Speed Bias Function

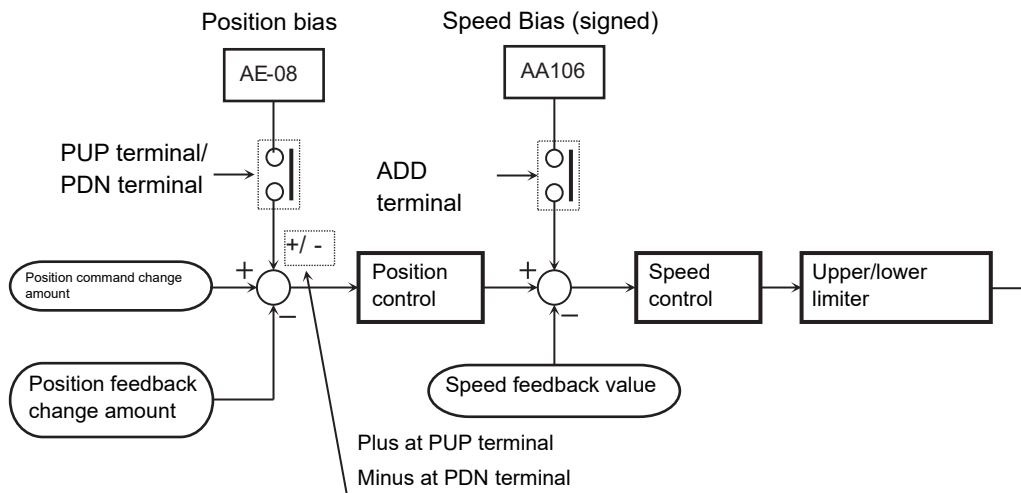
The function to apply a speed command bias when the pulse train position control is performed.

This function adds the set speed command bias at the start of the positioning process to enable quick startup.

Set the bias amount to the [AA106] adding frequency setting.

Assign 014(ADD) to any of the input terminal function. The bias amount is added/subtracted to the speed command while the ADD terminal is on.

Clear the speed command bias amount before the positioning process is completed. If the speed bias amount is added during stop, the stop position will be misaligned accordingly.



Detecting Excessive Position Deviation

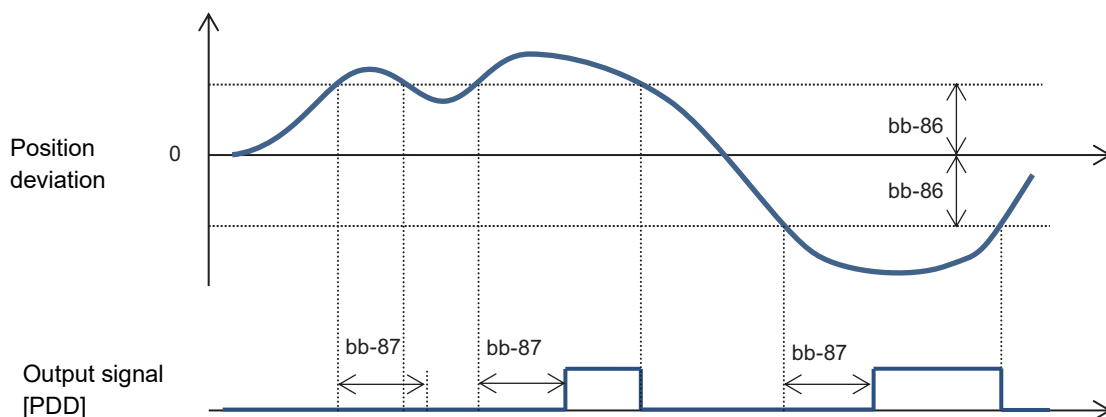
When the [bb-87] abnormal position deviation time passes with the deviation of the position feedback against the position command exceeding 100 pls of the [bb-86] abnormal position deviation detection level, it is determined to be abnormal.

The position deviation can be checked with the [dA-26] pulse train position deviation monitor.

When the behavior of the abnormal position deviation [bb-85] is 00, the output terminal [PDD] is turned on.

When the behavior of the abnormal position deviation [bb-85] is 01, the output terminal [PDD] is turned on and there is a trip with the [E106] position deviation error.

The position deviation is cleared with on/off of the input terminal 072[PCLR] position deviation clear or the trip reset.



8-4-8 Orientation Control

When [ORT] terminal is turned ON, the orientation control is activated.

The orientation control is available for the pulse train position control.

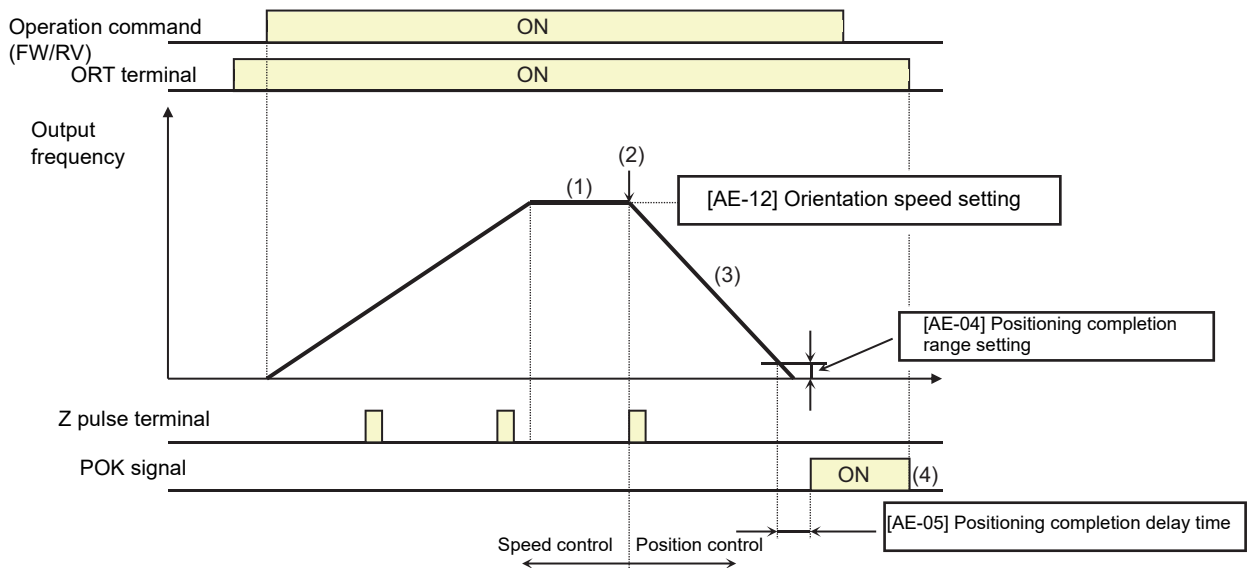
Used with the [AA121] control method set to 10: vector control with sensor and the [AA123] vector control mode set to 00: speed torque control mode or 01: pulse train position control mode.

This function enables you to determine the position at any point within one rotation of the motor. This can be used for replacing the main axis of a machine tool, etc.



Precautions for Correct Use

- For using this function, it is required to set the [AA121] control method to 10: vector control with sensor and use the encoder feedback.
- See also 7-2-16 *Encoder Feedback Control* on page 7-37.
- The Z pulse (one rotation position signal) is used as the reference signal for the positioning.
 - (1) When the encoder is connected to the PG option unit:
Input the Z pulse between EZP-EZN.
 - (2) When the encoder is connected to the control circuit terminal block:
Assign the input terminal function 109:PLZ to any of the input terminal and input the Z pulse.



- (1) When the operation command is turned on while the [ORT] terminal is on, there is an acceleration until the [AE-12] orientation speed and a constant speed is entered.
(During the operation, the speed is shifted to the orientation speed as soon as the ORT terminal is tuned on.)
- (2) After the orientation speed is reached, there is a shift to the position control when the first Z pulse is detected.
- (3) The position control is operated at the [AE-11] orientation stop position + one rotation for the forward rotation and the [AE-11] orientation stop position - two rotations for the reverse rotation as a target value.
The larger the [AE-07] position loop gain is, the shorter the deceleration time becomes.
(The deceleration time setting is not followed.)

(4) When the [AE-05] positioning completion delay time passes after the remaining number of pulses enters the [AE-04] positioning completion range setting, the [POK] signal is output.

(The output continues until the ORT terminal is turned off.)

After the positioning completes, the servo lock status continues until the operation command is turned off.

● Parameter

| Item | Function Code | Data/ Data Range | Description | Default data |
|---|--------------------|-----------------------|---|--------------|
| Control mode selection, 1st-motor | [AA121] | 10 | Vector control with sensor | 00 |
| Vector control mode selection, 1st-motor | [AA123] | 00 | Speed/Torque control mode | 00 |
| | | 01 | Pulse train position control mode | |
| Pulse train detection object selection | [CA-90] | 00 | Disabled | 00 |
| | | 01 | Pulse train frequency command | |
| | | 02 | Speed feedback | |
| | | 03 | Pulse count | |
| Encoder constant setting | [CA-81] | 32 to 65535 | Setting of the number of pulses. | 1024 |
| Encoder position selection | [CA-82] | 00 | A phase precedes | 00 |
| | | 01 | B phase precedes | |
| Encoder constant setting | [ob-01] | 32 to 65535 | Setting of the number of pulses. | 1024 |
| Encoder position selection | [ob-02] | 00 | A phase precedes | 00 |
| | | 01 | B phase precedes | |
| Stop position selection of Home search function | [AE-10] | 00 | Parameter setting | 00 |
| | | 01 | Option 1 | |
| | | 02 | Option 2 | |
| | | 03 | Option 3 | |
| Stop position of Home search function | [AE-11] | 0 to 4095 | Note 2) | 0 |
| Speed reference of Home search function | [AE-12] | 0.00 to 120.00(Hz) | Note 1) | 0.00 |
| Direction of Home search function | [AE-13] | 00 | Forward rotation | 00 |
| | | 01 | Reverse rotation | |
| Positioning complete range setting | [AE-04] | 0 to 10000(pls) | Set the value equivalent to encoder 4 multiplication | 5 |
| Positioning complete delay time setting | [AE-05] | 0.00 to 10.00(s) | Set the time from the positioning completion to the output of the [POK] signal. | 0.00 |
| Position feed-forward gain setting | [AE-06] | 0 to 655.35 | Position feed forward gain. | 0.00 |
| Position loop gain setting | [AE-07] | 0.00 to 100.00(rad/s) | Position loop gain. | 0.50 |
| Input terminal | [CA-01] to [CA-11] | 069 | ORT: Orientation | - |
| | | 109 | PLZ: Pulse train input Z | |
| Output terminal | [CC-01] to [CA-06] | 043 | POK: Positioning completion | - |
| Relay output terminal | [CA-07] | | | |

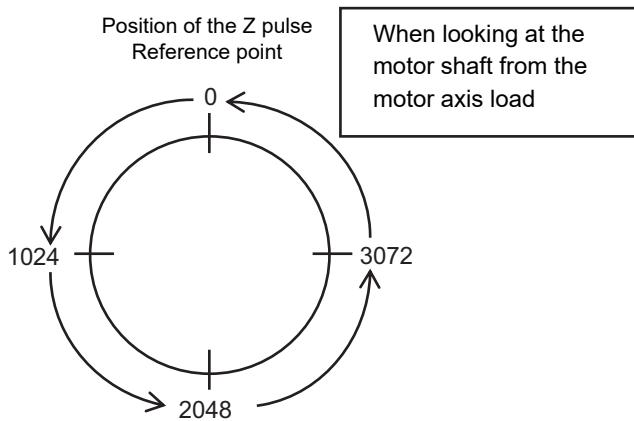


Precautions for Correct Use

- Do not set the orientation speed setting to a high frequency value because the inverter decelerates and completes positioning within 2 rotations. Decelerating to stop causes a rapid movement and gives a large impact on the equipment. The overvoltage protection may cause a trip.
- Set the orientation stop position by dividing one rotation to 4095 (0 to 4095) in the forward rotation direction starting the reference point. (4096 division regardless of the number of pulses for the encoder.)
- When ORT terminal with the orientation control is turned OFF during motor operation, the motor is decelerated/stopped and the output is cut off. When the motor is operated again, turn the operation command OFF.

The reference point is where the pulse is input between EZP-EZN and the stop target position is located in a layout shown in the diagram to the left from the viewpoint of the motor axis load. (For a positive phase connection)

Do not start the positioning process until the output frequency reaches the orientation speed setting.



Adjustment of Stop Position at the Positioning Control

Adjusting the stop position at the positioning operation

| Occurrence | Workaround Examples |
|---|--|
| Stop position is short Position shortens | <ul style="list-style-type: none"> • Adjust by increasing [AE-64] by 5%. or • Adjust by increasing [AE-65] by 5%. |
| Stop position is short Position shortens | <ul style="list-style-type: none"> • Adjust by decreasing [AE-64] by 5%. or • Adjust by decreasing [AE-65] by 5%. |

● **Parameter**

| Item | Function Code | Data/ Data Range | Description | Default data |
|---|---------------|--------------------|--|--------------|
| Deceleration stop distance calculation Gain | [AE-64] | 50.00 to 200.00(%) | Adjust against the stop distance. | 100.00 |
| Deceleration stop distance calculation Bias | [AE-65] | 0.00 to 655.35(%) | Adjust the output frequency for the positioning operation. | 0.00 |

Adjustment of Gain at the Positioning Control

Adjusting the control gain at the positioning operation

| Occurrence | Workaround Examples |
|--|--|
| The follow-up for the positioning stop is bad. | <ul style="list-style-type: none"> Adjust by increasing [AE-07] by 5%. or Adjust by increasing [AE-67] and [AE-66] by 1%. |
| An abrupt behavior occurs at the positioning stop. | <ul style="list-style-type: none"> Adjust by decreasing [AE-07] by 5%. or Adjust by decreasing [AE-67] and [AE-66] by 1%. |
| An axis vibrates during the stop | Adjust by decreasing [AE-07] by 5%. |

● Parameter

| Item | Function Code | Data/Data Range | Description | Default data |
|----------------------------|---------------|-------------------|---|--------------|
| Position loop gain setting | [AE-07] | 0.00 to 100.00 | Adjust the position loop gain. | 0.50 |
| Speed Limit in APR control | [AE-66] | 0.00 to 100.00(%) | Limit the output at the positioning. | 1.00 |
| APR start speed | [AE-67] | 0.00 to 100.00(%) | Set the speed at the positioning start. | 0.20 |



Precautions for Correct Use

- Set [AE-66] and [AE-67] to the ratios against the [Hb105] maximum frequency.
- Once the positioning operation is entered, the control starts at the speed set to the [AE-67] APR start speed.
- During the positioning operation, the speed is limited to that set to the [AE-66] APR control speed limit. During the positioning, the acceleration/deceleration time is 0 and the output follows the internal position control results.
- For the positioning operation, specify the stop behavior with the following functions
 - Absolute value control
 - Zero return
 - Orientation
 - SON terminal operation (at position servo)
 - DC braking (at position servo lock control)

8-4-9 Absolute Position Control

For the absolute position control, there is a move to a target position according to

- (1) position command,
- (2) speed command (frequency command),
- (3) acceleration time, deceleration time, and then the position servo lock status is entered. (The servo lock status is kept until the operation command is turned off.)

For the frequency command and acceleration/deceleration command at the absolute position control, those selected at that time are followed.

When the position command is small, there may be the deceleration and then positioning without reaching the speed command value.

The direction of the operation command (FW, RV) in the absolute position control mode does not have a meaning as the rotation direction. They behave as the signals for operating/stopping. The rotation direction specifies the forward rotation if (target position - current position) is plus and the reverse rotation if minus.

When the zero return operation (as discussed later) is not performed, if the [AE-61] current position memory at power-off is 00, the position at power-on is treated as the origin (position = 0). •If the [AE-61] is 01, the position at the previous power-off is treated as the (position = 0).

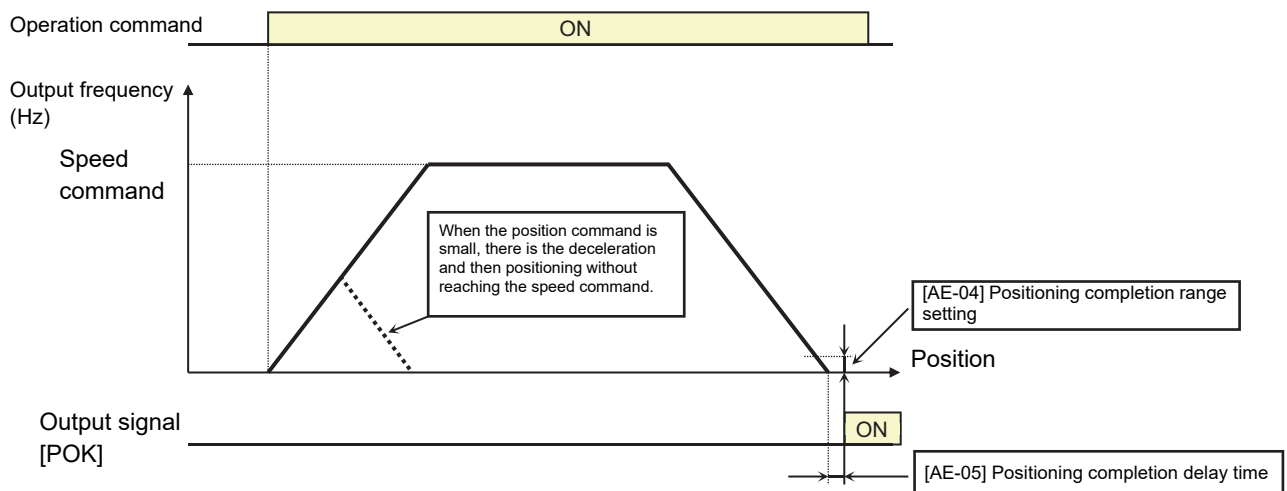
When the deviation between the position command and current position is 0, if the operation command is turned on, the positioning operation is performed immediately.

The current position command can be monitored with the [FA-20] position command monitor.



Precautions for Correct Use

- For using this function, set the [AA121] control method to 10 (vector control with sensor, and set the [AA123] vector control mode selection to 02: absolute position control or 03: high resolution absolute position control.
- This function requires using the encoder feedback
- See also 7-2-16 *Encoder Feedback Control* on page 7-37.
- When the [AA123] vector control mode selection is set to 03: high resolution absolute position control, the control is performed with the 4 multiplication number of pulses used for the internal calculation.
(Set the multistage position command and position range designation with the 4 multiplication accuracy.)
- The position command can be switched at a maximum of 16 stages in combination of the input terminals.
- The trip reset or reset signal input does not clear the current position monitor.
- When the PCLR terminal is assigned, turning on the PCLR terminal clears the current position monitor.
- In the absolute position control mode, the ATR terminal is disabled. (The torque control does not operate.)
- In the absolute position control mode, the STAT terminal is disabled. (The pulse train position control does not operate.)
- When the absolute position control is enabled (AA123=02, 03), the orientation function is disabled.



Shortest Position Control

When the [AE-56] positioning mode selection is set to 01 (without limit), the rotation direction is determined so that the moving distance to a target position is the shortest for applications such as a turntable.

(Application example) A turntable with eight positioning points

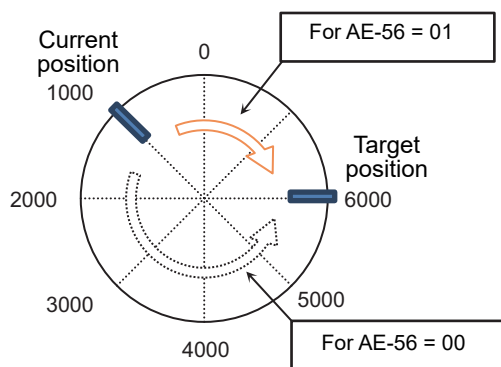
Assume a case of moving from the current position (1000 pulse) to the target position (6000 pulse).

When [AE-56] = 00 (with limit), Since (target position) - (current position) = +5000 pulse, the rotation is in the forward direction.

When [AE-56] = 01 (without limit), the move is in the reverse direction with the shorter moving distance comparing the forward and reverse directions.

Moving distance in the forward direction: +5000 pulse

Moving distance in the reverse direction: -3000 pulse



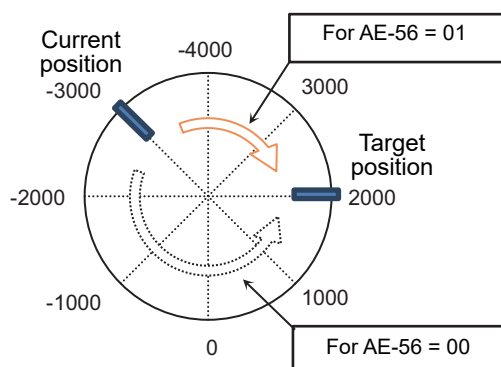
For the above example, Set the [AE-52] forward rotation side position range designation = 7999 and [AE-54] reverse rotation side position range designation = 0.

Also, each positioning point is required to be set in this range.

Depending on the setting for the position range designation, the following settings are also allowed.

[AE-52]=3999

[AE-53]=-4000



Precautions for Correct Use

- When [AE-56] = 01, the [E104] position control range error does not occur.
- In the upper case, when moving the position of 7000 pulse to that of 1000 pulse, the forward rotation side position range (7999) is exceeded, however, the current position monitor gets back to 0.

Multistage Position Switching Function

By combining 076 to 079 ([CP1] terminal to [CP4] terminal), the multistage position commands 0 to 15 can be switched.

For setting the position command, use the multistage position command 0 to 15 ([AE-20] to [AE-50]).

When there are no terminal assignments, the multistage position command 0 ([AE-20]) becomes the position command.

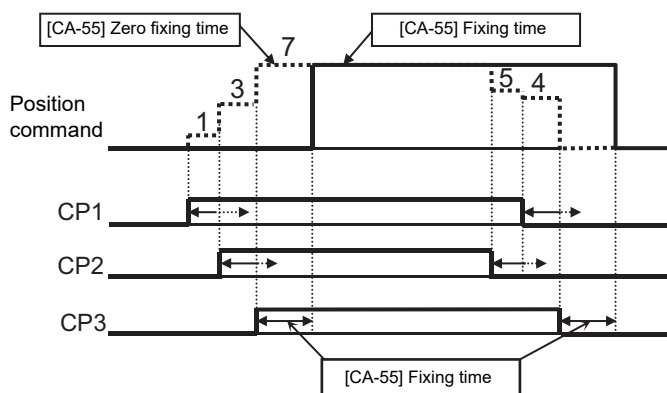
| Position command | CP4 | CP3 | CP2 | CP1 |
|------------------------|-----|-----|-----|-----|
| Multistage position 0 | OFF | OFF | OFF | OFF |
| Multistage position 1 | OFF | OFF | OFF | ON |
| Multistage position 2 | OFF | OFF | ON | OFF |
| Multistage position 3 | OFF | OFF | ON | ON |
| Multistage position 4 | OFF | ON | OFF | OFF |
| Multistage position 5 | OFF | ON | OFF | ON |
| Multistage position 6 | OFF | ON | ON | OFF |
| Multistage position 7 | OFF | ON | ON | ON |
| Multistage position 8 | ON | OFF | OFF | OFF |
| Multistage position 9 | ON | OFF | OFF | ON |
| Multistage position 10 | ON | OFF | ON | OFF |
| Multistage position 11 | ON | OFF | ON | ON |
| Multistage position 12 | ON | ON | OFF | OFF |
| Multistage position 13 | ON | ON | OFF | ON |
| Multistage position 14 | ON | ON | ON | OFF |
| Multistage position 15 | ON | ON | ON | ON |



Precautions for Correct Use

- When inputting the multistage position command, the waiting time until the terminal input is fixed can be set. The transition state before the input is fixed can be prevented from being adopted as the input.
- With the [CA-55] multistage input fixing time, the fixing time can be adjusted. Finally, after the [CA-55] setting time passes without any changes of the input, the data is fixed. (Note that a longer fixing time causes a bad performance of the input response.)

Example using [CP1] to [CP3] as the input terminals



Speed/Position Switching Function

This function is used to switch the speed control and the position control. Allocate any of the input terminal functions to 084 (SPD: (Speed/Position switching)).

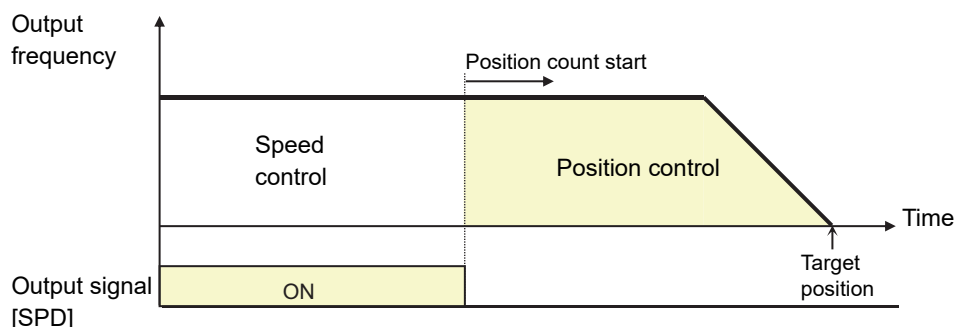
Turn on this terminal when the speed control operation is performed in the absolute position control mode.

While the 084[SPD] terminal is on, the current position monitor is 0. Therefore, when the [SPD] terminal is turned off during the operation, the position control operation starts at that time. (Speed/position switching)



Precautions for Correct Use

- When switching the speed to position, if the deviation between the position command and current position is 0, the stop operation is performed immediately. (Depending on the position loop gain, there is a possibility of hunting)
- Also, while the [SPD] terminal is on, there is a move in the direction depending on the operation command. For switching the speed to position, note the sign of the command.



Teaching Function

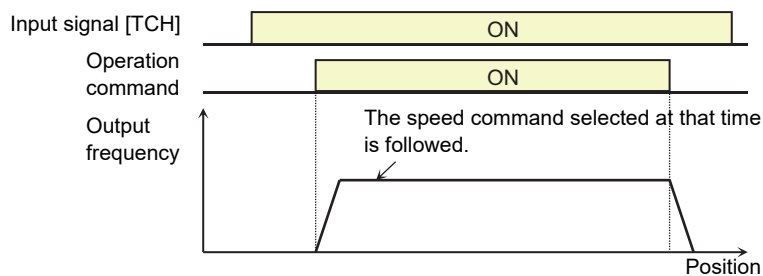
Function to rotate and stop a motor and store the position as a position command at any position command area.

Assign 110[TCH].

When the [AA123] vector control mode selection is 02 (absolute position control) or 03 (high resolution absolute position control), the teaching terminal is functioning.

- Select the position command to set at the [AE-60] teaching selection.
- Operate the work.

Enter the operation command while the [TCH] terminal is on. • For the speed command and acceleration/deceleration command at this time, those selected at that time are followed.



- (c) Once the desired position is reached, press the save (2 key) on the LCD operator.
- (d) The current position is set in the are corresponding to the position command destination set to the [AE-60] teaching selection. (However, [AE-60] itself is not saved. After power-off or the reset, it becomes 00 (X00).)

| [AE-60] setting value | Position command to be set |
|-----------------------|---|
| 00 | [AE-20]: Multistage position command 0 |
| 01 | [AE-22]: Multistage position command 1 |
| 02 | [AE-24]: Multistage position command 2 |
| 03 | [AE-26]: Multistage position command 3 |
| 04 | [AE-28]: Multistage position command 4 |
| 05 | [AE-30]: Multistage position command 5 |
| 06 | [AE-32]: Multistage position command 6 |
| 07 | [AE-34]: Multistage position command 7 |
| 08 | [AE-36]: Multistage position command 8 |
| 09 | [AE-38]: Multistage position command 9 |
| 10 | [AE-40]: Multistage position command 10 |
| 11 | [AE-42]: Multistage position command 11 |
| 12 | [AE-44]: Multistage position command 12 |
| 13 | [AE-46]: Multistage position command 13 |
| 14 | [AE-48]: Multistage position command 14 |
| 15 | [AE-50]: Multistage position command 15 |

If the power supply of the inverter control circuit (R0,T0) is input, the teaching is allowed. Since operating the work with an external unit, etc. also enables the current position monitor to work, the teaching is allowed even if the operation is performed without an inverter.



Precautions for Correct Use

However, make sure that the power supply of the inverter power circuit (R, S, T) is shut off. •Or make sure that the connection between the output of the inverter (U, V, W) and the motor is shut off. Otherwise, you run the risk of injury and damage.

Zero Return Function

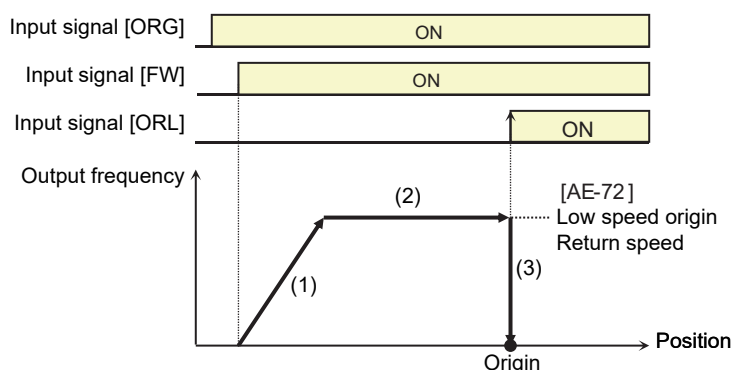
With the [AE-70] zero return mode selection, three types of zero return operations are performed. Once the zero return completes, the current position is cleared (= 0).

The direction of the [AE-71] zero return is selected with the zero return direction selection.

When the zero return is not performed, the position at power-on follows the [AE-61] current position memory at power-off and the position control is performed.

The Zero Return Function is activated only in absolute position control. When ORG terminal is turned OFF while the zero return operation, the operation is shifted to absolute position control. Allocate any of input terminal function to 65 (SON (Servo ON)). After turning [SON] terminal ON, start the zero return function.

● Low Speed Zero Return ([AE-70] = 00)

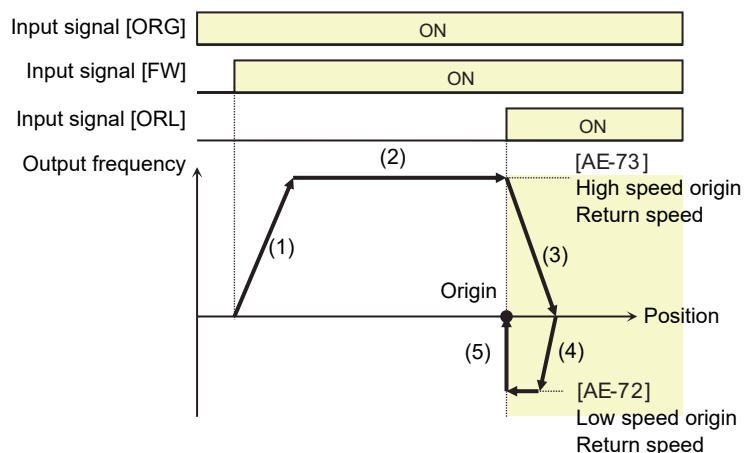


Follows the acceleration time to accelerate to the low speed zero return speed. (1)

Operates at the low speed zero return speed. (2)

Positioning when the ORL signal is input. (3)

● High Speed Zero Return 1 ([AE-70] = 01)



Follows the acceleration time to accelerate to the high speed zero return speed. (1)

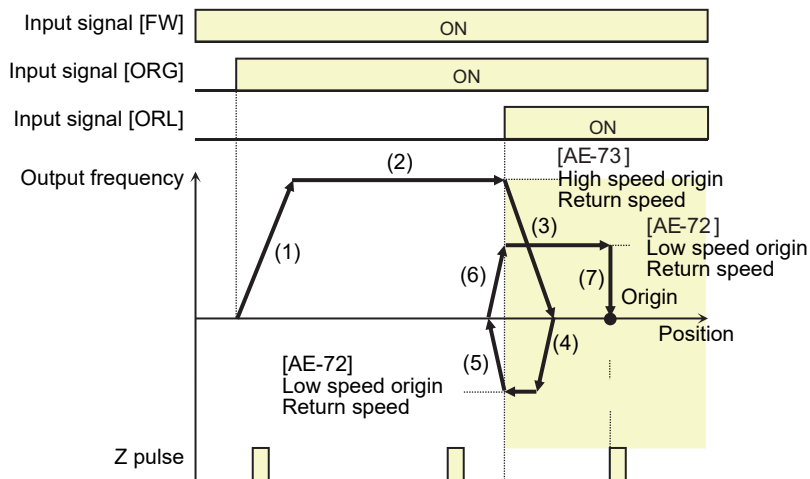
Operates at the high speed zero return speed. (2)

Starts the deceleration when the ORL signal is turned on. (3)

Operates in the reverse rotation direction at the low speed zero return speed. (4)

Positioning when the ORL signal is turned off. (5)

● High Speed Zero Return 2 ([AE-70] = 02)



Follows the acceleration time to accelerate to the high speed zero return speed. (1)

Operates at the high speed zero return speed. (2)

Starts the deceleration when the ORL signal is turned on. (3)

Operates in the reverse rotation direction at the low speed zero return speed. (4)

Starts the deceleration when the ORL signal is turned off. (5)

Operates in the forward rotation direction at the low speed zero return speed. (6)

Positioning at the first Z pulse after the ORL signal is turned on. (7)

Forward/Reverse Drive Stop Function (FOT/ROT)

Function to prevent the operation range from being deviated using the signal from the control range limit switch.

The torque limit is restricted to 10% on the forward rotation side when the 082[FOT] terminal is input and on the reverse rotation side when the 083[ROT] terminal is input. This is applicable as the limit switch at the edge of the machine.

At both ends of the machine edge, provide a mechanical mechanism such as a stopper.

Position Range Designation Function

Specify the position control range at the [AE-52] position range designation (forward rotation side) / [AE-54] position range designation (reverse rotation side).

When the current position monitor exceeds this setting, there is a trip with the position control range error (E104) and the inverter becomes the free-running status.

The multi-step position command set in the Multi-step Position Command 0 to 7 (AE-20 to AE-50) is subject to these upper limit setting.

You cannot set a position command value over the position limit setting.

Position Control Related Parameters

| Item | Function Code | Data/Data Range | Description |
|--|---------------|--|--|
| Control Method | [AA121] | 10 | Vector control with sensor*1 |
| Vector control mode selection | [AA123] | 02 | Absolute position control |
| | | 03 | High resolution absolute position control |
| Multistage position command 0 | [AE-20] | [AE-54] to [AE-52] | Set the position command for the multistage speed command to each. |
| Multistage position command 1 | [AE-22] | [AE-54] to [AE-52] | |
| Multistage position command 2 | [AE-24] | [AE-54] to [AE-52] | |
| Multistage position command 3 | [AE-26] | [AE-54] to [AE-52] | |
| Multistage position command 4 | [AE-28] | [AE-54] to [AE-52] | |
| Multistage position command 5 | [AE-30] | [AE-54] to [AE-52] | |
| Multistage position command 6 | [AE-32] | [AE-54] to [AE-52] | |
| Multistage position command 7 | [AE-34] | [AE-54] to [AE-52] | |
| Multistage position command 8 | [AE-36] | [AE-54] to [AE-52] | |
| Multistage position command 9 | [AE-38] | [AE-54] to [AE-52] | |
| Multistage position command 10 | [AE-40] | [AE-54] to [AE-52] | |
| Multistage position command 11 | [AE-42] | [AE-54] to [AE-52] | |
| Multistage position command 12 | [AE-44] | [AE-54] to [AE-52] | |
| Multistage position command 13 | [AE-46] | [AE-54] to [AE-52] | |
| Multistage position command 14 | [AE-48] | [AE-54] to [AE-52] | |
| Multistage position command 15 | [AE-50] | [AE-54] to [AE-52] | |
| Position range designation (forward rotation side) | [AE-52] | Condition 1: 0 to +268435455 Condition 2: 0 to +1073741823 | Condition 1: Except for the condition 2 Condition 2: [AA121] = 10, [AA123] = 03 |
| Position range designation (reverse rotation side) | [AE-54] | Condition 1: -268435455 to 0 Condition 2: -1073741823 to 0 | Condition 1: Except for the condition 2 Condition 2: [AA121] = 10, [AA123] = 03 |
| Position command monitor | [FA-20] | Condition 1: -268435455 to +268435455 Condition 2: -1073741823 to +1073741823 | Condition 1: Except for the condition 2 Condition 2: [AA121] = 10, [AA123] = 03 |

*1. When the sensor vector control is used, set load specification selection (Set Ub-03 to 02).

Position Memory at Power-Off

This function is used to set the current position to the current position monitor when the power supply of an inverter is cycled after the position data is stored in EEPROM at inverter power-off. The home position fixed with the homing function can be used after the power supply is cycled.

By setting the [AE-61] current position memory at power-off to 01, the current position data at power-off can be stored.

Use this for the application where the shaft of the motor is locked at power-off.



Precautions for Correct Use

- For the machine of which the shaft idles at power-off, there is likely to be a gap between the stored position and the current position when the power is turned on again.
- This function is used to provide memory for position when a power supply in a main circuit is cut off. Note that the position when the power is cut off during the operation only in control power supply at 24 V can not be stored.
- Motor's rotation at the power-off may cause a gap between the stored position and the current position since the rotation amount is not counted. When the power supply of the inverter is turned off, take the action to disallow the rotation with a brake.
- If the motor rotates after the power supply of the inverter is turned OFF, operate an inverter after a homing position is determined with the homing function.
- Even if a brake stops the motor rotation at the power-off, there is likely a gap corresponding to the backlash for the brake. The gap accumulates every power-off/on and ends up the expansion. So, reset the gap once several times with the homing function.

Position Data Preset

When the 085[PSET] terminal is turned on, the current position monitor (can be monitored with [dA-20]) is overwritten with the value set to the [AE-62] preset position data.

Available for restarting in the middle of the positioning process, etc. (Data is overwritten at the ON edge of the [PSET] terminal.)

Position Control Related Parameters

| Item | Function Code | Data/ Data Range | Description | Default data |
|--------------------------------------|-----------------------|--|--|--------------|
| Position control mode selection | [AE-56] | 00 | With limit | 00 |
| | | 01 | Without limit | |
| Teach-in function target selection | [AE-60] | 00 | Multistage position command 0 (AE-20) | 00 |
| | | 01 | Multistage position command 1 (AE-22) | |
| | | 02 | Multistage position command 2 (AE-24) | |
| | | 03 | Multistage position command 3 (AE-26) | |
| | | 04 | Multistage position command 4 (AE-28) | |
| | | 05 | Multistage position command 5 (AE-30) | |
| | | 06 | Multistage position command 6 (AE-32) | |
| | | 07 | Multistage position command 7 (AE-34) | |
| | | 08 | Multistage position command 8 (AE-36) | |
| | | 09 | Multistage position command 9 (AE-38) | |
| | | 10 | Multistage position command 10 (AE-40) | |
| | | 11 | Multistage position command 11 (AE-42) | |
| | | 12 | Multistage position command 12 (AE-44) | |
| | | 13 | Multistage position command 13 (AE-46) | |
| | | 14 | Multistage position command 14 (AE-48) | |
| | | 15 | Multistage position command 15 (AE-50) | |
| Current position saving at power-off | [AE-61] | 00 | Disabled | 00 |
| | | 01 | Enabled | |
| Preset position data | [AE-62] | Condition 1: -268435455 to +268435455 Condition 2: -1073741823 to +1073741823 | Condition 1: Except for the condition 2 Condition 2: [AA121] = 10, [AA123] = 03 | 0 |
| Reset selection | [CA-72] | 02 | Enabled Only at Trip (On to Release) | - |
| | | 03 | Enabled Only at Trip (Off to Release) | |
| Input terminal function | [CA-01] to [CA-11] | 072 | PCLR: Position deviation clear | - |
| | | 076 | CP1: Position command selection 1 | |
| | | 077 | CP2: Position command selection 2 | |
| | | 078 | CP3: Position command selection 3 | |
| | | 079 | CP4: Position command selection 4 | |

Zero Return Related Parameters

| Item | Function Code | Data/ Data Range | Description | Default data |
|-------------------------------|--------------------|---------------------|---|--------------|
| Homing function selection | [AE-70] | 00 | Low speed zero return | 00 |
| | | 01 | High speed zero return 1 | |
| | | 02 | High speed zero return 2 | |
| Direction of homing function | [AE-71] | 00 | Forward rotation | 00 |
| | | 01 | Reverse rotation | |
| Low-speed of homing function | [AE-72] | 0.00 to 10.00(Hz) | Speed in the low speed zero return mode. | 0.00 |
| High-Speed of homing function | [AE-73] | 0.00 to 590.00(Hz) | Speed in the high speed zero return mode. | 0.00 |
| Input terminal function | [CA-01] to [CA-11] | 072 | PCLR: Position deviation clear | - |
| | | 076 | CP1: Position command selection 1 | |
| | | 077 | CP2: Position command selection 2 | |
| | | 078 | CP3: Position command selection 3 | |
| | | 079 | CP4: Position command selection 4 | |
| | | 080 | ORL: Origin limit signal | |
| | | 081 | ORG: Zero return start signal | |
| | | 082 | FOT: Forward rotation drive stop | |
| | | 083 | ROT: Reverse rotation drive stop | |
| | | 084 | SPD: Speed/position switching | |
| | | 085 | PSET: Position data preset | |
| | | 110 | TCH: Teaching | |

8-4-10 Servo Lock (SON)

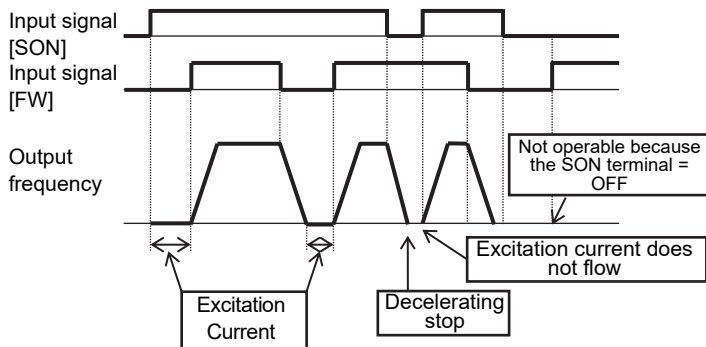
This function makes a motor the servo lock status with the servo lock terminal [SON] command. Assigning the input terminal function 054[SON] triggers this function.



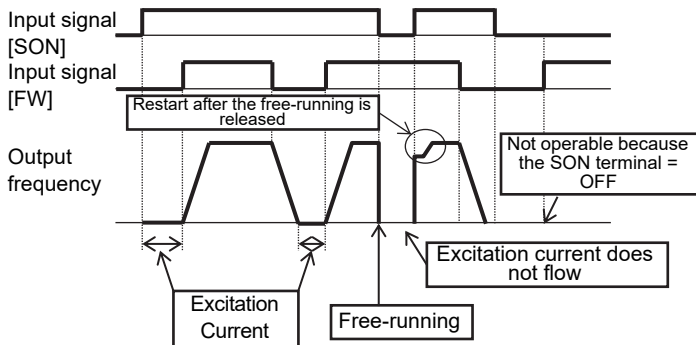
Precautions for Correct Use

- Inputting the servo ON (SON) signal causes the motor shaft to be locked. To make a motor the servo lock status, set Control Method [AA121] to 10 (Sensor vector control), [AA123] Vector Control Mode Selection to 02 (Absolute position control) or to 03 (High-resolution absolute position control).
When you select the setting other than mentioned earlier, this is a speed servo lock. The stop position will be misaligned when the speed is offset.
- This is valid when the control method [AA121] is 09: IM 0 Hz range sensorless vector control or 10: IM vector control with sensor.
- When [SON] is assigned to the input terminal function, the operation is not accepted unless [SON] is turned on.
- During the operation, when [SON] is turned off, there is an operation according to the [AA115] stop method selection. If the free-running occurs, the settings for the restart after releasing the free-running is followed at the time of restart.
- When the backup excitation function [FOC] is assigned to the input terminal, the servo lock function [SON] does not operate.

- For the [AA115] stop method selection is 00



- For the [AA115] stop method selection is 01



● Parameter

| Item | Parameter | Data | Description | Default data |
|--------------------------------------|--------------------|-----------------|--|--------------|
| Input terminal function | [CA-01] to [CA-11] | 054 | Servo lock function [SON] | - |
| STOP mode selection, 1st-motor | [AA115] | 00 | Perform the deceleration stop when the operation command is off. | 00 |
| | | 01 | Perform the free-running when the operation command is off. | |
| Restart mode after FRS release | [bb-40] | 00 | Perform the 0 Hz restart. | 00 |
| | | 01 | Perform the frequency matching restart.*1 | |
| | | 02 | Perform the frequency pull-in restart.*2 | |
| | | 03 | XXXXXX | |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | Set the waiting time after an operation command. | 0.3 |

*1. Refer to 7-5-3 *Frequency Matching Start* on page 7-65.

*2. Refer to 7-5-4 *Frequency Pull-in Start* on page 7-69.



Precautions for Correct Use

- If the torque at the time of start is insufficient, it may be improved by adjusting the starting boost amount [HC111][HC112] or speed response [HA115].
Refer to 7-2 *Selection of Motor Control Methods* on page 7-5.
- If the torque at the time of start is insufficient, it may be improved by using the torque bias function.
Refer to 7-3-6 *Torque Bias Function* on page 7-54.

8-5 Cooling Fan Control

[bA-70] Setting the selection of the cooling fan operation allows you to set the operation of the cooling fan.

For [bA-70]=00, the cooling fan runs all the time.

For [bA-70]=01, the cooling fan runs when the inverter becomes the output status. The fan runs for three minutes after the operation stops.

For [bA-70]=02, the cooling fan runs depending on the temperature of the head sink detected by the inverter.



Precautions for Correct Use

When the instantaneous power failure or power-off occurs while the cooling fan is running, it is suspended regardless of the [bA-70] cooling fan operation, and automatically resumes after the restoration of power.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--------------------------------------|-----------|------|--|--------------|
| Cooling FAN control method selection | [bA-70] | 00 | Running all the time: The fan runs all the time. | 00 |
| | | 01 | Running in operation: The fan runs automatically when the inverter becomes the operating status. The fan continuously runs for three minutes after the operation stops and then automatically stops. The cooling fan runs when the head sink temperature of the inverter exceeds 60°C. If the head sink temperature is under 50°C for more than three minutes, the cooling fan is allowed to be stopped. | |
| | | 02 | Running depending on the temperature: The cooling fan runs when the head sink temperature of the inverter exceeds 40°C. If the head sink temperature is under 40°C for more than three minutes, the cooling fan automatically stops. | |

- For checking the head sink temperature, see *5-7 Cooling Fin Temperature Monitor* on page 5-14.
- For the replacement timing of the cooling fan, see *5-9 Life Monitor* on page 5-17.

8-6 Alarm Signal

8-6-1 Alarm Signal (AL)

If an overcurrent, overvoltage, or some other error occurs, the inverter shuts off its output and generates an alarm signal. This is called a "Trip".

A trip state can be canceled by resetting the inverter, by which the alarm signal also turns OFF.

To reset the inverter, press the STOP/RESET key or input the reset terminal. However, you may not be able to reset some trip factors by using these methods. In such case, cycle the power supply.

The [AL] function is assigned in the initial state to the contact c relay [CC-07] of AL1-AL0 and AL2-AL0.

You can set the output specifications of contacts a and b to output terminals 11-15, relay output terminals 16A-16C, AL1-AL0, and AL2-AL0 individually.



Precautions for Correct Use

When an inverter outputs error by an interruption of its power supply, in some cases, changes of wirings and contact selections may alleviate this symptom.

Alarm Relay AL

The operations of AL1-AL0 and AL2-AL0 are as follows.

| [CC-17] | Control power | Inverter error output | Output terminal state | |
|---------|---------------|-----------------------|-----------------------|---------|
| | | | AL1-AL0 | AL2-AL0 |
| 00 | On | Abnormal | Close | Open |
| | | Normal | Open | Close |
| | Off | - | Open | Close |
| 01 | On | Abnormal | Open | Close |
| | | Normal | Close | Open |
| | Off | - | Open | Close |

The specifications of the relay contacts AL1-AL0 and AL2-AL0 are as follows.

| | | Resistive load | Inductive load |
|---------|--------------------------|---------------------------|---------------------------|
| AL1-AL0 | Maximum contact capacity | AC250V,2A DC30V,3A | AC250V,0.2A DC30V,0.6A |
| | Minimum contact capacity | AC100V,10mA DC5V,100mA | |
| AL2-AL0 | Maximum contact capacity | AC250V,1A DC30V,1A | AC250V,0.2A DC30V,0.2A |
| | Minimum contact capacity | AC100V,10mA DC5V,100mA | |

Relay Output 16C

The operations of 16C are as follows.

| [CC-16] | Control power | Functional operation | Output terminal state |
|---------|---------------|----------------------|-----------------------|
| 00 | On | ON | Close |
| | | OFF | Open |
| | Off | - | Open |
| 01 | On | ON | Open |
| | | OFF | Close |
| | Off | - | Open |

The specifications of the relay contact 16C are as follows.

| | | Resistive load | Inductive load |
|-----|--------------------------|----------------|----------------|
| 16C | Maximum contact capacity | AC250V,2A | AC250V,1A |
| | Minimum contact capacity | AC250V,1mA | |

● Parameter

| Item | Parameter | Data | Description |
|---|--------------------|------|--|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 017 | An alarm signal is output to the output terminal to which 017 [AL] has been assigned. ON: When an alarm has occurred OFF: When no alarm has occurred |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |
| Output terminal function selection | [CC-11] to [CC-15] | 00 | Operates as contact a (NO). |
| | | 01 | Operates as contact b (NC). |
| 1a relay output terminal function selection a/b (NO/NC) selection | [CC-16] | 00 | Operates as contact a (NO). |
| | | 01 | Operates as contact b (NC). |
| 1c relay output terminal function selection a/b (NO/NC) selection | [CC-17] | 00 | See the table at the upper left. |
| | | 01 | |

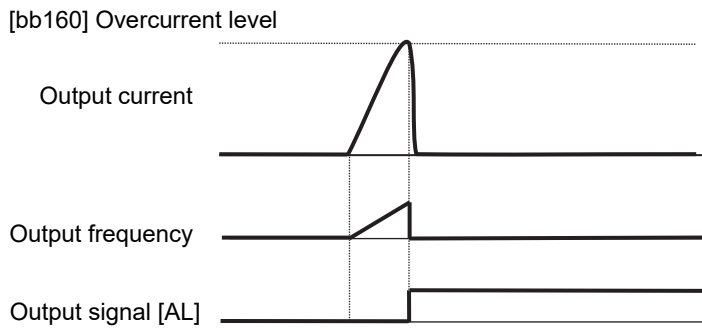
Contact a:

The contact closes when the functional operation is ON and opens when OFF.

Contact b:

The contact closes when the functional operation is OFF and opens when ON.

Example: [E001] occurred when the current reached the overcurrent level.



8-6-2 Fatal Fault Signal (MJA)

The following table shows signals that are output when any of trips occurs. It is different from the Output signal 017 (AL) that will be output for all trips.

This signal converts the trips caused by a hardware failure.

Trips that are evaluated as serious faults are as follows.



Precautions for Correct Use

The inverter hardware may have a fault when this signal is output. Check the error history and deal with the situation appropriately.

| Error code | Name | Description |
|------------|--|--|
| E008 | Memory element error | The memory element of the inverter is under an abnormal condition. |
| E010 | Current detector error | The current detector of the inverter is under an abnormal condition. |
| E011 | CPU error | The drive CPU of the inverter is under an abnormal condition. |
| E014 | Ground fault error | The inverter has a ground fault. |
| E019 | Temperature detector error | The temperature detector of the inverter is under an abnormal condition. |
| E020 | Cooling fan rotation speed reduction error | The cooling fan rotation speed of the inverter has reduced, preventing the inverter from dissipating heat. |

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|------|---|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 018 | The signal will be output when a serious fault error occurs in the output terminal to which 018 [AL] has been assigned. OFF: No serious fault has occurred. ON: A serious fault has occurred. |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |

8-6-3 Alarm Code

Alarm code is used to output the inverter trip factor as a 3-bit or 4-bit code signal.

Assign the output terminal functions 084 [AC0] to 087 [AC3] alarm code to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

Assign 084 [AC0] to 087 [AC3] to the output terminal functions [CC-01] to [CC-07].

The 4-bit output mode is selected when 087 [AC3] is assigned to the output terminal function, whereas the 3-bit output mode is selected when it is not assigned.

The table below shows the alarm codes to be output.



Precautions for Correct Use

- The output state switches depending on whether 087 [AC3] has been set to [CC-01] to [CC-07]. The 4-bit output mode is selected when 087 [AC3] has been set, and the signals 084 [AC0], 085 [AC1], 086 [AC2], and 087 [AC3] will be output in accordance with the table below even when all of them have not been set.
- The signals will be output in the 3-bit mode when one of or any pair from 084 [AC0], 085 [AC1], and 086 [AC2] have been set. The signals 084 [AC0], 085 [AC1], and 086 [AC2] will be output in accordance with the table below even when all of them have not been set.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|------------|--|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 084 to 087 | 084: [AC0] alarm code 0 085: [AC1] alarm code 1 086: [AC2] alarm code 2 087: [AC3] alarm code 3 The signal is output when a trip occurs at the output terminal assigned. |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |

Alarm Code

| Output terminal function | | | | When a 4-bit code is selected (with [AC3]) | | When a 3-bit code is selected (without [AC3]) | |
|--------------------------|-----|-----|-----|--|---|---|---|
| AC3 | AC2 | AC1 | AC0 | Cause code | Trip description | Cause code | Trip description |
| 0 | 0 | 0 | 0 | Normal | Normal | Normal | Normal |
| 0 | 0 | 0 | 1 | E001 | Overcurrent error | E001 | Overcurrent error |
| 0 | 0 | 1 | 0 | E005,E038,E039 | Motor overload error, low-speed range overload error, controller overload error | E005,E038,E039 | Motor overload error, low-speed range overload error, controller overload error |
| 0 | 0 | 1 | 1 | E007,E015 | Overvoltage, incoming overvoltage error | E007,E015 | Overvoltage, incoming overvoltage error |
| 0 | 1 | 0 | 0 | E009 | Undervoltage error | E009 | Undervoltage error |
| 0 | 1 | 0 | 1 | E016 | Momentary interruption error | E016 | Momentary interruption error |
| 0 | 1 | 1 | 0 | E030 | IGBT error | E030 | IGBT error |
| 0 | 1 | 1 | 1 | E006 | Braking resistor overload error | - | Other than above |

| Output terminal function | | | | When a 4-bit code is selected (with [AC3]) | | When a 3-bit code is selected (without [AC3]) | |
|--------------------------|-----|-----|-----|---|--|--|------------------|
| AC3 | AC2 | AC1 | AC0 | Cause code | Trip description | Cause code | Trip description |
| 1 | 0 | 0 | 0 | E008,E011 | Memory element error, CPU error | - | - |
| 1 | 0 | 0 | 1 | E010 | Detector error | - | - |
| 1 | 0 | 1 | 0 | E012,E013, E035,E036 | External error, USP error, thermistor error, break fault | - | - |
| 1 | 0 | 1 | 1 | E014 | Ground fault protection | - | - |
| 1 | 1 | 0 | 0 | E040,E041, E042,E043, E044,E045 | Keypad communication error, RS485 communica- tion error, RTC error, EzSQ executive instruc- tion error, overflow error, illegal instruction error | - | - |
| 1 | 1 | 0 | 1 | E020,E021 | Abnormal temperature error caused by reduced rotation speed of the cool- ing fan, abnormal tem- perature error | - | - |
| 1 | 1 | 1 | 0 | E024,E034 | Input open-phase error, output open-phase error | - | - |
| 1 | 1 | 1 | 1 | Other than above | EzSQ assignment error 0 to 9, etc. | - | - |

8-6-4 Overload Warning Function (OL/OL2)

The overload warning function can be set so that the inverter outputs an overload warning if the load is too large, before it causes an overload trip.

Assign the output terminal functions 035 [OL] and 036 [OL2] overload prewarning signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The overload prewarning signals [OL] and [OL2] will be output when the output currents exceed the corresponding overload prewarning level.

You can output the signal in accordance with the operating state by changing the overload prewarning signal output mode selection [CE105].

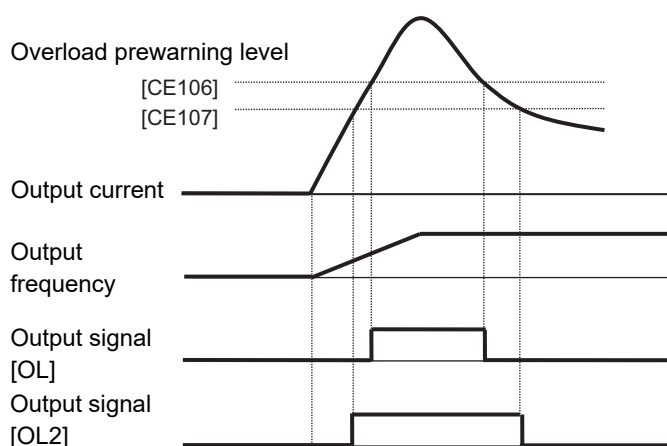
This function is effective, especially for conveyors, to prevent machine failure that may occur when the load increases because an excessive number of packages are loaded, or to prevent carrier lines from stopping because of an overload error of the inverter.



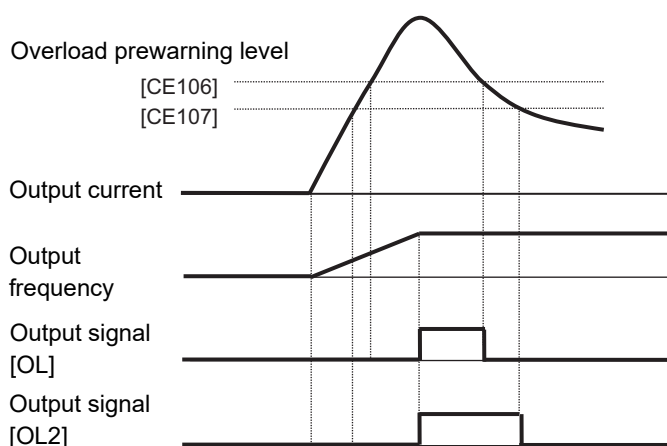
Precautions for Correct Use

- An overcurrent error may occur before the signal is output when the overload prewarning level has been set to an excessively high value. In this case, reduce the overload prewarning level.
- Small fluctuations in the frequency input may hinder the speed from being determined as constant when an analog input is used as the frequency command. In this case, change the overload prewarning signal output mode selection [CE105] to 00 (valid in operation).

When [CE105] = 00



When [CE105] = 01



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|---|---|-----------------------------|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | | 035 [OL]: Overload prewarning signal 1 is output. | - |
| Relay output terminal function selection 16A-16C | [CC-06] | 035 036 | 036 [OL2]: Overload prewarning signal 2 is output. | - |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | OFF: Less than or equal to the overload prewarning signal level ON: More than or equal to the overload prewarning signal level | - |
| Over current signal output mode selection, 1st motor | [CE105] | 00 | Valid in operation | 01 |
| | | 01 | Valid only in constant speed operation | |
| Over current detection level 1, 1st motor | [CE106] | (0.0 to 2.0) x inverter rated current*1 | Specify the current level at which the overload prewarning signal is output. | 1.0x Inverter rated current |
| [FM] monitor bias adjustment | [CE107] | | The signal will be output when the current exceeds the overload prewarning signal level. | 1.0x Inverter rated current |

- *1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.
- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
 - 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
 - 3) Drive programming: 0.01% (Rated ratio)

8-6-5 Low Current Signal (LOC)

This signal is output when the output current falls to or below the Low Current Detection Level (CE102). The low current detection signal can be output when the load has reduced.

The low current signals 033 [LOC] and 034 [LOC2] will be output when the output currents becomes lower than the low current detection levels [CE102] and [CE103], respectively.

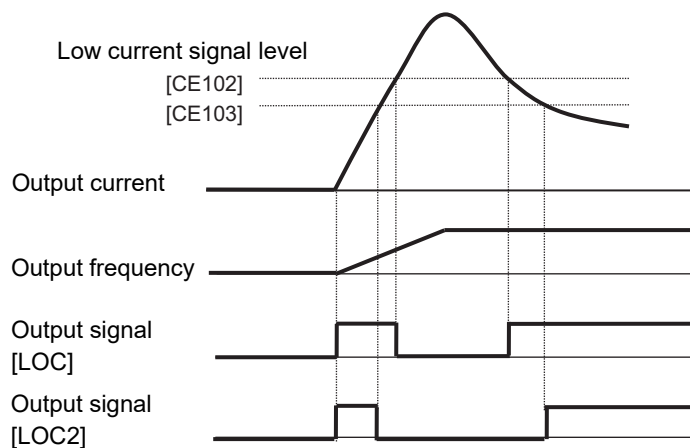
You can output the signal in accordance with the operating state by changing the low current signal output mode selection [CE101].



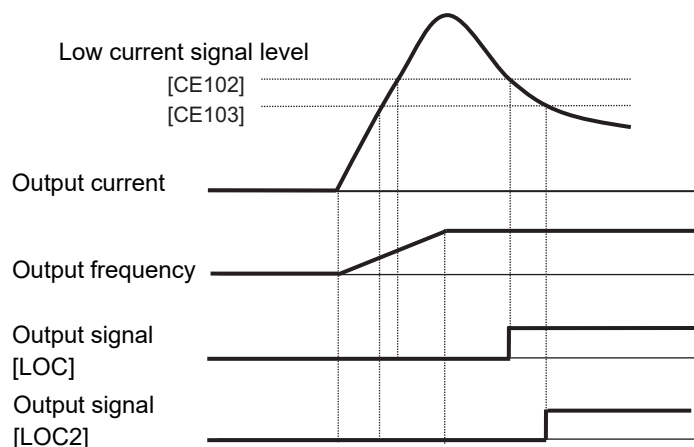
Precautions for Correct Use

Small fluctuations in the frequency input may hinder the speed from being determined as constant when an analog input is used as the frequency command. In this case, change the low current signal output mode selection [CE101] to 00 (valid in operation).

When [CE101] = 00



When [CE101] = 01



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|---|---|-----------------------------|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 033 034 | 033 [LOC]: Low current signal 1 is output. | - |
| Relay output terminal function selection 16A-16C | [CC-06] | | 034 [LOC2]: Low current signal 2 is output. | - |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | OFF: Less than or equal to the low current signal level ON: More than or equal to the low current signal level | - |
| Low current signal output mode selection, 1st motor | [CE101] | 00 | Valid in operation | 01 |
| | | 01 | Valid only in constant speed operation | |
| Low current detection level 1, 1st motor | [CE102] | (0.0 to 2.0) x inverter rated current ^{*1} | Specify the current level at which the low current prewarning signal is output. | 1.0x Inverter rated current |
| Low current detection level 2, 1st motor | [CE103] | | The signal will be output when the current becomes lower than the low current prewarning detection level. | 1.0x Inverter rated current |

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

- 1) Operator or CX-Drive: 0.1A or 0.1V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
- 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1A, 0.1V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- 3) Drive programming: 0.01% (Rated ratio)

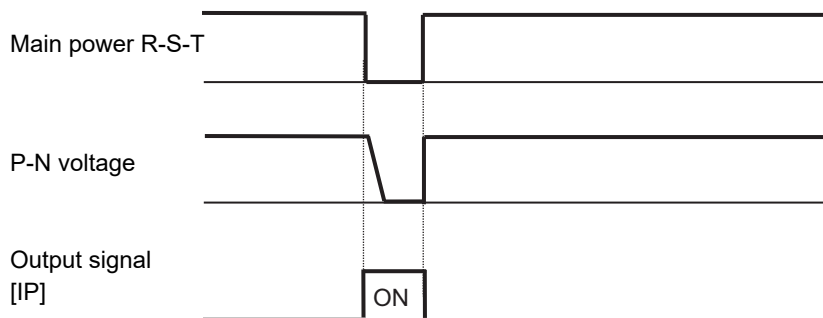
8-6-6 Momentary Power Interruption Signal (IP)

Assign the output terminal function 020 [IP] under momentary interruption signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The momentary interruption signal can be output when a momentary interruption occurs in the inverter main power.

An interruption in the main power can be output as a signal when the control power is supplied via a separate line.

Example of a momentary interruption



Precautions for Correct Use

- The momentary interruption signal [IP] is valid when the main power is input from R-S-T.
- The momentary interruption signal [IP] is output while the control power of the inverter remains (including when a 24-V power supply is used).
- To set errors that will be generated when a momentary interruption occurs, refer to 8-3-6 *Instantaneous Power Interruption/Undervoltage Detection* on page 8-72.
- To perform retry restart operation without generating errors when a momentary interruption occurs, refer to 8-2-6 *Restart during Power Interruption/Undervoltage* on page 8-52.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|------|--|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 020 | The momentary interruption signal [IP] is output. OFF: Input power to R-S-T has been established. ON: Input power to R-S-T was established and then interrupted. |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |

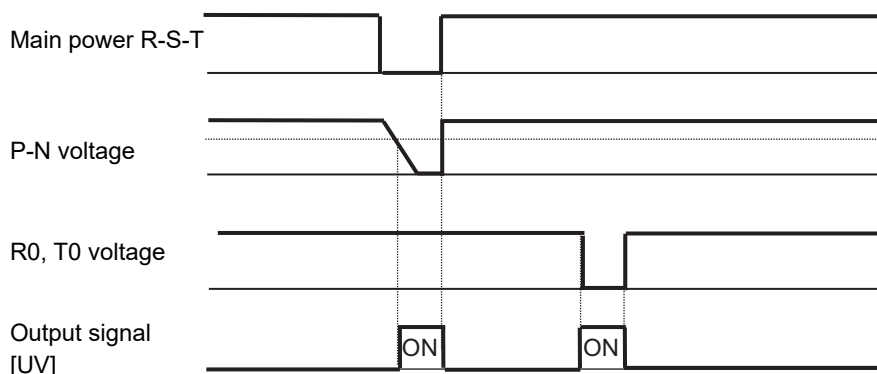
8-6-7 Signal during Undervoltage (UV)

Assign the output terminal function 021 [UV] undervoltage signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The undervoltage signal can be output when a power failure occurs in the main power and control power.

You can output the signal by assigning the undervoltage signal 021 [UV] to the output terminal selection.

Example of an undervoltage (R0 and T0/24V are supplied from a separate power)



Precautions for Correct Use

- The undervoltage signal [UV] is output while the control power of the inverter remains (including when a 24-V power supply is used).
- To set errors that will be generated when an undervoltage occurs, refer to *8-3-6 Instantaneous Power Interruption/Undervoltage Detection* on page 8-72.
- To perform retry restart operation without generating errors when an undervoltage occurs, refer to *8-2-6 Restart during Power Interruption/Undervoltage* on page 8-52.
- The [UV] signal is output under an undervoltage state irrespective of the occurrence of a trip.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|------|---|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 021 | The undervoltage signal [UV] is output. OFF: Internal PN voltage and control power have been established. ON: Internal PN voltage or control power is insufficient. |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |

8-6-8 Motor Thermal Warning Signal (THM)

Assign the output terminal function 026 [THM] motor thermal warning signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

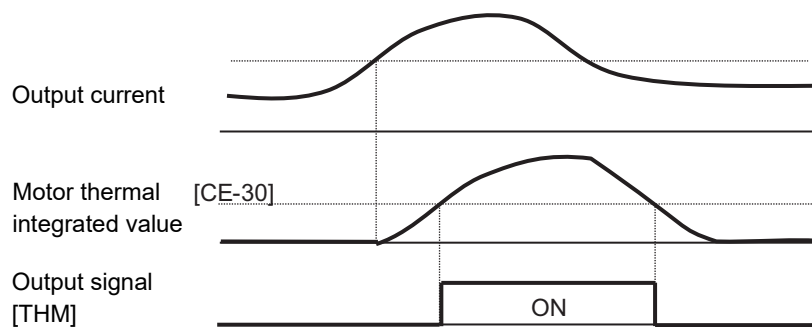
You can understand the state from the signal before the motor overload error [E005] is generated by the electronic thermal function.



Precautions for Correct Use

- The motor overload error [E005] will be generated when the motor thermal integrated value reaches 100.00%.
- For the settings of motor electronic thermal, refer to 6-6-1 *Electronic Thermal Setting* on page 6-48.

Example Operation (When Thermal Subtractions Enabled)



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|-------------------|--|--------------|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 026 | The thermal warning signal [THM] of the motor is output. OFF: The motor thermal integrated value is smaller than the level. ON: The motor thermal integrated value is equal to or larger than the level. | - |
| Relay output terminal function selection 16A-16C | [CC-06] | | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | | |
| Electronic thermal warning level (MTR) | [CE-30] | 0.00 to 100.00(%) | The signal [THM] is turned on when the thermal integrated value of the motor is equal to or larger than the set level. This function does not work when this level has been set to 0.00. | 80.0 |

8-6-9 Inverter Thermal Warning Signal (THC)

Assign the output terminal function 027 [THC] controller (inverter) thermal warning signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

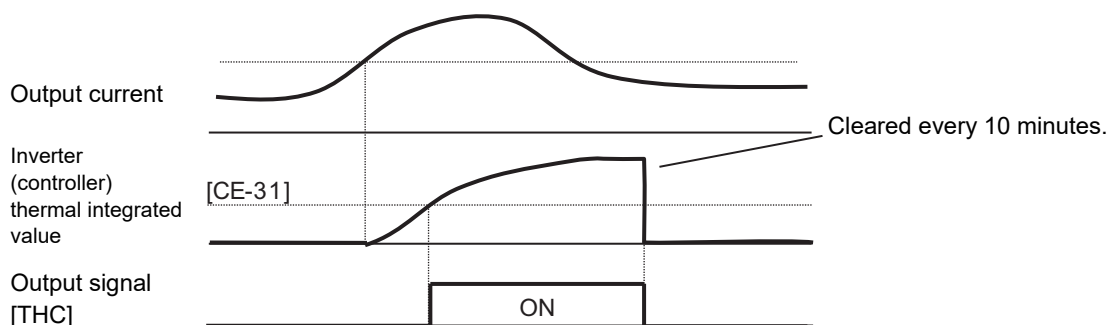
You can understand the state from the signal before the controller overload error [E039] is generated by the electronic thermal function.



Precautions for Correct Use

- The controller overload error [E039] will be generated when the inverter thermal integrated value reaches 100.00%.
- For the protection of inverters, electronic thermal characteristics of inverters are fixed and specific to the type.
- Inverter thermal values are cleared every 10 minutes. However, integration is processed in a dual-redundant system, so that the value may not be cleared when the current is high and the integrated value increases.

Operation Example



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|-------------------|---|--------------|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | | The thermal warning signal [THC] of the inverter is output. | |
| Relay output terminal [16] function | [CC-06] | 027 | OFF: The inverter thermal integrated value is smaller than the level. | - |
| Relay output terminal [AL] function | [CC-07] | | ON: The inverter thermal integrated value is equal to or larger than the level. | |
| Electronic thermal warning level (CTL) | [CE-31] | 0.00 to 100.00(%) | The signal [THC] is turned on when the thermal integrated value of the inverter is equal to or larger than the set level. | 80.0 |

8-6-10 Cooling Fin Overheat Warning Signal (OHF)

This signal is output when the output current falls to or below the Low Current Detection Level (CE102).

Assign the output terminal function 032 [OHF] cooling fin heating prewarning signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

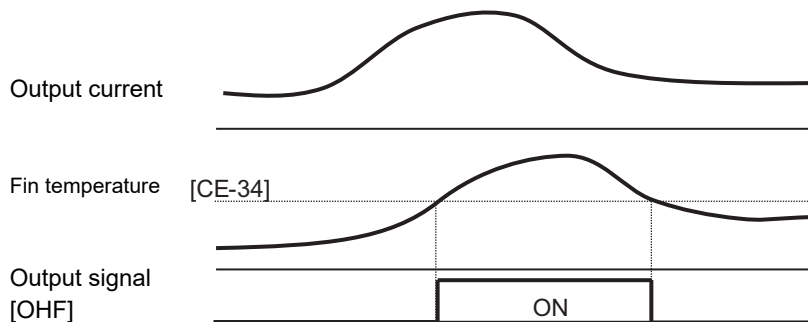
You can understand the state from the signal before the temperature error [E021] is generated by the cooling fin heating prewarning level function.



Precautions for Correct Use

The temperature error [E021] is generated when the cooling fin temperature exceeds 120°C.

Operation Example



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|--------------|--|--------------|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 032 | The cooling fin heating prewarning signal [OHF] is output. OFF: Fin temperature is lower than the prewarning level. ON: Fin temperature is equal to or higher than the prewarning level. | - |
| Relay output terminal function selection 16A-16C | [CC-06] | | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | | |
| Cooling FAN over-heat warning level | [CE-34] | 0 to 200(°C) | The signal [OHF] is turned on when the cooling fin temperature is equal to or higher than the set level. | 120 |

8-6-11 Capacitor Life Warning Signal (WAC)

Assign the output terminal function 029 [WAC] capacitor life prewarning signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The life spans of the capacitors on the circuit board are diagnosed from the temperature inside the inverter and the energized time.

The state of this signal can be monitored by using the life diagnostic monitor. Refer to *5-9 Life Monitor* on page 5-17.

A warning will also be displayed in the display icons on the LCD operator.



Precautions for Correct Use

You are recommended to replace or repair the inverter when a warning about capacitor lives is generated.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|----------|--|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 029 | The capacitor life prewarning signal (on board) [WAC] is output. OFF: No warning ON: Time to replace the circuit board because the capacitors has reached their life spans |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |
| Life diagnostic monitor | [dC-16] | LL to HH | The monitors become H at the end of the life spans. The monitor on the right indicates the lives of the capacitors on the circuit board, whereas that on the left indicates the life of the cooling fan. |

8-6-12 Cooling Fan Life Warning Signal (WAF)

This signal will be output when the rotation speed of the inverter's built-in cooling fan decreases to 75% or less.

Assign the output terminal function 030 [WAF] cooling fan rotation speed reduction signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The signal is output when it is detected that the rotation speed of the cooling fan incorporated in the inverter has decreased to 75% or less.

The state of this signal can be monitored by using the life diagnostic monitor. Refer to *5-9 Life Monitor* on page 5-17.

A warning will also be displayed in the display icons on the LCD operator.



Precautions for Correct Use

- Check the cooling fan for clogging when this signal is output.
- When the Cooling Fan Operation (bA-70) is set to 01 (Enabled during RUN (including 3 minutes after power on/stop), this signal will not be output while the fan is stopped).

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|----------|---|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 030 | The cooling fan rotation speed reduction signal [WAF] is output. OFF: No warning ON: Fan rotation speed has decreased |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |
| Life diagnostic monitor | [dC-16] | LL to HH | The monitors become H at the end of the life spans. The monitor on the right indicates the lives of the capacitors on the circuit board, whereas that on the left indicates the life of the cooling fan. |

8-6-13 RUN Time Over Signal (RNT)

If the total RUN time or ON time of the inverter exceeds the RUN Time/Power ON Time level (CE-36), the inverter will output a RUN time over (RNT).

Assign the output terminal function 024 [RNT] RUN time over signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

Specify the RUN time/power-on time level [CE-36].



Precautions for Correct Use

When specifying the time level as a guideline for replacement, use a number with an adequate margin.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|-------------------|--|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 024 | The RUN time over signal [RNT] is output. OFF: Less than or equal to the RUN time level ON: More than the RUN time level |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |
| RUN time/power-on time level | [CE-36] | 0 to 100000[hour] | This function does not work when this level has been set to 0. Specify 1 to 100,000 hours. |
| Cumulative operating hours monitor during RUN | [dC-22] | 0 to 100000[hour] | The number of hours when the inverter outputs is stored for monitoring. |

8-6-14 Power ON Time Over Signal

If the total RUN time or ON time of the inverter exceeds the RUN Time/Power ON Time level (CE-36), the inverter will output a Power ON time over (ONT).

Assign the output terminal function 025 [ONT] power-on time over signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

Assign 025 (ONT) to the output terminal.

Specify the power-on time level [CE-36].



Precautions for Correct Use

When specifying the time level as a guideline for replacement, use a number with an adequate margin.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|-------------------|--|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 025 | The power-on time over [ONT] is output. OFF: Less than or equal to the power-on time level ON: More than the power-on time level |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |
| RUN time/power-on time level | [CE-36] | 0 to 100000[hour] | This function does not work when this level has been set to 0. Specify 1 to 100,000 hours. |
| Cumulative power-on time monitor | [dC-24] | 0 to 100000[hour] | The number of hours when the inverter has been turned on is stored for monitoring. |

8-6-15 Incoming Overvoltage Signal (OVS)

Assign the output terminal function 081 [OVS] incoming overvoltage signal to one of [CC-01] to [CC-17] that corresponds to the output terminal and output the signal.

The incoming overvoltage signal [OVS] turns on when the PN voltage of the main circuit exceeds the voltage level specified with the incoming overvoltage level selection [bb-62] for 100 s continuously.

When incoming overvoltage level [bb-61] is set to 00, the signal [OVS] will be output.

When incoming overvoltage level [bb-61] is set to 01, the signal [OVS] will be output, while a trip being made due to incoming overvoltage error [E015].



Precautions for Correct Use

This function performs detection only when the inverter is stopped. This function does not work while the inverter is in operation.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|--|--|--|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 081 | The signal [OVS] is output when the incoming voltage is high. OFF: Less than or equal to the incoming overvoltage level ON: More than the incoming overvoltage level | - |
| Relay output terminal function selection 16A-16C | [CC-06] | | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | | |
| Power supply over voltage selection | [bb-61] | 00 | The signal [OVS] will be output. | 00 |
| | | 01 | The signal [OVS] will be output, while a trip being made due to incoming overvoltage error [E015]. | |
| Power supply over voltage level setting | [bb-62] | (200-V class) 300.0Vdc to 410.0Vdc (400-V class) 600.0Vdc to 820.0Vdc | The number of hours when the inverter has been turned on is stored for monitoring. | (200V class) 390.0 (400V class) 780.0 |

8-7 Terminal Output During Run

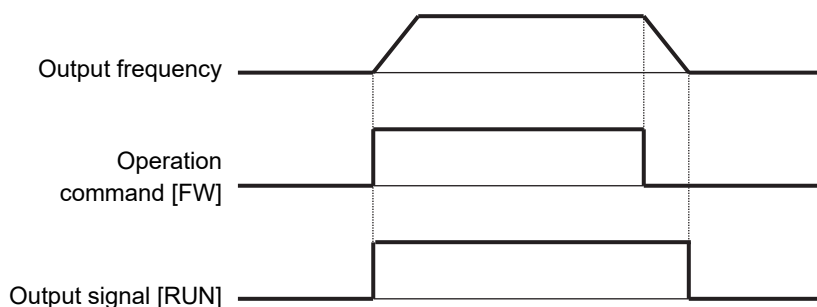
8-7-1 Signal during RUN (RUN)

This signal is output while an inverter operates.

Assign the output terminal function 001 [RUN] running signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The timing chart is as follows.

Run signal is output until a motor stops even if the operation command (FW) is OFF.



Precautions for Correct Use

- The signal becomes ON not only when the motor is operating at normal rotation but also when a voltage is output to the motor as a function such as DC breaking.
- The signal [RUN] will not be output when the inverter is waiting for a retry or DC breaking.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|------|---|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 001 | The signal [RUN] is output to the output terminal assigned. |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |

8-7-2 Signal during RUN (FWR/RVR)

Forward Run Signal (FWR)

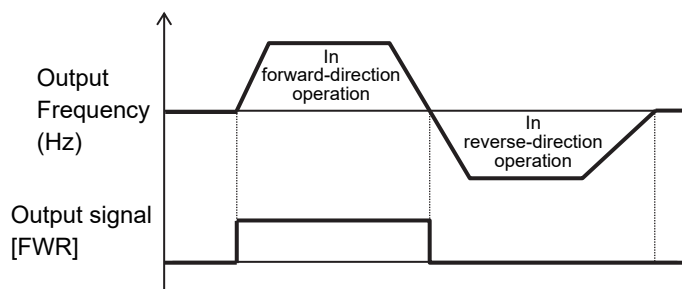
Assign the output terminal function 008 [FWR] forward-direction operating signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

You can output the signal only when the inverter is operating in the forward direction by assigning 008 [FWR] to the output terminal function selection.

This signal is output while the inverter performs the forward operation.

While the inverter performs the reverse operation or when stopped, this signal is not output.

The timing chart is as follows.



Reverse Run Signal (RVR)

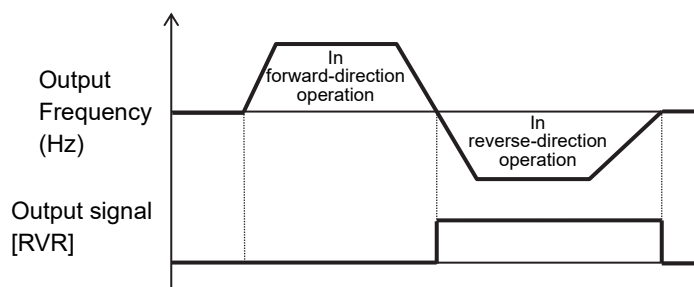
Assign the output terminal function 009 [RVR] reverse-direction operating signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

You can output the signal only when the inverter is operating in the reverse direction by assigning 009 [RVR] to the output terminal function selection.

This signal is output while the inverter performs the reverse operation.

While the inverter performs the reverse operation or when stopped, this signal is not output.

The timing chart is as follows.



Precautions for Correct Use

[FWR] and [RVR] will not be output during DC braking or when the servo is on.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|------|--|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 008 | [FWR]: The forward-direction operation signal is output to the output terminal assigned. |
| Relay output terminal function selection 16A-16C | [CC-06] | 009 | [RVR]: The reverse-direction operation signal is output to the output terminal assigned. |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |

8-7-3 Starting Contact Signal

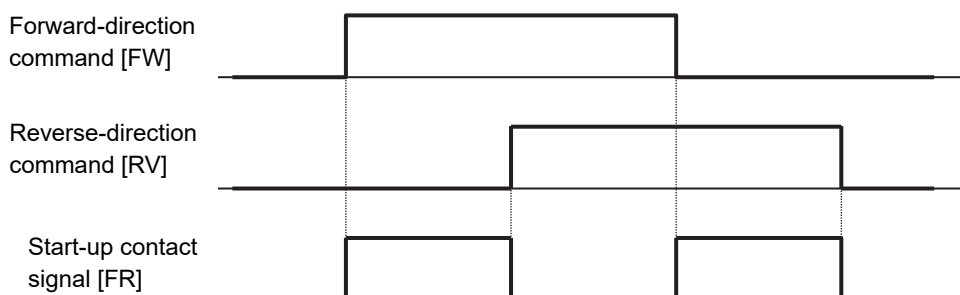
Assign the output terminal function 031 [FR] start-up contact signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The start-up contact signal 031 [FR] is output while the inverter accepts operation commands.

The start-up contact signal [FR] is output in accordance with the state how the operation command is accepted even when the destination of the operation command is not a contact.

The timing chart is as follows.

(Ex.) In the case of a terminal command



Precautions for Correct Use

- When the inverter is operated by using terminal commands, simultaneous inputs of the forward-direction command [FW] and the reverse-direction command [RV] will cause a command mismatch, which is interpreted as the stop command. In this case, the [FR] signal will not be output.
- The signal becomes ON not only when the motor is operating at normal rotation but also when a voltage is output to the motor as a function such as DC breaking.
- When the operation enable signal 101 [REN] has been assigned and set to OFF, the signal [FR] becomes OFF because the inverter cannot be operated.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|------|--|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 031 | [FR]: The start-up contact signal is output to the output terminal assigned. |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |

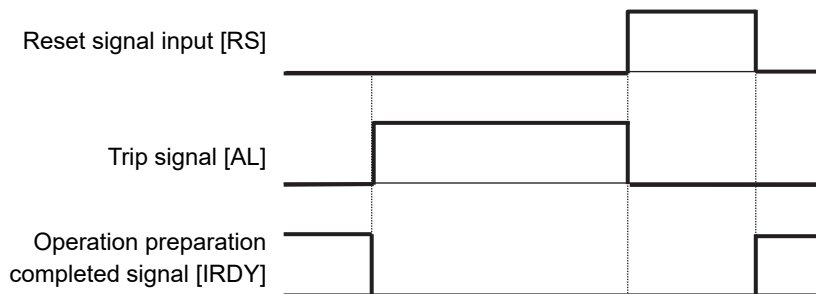
8-7-4 Operation Ready (IRDY)

Assign the output terminal function 007 [IRDY] operation preparation completed signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The operation preparation completed signal 007 [IRDY] is output when the inverter can accept operation commands.

The timing chart is as follows.

(Ex.) In the case of a terminal command



Precautions for Correct Use

- When this signal is not output, the inverter cannot be operated even if operation commands are input.
- This signal is turned OFF in the following cases or a condition:
 - During operation ready with power-ON.
 - When undervoltage of the R-S-T input voltage occurs
 - While the inverter has been tripped
 - Under a free run stop command

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|------|---|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | 007 | [IRDY]: The operation preparation completed signal is output to the output terminal assigned. |
| Relay output terminal function selection 16A-16C | [CC-06] | | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |

8-8 Frequency Arrival Signal (FA1 to FA5)

These frequency arrival signals will be output when the output frequency reaches the set level.

Allocate output terminals 11 to 15 (CC-01 to CC-05) or relay output 16 AL (CC-06, CC-07) to 002 (FA1: Constant speed arrival signal), 003 (FA2: Set frequency exceeded signal), 004 (FA3: Set frequency only signal), 005 (FA4: Set frequency exceeded signal 2), 006 (FA5: Set frequency only signal 2).

Below is the hysteresis of the frequency arrival signal:

ON: Set frequency - 1% of maximum frequency [Hz]

OFF: Set frequency - 2% of maximum frequency [Hz]

When the above parameter is set to 04 (FA3) and 06 (FA5), the hysteresis during acceleration is:

ON: Set frequency - 1% of maximum frequency [Hz]

OFF: Set frequency - 2% of maximum frequency [Hz]

And the hysteresis during deceleration is:

ON: Set frequency - 1% of maximum frequency [Hz]

OFF: Set frequency - 2% of maximum frequency [Hz]

8-8-1 Output Signal on Constant Speed Arrival (FA1)

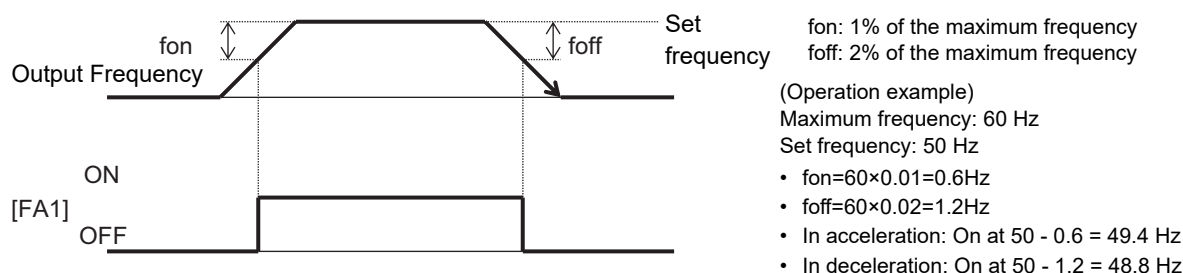
The signal will be output when the frequency has reached the enabled frequency command.

Assign the output terminal function 002 [FA1] constant-speed reaching output signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.



Precautions for Correct Use

The signal [FA1] may not be output stably when the frequency command fluctuates because an analog input command is used. In this case, the symptom may be alleviated by using the ON/OFF delay function of the output terminal.



● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|------|---|
| Output terminal function selection | [CC-01] to [CC-05] | 002 | [FA1]: The constant-speed reaching output will be output as a signal to the output terminal assigned. |
| Relay output terminal function selection | [CC-06] | | |
| Relay output terminal function selection | [CC-07] | | |

8-8-2 Set Frequency Exceeded Signal (FA2/FA4)

FA2 will be output when the output frequency exceeds the Arrival Frequency During Acceleration/Deceleration 1 (CE-10/CE-11); FA4 will be output when the output frequency exceeds the Arrival Frequency During Acceleration/Deceleration 2 (CE-12/CE-13).

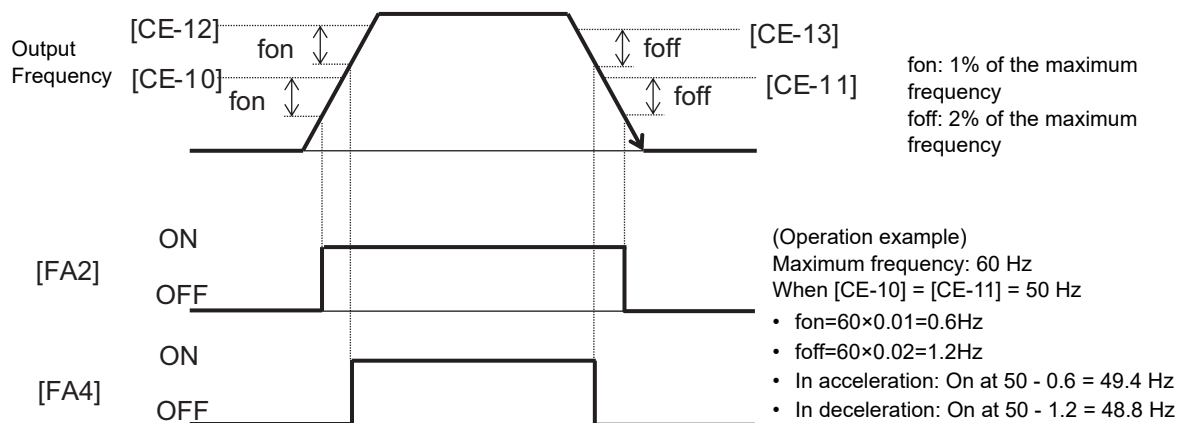
Assign the output terminal functions 003 [FA2] and 005 [FA4] exceeding set frequency signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signals.

The signals [FA2] and [FA4] can be output to output terminal functions individually as the exceeding set frequency output signal.



Precautions for Correct Use

- The operation of [FA2] can be set through [CE-10] and [CE-11].
- The operation of [FA4] can be set through [CE-12] and [CE-13].



● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|--------------------|--|
| Output terminal function selection | [CC-01] to [CC-05] | 003 005 | 003 [FA2]: The exceeding set frequency signal will be output to the output terminal assigned. 005 [FA4]: The exceeding set frequency signal 2 will be output to the output terminal assigned. |
| Relay output terminal function selection | [CC-06] | | |
| Relay output terminal function selection | [CC-07] | | |
| Acceleration reaching frequency 1 | [CE-10] | 0.00 to 590.00(Hz) | The frequency to judge that the frequency has been reached in acceleration and output the signal [FA2]. |
| Deceleration reaching frequency 1 | [CE-11] | 0.00 to 590.00(Hz) | The frequency to judge that the frequency has been reached in deceleration and output the signal [FA2]. |
| Acceleration reaching frequency 2 | [CE-12] | 0.00 to 590.00(Hz) | The frequency to judge that the frequency has been reached in acceleration and output the signal [FA4]. |
| Deceleration reaching frequency 2 | [CE-13] | 0.00 to 590.00(Hz) | The frequency to judge that the frequency has been reached in deceleration and output the signal [FA4]. |

8-8-3 Set Frequency Matched Signal (FA3/FA5)

FA3 outputs signals when the output frequency during acceleration/deceleration reaches the value of Arrival Frequency Setting During Acceleration/Deceleration 1 (CE-10, CE-11).

FA5 outputs signals when the output frequency during acceleration/deceleration reaches the value of Arrival Frequency Setting During Acceleration/Deceleration 2 (CE-12, CE-13).

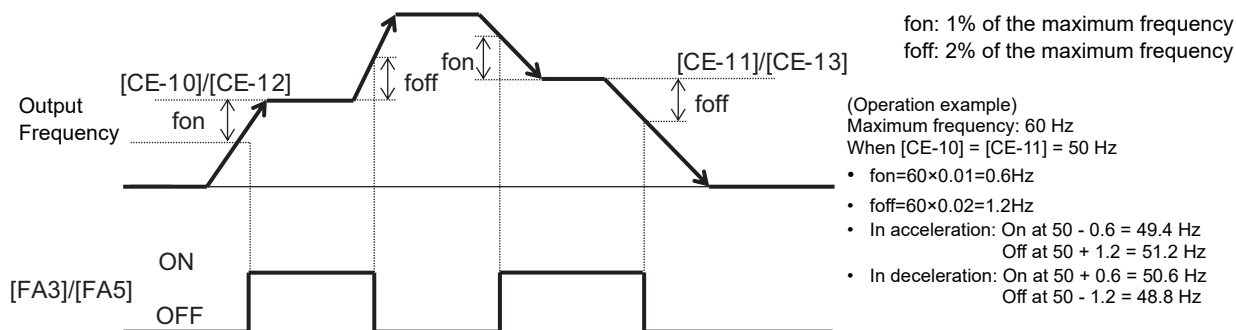
Assign the output terminal functions 004 [FA3] and 006 [FA5] set frequency only output signals to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signals.

The signals [FA3] and [FA5] can be output individually.



Precautions for Correct Use

- The operation of [FA3] can be set through [CE-10] and [CE-11].
- The operation of [FA5] can be set through [CE-12] and [CE-13].



● Parameter

| Item | Parameter | Data | Description | Default data |
|---|--------------------|--------------------|---|--------------|
| Output terminal function selection | [CC-01] to [CC-05] | 004 006 | [FA3]: The set frequency only reaching signal will be output to the output terminal assigned. | - |
| Relay output terminal function selection | [CC-06] | | [FA5]: The set frequency only reaching signal 2 will be output to the output terminal assigned. | |
| Relay output terminal function selection | [CC-07] | | | |
| Arrival frequency setting during acceleration 1 | [CE-10] | 0.00 to 590.00(Hz) | The frequency to judge that the frequency has been reached in acceleration and output the signal [FA3]. | 0.00 |
| Arrival frequency setting during deceleration 1 | [CE-11] | 0.00 to 590.00(Hz) | The frequency to judge that the frequency has been reached in deceleration and output the signal [FA3]. | 0.00 |
| Arrival frequency setting during acceleration 2 | [CE-12] | 0.00 to 590.00(Hz) | The frequency to judge that the frequency has been reached in acceleration and output the signal [FA5]. | 0.00 |
| Arrival frequency setting during deceleration 2 | [CE-13] | 0.00 to 590.00(Hz) | The frequency to judge that the frequency has been reached in deceleration and output the signal [FA5]. | 0.00 |

8-8-4 0-Hz Detection Signal (ZS)

Assign the output terminal function 040 [ZS] 0-Hz detection signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

This function is to output a signal when the output frequency of the inverter becomes lower than the level specified with the 0-Hz detection value level [CE-33].

When the feedback circuit board is used, the actual frequency of the motor is evaluated for outputting the signal.

ZS Signal is switched only by existence or non-existence of speed detection at any control modes in the following way:

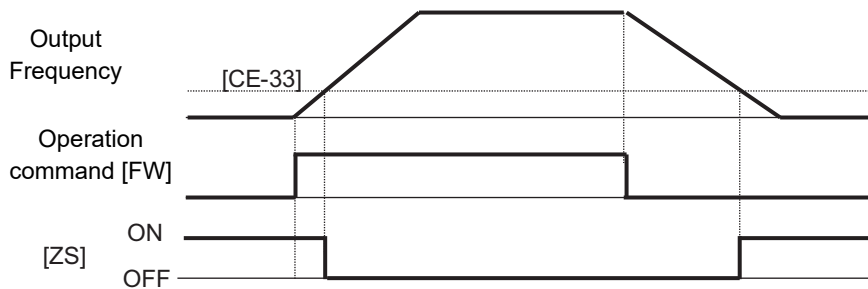
Without speed detection: Output frequency monitor (dA-01)

With speed detection: Frequency detection monitor Absolute values of (dA-08)



Precautions for Correct Use

While the operation is stopped, the [ZS] signal becomes ON state because the frequency is 0 Hz.



● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|--------------------|---|--------------|
| Output terminal function selection | [CC-01] to [CC-05] | 040 | [ZS]: The 0-Hz signal is output to the output terminal assigned. | - |
| Relay output terminal function selection | [CC-06] | | | |
| Relay output terminal function selection | [CC-07] | | | |
| Zero speed detection level | [CE-33] | 0.00 to 100.00(Hz) | The frequency setting value to estimate 0-Hz state when [ZS] is output. | 0.50 |

8-9 Applied Output

8-9-1 Analog Disconnection Signal

Assign the output terminal functions 050 [Ai1Dc], 051 [Ai2Dc], and 052 [Ai3Dc] analog break signals to one of [CC-01] to [CC-17] that corresponds to the output terminal and output the signals.

The signals will be output when the input values of the analog inputs [Ai1], [Ai2], and [Ai3] are within the range from the lower limit level to the upper limit level of the window comparators. The analog inputs can be monitored at any value, so that this function can be used for detecting breaks, for example.

A hysteresis width can be specified to the upper and lower limit levels of the window comparator.

A level and a hysteresis width can be specified to each of the analog inputs [Ai1], [Ai2], and [Ai3] individually.



Precautions for Correct Use

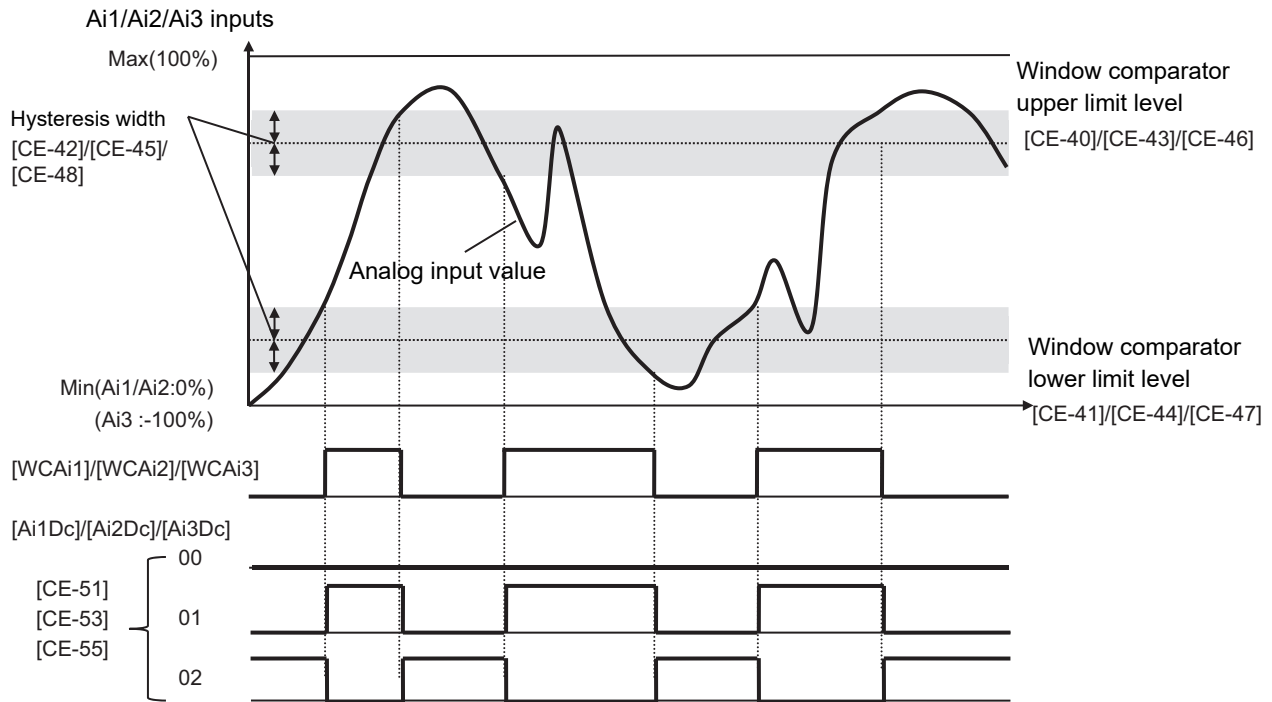
- When the signal [WCAi1], [WCAi2], or [WCAi3] is output, the value adopted to the analog input can be fixed to any value. Specify the value using the break operation level [Ai1], [Ai2], or [Ai3].
- When the analog hold function [AHD] is enabled, the input being held has higher priority.

● Parameter

| Item | Parameter | Data | Description |
|--|---|-------------------------------|--|
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | | The signals 050 [Ai1Dc], 051 [Ai2Dc], and 052 [Ai3Dc] will be output to the output terminal assigned. |
| Relay output terminal function selection 16A-16C | [CC-06] | 050 051 052 | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |
| Output terminal function selection 11-15 | [CC-01] to [CC-05] | | The signals 056 [WCAi1], 057 [WCAi2], and 058 [WCAi3] will be output to the output terminal assigned. |
| Relay output terminal function selection 16A-16C | [CC-06] | 056 057 058 | |
| Relay output terminal function selection AL1-AL0/AL2-AL0 | [CC-07] | | |
| Window comparator Ai1/Ai2/Ai3 upper limit level | Ai1:[CE-40] Ai2:[CE-43] Ai3:[CE-46] | 0 to 100(%) -100 to 100(%) | Specify the upper limits of the analog inputs. The setting ranges are limited to the lower limits or greater. |
| Window comparator Ai1/Ai2/Ai3 lower limit level | Ai1:[CE-41] Ai2:[CE-44] Ai3:[CE-47] | 0 to 100(%) -100 to 100(%) | Specify the lower limits of the analog inputs. The setting ranges are limited to the upper limits or smaller. |
| Window comparator Ai1/Ai2/Ai3 hysteresis width | Ai1:[CE-42] Ai2:[CE-45] Ai3:[CE-48] | 0 to 10(%) | The maxim hysteresis widths are limited to (upper limit level - lower limit level)/2. |
| Ai1/Ai2/Ai3 abnormal condition analog operation level | Ai1:[CE-50] Ai2:[CE-52] Ai3:[CE-54] | 0 to 100(%) -100 to 100(%) | Specify the input values when the input become within the ranges according to their operation level selection. |

| Item | Parameter | Data | Description |
|---|---|------|---|
| Ai1/Ai2/Ai3 abnormal condition analog operation level selection | Ai1:[CE-51] Ai2:[CE-53] Ai3:[CE-55] | 00 | Disabled |
| | | 01 | When the enabled WC signal is in operation (within the range) |
| | | 02 | When the enabled WC signal is out of operation (beyond the range) |

Window Comparator Operation



In the window comparator function, the signal will be output when the input level is within the specified range.

In the break detection function, the signal will be output when the input level is out of the specified range.

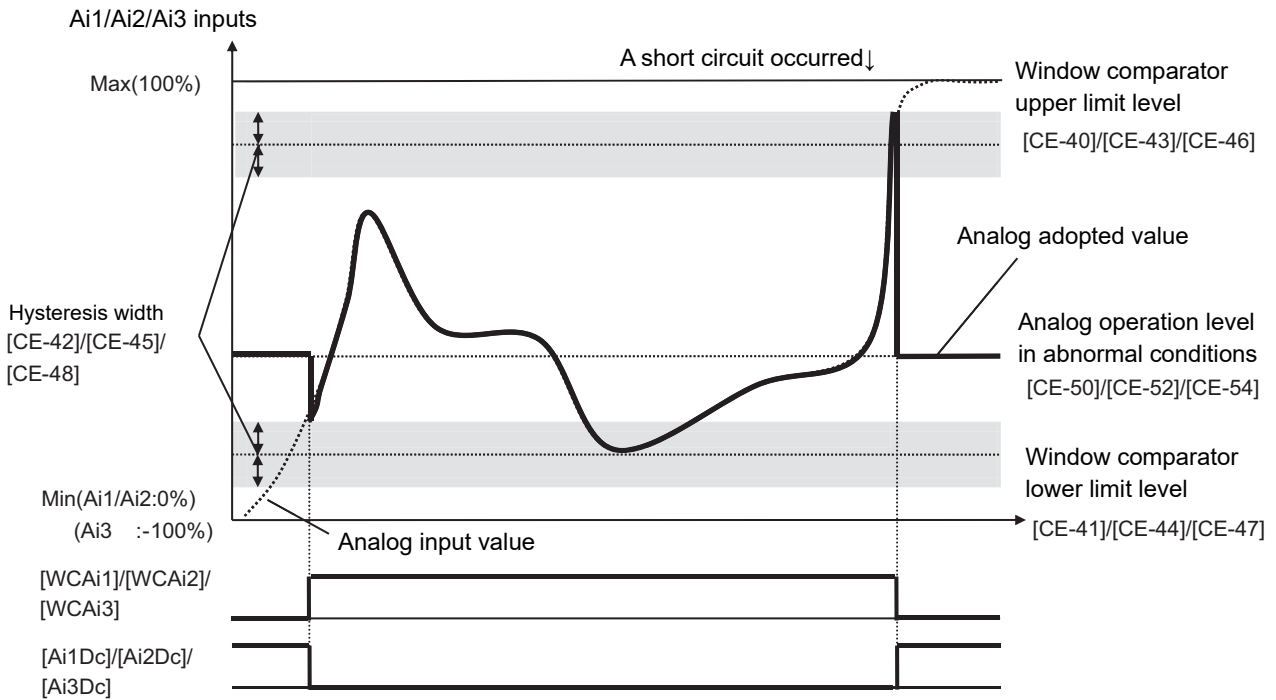
The logical values of the output signals can be modified through [CC-11] to [CC-17].

Specify the analog operation level to maintain the output level when the analog input becomes the maximum value because of a short circuit or when the analog input becomes 0 V because of a break.

To prevent the signal from being output at power-on, specify the on delay times [CC-20], [CC-22], [CC-24], [CC-26], [CC-28], [CC-30], and [CC-32] of the output terminals.

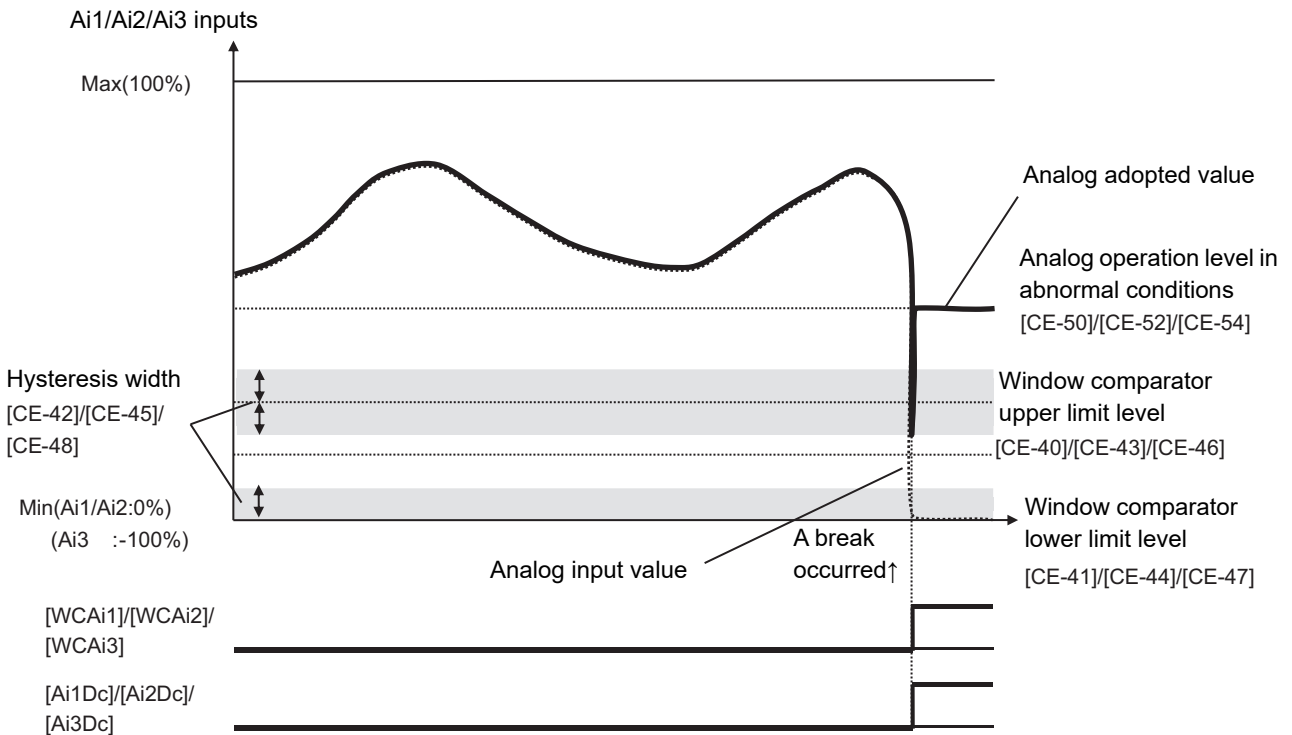
Output Operation in Abnormal Conditions

Example when [CE-51]/[CE-53]/[CE-55] = 02

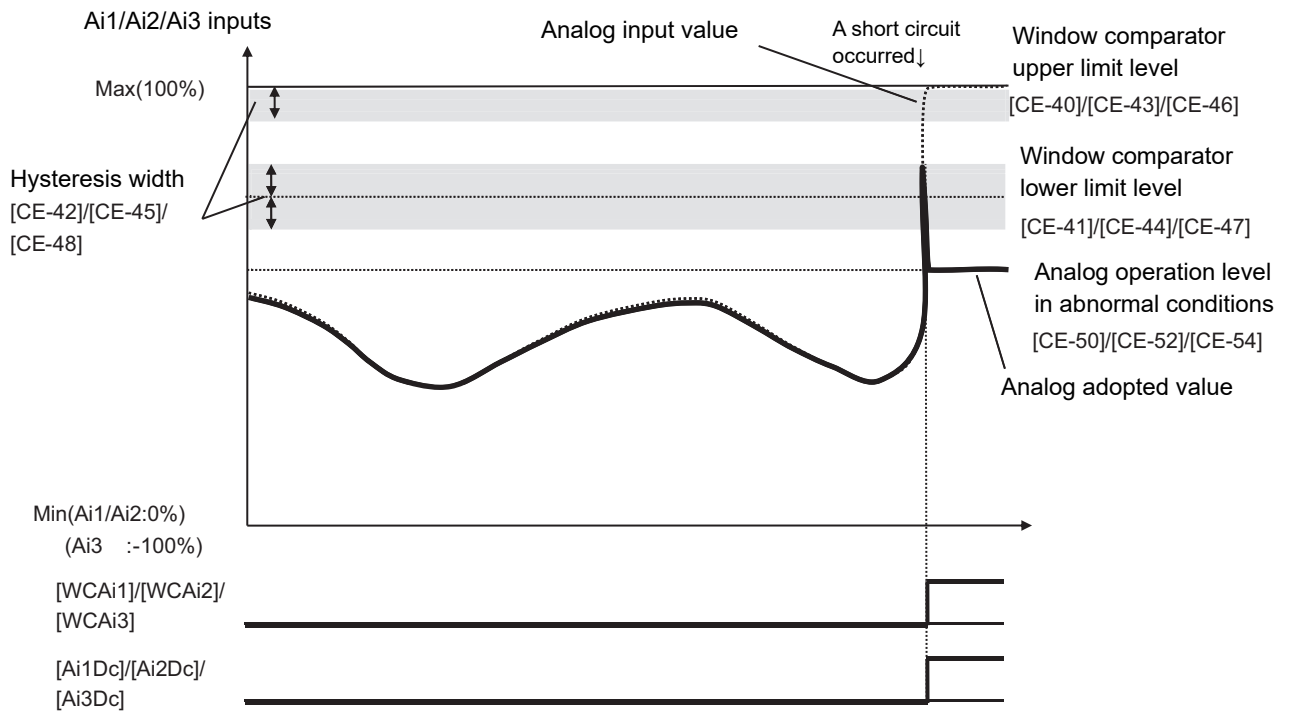


Example when [CE-51]/[CE-53]/[CE-55] = 01

- When the analog input becomes the minimum value (Min) because of a break in the input wire



- When the analog input becomes the maximum value (Max) because of a short circuit in the input wire



8-9-2 Logical Output Signal

You can combine the operation of the output terminal function to perform a logical operation for output signals in the inverter to output various signals.

You can select three types of operators: AND, OR, and XOR.



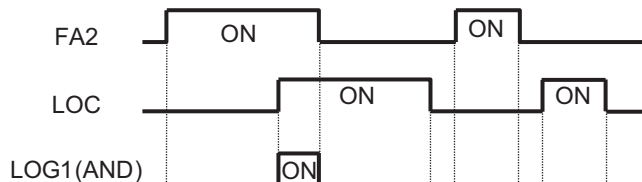
Precautions for Correct Use

All output signals are subject to operation. However, you are not able to include the results of logical operations [LOG1] to [LOG7] into the targets of arithmetic operation.

| Selected signal | Arithmetic operation target 1 selection | Arithmetic operation target 2 selection | Operator selection |
|-------------------------------------|---|---|--------------------|
| 068: Logical output signal 1 (LOG1) | [CC-40] | [CC-41] | [CC-42] |
| 069: Logical output signal 2 (LOG2) | [CC-43] | [CC-44] | [CC-45] |
| 070: Logical output signal 3 (LOG3) | [CC-46] | [CC-47] | [CC-48] |
| 071: Logical output signal 4 (LOG4) | [CC-49] | [CC-50] | [CC-51] |
| 072: Logical output signal 5 (LOG5) | [CC-52] | [CC-53] | [CC-54] |
| 073: Logical output signal 6 (LOG6) | [CC-55] | [CC-56] | [CC-57] |
| 074: Logical output signal 7 (LOG7) | [CC-58] | [CC-59] | [CC-60] |

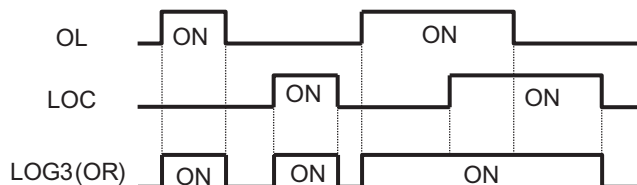
(Ex.1) Use a signal for which an AND operation has been performed with a frequency equal to or above the set frequency (003: FA2) and a low current signal (033: LOC), and, when a current lowers after the frequency has been determined, output the signal as Logical output 1 (LOG1) to Output terminal function 1.

- Output terminal function 1 [CC-01]: 062 (LOG1)
- Logical output signal 1 selection 1 [CC-40]: 003 (FA2)
- Logical output signal 1 selection 2 [CC-41]: 033 (LOC)
- Logical output signal 1 operator [CC-42]: 00 (AND)



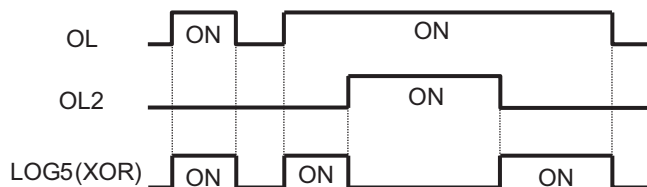
(Ex.2) Use a signal for which an OR operation has been performed with an overload advance notice signal (035: OL) and a thermal warning signal (026: THM), and, when a current falls outside the range, output the signal as Logical output 3 (LOG3) to Output terminal function 2.

- Output terminal function 2 [CC-02]: 063 (LOG3)
- Logical output signal 3 selection 1 [CC-43]: 035 (OL)
- Logical output signal 3 selection 2 [CC-44]: 026 (THM)
- Logical output signal 3 operator [CC-45]: 01 (OR)



(Ex.3) Use a signal for which an XOR operation has been performed with an overload advance notice signal (035: OL) and an overload advance notice signal 2 (036: OL2), and, when a current falls within a certain range, output the signal as Logical output 5 (LOG5) to Output terminal function 3.

- Output terminal function 3 [CC-03]: 066 (LOG5)
- Logical output signal 5 selection 1 [CC-46]: 035 (OL)
- Logical output signal 5 selection 2 [CC-47]: 036 (OL2)
- Logical output signal 5 operator [CC-48]: 02 (XOR)



● Parameter

| Item | Parameter | Data | Description |
|--|---|--|--------------------------------------|
| Output terminal function selection Relay output terminal function selection | [CC-01] to [CC-05] | 062 063 064 065 066 067 068 | LOG1: Result of logical operation 1 |
| 16C relay output terminal function selection | [CC-06] | | LOG2: Result of logical operation 2 |
| AL relay output terminal function selection | [CC-07] | | LOG3: Result of logical operation 3 |
| | | | LOG4: Result of logical operation 4 |
| | | | LOG5: Result of logical operation 5 |
| | | | LOG6: Result of logical operation 6 |
| | | | LOG7: Result of logical operation 7 |
| Logical output signal selection 1 | [CC-40], [CC-43], [CC-46], [CC-49], [CC-52], [CC-55], [CC-58] | Select from the output terminal function selection data (excluding LOG1 to LOG7) | Select Arithmetic operation target 1 |
| Logical output signal selection 2 | [CC-41], [CC-44], [CC-47], [CC-50], [CC-53], [CC-56], [CC-59] | Select from the output terminal function selection data (excluding LOG1 to LOG7) | Select Arithmetic operation target 2 |
| Logical output signal operator selection | [CC-42], [CC-45], [CC-48], [CC-51], [CC-54], [CC-57], [CC-60] | 00 | AND |
| | | 01 | OR |
| | | 02 | XOR |

8-10 Input Terminal Function

8-10-1 Overview

Input terminals 1 to 9, A, and B are open collector inputs. Pulse inputting is possible for Terminals A and B.

For the content of an input signal, by allocating the functions that you want to operate to [CA-01] to [CA-11], you will be able to operate the functions with a corresponding input terminal operation.

You can switch a contact for an input signal with the Contacts a/b selection functions of [CA-21] to [CA-31].

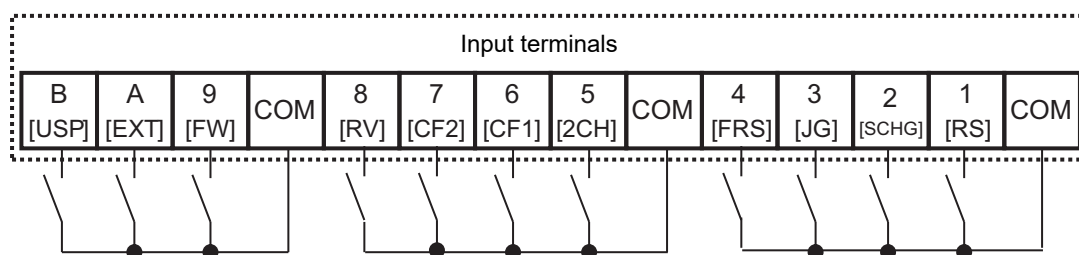
When a function is selected for many targets, the targets will be set to 00 [without allocation], excluding the finally set function selection.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|---|---|
| Input terminal function selection | [CA-01] to [CA-11] | Next item: Table of input terminal selections | Outputs the allocated function to the corresponding input terminal. |
| Selection of Input terminals a/b (NO/NC) | [CA-21] to [CA-31] | 00 | Operates as Contact a (NO). |
| | | 01 | Operates as Contact b (NC). |

● Terminals corresponding to parameters

| Terminal block symbol | Function setting destination parameter |
|-----------------------|--|
| 1 | [CA-01] |
| 2 | [CA-02] |
| 3 | [CA-03] |
| 4 | [CA-04] |
| 5 | [CA-05] |
| 6 | [CA-06] |
| 7 | [CA-07] |
| 8 | [CA-08] |
| 9 | [CA-09] |
| A | [CA-10] |
| B | [CA-11] |



● Input Terminal Selections

| Function No. | Abbreviation | Function name | Page |
|--------------|--------------|--|----------|
| 000 | no | Without allocation | - |
| 001 | FW | Normal rotation | P. 6-20 |
| 002 | RV | Reverse rotation | P. 6-20 |
| 003 | CF1 | Multistage speed 1 | P. 6-38 |
| 004 | CF2 | Multistage speed 2 | P. 6-38 |
| 005 | CF3 | Multistage speed 3 | P. 6-38 |
| 006 | CF4 | Multistage speed 4 | P. 6-38 |
| 007 | SF1 | Multistage speed bit 1 | P. 6-39 |
| 008 | SF2 | Multistage speed bit 2 | P. 6-39 |
| 009 | SF3 | Multistage speed bit 3 | P. 6-39 |
| 010 | SF4 | Multistage speed bit 4 | P. 6-39 |
| 011 | SF5 | Multistage speed bit 5 | P. 6-39 |
| 012 | SF6 | Multistage speed bit 6 | P. 6-39 |
| 013 | SF7 | Multistage speed bit 7 | P. 6-39 |
| 014 | ADD | Addition of frequency | P. 6-41 |
| 015 | SCHG | Switching of instruction | P. 6-35 |
| 016 | STA | 3-wire starting up | P. 6-21 |
| 017 | STP | 3-wire stopping | P. 6-21 |
| 018 | F/R | 3-wire normal and reverse | P. 6-21 |
| 019 | AHD | Retention of analog instruction | P. 6-42 |
| 020 | FUP | Acceleration through remote operation | P. 6-41 |
| 021 | FDN | Deceleration through remote operation | P. 6-41 |
| 022 | UDC | Clearing of remote operation data | P. 6-41 |
| 023 | F-OP | Forced switching of instruction | P. 6-43 |
| 024 | SET | Second control | P. 8-80 |
| 028 | RS | Reset | P. 8-159 |
| 029 | JG | Jogging | P. 8-83 |
| 030 | DB | Braking with external direct current | P. 7-83 |
| 031 | 2CH | 2-step acceleration/deceleration | P. 6-58 |
| 032 | FRS | Stopping of free running | P. 7-82 |
| 033 | EXT | External abnormality | P. 8-70 |
| 034 | USP | Prevention of power restoration restarting | P. 8-71 |
| 035 | CS | Commercial switch | P. 8-81 |
| 036 | SFT | Soft-lock | P. 3-33 |
| 037 | BOK | Brake check | P. 8-85 |
| 038 | OLR | Switching of overload limit | P. 8-40 |
| 039 | KHC | Clearing of integrated input power | P. 5-15 |
| 040 | OKHC | Clearing of integrated output power | P. 5-16 |
| 041 | PID | PID1 invalidation | P. 8-18 |
| 042 | PIDC | Resetting of PID1 integration | P. 8-17 |
| 043 | PID2 | PID2 invalidation | P. 8-33 |
| 044 | PIDC2 | Resetting of PID2 integration | P. 8-33 |
| 045 | PID3 | PID3 invalidation | P. 8-33 |
| 046 | PIDC3 | Resetting of PID3 integration | P. 8-33 |
| 047 | PID4 | PID4 invalidation | P. 8-33 |
| 048 | PIDC4 | Resetting of PID4 integration | P. 8-33 |
| 051 | SVC1 | PID1 multistage target value 1 | P. 8-12 |
| 052 | SVC2 | PID1 multistage target value 2 | P. 8-12 |
| 053 | SVC3 | PID1 multistage target value 3 | P. 8-12 |
| 054 | SVC4 | PID1 multistage target value 4 | P. 8-12 |
| 055 | PRO | Switching of PID gain | P. 8-18 |
| 056 | PIO1 | Switching of PID output | P. 8-26 |

| Function No. | Abbreviation | Function name | Page |
|--------------|--------------|--|----------|
| 057 | PIO2 | Switching of PID2 output | P. 8-26 |
| 058 | SLEP | Satisfaction of SLEEP condition | P. 8-21 |
| 059 | WAKE | Satisfaction of WAKE condition | P. 8-21 |
| 060 | TL | Validation of torque limit | P. 7-48 |
| 061 | TRQ1 | Torque limit switchover 1 | P. 7-48 |
| 062 | TRQ2 | Torque limit switchover 2 | P. 7-48 |
| 063 | PPI | Switching of PPI control | P. 7-43 |
| 064 | CAS | Switching of control gain | P. 7-43 |
| 065 | SON | Servo ON | P. 8-120 |
| 066 | FOC | Auxiliary excitation | P. 7-78 |
| 067 | ATR | Validation of torque control | P. 7-56 |
| 068 | TBS | Validation of torque bias | P. 7-54 |
| 069 | ORT | Orientation | P. 8-105 |
| 071 | LAC | Cancellation of LAD | P. 6-70 |
| 072 | PCLR | Clearing of positional deviation | P. 8-99 |
| 073 | STAT | Permission to inputting of pulse string position instruction | P. 8-99 |
| 074 | PUP | Addition of positional bias | P. 8-99 |
| 075 | PDN | Subtraction of positional bias | P. 8-99 |
| 076 | CP1 | Positional instruction selection 1 | P. 8-111 |
| 077 | CP2 | Positional instruction selection 2 | P. 8-111 |
| 078 | CP3 | Positional instruction selection 3 | P. 8-111 |
| 079 | CP4 | Positional instruction selection 4 | P. 8-111 |
| 080 | ORL | Origin limit signal | P. 8-114 |
| 081 | ORG | Return-to-origin start up signal | P. 8-114 |
| 082 | FOT | Stopping of normal rotation driving | P. 8-115 |
| 083 | ROT | Stopping of reverse rotation driving | P. 8-115 |
| 084 | SPD | Switching of speed position | P. 8-112 |
| 085 | PSET | Presetting of positional data | P. 8-117 |
| 086 | Mi1 | General purpose input 1 | P. 8-154 |
| 087 | Mi2 | General purpose input 2 | P. 8-154 |
| 088 | Mi3 | General purpose input 3 | P. 8-154 |
| 089 | Mi4 | General purpose input 4 | P. 8-154 |
| 090 | Mi5 | General purpose input 5 | P. 8-154 |
| 091 | Mi6 | General purpose input 6 | P. 8-154 |
| 092 | Mi7 | General purpose input 7 | P. 8-154 |
| 093 | Mi8 | General purpose input 8 | P. 8-154 |
| 094 | MI9 | General purpose input 9 | P. 8-154 |
| 095 | MI10 | General purpose input 10 | P. 8-154 |
| 096 | MI11 | General purpose input 11 | P. 8-154 |
| 097 | PCC | Clearing of pulse counter | P. 8-167 |
| 098 | ECOM | Starting up of EzCOM | P. 9-101 |
| 099 | PRG | Starting of EzSQ program | P. 8-154 |
| 100 | HLD | Stopping of acceleration/deceleration | P. 6-66 |
| 101 | REN | Operation permission signal | P. 6-46 |
| 102 | DISP | Fixation of display | P. 3-47 |
| 103 | PLA | Pulse string input A | P. 8-167 |
| 104 | PLB | Pulse string input B | P. 8-167 |
| 105 | EMF | Emergency forced operation | P. 8-94 |
| 107 | COK | Contactork check signal | P. 8-91 |
| 109 | PLZ | Pulse string input Z | P. 8-105 |
| 110 | TCH | Teaching signal | P. 8-112 |

8-10-2 Input Terminal Selections

You can set input specifications for Contact a or Contact b separately for Input terminals 1 to 9, A, and B.



Precautions for Correct Use

Even when the "Selection of Input terminals a/b" is used, a terminal allocated with a "028 [RS] signal" always operates as Contact a (NO).

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|---|---|
| Input terminal function selection | [CA-01] to [CA-11] | Next item: Table of input terminal selections | Outputs the allocated function to the corresponding input terminal. |
| Selection of Input terminals a/b (NO/NC) | [CA-21] to [CA-31] | 00 | Operates as Contact a (NO). |
| | | 01 | Operates as Contact b (NC). |

- Contact a: Closes with "ON," and opens with "OFF."
- Contact b: Closes with "OFF," and opens with "ON."

| Input terminal | Switching between Contact a and Contact b |
|----------------|---|
| 1 | [CA-21] |
| 2 | [CA-22] |
| 3 | [CA-23] |
| 4 | [CA-24] |
| 5 | [CA-25] |
| 6 | [CA-26] |
| 7 | [CA-27] |
| 8 | [CA-28] |
| 9 | [CA-29] |
| A | [CA-30] |
| B | [CA-31] |

8-10-3 Input Terminal Response Time

You can set a response time per input terminal.

This function is effective for removing noise caused by chattering, etc.

If stable terminal input is not secured due to chattering, increase the set value. However, increasing the set value results in a slow response.

For the correspondence between input terminals and parameters, please refer to the table shown on the below.

| Input terminal | Response time |
|----------------|---------------|
| 1 | [CA-41] |
| 2 | [CA-42] |
| 3 | [CA-43] |
| 4 | [CA-44] |
| 5 | [CA-45] |
| 6 | [CA-46] |
| 7 | [CA-47] |
| 8 | [CA-48] |
| 9 | [CA-49] |
| A | [CA-50] |
| B | [CA-51] |

● Parameter

| Item | Parameter | Data | Description |
|------------------------------|---|----------------------------|-----------------------|
| Input terminal response time | [CA-41]/[CA-42]/[CA-43]/[CA-44]/ [CA-45]/[CA-46]/[CA-47]/[CA-48]/ [CA-49]/[CA-50]/[CA-51] | 0 to 400(ms) ^{*1} | Sets a response time. |

*1. When setting to 0, the operation starts about at 1 ms.

(Ex.) Operation of Input terminal 1



8-10-4 Reset

You can cancel the tripped inverter.

For resetting, press the Stop/Reset key on the LCD operator or turn on the [RS] reset terminal.

To use the reset terminal, allocate the "028 [RS] reset" to the input terminal function.

Regardless of the settings, the reset terminal is set to serve as Contact a (NO).

With the "Reset selection [CA-72]," you can select a timing for cancelling the trip with the RS terminal. You can make the "[RS] terminal" valid only at a timing for cancelling the trip in the event of an abnormality.



Precautions for Correct Use

- Do not use the "[RS] reset terminal" in order to interrupt the output of the inverter. To interrupt the output of the inverter with a signal input, use the "[FRS] free run stopping terminal" of the input terminal function.
- When a reset signal is input during retry stand-by, the operation starts with the frequency at the time of interruption kept un-cleared.

● Parameter

| Item | Parameter | Data | Description | Default data |
|--|--------------------|---|---|-----------------------------|
| Reset mode selection | [CA-72] | 00 | At ON, cancels the trip (Ex.1). At normal: Interrupts the output. At abnormal: Cancels the trip. | 00 |
| | | 01 | At OFF, cancels the trip (Ex.2). At normal: Interrupts the output. At abnormal: Cancels the trip. | |
| | | 02 | At ON, cancels the trip (Ex.1 and Ex.3). At normal: Invalid At abnormal: Cancels the trip. | |
| | | 03 | At OFF, cancels the trip (Ex.2 and Ex.4). At normal: Invalid At abnormal: Cancels the trip. | |
| Restart mode after RS release | [bb-41] | 00 | Starts with 0 Hz | 00 |
| | | 01 | Starts frequency adjustment | |
| | | 02 | Restarts frequency acquisition | |
| Input terminals 1 to 9, A, and B | [CA-01] to [CA-11] | 028 | RS: Reset function | - |
| Retry wait time before motor restart | [bb-26] | 0.3 to 100.0(s) | A stand-by time for restarting after resetting, and after an operation instruction has been given | 0.3 |
| Restart frequency threshold | [bb-42] | 0.00 to 590.00(Hz) | The lower limit frequency setting for restarting | 0.00 |
| Restart level of Active frequency matching | [bb-43] | (0.2 to 2.0) × Inverter rated current ^{*1} | The current limit level when restarting frequency acquisition | 1.0× Inverter rated current |
| Restart constant(speed) of Active frequency matching | [bb-44] | 0.10 to 30.00 (sec) | The deceleration rate at the time of frequency acquisition | 0.5 |

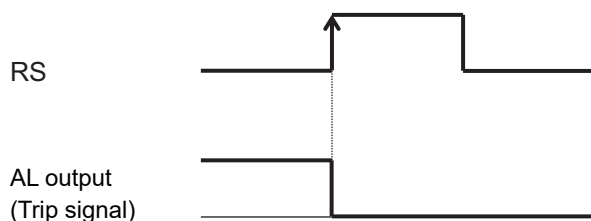
| Item | Parameter | Data | Description | Default data |
|---|-----------|---|---|-----------------------------|
| Constant (voltage) for frequency acquisition restarting | [bb-45] | 0.10 to 30.00 (sec) | The start time of frequency acquisition | 0.5 |
| Excessive current prevention level at the time of frequency acquisition | [bb-46] | (0.2 to 2.0) × Inverter rated current*1 | The limit current value setting for the excessive current prevention level at the time of frequency acquisition | 1.0× Inverter rated current |
| Start frequency selection at the time of frequency acquisition | [bb-47] | 00 | Frequency at the time of interruption | 00 |
| | | 01 | Maximum frequency | |
| | | 02 | Set frequency | |

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

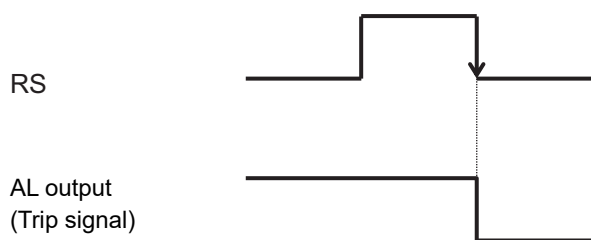
- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
- 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- 3) Drive programming: 0.01% (Rated ratio)

Examples of Resetting Operations

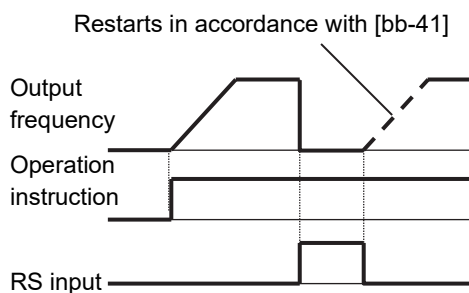
(Ex.1) Cancelling the trip at ON ([CA-72]=00,02)



(Ex.2) Cancelling the trip at OFF ([CA-72]=01,03)

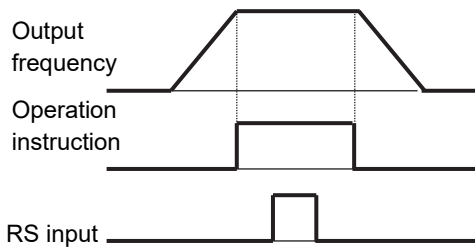


(Ex.3) Validating resetting at normal ([CA-72]=00,01)



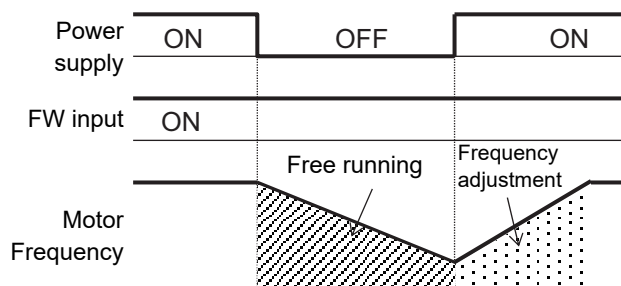
(Ex.4) Invalidating resetting at normal ([CA-72]=02,03)

Resetting is invalidated during operation.



Examples of Restarting When Resetting

(Ex.5) When frequency adjustment restarting is selected ([bb-41]=01)



In the “Reset restarting selection [bb-41],” selecting “01 (frequency adjustment restarting)” allows you to perform the frequency adjustment restarting when turning on the power supply again. When “00 (Restarting with 0 Hz)” is set, the operation starts from 0 Hz without waiting for the “Retry stand-by time for instantaneous power failure and insufficient voltage [bb-26].”

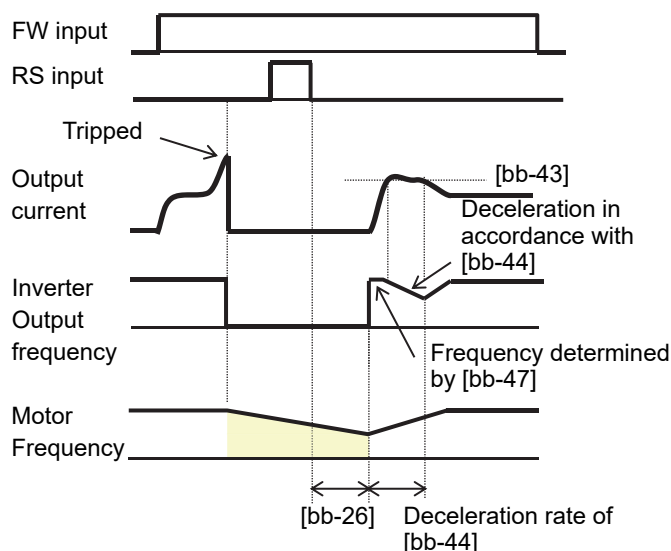


Precautions for Correct Use

Even when the frequency adjustment restarting is selected, the “Restarting with 0 Hz” occurs in the cases shown below.

- When an output frequency is 1/2 of a base frequency or below
- When the induced voltage of the motor quickly attenuates
- When the “Lower limit setting for frequency adjustment [bb-42]” is set, and a frequency equal to or below this set frequency is detected

(Ex.6) When frequency acquisition restarting is selected ([bb-41]=02)



- After the “Retry stand-by time for instantaneous power failure and insufficient voltage [bb-26]” has elapsed, the output starts at a frequency conforming to the “Constant (frequency) for frequency acquisition restarting [bb-44].” After that, during a time of the “Constant (voltage) for restarting [bb-45],” the motor speed is acquired. At that time, to reduce the output current with the “Restarting level of acquisition [bb-43],” deceleration occurs in accordance with the “Constant (frequency) for restarting [bb-44].”
- When the output current lowers below the “Restarting level of acquisition [bb-43],” acceleration starts. If a trip occurs due to an excessive current even in this method, lower the “Restarting level of acquisition [bb-43]” or the “Excessive current prevention level [bb-46].”



Precautions for Correct Use

When the “Start frequency selection [bb-47]” is set to “00 (Frequency at the time of interruption),” the operation starts at a frequency at the time of the previous interruption even when a reset signal is input during retry stand-by.

8-10-5 Analog Input

Output frequency to the following analog input (frequency command) is set.

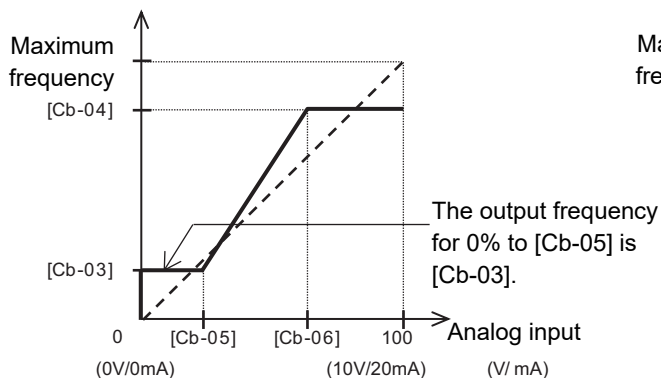
- Ai1 (0 to 10 V/0 to 20 mA)
- Ai2 (0 to 10 V/0 to 20 mA)
- Ai3 (-10 to 10 V)

Relation between Analog Input Ai1 and Frequency Command

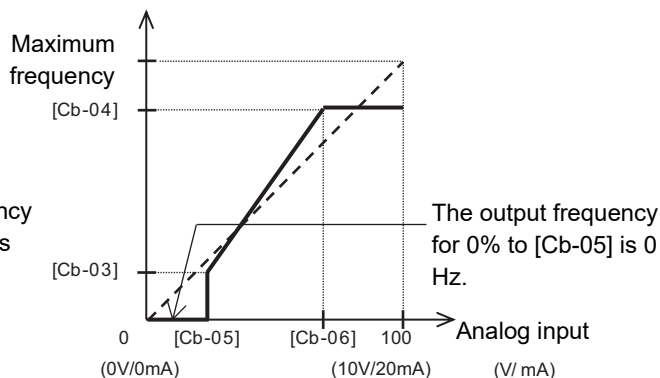
The following table is a relation between Analog Input Ai1 and Frequency Command.

| Item | Parameter | Data | Description | Default data |
|---|-----------|---------------------|--|--------------|
| Filter time constant of Terminal [Ai1] | [Cb-01] | 1 to 500(ms) | Filters the input. | 16 |
| Start value of Terminal [Ai1] | [Cb-03] | 0.00 to 100.00(%) | Sets a frequency instruction ratio when setting a start ratio for analog input. | 0.00 |
| End value of Terminal [Ai1] | [Cb-04] | 0.00 to 100.00(%) | Sets a frequency instruction ratio when setting an end ratio for analog input. | 100.00 |
| Start rate of Terminal [Ai1] | [Cb-05] | 0.0 to [Cb-06](%) | With respect to a minimum ratio for analog input for 0 to 10 V/0 to 20 mA, sets a start ratio. | 0.0 |
| End rate of Terminal [Ai1] | [Cb-06] | [Cb-05] to 100.0(%) | With respect to an external frequency instruction for 0 to 10 V, 0 to 20 mA, sets an end ratio. | 100.0 |
| Start point selection of Terminal [Ai1] | [Cb-07] | 00 | For an instruction for a value of one of 0.00% to the "Start amount [Cb-03]" and to the "End amount [Cb-04]," whichever is lower, one of the values of the "Start amount [Cb-03]" and the "End amount [Cb-04]," whichever is lower, is output. | 01 |
| | | 01 | For an instruction for a value of one of 0.00% to the "Start amount [Cb-03]" and to the "End amount [Cb-04]," whichever is lower, a value of 0.00% is output. | |

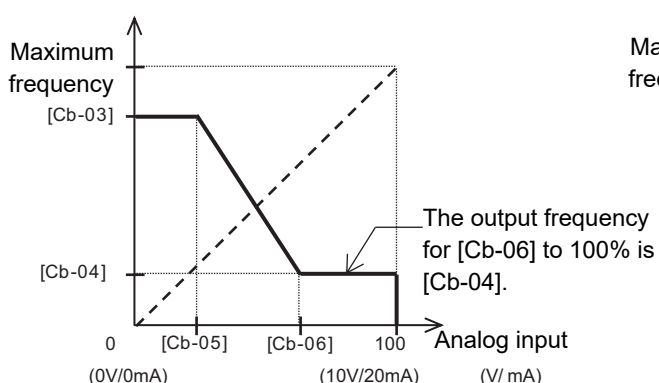
(Ex.1-1) [Cb-07]=00



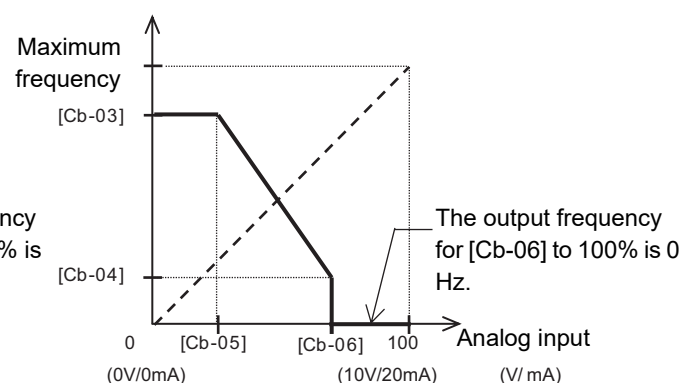
(Ex.2-1) [Cb-07]=01



(Ex.1-2) [Cb-07]=00



(Ex.2-2) [Cb-07]=01

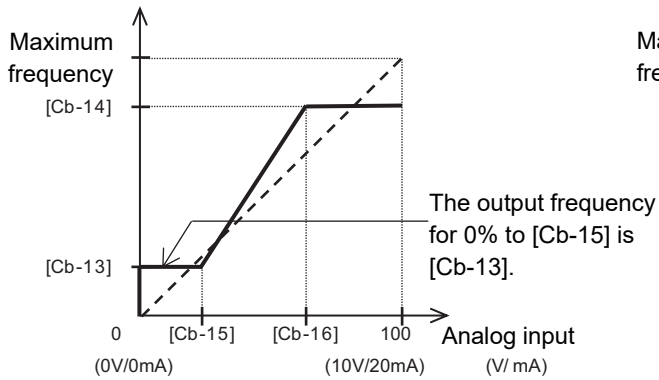


Relation between Analog Input Ai2 and Frequency Command

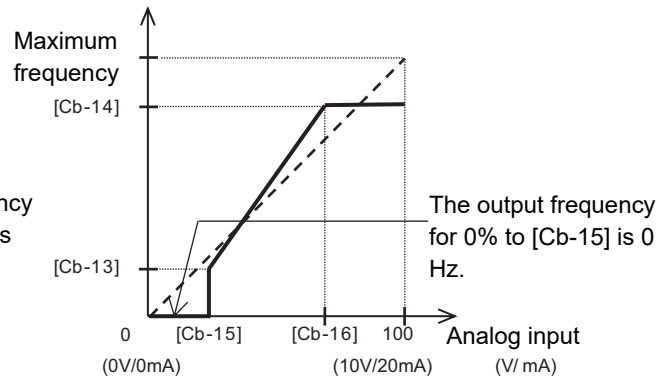
The following table is a relation between Analog Input Ai2 and Frequency Command.

| Item | Parameter | Data | Description | Default data |
|---|-----------|---------------------|--|--------------|
| Filter time constant of Terminal [Ai2] | [Cb-11] | 1 to 500(ms) | Filters the input. | 16 |
| Start value of Terminal [Ai2] | [Cb-13] | 0.00 to 100.00(%) | Sets a frequency instruction ratio when setting a start ratio for analog input. | 0.00 |
| End value of Terminal [Ai2] | [Cb-14] | 0.00 to 100.00(%) | Sets a frequency instruction ratio when setting an end ratio for analog input. | 100.00 |
| Start rate of Terminal [Ai2] | [Cb-15] | 0.0 to [Cb-16](%) | With respect to a minimum ratio for analog input for 0 to 10 V/0 to 20 mA, sets a start ratio. | 20.0 |
| End rate of Terminal [Ai2] | [Cb-16] | [Cb-17] to 100.0(%) | With respect to an external frequency instruction for 0 to 10 V, 0 to 20 mA, sets an end ratio. | 100.0 |
| Start point selection of Terminal [Ai2] | [Cb-17] | 00 | For an instruction for a value of one of 0.00% to the "Start amount [Cb-13]" and to the "End amount [Cb-14]," whichever is lower, one of the values of the "Start amount [Cb-13]" and the "End amount [Cb-14]," whichever is lower, is output. | 01 |
| | | 01 | For an instruction for a value of one of 0.00% to the "Start amount [Cb-13]" and to the "End amount [Cb-14]," whichever is lower, a value of 0.00% is output. | |

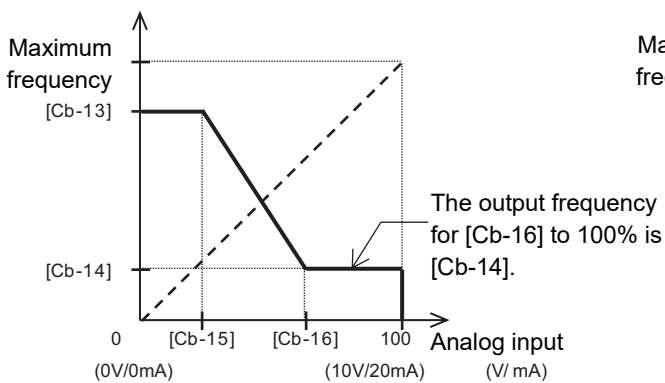
(Ex.1-1) [Cb-17]=00



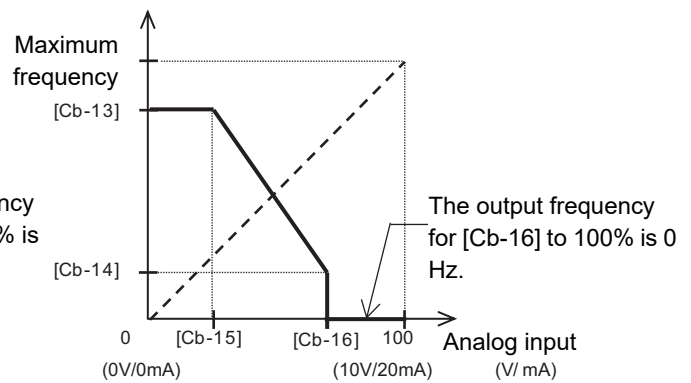
(Ex.2-1) [Cb-18]=01



(Ex.1-2) [Cb-17]=00



(Ex.2-2) [Cb-17]=01

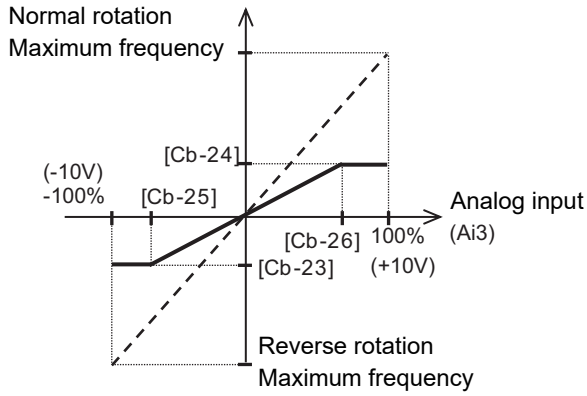


Relation between Analog Input Ai3 and Frequency Command

The following table is a relation between Analog Input Ai3 and Frequency Command.

| Item | Parameter | Data | Description | Default data |
|--|-----------|----------------------|---|--------------|
| Filter time constant of Terminal [Ai3] | [Cb-21] | 1 to 500(ms) | Filters the input. | 16 |
| Terminal [Ai3] selection | [Cb-22] | 00 | Individual | 00 |
| | | 01 | Added to [Ai1]/[Ai2], with reversibility | |
| | | 02 | Added to [Ai1]/[Ai2], without reversibility | |
| Start value of Terminal [Ai3] | [Cb-23] | -100.00 to 100.00(%) | Sets a frequency instruction ratio when setting a start ratio for analog input. | -100.00 |
| End value of Terminal [Ai3] | [Cb-24] | -100.00 to 100.00(%) | Sets a frequency instruction ratio when setting an end ratio for analog input. | 100.00 |
| Start rate of Terminal [Ai3] | [Cb-25] | -100.0 to [Cb-26](%) | With respect to a minimum ratio for analog input for -10 to 10V, sets a start ratio. | -100.00 |
| End rate of Terminal [Ai3] | [Cb-26] | [Cb-25] to 100.0(%) | With respect to an external frequency instruction for -10 to 10 V, sets an end ratio. | 100.00 |

(Ex.3)

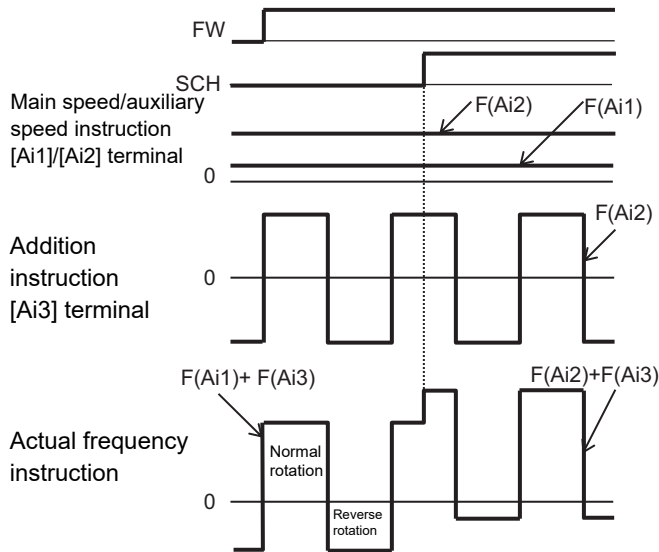


Adding Analog Input [Ai3] to [Ai1][Ai2]

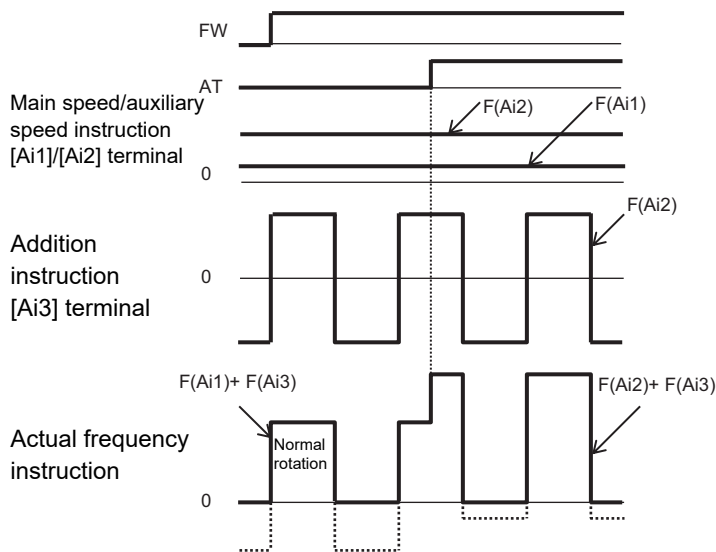
You can forcibly add an input of the [Ai3] terminal to [Ai1]/[Ai2].

You are able to make an input of ± 10 V to the [Ai3] terminal. Use [Cb-22] to select whether the output of reversibility for normal rotation or reverse rotation is possible after making an addition.

(Ex.4-1) [Cb-22]=01 (with reversibility)



(Ex.4-2) [Cb-22]=02 (without reversibility)



Analog Input Filter Settings

To give a frequency instruction with an external analog signal, you can set a sampling time for voltage input or current input.

This feature is effective for removing noise from the frequency setting circuit.

Increase the set value if noise negatively affects a stable operation. Note that the greater the set value, the lower the responsiveness. When this feature is used for a PID instruction, and a filter is set, the filter would affect the feedback, and therefore a fine operation would not be achieved.

| Item | Parameter | Data | Description | Default data |
|--|-----------|----------------|--|--------------|
| Filter time constant of Terminal [Ai1] | [Cb-01] | 1. to 500.(ms) | Sets a time constant for the input filter. | 16 |
| Filter time constant of Terminal [Ai2] | [Cb-11] | 1. to 500.(ms) | Sets a time constant for the input filter. | 16 |
| Filter time constant of Terminal [Ai3] | [Cb-21] | 1. to 500.(ms) | Sets a time constant for the input filter. | 16 |

8-10-6 Pulse Count Function

For the pulse counting function, the terminal input monitoring mode and the phase coefficient monitoring mode are available.

When the "Selection of targets for pulse string input detection [CA-90]" ranges from 00 to 02, the terminal input monitoring mode becomes valid. When [CA-90] is set to "03 (pulse count)," the phase coefficient monitoring mode becomes valid.

You can monitor the acquired pulses with the pulse counter monitor served as an accumulation counter.

By turning on [PCC] (Clearing of pulse counter), you can clear the accumulated counter value.



Precautions for Correct Use

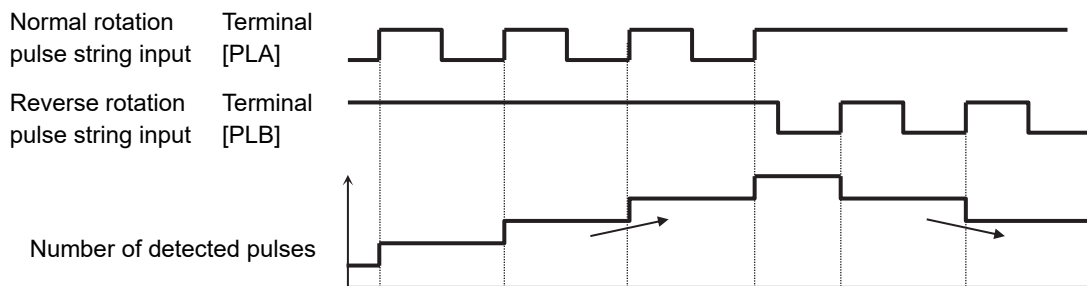
- The maximum input pulse in the phase coefficient monitoring mode becomes a maximum of 32 kpps. (When the duty ratio is approximately 50%)
- An accumulation counter value cannot be stored. After the power supply is turned on, the value becomes zero.
- The maximum input pulse in the terminal input monitoring mode depends on the settings of the input terminal response functions [CA-41] to [CA-51].

● **Parameter**

| Item | Parameter | Data | Description | Default data |
|--|--------------------|-----------------|--|--------------|
| Input terminal function | [CA-01] to [CA-11] | 103 | [PLA]: Accepts a pulse input. | - |
| | | 104 | [PLB]: Accepts a pulse input. | |
| | | 097 | [PCC]: Clears the integrated value. | |
| Output terminal function | [CC-01] to [CC-07] | 091 | [PCMP]: Outputs pulse compare-match signals. | - |
| Pulse train detection object selection | [CA-90] | 00 | Disabled | 00 |
| | | 01 | Frequency command | |
| | | 02 | Speed feedback | |
| | | 03 | Pulse count | |
| Mode selection of pulse train input | [CA-91] | 00 | 90° phase difference | 00 |
| | | 01 | forward/reverse rotation command and rotation direction | |
| | | 02 | forward/reverse rotation pulse string | |
| Comparing match output ON-level for Pulse count | [CA-97] | 0 to 65535 | When the number of pulses reaches this set value, Turn on [PCMP]. | 0 |
| Comparing match output OFF-level for Pulse count | [CA-98] | 0 to 65535 | When the number of pulses reaches this set value, Turn off [PCMP]. | 0 |
| Comparing match output Maximum value for Pulse count | [CA-99] | 0 to 65535 | A one-shot pulse can be achieved when the value is 0. When the number of pulses reaches the set value, the internal counter is cleared. | 0 |
| Pulse counter monitor | [dA-28] | 0 to 2147483647 | Displays the counter integrated value. | - |

Terminal Input Monitoring Mode

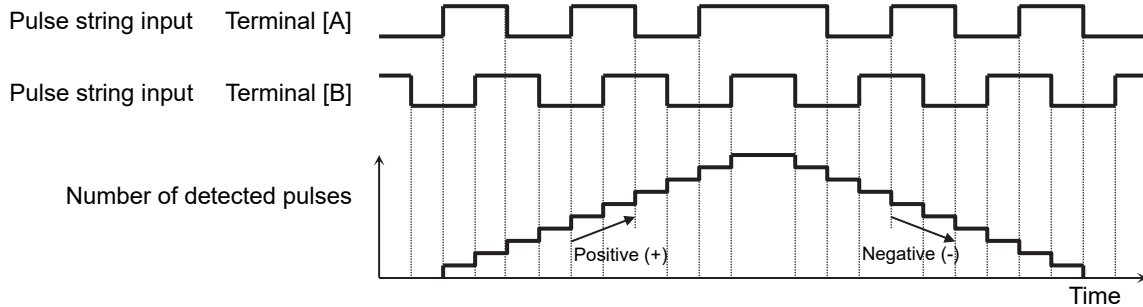
Monitors whether the input terminal functions [PLA] and [PLB] are turned on.



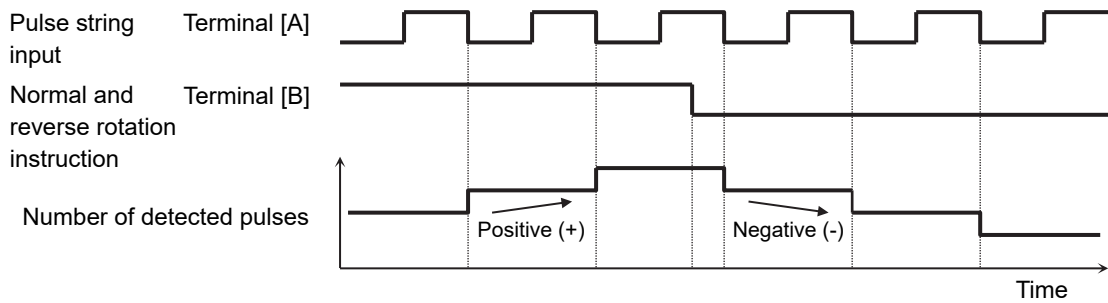
Phase Coefficient Monitoring Mode

Input terminals [A] and [B] become available for pulse string inputs.

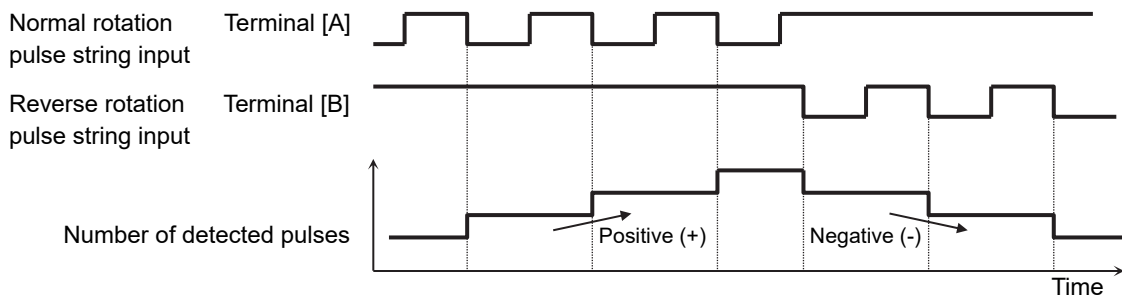
(a) Mode 0: [CA-91]=00 90° Phase difference pulse string



(b) Mode 1: [CA-91]=01 Normal and reverse rotation instruction + Pulse string



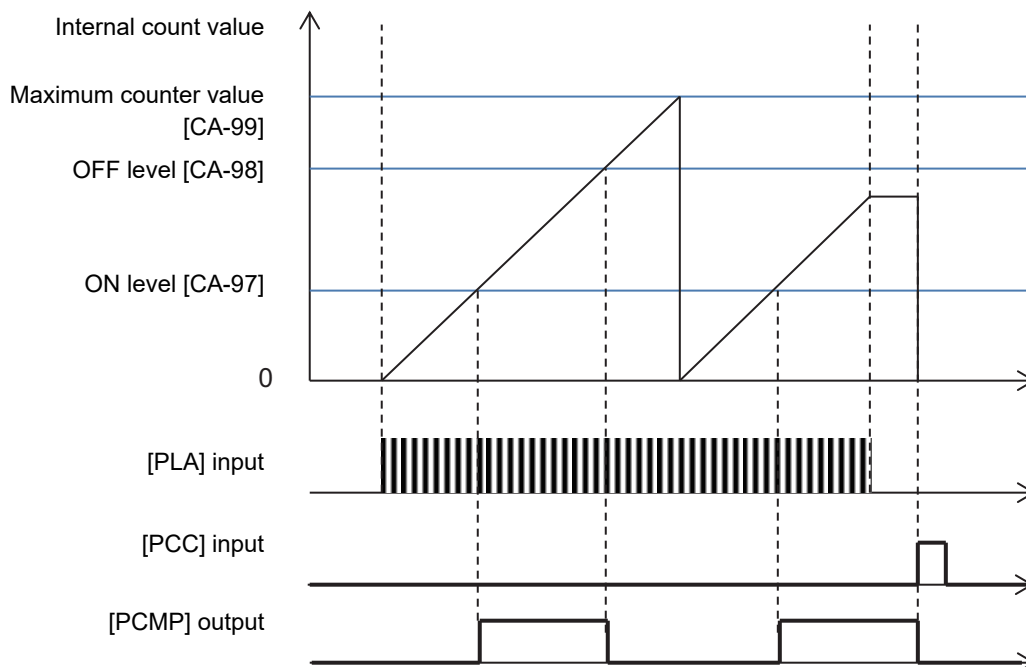
(c) Mode 2: [CA-91]=02 Normal rotation pulse string + Reverse rotation pulse string



Example of Pulse Counter Operation

The following shows how the pulse counter operates.

You can monitor the acquired pulses with the pulse counter monitor [dA-28] served as an accumulation counter.



8-10-7 Automatic Reset Function

When the “[bb-10] automatic reset selection” is set to 01, resetting is performed after the “[bb-12] automatic resetting stand-by time” has elapsed from when an operation instruction has been turned off.

When the “[bb-10] automatic reset selection” is set to 02, resetting is performed after the “[bb-12] automatic resetting stand-by time” has elapsed from when an error has occurred.

By setting the “Alarm output selection [bb-11]” to 01 while automatic resetting is valid, you can invalidate the output of the “Alarm [AL]” during automatic resetting operation.

Upon automatic resetting has been performed for the number of times set with the “[bb-13] automatic resetting count setting,” no error will be cancelled, but a trip occurs.

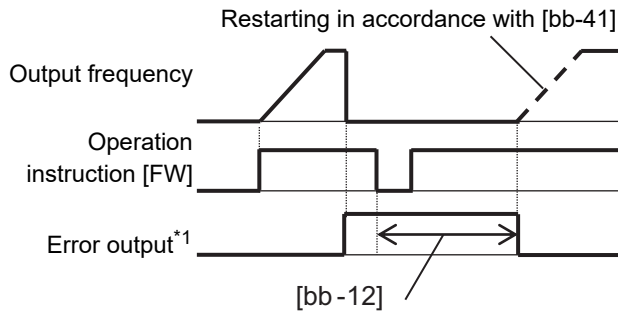


Precautions for Correct Use

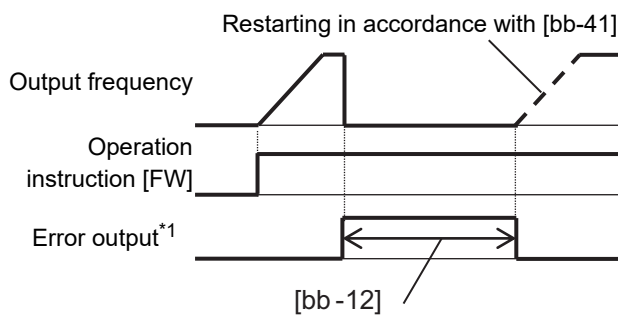
- When the “[bb-10] automatic reset selection” is set to 01, resetting starts when the STOP/RESET key is pressed as long as an instruction is given through the LCD operator.
- When resetting is performed manually, and a control power supply is turned on again, the number of automatic resetting counted internal is cleared.

The following is an example of operation of automatic resetting.

(Ex.1) When [bb-10]=01



(Ex.2) When [bb-10]=02



*1. When [bb-11]=00, the error output becomes the "[AL] output."

● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|-----------------|--|--------------|
| Automatic reset selection | [bb-10] | 00 | Invalid | 00 |
| | | 01 | Resetting starts when the operation instruction is turned off. | |
| | | 02 | Resetting starts after the set time has elapsed. | |
| Alarm signal selection at Automatic error reset is active | [bb-11] | 00 | Outputting is available. | 00 |
| | | 01 | Outputting is not available. | |
| Automatic error reset wait time | [bb-12] | 0 to 600(s) | Sets a stand-by time from when resetting starts to when actual resetting starts. | 2 |
| Automatic error reset number | [bb-13] | 0 to 10 (times) | Sets the number of automatic resetting. | 3 |

● Automatic Reset target

| Error No. | Error Name | Target |
|-----------|--|--------|
| E001 | Overcurrent error | Yes |
| E005 | Motor overload error | Yes |
| E006 | Braking resistor overload error | Yes |
| E007 | Overvoltage error | Yes |
| E008 | Memory error | |
| E009 | Undervoltage error | Yes |
| E010 | Current detector error | |
| E011 | CPU error | |
| E012 | External trip error | |
| E013 | USP error | |
| E014 | Ground fault error | |
| E015 | Incoming overvoltage error | |
| E016 | Instantaneous power failure error | Yes |
| E019 | Temperature detector error | Yes |
| E020 | Cooling fan rotation speed reduction temperature error | Yes |
| E021 | Temperature error | Yes |
| E024 | Input open-phase error | Yes |
| E030 | IGBT error | Yes |
| E034 | Output open-phase error | Yes |
| E035 | Thermistor error | |
| E036 | Brake error | Yes |
| E038 | Low-speed range overload error | Yes |
| E039 | Controller overload error | Yes |
| E040 | Operator keypad disconnection error | Yes |
| E041 | RS485 communication error | Yes |
| E042 | RTC error | Yes |
| E043 | EzSQ illegal instruction error | |
| E044 | EzSQ nest count error | |
| E045 | Executive instruction error | |
| E050 | EzSQ user-assigned error 0 | |
| E051 | EzSQ user-assigned error 1 | |
| E052 | EzSQ user-assigned error 2 | |
| E053 | EzSQ user-assigned error 3 | |
| E054 | EzSQ user-assigned error 4 | |
| E055 | EzSQ user-assigned error 5 | |
| E056 | EzSQ user-assigned error 6 | |
| E057 | EzSQ user-assigned error 7 | |
| E058 | EzSQ user-assigned error 8 | |
| E059 | EzSQ user-assigned error 9 | |
| E060 | Option 1 error 0 | Yes |
| E061 | Option 1 error 1 | Yes |
| E062 | Option 1 error 2 | Yes |
| E063 | Option 1 error 3 | Yes |

| Error No. | Error Name | Target |
|-----------|------------------------------|--------|
| E064 | Option 1 error 4 | Yes |
| E065 | Option 1 error 5 | Yes |
| E066 | Option 1 error 6 | Yes |
| E067 | Option 1 error 7 | Yes |
| E068 | Option 1 error 8 | Yes |
| E069 | Option 1 error 9 | |
| E070 | Option 2 error 0 | Yes |
| E071 | Option 2 error 1 | Yes |
| E072 | Option 2 error 2 | Yes |
| E073 | Option 2 error 3 | Yes |
| E074 | Option 2 error 4 | Yes |
| E075 | Option 2 error 5 | Yes |
| E076 | Option 2 error 6 | Yes |
| E077 | Option 2 error 7 | Yes |
| E078 | Option 2 error 8 | Yes |
| E079 | Option 2 error 9 | |
| E080 | Option 3 error 0 | Yes |
| E081 | Option 3 error 1 | Yes |
| E082 | Option 3 error 2 | Yes |
| E083 | Option 3 error 3 | Yes |
| E084 | Option 3 error 4 | Yes |
| E085 | Option 3 error 5 | Yes |
| E086 | Option 3 error 6 | Yes |
| E087 | Option 3 error 7 | Yes |
| E088 | Option 3 error 8 | Yes |
| E089 | Option 3 error 9 | |
| E090 | STO shutoff error | |
| E091 | STO internal error | |
| E092 | STO path 1 error | |
| E093 | STO path 2 error | |
| E094 | FS option internal error | |
| E095 | FS option path 1 error | |
| E096 | FS option path 2 error | |
| E097 | FS option connection error | |
| E100 | Encoder disconnection error | |
| E104 | Position control range error | Yes |
| E105 | Speed deviation error | Yes |
| E106 | Position deviation error | Yes |
| E107 | Over-speed error | Yes |
| E110 | Contact error | Yes |
| E112 | FB option connection error | |
| E120 | PID Startup error | Yes |

8-11 Output Terminal Function

8-11-1 Overview

Output terminals 11 to 15 are used for open collector output, and Relay output terminals 16 and 17 are used for relay output. Relay output 16 serves as a contact a relay, and Relay output 17 serves as a contact c relay.

For the content of an output signal, by allocating the functions that you want to output to [CC-01] to [CC-07], you will be able to allow the corresponding output terminal contacts to operate.

You can switch an output signal level with the Contacts a/b selection functions of [CC-11] to [CC-17].



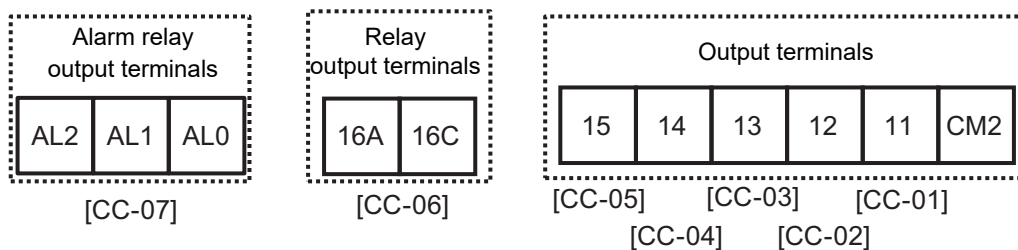
Precautions for Correct Use

To use the contact c relay, please check the control circuit power supply and the relay output terminals whether they are turned on or off.

● Parameter

| Item | Parameter | Data | Description |
|--|--------------------|--|--|
| Output terminal function selection | [CC-01] to [CC-05] | Next item: Table of output terminal selections | Outputs the allocated function to the corresponding output terminal. |
| Relay output terminal function selection | [CC-06] | | |
| Relay output terminal function selection | [CC-07] | | |
| Output terminal function selection | [CC-11] to [CC-15] | 00 | Operates as Contact a (NO). |
| Relay output terminal function selection a/b (NO/NC) selection | [CC-16] | 01 | Operates as Contact b (NC). |
| Relay output terminal function selection a/b (NO/NC) selection | [CC-17] | | |

● Terminals Corresponding to Parameters



● Output Terminal Selections

| Function No. | Abbreviation | Function name | Page |
|--------------|--------------|---------------------------------------|----------|
| 000 | no | Without allocation | - |
| 001 | RUN | During operation | P. 8-140 |
| 002 | FA1 | When the constant speed is attained | P. 8-144 |
| 003 | FA2 | Equal to or above the set frequency | P. 8-145 |
| 004 | FA3 | Set frequency only | P. 8-146 |
| 005 | FA4 | Equal to or above the set frequency 2 | P. 8-145 |
| 006 | FA5 | Set frequency only 2 | P. 8-146 |
| 007 | IRDY | Operation ready completion | P. 8-143 |
| 008 | FWR | During normal rotation operation | P. 8-141 |
| 009 | RVR | During reverse rotation operation | P. 8-141 |
| 010 | FREF | Frequency command panel | P. 6-26 |
| 011 | REF | Operation command panel | P. 6-26 |
| 012 | SETM | Second control under selection | P. 8-80 |
| 016 | OPO | Optional output | P. 8-63 |
| 017 | AL | Alarm signal | P. 8-123 |
| 018 | MJA | Severe failure signal | P. 8-125 |
| 019 | OTQ | Excessive torque | P. 7-51 |
| 020 | IP | During instantaneous power failure | P. 8-131 |
| 021 | UV | Under insufficient voltage | P. 8-132 |
| 022 | TRQ | During torque limitation | P. 7-48 |
| 023 | IPS | During power failure deceleration | P. 8-63 |
| 024 | RNT | RUN time elapsed | P. 8-137 |
| 025 | ONT | Power supply ON time elapsed | P. 8-138 |
| 026 | THM | Electronic thermal warning (motor) | P. 8-133 |
| 027 | THC | Electronic thermal warning (inverter) | P. 8-134 |
| 029 | WAC | Capacitor life advance notice | P. 8-136 |
| 030 | WAF | Fan life advance notice | P. 8-136 |
| 031 | FR | Operation command signal | P. 8-142 |
| 032 | OHF | Cooling fin heating advance notice | P. 8-135 |
| 033 | LOC | Low current signal | P. 8-129 |
| 034 | LOC2 | Low current signal 2 | P. 8-129 |
| 035 | OL | Overload advance notice | P. 8-127 |
| 036 | OL2 | Overload advance notice 2 | P. 8-127 |
| 037 | BRK | Brake release | P. 8-85 |
| 038 | BER | Brake abnormality | P. 8-85 |
| 039 | CON | Contact control | P. 8-91 |
| 040 | ZS | 0 Hz detection signal | P. 8-147 |
| 041 | DSE | Excessive speed deviation | P. 8-78 |
| 042 | PDD | Excessive positional deviation | P. 8-104 |
| 043 | POK | Positioning completed | P. 8-108 |
| 044 | PCMP | Pulse count compare-match | P. 8-167 |
| 045 | OD | PID excessive deviation | P. 8-33 |
| 046 | FBV | PID feedback comparison | P. 8-34 |
| 047 | OD2 | PID2 excessive deviation | P. 8-33 |
| 048 | FBV2 | PID2 feedback comparison | P. 8-34 |
| 049 | NDc | Communication disconnection | P. 9-2 |
| 050 | Ai1Dc | Analog disconnection Ai1 | P. 8-148 |
| 051 | Ai2Dc | Analog disconnection Ai2 | P. 8-148 |
| 052 | Ai3Dc | Analog disconnection Ai3 | P. 8-148 |
| 056 | WCAi1 | Window comparator Ai1 | P. 8-148 |
| 057 | WCAi2 | Window comparator Ai2 | P. 8-148 |
| 058 | WCAi3 | Window comparator Ai3 | P. 8-148 |

| Function No. | Abbreviation | Function name | Page |
|--------------|--------------|-------------------------------------|----------|
| 062 | LOG1 | Result of logical operation 1 | P. 8-151 |
| 063 | LOG2 | Result of logical operation 2 | P. 8-151 |
| 064 | LOG3 | Result of logical operation 3 | P. 8-151 |
| 065 | LOG4 | Result of logical operation 4 | P. 8-151 |
| 066 | LOG5 | Result of logical operation 5 | P. 8-151 |
| 067 | LOG6 | Result of logical operation 6 | P. 8-151 |
| 068 | LOG7 | Result of logical operation 7 | P. 8-151 |
| 069 | MO1 | General purpose output 1 | P. 8-173 |
| 070 | MO2 | General purpose output 2 | P. 8-173 |
| 071 | MO3 | General purpose output 3 | P. 8-173 |
| 072 | MO4 | General purpose output 4 | P. 8-173 |
| 073 | MO5 | General purpose output 5 | P. 8-173 |
| 074 | MO6 | General purpose output 6 | P. 8-173 |
| 075 | MO7 | General purpose output 7 | P. 8-173 |
| 076 | EMFC | During-Em-Force signal | P. 8-94 |
| 077 | EMBP | During-bypass-mode signal | P. 8-96 |
| 080 | LBK | Flat battery of LCD operator | P. 3-48 |
| 081 | OVS | Excessive voltage of accepted power | P. 8-139 |
| 084 | AC0 | Alarm code bit 0 | P. 8-126 |
| 085 | AC1 | Alarm code bit 1 | P. 8-126 |
| 086 | AC2 | Alarm code bit 2 | P. 8-126 |
| 087 | AC3 | Alarm code bit 3 | P. 8-126 |
| 089 | OD3 | PID3 excessive deviation | P. 8-33 |
| 090 | FBV3 | PID3 feedback comparison | P. 8-34 |
| 091 | OD4 | PID4 excessive deviation | P. 8-33 |
| 092 | FBV4 | PID4 feedback comparison | P. 8-34 |
| 093 | SSE | PID soft start abnormality | P. 8-20 |

8-11-2 Output Terminal NO/NC Selections

You can set output specifications for Contact a or Contact b separately for Output terminals 11 to 15 and Relay output terminals 16 and 17.

● Parameter

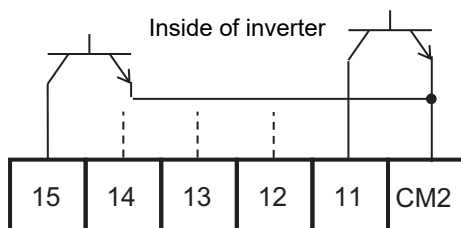
| Item | Parameter | Data | Description |
|--|--------------------|--------|--|
| Output terminal function selection | [CC-11] to [CC-15] | 00, 01 | 00: Contact a (normally open) operation 01: Contact b (normally closed) operation |
| Relay output terminal function selection a/b (NO/NC) selection | [CC-16] | | |
| Relay output terminal function selection a/b (NO/NC) selection | [CC-17] | | |

- Contact a: Closes with “ON,” and opens with “OFF.”
- Contact b: Closes with “OFF,” and opens with “ON.”

Open Collector Output Terminals

The specifications of Output terminals 11 to 15 are as shown below. The same specifications are applied.

| | Electrical characteristics |
|--------------------------|--|
| Terminals (11 to 15)-CM2 | Voltage drop at ON: 4 V or below Allowable maximum voltage: DC 27 V Allowable maximum current: 50 mA |

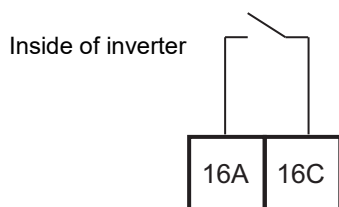


The open collector output operation is as shown below.

| [CC-11] to [CC-15] | Control power supply | Output of inverter function | Open collector operation |
|--------------------|----------------------|-----------------------------|--------------------------|
| 00 (Contact a) | On | ON | Close |
| | | OFF | Open |
| | Off | - | - |
| 01 (Contact b) | On | ON | Open |
| | | OFF | Close |
| | Off | - | - |

Relay 1a Output Terminals

The specifications of Relay 1a output terminals 16A to 16C are as shown below.



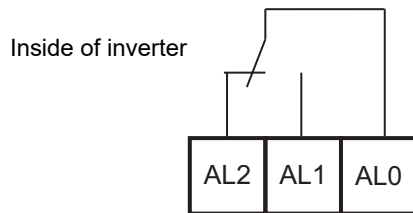
| | Electrical characteristics |
|---------|--|
| 16A-16C | Voltage drop at ON: 4 V or below Allowable maximum voltage: DC 27 V Allowable maximum current: 50 mA |

The operations of 16A to 16C are as shown below.

| [CC-16] | Control power supply | Output of inverter function | Relay operation |
|-------------------|----------------------|-----------------------------|-----------------|
| 00 (Contact a) | On | ON | Close |
| | | OFF | Open |
| | Off | - | Open |
| 01 (Contact b) | On | ON | Open |
| | | OFF | Close |
| | Off | - | Open |

Relay 1c Output Terminals

The specification of Relay 1c output terminals AL1 to AL0/AL2 to AL0 are as shown below.



| | | Resistance load | Induced load |
|---------|--------------------------|-----------------------------|-----------------------------|
| AL1-AL0 | Maximum contact capacity | AC250V, 2A DC30V, 3A | AC250V, 0.2A DC30V, 0.6A |
| | Minimum contact capacity | AC100V, 10mA DC5V, 100mA | |
| AL2-AL0 | Maximum contact capacity | AC250V, 1A DC30V, 1A | AC250V, 0.2A DC30V, 0.2A |
| | Minimum contact capacity | AC100V, 10mA DC5V, 100mA | |

- The operations of AL1 to AL0/AL2 to AL0 are as shown below.

| [CC-17] | Control power supply | Output of inverter function | Output terminal state | |
|-----------------------|----------------------|-----------------------------|-----------------------|---------|
| | | | AL1-AL0 | AL2-AL0 |
| 00 | On | ON | Close | Open |
| | | OFF | Open | Close |
| | Off | - | Open | Close |
| 01 (Initial value) | On | ON | Open | Close |
| | | OFF | Close | Open |
| | Off | - | Open | Close |

8-11-3 Output Terminal ON Delay/OFF Delay

You can set an on-delay/off-delay time per output terminal.

You can make a setting per output terminal. For the correspondence between output terminals and parameters, please refer to the table shown on the below.



Precautions for Correct Use

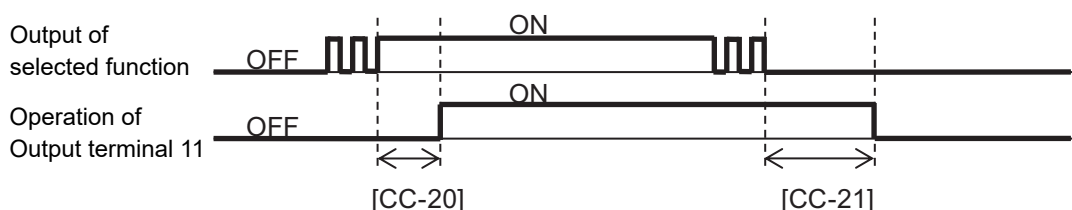
All output signals immediately turn ON/OFF upon a condition is satisfied. Chattering could occur depending on a selected signal. This function is available for retaining/delaying such a signal.

| Output terminals | On-delay time | Off-delay time |
|------------------|---------------|----------------|
| 11 | [CC-20] | [CC-21] |
| 12 | [CC-22] | [CC-23] |
| 13 | [CC-24] | [CC-25] |
| 14 | [CC-26] | [CC-27] |
| 15 | [CC-28] | [CC-29] |
| 16A-16C | [CC-30] | [CC-31] |
| AL1-AL0/AL2-AL0 | [CC-32] | [CC-33] |

● Parameter

| Item | Parameter | Data | Description |
|-----------------------|---|-------------------|-------------------------|
| Output on-delay time | [CC-20]/[CC-22]/[CC-24]/ [CC-26]/[CC-28]/[CC-30]/ [CC-32] | 0.00 to 100.00(s) | Sets an on-delay time. |
| Output off-delay time | [CC-21]/[CC-23]/[CC-25]/ [CC-27]/[CC-29]/[CC-31]/ [CC-33] | 0.00 to 100.00(s) | Sets an off-delay time. |

(Ex.) Operation of Output terminal 11



8-11-4 Analog Output Terminal Adjustment

You can select, using some parameter codes, data to be output to the Analog output Ao1-L and Ao2-L terminals and the Digital pulse output FM-CM1 terminal.

Selectable Parameter Codes

The below table shows selectable parameter codes.

The output scale ranges are specified when bias settings are each set to 0.0%, and gain settings are each set to 100.0%.

You can adjust the output scale ranges with bias settings and gain settings.

Using the bias function, you can output, from data that can output “(±) data,” “(-) data” in a range from which outputting is available.

When selecting the output monitor, set the registered number of each code. For example, when using dA-02 of output current monitor via [Ao1] terminal, set “10002(2712h)” to Cd-04.

| Code | Name | Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA / 0 to 100%) | Remarks |
|-------|--------------------------------------|--|----------------------------------|
| dA-01 | Output frequency monitor | 0.00 to Maximum speed (Hz) | |
| dA-02 | Output current monitor | (0.00 to 2.00) × Inverter rated current (A) | |
| dA-04 | Frequency command | 0.00 to Maximum speed (Hz) | Outputting is possible with (±). |
| dA-08 | Detected speed value monitor | 0.00 to Maximum speed (Hz) | Outputting is possible with (±). |
| dA-12 | Output frequency monitor (with sign) | 0.00 to Maximum speed (Hz) | Outputting is possible with (±). |
| dA-14 | Frequency upper limit monitor | 0.00 to Maximum speed (Hz) | |
| dA-15 | Torque command monitor | 0 to Motor rated torque × 500% (Nm) ^{*1} | Outputting is possible with (±). |
| dA-16 | Torque limit monitor | 0 to Motor rated torque × 500% (Nm) ^{*1} | Outputting is possible with (±). |
| dA-17 | Output torque monitor | 0 to Motor rated torque × 500% (Nm) ^{*1} | Outputting is possible with (±). |

| Code | Name | Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA / 0 to 100%) | Remarks |
|-------|---|--|--|
| dA-18 | Output voltage monitor | 0 to Rated voltage × 133% (V) | |
| dA-30 | Input power monitor | 0.00 to Rated power × 200% (kW) | |
| dA-34 | Output power monitor | 0.00 to Rated power × 200% (kW) | Outputting is possible with (±). Outputting with (+) at powered state and with (-) at regenerative state. |
| dA-38 | Motor temperature monitor | -20.0 to 200.0(°C) | |
| dA-40 | DC voltage monitor | (200 V class) 0.0 to 400.0 (Vdc) (400 V class) 0.0 to 800.0 (Vdc) | |
| dA-41 | Braking circuit (BRD) duty ratio monitor | 0.00 to 100.00(%) | |
| dA-42 | Electronic thermal duty ratio monitor (motor) | 0.00 to 100.00(%) | |
| dA-43 | Electronic thermal duty ratio monitor (inverter) | 0.00 to 100.00(%) | |
| dA-61 | Analog input [Ai1] monitor | 0.00 to 100.00(%) | |
| dA-62 | Analog input [Ai2] monitor | 0.00 to 100.00(%) | |
| dA-63 | Analog input [Ai3] monitor | -100.00 to 100.00(%) | Outputting is possible with (±). |
| dA-70 | Pulse string input monitor (main body) | -100.00 to 100.00(%) | Outputting is possible with (±). |
| dA-71 | Pulse string input monitor (option) | -100.00 to 100.00(%) | Outputting is possible with (±). |

*1. To calculate the motor rated torque (100%), use the following formula.

Motor rated torque = 79.58 × Motor capacity × Number of poles/Base frequency

Example: Motor rated torque = 79.58 × 5.5 (kW) × 4 (P)/50 (Hz) ≈ 35 Nm



Precautions for Correct Use

Data with (±) will be applied to [FM], [Ao1], and [Ao2] when [Cd-12], [Cd-22], and [Cd-32] are 01, respectively. If [Cd-12], [Cd-22], and [Cd-32] are 00, respectively, data with (-) is output as the absolute value with (+).

| Code | Name | Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA / 0 to 100%) | Remarks |
|-------|------------------------------|--|----------------------------------|
| db-18 | Analog output monitor YA1 | 0.00 to 10000 | |
| db-19 | Analog output monitor YA2 | 0.00 to 10000 | |
| db-20 | Analog output monitor YA3 | 0.00 to 10000 | |
| db-21 | Analog output monitor YA4 | 0.00 to 10000 | |
| db-22 | Analog output monitor YA5 | 0.00 to 10000 | |
| db-23 | Analog output monitor YA6 | 0.00 to 10000 | |
| db-30 | PID1 feedback data 1 monitor | -100.00 to 100.00(%) ^{*1} | Outputting is possible with (±). |
| db-32 | PID1 feedback data 2 monitor | -100.00 to 100.00(%) ^{*1} | Outputting is possible with (±). |
| db-34 | PID1 feedback data 3 monitor | -100.00 to 100.00(%) ^{*1} | Outputting is possible with (±). |
| db-36 | PID2 feedback data monitor | -100.00 to 100.00(%) ^{*2} | Outputting is possible with (±). |
| db-38 | PID3 feedback data monitor | -100.00 to 100.00(%) ^{*3} | Outputting is possible with (±). |
| db-40 | PID4 feedback data monitor | -100.00 to 100.00(%) ^{*4} | Outputting is possible with (±). |
| db-42 | PID1 target value monitor | -100.00 to 100.00(%) ^{*1} | Outputting is possible with (±). |

| Code | Name | Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA / 0 to 100%) | Remarks |
|-------|---------------------------------|--|----------------------------------|
| db-44 | PID1 feedback data monitor | -100.00 to 100.00(%) ^{*1} | Outputting is possible with (±). |
| db-50 | PID1 output monitor | -100.00 to 100.00(%) | Outputting is possible with (±). |
| db-51 | PID1 deviation monitor | -200.00 to 200.00(%) | Outputting is possible with (±). |
| db-52 | PID1 deviation 1 monitor | -200.00 to 200.00(%) | Outputting is possible with (±). |
| db-53 | PID1 deviation 2 monitor | -200.00 to 200.00(%) | Outputting is possible with (±). |
| db-54 | PID1 deviation 3 monitor | -200.00 to 200.00(%) | Outputting is possible with (±). |
| db-55 | PID2 output monitor | -100.00 to 100.00(%) | Outputting is possible with (±). |
| db-56 | PID2 deviation monitor | -200.00 to 200.00(%) | Outputting is possible with (±). |
| db-57 | PID3 output monitor | -100.00 to 100.00(%) | Outputting is possible with (±). |
| db-58 | PID3 deviation monitor | -200.00 to 200.00(%) | Outputting is possible with (±). |
| db-59 | PID4 output monitor | -100.00 to 100.00(%) | Outputting is possible with (±). |
| db-60 | PID4 deviation monitor | -200.00 to 200.00(%) | Outputting is possible with (±). |
| db-64 | PID feedforward monitor | 0.00 to 100.00(%) | |
| dC-15 | Cooling fin temperature monitor | -20.0 to 200.0(°C) | |

*1. Data range varies depending on the data from [AH-04] to [AH-06].

*2. Data range varies depending on the data from [AJ-04] to [AJ-06].

*3. Data range varies depending on the data from [AJ-24] to [AJ-26].

*4. Data range varies depending on the data from [AJ-44] to [AJ-46].

| Code | Name | Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA / 0 to 100%) | Remarks |
|-------|---------------------------------|--|----------------------------------|
| FA-01 | Main speed command monitor | 0.00 to 590.00(Hz) | |
| FA-02 | Auxiliary speed command monitor | 0.00 to 590.00(Hz) | |
| FA-15 | Torque command monitor | Motor rated torque × (-500.0 to 500.0(%) ^{*1} | Outputting is possible with (±). |
| FA-16 | Torque bias command monitor | Motor rated torque × (-500.0 to 500.0(%) ^{*1} | Outputting is possible with (±). |
| FA-30 | PID1 target value 1 | 0.00 to 100.00(%) ^{*2} | |
| FA-32 | PID1 target value 2 | 0.00 to 100.00(%) ^{*2} | |
| FA-34 | PID1 target value 3 | 0.00 to 100.00(%) ^{*2} | |
| FA-36 | PID2 target value | 0.00 to 100.00(%) ^{*3} | |
| FA-38 | PID3 target value | 0.00 to 100.00(%) ^{*4} | |
| FA-40 | PID4 target value | 0.00 to 100.00(%) ^{*5} | |

*1. To calculate the motor rated torque (100%), use the following formula.

Motor rated torque = 79.58 × Motor capacity × Number of poles/Base frequency

Example: Motor rated torque = 79.58 × 5.5 (kW) × 4 (P)/50 (Hz) ≈ 35 Nm

*2. Data range varies depending on the data from [AH-04] to [AH-06].

*3. Data range varies depending on the data from [AJ-04] to [AJ-06].

*4. Data range varies depending on the data from [AJ-24] to [AJ-26].

*5. Data range varies depending on the data from [AJ-44] to [AJ-46].

8-11-5 Analog Output Terminal Switch Settings

With Analog output terminals Ao1 and Ao2, you can select voltage output or current output by operating Switches SW3 and SW4 on the substrate.



Precautions for Correct Use

- In the switch setting on the substrate during factory setting, [A01] is output voltage; [A02] is output current.
- Operate the switches on the substrate while the inverter power supply is turned off.
- When [Cd-10]=01 is set, [FM], [Ao1], and [Ao2] respectively perform outputs in accordance with values of [Cd-15], [Cd-25], and [Cd-35].

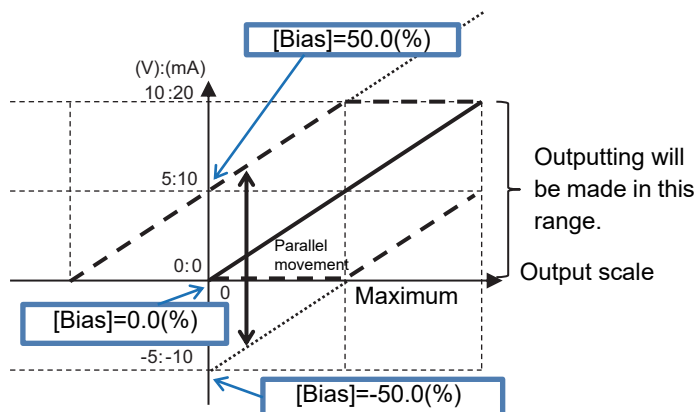
● Parameter

| Item | Parameter | Data | Description | Default data |
|---|-----------|--|--|--------------|
| [Ao1] monitor output selection | [Cd-04] | Parameter number for 8-11-4 Analog Output Terminal Adjustment on page 8-178. | Sets a parameter number. | [dA-01] |
| [Ao2] monitor output selection | [Cd-05] | | | [dA-01] |
| Analog monitor adjust mode enable | [Cd-10] | 00 | Invalid. | 00 |
| | | 01 | Valid. Outputs to terminals output levels in the adjustment mode. | |
| Filter time constant of [Ao1] monitor | [Cd-21] | 1 to 500[ms] | Filters and outputs the selected data. | 100 |
| [Ao1] Data type selection | [Cd-22] | 00 | Outputs the absolute value of data. | 00 |
| | | 01 | Outputs data with a symbol as is. | |
| [Ao1] monitor bias adjustment | [Cd-23] | -100.0 to 100.0[%] | Biases data to adjust Point 0 of data. | 0.0 |
| [Ao1] monitor gain adjustment | [Cd-24] | -1000.0 to 1000.0[%] | Apply a gain to data to adjust an inclination in data. | 100.0 |
| Output level setting at [Ao1] monitor adjust mode | [Cd-25] | -100.0 to 100.0[%] | Sets output in the adjustment mode. It selects the maximum output (at 100.0%), the minimum output (at 0.0%) ([Cd-22]=00), or the minimum output (at -100.0%) ([Cd-22]=01). | 100.0 |
| Filter time constant of [Ao2] monitor | [Cd-31] | 1 to 500[ms] | Filters and outputs the selected data. | 100 |
| [Ao2] Data type selection | [Cd-32] | 00 | Outputs the absolute value of data. | 0 |
| | | 01 | Outputs data with a symbol as is. | |
| [Ao2] monitor bias adjustment | [Cd-33] | -100.0 to 100.0[%] | Biases data to adjust Point 0 of data. | 20.0 |
| [Ao2] monitor gain adjustment | [Cd-34] | -1000.0 to 1000.0[%] | Apply a gain to data to adjust an inclination in data. | 80.0 |
| Output level setting at [Ao2] monitor adjust mode | [Cd-35] | -100.0 to 100.0[%] | Sets output in the adjustment mode. It selects the maximum output (at 100.0%), the minimum output (at 0.0%) ([Cd-32]=00), or the minimum output (at -100.0%) ([Cd-32]=01). | 100.0 |

Bias Adjustment of Analog Output

| Terminal | Current/voltage | Bias parameter |
|----------|---------------------------|----------------|
| Ao1 | Common to voltage/current | [Cd-23] |
| Ao2 | Common to voltage/current | [Cd-33] |

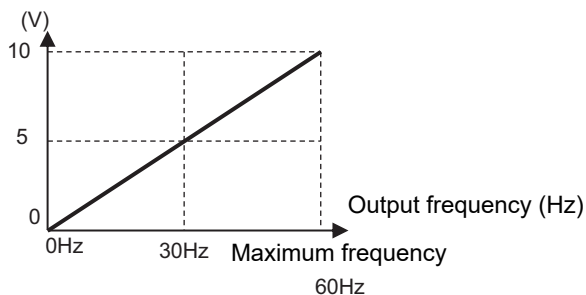
You can bias Point 0 as shown in the below figure.



(Ex.) Outputting information on the “[dA-01] output frequency monitor” to [Ao1] in a voltage range from 0 to 10 V

Output in a range from 0 Hz to the maximum frequency (60 Hz).

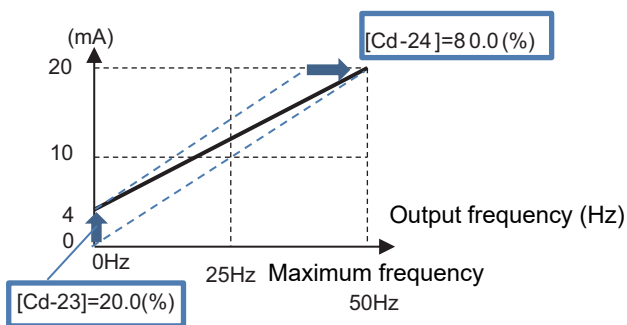
[Cd-23]=0.0%, [Cd-24]=100.0%



(Ex.) Outputting information on the output frequency monitor to [Ao1] in a current range from 4 to 20 mA

Output in a range from 0 Hz to the maximum frequency (50 Hz).

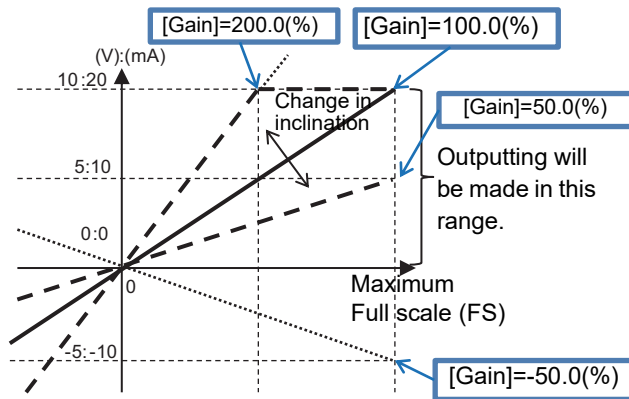
[Cd-23]=20.0%, [Cd-24]=80.0%



Gain Adjustment of Analog Output

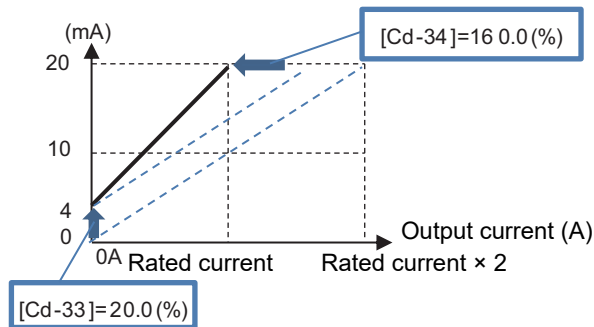
| Terminal | Current/voltage | Gain parameter |
|----------|---------------------------|----------------|
| Ao1 | Common to voltage/current | [Cd-24] |
| Ao2 | Common to voltage/current | [Cd-34] |

You can change an inclination as shown in the below figure.



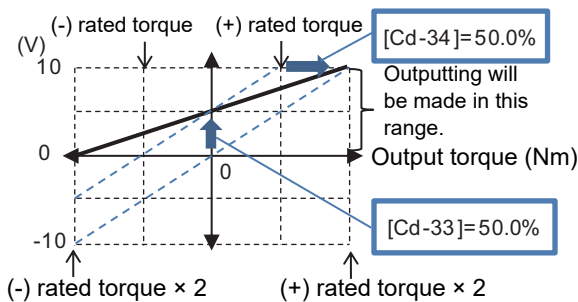
(Ex.) Outputting information on the output current monitor to [Ao2] in a current range from 4 to 20 mA
 Monitor the current in a range from 0 A to the inverter rated current.

[Cd-33]=20.0%, [Cd-34]=160.0%



(Ex.) Outputting information on the output torque monitor to [Ao2] in a voltage range from 0 to 10 V
 Set a voltage output range from 0 to 10 V in a torque range from -200 to 200%.

[Cd-32]=01, [Cd-33]=50.0%, [Cd-34]=50.0%



Note When [Cd-32]=00 is set in the above described example, corresponding values in a range from 5 to 10 V will be output for a range from 0 to -200% on the “(-) rated torque” side.

Analog Monitor Adjustment Mode: [Ao1] and [Ao2] Output

Setting the analog monitor adjustment mode [Cd-10] to 01 fixes the outputs of the [Ao1] and [Ao2] output terminals.

With the output fixed with [Ao1], an output set with [Cd-25] is made for the full-scale value of the monitor selected with [Cd-04].

With the output fixed with [Ao2], an output set with [Cd-35] is made for the full-scale value of the monitor selected with [Cd-05].

(Ex.) Outputting from [Ao1] information on the output current monitor in a range from 4 to 20 mA

I want to perform outputting in a range from 4 to 20 mA when a current ranging from 0 A to a current value of Inverter rated current \times 2 flows.

(The standard points are a current in a range from 0 A to a current value of Inverter rated current \times 2)

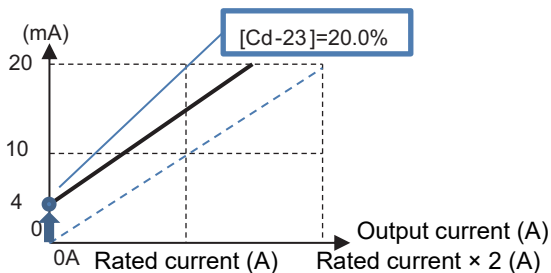
| Code | Name | Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA) |
|-------|------------------------|--|
| dA-02 | Output current monitor | (0.00 to 2.00) \times Inverter rated current (A) |

- 1 Check that [SW3] on the substrate is set to a current of 20 mA, and then turn on the power supply.

Set [Cd-04]=[dA-02]. Setting [Cd-10] to 01 and [Cd-25] to 0.0% sets the output from the [Ao1] terminal to 0 mA.

- 2 When the standard point you want to output is 0 A, and when you want to output 4 mA from [Ao1], adjust [Cd-23] to approximately 20.0%, and check if 4 mA is output.

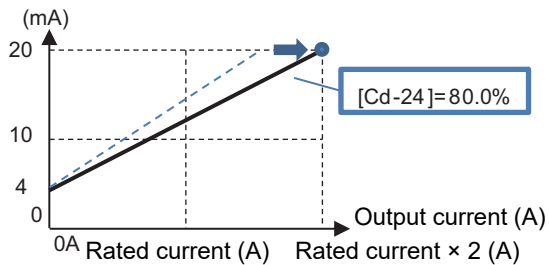
(For example, see and wait with a range from 15.0% to 25.0%.)



- 3 Setting [Cd-25] to 100.0% sets the output from the [Ao2] terminal to approximately 20 mA.

- 4** Adjust the inclination with [Cd-24]. Change [Cd-24] to make an adjustment immediately before the point at which [Ao2] begins lowering from 20 mA.
(For example, see and wait with a range from 75.0 to 85.0%.)

[Cd-23]=20.0%, [Cd-24]=80.0%



- 5** Returning [Cd-10] to 00 starts current output of [Ao1] that is adjusted.

8-11-6 Output Functions (FM)

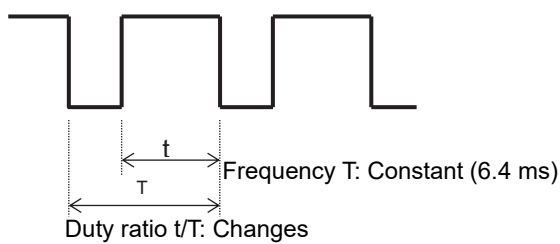
With the FM output function, you can make selections from the PWM output in which a duty ratio changes and the digital frequency output in which a frequency changes.



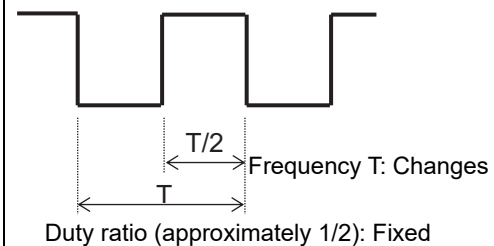
Precautions for Correct Use

- The finally determined output does not exceed an output range of the [FM] output terminal.
- When [Cd-10]=01 is set, [FM], [Ao1], and [Ao2] respectively perform outputs in accordance with the values of [Cd-15], [Cd-25], and [Cd-35].

(Ex.1) [Cd-01]=00 PWM output



(Ex.2) [Cd-01]=01 Digital frequency output



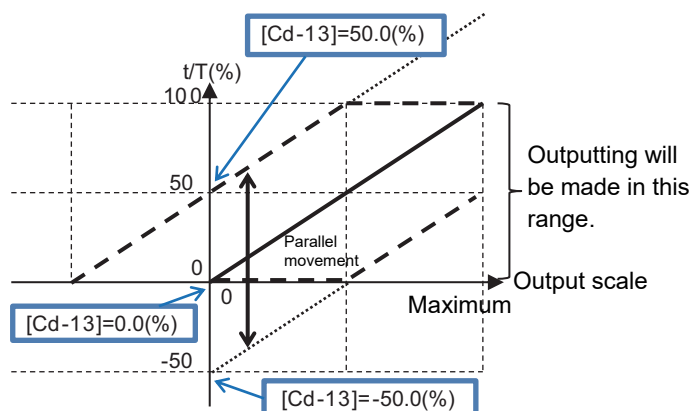
● Parameter

When selecting the output monitor, set the registered number of each code. For example, when using dA-02 of output current monitor via [FM] output terminal, set “10002(2712h)” to [Cd-03].

| Item | Parameter | Data | Description | Default data |
|--|-----------|--|--|--------------|
| [FM] monitor output wave form selection | [Cd-01] | 00 | PWM output (Frequency: 6.4 ms) | 00 |
| | | 01 | Digital frequency output | |
| [FM] monitor output base frequency (at PWM output) | [Cd-02] | 0 to 3600[Hz] | [FM] terminal output frequency in the full scale. | 2880 |
| [FM] monitor output selection | [Cd-03] | Parameter number for 8-11-4 Analog Output Terminal Adjustment on page 8-178. | Sets a parameter number. | [dA-01] |
| Analog monitor adjust mode enable | [Cd-10] | 00 | Invalid. | 00 |
| | | 01 | Valid. Outputs to terminals output levels in the adjustment mode. | |
| Filter time constant of [FM] monitor | [Cd-11] | 1 to 500[ms] | Filters FM output data. | 100 |
| [FM] Data type selection | [Cd-12] | 00 | Outputs the absolute value of data. | 00 |
| | | 01 | Outputs data with a symbol. | |
| [FM] monitor bias adjustment | [Cd-13] | -100.0 to 100.0[%] | Biases data to adjust Point 0 of data. | 0.0 |
| [FM] monitor gain adjustment | [Cd-14] | -1000.0 to 1000.0[%] | Apply a gain to data to adjust an inclination in data. | 100.0 |
| Output level setting at [FM] monitor adjust mode | [Cd-15] | -100.0 to 100.0[%] | Sets output in the adjustment mode. It selects the maximum output (at 100.0%), the minimum output (at 0.0%) ([Cd-12]=00), or the minimum output (at -100.0%) ([Cd-12]=01). | 100.0 |

[Cd-01] [FM] Terminal Output Form Selection is Set to 00

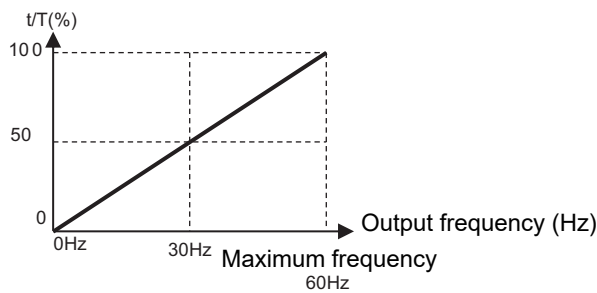
With the “Bias adjustment [Cd-13]” of the “PWM output,” you can bias Point 0 as shown in the below figure.



(Ex.) PWM-outputting [dA-01] output frequency monitor

Output until a current reaches the maximum frequency when the PWM output is 100%.

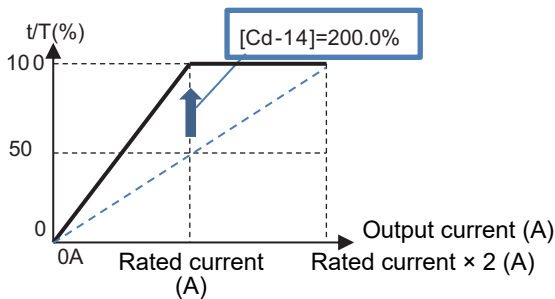
[Cd-13]=0.0%, [Cd-14]=100.0%



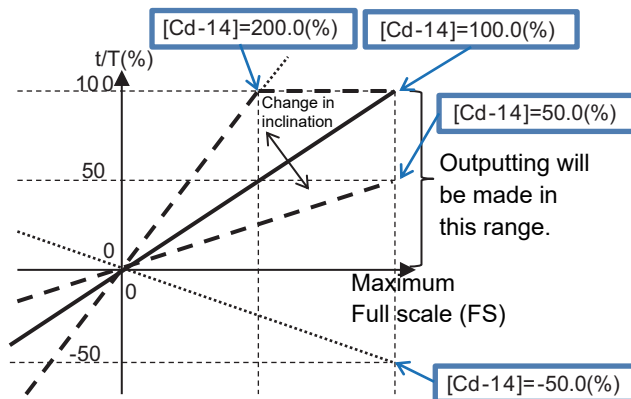
(Ex.) PWM-outputting [dA-02] output current monitor

Output until a current reaches the inverter rated current when the PWM output is 100%.

[Cd-13]=0.0%, [Cd-14]=200.0%



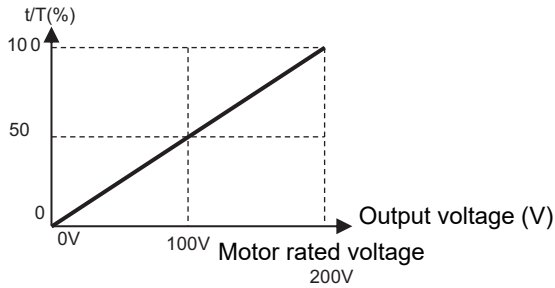
With the “Gain adjustment [Cd-14]” of the “PWM output,” you can change an inclination as shown in the below figure.



(Ex.) PWM-outputting [dA-18] output voltage monitor

Monitoring of Output Voltage

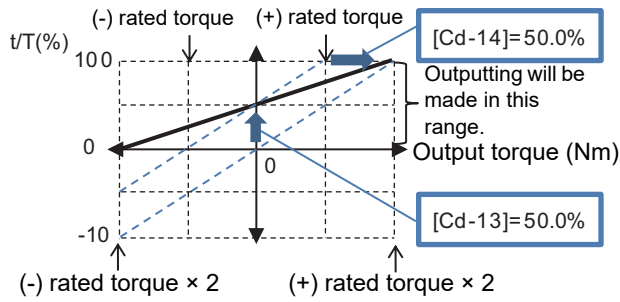
[Cd-13]=0.0%, [Cd-14]=133.0%



(Ex.) PWM-outputting [dA-17] output torque monitor

Set PWM output range from 0 to 100% in a torque range from -200 to 200%.

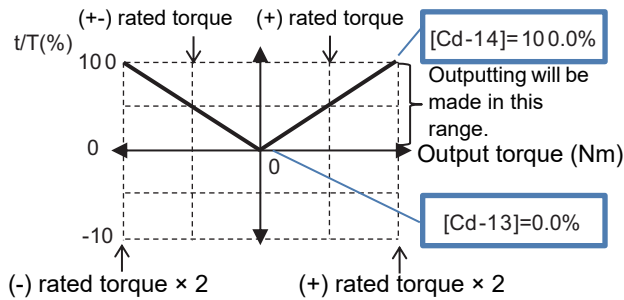
[Cd-12]=01, [Cd-13]=50.0%, [Cd-14]=50.0%



(Ex.) PWM-outputting [dA-17] output torque monitor

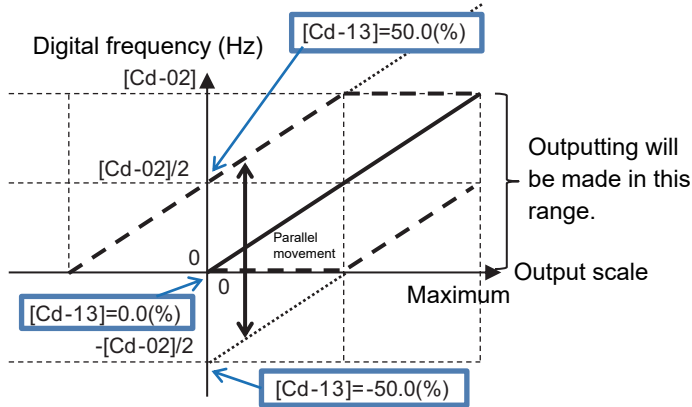
Set PWM output range from 0 to 100% in a torque range from 0 to ±200%.

[Cd-12]=00, [Cd-13]=0.0%, [Cd-14]=100.0%



[Cd-01] [FM] Terminal Output Form Selection is Set to 01

With the "Bias adjustment [Cd-13]" of the "Digital frequency output," you can bias Point 0 as shown in the below figure.

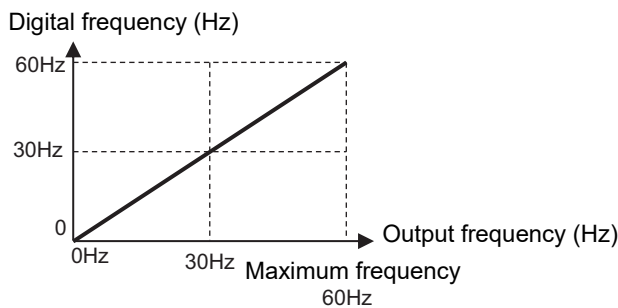


(Ex.) Digital-frequency-outputting information on [dA-01] output frequency monitor

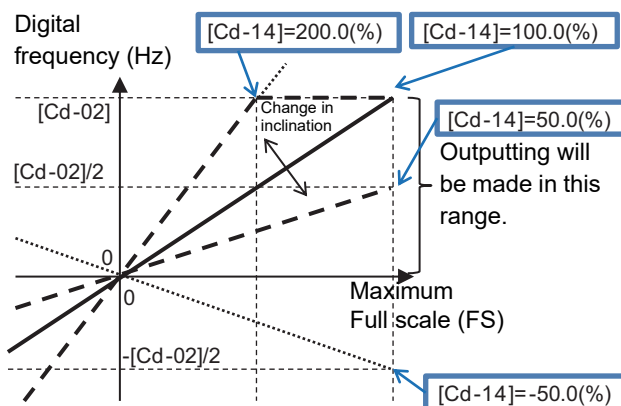
Output so that the maximum values of the digital frequency output corresponds to the maximum frequency.

When the maximum frequency is 60 Hz, set [Cd-02]=60Hz.

[Cd-13]=0.0%, [Cd-14]=100.0%



With the "Gain adjustment [Cd-14]" of the "Digital frequency output," you can change an inclination as shown in the below figure.

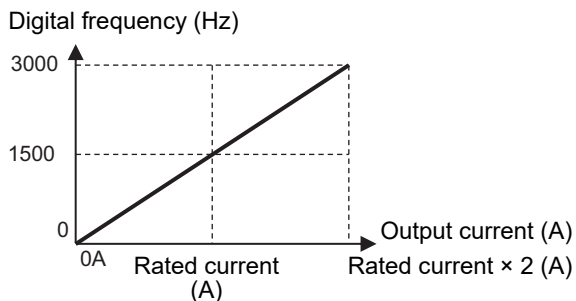


(Ex.) Digital-frequency-outputting information on [dA-02] output current monitor

When a current equivalent to inverter rated current flows, provide output at 1,500 Hz.

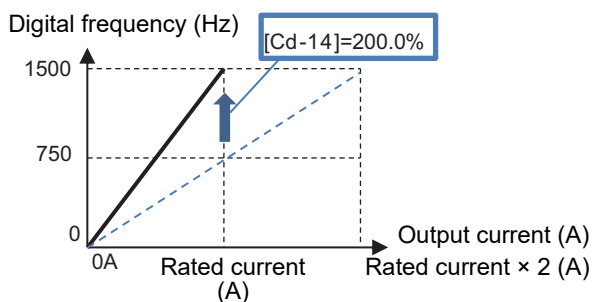
Set [Cd-02]=3000Hz.

[Cd-13]=0.0%, [Cd-14]=100.0%



Set [Cd-02]=1500Hz.

[Cd-13]=0.0%, [Cd-14]=200.0%



Analog Monitor Adjustment Mode: [FM] Output

Setting the analog monitor adjustment mode [Cd-10] to 01 fixes the output of the [FM] output terminal.

With the fixed output, an output set with [Cd-12] is made for the full-scale value of the monitor selected with [Cd-03].

(Ex.) Outputting the output current monitor with the PWM output

When a current equivalent to inverter rated current flows, provide output with a PWM output at 100%. (The standard point is the inverter rated current.)

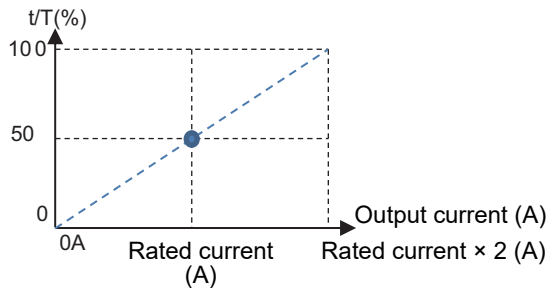
| Code | Name | Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA) |
|-------|------------------------|--|
| dA-02 | Output current monitor | (0.00 to 2.00) × Inverter rated current (A) |

1 Set [Cd-01]=00 and [Cd-03]=(dA-02).

Setting [Cd-10] to 01 outputs PWM from the [FM] terminal in accordance with [Cd-12].

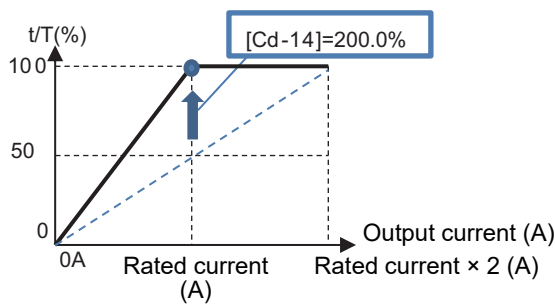
- 2** When the standard point at which you want to perform outputs is the rated current value, since the rated current has a maximum scale of Rated current \times 2.00, set a point that is half of it. First set [Cd-12] to 50.0% (corresponding to the inverter rated current).

In this state, since the full scale of the output current monitor is Rated current \times 2.00, the [FM] terminal outputs PWM of 50% duty, which is an output at the rated current (= Rated current \times 2.00 \times 50.0%).



- 3** Adjust the inclination with [Cd-14]. Change [Cd-14] to make an adjustment toward the point from which PWM of 100% duty is output. (For example, see and wait with a range from 190.0% to 210.0%.)

[Cd-13]=0.0%, [Cd-14]=200.0%



- 4** Returning [Cd-10] to 00 starts the PWM output of [FM] that is adjusted.

9

Communications Functions

This section describes the communications functions.

| | | |
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9-1 Communication Specifications

The 3G3RX2 Series has an RS485 communications capability that enables the inverter to communicate with an external controller from its RS485 communication terminal block on the control terminal block PCB.

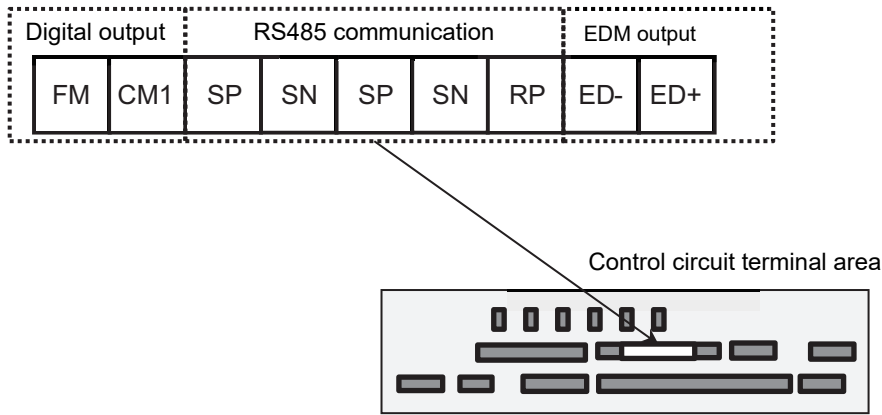
Communications Specifications

| Item | Modbus mode | Remarks |
|-----------------------|--|---------------------------------|
| Transmission speed | 2,400/4,800/9,600/19,200/38,400/57,600/76,800/115,200 bps | Selectable via Digital Operator |
| Communications method | Half duplex communication method | |
| Synchronous mode | Non-synchronous mode | |
| Transmission code | Binary | |
| Transmission method | Transmission starts with Least Significant Bit (LSB first) | |
| Applicable interface | RS-485 | |
| Data bit length | 8 bits | |
| Parity | No/Even/Odd | Selectable via Digital Operator |
| Stop bit length | 1/2 bits | Selectable via Digital Operator |
| Start mode | Half side start mode by host side command | |
| Waiting time | 0 to 1,000 [ms] | Selectable via Digital Operator |
| Connection form | 1:N (N=32) | Selectable via Digital Operator |
| Error check | Overrun/Framing/CRC-16/Horizontal parity | |

RS485 Port Specifications and Connections

The RS485 communications function uses RS485 communication terminal block for terminals of the control circuit.

Wire the RS485 communications terminal block as follows.



| Abbreviated Terminal Name | Description | Function |
|---------------------------|--|--|
| SP | RS485 Sending/receiving terminal + side | At + side of Sending/receiving signal of RS485 communications |
| SN | RS485 Sending/receiving terminal - side | At - side of Sending/receiving signal of RS485 communications |
| RP | Enable terminating resistor terminal | A terminal which enables internal terminating resistor (100Ω). The internal terminating resistor can be enabled when you connect – side of RS485 communication sending/receiving terminal (for connecting terminating resistor) to RP. |
| (SN) | RS485 Sending/receiving terminal - side (for connecting terminating resistors) | |
| (CM1) | Signal ground | You can connect a signal ground of an external communication device. (Also for FM terminal) |

The wire size and tightening torque recommended for RS485 communication terminal block are as follows.

| Screw size | Tightening torque [N·m] | Wire type | Wire size [mm ²] |
|------------|-------------------------|----------------------------|--|
| M2 | 0.22 to 0.25 | Solid wire | 0.14 to 1.5 (If two equal-sized wires are connected to one pole: 0.14 to 0.5) |
| | | Stranded wire | 0.14 to 1.0 (If two equal-sized wires are connected to one pole: 0.14 to 0.2) |
| | | Stranded wire with ferrule | 0.25 to 0.5 (Example: PC-1.25F7 1.25=3AF from JST Mfg. Co., Ltd.) |

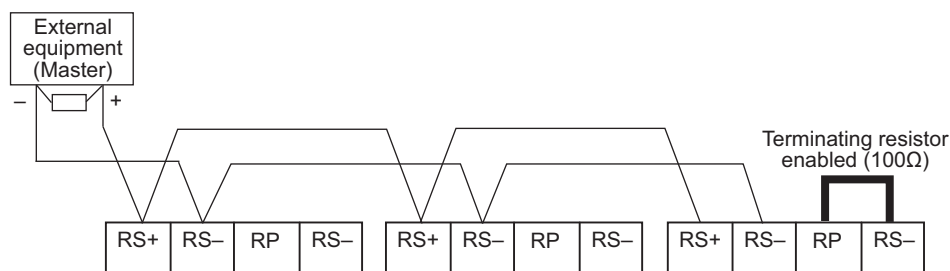
Connections

Connect the inverters parallel to each other as shown below. For termination, enable the terminating resistor only for the terminal Inverter.

Use the terminating resistor even if you have only one Inverter connected.

Selecting a terminating resistor that matches the cable impedance improves the terminating effect.

For the 3G3RX2 Series Inverter, shorting the RP and RS terminals enables the built-in terminating resistor (100 Ω).



Settings

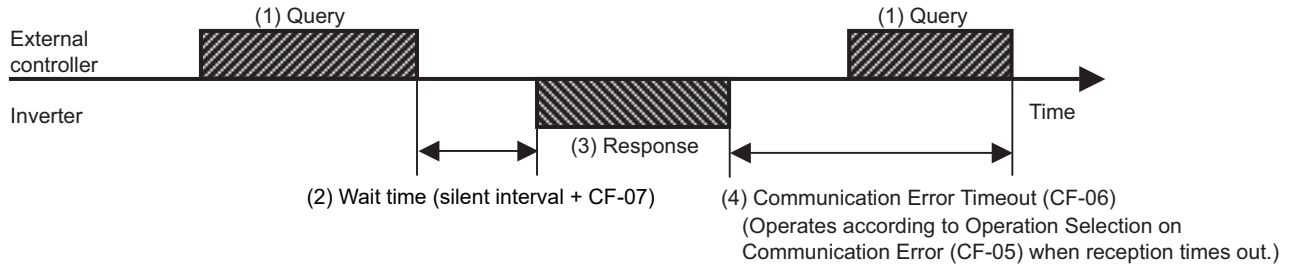
To configure the 3G3RX2 Series Inverter for RS485 communications, the following settings are required.

| Parameter No. | Function name | Data | Default data | Unit |
|----------------|---|---|--------------|------|
| CF-01 | RS485 communication baud rate selection | 03: 2400 bps | 05 | |
| | | 04: 4800 bps | | |
| | | 05: 9600 bps | | |
| | | 06: 19200 bps | | |
| | | 07: 38400 bps | | |
| | | 08: 57600 bps | | |
| | | 09: 76800 bps | | |
| | | 10: 115200 bps | | |
| CF-02 | RS485 communication Node allocation | 1. to 247.: Allocate each inverter's station number. Set station numbers to control several inverters simultaneously. | 1. | |
| CF-03 | RS485 communication parity selection | 00: Without parity 01: Even number parity 02: Odd number parity | 00 | |
| CF-04 | RS485 communication stop-bit selection | 01: 1 bit | 01 | |
| | | 02: 2 bit | | |
| CF-05 | RS485 communication error selection | 00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop | 02 | |
| CF-06 | RS485 communication timeout setting | 0.00: Function disabled | 0.00 | s |
| | | 0.01 to 100.00: Length of time to occurrence of a communications timeout | | |
| CF-07 | RS485 communication wait time setting | 0 to 1000: Time to wait for response from the inverter | 2 | ms |
| CF-08 | RS485 communication mode selection | 01: Modbus-RTU 02: EzCOM 03: EzCOM management | 01 | |
| CC-01 to CC-07 | Output Terminal Function | 049: [NDC] signal is turned ON when a communication disconnection occurs. Turn the signal OFF by resetting errors. | - | |

9-2 Modbus Method

Communications Procedure

The inverter communicates with an external controller as follows.



- (1) Frame (Query) that is sent from the external control device to the inverter
- (2) After receiving a query frame, the inverter waits for the total time of the Silent Interval and the Communication Wait Time (CF-07), before returning a response.

Silent Interval

The wait time that is specified on Modbus communication; its data length is 3.5 characters (3.5 bytes).

It depends on the Modbus communication speed setting.

- (3) Frame (Response) that is sent from the inverter back to the external controller
- (4) After sending a response, the inverter monitors the time until it completes receiving the query frame from the external control device. The inverter judges it as a communications error if it receives no response within the Communication Error Timeout Time (CF-06).

Then, the inverter operates according the Operation Selection on Communication Error (CF-05), while waiting for the reception of the first data again.

The monitoring of the Communication Error Timeout Time starts from the first sending/receiving operation is established after the power supply is cycled or after the inverter is reset.

The inverter does not recognize as a communications error timeout if the sending/receiving operation is not established at all.

For setting details, refer to the following information.

| Parameter No. | Function name | Data | Default data | Unit |
|---------------|---------------------------------------|---|--------------|------|
| CF-05 | RS485 communication error selection | 00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: (Deceleration stop) | 02 | |
| CF-06 | RS485 communication timeout setting | 0.00: Function disabled 0.01 to 100.00: Length of time to occurrence of a communications error timeout | 0.00 | s |
| CF-07 | RS485 communication wait time setting | 0 to 1000: Time to wait for response from the inverter (exclude silent inverter) | 2 | ms |

Query Frame Configuration

The format of a query frame (command) is as follows.

| |
|---------------|
| Slave address |
| Function code |
| Data |
| Error check |

<Slave Address>

- A serial number from 1 to 32 preset for each inverter (slave). Only the inverter that matches the slave address specified in the query will capture that query.
- Set the slave address to 0 to perform broadcasting (distributing a query to all slave addresses at a time).
- During a broadcast, you cannot perform data call or loop-back operation.

<Function Code>

This specifies the function to be performed by the inverter.

Function Code

| Function code | Function | Maximum number of data bytes per message | Maximum number of coils/registers per message |
|---------------|---|--|---|
| 01 hex | Reads out the state of coil | 4 | 32 coils (bitwise) |
| 03 hex | Reads out the content of retention register | 32 | 16 registers (in bytes) |
| 05 hex | Writes to coil | 2 | 1 coil (bitwise) |
| 06 hex | Writes to retention register | 2 | 1 register (in bytes) |
| 08 hex | Loopback test | – | – |
| 0F hex | Writes to multiple coils | 4 | 32 coils (bitwise) |
| 10 hex | Writes to multiple retention registers | 32 | 16 registers (in bytes) |

<Data>

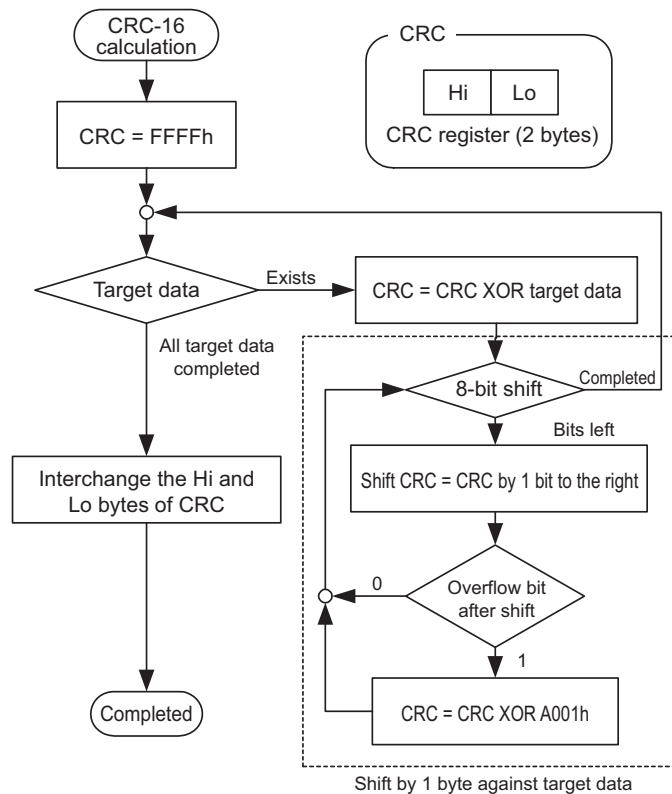
- This sends the function command.
- The data format differs depending on the function code.

| Data name | Description |
|------------------|--|
| Coil | Two values can be read and written (1 bit length). |
| Holding register | Data with 16 bit length can be read and written. |

<Error Check>

- CRC (Cyclic Redundancy Check) is used for error checking.
- The CRC code is 16-bit data generated for any data block with a data length in 8-bit unit.
- For CRC code generation, the following generator polynomial is used: CRC-16 ($X^{16} + X^{15} + X^2 + 1$).

CRC-16 Polynomial Calculation Example



<Header/Trailer (Silent Interval)>

- The silent interval is the length of time during which the inverter waits after receiving a query from the master, before sending back a response to it.
- Be sure to include a silent interval of 3.5 characters (3.5 bytes) as the wait time. If less than 3.5 characters, the inverter will send no response.
- The actual wait time during communications is the sum of the silent interval (3.5 characters) and the Communication Wait Time (CF-07).

Response Frame Configuration

<Required Communications Time>

- The time that the inverter takes to send a response after receiving a query is the sum of the silent interval (3.5 characters) and the Communication Wait Time (CF-07).
- After receiving a response from an inverter, be sure to include an interval equivalent to the silent interval (3.5 characters) or more before sending the next query to the inverter.

<Normal Response>

- If a query includes the loop-back function code (08 hex), the inverter sends back a response with the same content as that of the query.
- If a query includes a function code for writing data to a holding register/coil (05 hex, 06 hex, 0F hex, 10 hex), the inverter returns the query as a response.
- If a query includes a function code for reading data from a holding register/coil (01 hex, 03 hex), the inverter sends back a response that includes the same slave address and function code as the query, with the read data.

<Abnormal Response>

Field Configuration

| |
|----------------|
| Slave address |
| Function code |
| Exception code |
| CRC-16 |

- If an error (except for a communications error) is found in the query content, the inverter will return an exception response without performing any operation.
- For the cause of an error, check the function code for the response. The function code for an exception response is the sum of the function code for the query and 80 hex.
- For the cause of an error, check the exceptional code.

Exception code

| Code | Description |
|--------|--|
| 01 hex | An unsupported function is specified. |
| 02 hex | The specified address does not exist. |
| 03 hex | The specified data is in an unacceptable format. |
| 21 hex | Writing to a holding register is specified, but the data is out of the range allowed for the inverter. |
| 22 hex | The inverter does not allow this function because: <ul style="list-style-type: none"> • Inverter is in an operation busy state. • Function attempts to change a register that cannot be changed during RUN. • Function attempts to issue the Enter command during RUN (in an undervoltage state). • Function attempts to write data to a register during trip (in an undervoltage state). • Function attempts to write data to a read-only register (coil). |

23h The writing function code is used in read-only function parameter.

26h While data is being written into the inverter, or the inverter's data is being initialized, some data is written into the inverter.

27h There was an access to only the higher side register of 2 register long parameter.

<No Response>

The inverter will ignore the query and send back no response if:

- It receives a broadcast query.
- It detects a communications error in receiving a query.
- The slave address specified in a query does not match the inverter's slave address setting.
- The length of the time interval set for the inverter to receive the next data of the message after receiving a message is less than 3.5 characters.
- The data length of a query is inappropriate.
- The length of the reception interval in a frame exceeds the 1.5 characters.
- The error check code specified in a query does not match (CRC error).
- When it received query of slave address 250 to 254

Note Provide a timer on the master side for monitoring the response and set it to resend the same query if no response is received within the set time.

9-3 Explanation of Each Function Code

Read Coil Status [01 hex]

Reads the coil status (ON/OFF).



Precautions for Correct Use

The byte order was changed when data over 1 bite is processed with reading function of several coils via Modbus communication.

Receive data in the data layout as shown below, according to the number of data bytes to be read.

- Data received as 1-byte data (1 to 8 coils)

| |
|------------------|
| Coil 8 to Coil 1 |
|------------------|

- Data received as 2-byte data (9 to 16 coils)

| | |
|------------------|-------------------|
| Coil 8 to Coil 1 | Coil 16 to Coil 9 |
|------------------|-------------------|

- Data received as 3-byte data (17 to 24 coils)

| | | |
|------------------|-------------------|--------------------|
| Coil 8 to Coil 1 | Coil 16 to Coil 9 | Coil 24 to Coil 17 |
|------------------|-------------------|--------------------|

- Data received as 4-byte data (25 to 32 coils)

| | | | |
|------------------|-------------------|--------------------|--------------------|
| Coil 8 to Coil 1 | Coil 16 to Coil 9 | Coil 24 to Coil 17 | Coil 32 to Coil 25 |
|------------------|-------------------|--------------------|--------------------|

Example

When inverter's input terminal function 1 to 6 with slave address 8 is read out, the input terminal status is shown as below table.

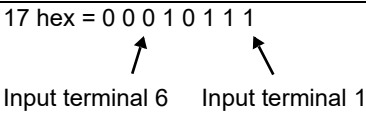
| Item | Data | | | | | |
|--------------------|----------|----------|----------|----------|----------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Input terminal No. | | | | | | |
| Coil number | 0005 hex | 0006 hex | 0007 hex | 0008 hex | 0009 hex | 000A hex |
| Terminal status | ON | ON | ON | OFF | ON | OFF |

Coil numbers 000B hex and 000C hex are OFF.

Query

| No. | Field name | Example [hex] | Remarks |
|-----|---------------------------------------|---------------|------------------------------------|
| 1 | Slave address ^{*1} | 08 | |
| 2 | Function code | 01 | |
| 3 | Coil start number (MSB) ^{*2} | 00 | (Coil address) = (Coil number) – 1 |
| 4 | Coil start number (LSB) ^{*2} | 04 | |
| 5 | Number of coils (MSB) ^{*3} | 00 | |
| 6 | Number of coils (LSB) ^{*3} | 06 | |
| 7 | CRC-16 (MSB) | 5C | |
| 8 | CRC-16 (LSB) | 90 | |

Response

| No. | Field name | Example [hex] | Remarks |
|-----|-------------------------|---------------|--|
| 1 | Slave address | 08 | |
| 2 | Function code | 01 | |
| 3 | Number of data bytes | 01 | |
| 4 | Coil data ^{*4} | 17 | 17 hex = 0 0 0 1 0 1 1 1  |
| 5 | CRC-16 (MSB) | 12 | |
| 6 | CRC-16 (LSB) | 1A | |

- *1. Broadcasting cannot be performed.
- *2. Note that the coil start number is 0004, which is 1 less than the coil number 0005.
- *3. If the number of coils to be read is set to 0 or more than 32, an error code (03 hex) will be returned.
- *4. Data as much as the number of data bytes will be transferred.

Data received to a response shows status of coil No. 0007h to 000Eh (Input terminal 1 to 8). Therefore, the received data “17 hex = 00010111 binary” can be read from the LSB that shows the status of coil number 0007 hex, as follows:

| Coil No. | 00Fh | 00Eh | 00Dh | 00Ch | 00Bh | 00Ah | 009h | 008h | 007h | 006h | 005h |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|
| Coil Status | OFF | OFF | OFF | OFF | OFF | OFF | ON | OFF | ON | ON | ON |
| Input Terminal No. | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

If, in the last coil data, the read coil exceeds the defined coil range, such out-of-range coil data will be transferred as 0.

If the Read Coil Status function is not executed normally, refer to *Exception Response* on page 9-18.

Read from Holding Register [03 hex]

Reads the contents of consecutive holding registers. From the specified holding register, the specified number of holding registers can be read.

Example

To read past trip data from the inverter with slave address 5.

(Read out factors of trip monitor 1 and output frequency.)

| Item | Previous factor | Previous inverter status |
|-------------------------|------------------------------------|---------------------------|
| Holding register number | 03E9h | 03EAh, 03EBh |
| Data | Data Overvoltage (E007) (0007h) | 60.00Hz (0000h, 1770h) |

Query

| No. | Field Name | Example (hex) | Remarks |
|-----|---|---------------|--|
| 1 | Slave address ^{*1} | 05 | |
| 2 | Function code | 03 | |
| 3 | Register starting number (high) ^{*2} | 03 | (Register address) = (Register number) – 1 |
| 4 | Register starting number (low) ^{*2} | E8 | |
| 5 | The number of retention registers (high) | 00 | 3 registers |
| 6 | The number of retention registers (low) | 03 | |
| 7 | CRC-16 (high) | 84 | |
| 8 | CRC-16 (low) | 3F | |

*1. Broadcasting cannot be performed.

*2. Note that the register start number is 03E8h hex, which is 1 less than the register number 03E9h hex.

Response

| No. | Field Name | Example (hex) | Remarks |
|-----|-----------------------------------|---------------|---|
| 1 | Slave address | 05 | |
| 2 | Function code | 03 | |
| 3 | Data bytes ^{*1} | 06 | |
| 4 | Register starting number (high) | 00 | 0007 hex → 07 decimal → E07 (Factor: Overvoltage) |
| 5 | Register starting number (low) | 07 | |
| 6 | Register starting number+1 (high) | 00 | 60.00Hz (000h, 1770h) |
| 7 | Register starting number+1 (low) | 00 | |
| 8 | Register starting number+2 (high) | 17 | |
| 9 | Register starting number+2 (low) | 70 | |
| 10 | CRC-16 (high) | A8 | |
| 11 | CRC-16 (low) | 61 | |

*1. Data as much as the number of data bytes will be transferred. In this example, the inverter sends back 4 bytes of data from two holding registers.

If the Read from Holding Register function is executed normally, refer to *Exception Response* on page 9-18.

Write to Coil [05 hex]

Writes the ON/OFF status to a single coil. The coil status changes as shown in the table below.

| Data | Coil status | |
|--------------------|-------------|-----------|
| | OFF to ON | ON to OFF |
| Written data (MSB) | FF hex | 00 hex |
| Written data (LSB) | 00 hex | 00 hex |

Example

To issue the RUN command to the inverter with slave address 10.

To operate the inverter, you need to set AA111 to 03. Write the RUN command to the coil number 0001.

Query

| No. | Field name | Example [hex] | Remarks |
|-----|---------------------------------------|---------------|------------------------------------|
| 1 | Slave address ^{*1} | 0A | |
| 2 | Function code | 05 | |
| 3 | Coil start number (MSB) ^{*2} | 00 | (Coil address) = (Coil number) – 1 |
| 4 | Coil start number (LSB) ^{*2} | 00 | |
| 5 | Written data (MSB) | FF | OFF to ON: FF00 hex |
| 6 | Written data (LSB) | 00 | |
| 7 | CRC-16 (MSB) | 8D | |
| 8 | CRC-16 (LSB) | 41 | |

Response

| No. | Field name | Example [hex] |
|-----|-------------------------|---------------|
| 1 | Slave address | 0A |
| 2 | Function code | 05 |
| 3 | Coil start number (MSB) | 00 |
| 4 | Coil start number (LSB) | 00 |
| 5 | Written data (MSB) | FF |
| 6 | Written data (LSB) | 00 |
| 7 | CRC-16 (MSB) | 8D |
| 8 | CRC-16 (LSB) | 41 |

*1. During a broadcast, no response will be sent back.

*2. Note that the coil start number is 0000, which is 1 less than the coil number 0001.

If the Write to Coil function is not executed normally, refer to *Exception Response* on page 9-18.

Write to Holding Register [06 hex]

Writes data to the specified holding register.

Example

To write 50 Hz to the inverter with slave address as the 1st Base Frequency value.

Because the holding register 2F4E hex for the Multispeed-0 setting, 1st-motor (Ab110) has a data resolution of 0.01 Hz, to set 50 Hz, set the written data to 5000 (1388 hex).

Query

| No. | Field Name | Example (hex) |
|-----|---|---------------|
| 1 | Slave address ^{*1} | 01 |
| 2 | Function code | 06 |
| 3 | Register starting number (high) ^{*2} | 2F |
| 4 | Register starting number (low) ^{*2} | 4D |
| 5 | Data to be changed (high) | 13 |
| 6 | Data to be changed (low) | 88 |
| 7 | CRC-16 (high) | 1C |
| 8 | CRC-16 (low) | 5F |

*1. During a broadcast, no response will be sent back.

*2. Note that the register start number is 2F4D hex, which is 1 less than the register number 2F4E hex.

Response

| No. | Field Name | Example (hex) |
|-----|---------------------------------|---------------|
| 1 | Slave address | 01 |
| 2 | Function code | 06 |
| 3 | Register starting number (high) | 2F |
| 4 | Register starting number (low) | 4D |
| 5 | Data to be changed (high) | 13 |
| 6 | Data to be changed (low) | 88 |
| 7 | CRC-16 (high) | 1C |
| 8 | CRC-16 (low) | 5F |

Note that, except for FA-01, changing the parameter value on the data display does not update the displayed data realtime.

To view the updated value, once return to the parameter display and then display the data again.

If the Write to Holding Register function is executed normally, refer to *Exception Response* on page 9-18.

Loop-back Test [08 hex]

Checks the communications between the master and the slave. Any value can be used for test data.

Example

To perform a loop-back test on the inverter with slave address 1.

Query

| No. | Field name | Example [hex] |
|-----|-----------------------------|---------------|
| 1 | Slave address ^{*1} | 01 |
| 2 | Function code | 08 |
| 3 | Test sub code (MSB) | 00 |
| 4 | Test sub code (LSB) | 00 |
| 5 | Data (MSB) | Any |
| 6 | Data (LSB) | Any |
| 7 | CRC-16 (MSB) | CRC |
| 8 | CRC-16 (LSB) | CRC |

Response

| No. | Field name | Example [hex] |
|-----|-----------------------------|---------------|
| 1 | Slave address ^{*1} | 01 |
| 2 | Function code | 08 |
| 3 | Test sub code (MSB) | 00 |
| 4 | Test sub code (LSB) | 00 |
| 5 | Data (MSB) | Any |
| 6 | Data (LSB) | Any |
| 7 | CRC-16 (MSB) | CRC |
| 8 | CRC-16 (LSB) | CRC |

*1. Broadcasting cannot be performed.

The test sub code supports the Echo Query Data command (00 hex, 00 hex) only. Other commands are not supported.

Write to Multiple Coils [0F hex]

Rewrites the ON/OFF status to consecutive multiple coils.



Precautions for Correct Use

The byte order was changed when data over 1 byte is processed with writing function of several coils via Modbus. In addition, due to the specifications of Modbus communication, the inverter cannot process any odd number of bytes.

If the data to be written has an odd number of bytes, add 1 byte of padding data.

Send data in the data layout for an even number of bytes as shown below, according to the number of data bytes to be written.

- Data sent as 1-byte data (1 to 8 coils)

| | |
|------------------|----------------|
| Coil 8 to Coil 1 | (Padding data) |
|------------------|----------------|

- Data sent as 2-byte data (9 to 16 coils)

| | |
|------------------|-------------------|
| Coil 8 to Coil 1 | Coil 16 to Coil 9 |
|------------------|-------------------|

- Data sent as 3-byte data (17 to 24 coils)

| | | | |
|------------------|-------------------|--------------------|----------------|
| Coil 8 to Coil 1 | Coil 16 to Coil 9 | Coil 24 to Coil 17 | (Padding data) |
|------------------|-------------------|--------------------|----------------|

- Data sent as 4-byte data (25 to 32 coils)

| | | | |
|------------------|-------------------|--------------------|--------------------|
| Coil 8 to Coil 1 | Coil 16 to Coil 9 | Coil 24 to Coil 17 | Coil 32 to Coil 25 |
|------------------|-------------------|--------------------|--------------------|

Note, however, that this Inverter does not send data of 2 bytes or more because it can write to coil numbers 0001 hex to 000F hex.

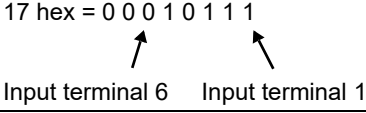
Example

Change Inverter's input terminals 1 to 6 for slave address 5.

Change input terminals into statuses shown below table.

| Item | Data | | | | | |
|-------------------------------|----------|----------|----------|----------|----------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Multi-function input terminal | 1 | 2 | 3 | 4 | 5 | 6 |
| Coil number | 0005 hex | 0006 hex | 0007 hex | 0008 hex | 0009 hex | 000A hex |
| Terminal status | ON | ON | ON | OFF | ON | OFF |

Query

| No. | Field name | Example [hex] | Remarks |
|-----|---------------------------------------|---------------|--|
| 1 | Slave address ^{*1} | 05 | |
| 2 | Function code | 0F | |
| 3 | Coil start number (MSB) ^{*2} | 00 | (Coil address) = (Coil number) – 1 |
| 4 | Coil start number (LSB) ^{*2} | 04 | |
| 5 | Number of coils (MSB) | 00 | |
| 6 | Number of coils (LSB) | 06 | |
| 7 | Number of bytes ^{*3} | 02 | |
| 8 | Change data (MSB) ^{*3} | 17 | 17 hex = 0 0 0 1 0 1 1 1  |
| 9 | Change data (LSB) ^{*3} | 00 | |
| 10 | CRC-16 (MSB) | DB | |
| 11 | CRC-16 (LSB) | 3E | |

Response

| No. | Field name | Example [hex] |
|-----|-------------------------|---------------|
| 1 | Slave address | 05 |
| 2 | Function code | 0F |
| 3 | Coil start number (MSB) | 00 |
| 4 | Coil start number (LSB) | 04 |
| 5 | Number of coils (MSB) | 00 |
| 6 | Number of coils (LSB) | 06 |
| 7 | CRC-16 (MSB) | 34 |
| 8 | CRC-16 (LSB) | 4C |

*1. During a broadcast, no response will be sent back.

*2. Note that the coil start number is 0004, which is 1 less than the coil number 0005.

*3. Since the change data comprises both MSB and LSB as a set, make the byte to be an even number by adding 1, even if the byte which actually needs to be changed is an odd number.

Input terminal is recognized as ON when either the terminal block input or the communications setting turns ON.

If the Write to Holding Register function is not executed normally, refer to *Exception Response* on page 9-18.

Write to Multiple Holding Registers [10 hex]

Writes data to consecutive multiple holding registers.

Example

To write 3,000 seconds to the inverter with slave address 1 as the 1st Acceleration Time 1 (FA-10) value.

Because the holding registers 2B02 hex to 2B03 hex for the 1st Acceleration Time (FA-10) has a data resolution of 0.01 seconds, to set 3,000 seconds, set the written data to 300000 (493E0 hex).

Query

| No. | Field name | Example [hex] | Remarks |
|-----|--|---------------|--|
| 1 | Slave address ^{*1} | 01 | |
| 2 | Function code | 10 | |
| 3 | Register start address (MSB) ^{*2} | 2B | (Register address) = (Register number) – 1 |
| 4 | Register start address (LSB) ^{*2} | 01 | |
| 5 | Number of holding registers (MSB) | 00 | |
| 6 | Number of holding registers (LSB) | 02 | |
| 7 | Number of bytes ^{*3} | 04 | |
| 8 | Written data 1 (MSB) | 00 | 000493E0 hex → 300000 decimal → 3,000.00 s |
| 9 | Written data 1 (LSB) | 04 | |
| 10 | Written data 2 (MSB) | 93 | |
| 11 | Written data 2 (LSB) | E0 | |
| 12 | CRC-16 (MSB) | 9E | |
| 13 | CRC-16 (LSB) | 9F | |

Response

| No. | Field name | Example [hex] |
|-----|-----------------------------------|---------------|
| 1 | Slave address | 01 |
| 2 | Function code | 10 |
| 3 | Register start address (MSB) | 2B |
| 4 | Register start address (LSB) | 01 |
| 5 | Number of holding registers (MSB) | 00 |
| 6 | Number of holding registers (LSB) | 02 |
| 7 | CRC-16 (MSB) | E5 |
| 8 | CRC-16 (LSB) | 34 |

*1. During a broadcast, no response will be sent back.

*2. Note that the register start address is 2B01 hex, which is 1 less than the register number 2B02 hex.

*3. This is not the number of holding registers, but the number of bytes to be changed actually.

If the Write to Holding Register function is not executed normally, refer to *Exception Response* on page 9-18.

Exception Response

The broadcast and master request for response. Although the slave Inverter normally returns a response to the query, it will return an exception response if the query has an error.

A exception response has the following field configuration.

| Field Configuration |
|---------------------|
| Slave address |
| Function code |
| Exception code |
| CRC-16 |

The details of the field configuration are as shown below. An exception response will have a function code, which is the sum of the function code value of the query and 80 hex. A exception code shows the reason why the exception response is returned.

Function code

| Query | Exception response |
|--------|--------------------|
| 01 hex | 81 hex |
| 03 hex | 83 hex |
| 05 hex | 85 hex |
| 06 hex | 86 hex |
| 0F hex | 8F hex |
| 10 hex | 90 hex |

Exception code

| Code | Description |
|--------|--|
| 01 hex | An unsupported function was specified |
| 02 hex | The specified address does not exist |
| 03 hex | The specified data is in an unacceptable format |
| 21 hex | Writing to a holding register is specified, but the data is out of the range allowed for the inverter. |
| 22 hex | The inverter is in the state that it doesn't permit functions to be executed as following: A register for which changes are inhibited during running was about to be changed. |
| | Data was written to a register to which soft-lock has been applied. |
| | An ENTER instruction was executed during running. |
| | An ENTER instruction was executed during undervoltage. |
| | Data was about to be written to a register when auto-tuning is enable; and so on. |
| 23 hex | A function code for writing was used to the parameter specialized for readout |
| 26 hex | Data was written during data writing or execution of data initialization. |
| 27 hex | There was an access to only the higher side register of 2 register long parameter. |

9-4 Saving a Change to Holding Register (Enter Command)

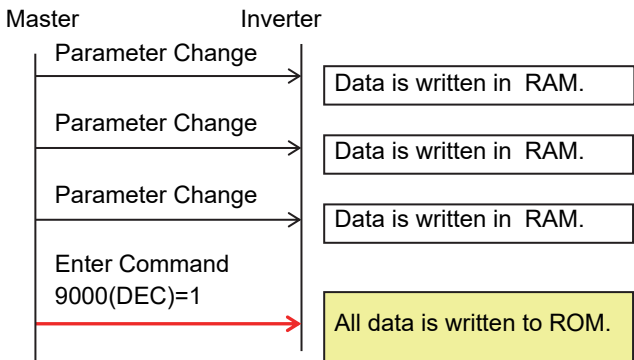
The Write to Holding Register (06 hex) or Write to Consecutive Holding Registers (10 hex) function is used to enable the new data. However, the new data is not stored in the EEPROM of the inverter and is restored to the previous value when the inverter power supply is shut off.

To store a change to holding registers in the inverter’s EEPROM memory, issue the Enter command according to the following procedure. In addition, after changing a control parameter, you need to recalculate the motor parameters. In this case, also use the Enter command to execute recalculation.

How to Issue Enter Command

Write 1 to Holding Register (9000(DEC) with writing command (06h) to Holding Register.

Enter Command



9-4 Saving a Change to Holding Register (Enter Command)

Data Write Mode

To change to the data write mode, use the Write to Holding Register (06 hex) command to write 1 in the holding register (9002 (DEC)).

The new data that is changed using the Write to Holding Register (06 hex) command in the data write mode is stored in both the temporary RAM and non-volatile ROM. Concurrently, the data write mode is canceled.

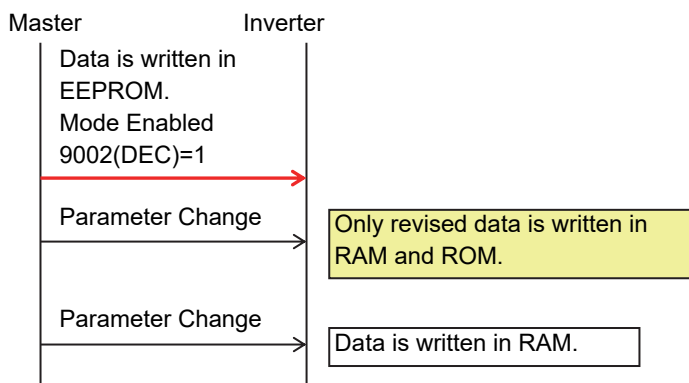
If a command other than the Write to Holding Register (06 hex) is received in the data write mode, the data write mode is canceled.



Precautions for Correct Use

- After receiving the Enter command, the inverter returns a response to the host and writes the value to the EEPROM memory. You can monitor the during data write signal (Coil No. 0049 hex) to check whether the data is written.
- Since the inverter's EEPROM memory has a limit for the number of rewrites (approximately 100,000 times), the inverter life may be shortened if the Enter command is frequently used.

Data Writing Mode



Re-calculation of Control Processing Internal Variable

Control processing internal variable is calculated when 1 is written to Holding Register (9010(DEC)) with writing command (06h) to Holding Register.

9-5 Modbus Communication Register Number List

9-5-1 Coil Number List

R/W in the list shows whether data can be read from, or written to, the coil or holding register.

R: Read only

R/W: Read and Write enabled



Precautions for Correct Use

- The “Coil No.” in the table header shows the coil number used inside the inverter.
- The “Modbus coil spec. No.” in the table header shows the coil number used to actually specify the coil in the Modbus communication process.
This coil number is 1 less than the inverter “Coil No.” according to the Modbus communication specifications.

Coil Number List

| Coil No. | Modbus coil spec. No. | Item | R/W | Description |
|----------|-----------------------|----------------------------|-----|---|
| 0000h | | (Reserved) | | |
| 0001h | 0000h | Operation command | R/W | 1: Run 0: Stop (enabled when AA111/AA211=03) |
| 0002h | 0001h | Rotation direction command | R/W | 1: Reverse 0: Normal (enabled when AA111/AA211=03) |
| 0003h | 0002h | External trip [EXT] | R/W | 1: Trip 0: Not trip |
| 0004h | 0003h | Trip reset [RS] | R/W | 1: Reset 0: Not reset |
| 0005h | 0004h | Input terminal 1 | R/W | 1: ON 0: OFF*1 |
| 0006h | 0005h | Input terminal 2 | R/W | 1: ON 0: OFF*1 |
| 0007h | 0006h | Input terminal 3 | R/W | 1: ON 0: OFF*1 |
| 0008h | 0007h | Input terminal 4 | R/W | 1: ON 0: OFF*1 |
| 0009h | 0008h | Input terminal 5 | R/W | 1: ON 0: OFF*1 |
| 000Ah | 0009h | Input terminal 6 | R/W | 1: ON 0: OFF*1 |
| 000Bh | 000Ah | Input terminal 7 | R/W | 1: ON 0: OFF*1 |
| 000Ch | 000Bh | Input terminal 8 | R/W | 1: ON 0: OFF*1 |
| 000Dh | 000Ch | Input terminal 9 | R/W | 1: ON 0: OFF*1 |
| 000Eh | 000Dh | Input terminal A | R/W | 1: ON 0: OFF*1 |

| Coil No. | Modbus coil spec. No. | Item | R/W | Description |
|----------------|-----------------------|-------------------------------------|-----|---|
| 000Fh | 000Eh | Input terminal B | R/W | 1: ON 0: OFF ^{*1} |
| 0010h | 000Fh | (Reserved) | | |
| 0011h | 0010h | (Reserved) | | |
| 0012h | 0011h | (Reserved) | | |
| 0013h | 0012h | (Reserved) | | |
| 0014h | 0013h | (Reserved) | | |
| 0015h | 0014h | Operating status | R | 1: Rotating in normal direction, rotating in reverse direction 0: Other than rotating in normal/reverse rotation (linked with dA-03) |
| 0016h | 0015h | Rotation direction | R | 1: Rotating in reverse direction 0: Rotating in normal direction (linked with dA-03) |
| 0017h | 0016h | Inverter operation ready completion | R | 1: Ready 0: Not ready |
| 0018h | 0017h | (Reserved) | | |
| 0019h | 0018h | Output terminal 11 | R | 1: ON 0: OFF |
| 001Ah | 0019h | Output terminal 12 | R | 1: ON 0: OFF |
| 001Bh | 001Ah | Output terminal 13 | R | 1: ON 0: OFF |
| 001Ch | 001Bh | Output terminal 14 | R | 1: ON 0: OFF |
| 001Dh | 001Ch | Output terminal 15 | R | 1: ON 0: OFF |
| 001Eh | 001Dh | Output terminal 16 | R | 1: ON 0: OFF |
| 001Fh | 001Eh | Output terminal AL | R | 1: ON 0: OFF |
| 0020h to 0048h | 001Fh to 0047h | (Reserved) | | |
| 0049h | 0048h | Data being written | R | 1: Being written 0: Normal state |
| 004Ah | 0049h | CRC error | R | 1: With error 0: No error ^{*2} |
| 004Bh | 004Ah | Overrun error | R | 1: With error 0: No error ^{*2} |
| 004Ch | 004Bh | Framing error | R | 1: With error 0: No error ^{*2} |
| 004Dh | 004Ch | Parity error | R | 1: With error 0: No error ^{*2} |
| 004Eh | 004Dh | Sum check error | R | 1: With error 0: No error ^{*2} |
| 004Fh | 004Eh | (Reserved) | | |

*1. While either the control circuit terminal block or the coil is ON, an inverter becomes ON. The input of the control circuit terminal block is prioritized. In some cases, the coil ON status cannot be reset from the master due to communication disconnection. To turn the coil OFF, change the control circuit terminal block from ON to OFF.

*2. Communication errors are kept until an error reset is input. The reset can be available during the operation.

9-5-2 Group d Register List



Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 2711h | 2710h | Output frequency monitor | dA-01 | R | 0 to 59000 | 0.01(Hz) |
| 2712h | 2711h | Output current monitor | dA-02 | R | 0 to 65535 | 0.01(A) |
| 2713h | 2712h | Operation direction monitor | dA-03 | R | 00: o (Stopped) 01: d (0Hz output) 02: F (Normal rotation in process) 03: r (Reverse rotation in process) | - |
| 2714h | 2713h | Frequency command after calculation | dA-04 (HIGH) | R | -59000 to 59000 | 0.01(Hz) |
| 2715h | 2714h | | dA-05 (LOW) | R | | |
| 2716h | 2715h | Output frequency conversion monitor | dA-06 (HIGH) | R | 0 to 5900000 | 0.01 |
| 2717h | 2716h | | dA-07 (LOW) | R | | |
| 2718h | 2717h | Speed detection value monitor | dA-08 (HIGH) | R | -59000 to 59000 | 0.01(Hz) |
| 2719h | 2718h | | dA-09 (LOW) | R | | |
| 271Ch | 2719h | Output frequency monitor (with sign) | dA-12 (HIGH) | R | -59000 to 59000 | 0.01(Hz) |
| 271Dh | 271Ch | | dA-13 (LOW) | R | | |
| 271Eh | 271Dh | Frequency upper limit monitor | dA-14 | R | 0 to 59000 | 0.01(Hz) |
| 271Fh | 271Eh | Torque command monitor after calculation | dA-15 | R | -10000 to 10000 | 0.1(%) |
| 2720h | 271Fh | Torque limit monitor | dA-16 | R | 0 to 5000 | 0.1(%) |
| 2721h | 2720h | Output torque monitor | dA-17 | R | -10000 to 10000 | 0.1(%) |
| 2722h | 2721h | Output voltage monitor | dA-18 | R | 0 to 8000 | 0.1(V) |
| 2724h | 2723h | Current position monitor | dA-20 (HIGH) | R | In the case of AA121=10 and AA123=03, data range -2147483648 to 2147483647. | 1(pls) |
| 2725h | 2724h | | dA-21 (LOW) | R | In the case of the condition mentioned above, data range -536870912 to 536870911 | |
| 272Ah | 2729h | Pulse train position deviation monitor | dA-26 (HIGH) | R | -2147483647 to 2147483647 | 1(pls) |
| 272Bh | 272Ah | | dA-27 (LOW) | R | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|-----------------------|
| 272Ch | 272Bh | Pulse counter monitor | dA-28 (HIGH) | R | 0 to 2147483647 | 1(pls) |
| 272Dh | 272Ch | | dA-29 (LOW) | R | | |
| 272Eh | 272Dh | Input power monitor | dA-30 | R | 0 to 60000 (to 132kW) 0 to 20000 (160 kW to) | 0.01(kWh) 0.1(kWh) |
| 2730h | 273Fh | Integrated input power monitor | dA-32 (HIGH) | R | 0 to 10000000 | 0.1(kWh) |
| 2731h | 2730h | | dA-33 (LOW) | R | | |
| 2732h | 2731h | Output power monitor | dA-34 | R | 0 to 60000 (to 132 kW) 0 to 20000 (160 kW to) | 0.01(kWh) 0.1(kWh) |
| 2734h | 2733h | Integrated output power monitor | dA-36 (HIGH) | R | 0 to 10000000 | 0.1(kWh) |
| 2735h | 2734h | | dA-37 (LOW) | R | | |
| 2736h | 2735h | Motor temperature monitor | dA-38 | R | -200 to 2000 | 0.1(°C) |
| 2738h | 2737h | DC voltage monitor | dA-40 | R | 0 to 10000 | 0.1(Vdc) |
| 2739h | 2738h | BRD load factor monitor | dA-41 | R | 0 to 10000 | 0.01(%) |
| 273Ah | 2739h | Electronic thermal duty ratio monitor MTR | dA-42 | R | 0 to 10000 | 0.01(%) |
| 273Bh | 273Ah | Electronic thermal duty ratio monitor CTL | dA-43 | R | 0 to 10000 | 0.01(%) |
| 273Dh | 273Ch | Integrated output power monitor | dA-45 | R | 00: no input 01: P-1A 02: P-2A 03: P-1b 04: P-2b 05: P-1C 06: P-2C 07: STO | - |
| 2742h | 2741h | Terminal block option mounted state | dA-50 | R | 00:STD-TM1 (fixed value) | - |
| 2743h | 2742h | Input terminal monitor | dA-51 | R | LLLLLLLLLLLLL to HHHHHHHHHHH [L:OFF/H:ON] [Left side] (terminal B) (terminal A) (terminal 9) - (terminal1) [Right side] | 1 |
| 2746h | 2725h | Output terminal monitor | dA-54 | R | LLLLLLL-HHHHHHH [L:OFF/H:ON] [Left side] (terminal AL) (terminal 16C) (terminal 15) - (terminal 11) [Right side] | 1 |
| 274Ch | 274Bh | Analog I/O selection monitor | dA-60 | R | AAAAAAAA- VVVVVVVV [A: current/V: voltage] [Left side] (Reserved)(Reserved) (Reserved) (terminal Ai3 (Ii3/Vi3)) (terminal Ao2) (terminal Ao1) (terminal Ai2) (terminal Ai1) [Right side] | 1 |
| 274Dh | 274Ch | Analog input [Ai1] monitor | dA-61 | R | 0 to 10000 | 0.01(%) |
| 274Eh | 274Dh | Analog input [Ai2] monitor | dA-62 | R | 0 to 10000 | 0.01(%) |
| 274Fh | 274Eh | Analog input [Ai3] monitor | dA-63 | R | -10000 to 10000 | 0.01(%) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--------------------------------------|---------------|-----|---|--|
| 2756h | 2755h | Pulse string input monitor main body | dA-70 | R | -10000 to 10000 | 0.01(%) |
| 2757h | 2756h | Pulse string input monitor option | dA-71 | R | -10000 to 10000 | 0.01(%) |
| 2761h | 2760h | Option slot 1 mounted state | dA-81 | R | 00: None | - |
| 2762h | 2761h | Option slot 2 mounted state | dA-82 | R | 00: None 33: RX2-PG | - |
| 2763h | 2762h | Option slot 3 mounted state | dA-83 | R | 00: None | - |
| 2775h | 2774h | Program download monitor | db-01 | R | 00: Without a program 01: With a program | - |
| 2776h | 2775h | Program No. monitor | db-02 | R | 0 to 9999 | 1 |
| 2777h | 2776h | Program counter (Task-1) | db-03 | R | 1 to 1024 | 1 |
| 2778h | 2777h | Program counter (Task-2) | db-04 | R | 1 to 1024 | 1 |
| 2779h | 2778h | Program counter (Task-3) | db-05 | R | 1 to 1024 | 1 |
| 277Ah | 2779h | Program counter (Task-4) | db-06 | R | 1 to 1024 | 1 |
| 277Bh | 277Ah | Program counter (Task-5) | db-07 | R | 1 to 1024 | 1 |
| 277Ch | 277Bh | User monitor 0 | db-08 (HIGH) | R | -2147483647 to 2147483647 | 1 |
| 277Dh | 277Ch | | db-09 (LOW) | R | | |
| 277Eh | 277Dh | User monitor 1 | db-10 (HIGH) | R | -2147483647 to 2147483647 | 1 |
| 277Fh | 277Eh | | db-11 (LOW) | R | | |
| 2780h | 277Fh | User monitor 2 | db-12 (HIGH) | R | -2147483647 to 2147483647 | 1 |
| 2781h | 2780h | | db-13 (LOW) | R | | |
| 2782h | 2781h | User monitor 3 | db-14 (HIGH) | R | -2147483647 to 2147483647 | 1 |
| 2783h | 2782h | | db-15 (LOW) | R | | |
| 2784h | 2783h | User monitor 4 | db-16 (HIGH) | R | -2147483647 to 2147483647 | 1 |
| 2785h | 2784h | | db-17 (LOW) | R | | |
| 2786h | 2785h | Analog output monitor YA0 | db-18 | R | 0 to 10000 | 0.01(%) |
| 2787h | 2786h | Analog output monitor YA1 | db-19 | R | 0 to 10000 | 0.01(%) |
| 2788h | 2787h | Analog output monitor YA2 | db-20 | R | 0 to 10000 | 0.01(%) |
| 2792h | 2791h | PID1 feedback data 1 monitor | db-30 (HIGH) | R | -10000 to 10000 ^{*1} | Unit differs depending on setting [AH-03] [AH-06]. |
| 2793h | 2792h | | db-31 (LOW) | R | | |
| 2794h | 2793h | PID1 feedback data 2 monitor | db-32 (HIGH) | R | -10000 to 10000 ^{*1} | Unit differs depending on setting [AH-03] [AH-06]. |
| 2795h | 2794h | | db-33 (LOW) | R | | |
| 2796h | 2795h | PID1 feedback data 3 monitor | db-34 (HIGH) | R | -10000 to 10000 ^{*1} | Unit differs depending on setting [AH-03] [AH-06]. |
| 2797h | 2796h | | db-35 (LOW) | R | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|--|
| 2798h | 2797h | PID2 feedback data monitor | db-36 (HIGH) | R | -10000 to 10000* ² | Unit differs depending on setting [AJ-03] [AJ-06]. |
| 2799h | 2798h | | db-37 (LOW) | R | | |
| 279Ah | 2799h | PID3 feedback data monitor | db-38 (HIGH) | R | -10000 to 10000* ³ | Unit differs depending on setting [AJ-23] [AJ-26]. |
| 279Bh | 279Ah | | db-39 (LOW) | R | | |
| 279Ch | 279Bh | PID4 feedback data monitor | db-40 (HIGH) | R | -10000 to 10000* ⁴ | Unit differs depending on setting [AJ-43] [AJ-46]. |
| 279Dh | 279Ch | | db-41 (LOW) | R | | |
| 279Eh | 279Dh | PID1 target value monitor after calculation | db-42 (HIGH) | R | -10000 to 10000* ¹ | Unit differs depending on setting [AH-03] [AH-06]. |
| 279Fh | 279Eh | | db-43 (LOW) | R | | |
| 27A0h | 279Fh | PID1 feedback data | db-44 (HIGH) | R | -10000 to 10000* ¹ | Unit differs depending on setting [AH-03] [AH-06]. |
| 27A1h | 27A0h | | db-45 (LOW) | R | | |
| 27A6h | 27A5h | PID1 output monitor | db-50 | R | -10000 to 10000 | 0.01(%) |
| 27A7h | 27A6h | PID1 deviation monitor | db-51 | R | -20000 to 20000 | 0.01(%) |
| 27A8h | 27A7h | PID1 deviation 1 monitor | db-52 | R | -20000 to 20000 | 0.01(%) |
| 27A9h | 27A8h | PID1 deviation 2 monitor | db-53 | R | -20000 to 20000 | 0.01(%) |
| 27AAh | 27A9h | PID1 deviation 3 monitor | db-54 | R | -20000 to 20000 | 0.01(%) |
| 27ABh | 27AAh | PID2 output monitor | db-55 | R | -10000 to 10000 | 0.01(%) |
| 27ACh | 27ABh | PID2 deviation monitor | db-56 | R | -20000 to 20000 | 0.01(%) |
| 27ADh | 27ACh | PID3 output monitor | db-57 | R | -10000 to 10000 | 0.01(%) |
| 27AEh | 27ADh | PID3 deviation monitor | db-58 | R | -20000 to 20000 | 0.01(%) |
| 27AFh | 27AEh | PID4 output monitor | db-59 | R | -10000 to 10000 | 0.01(%) |
| 27B0h | 27AFh | PID4 deviation monitor | db-60 | R | -20000 to 20000 | 0.01(%) |
| 27B1h | 27B0h | PID current P gain monitor | db-61 | R | 0 to 1000 | 0.1(%) |
| 27B2h | 27B1h | PID current I gain monitor | db-62 | R | 0 to 36000 | 0.1(s) |
| 27B3h | 27B2h | PID current D gain monitor | db-63 | R | 0 to 10000 | 0.01(s) |
| 27B4h | 27B3h | PID feed-forward monitor | db-64 | R | 0 to 10000 | 0.01(%) |
| 27D9h | 27D8h | Inverter load type selection monitor | dC-01 | R | 00: very low duty 01: low duty 02: normal duty | - |
| 27DAh | 27D9h | Rated current monitor | dC-02 | R | 0 to 65535 | 0.1(A) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|------------|
| 27DFh | 27DEh | Speed command destination monitor (main) | dC-07 | R | 00: disabled 01: Ai1 02: Ai2 03: Ai3 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Multistage speed 0 08: Sub speed 09: Multistage speed 1 10: Multistage speed 2 11: Multistage speed 3 12: Multistage speed 4 13: Multistage speed 5 14: Multistage speed 6 15: Multistage speed 7 16: Multistage speed 8 17: Multistage speed 9 18: Multistage speed 10 19: Multistage speed 11 20: Multistage speed 12 21: Multistage speed 13 22: Multistage speed 14 23: Multistage speed 15 24: JG 25: RS485 26: Option 1 27: Option 2 28: Option 3 29: Pulse array (Inverter) 30: Pulse array (Option) 31: Drive Programming 32: PID 33: (Reserved) 34: AHD retention speed | - |
| 28DFh | 27DFh | Speed command destination monitor (auxiliary) | dC-08 | R | 00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on operator keypad 03: RS485 setting 04: Option 1 05: Option 2 06: Option 3 | - |
| 27E2h | 27E1h | Operation command destination monitor | dC-10 | R | 00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on operator keypad 03: RS485 setting 04: Option 1 05: Option 2 06: Option 3 | - |
| 27E7h | 27E6h | Cooling fin temperature monitor | dC-15 | R | -200 to 2000 | 0.1(°C) |
| 27E8h | 27E7h | Life diagnostic monitor | dC-16 | R | 0 to 0xFF | 1 |
| 27ECh | 27EBh | Total start-up count | dC-20 | R | 1 to 65535 | 1 |
| 27EDh | 27ECh | Power-on count | dC-21 | R | 1 to 65535 | 1 |
| 27EEh | 27EDh | Cumulative operating hours monitor during RUN | dC-22 (HIGH) | R | 0 to 1000000 | 1(hr) |
| 27EFh | 27EEh | | dC-23 (LOW) | | | |
| 27F0h | 27EFh | Cumulative power-on time | dC-24 (HIGH) | R | 0 to 1000000 | 1(hr) |
| 27F1h | 27F0h | | dC-25 (LOW) | | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 27F2h | 27F1h | Cumulative operating time of cooling fan | dC-26 (HIGH) | R | 0 to 1000000 | 1(hr) |
| 27F3h | 27F2h | | dC-27 (LOW) | | | |
| 27FDh | 27F3h | Detailed monitor for icon 2 LIM | dC-37 | R | 00: Condition other than below 01: Overcurrent suppression in process 02: Overload being limited 03: Overvoltage suppression in process 04: Torque being limited 05: Upper/lower limit and jump frequency setting being limited 06: Setting of minimum frequency being limited | - |
| 27FEh | 27FDh | Detailed monitor for icon 2 ALT | dC-38 | R | 00: Condition other than below 01: Overload advance notice 02: Motor thermal advance notice 03: Controller thermal advance notice 04: Motor overheat advance notice | - |
| 27FFh | 27FEh | Detailed monitor for icon 2 RETRY | dC-39 | R | 00: Condition other than below 01: Retry standby 02: Restart standby | - |
| 2800h | 27FFh | Detailed monitor for icon 2 NRDY | dC-40 | R | 00: Preparation completed condition other than below IRDY=OFF 01: Trip occurred 02: Power supply abnormality 03: Resetting 04: STO 05: Standby 06: Data inconsistency Others (including no FB, consistency of settings of A and B phases, etc.) 07: Sequence abnormality 08: Free run 09: Forced stop | - |
| 2805h | 2804h | IM/SM monitor | dC-45 | R | 00: Induction motor IM being selected 01: Synchronous motor SM (permanent magnet motor PMM) being selected | - |
| 280Ah | 2809h | Firmware Ver. monitor | dC-50 | R | 0 to 0xFFFF Upper 1 byte: Major version no lower 1 byte : Minorversion no | 1 |
| 280Dh | 280Ch | Firmware Gr. monitor | dC-53 | R | 00 (Standard) | 1 |
| 03E8h | 03E7h | Trip count monitor | dE-01 | R | 0 to 65535 | 1 |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|------------|
| 03E9h | 03E8h | Trip monitor 1 Factor | dE-11 | R | 1 to 255 | 1 |
| 03EAh | 03E9h | Trip monitor 1 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 03EBh | 03EAh | (with sign) | | | | |
| 03ECh | 03EBh | Trip monitor 1 Output current | | | 0 to 65535 | 0.01(A) |
| 03EDh | 03ECh | Trip monitor 1 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 03EEh | 03EDh | Trip monitor 1 Inverter state | | | 0 to 8 ^{*5} | 1 |
| 03EFh | 03EEh | Trip monitor 1 LAD state | | | 0 to 5 ^{*5} | 1 |
| 03F0h | 03EFh | Trip monitor 1 INV control mode | | | 0 to 11 ^{*5} | 1 |
| 03F1h | 03F0h | Trip monitor 1 Limit state | | | 0 to 6 ^{*5} | 1 |
| 03F2h | 03F1h | Trip monitor 1 Special state | | | 0 to 6 ^{*5} | 1 |
| 03F4h | 03F3h | Trip monitor 1 RUN time | | | 0 to 1000000 | 1(hr) |
| 03F5h | 03F4h | | | | | |
| 03F6h | 03F5h | Trip monitor 1 Power ON time | | | 0 to 1000000 | 1(hr) |
| 03F7h | 03F6h | | | | | |
| 03F8h | 03F7h | Trip monitor 1 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | 1 |
| 03F9h | 03F8h | Trip monitor 1 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | 1 |
| 03FAh | 03F9h | Trip monitor 1 Absolute time (hour, minute) | | | 00 to 23 (BCD code) 00 to 59 (BCD code) | 1 |
| 03FDh | 03FCh | Trip monitor 2 Factor | dE-12 | R | 1 to 255 | 1 |
| 03FEh | 03FDh | Trip monitor 2 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 03FFh | 03FEh | (with sign) | | | | |
| 0400h | 03FFh | Trip monitor 2 Output current | | | 0 to 65535 | 0.01(A) |
| 0401h | 0400h | Trip monitor 2 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 0402h | 0401h | Trip monitor 2 Inverter state | | | 0 to 8 ^{*5} | 1 |
| 0403h | 0402h | Trip monitor 2 LAD state | | | 0 to 5 ^{*5} | 1 |
| 0404h | 0403h | Trip monitor 2 INV control mode | | | 0 to 11 ^{*5} | 1 |
| 0405h | 0404h | Trip monitor 2 Limit state | | | 0 to 6 ^{*5} | 1 |
| 0406h | 0405h | Trip monitor 2 Special state | | | 0 to 6 ^{*5} | 1 |
| 0408h | 0407h | Trip monitor 2 RUN time | | | 0 to 1000000 | 1(hr) |
| 0409h | 0408h | | | | | |
| 040Ah | 0409h | Trip monitor 2 Power ON time | | | 0 to 1000000 | 1(hr) |
| 040Bh | 040Ah | | | | | |
| 040Ch | 040Bh | Trip monitor 2 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 040Dh | 040Ch | Trip monitor 2 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 040Eh | 040Dh | Trip monitor 2 Absolute time (hour, minute) | | | 00 to 23 (BCD code) 00 to 59 (BCD code) | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|--|----------|--|------------|
| 0411h | 0410h | Trip monitor 3 Factor | dE-13 | R | 1 to 255 | - |
| 0412h | 0411h | Trip monitor 3 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 0413h | 0412h | (with sign) | | | | |
| 0414h | 0413h | Trip monitor 3 Output current | | | 0 to 65535 | 0.01(A) |
| 0415h | 0414h | Trip monitor 3 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 0416h | 0415h | Trip monitor 3 Inverter state | | | 0 to 8 ⁺⁵ | 1 |
| 0417h | 0416h | Trip monitor 3 LAD state | | | 0 to 5 ⁺⁵ | 1 |
| 0418h | 0417h | Trip monitor 3 INV control mode | | | 0 to 11 ⁺⁵ | 1 |
| 0419h | 0418h | Trip monitor 3 Limit state | | | 0 to 6 ⁺⁵ | 1 |
| 041Ah | 0419h | Trip monitor 3 Special state | | | 0 to 6 ⁺⁵ | 1 |
| 041Ch | 041Bh | Trip monitor 3 RUN time | | | 0 to 1000000 | 1(hr) |
| 041Dh | 041Ch | | | | | |
| 041Eh | 041Dh | Trip monitor 3 Power ON time | | | 0 to 1000000 | 1(hr) |
| 041Fh | 041Eh | | | | | |
| 0420h | 041Fh | Trip monitor 3 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 0421h | 0420h | Trip monitor 3 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 0422h | 0421h | Trip monitor 3 Absolute time (hour, minute) | | | 00 to 23 (BCD code) 00 to 59 (BCD code) | - |
| 0425h | 0424h | Trip monitor 4 Factor | | | dE-14 | R |
| 0426h | 0425h | Trip monitor 4 Output frequency | -59000 to 59000 | 0.01(Hz) | | |
| 0427h | 0426h | (with sign) | | | | |
| 0428h | 0427h | Trip monitor 4 Output current | 0 to 65535 | 0.01(A) | | |
| 0429h | 0428h | Trip monitor 4 P-N DC voltage | 0 to 10000 | 0.1(Vdc) | | |
| 042Ah | 0429h | Trip monitor 4 Inverter state | 0 to 8 ⁺⁵ | 1 | | |
| 042Bh | 042Ah | Trip monitor 4 LAD state | 0 to 5 ⁺⁵ | 1 | | |
| 042Ch | 042Bh | Trip monitor 4 INV control mode | 0 to 11 ⁺⁵ | 1 | | |
| 042Dh | 042Ch | Trip monitor 4 Limit state | 0 to 6 ⁺⁵ | 1 | | |
| 042Eh | 042Dh | Trip monitor 4 Special state | 0 to 6 ⁺⁵ | 1 | | |
| 0430h | 042Fh | Trip monitor 4 RUN time | 0 to 1000000 | 1(hr) | | |
| 0431h | 0430h | | | | | |
| 0432h | 0431h | Trip monitor 4 Power ON time | 0 to 1000000 | 1(hr) | | |
| 0433h | 0432h | | | | | |
| 0434h | 0433h | Trip monitor 4 Absolute time (year, month) | 00 to 99 (BCD code) 01 to 12 (BCD code) | - | | |
| 0435h | 0434h | Trip monitor 4 Absolute time (day, day of the week) | 01 to 31 (BCD code) 00 to 06 (BCD code) | - | | |
| 0436h | 0435h | Trip monitor 4 Absolute time (hour, minute) | 00 to 23 (BCD code) 00 to 59 (BCD code) | - | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|------------|
| 0439h | 0438h | Trip monitor 5 Factor | dE-15 | R | 1 to 255 | 1 |
| 043Ah | 0439h | Trip monitor 5 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 043Bh | 043Ah | (with sign) | | | | |
| 043Ch | 043Bh | Trip monitor 5 Output current | | | 0 to 65535 | 0.01(A) |
| 043Dh | 043Ch | Trip monitor 5 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 043Eh | 043Dh | Trip monitor 5 Inverter state | | | 0 to 8 ^{*5} | 1 |
| 043Fh | 043Eh | Trip monitor 5 LAD state | | | 0 to 5 ^{*5} | 1 |
| 0440h | 043Fh | Trip monitor 5 INV control mode | | | 0 to 11 ^{*5} | 1 |
| 0441h | 0440h | Trip monitor 5 Limit state | | | 0 to 6 ^{*5} | 1 |
| 0442h | 0441h | Trip monitor 5 Special state | | | 0 to 6 ^{*5} | 1 |
| 0444h | 0443h | Trip monitor 5 RUN time | | | 0 to 1000000 | 1(hr) |
| 0445h | 0444h | | | | | |
| 0446h | 0445h | Trip monitor 5 Power ON time | | | 0 to 1000000 | 1(hr) |
| 0447h | 0446h | | | | | |
| 0448h | | Trip monitor 5 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 0449h | 0448h | Trip monitor 5 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 044Ah | 0449h | Trip monitor 5 Absolute time (hour, minute) | | | 00 to 23 (BCD code) 00 to 59 (BCD code) | - |
| 044Dh | 044Ch | Trip monitor 6 Factor | dE-16 | R | 1 to 255 | 1 |
| 044Eh | 044Dh | Trip monitor 6 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 044Fh | 044Eh | (with sign) | | | | |
| 0450h | 044Fh | Trip monitor 6 Output current | | | 0 to 65535 | 0.01(A) |
| 0451h | 0450h | Trip monitor 6 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 0452h | 0451h | Trip monitor 6 Inverter state | | | 0 to 8 ^{*5} | 1 |
| 0453h | 0452h | Trip monitor 6 LAD state | | | 0 to 5 ^{*5} | 1 |
| 0454h | 0453h | Trip monitor 6 INV control mode | | | 0 to 11 ^{*5} | 1 |
| 0455h | 0454h | Trip monitor 6 Limit state | | | 0 to 6 ^{*5} | 1 |
| 0456h | 0455h | Trip monitor 6 Special state | | | 0 to 6 ^{*5} | 1 |
| 0458h | 0457h | Trip monitor 6 RUN time | | | 0 to 1000000 | 1(hr) |
| 0459h | 0458h | | | | | |
| 045Ah | 0459h | Trip monitor 6 Power ON time | | | 0 to 1000000 | 1(hr) |
| 045Bh | 045Ah | | | | | |
| 045Ch | 045Bh | Trip monitor 6 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 045Dh | 045Ch | Trip monitor 6 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 045Eh | 045Dh | Trip monitor 6 Absolute time (hour, minute) | | | 00 to 23 (BCD code) 00 to 59 (BCD code) | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|------------|
| 0461h | 0460h | Trip monitor 7 Factor | dE-17 | R | 1 to 255 | 1 |
| 0462h | 0461h | Trip monitor 7 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 0463h | 0462h | (with sign) | | | | |
| 0464h | 0463h | Trip monitor 7 Output current | | | 0 to 65535 | 0.01(A) |
| 0465h | 0464h | Trip monitor 7 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 0466h | 0465h | Trip monitor 7 Inverter state | | | 0 to 8 ⁺⁵ | 1 |
| 0467h | 0466h | Trip monitor 7 LAD state | | | 0 to 5 ⁺⁵ | 1 |
| 0468h | 0467h | Trip monitor 7 INV control mode | | | 0 to 11 ⁺⁵ | 1 |
| 0469h | 0468h | Trip monitor 7 Limit state | | | 0 to 6 ⁺⁵ | 1 |
| 046Ah | 0469h | Trip monitor 7 Special state | | | 0 to 6 ⁺⁵ | 1 |
| 046Ch | 046Ah | Trip monitor 7 RUN time | | | 0 to 1000000 | 1(hr) |
| 046Dh | 046Ch | | | | | |
| 046Eh | 046Dh | Trip monitor 7 Power ON time | | | 0 to 1000000 | 1(hr) |
| 046Fh | 046Eh | | | | | |
| 0470h | 046Fh | Trip monitor 7 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 0471h | 0470h | Trip monitor 7 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 0472h | 0471h | Trip monitor 7 Absolute time (hour, minute) | | | 00 to 23 (BCD code) 00 to 59 (BCD code) | - |
| 0475h | 0474h | Trip monitor 8 Factor | dE-18 | R | 1 to 255 | 1 |
| 0476h | 0475h | Trip monitor 8 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 0477h | 0476h | (with sign) | | | | |
| 0478h | 0477h | Trip monitor 8 Output current | | | 0 to 65535 | 0.01(A) |
| 0479h | 0478h | Trip monitor 8 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 047Ah | 0479h | Trip monitor 8 Inverter state | | | 0 to 8 ⁺⁵ | 1 |
| 047Bh | 047Ah | Trip monitor 8 LAD state | | | 0 to 5 ⁺⁵ | 1 |
| 047Ch | 047Bh | Trip monitor 8 INV control mode | | | 0 to 11 ⁺⁵ | 1 |
| 047Dh | 047Ch | Trip monitor 8 Limit state | | | 0 to 6 ⁺⁵ | 1 |
| 047Eh | 047Dh | Trip monitor 8 Special state | | | 0 to 6 ⁺⁵ | 1 |
| 0480h | 047Eh | Trip monitor 8 RUN time | | | 0 to 1000000 | 1(hr) |
| 0481h | 0480h | | | | | |
| 0482h | 0481h | Trip monitor 8 Power ON time | | | 0 to 1000000 | 1(hr) |
| 0483h | 0482h | | | | | |
| 0484h | 0483h | Trip monitor 8 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 0485h | 0484h | Trip monitor 8 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 0486h | 0485h | Trip monitor 8 Absolute time (hour, minute) | | | 00 to 23 (BCD code) 00 to 59 (BCD code) | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|--|----------|--|------------|
| 0489h | | Trip monitor 9 Factor | dE-19 | R | 1 to 255 | 1 |
| 048Ah | 0489h | Trip monitor 9 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 048Bh | 048Ah | (with sign) | | | | |
| 048Ch | 048Bh | Trip monitor 9 Output current | | | 0 to 65535 | 0.01(A) |
| 048Dh | 048Ch | Trip monitor 9 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 048Eh | 048Dh | Trip monitor 9 Inverter state | | | 0 to 8 ^{*5} | 1 |
| 048Fh | 048Eh | Trip monitor 9 LAD state | | | 0 to 5 ^{*5} | 1 |
| 0490h | 048Fh | Trip monitor 9 INV control mode | | | 0 to 11 ^{*5} | 1 |
| 0491h | 0490h | Trip monitor 9 Limit state | | | 0 to 6 ^{*5} | 1 |
| 0492h | 0491h | Trip monitor 9 Special state | | | 0 to 6 ^{*5} | 1 |
| 0494h | 0493h | Trip monitor 9 RUN time | | | 0 to 1000000 | 1(hr) |
| 0495h | 0494h | | | | | |
| 0496h | 0495h | Trip monitor 9 Power ON time | | | 0 to 1000000 | 1(hr) |
| 0497h | 0496h | | | | | |
| 0498h | 0497h | Trip monitor 9 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 0499h | 0498h | Trip monitor 9 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 049Ah | 0499h | Trip monitor 9 Absolute time (hour, minute) | | | 00 to 23 (BCD code) 00 to 59 (BCD code) | - |
| 049Dh | 049Ch | Trip monitor 10 Factor | | | dE-20 | R |
| 049Eh | 049Dh | Trip monitor 10 Output frequency | -59000 to 59000 | 0.01(Hz) | | |
| 049Fh | 049Eh | (with sign) | | | | |
| 04A0h | 049Fh | Trip monitor 10 Output current | 0 to 65535 | 0.01(A) | | |
| 04A1h | 04A0h | Trip monitor 10 P-N DC voltage | 0 to 10000 | 0.1(Vdc) | | |
| 04A2h | 04A1h | Trip monitor 10 Inverter state | 0 to 8 ^{*5} | 1 | | |
| 04A3h | 04A2h | Trip monitor 10 LAD state | 0 to 5 ^{*5} | 1 | | |
| 04A4h | 04A3h | Trip monitor 10 INV control mode | 0 to 11 ^{*5} | 1 | | |
| 04A5h | 04A4h | Trip monitor 10 Limit state | 0 to 6 ^{*5} | 1 | | |
| 04A6h | 04A5h | Trip monitor 10 Special state | 0 to 6 ^{*5} | 1 | | |
| 04A8h | 04A7h | Trip monitor 10 RUN time | 0 to 1000000 | 1(hr) | | |
| 04A9h | 04A8h | | | | | |
| 04AAh | 04A9h | Trip monitor 10 Power ON time | 0 to 1000000 | 1(hr) | | |
| 04ABh | 04AAh | | | | | |
| 04ACh | 04ABh | Trip monitor 10 Absolute time (year, month) | 00 to 99 (BCD code) 01 to 12 (BCD code) | - | | |
| 04ADh | 04ACh | Trip monitor 10 Absolute time (day, day of the week) | 01 to 31 (BCD code) 00 to 06 (BCD code) | - | | |
| 04AEh | 04ADh | Trip monitor 10 Absolute time (hour, minute) | 00 to 23 (BCD code) 00 to 59 (BCD code) | - | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|--|-----|--|------------|
| 04B1h | 04B1h | Retry monitor 1 Factor | dE-31 | R | 1 to 255 | 1 |
| 04B2h | 04B1h | Retry monitor 1 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 04B3h | 04B2h | (with sign) | | | | |
| 04B4h | 04B3h | Retry monitor 1 Output current | | | 0 to 65535 | 0.01(A) |
| 04B5h | 04B4h | Retry monitor 1 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 04B6h | 04B5h | Retry monitor 1 Inverter state | | | 0 to 8 ⁺⁵ | 1 |
| 04B7h | 04B6h | Retry monitor 1 LAD state | | | 0 to 5 ⁺⁵ | 1 |
| 04B8h | 04B7h | Retry monitor 1 INV control mode | | | 0 to 11 ⁺⁵ | 1 |
| 04B9h | 04B8h | Retry monitor 1 Limit state | | | 0 to 6 ⁺⁵ | 1 |
| 04BAh | 04B9h | Retry monitor 1 Special state | | | 0 to 6 ⁺⁵ | 1 |
| 04BCh | 04BBh | Retry monitor 1 RUN time | | | 0 to 1000000 | 1(hr) |
| 04BDh | 04BCh | | | | | |
| 04BEh | 04BDh | Retry monitor 1 Power ON time | | | 0 to 1000000 | 1(hr) |
| 04BFh | 04BEh | | | | | |
| 04C0h | 04BFh | Retry monitor 1 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 04C1h | 04C0h | Retry monitor 1 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 04C2h | 04C1h | Retry monitor 1 Absolute time (hour, minute) | 00 to 23 (BCD code) 00 to 59 (BCD code) | - | | |
| 04C5h | 04C4h | Retry monitor 2 Factor | dE-32 | R | 1 to 255 | 1 |
| 04C6h | 04C5h | Retry monitor 2 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 04C7h | 04C6h | (with sign) | | | | |
| 04C8h | 04C7h | Retry monitor 2 Output current | | | 0 to 65535 | 0.01(A) |
| 04C9h | 04C8h | Retry monitor 2 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 04CAh | 04C9h | Retry monitor 2 Inverter state | | | 0 to 8 ⁺⁵ | 1 |
| 04CBh | 04CAh | Retry monitor 2 LAD state | | | 0 to 5 ⁺⁵ | 1 |
| 04CCh | 04CBh | Retry monitor 2 INV control mode | | | 0 to 11 ⁺⁵ | 1 |
| 04CDh | 04CCh | Retry monitor 2 Limit state | | | 0 to 6 ⁺⁵ | 1 |
| 04CEh | 04CDh | Retry monitor 2 Special state | | | 0 to 6 ⁺⁵ | 1 |
| 04D0h | 04CFh | Retry monitor 2 RUN time | | | 0 to 1000000 | 1(hr) |
| 04D1h | 04D0h | | | | | |
| 04D2h | 04D1h | Retry monitor 2 Power ON time | | | 0 to 1000000 | 1(hr) |
| 04D3h | 04D2h | | | | | |
| 04D4h | 04D3h | Retry monitor 2 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 04D5h | 04D4h | Retry monitor 2 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 04D6h | 04D5h | Retry monitor 2 Absolute time (hour, minute) | 00 to 23 (BCD code) 00 to 59 (BCD code) | - | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|--|-----|--|------------|
| 04D9h | 04D8h | Retry monitor 3 Factor | dE-33 | R | 1 to 255 | 1 |
| 04DAh | 04D9h | Retry monitor 3 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 04DBh | 04DAh | (with sign) | | | | |
| 04DCh | 04DBh | Retry monitor 3 Output current | | | 0 to 65535 | 0.01(A) |
| 04DDh | 04DCh | Retry monitor 3 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 04DEh | 04DDh | Retry monitor 3 Inverter state | | | 0 to 8 ^{*5} | 1 |
| 04DFh | 04DEh | Retry monitor 3 LAD state | | | 0 to 5 ^{*5} | 1 |
| 04E0h | 04DFh | Retry monitor 3 INV control mode | | | 0 to 11 ^{*5} | 1 |
| 04E1h | 04E0h | Retry monitor 3 Limit state | | | 0 to 6 ^{*5} | 1 |
| 04E2h | 04E1h | Retry monitor 3 Special state | | | 0 to 6 ^{*5} | 1 |
| 04E4h | 04E3h | Retry monitor 3 RUN time | | | 0 to 1000000 | 1(hr) |
| 04E5h | 04E4h | | | | | |
| 04E6h | 04E5h | Retry monitor 3 Power ON time | | | 0 to 1000000 | 1(hr) |
| 04E7h | 04E6h | | | | | |
| 04E8h | 04E7h | Retry monitor 3 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 04E9h | 04E8h | Retry monitor 3 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 04EAh | 04E9h | Retry monitor 3 Absolute time (hour, minute) | 00 to 23 (BCD code) 00 to 59 (BCD code) | - | | |
| 04EDh | 04ECh | Retry monitor 4 Factor | dE-34 | R | 1 to 255 | 1 |
| 04EEh | 04EDh | Retry monitor 4 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 04EFh | 04EEh | (with sign) | | | | |
| 04F0h | 04EFh | Retry monitor 4 Output current | | | 0 to 65535 | 0.01(A) |
| 04F1h | 04F0h | Retry monitor 4 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 04F2h | 04F1h | Retry monitor 4 Inverter state | | | 0 to 8 ^{*5} | 1 |
| 04F3h | 04F2h | Retry monitor 4 LAD state | | | 0 to 5 ^{*5} | 1 |
| 04F4h | 04F3h | Retry monitor 4 INV control mode | | | 0 to 11 ^{*5} | 1 |
| 04F5h | 04F4h | Retry monitor 4 Limit state | | | 0 to 6 ^{*5} | 1 |
| 04F6h | 04F5h | Retry monitor 4 Special state | | | 0 to 6 ^{*5} | 1 |
| 04F8h | 04F7h | Retry monitor 4 RUN time | | | 0 to 1000000 | 1(hr) |
| 04F9h | 04F8h | | | | | |
| 04FAh | 04F9h | Retry monitor 4 Power ON time | | | 0 to 1000000 | 1(hr) |
| 04FBh | 04FAh | | | | | |
| 04FCh | 04FBh | Retry monitor 4 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 04FDh | 04FCh | Retry monitor 4 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 04FEh | 04FDh | Retry monitor 4 Absolute time (hour, minute) | 00 to 23 (BCD code) 00 to 59 (BCD code) | - | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|--|-----|--|------------|
| 0501h | | Retry monitor 5 Factor | dE-35 | R | 1 to 255 | 1 |
| 0502h | 0501h | Retry monitor 5 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 0503h | 0502h | (with sign) | | | | |
| 0504h | 0503h | Retry monitor 5 Output current | | | 0 to 65535 | 0.01(A) |
| 0505h | 0504h | Retry monitor 5 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 0506h | 0505h | Retry monitor 5 Inverter state | | | 0 to 8 ⁺⁵ | 1 |
| 0507h | 0506h | Retry monitor 5 LAD state | | | 0 to 5 ⁺⁵ | 1 |
| 0508h | 0507h | Retry monitor 5 INV control mode | | | 0 to 11 ⁺⁵ | 1 |
| 0509h | 0508h | Retry monitor 5 Limit state | | | 0 to 6 ⁺⁵ | 1 |
| 050Ah | 0509h | Retry monitor 5 Special state | | | 0 to 6 ⁺⁵ | 1 |
| 050Ch | 050Bh | Retry monitor 5 RUN time | | | 0 to 1000000 | 1(hr) |
| 050Dh | 050Ch | | | | | |
| 050Eh | 050Dh | Retry monitor 5 Power ON time | | | 0 to 1000000 | 1(hr) |
| 050Fh | 050Eh | | | | | |
| 0510h | 050Fh | Retry monitor 5 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 0511h | 0510h | Retry monitor 5 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 0512h | 0511h | Retry monitor 5 Absolute time (hour, minute) | 00 to 23 (BCD code) 00 to 59 (BCD code) | - | | |
| 0515h | 0514h | Retry monitor 6 Factor | dE-36 | R | 1 to 255 | 1 |
| 0516h | 0515h | Retry monitor 6 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 0517h | 0516h | (with sign) | | | | |
| 0518h | 0517h | Retry monitor 6 Output current | | | 0 to 65535 | 0.01(A) |
| 0519h | 0518h | Retry monitor 6 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 051Ah | 0519h | Retry monitor 6 Inverter state | | | 0 to 8 ⁺⁵ | 1 |
| 051Bh | 051Ah | Retry monitor 6 LAD state | | | 0 to 5 ⁺⁵ | 1 |
| 051Ch | 051Bh | Retry monitor 6 INV control mode | | | 0 to 11 ⁺⁵ | 1 |
| 051Dh | 051Ch | Retry monitor 6 Limit state | | | 0 to 6 ⁺⁵ | 1 |
| 051Eh | 051Dh | Retry monitor 6 Special state | | | 0 to 6 ⁺⁵ | 1 |
| 0520h | 051Fh | Retry monitor 6 RUN time | | | 0 to 1000000 | 1(hr) |
| 0521h | 0520h | | | | | |
| 0522h | 0521h | Retry monitor 6 Power ON time | | | 0 to 1000000 | 1(hr) |
| 0523h | 0522h | | | | | |
| 0524h | 0523h | Retry monitor 6 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 0525h | 0524h | Retry monitor 6 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 0526h | 0525h | Retry monitor 6 Absolute time (hour, minute) | 00 to 23 (BCD code) 00 to 59 (BCD code) | - | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|--|-----|--|------------|
| 0529h | 0528h | Retry monitor 7 Factor | dE-37 | R | 1 to 255 | 1 |
| 052Ah | 0529h | Retry monitor 7 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 052Bh | 052Ah | (with sign) | | | | |
| 052Ch | 052Bh | Retry monitor 7 Output current | | | 0 to 65535 | 0.01(A) |
| 052Dh | 052Ch | Retry monitor 7 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 052Eh | 052Dh | Retry monitor 7 Inverter state | | | 0 to 8 ^{*5} | 1 |
| 052Fh | 052Eh | Retry monitor 7 LAD state | | | 0 to 5 ^{*5} | 1 |
| 0530h | 052Fh | Retry monitor 7 INV control mode | | | 0 to 11 ^{*5} | 1 |
| 0531h | 0530h | Retry monitor 7 Limit state | | | 0 to 6 ^{*5} | 1 |
| 0532h | 0531h | Retry monitor 7 Special state | | | 0 to 6 ^{*5} | 1 |
| 0534h | 0533h | Retry monitor 7 RUN time | | | 0 to 1000000 | 1(hr) |
| 0535h | 0534h | | | | | |
| 0536h | 0535h | Retry monitor 7 Power ON time | | | 0 to 1000000 | 1(hr) |
| 0537h | 0536h | | | | | |
| 0538h | 0537h | Retry monitor 7 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 0539h | 0538h | Retry monitor 7 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 053Ah | | Retry monitor 7 Absolute time (hour, minute) | 00 to 23 (BCD code) 00 to 59 (BCD code) | - | | |
| 053Dh | 053Ch | Retry monitor 8 Factor | dE-38 | R | 1 to 255 | 1 |
| 053Eh | 053Dh | Retry monitor 8 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 053Fh | 053Eh | (with sign) | | | | |
| 0540h | 053Fh | Retry monitor 8 Output current | | | 0 to 65535 | 0.01(A) |
| 0541h | 0540h | Retry monitor 8 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 0542h | 0541h | Retry monitor 8 Inverter state | | | 0 to 8 ^{*5} | 1 |
| 0543h | 0542h | Retry monitor 8 LAD state | | | 0 to 5 ^{*5} | 1 |
| 0544h | 0543h | Retry monitor 8 INV control mode | | | 0 to 11 ^{*5} | 1 |
| 0545h | 0544h | Retry monitor 8 Limit state | | | 0 to 6 ^{*5} | 1 |
| 0546h | 0545h | Retry monitor 8 Special state | | | 0 to 6 ^{*5} | 1 |
| 0548h | 0547h | Retry monitor 8 RUN time | | | 0 to 1000000 | 1(hr) |
| 0549h | 0548h | | | | | |
| 054Ah | 0549h | Retry monitor 8 Power ON time | | | 0 to 1000000 | 1(hr) |
| 054Bh | 054Ah | | | | | |
| 054Ch | 054Bh | Retry monitor 8 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 054Dh | 054Ch | Retry monitor 8 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 054Eh | 054Dh | Retry monitor 8 Absolute time (hour, minute) | 00 to 23 (BCD code) 00 to 59 (BCD code) | - | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|--|----------|--|------------|
| 0551h | 0550h | Retry monitor 9 Factor | dE-39 | R | 1 to 255 | 1 |
| 0552h | 0551h | Retry monitor 9 Output frequency | | | -59000 to 59000 | 0.01(Hz) |
| 0553h | 0552h | (with sign) | | | | |
| 0554h | 0553h | Retry monitor 9 Output current | | | 0 to 65535 | 0.01(A) |
| 0555h | 0554h | Retry monitor 9 P-N DC voltage | | | 0 to 10000 | 0.1(Vdc) |
| 0556h | 0555h | Retry monitor 9 Inverter state | | | 0 to 8 ⁺⁵ | 1 |
| 0557h | 0556h | Retry monitor 9 LAD state | | | 0 to 5 ⁺⁵ | 1 |
| 0558h | 0557h | Retry monitor 9 INV control mode | | | 0 to 11 ⁺⁵ | 1 |
| 0559h | 0558h | Retry monitor 9 Limit state | | | 0 to 6 ⁺⁵ | 1 |
| 055Ah | 0559h | Retry monitor 9 Special state | | | 0 to 6 ⁺⁵ | 1 |
| 055Ch | 055Bh | Retry monitor 9 RUN time | | | 0 to 1000000 | 1(hr) |
| 055Dh | 055Ch | | | | | |
| 055Eh | 055Dh | Retry monitor 9 Power ON time | | | 0 to 1000000 | 1(hr) |
| 055Fh | 055Eh | | | | | |
| 0560h | 055Fh | Retry monitor 9 Absolute time (year, month) | | | 00 to 99 (BCD code) 01 to 12 (BCD code) | - |
| 0561h | 0560h | Retry monitor 9 Absolute time (day, day of the week) | | | 01 to 31 (BCD code) 00 to 06 (BCD code) | - |
| 0562h | 0561h | Retry monitor 9 Absolute time (hour, minute) | | | 00 to 23 (BCD code) 00 to 59 (BCD code) | - |
| 0565h | 0564h | Retry monitor 10 Factor | | | dE-40 | R |
| 0566h | 0565h | Retry monitor 10 Output frequency | -59000 to 59000 | 0.01(Hz) | | |
| 0567h | 0566h | (with sign) | | | | |
| 0568h | 0567h | Retry monitor 10 Output current | 0 to 65535 | 0.01(A) | | |
| 0569h | 0568h | Retry monitor 10 P-N DC voltage | 0 to 10000 | 0.1(Vdc) | | |
| 056Ah | 0569h | Retry monitor 10 Inverter state | 0 to 8 ⁺⁵ | 1 | | |
| 056Bh | 056Ah | Retry monitor 10 LAD state | 0 to 5 ⁺⁵ | 1 | | |
| 056Ch | 056Bh | Retry monitor 10 INV control mode | 0 to 11 ⁺⁵ | 1 | | |
| 056Dh | 056Ch | Retry monitor 10 Limit state | 0 to 6 ⁺⁵ | 1 | | |
| 056Eh | 056Dh | Retry monitor 10 Special state | 0 to 6 ⁺⁵ | 1 | | |
| 0570h | 056Fh | Retry monitor 10 RUN time | 0 to 1000000 | 1(hr) | | |
| 0571h | 0570h | | | | | |
| 0572h | 0571h | Retry monitor 10 Power ON time | 0 to 1000000 | 1(hr) | | |
| 0573h | 0572h | | | | | |
| 0574h | 0573h | Retry monitor 10 Absolute time (year, month) | 00 to 99 (BCD code) 01 to 12 (BCD code) | - | | |
| 0575h | 0574h | Retry monitor 10 Absolute time (day, day of the week) | 01 to 31 (BCD code) 00 to 06 (BCD code) | - | | |
| 0576h | 0575h | Retry monitor 10 Absolute time (hour, minute) | 00 to 23 (BCD code) 00 to 59 (BCD code) | - | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|-----------------|-----|----------------------------|------------|
| 05DCh | 050Bh | Warning monitor | dE-50 | R | 0 to 65535 | 1 |
| 2328h | 2327h | ENTER instruction (Writing to Data Flash) | - | W | 01: writing all parameters | - |
| 232Ah | 2329h | 1 register writing mode | - | W | 01: enabled | - |
| 2332h | 2321h | Motor constant recalculation (motor constant standard data not to be developed) | - | W | 01: enabled | - |
| 2906h | 2905h | RS485 Set frequency | - | R/W | -59000 to + 59000 | 0.01(Hz) |
| 2907h | 2906h | (Signed) (Common to main speed and auxiliary speed) | - | R/W | | |
| 291Eh | 291Dh | RS485 Torque command | - | R/W | -5000 to 5000 | 0.1(%) |
| 2922h | 2921h | RS485 Torque bias | - | R/W | -5000 to 5000 | 0.1(%) |
| 2926h | 2925h | RS485 Torque control speed limit value (for normal rotation) | - | R/W | 0 to 59000 | 0.01(Hz) |
| 2927h | 2926h | RS485 Torque control speed limit value (for reverse rotation) | - | R/W | 0 to 59000 | 0.01(Hz) |
| 2932h | 2931h | RS485 PID target value | - | R/W | -10000 to 10000 | 0.01(%) |
| 2933h | 2932h | | - | R/W | | |
| 293Ah | 2939h | RS485 PID feedback data | - | R/W | -10000 to 10000 | 0.01(%) |
| 293Bh | 293Ah | | - | R/W | | |
| 2946h | 2945h | RS485 Torque limit | - | R/W | 0 to 5000 | 0.1(%) |
| 3EB5h | 3EB4h | Output terminal function option output (OPO output) | - | R/W | 0 to 0x7F | 1 |
| 3EBCh | 3EBBh | Coil data 0 (coil No. 0001h - 000Fh) | - | R/W | 0 to 0xFFFF | 1 |
| 3EBDh | 3EBCh | Coil data 1 (coil No. 0010h - 001Fh) | - | R | 0 to 0xFFFF | 1 |
| 3EBEh | 3EDDh | Coil data 2 (coil No. 0020h - 002Fh) | - | R | 0 to 0xFFFF | 1 |
| 3EBFh | 3EDEh | Coil data 3 (coil No. 0030h - 003Fh) | - | R | 0 to 0xFFFF | 1 |
| 3EC0h | 3EBFh | Coil data 4 (coil No. 0040h - 004Fh) | - | R | 0 to 0xFFFF | 1 |
| | | Reserved | dA-46, dA-47 | | | |

*1. Data range varies in [AH-04] to [AH-06].

*2. Data range varies in [AJ-04] to [AJ-06].

*3. Data range varies in [AJ-24] to [AJ-26].

*4. Data range varies in [AJ-44] to [AJ-46].

*5. For the detail, see C Table of Parameters *Details of Trip Retry* on page C-18.

9-5-3 Group F Register List



Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|------------------------------|---------------|-----|---|--|
| 2AF9h | 2AF8h | Main Speed reference monitor | FA-01 | R/W | 0 to 59000 | 0.01Hz |
| 2AFAh | 2AF9h | Sub Speed reference monitor | FA-02 (HIGH) | R/W | -59000 to +59000 (monitor) 0 to 59000 (setting) | 0.01(Hz) |
| 2AFBh | 2AFAh | | FA-03 (LOW) | R/W | | |
| 2B02h | 2B01h | Acceleration time monitor | FA-10 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2B03h | 2B02h | | FA-11 (LOW) | R/W | | |
| 2B04h | 2B03h | Deceleration time monitor | FA-12 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2B05h | 2B04h | | FA-13 (LOW) | R/W | | |
| 2B07h | 2B06h | Torque reference monitor | FA-15 | R/W | -5000 to 5000 | 0.1(%) |
| 2B08h | 2B07h | Torque bias monitor | FA-16 | R/W | -5000 to 5000 | 0.1(%) |
| 2B0Ch | 2B0Bh | Position reference monitor | FA-20 (HIGH) | R/W | -268435455 to 268435455 | 1 |
| 2B0Dh | 2B0Ch | | FA-21 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 2B16h | 2B15h | PID1 Set Value 1 monitor | FA-30 (HIGH) | R/W | 0 to 10000 ^{*1} | Unit differs depending on setting [AH-03] [AH-06]. |
| 2B17h | 2B16h | | FA-31 (LOW) | R/W | | |
| 2B18h | 2B17h | PID1 Set Value 2 monitor | FA-32 (HIGH) | R/W | 0 to 10000 ^{*1} | Unit differs depending on setting [AH-03] [AH-06]. |
| 2B19h | 2B18h | | FA-33 (LOW) | R/W | | |
| 2B1Ah | 2B19h | PID1 Set Value 3 monitor | FA-34 (HIGH) | R/W | 0 to 10000 ^{*1} | Unit differs depending on setting [AH-03] [AH-06]. |
| 2B1Bh | 2B1Ah | | FA-35 (LOW) | R/W | | |
| 2B1Ch | 2B1Bh | PID2 Set Value monitor | FA-36 (HIGH) | R/W | 0 to 10000 ^{*2} | Unit differs depending on setting [AJ-03] [AJ-06]. |
| 2B1Dh | 2B1Ch | | FA-37 (LOW) | R/W | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|------------------------|---------------|-----|--------------------------|--|
| 2B1Eh | 2B1Dh | PID3 Set Value monitor | FA-38 (HIGH) | R/W | 0 to 10000 ^{*3} | Unit differs depending on setting [AJ-23] [AJ-26]. |
| 2B1Fh | 2B1Eh | | FA-39 (LOW) | R/W | | |
| 2B20h | 2B1Fh | PID4 Set Value monitor | FA-40 (HIGH) | R/W | 0 to 10000 ^{*4} | Unit differs depending on setting [AJ-43] [AJ-46]. |
| 2B21h | 2B20h | | FA-41 (LOW) | R/W | | |

*1. Data range varies in [AH-04] to [AH-06].

*2. Data range varies in [AJ-04] to [AJ-06].

*3. Data range varies in [AJ-24] to [AJ-26].

*4. Data range varies in [AJ-44] to [AJ-46].

9-5-4 Group A Register List



Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|------------|
| 2EE1h | 2EF0h | Main speed input source selection, 1st-motor | AA101 | R/W | 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved) | - |
| 2EE2h | 2EE1h | Sub frequency input source selection, 1st-motor | AA102 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved) | - |
| 2EE4h | 2EE3h | Sub speed setting, 1st-motor | AA104 | R/W | 0 to 59000 | 0.01(Hz) |
| 2EE5h | 2EE4h | Calculation symbol selection for Speed reference, 1st-motor | AA105 | R/W | 00: Disabled 01: Addition 02: Subtraction 03: Multiplication | - |
| 2EE6h | 2EE5h | Add frequency setting, 1st-motor | AA106 (HIGH) | R/W | -59000 to 59000 | 0.01(Hz) |
| 2EE7h | 2EE6h | | AA107 (LOW) | R/W | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|------------|
| 2EEBh | 2EEAh | Run-command input source selection, 1st-motor | AA111 | R/W | 00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on operator LCD Operator 03: RS485 04: Option 1 05: Option 2 06: Option 3 | - |
| 2EECh | 2EEBh | RUN-key Direction of LCD operator, 1st-motor | AA-12 | R/W | 00: Normal rotation 01: Reverse rotation | - |
| 2EEDh | 2EECh | STOP-key enable at RUN-command from terminal, 1st-motor | AA-13 | R/W | 00: Disabled 01: Enabled 02: Only reset is enabled | - |
| 2EEEh | 2EEDh | RUN-direction restriction, 1st-motor | AA114 | R/W | 00 (No limitation)/01 (Only normal rotation)/ 02 (Only reverse rotation) | - |
| 2EEFh | 2EEEh | STOP mode selection, 1st-motor | AA115 | R/W | 00 (Deceleration stop)/ 01 (Free run stop) | - |
| 2EF5h | 2EF4h | Control mode selection, 1st-motor | AA121 | R/W | 00 ([V/f] Fixed torque characteristics (IM))/ 01 ([V/f] Reducing torque characteristics (IM))/ 02 ([V/f] Free V/f (IM))/ 03 ([V/f] Auto torque boost (IM))/ 04 ([V/f with sensor] Fixed torque characteristics (IM))/ 05 ([V/f with sensor] Reduced torque characteristics (IM))/ 06 ([V/f with sensor] Free V/f (IM))/ 07 ([V/f with sensor] Auto torque boost (IM))/ 08 (Sensorless vector control (IM))/ 09 (Zero-Hz range sensorless vector control (IM)) ^{*1} / 10 (Vector control with sensor (IM)) ^{*1} / 11 (Synchronous start type sensorless vector control (SM/PMM))/ 12 (IVMS start type sensorless vector control (SM/PMM)) ^{*2} | - |
| 2EF7h | 2EF6h | Vector control mode selection, 1st-motor | AA123 | R/W | 00 (Speed/torque control mode)/ 01 (Pulse string position control mode)/ 02 (Absolute position control mode)/ 03 (High-resolution absolute position control mode) | - |
| 2F45h | 2F44h | Frequency conversion gain | Ab-01 | R/W | 1 to 10000 | 0.01 |
| 2F47h | 2F46h | Multispeed operation selection | Ab-03 | R/W | 00 (16th speed: binary (CF1 to CF4))/ 01 (8th speed: bit (SF1-SF7)) | - |
| 2F4Eh | 2F4Dh | Multispeed-0 setting, 1st-motor | Ab110 | R/W | 0 to 59000 | 0.01(Hz) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|---|------------|
| 2F4Fh | 2F4Eh | Multispeed-1 setting | Ab-11 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F50h | 2F4Fh | Multispeed-2 setting | Ab-12 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F51h | 2F50h | Multispeed-3 setting | Ab-13 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F52h | 2F51h | Multispeed-4 setting | Ab-14 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F53h | 2F52h | Multispeed-5 setting | Ab-15 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F54h | 2F53h | Multispeed-6 setting | Ab-16 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F55h | 2F54h | Multispeed-7 setting | Ab-17 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F56h | 2F55h | Multispeed-8 setting | Ab-18 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F57h | 2F56h | Multispeed-9 setting | Ab-19 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F58h | 2F57h | Multispeed-10 setting | Ab-20 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F59h | 2F58h | Multispeed-11 setting | Ab-21 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F5Ah | 2F59h | Multispeed-12 setting | Ab-22 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F5Bh | 2F5Ah | Multispeed-13 setting | Ab-23 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F5Ch | 2F5Bh | Multispeed-14 setting | Ab-24 | R/W | 0 to 59000 | 0.01(Hz) |
| 2F5Dh | 2F5Ch | Multispeed-15 setting | Ab-25 | R/W | 0 to 59000 | 0.01(Hz) |
| 2FA9h | 2FA8h | Acceleration/ Deceleration Time input selection | AC-01 | R/W | 00: Parameter setting 01: Option 1 02: Option 2 03: Option 3 04: DriveProgramming | - |
| 2FAAh | 2FA9h | Acceleration/ Deceleration Selection | AC-02 | R/W | 00: Common 01: Multi-stage acceleration/deceleration | - |
| 2FABh | 2FAAh | Acceleration curve selection | AC-03 | R/W | 00: Linear 01: S-shaped 02: U-shaped 03: Reverse U-shaped 04: Elevator S-shaped | - |
| 2FACH | 2FABh | Deceleration curve selection | AC-04 | R/W | 00: Linear 01: S-shaped 02: U-shaped 03: Reverse U-shaped 04: Elevator S-shaped | - |
| 2FADh | 2FACH | Acceleration curve constant setting | AC-05 | R/W | 1 to 10 | 1 |
| 2FAEh | 2FADh | Deceleration curve constant setting | AC-06 | R/W | 1 to 10 | 1 |
| 2FB0h | 2FAFh | EL-S-curve ratio @start of acceleration | AC-08 | R/W | 0 to 100 | 1(%) |
| 2FB1h | 2FB0h | EL-S-curve ratio @end of acceleration | AC-09 | R/W | 0 to 100 | 1(%) |
| 2FB2h | 2FB1h | EL-S-curve ratio @start of deceleration | AC-10 | R/W | 0 to 100 | 1(%) |
| 2FB3h | 2FB2h | EL-S-curve ratio @end of deceleration | AC-11 | R/W | 0 to 100 | 1(%) |
| 2FB7h | 2FB6h | Select method to switch to Accel2/Decel2 Profile, 1st-motor | AC115 | R/W | 00: [2CH] terminal 01: Parameter setting 02: Switching normal/reverse rotation | - |
| 2FB8h | 2FB7h | Accel1 to Accel2 Frequency transition point, 1st-motor | AC116 | R/W | 0 to 59000 | 0.01(Hz) |
| 2FB9h | 2FB8h | Decel1 to Decel2 Frequency transition point, 1st-motor | AC117 | R/W | 0 to 59000 | 0.01(Hz) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|-------------------------|------------|
| 2FBCh | 2FBBh | Acceleration time setting 1, 1st-motor | AC120 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FBDh | 2FBCCh | | AC121 (LOW) | R/W | | |
| 2FBEh | 2FBDh | Deceleration time setting 1, 1st-motor | AC122 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FBFh | 2FBEh | | AC123 (LOW) | R/W | | |
| 2FC0h | 2FBFh | Acceleration time setting 2, 1st-motor | AC124 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FC1h | 2FC0h | | AC125 (LOW) | R/W | | |
| 2FC2h | 2FC1h | Deceleration time setting 2, 1st-motor | AC126 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FC3h | 2FC2h | | AC127 (LOW) | R/W | | |
| 2FC6h | 2FC5h | Acceleration time setting for Multispeed-1 | AC-30 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FC7h | 2FC6h | | AC-31 (LOW) | R/W | | |
| 2FC8h | 2FC7h | Deceleration time setting for Multispeed-1 | AC-32 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FC9h | 2FC8h | | AC-33 (LOW) | R/W | | |
| 2FCAh | 2FC9h | Acceleration time setting for Multispeed-2 | AC-34 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FCBh | 2FCAh | | AC-35 (LOW) | R/W | | |
| 2FCCh | 2FCBh | Deceleration time setting for Multispeed-2 | AC-36 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FCDh | 2FCCh | | AC-37 (LOW) | R/W | | |
| 2FCEh | 2FCDh | Acceleration time setting for Multispeed-3 | AC-38 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FCFh | 2FCEh | | AC-39 (LOW) | R/W | | |
| 2FD0h | 2FCFh | Deceleration time setting for Multispeed-3 | AC-40 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FD1h | 2FD0h | | AC-41 (LOW) | R/W | | |
| 2FD2h | 2FD1h | Acceleration time setting for Multispeed-4 | AC-42 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FD3h | 2FD2h | | AC-43 (LOW) | R/W | | |
| 2FD4h | 2FD3h | Deceleration time setting for Multispeed-4 | AC-44 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FD5h | 2FD4h | | AC-45 (LOW) | R/W | | |
| 2FD6h | 2FD5h | Acceleration time setting for Multispeed-5 | AC-46 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FD7h | 2FD6h | | AC-47 (LOW) | R/W | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|-------------------------|------------|
| 2FD8h | 2FD7h | Deceleration time setting for Multispeed-5 | AC-48 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FD9h | 2FD8h | | AC-49 (LOW) | R/W | | |
| 2FDAh | 2FD9h | Acceleration time setting for Multispeed-6 | AC-50 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FDBh | 2FDAh | | AC-51 (LOW) | R/W | | |
| 2FDCCh | 2FDBh | Deceleration time setting for Multispeed-6 | AC-52 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FDDh | 2FDCCh | | AC-53 (LOW) | R/W | | |
| 2FDEh | 2FDDh | Acceleration time setting for Multispeed-7 | AC-54 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FDFh | 2FDEh | | AC-55 (LOW) | R/W | | |
| 2FE0h | 2FDFh | Deceleration time setting for Multispeed-7 | AC-56 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FE1h | 2FE0h | | AC-57 (LOW) | R/W | | |
| 2FE2h | 2FE1h | Acceleration time setting for Multispeed-8 | AC-58 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FE3h | 2FE2h | | AC-59 (LOW) | R/W | | |
| 2FE4h | 2FE3h | Deceleration time setting for Multispeed-8 | AC-60 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FE5h | 2FE4h | | AC-61 (LOW) | R/W | | |
| 2FE6h | 2FE5h | Acceleration time setting for Multispeed-9 | AC-62 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FE7h | 2FE6h | | AC-63 (LOW) | R/W | | |
| 2FE8h | 2FE7h | Deceleration time setting for Multispeed-9 | AC-64 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FE9h | 2FE8h | | AC-65 (LOW) | R/W | | |
| 2FEAh | 2FE9h | Acceleration time setting for Multispeed-10 | AC-66 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FEBh | 2FEAh | | AC-67 (LOW) | R/W | | |
| 2FECh | 2FEBh | Deceleration time setting for Multispeed-10 | AC-68 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FEDh | 2FECh | | AC-69 (LOW) | R/W | | |
| 2FEEh | 2FEDh | Acceleration time setting for Multispeed-11 | AC-70 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FEFh | 2FEEh | | AC-71 (LOW) | R/W | | |
| 2FF0h | 2FEFh | Deceleration time setting for Multispeed-11 | AC-72 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FF1h | 2FF0h | | AC-73 (LOW) | R/W | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|------------|
| 2FF2h | 2FF1h | Acceleration time setting for Multispeed-12 | AC-74 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FF3h | 2FF2h | | AC-75 (LOW) | R/W | | |
| 2FF4h | 2FF3h | Deceleration time setting for Multispeed-12 | AC-76 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FF5h | 2FF4h | | AC-77 (LOW) | R/W | | |
| 2FF6h | 2FF5h | Acceleration time setting for Multispeed-13 | AC-78 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FF7h | 2FF6h | | AC-79 (LOW) | R/W | | |
| 2FF8h | 2FF7h | Deceleration time setting for Multispeed-13 | AC-80 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FF9h | 2FF8h | | AC-81 (LOW) | R/W | | |
| 2FFAh | 2FF9h | Acceleration time setting for Multispeed-14 | AC-82 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FFBh | 2FFAh | | AC-83 (LOW) | R/W | | |
| 2FFCh | 2FFBh | Deceleration time setting for Multispeed-14 | AC-84 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FFDh | 2FFCh | | AC-85 (LOW) | R/W | | |
| 2FFEh | 2FFDh | Acceleration time setting for Multispeed-15 | AC-86 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 2FFFh | 2FFEh | | AC-87 (LOW) | R/W | | |
| 3000h | 2FFFh | Deceleration time setting for Multispeed-15 | AC-88 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 3001h | 3000h | | AC-89 (LOW) | R/W | | |
| 300Dh | 300Ch | Torque reference input source selection | Ad-01 | R/W | 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation | - |
| 300Eh | 300Dh | Torque reference value setting | Ad-02 | R/W | -500.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 0.1(%) |
| 300Fh | 300Eh | Polarity selection for torque reference | Ad-03 | R/W | 00: As per the sign 01: Follow the revolution direction | - |
| 3010h | 300Fh | Switching time of Speed control to Torque control | Ad-04 | R/W | 0 to 1000 | 1(ms) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|------------|
| 3017h | 3016h | Torque bias input source selection | Ad-11 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation | - |
| 3018h | 3017h | Torque bias value setting | Ad-12 | R/W | -500.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 0.1(%) |
| 3019h | 3018h | Polarity selection for torque bias | Ad-13 | R/W | 00: As per the sign 01: Follow the revolution direction | - |
| 301Ah | 3019h | Terminal [TBS] active | Ad-14 | R/W | 00: Disabled 01: Enabled | - |
| 3034h | 3033h | Input selection for speed limit at torque control | Ad-40 | R/W | 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 3035h | 3034h | Speed limit at torque control (at Forward rotation) | Ad-41 | R/W | 0 to 59000 | 0.01(Hz) |
| 3036h | 3035h | Speed limit at torque control (at Reverse rotation) | Ad-42 | R/W | 0 to 59000 | 0.01(Hz) |
| 3071h | 3070h | Electronic gear setting point selection | AE-01 | R/W | 00: Feedback side 01: Command side | - |
| 3072h | 3071h | Electronic gear ratio numerator | AE-02 | R/W | 1 to 10000 | 1 |
| 3073h | 3072h | Electronic gear ratio denominator | AE-03 | R/W | 1 to 10000 | 1 |
| 3074h | 3073h | Positioning complete range setting | AE-04 | R/W | 0 to 10000 | 1(pls) |
| 3075h | 3074h | Positioning complete delay time setting | AE-05 | R/W | 0 to 1000 | 0.01(s) |
| 3076h | 3075h | Position feed-forward gain setting | AE-06 | R/W | 0 to 65535 | 0.01 |
| 3077h | 3076h | Position loop gain setting | AE-07 | R/W | 0 to 10000 | 0.01 |
| 3078h | 3077h | Position bias setting | AE-08 | R/W | -2048 to 2048 | 1(pls) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|---|------------|
| 307Ah | 3078h | Stop position selection of Home search function | AE-10 | R/W | 00: Parameter setting 01: Option 1 02: Option 2 03: Option 3 | - |
| 307Bh | 307Ah | Stop position of Home search function | AE-11 | R/W | 0 to 4095 | 1 |
| 307Ch | 307Bh | Speed reference of Home search function | AE-12 | R/W | 0.00 to 120.00 | 0.01(Hz) |
| 307Dh | 307Ch | Direction of Home search function | AE-13 | R/W | 00: Normal rotation 01: Reverse rotation | - |
| 3084h | 3083h | Position reference 0 setting | AE-20 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 3085h | 3084h | | AE-21 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 3086h | 3085h | Position reference 1 setting | AE-22 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 3087h | 3086h | | AE-23 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 3088h | 3087h | Position reference 2 setting | AE-24 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 3089h | 3088h | | AE-25 | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 308Ah | 3089h | Position reference 3 setting | AE-26 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 308Bh | 308Ah | | AE-27 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 308Ch | 308Bh | Position reference 4 setting | AE-28 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 308Dh | 308Ch | | AE-29 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 308Eh | 308Dh | Position reference 5 setting | AE-30 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 308Fh | 308Eh | | AE-31 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 3090h | 308Fh | Position reference 6 setting | AE-32 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 3091h | 3090h | | AE-33 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 3092h | 3091h | Position reference 7 setting | AE-34 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 3093h | 3092h | | AE-35 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 3094h | 3093h | Position reference 8 setting | AE-36 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 3095h | 3094h | | AE-37 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 3096h | 3095h | Position reference 9 setting | AE-38 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 3097h | 3096h | | AE-39 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 3098h | 3097h | Position reference 10 setting | AE-40 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 3099h | 3098h | | AE-41 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|---|------------|
| 309Ah | 3099h | Position reference 11 setting | AE-42 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 309Bh | 309Ah | | AE-43 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 309Ch | 309Bh | Position reference 12 setting | AE-44 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 309Dh | 309Ch | | AE-45 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 309Eh | 309Dh | Position reference 13 setting | AE-46 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 309Fh | 309Eh | | AE-47 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 30A0h | 309Fh | Position reference 14 setting | AE-48 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 30A1h | 30A0h | | AE-49 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 30A2h | 30A1h | Position reference 15 setting | AE-50 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 30A3h | 30A2h | | AE-51 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 30A4h | 30A3h | Position control range setting(forward) | AE-52 (HIGH) | R/W | 0 to 268435455 | 1(pls) |
| 30A5h | 30A4h | | AE-53 (LOW) | R/W | In high resolution mode: 0 to 1073741823 | |
| 30A6h | 30A5h | Position control range setting(reverse) | AE-54 (HIGH) | R/W | -268435455 to 0 | 1(pls) |
| 30A7h | 30A6h | | AE-55 (LOW) | R/W | In high resolution mode: -1073741823 to 0 | |
| 30A8h | 30A7h | Position control mode selection | AE-56 | R/W | 00: With limit 01: Without limit | - |
| 30Ach | 30ABh | Teach-in function target selection | AE-60 | R/W | 00 (X00) to 15 (X15) | - |
| 30Adh | 30ACh | Current position saving at power-off | AE-61 | R/W | 00: Disabled 01: Enabled | - |
| 30Aeh | 30ADh | Preset position data | AE-62 (HIGH) | R/W | -268435455 to 268435455 | 1(pls) |
| 30Afh | 30AEh | | AE-63 (LOW) | R/W | In high resolution mode: -1073741823 to 1073741823 | |
| 30B0h | 30AFh | Deceleration stop distance calculation Gain | AE-64 | R/W | 5000 to 20000 | 0.01(%) |
| 30B1h | 30B0h | Deceleration stop distance calculation Bias | AE-65 | R/W | 0 to 65535 | 0.01(%) |
| 30B2h | 30B1h | Speed Limit in APR control | AE-66 | R/W | 0 to 10000 | 0.01(%) |
| 30B3h | 30B2h | APR start speed | AE-67 | R/W | 0 to 10000 | 0.01(%) |
| 30B6h | 30B5h | Homing function selection | AE-70 | R/W | 00: Low speed zero return 01: High speed zero return 02: High speed zero return 2 | - |
| 30B7h | 30B6h | Direction of homing function | AE-71 | R/W | 00: Normal rotation 01: Reverse rotation | - |
| 30B8h | 30B7h | Low-speed of homing function | AE-72 | R/W | 0 to 1000 | 0.01(Hz) |
| 30B9h | 30B8h | High-Speed of homing function | AE-73 | R/W | 0 to 59000 | 0.01(Hz) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|------------|
| 30D5h | 30D4h | DC braking selection, 1st-motor | AF101 | R/W | 00: Disabled 01: Enabled 02: Frequency command | - |
| 30D6h | 30D5h | Braking type selection, 1st-motor | AF102 | R/W | 00: DC braking 01: Speed servo lock 02: Position servo lock | - |
| 30D7h | 30D6h | DC braking frequency, 1st-motor | AF103 | R/W | 0 to 59000 | 0.01(Hz) |
| 30D8h | 30D7h | DC braking delay time, 1st-motor | AF104 | R/W | 0 to 500 | 0.01(s) |
| 30D9h | 30D8h | DC braking force setting, 1st-motor | AF105 | R/W | 0 to 100 | 1(%) |
| 30Dah | 30D9h | DC braking active time at stop, 1st-motor | AF106 | R/W | 0 to 6000 | 0.01(s) |
| 30DBh | 30DAh | DC braking operation method selection, 1st-motor | AF107 | R/W | 00: Edge mode 01: Level mode | - |
| 30DCh | 30DBh | DC braking force at start, 1st-motor | AF108 | R/W | 0 to 100 | 1(%) |
| 30DDh | 30DCh | DC braking active time at start, 1st-motor | AF109 | R/W | 0 to 6000 | 0.01(s) |
| 30E8h | 30E7h | ContactorControl Enable, 1st-motor | AF120 | R/W | 00: Disabled 01: Enabled: primary side 02: Enabled: secondary side | - |
| 30E9h | 30E8h | Run delay time, 1st-motor | AF121 | R/W | 0 to 200 | 0.01(s) |
| 30Eah | 30E9h | Contactor off delay time, 1st-motor | AF122 | R/W | 0 to 200 | 0.01(s) |
| 30Ebh | 30Eah | Contactor answer back check time, 1st-motor | AF123 | R/W | 0 to 500 | 0.01(s) |
| 30F2h | 30F1h | Brake Control Enable, 1st-motor | AF130 | R/W | 00: Disabled 01: Brake control 1 common in forward/reverse rotation 02: Brake control 1 forward/reverse set individually 03: Brake control 2 | - |
| 30F3h | 30F2h | Brake Wait Time for Release, 1st-motor (Forward side) | AF131 | R/W | 0 to 500 | 0.01(s) |
| 30F4h | 30F3h | Brake Wait Time for Accel., 1st-motor (Forward side) | AF132 | R/W | 0 to 500 | 0.01(s) |
| 30F5h | 30F4h | Brake Wait Time for Stopping, 1st-motor (Forward side) | AF133 | R/W | 0 to 500 | 0.01(s) |
| 30F6h | 30F5h | Brake Wait Time for Confirmation, 1st-motor (Forward side) | AF134 | R/W | 0 to 500 | 0.01(s) |
| 30F7h | 30F6h | Brake Release Frequency Setting, 1st-motor (Forward side) | AF135 | R/W | 0 to 59000 | 0.01(Hz) |
| 30F8h | 30F7h | Brake Release Current Setting, 1st-motor (Forward side) | AF136 | R/W | (0.0 to 2.0) × Inverter rated current ^{*3} | 0.1(A) |
| 30F9h | 30F8h | Braking Frequency, 1st-motor (Forward side) | AF137 | R/W | 0 to 59000 | 0.01(Hz) |
| 30Fah | 30F9h | Brake Wait Time for Release, 1st-motor (Reverse side) | AF138 | R/W | 0 to 500 | 0.01(s) |
| 30FBh | 30FAh | Brake Wait Time for Accel., 1st-motor (Reverse side) | AF139 | R/W | 0 to 500 | 0.01(s) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|------------|
| 30FCh | 30FBh | Brake Wait Time for Stopping, 1st-motor (Reverse side) | AF140 | R/W | 0 to 500 | 0.01(s) |
| 30FDh | 30FCh | Brake Wait Time for Confirmation, 1st-motor (Reverse side) | AF141 | R/W | 0 to 500 | 0.01(s) |
| 30Feh | 30FDh | Brake Release Frequency Setting, 1st-motor (Reverse side) | AF142 | R/W | 0 to 59000 | 0.01(Hz) |
| 30FFh | 30FEh | Brake Release Current Setting, 1st-motor (Reverse side) | AF143 | R/W | (0.0 to 2.0) × Inverter rated current*3 | 0.1(A) |
| 3100h | 30FFh | Braking Frequency, 1st-motor (Reverse side) | AF144 | R/W | 0 to 59000 | 0.01(Hz) |
| 3106h | 3105h | Brake open delay time, 1st-motor | AF150 | R/W | 0 to 200 | 0.01(s) |
| 3107h | 3106h | Brake close delay time, 1st-motor | AF151 | R/W | 0 to 200 | 0.01(s) |
| 3108h | 3107h | Brake answer back check time, 1st-motor | AF152 | R/W | 0 to 500 | 0.01(s) |
| 3109h | 3108h | Servo lock/ DC injection time at start, 1st-motor | AF153 | R/W | 0 to 1000 | 0.01(s) |
| 310Ah | 3109h | Servo lock/ DC injection time at stop, 1st-motor | AF154 | R/W | 0 to 1000 | 0.01(s) |
| 3139h | 3138h | Jump frequency 1, 1st-motor | AG101 | R/W | 0 to 59000 | 0.01(Hz) |
| 313Ah | 3139h | Jump frequency width 1, 1st-motor | AG102 | R/W | 0 to 1000 | 0.01(Hz) |
| 313Bh | 313Ah | Jump frequency 2, 1st-motor | AG103 | R/W | 0 to 59000 | 0.01(Hz) |
| 313Ch | 313Bh | Jump frequency width 2, 1st-motor | AG104 | R/W | 0 to 1000 | 0.01(Hz) |
| 313Dh | 313Ch | Jump frequency 3, 1st-motor | AG105 | R/W | 0 to 59000 | 0.01(Hz) |
| 313Eh | 313Dh | Jump frequency width 3, 1st-motor | AG106 | R/W | 0 to 1000 | 0.01(Hz) |
| 3142h | 3141h | Acceleration stop frequency setting, 1st-motor | AG110 | R/W | 0 to 59000 | 0.01(Hz) |
| 3143h | 3142h | Acceleration stop time setting, 1st-motor | AG111 | R/W | 0 to 600 | 0.1(s) |
| 3144h | 3143h | Deceleration stop frequency setting, 1st-motor | AG112 | R/W | 0 to 59000 | 0.01(Hz) |
| 3145h | 3144h | Deceleration stop time setting, 1st-motor | AG113 | R/W | 0 to 600 | 0.1(s) |
| 314Ch | 314Bh | Jogging frequency | AG-20 | R/W | 0 to 1000 | 0.01(Hz) |
| 314Dh | 314Ch | Jogging stop mode selection | AG-21 | R/W | 00: Disabled during FRS operation at stop 01: Disabled during deceleration stop operation 02: Disabled during DB operation at stop 03: Enabled during FRS operation at stop 04: Enabled during deceleration stop operation 05: Enabled during DB operation at stop | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|--|
| 319Dh | 319Ch | PID1 enable | AH-01 | R/W | 00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output | - |
| 319Eh | 319Dh | PID1 deviation inverse | AH-02 | R/W | 00: Disabled 01: Enabled | - |
| 319Fh | 319Eh | Unit selection for PID1 | AH-03 | R/W | See <Unit options> on page C-70 at the end of Appendices C | 1 |
| 31A0h | 319Fh | PID1 scale adjustment (at 0%) | AH-04 | R/W | -10000 to 10000 | 1 |
| 31A1h | 31A0h | PID1 scale adjustment (at 100%) | AH-05 | R/W | -10000 to 10000 | 1 |
| 31A2h | 31A1h | PID1 scale adjustment (point position) | AH-06 | R/W | 00:0000. 01:0000.0 02:000.00 03:00.000 04:0.0000 | - |
| 31A3h | 31A2h | Input source selection of Set-point for PID1 | AH-07 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 31A6h | 31A5h | Set-point-1 setting for PID1 | AH-10 (HIGH) | R/W | -100.00 to 100.00*4 | Unit differs depending on setting [AH-03] [AH-06]. |
| 31A7h | 31A6h | | AH-11 (LOW) | R/W | | |
| 31A8h | 31A7h | PID1 Multi stage set-point 1 setting | AH-12 (HIGH) | R/W | | Unit differs depending on setting [AH-03] [AH-06]. |
| 31A9h | 31A8h | | AH-13 (LOW) | R/W | | |
| 31Aah | 31A9h | PID1 Multi stage set-point 2 setting | AH-14 (HIGH) | R/W | | Unit differs depending on setting [AH-03] [AH-06]. |
| 31Abh | 31Aah | | AH-15 (LOW) | R/W | | |
| 31Ach | 31Abh | PID1 Multi stage set-point 3 setting | AH-16 (HIGH) | R/W | | Unit differs depending on setting [AH-03] [AH-06]. |
| 31Adh | 31Ach | | AH-17 (LOW) | R/W | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---------------------------------------|---------------|-----|--|--|
| 31Aeh | 31Adh | PID1 Multi stage set-point 4 setting | AH-18 (HIGH) | R/W | -100.00 to 100.00*4 | Unit differs depending on setting [AH-03] [AH-06]. |
| 31Afh | 31Aeh | | AH-19 (LOW) | R/W | | |
| 31B0h | 31Afh | PID1 Multi stage set-point 5 setting | AH-20 (HIGH) | R/W | | Unit differs depending on setting [AH-03] [AH-06]. |
| 31B1h | 31B0h | | AH-21 (LOW) | R/W | | |
| 31B2h | 31B1h | PID1 Multi stage set-point 6 setting | AH-22 (HIGH) | R/W | | Unit differs depending on setting [AH-03] [AH-06]. |
| 31B3h | 31B2h | | AH-23 (LOW) | R/W | | |
| 31B4h | 31B3h | PID1 Multi stage set-point 7 setting | AH-24 (HIGH) | R/W | | Unit differs depending on setting [AH-03] [AH-06]. |
| 31B5h | 31B4h | | AH-25 (LOW) | R/W | | |
| 31B6h | 31B5h | PID1 Multi stage set-point 8 setting | AH-26 (HIGH) | R/W | | Unit differs depending on setting [AH-03] [AH-06]. |
| 31B7h | 31B6h | | AH-27 (LOW) | R/W | | |
| 31B8h | 31B7h | PID1 Multi stage set-point 9 setting | AH-28 (HIGH) | R/W | | Unit differs depending on setting [AH-03] [AH-06]. |
| 31B9h | 31B8h | | AH-29 (LOW) | R/W | | |
| 31Bah | 31B9h | PID1 Multi stage set-point 10 setting | AH-30 (HIGH) | R/W | | Unit differs depending on setting [AH-03] [AH-06]. |
| 31BBh | 31Bah | | AH-31 (LOW) | R/W | | |
| 31BCh | 31BBh | PID1 Multi stage set-point 11 setting | AH-32 (HIGH) | R/W | Unit differs depending on setting [AH-03] [AH-06]. | |
| 31BDh | 31BCh | | AH-33 (LOW) | R/W | | |
| 31Beh | 31BDh | PID1 Multi stage set-point 12 setting | AH-34 (HIGH) | R/W | Unit differs depending on setting [AH-03] [AH-06]. | |
| 31BFh | 31Beh | | AH-35 (LOW) | R/W | | |
| 31C0h | 31BFh | PID1 Multi stage set-point 13 setting | AH-36 (HIGH) | R/W | Unit differs depending on setting [AH-03] [AH-06]. | |
| 31C1h | 31C0h | | AH-37 (LOW) | R/W | | |
| 31C2h | 31C1h | PID1 Multi stage set-point 14 setting | AH-38 (HIGH) | R/W | Unit differs depending on setting [AH-03] [AH-06]. | |
| 31C3h | 31C2h | | AH-39 (LOW) | R/W | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|--|
| 31C4h | 31C3h | PID1 Multi stage set-point 15 setting | AH-40 (HIGH) | R/W | -100.00 to 100.00* ⁴ | Unit differs depending on setting [AH-03] [AH-06]. |
| 31C5h | 31C4h | | AH-41 (LOW) | R/W | | |
| 31C6h | 31C5h | Input source selection of Set-point 2 for PID1 | AH-42 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 31C8h | 31C7h | Set-point 2 setting for PID1 | AH-44 (HIGH) | R/W | -100.00 to 100.00* ⁴ | Unit differs depending on setting [AH-03] [AH-06]. |
| 31C9h | 31C8h | | AH-45 (LOW) | R/W | | |
| 31Cah | 31C9h | Input source selection of Set-point 3 for PID1 | AH-46 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 31CCh | 31CBh | Set-point 3 setting for PID1 | AH-48 (HIGH) | R/W | -100.00 to 100.00* ⁴ | Unit differs depending on setting [AH-03] [AH-06]. |
| 31CDh | 31CCh | | AH-49 (LOW) | R/W | | |
| 31Ceh | 31CDh | Calculation symbol selection of Set-point 1 for PID1 | AH-50 | R/W | 01: Addition 02: Subtraction 03: Multiplication 04: Division 05: Minimum deviation 06: Maximum deviation | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|------------|
| 31CFh | 31CEh | Input source selection of Process data 1 for PID1 | AH-51 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 31D0h | 31CFh | Input source selection of Process data 2 for PID1 | AH-52 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 31D1h | 31D0h | Input source selection of Process data 3 for PID1 | AH-53 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 31D2h | 31D1h | Calculation symbol selection of Process data for PID1 | AH-54 | R/W | 01: Addition 02: Subtraction 03: Multiplication 04: Division 05: Square root of FB1 06: Square root of FB2 07: Square root of (FB1-FB2) 08: Average of PV-1 to PV-3 09: Minimum data of PV-1 to PV-3 10: Maximum data of PV-1 to PV-3 | - |
| 31D8h | 31D7h | PID1 gain change method selection | AH-60 | R/W | 00: Only gain 1 01: [PRO] terminal switch | - |
| 31D9h | 31D8h | PID1 proportional gain 1 | AH-61 | R/W | 0 to 1000 | 0.1 |
| 31Dah | 31D9h | PID1 integral time constant 1 | AH-62 | R/W | 0 to 36000 | 0.1(s) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|---|------------|
| 31DBh | 31DAh | PID1 derivative gain 1 | AH-63 | R/W | 0 to 10000 | 0.01(s) |
| 31DCh | 31DBh | PID proportional gain 2 | AH-64 | R/W | 0 to 1000 | 0.1 |
| 31DDh | 31DCh | PID integral time constant 2 | AH-65 | R/W | 0 to 36000 | 0.1(s) |
| 31Deh | 31DDh | PID1 derivative gain 2 | AH-66 | R/W | 0 to 10000 | 0.01(s) |
| 31DFh | 31DEh | PID1 gain change time | AH-67 | R/W | 0 to 10000 | 1(ms) |
| 31E2h | 31E1h | PID feed-forward selection | AH-70 | R/W | 00 (Disabled) 01 Ai1 terminal input 02 Ai2 terminal input 03 Ai3 terminal input 04 (Reserved) 05 (Reserved) 06 (Reserved) | - |
| 31E3h | 31E2h | PID1 output range | AH-71 | R/W | 0 to 10000 | 0.01(%) |
| 31E4h | 31E3h | PID1 Deviation over level | AH-72 | R/W | 0 to 10000 | 0.01(%) |
| 31E5h | 31E4h | PID1 Feedback compare signal turn-off level | AH-73 | R/W | 0 to 10000 | 0.01(%) |
| 31E6h | 31E5h | PID1 Feedback compare signal turn-on level | AH-74 | R/W | 0 to 10000 | 0.01(%) |
| 31E7h | 31E6h | PID soft start function enable | AH-75 | R/W | 00: Disabled 01: Enabled | - |
| 31E8h | 31E7h | PID soft start target level | AH-76 | R/W | 0 to 10000 | 0.01(%) |
| 31Eah | 31E9h | Acceleration time setting for PID soft start function | AH-78 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 31Ebh | 31EAh | | AH-79 (LOW) | R/W | | |
| 31Ech | 31EBh | PID soft start time | AH-80 | R/W | 0 to 60000 | 0.01(s) |
| 31Edh | 31ECh | PID soft start error detection enable | AH-81 | R/W | 00: Disabled 01: Enabled: error output 02: Enabled: warning | - |
| 31Eeh | 31EDh | PID soft start error detection level | AH-82 | R/W | 0 to 10000 | 0.01(%) |
| 31F1h | 31F0h | PID sleep trigger selection | AH-85 | R/W | 00: Disabled 01: Low output 02: [SLEP] terminal | - |
| 31F2h | 31F1h | PID sleep start level | AH-86 | R/W | 0 to 59000 | 0.01(Hz) |
| 31F3h | 31F2h | PID sleep active time | AH-87 | R/W | 0 to 10000 | 0.01(s) |
| 31F4h | 31F3h | Setpoint boost before PID sleep enable | AH-88 | R/W | 00: Disabled 01: Enabled | - |
| 31F5h | 31F4h | Setpoint boost time | AH-89 | R/W | 0 to 10000 | 0.01(s) |
| 31F6h | 31F5h | Setpoint boost value | AH-90 | R/W | 0 to 10000 | 0.01(%) |
| 31F7h | 31F6h | Minimum RUN time before PID sleep | AH-91 | R/W | 0 to 10000 | 0.01(s) |
| 31F8h | 31F7h | Minimum active time of PID sleep | AH-92 | R/W | 0 to 10000 | 0.01(s) |
| 31F9h | 31F8h | PID sleep trigger selection | AH-93 | R/W | 01: Deviation amount 02: Low feedback 03: [WAKE] terminal | - |
| 31Fah | 31F9h | PID wake start level | AH-94 | R/W | 0 to 10000 | 0.01(%) |
| 31FBh | 31FAh | PID wake start time | AH-95 | R/W | 0 to 10000 | 0.01(s) |
| 31FCh | 31FBh | PID wake start deviation value | AH-96 | R/W | 0 to 10000 | 0.01(%) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|--|
| 3201h | 3200h | PID2 enable | AJ-01 | R/W | 00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output | - |
| 3202h | 3201h | PID2 deviation inverse | AJ-02 | R/W | 00: Disabled 01: Enabled | - |
| 3203h | 3202h | PID2 unit selection | AJ-03 | R/W | See <Unit options> on page C-70 at the end of Appendices C | - |
| 3204h | 3203h | PID2 scale adjustment (at 0%) | AJ-04 | R/W | -10000 to 10000 | 1 |
| 3205h | 3204h | PID2 scale adjustment (at 100%) | AJ-05 | R/W | -10000 to 10000 | 1 |
| 3206h | 3205h | PID2 scale adjustment (point position) | AJ-06 | R/W | 00:0000. 01:0000.0 02:000.00 03:00.000 04:0.0000 | - |
| 3207h | 3206h | Input source selection of Set-point for PID2 | AJ-07 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation | - |
| 320Ah | 3209h | Set-point setting for PID2 | AJ-10 (HIGH) | R/W | -100.00 to 100.00*1 | Unit differs depending on setting [AJ-03] [AJ-06]. |
| 320Bh | 320Ah | | AJ-11 (LOW) | R/W | | |
| 320Ch | 320Bh | Input source selection of Process data for PID2 | AJ-12 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 320Dh | 320Ch | PID2 proportional gain | AJ-13 | R/W | 0 to 1000 | 0.1 |
| 320Eh | 320Dh | PID2 integral time constant | AJ-14 | R/W | 0 to 36000 | 0.1(s) |
| 320Fh | 320Eh | PID2 derivative gain | AJ-15 | R/W | 0 to 10000 | 0.01(s) |
| 3210h | 320Fh | PID2 output range | AJ-16 | R/W | 0 to 10000 | 0.01(%) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|---|--|
| 3211h | 3210h | PID2 Deviation over level | AJ-17 | R/W | 0 to 10000 | 0.01(%) |
| 3212h | 3211h | PID2 Feedback compare signal turn-off level | AJ-18 | R/W | 0 to 10000 | 0.01(%) |
| 3213h | 3212h | PID2 Feedback compare signal turn-on level | AJ-19 | R/W | 0 to 10000 | 0.01(%) |
| 3215h | 3214h | PID3 enable | AJ-21 | R/W | 00 (Disabled)/ 01 (Enabled Without reverse output)/ 02 (Enabled With reverse output) | - |
| 3216h | 3215h | PID3 deviation inverse | AJ-22 | R/W | 00: Disabled 01: Enabled | - |
| 3217h | 3216h | PID3 unit selection | AJ-23 | R/W | See <Unit options> on page C-70 at the end of Appendices C | - |
| 3218h | 3217h | PID3 scale adjustment (at 0%) | AJ-24 | R/W | -10000 to 10000 | 1 |
| 3219h | 3218h | PID3 scale adjustment (at 100%) | AJ-25 | R/W | -10000 to 10000 | 1 |
| 321Ah | 3219h | PID3 scale adjustment (point position) | AJ-26 | R/W | 00:0000. 01:0000.0 02:000.00 03:00.000 04:0.0000 | - |
| 321Bh | 321Ah | Input source selection of Set-point for PID3 | AJ-27 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 321Eh | 321Dh | Set-point setting for PID3 | AJ-30 (HIGH) | R/W | -100.00 to 100.00*4 | Unit differs depending on setting [AJ-23] [AJ-26]. |
| 321Fh | 321Eh | | AJ-31 (LOW) | R/W | | |
| 3220h | 321Fh | Input source selection of Process data for PID3 | AJ-32 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|--|
| 3221h | 3220h | PID3 proportional gain | AJ-33 | R/W | 0 to 1000 | 0.1 |
| 3222h | 3221h | PID3 integral time constant | AJ-34 | R/W | 0 to 36000 | 0.1(s) |
| 3223h | 3222h | PID3 derivative gain | AJ-35 | R/W | 0 to 10000 | 0.01(s) |
| 3224h | 3223h | PID3 output range | AJ-36 | R/W | 0 to 10000 | 0.01(%) |
| 3225h | 3224h | PID3 Deviation over level | AJ-37 | R/W | 0 to 10000 | 0.01(%) |
| 3226h | 3225h | PID3 Feedback compare signal turn-off level | AJ-38 | R/W | 0 to 10000 | 0.01(%) |
| 3227h | 3226h | PID3 Feedback compare signal turn-on level | AJ-39 | R/W | 0 to 10000 | 0.01(%) |
| 3229h | 3228h | PID4 enable | AJ-41 | R/W | 00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output | 1 |
| 322Ah | 3229h | PID4 deviation inverse | AJ-42 | R/W | 00: Disabled 01: Enabled | 1 |
| 322Bh | 322Ah | PID4 unit selection | AJ-43 | R/W | See <Unit options> on page C-70 at the end of Appendices C | 1 |
| 322Ch | 322Bh | PID4 scale adjustment (at 0%) | AJ-44 | R/W | -10000 to 10000 | 1 |
| 322Dh | 322Ch | PID4 scale adjustment (at 100%) | AJ-45 | R/W | -10000 to 10000 | 1 |
| 322Eh | 322Dh | PID4 scale adjustment (point position) | AJ-46 | R/W | 0:00000. 01:0000.0 02:000.00 03:00.000 04:0.0000 | - |
| 322Fh | 322Eh | Input source selection of Set-point for PID4 | AJ-47 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 3232h | 3221h | Set-point setting for PID4 | AJ-50 (HIGH) | R/W | -100.00 to 100.00*4 | Unit differs depending on setting [AJ-43] [AJ-46]. |
| 3233h | 3232h | | AJ-51 (LOW) | R/W | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|---|------------|
| 3234h | 3233h | Input source selection of Process data for PID4 | AJ-52 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 3235h | 3234h | PID4 proportional gain | AJ-53 | R/W | 0 to 1000 | 0.1 |
| 3236h | 3235h | PID4 integral time constant | AJ-54 | R/W | 0 to 36000 | 0.1(s) |
| 3237h | 3236h | PID4 derivative gain | AJ-55 | R/W | 0 to 10000 | 0.01(s) |
| 3238h | 3237h | PID4 output range | AJ-56 | R/W | 0 to 10000 | 0.01(%) |
| 3239h | 3238h | PID4 Deviation over level | AJ-57 | R/W | 0 to 10000 | 0.01(%) |
| 323Ah | 3239h | PID4 Feedback compare signal turn-off level | AJ-58 | R/W | 0 to 10000 | 0.01(%) |
| 323Bh | 323Ah | PID4 Feedback compare signal turn-on level | AJ-59 | R/W | 0 to 10000 | 0.01(%) |
| 55F1h | 55F0h | Main speed input source selection, 2nd-motor | AA201 | R/W | same as AA101 | - |
| 55F2h | 55F1h | Sub speed input source selection, 2nd-motor | AA202 | R/W | same as AA102 | - |
| 55F4h | 55F3h | Sub speed setting, 2nd-motor | AA204 | R/W | same as AA104 | 0.01(Hz) |
| 55F5h | 55F4h | Calculation symbol selection for Speed reference, 2nd-motor | AA205 | R/W | same as AA105 | - |
| 55F6h | 55F5h | Add frequency setting, 2nd-motor | AA206 (HIGH) | R/W | same as AA106 | 0.01(Hz) |
| 55F7h | 55F6h | | AA207 (LOW) | R/W | | |
| 55FBh | 55FAh | Run-command input source selection, 2nd-motor | AA211 | R/W | same as AA111 | - |
| 55FEh | 55FDh | RUN-direction restriction, 2nd-motor | AA214 | R/W | same as AA114 | - |
| 55FFh | 55FEh | STOP mode selection, 2nd-motor | AA215 | R/W | same as AA115 | - |
| 5605h | 5604h | Control mode selection, 2nd-motor | AA221 | R/W | Same as AA121, except 12 | - |
| 5607h | 5606h | Vector control mode selection, 2nd-motor | AA223 | R/W | same as AA123 | - |
| 565Eh | 565Dh | Multispeed-0 setting, 2nd-motor | Ab210 | R/W | 0 to 59000 | 0.01(Hz) |
| 56C7h | 56C6h | Select method to switch to Accel2/Decel2 Profile, 2nd-motor | AC215 | R/W | same as AC115 | - |
| 56C8h | 56C7h | Accel1 to Accel2 Frequency transition point, 2nd-motor | AC216 | R/W | same as AC116 | 0.01(Hz) |
| 56C9h | 56C8h | Decel1 to Decel2 Frequency transition point, 2nd-motor | AC217 | R/W | same as AC117 | 0.01(Hz) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|-------------------------|------------|
| 56CCh | 56CBh | Acceleration time setting 1, 2nd-motor | AC220 (HIGH) | R/W | same as AC120 | 0.01(s) |
| 56CDh | 56CCh | | AC221 (LOW) | R/W | | |
| 56Ceh | 56CDh | Deceleration time setting 1, 2nd-motor | AC222 (HIGH) | R/W | same as AC122 | 0.01(s) |
| 56CFh | 56Ceh | | AC223 (LOW) | R/W | | |
| 56D0h | 56CFh | Acceleration time setting 2, 2nd-motor | AC224 (HIGH) | R/W | same as AC124 | 0.01(s) |
| 56D1h | 56D0h | | AC225 (LOW) | R/W | | |
| 56D2h | 56D1h | Deceleration time setting 2, 2nd-motor | AC226 (HIGH) | R/W | same as AC126 | 0.01(s) |
| 56D3h | 56D2h | | AC227 (LOW) | R/W | | |
| 57E5h | 57E4h | DC braking selection, 2nd-motor | AF201 | R/W | same as AF101 | - |
| 57E6h | 57E5h | Braking type selection, 2nd-motor | AF202 | R/W | same as AF102 | - |
| 57E7h | 57E6h | DC braking frequency, 2nd-motor | AF203 | R/W | same as AF103 | 0.01(Hz) |
| 57E8h | 57E7h | DC braking delay time, 2nd-motor | AF204 | R/W | same as AF104 | 0.01(s) |
| 57E9h | 57E8h | DC braking force setting, 2nd-motor | AF205 | R/W | same as AF105 | 1(%) |
| 57Eah | 57E9h | DC braking active time at stop, 2nd-motor | AF206 | R/W | same as AF106 | 0.01(s) |
| 57Ebh | 57EAh | DC braking operation method selection, 2nd-motor | AF207 | R/W | same as AF107 | - |
| 57Ech | 57EBh | DC braking force at start, 2nd-motor | AF208 | R/W | same as AF108 | 1(%) |
| 57Edh | 57ECh | DC braking active time at start, 2nd-motor | AF209 | R/W | same as AF109 | 0.01(s) |
| 57F8h | 57EDh | ContactoControl Enable, 2nd-motor | AF220 | R/W | same as AF120 | - |
| 57F9h | 57F8h | Run delay time, 2nd-motor | AF221 | R/W | same as AF121 | 0.01(s) |
| 57Fah | 57F9h | Contacto off delay time, 2nd-motor | AF222 | R/W | same as AF122 | 0.01(s) |
| 57FBh | 57FAh | Contacto answer back check time, 2nd-motor | AF223 | R/W | same as AF123 | 0.01(s) |
| 5802h | 5801h | Brake Control Enable, 2nd-motor | AF230 | R/W | same as AF130 | - |
| 5803h | 5802h | Brake Wait Time for Release, 2nd-motor (Forward side) | AF231 | R/W | same as AF131 | 0.01(s) |
| 5804h | 5803h | Brake Wait Time for Accel., 2nd-motor (Forward side) | AF232 | R/W | same as AF132 | 0.01(s) |
| 5805h | 5804h | Brake Wait Time for Stopping, 2nd-motor (Forward side) | AF233 | R/W | same as AF133 | 0.01(s) |
| 5806h | 5805h | Brake Wait Time for Confirmation, 2nd-motor (Forward side) | AF234 | R/W | same as AF134 | 0.01(s) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|-------------------------|------------|
| 5807h | 5806h | Brake Release Frequency Setting, 2nd-motor (Forward side) | AF235 | R/W | same as AF135 | 0.01(Hz) |
| 5808h | 5807h | Brake Release Current Setting, 2nd-motor (Forward side) | AF236 | R/W | same as AF136 | 0.1(A) |
| 5809h | 5808h | Braking Frequency, 2nd-motor (Forward side) | AF237 | R/W | same as AF137 | 0.01(Hz) |
| 580Ah | 5809h | Brake Wait Time for Release, 2nd-motor (Reverse side) | AF238 | R/W | same as AF138 | 0.01(s) |
| 580Bh | 580Ah | Brake Wait Time for Accel., 2nd-motor (Reverse side) | AF239 | R/W | same as AF139 | 0.01(s) |
| 580Ch | 580Bh | Brake Wait Time for Stopping, 2nd-motor (Reverse side) | AF240 | R/W | same as AF140 | 0.01(s) |
| 580Dh | 580Ch | Brake Wait Time for Confirmation, 2nd-motor (Reverse side) | AF241 | R/W | same as AF141 | 0.01(s) |
| 580Eh | 580Dh | Brake Release Frequency Setting, 2nd-motor (Reverse side) | AF242 | R/W | same as AF142 | 0.01(Hz) |
| 580Fh | 580Eh | Brake Release Current Setting, 2nd-motor (Reverse side) | AF243 | R/W | same as AF143 | 0.1(A) |
| 5810h | 580Fh | Braking Frequency, 2nd-motor (Reverse side) | AF244 | R/W | same as AF144 | 0.01(Hz) |
| 5816h | 5815h | Brake open delay time, 2nd-motor | AF250 | R/W | same as AF150 | 0.01(s) |
| 5817h | 5816h | Brake close delay time, 2nd-motor | AF251 | R/W | same as AF151 | 0.01(s) |
| 5818h | 5817h | Brake answer back check time, 2nd-motor | AF252 | R/W | same as AF152 | 0.01(s) |
| 5819h | 5818h | Servo lock/ DC injection time at start, 2nd-motor | AF253 | R/W | same as AF153 | 0.01(s) |
| 581Ah | 5819h | Servo lock/ DC injection time at stop, 2nd-motor | AF254 | R/W | same as AF154 | 0.01(s) |
| 5849h | 5848h | Jump frequency 1, 2nd-motor | AG201 | R/W | same as AG101 | 0.01(Hz) |
| 584Ah | 5849h | Jump frequency width 1, 2nd-motor | AG202 | R/W | same as AG102 | 0.01(Hz) |
| 584Bh | 584Ah | Jump frequency 2, 2nd-motor | AG203 | R/W | same as AG103 | 0.01(Hz) |
| 584Ch | 584Bh | Jump frequency width 2, 2nd-motor | AG204 | R/W | same as AG104 | 0.01(Hz) |
| 584Dh | 584Ch | Jump frequency 3, 2nd-motor | AG205 | R/W | same as AG105 | 0.01(Hz) |
| 584Eh | 584Dh | Jump frequency width 3, 2nd-motor | AG206 | R/W | same as AG106 | 0.01(Hz) |
| 5852h | 5851h | Acceleration stop frequency setting, 2nd-motor | AG210 | R/W | same as AG110 | 0.01(Hz) |
| 5853h | 5852h | Acceleration stop time setting, 2nd-motor | AG211 | R/W | same as AG111 | 0.1(s) |
| 5854h | 5853h | Deceleration stop frequency setting, 2nd-motor | AG212 | R/W | same as AG112 | 0.01(Hz) |
| 5854h | 5853h | Deceleration stop time setting, 2nd-motor | AG213 | R/W | same as AG113 | 0.1(s) |

*1. Cannot be selected if [Ub-03] load type selection is 01 (LD) or 00 (VLD).

- *2. Cannot be selected if [Ub-03] load type selection is 00 (VLD).
- *3. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.
- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A, V). When the data of [CF-11] Resister data selection is not set to 00 (A, V), it is not set or displayed correctly.)
 - 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A, V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
 - 3) Drive programming: 0.01% (Rated ratio)
- *4. Data range differs depending on [AH-04] - [AH-06].

9-5-5 Group b Register List



Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|------------|
| 32C9h | 32C8h | Frequency limit selection, 1st-motor | bA101 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option | - |
| 32Cah | 32C9h | Upper Frequency limit, 1st-motor | bA102 | R/W | 0 to 59000 | 0.01(Hz) |
| 32CBh | 32CAh | Lower Frequency limit, 1st-motor | bA103 | R/W | 0 to 59000 | 0.01(Hz) |
| 32D2h | 32D1h | Torque limit selection, 1st-motor | bA110 | R/W | 00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 | - |
| 32D3h | 32D2h | Torque limit parameter mode selection, 1st-motor | bA111 | R/W | 00: Four quadrant specific 01: [TRQ] terminal switch | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 32D4h | 32D3h | Torque limit 1 (Forward driving), 1st-motor | bA112 | R/W | 0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 0.1(%) |
| 32D5h | 32D4h | Torque limit 2 (Reverse regenerative), 1st-motor | bA113 | R/W | 0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 0.1(%) |
| 32D6h | 32D5h | Torque limit 3 (Reverse driving), 1st-motor | bA114 | R/W | 0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 0.1(%) |
| 32D7h | 32D6h | Torque limit 4 (Forward regenerative), 1st-motor | bA115 | R/W | 0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 0.1(%) |
| 32D8h | 32D7h | Torque limit LADSTOP selection, 1st-motor | bA116 | R/W | 00: Disabled 01: Enabled | - |
| 32DCh | 32DBh | Over current suppress enable, 1st-motor | bA120 | R/W | 00: Disabled 01: Enabled | - |
| 32DDh | 32DCh | Over current suppress Level, 1st-motor | bA121 | R/W | (0.0 to 2.0) × Inverter rated current ^{*1} | 0.1(A) |
| 32Deh | 32DDh | Overload restriction 1 mode selection, 1st-motor | bA122 | R/W | 00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/Increase speed at regeneration | - |
| 32DFh | 32Deh | Overload restriction 1 active level, 1st-motor | bA123 | R/W | (0.2 to 2.0) × Inverter rated current ^{*1} | 0.1(A) |
| 32E0h | 32DFh | Overload restriction 1 action time, 1st-motor | bA124 (HIGH) | R/W | 10 to 360000 | 0.01(s) |
| 32E1h | 32E0h | | bA125 (LOW) | R/W | | |
| 32E2h | 32E1h | Overload restriction 2 mode selection, 1st-motor | bA126 | R/W | 00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/Increase speed at regeneration | - |
| 32E3h | 32E2h | Overload restriction 2 active level, 1st-motor | bA127 | R/W | (0.2 to 2.0) × Inverter rated current ^{*1} | 0.1(A) |
| 32E4h | 32E3h | Overload restriction 2 Action time, 1st-motor | bA128 (HIGH) | R/W | 10 to 360000 | 0.01(s) |
| 32E5h | 32E4h | | bA129 (LOW) | R/W | | |
| 32E6h | 32E5h | Deceleration-stop at power failure | bA-30 | R/W | 00 (Disabled)/ 01 (Enabled: deceleration stop)/ 02 (Enabled: no recovery)/ 03 (Enabled: with recovery) | - |
| 32E7h | 32E6h | Decel-stop at power failure starting voltage | bA-31 | R/W | (200V class) 0- 4100 (400V class) 0- 8200 | 0.1(Vdc) |
| 32E8h | 32E7h | Decel-stop at power failure control target level | bA-32 | R/W | (200V class) 0- 4100 (400V class) 0- 8200 | 0.1(Vdc) |
| 32Eah | 32E9h | Decel-stop at power failure deceleration time | bA-34 (HIGH) | R/W | 1 to 360000 | 0.01(s) |
| 32Ebh | 32EAh | | bA-35 (LOW) | R/W | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 32Ech | 32EBh | Decel-stop at power failure freq. width at deceleration start | bA-36 | R/W | 0 to 1000 | 0.01(Hz) |
| 32Edh | 32ECh | Decel-stop at power failure DC-bus voltage constant control P-gain | bA-37 | R/W | 0 to 500 | 0.01 |
| 32Eeh | 32EDh | Decel-stop at power failure DC-bus voltage constant control I-gain | bA-38 | R/W | 0 to 15000 | 0.01(s) |
| 32F0h | 32EFh | Over-voltage suppression enable, 1st-motor | bA140 | R/W | 00: Disabled 01: DC voltage constant deceleration 02: Acceleration only at deceleration 03: Acceleration at constant speed/deceleration | - |
| 32F1h | 32F0h | Over-voltage suppression active level, 1st-motor | bA141 | R/W | (200Vclass) 3300 to 4000 (400Vclass) 6600 to 8000 | 0.1(Vdc) |
| 32F2h | 32F1h | Over-voltage suppression action time, 1st-motor | bA142 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 32F3h | 32F2h | | bA143 (LOW) | R/W | | |
| 32F4h | 32F3h | DC bus constant control proportional gain, 1st-motor | bA144 | R/W | 0 to 500 | 0.01 |
| 32F5h | 32F4h | DC bus constant control integral gain, 1st-motor | bA145 | R/W | 0 to 15000 | 0.01(s) |
| 32F6h | 32F5h | Over magnetization deceleration function selection, 1st_motor | bA146 | R/W | 00: Disabled 01: Regular operation 02: Operation only at deceleration 03: Level mode 04: Level mode only at deceleration | - |
| 32F7h | 32F6h | Over magnetization output filter time constant, 1st_motor | bA147 | R/W | 0 to 100 | 0.01(s) |
| 32F8h | 32F7h | Over magnetization voltage gain, 1st_motor | bA148 | R/W | 50 to 400 | 1(%) |
| 32F9h | 32F8h | Over magnetization level setting, 1st_motor | bA149 | R/W | (200V class) 3300 - 4000 (400V class) 6600 - 8000 | 0.1(Vdc) |
| 3304h | 3303h | Dynamic brake usage rate | bA-60 | R/W | 0.0 - 10.0×([bA-63]/minimum resistance) ^{2*2} | 0.1(%) |
| 3305h | 3304h | Dynamic brake selection | bA-61 | R/W | 00: Disabled 01: Enabled: disabled at stop 02: Enabled: enabled at stop | - |
| 3306h | 3305h | Dynamic brake active level | bA-62 | R/W | (200V class) 3300 - 4000 (400V class) 6600 - 8000 | 0.1(Vdc) |
| 3307h | 3306h | Dynamic brake resistor value | bA-63 | R/W | Minimum resistance - 600 ^{*2} | 0.1(Ω) |
| 330Eh | 330Dh | Cooling FAN control method selection | bA-70 | R/W | 00: Always ON 01: ON during operation 02: Temperature dependent | - |
| 330Fh | 330Eh | Cooling FAN accumulation running time clear selection | bA-71 | R/W | 00: Disabled 01: Clear | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|------------|
| 332Dh | 332Ch | Carrier speed setting, 1st-motor | bb101 | R/W | [Ub-03]=02: ND 0.5 to 16.0 (kHz) [Ub-03]=01: LD 0.5 to 12.0 (kHz) [Ub-03]=00: VLD 0.5 to 10.0 (kHz) *3 | 0.1kHz |
| 332Eh | 332Dh | Sprinkle carrier pattern selection, 1st-motor | bb102 | R/W | 00: Disabled 01: Pattern 1 enabled 02: Pattern 2 enabled 03: Pattern 3 enabled | - |
| 332Fh | 332Eh | Automatic-carrier reduction selection, 1st-motor | bb103 | R/W | 00: Disabled 01: Enabled: current 02: Enabled: temperature | - |
| 3336h | 3335h | Automatic error reset selection | bb-10 | R/W | 00: Disabled 01: Enabled with operation command OFF 02: Enable after the setting time | - |
| 3337h | 3336h | Alarm signal selection at Automatic error reset is active | bb-11 | R/W | 00: Output 01: Not output | - |
| 3338h | 3337h | Automatic error reset wait time | bb-12 | R/W | 0 to 600 | 1(s) |
| 3339h | 3338h | Automatic error reset number | bb-13 | R/W | 0 to 10 | 1 |
| 3340h | 3339h | The number of retries after instantaneous power failure | bb-20 | R/W | 0 to 16 / 255 | 1 |
| 3341h | 3340h | The number of retries after under voltage | bb-21 | R/W | 0 to 16 / 255 | 1 |
| 3342h | 3341h | The number of retries after over current | bb-22 | R/W | 0 to 5 | 1 |
| 3343h | 3342h | The number of retries after over voltage | bb-23 | R/W | 0 to 5 | 1 |
| 3344h | 3343h | Selection of restart mode @Instantaneous power failure/ under-voltage trip | bb-24 | R/W | 00: 0Hz 01: (Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop | - |
| 3345h | 3344h | Allowable under-voltage power failure time | bb-25 | R/W | 3 to 250 | 0.1(s) |
| 3346h | 3345h | Retry wait time before motor restart | bb-26 | R/W | 3 to 1000 | 0.1(s) |
| 3347h | 3346h | Instantaneous power failure/under-voltage trip alarm enable | bb-27 | R/W | 00: Disabled 01: Enabled at stop 02: Disabled at stop and deceleration stop | - |
| 3348h | 3347h | Selection of restart mode @over-current | bb-28 | R/W | 00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop | - |
| 3349h | 3348h | Wait time of restart @over-current | bb-29 | R/W | 3 to 1000 | 0.1(s) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 334Ah | 3349h | Selection of restart mode @over-voltage | bb-30 | R/W | 00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop | - |
| 334Bh | 334Ah | Wait time of restart @over-voltage | bb-31 | R/W | 0.3 to 100.0 (s) | 0.1(s) |
| 3354h | 3353h | Restart mode after FRS release | bb-40 | R/W | 00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed* ⁴ | - |
| 3355h | 3354h | Restart mode after RS release | bb-41 | R/W | 00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed* ⁴ | - |
| 3356h | 3355h | Restart frequency threshold | bb-42 | R/W | 0 to 59000 | 0.01(Hz) |
| 3357h | 3356h | Restart level of Active frequency matching | bb-43 | R/W | (0.0 to 2.0) × Inverter rated current* ¹ | 0.1(A) |
| 3358h | 3357h | Restart constant(speed) of Active frequency matching | bb-44 | R/W | 10 to 3000 | 0.01(s) |
| 3359h | 3358h | Restart constant(Voltage) of Active frequency matching | bb-45 | R/W | 10 to 3000 | 0.01(s) |
| 335Ah | 3359h | OC-suppress level of Active frequency matching | bb-46 | R/W | (0.0 to 2.0) × Inverter rated current* ¹ | 0.1(A) |
| 335Bh | 335Ah | Restart speed selection of Active frequency matching | bb-47 | R/W | 00: Cutoff frequency 01: Maximum frequency 02: Setting frequency | - |
| 3368h | 3367h | Over current detection level, 1st-motor | bb160 | R/W | (0.2 to 2.2) x Inverter ND rated current* ¹ | 0.1(A) |
| 3369h | 3368h | Power supply over voltage selection | bb-61 | R/W | 00: Warning 01: Error | - |
| 336Ah | 3369h | Power supply over voltage level setting | bb-62 | R/W | (200V class) 3000 - 4100 (400V class) 6000 - 8200 | 0.1(Vdc) |
| 336Ch | 336Bh | Ground fault selection | bb-64 | R/W | 00: Disabled 01: Enabled | - |
| 336Dh | 336Ch | Input phase loss enable | bb-65 | R/W | 00: Disabled 01: Enabled | - |
| 336Eh | 336Dh | Output phase loss enable | bb-66 | R/W | 00: Disabled 01: Enabled | - |
| 336Fh | 336Eh | Output phase loss detection sensitivity | bb-67 | R/W | 1 to 100 | 1(%) |
| 3372h | 3371h | Thermistor error level | bb-70 | R/W | 0 to 10000 | 1(Ω) |
| 337Ch | 337Bh | Over speed detection level | bb-80 | R/W | 0 to 1500 | 0.1(%) |
| 337Dh | 337Ch | Over speed detection time | bb-81 | R/W | 0 to 50 | 0.1(s) |
| 337Eh | 337Dh | Speed deviation error mode selection | bb-82 | R/W | 00: Warning 01: Error | - |
| 337Fh | 337Eh | Speed deviation error detection level | bb-83 | R/W | 0 to 1000 | 0.1(%) |
| 3380h | 337Fh | Speed deviation error detection time | bb-84 | R/W | 0 to 50 | 0.1(s) |
| 3381h | 3380h | Position deviation error mode selection | bb-85 | R/W | 00: Warning 01: Error | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|----------------------|
| 3382h | 3381h | Position deviation error detection level | bb-86 | R/W | 0 to 65535 ($\times 100$ pls) | 1($\times 100$ pls) |
| 3383h | 3382h | Position deviation error detection time | bb-87 | R/W | 0 to 50 | 0.1(s) |
| 33F5h | 33F4h | STO input display selection | bd-01 | R/W | 00: With indication 01: Without indication 02: Trip | - |
| 33F6h | 33F5h | STO input change time | bd-02 | R/W | 0 to 6000 | 0.01(s) |
| 33F7h | 33F6h | Display selection at STO input change time | bd-03 | R/W | 00: With indication 01: Without indication | - |
| 33F8h | 33F7h | Action selection after STO input change time | bd-04 | R/W | 00: Retain only the condition 01: Disabled 02: Trip | - |
| 59D9h | 59D8h | Frequency limit selection, 2nd motor | bA201 | R/W | Same as bA101 | - |
| 59Dah | 59D9h | Upper frequency limit, 2nd motor | bA202 | R/W | Same as bA102 | 0.01(Hz) |
| 59DBh | 59DAh | Lower frequency limit, 2nd motor | bA203 | R/W | Same as bA103 | 0.01(Hz) |
| 59E2h | 59E1h | Torque limit selection, 2nd-motor | bA210 | R/W | Same as bA110 | - |
| 59E3h | 59E2h | Torque limit parameter mode selection, 2nd-motor | bA211 | R/W | Same as bA111 | - |
| 59E4h | 59E3h | Torque limit 1 (Forward driving), 2nd-motor | bA212 | R/W | Same as bA112 | 0.1(%) |
| 59E5h | 59E4h | Torque limit 2 (Reverse regenerative), 2nd-motor | bA213 | R/W | Same as bA113 | 0.1(%) |
| 59E6h | 59E5h | Torque limit 3 (Reverse driving), 2nd-motor | bA214 | R/W | Same as bA114 | 0.1(%) |
| 59E7h | 59E6h | Torque limit 4 (Forward regenerative), 2nd motor | bA215 | R/W | Same as bA115 | 0.1(%) |
| 59E8h | 59E7h | Torque limit LADSTOP selection, 2nd-motor | bA216 | R/W | Same as bA116 | - |
| 59Ech | 59EBh | Over current suppress enable, 2nd-motor | bA220 | R/W | Same as bA120 | 1 |
| 59Edh | 59ECh | Over current suppress Level, 2nd-motor | bA221 | R/W | Same as bA121 | 0.1(A) |
| 59Eeh | 59EDh | Overload restriction 1 mode selection, 2nd-motor | bA222 | R/W | Same as bA122 | - |
| 59Efh | 59EEh | Overload restriction 1 active level, 2nd-motor | bA223 | R/W | Same as bA123 | 0.1(A) |
| 59F0h | 59EFh | Overload restriction 1 action time, 2nd-motor | bA224 (HIGH) | R/W | Same as bA124 | 0.01(s) |
| 59F1h | 59F0h | | bA225 (LOW) | R/W | | |
| 59F2h | 59F1h | Overload restriction 2 mode selection, 2nd-motor | bA226 | R/W | Same as bA126 | - |
| 59F3h | 59F2h | Overload restriction 2 active level, 2nd-motor | bA227 | R/W | Same as bA127 | 0.1(A) |
| 59F4h | 59F3h | Overload restriction 2 action time, 2nd-motor | bA228 (HIGH) | R/W | Same as bA128 | 0.01(s) |
| 59F5h | 59F4h | | bA229 (LOW) | R/W | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|---|------------|
| 5A00h | 59FFh | Over-voltage suppression enable, 2nd-motor | bA240 | R/W | Same as bA140 | - |
| 5A01h | 5A00h | Over-voltage suppression active level, 2nd-motor | bA241 | R/W | Same as bA141 | 0.1(Vdc) |
| 5A02h | 5A01h | Over-voltage suppression action time, 2nd-motor | bA242 (HIGH) | R/W | Same as bA142 | 0.01(s) |
| 5A03h | 5A02h | | bA243 (LOW) | R/W | | |
| 5A04h | 5A03h | DC bus constant control proportional gain, 2nd-motor | bA244 | R/W | Same as bA144 | 0.01 |
| 5A05h | 5A04h | DC bus constant control integral gain, 2nd-motor | bA245 | R/W | Same as bA145 | 0.01(s) |
| 5A06h | 5A05h | Over magnetization function selection, 2nd-motor | bA246 | R/W | Same as bA146 | - |
| 5A07h | 5A06h | Over magnetization output filter time constant, 2nd-motor | bA247 | R/W | Same as bA147 | 0.01(s) |
| 5A08h | 5A07h | Over magnetization voltage gain, 2nd-motor | bA248 | R/W | Same as bA148 | 1(%) |
| 5A09h | 5A08h | Over magnetization level setting, 2nd-motor | bA249 | R/W | Same as bA149 | 0.1(Vdc) |
| 5A3Dh | 5A3Ch | Carrier speed setting, 2nd-motor | bb201 | R/W | Same as bb101 | 0.1(kHz) |
| 5A3Eh | 5A3Dh | Sprinkle carrier pattern selection, 2nd-motor | bb202 | R/W | Same as bb102 | - |
| 5A3Fh | 5A3Eh | Automatic-carrier reduction selection, 2nd-motor | bb203 | R/W | Same as bb103 | - |
| 5A78h | 5A77h | Over current detection level, 2nd-motor | bb260 | R/W | Same as bb160 | 0.1(A) |
| 339Ah | 3399h | Electronic thermal level setting, 1st-motor | bC110 | R/W | (0.0 - 3.0) × Inverter rated current*1 | 0.1(A) |
| 339Bh | 339Ah | Electronic thermal characteristic selection, 1st-motor | bC111 | R/W | 00: Reduction characteristics 01: Constant torque characteristics 02: Arbitrary setting | - |
| 339Ch | 339Bh | Electronic thermal Subtraction function enable, 1st-motor | bC112 | R/W | 00: Disabled 01: Enabled | - |
| 339Dh | 339Ch | Electronic thermal Subtraction time, 1st-motor | bC113 | R/W | 1 to 1000 | 1(s) |
| 339Eh | 339Dh | Electronic thermal counter memory selection at Power-off | bC-14 | R/W | 00: Disabled 01: Enabled | - |
| 33A4h | 33A3h | Free electronic thermal frequency-1, 1st-motor | bC120 | R/W | 0.00 to [bC122] (Hz) | 0.01(Hz) |
| 33A5h | 33A4h | Free electronic thermal current-1, 1st-motor | bC121 | R/W | (0.0 to 3.0) × Inverter rated current*1 | 0.1(A) |
| 33A6h | 33A5h | Free electronic thermal frequency-2, 1st-motor | bC122 | R/W | [bC120] to [bC124] (Hz) | 0.01(Hz) |
| 33A7h | 33A6h | Free electronic thermal current-2, 1st-motor | bC123 | R/W | (0.0 to 3.0) × Inverter rated current*1 | 0.1(A) |
| 33A8h | 33A7h | Free electronic thermal frequency-3, 1st-motor | bC124 | R/W | [bC122] to 590.00 (Hz) | 0.01(Hz) |
| 33A9h | 33A8h | Free electronic thermal current-3, 1st-motor | bC125 | R/W | (0.0 to 3.0) × Inverter rated current*1 | 0.1(A) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|-------------------------|------------|
| 5AAAh | 33A9h | Electronic thermal level setting, 2nd-motor | bC210 | R/W | Same as bb110 | 0.1(A) |
| 5AABh | 5AAAh | Electronic thermal characteristic selection, 2nd-motor | bC211 | R/W | Same as bb111 | - |
| 5AACH | 5AABh | Electronic thermal Subtraction function enable, 2nd-motor | bC212 | R/W | Same as bC112 | - |
| 5AADh | 5AACH | Electronic thermal Subtraction time, 2nd-motor | bC213 | R/W | Same as bC113 | 1(s) |
| 5AB4h | 5AB3h | Free electronic thermal frequency-1, 2nd-motor | bC220 | R/W | 0.00 to [bC222] (Hz) | 0.01(Hz) |
| 5AB5h | 5AB4h | Free electronic thermal current-1, 2nd-motor | bC221 | R/W | Same as bC121 | 0.1(A) |
| 5AB6h | 5AB5h | Free electronic thermal frequency-2, 2nd-motor | bC222 | R/W | [bC220] to [bC224] (Hz) | 0.01(Hz) |
| 5AB7h | 5AB6h | Free electronic thermal current-2, 2nd-motor | bC223 | R/W | Same as bC123 | 0.1(A) |
| 5AB8h | 5AB7h | Free electronic thermal frequency-3, 2nd-motor | bC224 | R/W | [bC222] to 590.00 (Hz) | 0.01(Hz) |
| 5AB9h | 5AB8h | Free electronic thermal current-3, 2nd-motor | bC225 | R/W | Same as bC125 | 0.1(A) |

- *1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.
- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A, V). When the data of [CF-11] Resister data selection is not set to 00 (A, V), it is not set or displayed correctly.)
 - 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A, V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
 - 3) Drive programming: 0.01% (Rated ratio)
- *2. Minimum resistance values vary in inverter model.
- *3. 3G3RX2-B4750 to 3G3RX2-B413K shall be as follows.
[Ub-03]=02: 0.5 to 10.0(kHz)
[Ub-03]=00 or 01: 0.5 to 8.0(kHz)
- *4. The feedback input to input terminals A and B and the feedback input to option cassette RX2-PG are necessary.

9-5-6 Group C Register List



Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|-------------------------------------|---------------|-----|--|------------|
| 36B1h | 36B0h | Input terminal [1] function | CA-01 | R/W | See <List of input terminal functions> on page C-44. | - |
| 36B2h | 36B1h | Input terminal [2] function | CA-02 | R/W | | |
| 36B3h | 36B2h | Input terminal [3] function | CA-03 | R/W | | |
| 36B4h | 36B3h | Input terminal [4] function | CA-04 | R/W | | |
| 36B5h | 36B4h | Input terminal [5] function | CA-05 | R/W | | |
| 36B6h | 36B5h | Input terminal [6] function | CA-06 | R/W | | |
| 36B7h | 36B6h | Input terminal [7] function | CA-07 | R/W | | |
| 36B8h | 36B7h | Input terminal [8] function | CA-08 | R/W | | |
| 36B9h | 36B8h | Input terminal [9] function | CA-09 | R/W | | |
| 36Bah | 36B9h | Input terminal [A] function | CA-10 | R/W | | |
| 36BBh | 36BAh | Input terminal [B] function | CA-11 | R/W | | |
| 36C5h | 36C4h | Input terminal [1] active state | CA-21 | R/W | 00: Normally open: NO 01: Normally closed: NC | - |
| 36C6h | 36C5h | Input terminal [2] active state | CA-22 | R/W | | |
| 36C7h | 36C6h | Input terminal [3] active state | CA-23 | R/W | | |
| 36C8h | 36C7h | Input terminal [4] active state | CA-24 | R/W | | |
| 36C9h | 36C8h | Input terminal [5] active state | CA-25 | R/W | | |
| 36Cah | 36C9h | Input terminal [6] active state | CA-26 | R/W | | |
| 36CBh | 36CAh | Input terminal [7] active state | CA-27 | R/W | | |
| 36CCh | 36CBh | Input terminal [8] active state | CA-28 | R/W | | |
| 36CDh | 36CCh | Input terminal [9] active state | CA-29 | R/W | | |
| 36Ceh | 36CDh | Input terminal [A] active state | CA-30 | R/W | | |
| 36CFh | 36CEh | Input terminal [B] active state | CA-31 | R/W | | |
| 36D9h | 36D8h | Input terminal [1] response time | CA-41 | R/W | 0 to 400 | 1(ms) |
| 36Dah | 36D9h | Input terminal [2] response time | CA-42 | R/W | | 1(ms) |
| 36DBh | 36Dah | Input terminal [3] response time | CA-43 | R/W | | 1(ms) |
| 36DCh | 36DBh | Input terminal [4] response time | CA-44 | R/W | | 1(ms) |
| 36DDh | 36DCh | Input terminal [5] response time | CA-45 | R/W | | 1(ms) |
| 36Deh | 36DDh | Input terminal [6] response time | CA-46 | R/W | | 1(ms) |
| 36DFh | 36DEh | Input terminal [7] response time | CA-47 | R/W | | 1(ms) |
| 36E0h | 36DFh | Input terminal [8] response time | CA-48 | R/W | | 1(ms) |
| 36E1h | 36E0h | Input terminal [9] response time | CA-49 | R/W | | 1(ms) |
| 36E2h | 36E1h | Input terminal [A] response time | CA-50 | R/W | | 1(ms) |
| 36E3h | 36E2h | Input terminal [B] response time | CA-51 | R/W | | 1(ms) |
| 36E7h | 36E6h | Multistage input determination time | CA-55 | R/W | 0 to 2000 | 1(ms) |
| 36Ech | 36EBh | FUP/FDN overwrite target selection | CA-60 | R/W | 00: Frequency command 01: PID1 | - |
| 36Edh | 36ECh | FUP/FDN data save enable | CA-61 | R/W | 00: Not save 01: Save | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 36Eeh | 36EDh | FUP/FDN UDC selection | CA-62 | R/W | 00: 0Hz 01: saved data | - |
| 36F0h | 36EFh | Acceleration time setting for FUP/FDN function | CA-64 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 36F1h | 36F0h | | CA-65 (LOW) | R/W | | |
| 36F2h | 36F1h | Deceleration time setting for FUP/FDN function | CA-66 (HIGH) | R/W | 0 to 360000 | 0.01(s) |
| 36F3h | 36F2h | | CA-67 (LOW) | R/W | | |
| 36F6h | 36F5h | Speed reference source selection at [F-OP] is active | CA-70 | R/W | 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved) | - |
| 36F7h | 36F6h | RUN command source selection at [F-OP] is active | CA-71 | R/W | 00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD operator 03: RS485 04: Option 1 05: Option 2 06: Option 3 | - |
| 36F8h | 36F7h | Reset mode selection | CA-72 | R/W | 00: On to Release Trip 01: Off to Release Trip 02: On to Release at Trip 03: Of to Release at Trip | - |
| 3701h | 3700h | Encoder constant setting | CA-81 | R/W | 32 to 65535 | 1(pls) |
| 3702h | 3701h | Encoder position selection | CA-82 | R/W | 00: Phase-A is leading 01: Phase-B is leading | - |
| 3703h | 3702h | Motor gear ratio Numerator | CA-83 | R/W | 1 to 10000 | 1 |
| 3704h | 3703h | Motor gear ratio Denominator | CA-84 | R/W | 1 to 10000 | 1 |
| 370Ah | 3709h | Pulse train detection object selection | CA-90 | R/W | 00: Disabled 01: Frequency command 02: Speed feedback 03: Pulse count | - |
| 370Bh | 370Ah | Mode selection of pulse train input | CA-91 | R/W | 00: 90° phase difference 01: forward/reverse rotation command and rotation direction 02: forward/reverse rotation pulse string | - |
| 370Ch | 370Bh | Pulse train frequency Scale | CA-92 | R/W | 5 to 3200 | 0.01(kHz) |
| 370Dh | 370Ch | Pulse train frequency Filter time constant | CA-93 | R/W | 1 to 200 | 0.01(s) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|------------|
| 370Eh | 370Dh | Pulse train frequency Bias value | CA-94 | R/W | -1000 to 1000 | 0.1(%) |
| 370Fh | 370Eh | Pulse train frequency High Limit | CA-95 | R/W | 0 to 1000 | 0.1(%) |
| 3710h | 370Fh | Pulse train frequency detection low level | CA-96 | R/W | 0 to 1000 | 0.1(%) |
| 3711h | 3710h | Comparing match output ON-level for Pulse count | CA-97 | R/W | 0 to 65535 | 1 |
| 3712h | 3711h | Comparing match output OFF-level for Pulse count | CA-98 | R/W | 0 to 65535 | 1 |
| 3713h | 3712h | Comparing match output Maximum value for Pulse count | CA-99 | R/W | 0 to 65535 | 1 |
| 3715h | 3714h | Filter time constant of Terminal [Ai1] | Cb-01 | R/W | 1 to 500 | 1(ms) |
| 3717h | 3716h | Start value of Terminal [Ai1] | Cb-03 | R/W | 0 to 10000 | 0.01(%) |
| 3718h | 3717h | End value of Terminal [Ai1] | Cb-04 | R/W | 0 to 10000 | 0.01(%) |
| 3719h | 3718h | Start rate of Terminal [Ai1] | Cb-05 | R/W | 0 to 1000 (Cb-06) | 0.1(%) |
| 371Ah | 3719h | End rate of Terminal [Ai1] | Cb-06 | R/W | (Cb-05) 0 to 1000 | 0.1(%) |
| 371Bh | 371Ah | Start point selection of Terminal [Ai1] | Cb-07 | R/W | 00: Start amount 01: 0% | - |
| 371Fh | 371Eh | Filter time constant of Terminal [Ai2] | Cb-11 | R/W | 1 to 500 | 1(ms) |
| 3721h | 3720h | Start value of Terminal [Ai2] | Cb-13 | R/W | 0 to 10000 | 0.01(%) |
| 3722h | 3721h | End value of Terminal [Ai2] | Cb-14 | R/W | 0 to 10000 | 0.01(%) |
| 3723h | 3722h | Start rate of Terminal [Ai2] | Cb-15 | R/W | 0 to 1000 (Cb-16) | 0.1(%) |
| 3724h | 3723h | End rate of Terminal [Ai2] | Cb-16 | R/W | (Cb-15) 0 to 1000 | 0.1(%) |
| 3725h | 3724h | Start point selection of Terminal [Ai2] | Cb-17 | R/W | 00: Start amount 01: 0% | - |
| 3729h | 3728h | Filter time constant of Terminal [Ai3] | Cb-21 | R/W | 1 to 500 | 1(ms) |
| 372Ah | 3729h | Terminal [Ai3] selection | Cb-22 | R/W | 00: Single 01: Added to Ai1/Ai2: with reversibility 02: Added to Ai1/Ai2: without reversibility | - |
| 372Bh | 372Ah | Start value of Terminal [Ai3] | Cb-23 | R/W | -10000 to 10000 | 0.01% |
| 372Ch | 372Bh | End value of Terminal [Ai3] | Cb-24 | R/W | -10000 to 10000 | 0.01% |
| 372Dh | 372Ch | Start rate of Terminal [Ai3] | Cb-25 | R/W | -1000 to 1000 (Cb-26) | 0.1(%) |
| 372Eh | 372Dh | End rate of Terminal [Ai3] | Cb-26 | R/W | (Cb-25)-1000 to 1000 | 0.1(%) |
| 3732h | 3731h | [Ai1] Voltage/Current zero-gain adjustment | Cb-30 | R/W | -10000 to 10000 | 0.01(%) |
| 3733h | 3732h | [Ai1] Voltage/Current gain adjustment | Cb-31 | R/W | 0 to 20000 | 0.01(%) |
| 3734h | 3733h | [Ai2] Voltage/Current zero-gain adjustment | Cb-32 | R/W | -10000 to 10000 | 0.01(%) |
| 3735h | 3734h | [Ai2] Voltage/Current gain adjustment | Cb-33 | R/W | 0 to 20000 | 0.01(%) |
| 3736h | 3735h | [Ai3] Voltage/Current zero-gain adjustment | Cb-34 | R/W | -10000 to 10000 | 0.01(%) |
| 3737h | 3736h | [Ai3] Voltage gain adjustment | Cb-35 | R/W | 0 to 20000 | 0.01(%) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|-------------------------------------|---------------|-----|--|------------|
| 373Ch | 373Bh | Thermistor selection | Cb-40 | R/W | 00: Disabled 01: PTC resistance value enabled 02: NTC resistance value enabled | - |
| 373Dh | 373Ch | Thermistor gain adjustment | Cb-41 | R/W | 0 to 10000 | 0.1 |
| 3779h | 3778h | Output terminal [11] function | CC-01 | R/W | See <List of output terminal functions> on page C-49. | - |
| 377Ah | 3779h | Output terminal [12] function | CC-02 | R/W | | |
| 377Bh | 377Ah | Output terminal [13] function | CC-03 | R/W | | |
| 377Ch | 377Bh | Output terminal [14] function | CC-04 | R/W | | |
| 377Dh | 377Ch | Output terminal [15] function | CC-05 | R/W | | |
| 377Eh | 377Dh | Relay output terminal [16] function | CC-06 | R/W | | |
| 377Fh | 377Eh | Relay output terminal [AL] function | CC-07 | R/W | | |
| 3783h | 3782h | Output terminal [11] active state | CC-11 | R/W | 00: Normally open: NO 01: Normally closed: NC | - |
| 3784h | 3783h | Output terminal [12] active state | CC-12 | R/W | | |
| 3785h | 3784h | Output terminal [13] active state | CC-13 | R/W | | |
| 3786h | 3785h | Output terminal [14] active state | CC-14 | R/W | | |
| 3787h | 3786h | Output terminal [15] active state | CC-15 | R/W | | |
| 3788h | 3787h | Output terminal [16] active state | CC-16 | R/W | | |
| 3789h | 3788h | Output terminal [AL] active state | CC-17 | R/W | | |
| 378Ch | 378Bh | Output terminal [11] on-delay time | CC-20 | R/W | 0 to 10000 | 0.01(s) |
| 378Dh | 378Ch | Output terminal [11] off-delay time | CC-21 | R/W | 0 to 10000 | 0.01(s) |
| 378Eh | 378Dh | Output terminal [12] on-delay time | CC-22 | R/W | 0 to 10000 | 0.01(s) |
| 378Fh | 378Eh | Output terminal [12] off-delay time | CC-23 | R/W | 0 to 10000 | 0.01(s) |
| 3790h | 378Fh | Output terminal [13] on-delay time | CC-24 | R/W | 0 to 10000 | 0.01(s) |
| 3791h | 3790h | Output terminal [13] off-delay time | CC-25 | R/W | 0 to 10000 | 0.01(s) |
| 3792h | 3791h | Output terminal [14] on-delay time | CC-26 | R/W | 0 to 10000 | 0.01(s) |
| 3793h | 3792h | Output terminal [14] off-delay time | CC-27 | R/W | 0 to 10000 | 0.01(s) |
| 3794h | 3793h | Output terminal [15] on-delay time | CC-28 | R/W | 0 to 10000 | 0.01(s) |
| 3795h | 3794h | Output terminal [15] off-delay time | CC-29 | R/W | 0 to 10000 | 0.01(s) |
| 3796h | 3795h | Output relay [16] on-delay time | CC-30 | R/W | 0 to 10000 | 0.01(s) |
| 3797h | 3796h | Output relay [16] off-delay time | CC-31 | R/W | 0 to 10000 | 0.01(s) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 3798h | 3797h | Output relay [AL] on-delay time | CC-32 | R/W | 0 to 10000 | 0.01(s) |
| 3799h | 3798h | Output relay [AL] off-delay time | CC-33 | R/W | 0 to 10000 | 0.01(s) |
| 37A0h | 379Fh | Logical calculation target 1 selection of LOG1 | CC-40 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37A1h | 37A0h | Logical calculation target 2 selection of LOG1 | CC-41 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37A2h | 37A1h | Logical calculation symbol selection of LOG1 | CC-42 | R/W | 00:AND 01:OR 02:XOR | - |
| 37A3h | 37A2h | Logical calculation target 1 selection of LOG2 | CC-43 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37A4h | 37A3h | Logical calculation target 2 selection of LOG2 | CC-44 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37A5h | 37A4h | Logical calculation symbol selection of LOG2 | CC-45 | R/W | 00:AND 01:OR 02:XOR | - |
| 37A6h | 37A5h | Logical calculation target 1 selection of LOG3 | CC-46 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37A7h | 37A6h | Logical calculation target 2 selection of LOG3 | CC-47 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37A8h | 37A7h | Logical calculation symbol selection of LOG3 | CC-48 | R/W | 00:AND 01:OR 02:XOR | - |
| 37A9h | 37A8h | Logical calculation target 1 selection of LOG4 | CC-49 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37Aah | 37A9h | Logical calculation target 2 selection of LOG4 | CC-50 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37Abh | 37AAh | Logical calculation symbol selection of LOG4 | CC-51 | R/W | 00:AND 01:OR 02:XOR | - |
| 37Ach | 37ABh | Logical calculation target 1 selection of LOG5 | CC-52 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37Adh | 37ACh | Logical calculation target 2 selection of LOG5 | CC-53 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37Aeh | 37ADh | Logical calculation symbol selection of LOG5 | CC-54 | R/W | 00:AND 01:OR 02:XOR | - |
| 37Afh | 37AEh | Logical calculation target 1 selection of LOG6 | CC-55 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 37B0h | 37AFh | Logical calculation target 2 selection of LOG6 | CC-56 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37B1h | 37B0h | Logical calculation symbol selection of LOG6 | CC-57 | R/W | 00:AND 01:OR 02:XOR | - |
| 37B2h | 37B1h | Logical calculation target 1 selection of LOG7 | CC-58 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37B3h | 37B2h | Logical calculation target 2 selection of LOG7 | CC-59 | R/W | See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected. | - |
| 37B4h | 37B3h | Logical calculation symbol selection of LOG7 | CC-60 | R/W | 00:AND 01:OR 02:XOR | - |
| 37DDh | 37DCh | [FM] monitor output wave form selection | Cd-01 | R/W | 00: PWM 01: frequency | - |
| 37Deh | 37DDh | [FM] monitor output base frequency (at PWM output) | Cd-02 | R/W | 0 to 3600 | 1(Hz) |
| 37DFh | 37DEh | [FM] monitor output selection | Cd-03 | R/W | See the List of output monitor functions* ¹ | 1 |
| 37E0h | 37DFh | [Ao1] monitor output selection | Cd-04 | R/W | See the List of output monitor functions* ¹ | 1 |
| 37E1h | 37E0h | [Ao2] monitor output selection | Cd-05 | R/W | See the List of output monitor functions* ¹ | 1 |
| 37E6h | 37E5h | Analog monitor adjust mode enable | Cd-10 | R/W | 00: Disabled 01: Enabled | - |
| 37E7h | 37E6h | Filter time constant of [FM]monitor | Cd-11 | R/W | 1 to 500 | 1(ms) |
| 37E8h | 37E7h | [FM] Data type selection | Cd-12 | R/W | 00: absolute value 01: with sign | - |
| 37E9h | 37E8h | [FM] monitor bias adjustment | Cd-13 | R/W | -1000 to 1000 | 0.1(%) |
| 37Eah | 37E9h | [FM] monitor gain adjustment | Cd-14 | R/W | -10000 to 10000 | 0.1(%) |
| 37Ebh | 37EAh | Output level setting at [FM] monitor adjust mode | Cd-15 | R/W | -1000 to 1000 | 0.1(%) |
| 37F1h | 37F0h | Filter time constant of [Ao1] monitor | Cd-21 | R/W | 1 to 500 | 1(ms) |
| 37F2h | 37F1h | [Ao1] Data type selection | Cd-22 | R/W | 00: absolute value 01: with sign | - |
| 37F3h | 37F2h | [Ao1] monitor bias adjustment | Cd-23 | R/W | -1000 to 1000 | 0.1(%) |
| 37F4h | 37F3h | [Ao1] monitor gain adjustment | Cd-24 | R/W | -10000 to 10000 | 0.1(%) |
| 37F5h | 37F4h | Output level setting at [Ao1] monitor adjust mode | Cd-25 | R/W | -1000 to 1000 | 0.1(%) |
| 37FBh | 37FAh | Filter time constant of [Ao2] monitor | Cd-31 | R/W | 1 to 500 | 1(ms) |
| 37FCh | 37FBh | [Ao2] Data type selection | Cd-32 | R/W | 00: absolute value 01: with sign | - |
| 37FDh | 37FCh | [Ao2] monitor bias adjustment | Cd-33 | R/W | -1000 to 1000 | 0.1(%) |
| 37Feh | 37FDh | [Ao2] monitor gain adjustment | Cd-34 | R/W | -10000 to 10000 | 0.1(%) |
| 37FFh | 37FEh | Output level setting at [Ao2] monitor adjust mode | Cd-35 | R/W | -1000 to 1000 | 0.1(%) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|------------|
| 3841h | 3840h | Low current signal output mode selection, 1st motor | CE101 | R/W | 00: During acceleration/deceleration, at constant speed 01: Only at constant speed | - |
| 3842h | 3841h | Low current detection level 1, 1st motor | CE102 | R/W | (0.0 to 2.0) × Inverter rated current*2 | 0.1(A) |
| 3843h | 3842h | Low current detection level 2, 1st motor | CE103 | R/W | (0.0 to 2.0) × Inverter rated current*2 | 0.1(A) |
| 3845h | 3844h | Over current signal output mode selection, 1st motor | CE105 | R/W | 00: During acceleration/deceleration, at constant speed 01: Only at constant speed | - |
| 3846h | 3845h | Over current detection level 1, 1st motor | CE106 | R/W | (0.0 to 2.0) × Inverter rated current*2 | 0.1(A) |
| 3847h | 3846h | Over current detection level 2, 1st motor | CE107 | R/W | (0.0 to 2.0) × Inverter rated current*2 | 0.1(A) |
| 384Ah | 3849h | Arrival frequency setting during acceleration 1 | CE-10 | R/W | 0 to 59000 | 0.01(Hz) |
| 384Bh | 384Ah | Arrival frequency setting during deceleration 1 | CE-11 | R/W | 0 to 59000 | 0.01(Hz) |
| 384Ch | 384Bh | Arrival frequency setting during acceleration 2 | CE-12 | R/W | 0 to 59000 | 0.01(Hz) |
| 384Dh | 384Ch | Arrival frequency setting during deceleration 2 | CE-13 | R/W | 0 to 59000 | 0.01(Hz) |
| 3854h | 3853h | Over torque level (Forward driving), 1st motor | CE120 | R/W | 0 to 5000 | 0.1(%) |
| 3855h | 3854h | Over torque level (Reverse regenerative), 1st motor | CE121 | R/W | 0 to 5000 | 0.1(%) |
| 3856h | 3855h | Over torque level (Reverse driving), 1st motor | CE122 | R/W | 0 to 5000 | 0.1(%) |
| 3857h | 3856h | Over torque level (Forward regenerative), 1st motor | CE123 | R/W | 0 to 5000 | 0.1(%) |
| 385Eh | 385Dh | Electronic thermal warning level (MTR) | CE-30 | R/W | 0 to 10000 | 0.01(%) |
| 385Fh | 385Eh | Electronic thermal warning level (CTL) | CE-31 | R/W | 0 to 10000 | 0.01(%) |
| 3861h | 3860h | Zero speed detection level | CE-33 | R/W | 0 to 10000 | 0.01(Hz) |
| 3862h | 3861h | Cooling FAN over-heat warning level | CE-34 | R/W | 0 to 200 | 1(°C) |
| 3864h | 3863h | Accum.RUN (RNT)/Accum.Power-on (ONT) time setting | CE-36 (HIGH) | R/W | 0 to 100000 | 1(hr) |
| 3865h | 3864h | | CE-37 (LOW) | R/W | | |
| 3868h | 3867h | Window comparator for [Ai1] higher level | CE-40 | R/W | 0 to 100 | 1(%) |
| 3869h | 3868h | Window comparator for [Ai1] lower level | CE-41 | R/W | 0 to 100 | 1(%) |
| 386Ah | 3869h | Window comparator for [Ai1] hysteresis width | CE-42 | R/W | 0 to 10 | 1(%) |
| 386Bh | 386Ah | Window comparator for [Ai2] higher level | CE-43 | R/W | 0 to 100 | 1(%) |
| 386Ch | 386Bh | Window comparator for [Ai2] lower level | CE-44 | R/W | 0 to 100 | 1(%) |
| 386Dh | 386Ch | Window comparator for [Ai2] hysteresis width | CE-45 | R/W | 0 to 10 | 1(%) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 386Eh | 386Dh | Window comparator for [Ai3] higher level | CE-46 | R/W | -100 to 100 | 1(%) |
| 386Fh | 386Eh | Window comparator for [Ai3] lower level | CE-47 | R/W | -100 to 100 | 1(%) |
| 3870h | 386Fh | Window comparator for [Ai3] hysteresis width | CE-48 | R/W | 0 to 10 | 1(%) |
| 3872h | 3871h | Operation level at [Ai1] disconnection | CE-50 | R/W | 0 to 100 | 1(%) |
| 3873h | 3872h | Operation level selection at [Ai1] disconnection | CE-51 | R/W | 00: Disabled 01: Enabled: out of range 02: Enabled: within the range | - |
| 3874h | 3873h | Operation level at [Ai2] disconnection | CE-52 | R/W | 0 to 100 | 1(%) |
| 3875h | 3874h | Operation level selection at [Ai2] disconnection | CE-53 | R/W | 00: Disabled 01: Enabled: out of range 02: Enabled: within the range | - |
| 3876h | 3875h | Operation level at [Ai3] disconnection | CE-54 | R/W | -100 to 100 | 1(%) |
| 3877h | 3876h | Operation level selection at [Ai3] disconnection | CE-55 | R/W | 00: Disabled 01: Enabled: out of range 02: Enabled: within the range | - |
| 38A5h | 38A4h | RS485 communication baud rate selection | CF-01 | R/W | 03:2400bps 04:4800bps 05:9600bps 06:19.2kbps 07:38.4kbps 08:57.6kbps 09:76.8kbps 10:115.2kbps | - |
| 38A6h | 38A5h | RS485 communication Node allocation | CF-02 | R/W | 1 to 247 | 1 |
| 38A7h | 38A6h | RS485 communication parity selection | CF-03 | R/W | 00: Without parity 01: Even number parity 02: Odd number parity | - |
| 38A8h | 38A7h | RS485 communication stop-bit selection | CF-04 | R/W | 01: 1bit 02: 2bit | - |
| 38A9h | 38A8h | RS485 communication error selection | CF-05 | R/W | 00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: (Deceleration stop) | - |
| 38Aah | 38A9h | RS485 communication time-out setting | CF-06 | R/W | 0 to 10000 (0:Disable Communication Time-out) | 0.01(s) |
| 38Abh | 38AAh | RS485 communication wait time setting | CF-07 | R/W | 0 to 1000 | 1(ms) |
| 38Ach | 38ABh | RS485 communication mode selection | CF-08 | R/W | 01: Modbus-RTU 02: EzCOM 03: EzCOM management | - |
| 38AFh | 38AEh | Resister data selection | CF-11 | R/W | 00: A,V 01: % | - |
| 38B8h | 38B7h | EzCOM Start node No. | CF-20 | R/W | 01 to 08 | 1 |
| 38B9h | 38B8h | EzCOM End node No. | CF-21 | R/W | 01 to 08 | 1 |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 38Bah | 38B9h | EzCOM Start method selection | CF-22 | R/W | 00: ECOM terminal 01: (Modbus spec) | - |
| 38BBh | 38BAh | EzCOM data size | CF-23 | R/W | 01 to 05 | 1 |
| 38BCh | 38BBh | EzCOM destination address 1 | CF-24 | R/W | 1 to 47 | 1 |
| 38BDh | 38BCh | EzCOM destination resistor 1 | CF-25 | R/W | 0000 to FFFF | 1 |
| 38Beh | 38BDh | EzCOM source resistor 1 | CF-26 | R/W | 0000 to FFFF | 1 |
| 38BFh | 38BEh | EzCOM destination address 2 | CF-27 | R/W | 1 to 247 | 1 |
| 38C0h | 38BFh | EzCOM destination resistor 2 | CF-28 | R/W | 0000 to FFFF | 1 |
| 38C1h | 38C0h | EzCOM source resistor 2 | CF-29 | R/W | 0000 to FFFF | 1 |
| 38C2h | 38C1h | EzCOM destination address 3 | CF-30 | R/W | 1 to 247 | 1 |
| 38C3h | 38C2h | EzCOM destination resistor 3 | CF-31 | R/W | 0000 to FFFF | 1 |
| 38C4h | 38C3h | EzCOM source resistor 3 | CF-32 | R/W | 0000 to FFFF | 1 |
| 38C5h | 38C4h | EzCOM destination address 4 | CF-33 | R/W | 1 to 247 | 1 |
| 38C6h | 38C5h | EzCOM destination resistor 4 | CF-34 | R/W | 0000 to FFFF | 1 |
| 38C7h | 38C6h | EzCOM source resistor 4 | CF-35 | R/W | 0000 to FFFF | 1 |
| 38C8h | 38C7h | EzCOM destination address 5 | CF-36 | R/W | 1 to 247 | 1 |
| 38C9h | 38C8h | EzCOM destination resistor 5 | CF-37 | R/W | 0000 to FFFF | 1 |
| 38Cah | 38C9h | EzCOM source resistor 5 | CF-38 | R/W | 0000 to FFFF | 1 |
| 38D6h | 38D5h | USB communication Node allocation | CF-50 | R/W | 1 to 247 | 1 |
| 5F51h | 5F50h | Low current signal output mode selection, 2nd-motor | CE201 | R/W | Same as CE101 | - |
| 5F52h | 5F51h | Low current detection level 1, 2nd-motor | CE202 | R/W | Same as CE102 | 0.1(A) |
| 5F53h | 5F52h | Low current detection level 2, 2nd-motor | CE203 | R/W | Same as CE103 | 0.1(A) |
| 5F55h | 5F54h | Over current signal output mode selection, 2nd-motor | CE205 | R/W | Same as CE105 | - |
| 5F56h | 5F55h | Over current detection level 1, 2nd-motor | CE206 | R/W | Same as CE106 | 0.1(A) |
| 5F57h | 5F56h | Over current detection level 2, 2nd-motor | CE207 | R/W | Same as CE107 | 0.1(A) |
| 5F64h | 5F63h | Over torque level (Forward driving), 2nd-motor | CE220 | R/W | Same as CE120 | 0.1(%) |
| 5F65h | 5F64h | Over torque level (Reverse regenerative), 2nd-motor | CE221 | R/W | Same as CE121 | 0.1(%) |
| 5F66h | 5F65h | Over torque level (Reverse driving), 2nd-motor | CE222 | R/W | Same as CE122 | 0.1(%) |
| 5F67h | 5F66h | Over torque level (Forward regenerative), 2nd motor | CE223 | R/W | Same as CE123 | 0.1(%) |

*1. 0 to 65535 (Register No. of d, F code)

*2. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A, V).
When the data of [CF-11] Resister data selection is not set to 00 (A, V), it is not set or displayed correctly.)
- 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A, V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- 3) Drive programming: 0.01% (Rated ratio)

9-5-7 Group H Register List



Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|------------|
| 3A99h | 3A98h | Auto-tuning selection | HA-01 | R/W | 00: Disabled 01: Non-rotation 02: Rotation 03: IVMS | - |
| 3A9Ah | 3A99h | RUN command selection at Auto-tuning | HA-02 | R/W | 00: RUN key on LCD operator 01: [AA111]/[AA211] | - |
| 3A9Bh | 3A9Ah | Online auto-tuning selection | HA-03 | R/W | 00: Disabled 01: Enabled | - |
| 3AA2h | 3AA1h | Stabilization constant, 1st-motor | HA110 | R/W | 0 to 1000 | 1(%) |
| 3AA7h | 3AA6h | Speed response for Async. M, 1st-motor | HA115 | R/W | 0 to 1000 | 1(%) |
| 3AACH | 3AABh | ASR gain switching mode selection, 1st-motor | HA120 | R/W | 00: [CAS] terminal 01: setting switch | - |
| 3AADh | 3AACH | ASR gain switching time setting, 1st-motor | HA121 | R/W | 0 to 10000 | 1(ms) |
| 3AAEh | 3AADh | ASR gain mapping intermediate speed 1, 1st-motor | HA122 | R/W | 0 to 59000 | 0.01(Hz) |
| 3AAFh | 3AAEh | ASR gain mapping intermediate speed 2, 1st-motor | HA123 | R/W | 0 to 59000 | 0.01(Hz) |
| 3AB0h | 3AAFh | ASR gain mapping Maximum speed, 1st-motor | HA124 | R/W | 0 to 59000 | 0.01(Hz) |
| 3AB1h | 3AB0h | ASR gain mapping P-gain 1, 1st-motor | HA125 | R/W | 0 to 10000 | 0.1(%) |
| 3AB2h | 3AB1h | ASR gain mapping I-gain 1, 1st-motor | HA126 | R/W | 0 to 10000 | 0.1(%) |
| 3AB3h | 3AB2h | ASR gain mapping P-gain 1 at P-control, 1st-motor | HA127 | R/W | 0 to 10000 | 0.1(%) |
| 3AB4h | 3AB3h | ASR gain mapping P-gain 2, 1st-motor | HA128 | R/W | 0 to 10000 | 0.1(%) |
| 3AB5h | 3AB4h | ASR gain mapping I-gain 2, 1st-motor | HA129 | R/W | 0 to 10000 | 0.1(%) |
| 3AB6h | 3AB5h | ASR gain mapping P-gain 2 at P-control, 1st-motor | HA130 | R/W | 0 to 10000 | 0.1(%) |
| 3AB7h | 3AB6h | ASR gain mapping P-gain 3, 1st-motor | HA131 | R/W | 0 to 10000 | 0.1(%) |
| 3AB8h | 3AB7h | ASR gain mapping I-gain 3, 1st-motor | HA132 | R/W | 0 to 10000 | 0.1(%) |
| 3AB9h | 3AB8h | ASR gain mapping P-gain 4, 1st-motor | HA133 | R/W | 0 to 10000 | 0.1(%) |
| 3ABAh | 3AB9h | ASR gain mapping I-gain 4, 1st-motor | HA134 | R/W | 0 to 10000 | 0.1(%) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|--|------------------------------|
| 3AFEh | 3AFDh | Async. Motor capacity setting, 1st-motor | Hb102 | R/W | 1 to 16000 | 0.01(kW) |
| 3AFFh | 3AFEh | Async. Motor poles setting, 1st-motor | Hb103 | R/W | 2 to 48 (poles) | 1 |
| 3B00h | 3AFFh | Async. Motor Base frequency setting, 1st-motor | Hb104 | R/W | 10.00 to 590.00 (Hz) | 0.01(Hz) |
| 3B01h | 3B00h | Async. Motor Maximum frequency setting, 1st-motor | Hb105 | R/W | 10.00 to 590.00 (Hz) | 0.01(Hz) |
| 3B02h | 3B01h | Async. Motor rated voltage, 1st-motor | Hb106 | R/W | 1 to 1000 (V) | 1(V) |
| 3B04h | 3B03h | Async. Motor rated current, 1st-motor | Hb108 (HIGH) | R/W | 1 to 1000000 | 0.01(A) |
| 3B05h | 3B04h | | Hb109 (LOW) | R/W | | |
| 3B06h | 3B05h | Async. Motor constant R1, 1st-motor | Hb110 (HIGH) | R/W | 1 to 1000000000 | 0.000001 (Ω) |
| 3B07h | 3B06h | | Hb111 (LOW) | R/W | | |
| 3B08h | 3B07h | Async. Motor constant R2, 1st-motor | Hb112 (HIGH) | R/W | 1 to 1000000000 | 0.000001 (Ω) |
| 3B09h | 3B08h | | Hb113 (LOW) | R/W | | |
| 3B0Ah | 3B09h | Async. Motor constant L, 1st-motor | Hb114 (HIGH) | R/W | 1 to 1000000000 | 0.000001 (mH) |
| 3B0Bh | 3B0Ah | | Hb115 (LOW) | R/W | | |
| 3B0Ch | 3B0Bh | Async. Motor constant I _o , 1st-motor | Hb116 (HIGH) | R/W | 1 to 1000000 | 0.01(A) |
| 3B0Dh | 3B0Ch | | Hb117 (LOW) | R/W | | |
| 3B0Eh | 3B0Dh | Async. Motor constant J, 1st-motor | Hb118 (HIGH) | R/W | 1 to 1000000000 | 0.00001 (kg·m ²) |
| 3B0Fh | 3B0Eh | | Hb119 (LOW) | R/W | | |
| 3B1Ah | 3B19h | Minimum frequency adjustment, 1st-motor | Hb130 | R/W | 10 to 1000 | 0.01(Hz) |
| 3B1Bh | 3B1Ah | Reduced voltage start time setting, 1st-motor | Hb131 | R/W | 0 to 2000 | 1(ms) |
| 3B24h | 3B23h | Manual torque boost operational mode selection, 1st-motor | Hb140 | R/W | 00: Disabled 01: Always enabled 02: Enabled only for forward revolution 03: Enabled only for reverse revolution | - |
| 3B25h | 3B24h | Manual torque boost value, 1st-motor | Hb141 | R/W | 0 to 200 | 0.1(%) |
| 3B26h | 3B25h | Manual torque boost Peak speed, 1st-motor | Hb142 | R/W | 0 to 500 | 0.1(%) |
| 3B29h | 3B28h | Eco drive enable, 1st-motor | Hb145 | R/W | 00: Disabled 01: Enabled | - |
| 3B2Ah | 3B29h | Eco drive response adjustment, 1st-motor | Hb146 | R/W | 0 to 100 | 1(%) |
| 3B2Eh | 3B2Dh | Free-V/f frequency 1 setting, 1st-motor | Hb150 | R/W | 0 to 59000 (Hb152) | 0.01(Hz) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|------------------------------|------------|
| 3B2Fh | 3B2Eh | Free-V/f Voltage 1 setting, 1st-motor | Hb151 | R/W | 0 to 10000 | 0.1(V) |
| 3B30h | 3B2Fh | Free-V/f frequency 2 setting, 1st-motor | Hb152 | R/W | 0 to 59000(Hb150) to (Hb154) | 0.01(Hz) |
| 3B31h | 3B30h | Free-V/f Voltage 2 setting, 1st-motor | Hb153 | R/W | 0 to 10000 | 0.1(V) |
| 3B32h | 3B31h | Free-V/f frequency 3 setting, 1st-motor | Hb154 | R/W | 0 to 59000(Hb152) to (Hb156) | 0.01(Hz) |
| 3B33h | 3B32h | Free-V/f Voltage 3 setting, 1st-motor | Hb155 | R/W | 0 to 10000 | 0.1(V) |
| 3B34h | 3B33h | Free-V/f frequency 4 setting, 1st-motor | Hb156 | R/W | 0 to 59000(Hb154) to (Hb158) | 0.01(Hz) |
| 3B35h | 3B34h | Free-V/f Voltage 4 setting, 1st-motor | Hb157 | R/W | 0 to 10000 | 0.1(V) |
| 3B36h | 3B35h | Free-V/f frequency 5 setting, 1st-motor | Hb158 | R/W | 0 to 59000(Hb156) to (Hb160) | 0.01(Hz) |
| 3B37h | 3B36h | Free-V/f Voltage 5 setting, 1st-motor | Hb159 | R/W | 0 to 10000 | 0.1(V) |
| 3B38h | 3B37h | Free-V/f frequency 6 setting, 1st-motor | Hb160 | R/W | 0 to 59000(Hb158) to (Hb162) | 0.01(Hz) |
| 3B39h | 3B38h | Free-V/f Voltage 6 setting, 1st-motor | Hb161 | R/W | 0 to 10000 | 0.1(V) |
| 3B3Ah | 3B39h | Free-V/f frequency 7 setting, 1st-motor | Hb162 | R/W | 0 to 59000(Hb160) to (Hb104) | 0.01(Hz) |
| 3B3Bh | 3B3Ah | Free-V/f Voltage 7 setting, 1st-motor | Hb163 | R/W | 0 to 10000 | 0.1(V) |
| 3B42h | 3B41h | Slip Compensation P-gain with encoder, 1st-motor | Hb170 | R/W | 0 to 1000 | 1(%) |
| 3B43h | 3B42h | Slip Compensation I-gain with encoder, 1st-motor | Hb171 | R/W | 0 to 1000 | 1(%) |
| 3B4Ch | 3B4Bh | Output voltage gain, 1st-motor | Hb180 | R/W | 0 to 255 | 1(%) |
| 3B61h | 3B60h | Automatic torque boost voltage compensation gain, 1st-motor | HC101 | R/W | 0 to 255 | 1(%) |
| 3B62h | 3B61h | Automatic torque boost slip compensation gain, 1st-motor | HC102 | R/W | 0 to 255 | 1(%) |
| 3B6Ah | 3B69h | Zero speed area limit for Async.M-0SLV, 1st-motor | HC110 | R/W | 0 to 100 | 1(%) |
| 3B6Bh | 3B6Ah | Boost value at start for Async.M-SLV/IM-CLV, 1st-motor | HC111 | R/W | 0 to 50 | 1(%) |
| 3B6Ch | 3B6Bh | Boost value at start for Async.M-0SLV, 1st-motor | HC112 | R/W | 0 to 50 | 1(%) |
| 3B6Dh | 3B6Ch | Secondary resistance correction, 1st-motor | HC113 | R/W | 00: Disabled 01: Enabled | - |
| 3B6Eh | 3B6Dh | Counter direction run protection selection, 1st-motor | HC114 | R/W | 00: Disabled 01: Enabled | - |
| 3B74h | 3B73h | Torque current reference filter time constant, 1st-motor | HC120 | R/W | 0 to 100 | 1(ms) |
| 3B75h | 3B74h | Speed feedforward compensation gain, 1st-motor | HC121 | R/W | 0 to 1000 | 1(%) |
| 3BC6h | 3BC5h | Sync. Motor capacity setting, 1st-motor | Hd102 | R/W | 1 to 16000 | 0.01(kW) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|------------------------------|
| 3BC7h | 3BC6h | Sync. Motor poles setting, 1st-motor | Hd103 | R/W | 2 to 48 (poles) | 1 |
| 3BC8h | 3BC7h | Sync. Base frequency setting, 1st-motor | Hd104 | R/W | 1000 to 59000 | 0.01(Hz) |
| 3BC9h | 3BC8h | Sync. Maximum frequency setting, 1st-motor | Hd105 | R/W | 1000 to 59000 | 0.01(Hz) |
| 3BCAh | 3BC9h | Sync. Motor rated voltage, 1st-motor | Hd106 | R/W | 1 to 1000 | 1(V) |
| 3BCCh | 3BCBh | Sync. Motor rated current, 1st-motor | Hd108 (HIGH) | R/W | 1 to 1000000 | 0.01(A) |
| 3BCDh | 3CCCh | | Hd109 (LOW) | R/W | | |
| 3BCEh | 3BCDh | Sync. Motor constant R, 1st-motor | Hd110 (HIGH) | R/W | 1 to 1000000000 | 0.000001 (Ω) |
| 3BCFh | 3BCEh | | Hd111 (LOW) | R/W | | |
| 3BD0h | 3BCFh | Sync. Motor constant Ld, 1st-motor | Hd112 (HIGH) | R/W | 1 to 1000000000 | 0.000001 (mH) |
| 3BD1h | 3BD0h | | Hd113 (LOW) | R/W | | |
| 3BD2h | 3BD1h | Sync. Motor constant Lq, 1st-motor | Hd114 (HIGH) | R/W | 1 to 1000000000 | 0.000001 (mH) |
| 3BD3h | 3BD2h | | Hd115 (LOW) | R/W | | |
| 3BD4h | 3BD3h | Sync. Motor constant Ke, 1st-motor | Hd116 (HIGH) | R/W | 1 to 1000000 | 0.1m (Vs/rad) |
| 3BD5h | 3BD4h | | Hd117 (LOW) | R/W | | |
| 3BD6h | 3BD5h | Sync. Motor constant J, 1st-motor | Hd118 (HIGH) | R/W | 1 to 1000000000 | 0.00001 (kg·m ²) |
| 3BD7h | 3BD6h | | Hd119 (LOW) | R/W | | |
| 3BE2h | 3BE1h | Minimum Frequency for Sync. M-SLV, 1st-motor | Hd130 | R/W | 0 to 50 | 1(%) |
| 3BE3h | 3BE2h | No-Load current for Sync. M-SLV, 1st-motor | Hd131 | R/W | 0 to 100 | 1(%) |
| 3BE4h | 3BE3h | Starting Method for Sync. M, 1st-motor | Hd132 | R/W | 00: Position estimation disabled 01: Position estimation enabled | - |
| 3BE5h | 3BE4h | IMPE 0V wait number for Sync. M, 1st-motor | Hd133 | R/W | 0 to 255 | 1 |
| 3BE6h | 3BE5h | IMPE detect wait number for Sync. M, 1st-motor | Hd134 | R/W | 0 to 255 | 1 |
| 3BE7h | 3BE6h | IMPE detect number for Sync. M, 1st-motor | Hd135 | R/W | 0 to 255 | 1 |
| 3BE8h | 3BE7h | IMPE voltage gain for Sync. M, 1st-motor | Hd136 | R/W | 0 to 200 | 1(%) |
| 3BE9h | 3BE8h | IMPE Mg-pole position offset, 1st-motor | Hd137 | R/W | 0 to 359 | 1(deg) |
| 3BEDh | 3BECh | Carrier frequency at IVMS | Hd-41 | R/W | 5 to 160 | 0.01(Hz) |
| 3BEEh | 3BEDh | Filter gain of current detection at IVMS | Hd-42 | R/W | 0 to 1000 | 1 |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 3BEFh | 3BEEh | Open phase voltage detection gain | Hd-43 | R/W | 00: Gain 0 01: Gain 1 02: Gain 2 03: Gain 3 | - |
| 3BF0h | 3BEFh | Open phase switching threshold compensation | Hd-44 | R/W | 00: Disabled 01: Enabled | - |
| 3BF1h | 3BF0h | P-Gain for speed control, SM(PMM)-IVMS | Hd-45 | R/W | 0 to 1000 | 1 |
| 3BF2h | 3BF1h | I-Gain for speed control, SM(PMM)-IVMS | Hd-46 | R/W | 0 to 10000 | 1 |
| 3BF3h | 3BF2h | Wait time for open phase switching, SM(PMM)-IVMS | Hd-47 | R/W | 0 to 1000 | 1 |
| 3BF4h | 3BF3h | Limitation of decision about the drive direction, SM(PMM)-IVMS | Hd-48 | R/W | 00: Disabled 01: Enabled | - |
| 3BF5h | 3BF4h | Open phase voltage detection timing adjustment, SM(PMM)-IVMS | Hd-49 | R/W | 0 to 1000 | 1 |
| 3BF6h | 3BF5h | Minimum pulse width adjustment, SM(PMM)-IVMS | Hd-50 | R/W | 0 to 1000 | 1 |
| 3BF7h | 3BF6h | IVMS Current Limit for threshold | Hd-51 | R/W | 0 to 255 | 1 |
| 3BF8h | 3BF7h | IVMS Threshold Gain | Hd-52 | R/W | 0 to 255 | 1 |
| 3BFEh | 3BFDh | IVMS Carrier frequency start/end point | Hd-58 | R/W | 0 to 50 | 1(%) |
| 61B2h | 61B1h | Stabilization constant, 2nd-motor | HA210 | R/W | Same as HA110 | 1(%) |
| 61B7h | 61B6h | Speed response for Async.M, 2nd-motor | HA215 | R/W | Same as HA115 | 1(%) |
| 61BCh | 61BBh | ASR gain switching mode selection, 2nd-motor | HA220 | R/W | Same as HA115 | 1 |
| 61BDh | 61BCh | ASR gain switching time setting, 2nd-motor | HA221 | R/W | Same as HA121 | 1(ms) |
| 61Beh | 61BDh | ASR gain mapping intermediate speed 1, 2nd-motor | HA222 | R/W | Same as HA122 | 0.01(Hz) |
| 61BFh | 61BEh | ASR gain mapping intermediate speed 2, 2nd-motor | HA223 | R/W | Same as HA123 | 0.01(Hz) |
| 61C0h | 61BFh | ASR gain mapping Maximum speed, 2nd-motor | HA224 | R/W | Same as HA124 | 0.01(Hz) |
| 61C1h | 61C0h | ASR gain mapping P-gain 1, 2nd-motor | HA225 | R/W | Same as HA125 | 0.1(%) |
| 61C2h | 61C1h | ASR gain mapping I-gain 1, 2nd-motor | HA226 | R/W | Same as HA126 | 0.1(%) |
| 61C3h | 61C2h | ASR gain mapping P-gain 1 at P-control, 2nd-motor | HA227 | R/W | Same as HA127 | 0.1(%) |
| 61C4h | 61C3h | ASR gain mapping P-gain 2, 2nd-motor | HA228 | R/W | Same as HA128 | 0.1(%) |
| 61C5h | 61C4h | ASR gain mapping I-gain 2, 2nd-motor | HA229 | R/W | Same as HA129 | 0.1(%) |
| 61C6h | 61C5h | ASR gain mapping P-gain 2 at P-control, 2nd-motor | HA230 | R/W | Same as HA130 | 0.1(%) |
| 61C7h | 61C6h | ASR gain mapping P-gain 3, 2nd-motor | HA231 | R/W | Same as HA131 | 0.1(%) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|-------------------------|------------------------------|
| 61C8h | 61C7h | ASR gain mapping I-gain 3, 2nd-motor | HA232 | R/W | Same as HA132 | 0.1(%) |
| 61C9h | 61C8h | ASR gain mapping P-gain 4, 2nd-motor | HA233 | R/W | Same as HA133 | 0.1(%) |
| 61Cah | 61C9h | ASR gain mapping I-gain 4, 2nd-motor | HA234 | R/W | Same as HA134 | 0.1(%) |
| 620Eh | 620Dh | Async. Motor capacity setting, 2nd-motor | Hb202 | R/W | Same as Hb102 | 0.01(kW) |
| 620Fh | 620Eh | Async. Motor poles setting, 2nd-motor | Hb203 | R/W | Same as Hb103 | 1 |
| 6210h | 620Fh | Async. Motor Base frequency setting, 2nd-motor | Hb204 | R/W | Same as Hb104 | 0.01(Hz) |
| 6211h | 6210h | Async. Motor Maximum frequency setting, 2nd-motor | Hb205 | R/W | Same as Hb105 | 0.01(Hz) |
| 6212h | 6211h | Async. Motor rated voltage, 2nd-motor | Hb206 | R/W | Same as Hb106 | 1(V) |
| 6214h | 6213h | Async. Motor rated current, 2nd-motor | Hb208 (HIGH) | R/W | Same as Hb108 | 0.01(A) |
| 6215h | 6214h | | Hb209 (LOW) | R/W | | |
| 6216h | 6215h | Async. Motor constant R1, 2nd-motor | Hb210 (HIGH) | R/W | Same as Hb110 | 0.000001 (Ω) |
| 6217h | 6216h | | Hb211 (LOW) | R/W | | |
| 6218h | 6217h | Async. Motor constant R2, 2nd-motor | Hb212 (HIGH) | R/W | Same as Hb112 | 0.000001 (Ω) |
| 6219h | 6218h | | Hb213 (LOW) | R/W | | |
| 621Ah | 6219h | Async. Motor constant L, 2nd-motor | Hb214 (HIGH) | R/W | Same as Hb114 | 0.000001 (mH) |
| 621Bh | 621Ah | | Hb215 (LOW) | R/W | | |
| 621Ch | 621Bh | Async. Motor constant I _o , 2nd-motor | Hb216 (HIGH) | R/W | Same as Hb116 | 0.01(A) |
| 621Dh | 621Ch | | Hb217 (LOW) | R/W | | |
| 621Eh | 621Dh | Async. Motor constant J, 2nd-motor | Hb218 (HIGH) | R/W | Same as Hb118 | 0.00001 (kg·m ²) |
| 621Fh | 621Eh | | Hb219 (LOW) | R/W | | |
| 622Ah | 6229h | Minimum frequency adjustment, 2nd-motor | Hb230 | R/W | Same as Hb130 | 0.01(Hz) |
| 622Bh | 622Ah | Reduced voltage start time setting, 2nd-motor | Hb231 | R/W | Same as Hb131 | 1(ms) |
| 6234h | 6233h | Manual torque boost operational mode selection, 2nd-motor | Hb240 | R/W | Same as Hb140 | - |
| 6235h | 6234h | Manual torque boost value, 2nd-motor | Hb241 | R/W | Same as Hb141 | 0.1(%) |
| 6236h | 6235h | Manual torque boost Peak speed, 2nd-motor | Hb242 | R/W | Same as Hb142 | 0.1(%) |
| 6239h | 6238h | Eco drive enable, 2nd-motor | Hb245 | R/W | Same as Hb145 | - |
| 623Ah | 6239h | Eco drive response adjustment, 2nd-motor | Hb246 | R/W | Same as Hb146 | 1(%) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|------------------------------|------------|
| 623Eh | 623Dh | Free-V/f frequency 1 setting, 2nd-motor | Hb250 | R/W | 0 to 59000 (Hb252) | 0.01(Hz) |
| 623Fh | 623Eh | Free-V/f Voltage 1 setting, 2nd-motor | Hb251 | R/W | Same as Hb151 | 0.1(V) |
| 6240h | 623Fh | Free-V/f frequency 2 setting, 2nd-motor | Hb252 | R/W | 0 to 59000(Hb250) to (Hb254) | 0.01(Hz) |
| 6241h | 6240h | Free-V/f Voltage 2 setting, 2nd-motor | Hb253 | R/W | Same as Hb153 | 0.1(V) |
| 6242h | 6241h | Free-V/f frequency 3 setting, 2nd-motor | Hb254 | R/W | 0 to 59000(Hb252) to (Hb256) | 0.01(Hz) |
| 6243h | 6242h | Free-V/f Voltage 3 setting, 2nd-motor | Hb255 | R/W | Same as Hb155 | 0.1(V) |
| 6244h | 6243h | Free-V/f frequency 4 setting, 2nd-motor | Hb256 | R/W | 0 to 59000(Hb254) to (Hb258) | 0.01(Hz) |
| 6245h | 6244h | Free-V/f Voltage 4 setting, 2nd-motor | Hb257 | R/W | Same as Hb157 | 0.1(V) |
| 6246h | 6245h | Free-V/f frequency 5 setting, 2nd-motor | Hb258 | R/W | 0 to 59000(Hb256) to (Hb260) | 0.01(Hz) |
| 6247h | 6246h | Free-V/f Voltage 5 setting, 2nd-motor | Hb259 | R/W | Same as Hb159 | 0.1(V) |
| 6248h | 6247h | Free-V/f frequency 6 setting, 2nd-motor | Hb260 | R/W | 0 to 59000(Hb258) to (Hb262) | 0.01(Hz) |
| 6249h | 6248h | Free-V/f Voltage 6 setting, 2nd-motor | Hb261 | R/W | Same as Hb161 | 0.1(V) |
| 624Ah | 6249h | Free-V/f frequency 7 setting, 2nd-motor | Hb262 | R/W | 0 to 59000(Hb260) to (Hb204) | 0.01(Hz) |
| 624Bh | 624Ah | Free-V/f Voltage 7 setting, 2nd-motor | Hb263 | R/W | Same as Hb163 | 0.1(V) |
| 6252h | 6251h | Slip Compensation P-gain with encoder, 2nd-motor | Hb270 | R/W | Same as Hb170 | 1(%) |
| 6253h | 6252h | Slip Compensation I-gain with encoder, 2nd-motor | Hb271 | R/W | Same as Hb171 | 1(%) |
| 625Ch | 625Bh | Output voltage gain, 2nd-motor(V/f) | Hb280 | R/W | Same as Hb180 | 1(%) |
| 6271h | 6270h | Automatic torque boost voltage compensation gain, 2nd-motor | HC201 | R/W | Same as HC101 | 1(%) |
| 6272h | 6271h | Automatic torque boost slip compensation gain, 2nd-motor | HC202 | R/W | Same as HC102 | 1(%) |
| 627Ah | 6279h | Zero speed area limit for Async.M-0SLV, 2nd-motor | HC210 | R/W | Same as HC110 | 1(%) |
| 627Bh | 627Ah | Boost value at start for Async.M-SLV/IIM-CLV, 2nd-motor | HC211 | R/W | Same as HC111 | 1(%) |
| 627Ch | 627Bh | Boost value at start for Async.M-0SLV, 2nd-motor | HC212 | R/W | Same as HC112 | 1(%) |
| 627Dh | 627Ch | Secondary resistance correction, 2nd-motor | HC213 | R/W | Same as HC113 | - |
| 627Eh | 627Dh | Counter direction run protection selection, 2nd-motor | HC214 | R/W | Same as HC114 | - |
| 6284h | 6283h | Torque current reference filter time constant, 2nd-motor | HC220 | R/W | Same as HC120 | 1ms |
| 6285h | 6284h | Speed feedforward compensation gain, 2nd-motor | HC221 | R/W | Same as HC121 | 1(%) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|-------------------------|--|
| 62D6h | 62D5h | Sync. Motor capacity setting, 2nd-motor | Hd202 | R/W | Same as Hd102 | 0.01(kW) |
| 62D7h | 62D6h | Sync. Motor poles setting, 2nd-motor | Hd203 | R/W | Same as Hd103 | 1 |
| 62D8h | 62D7h | Sync. Base frequency setting, 2nd-motor | Hd204 | R/W | Same as Hd104 | 0.01(Hz) |
| 62D9h | 62D8h | Sync. Maximum frequency setting, 2nd-motor | Hd205 | R/W | Same as Hd105 | 0.01(Hz) |
| 62Dah | 62D9h | Sync. Motor rated voltage, 2nd-motor | Hd206 | R/W | Same as Hd106 | 1(V) |
| 62DCh | 62DBh | Sync. Motor rated current, 2nd-motor | Hd208 (HIGH) | R/W | Same as Hd108 | 0.01(A) |
| 62DDh | 62DCh | | Hd209 (LOW) | R/W | | |
| 62Deh | 62DDh | Sync. Motor constant R, 2nd-motor | Hd210 (HIGH) | R/W | Same as Hd110 | 0.000001 (Ω) |
| 62DFh | 62DEh | | Hd211 (LOW) | R/W | | |
| 62E0h | 62DFh | Sync. Motor constant Ld, 2nd-motor | Hd212 (HIGH) | R/W | Same as Hd112 | 0.000001 (mH) |
| 62E1h | 62E0h | | Hd213 (LOW) | R/W | | |
| 62E2h | 62E1h | Sync. Motor constant Lq, 2nd-motor | Hd214 (HIGH) | R/W | Same as Hd114 | 0.000001 (mH) |
| 62E3h | 62E2h | | Hd215 (LOW) | R/W | | |
| 62E4h | 62E3h | Sync. Motor constant Ke, 2nd-motor | Hd216 (HIGH) | R/W | Same as Hd116 | 0.1m (Vs/rad) |
| 62E5h | 62E4h | | Hd217 (LOW) | R/W | | |
| 62E6h | 62E5h | Sync. Motor constant J, 2nd-motor | Hd218 (HIGH) | R/W | Same as Hd118 | 0.00001 ($\text{kg}\cdot\text{m}^2$) |
| 62E7h | 62E6h | | Hd219 (LOW) | R/W | | |
| 62F2h | 62F1h | Minimum Frequency for Sync. M-SLV, 2nd-motor | Hd230 | R/W | Same as Hd130 | 1(%) |
| 62F3h | 62F2h | No-Load current for Sync. M-SLV, 2nd-motor | Hd231 | R/W | Same as Hd131 | 1(%) |
| 62F4h | 62F3h | Starting Method for Sync. M, 2nd-motor | Hd232 | R/W | Same as Hd132 | - |
| 62F5h | 62F4h | IMPE 0V wait number for Sync. M, 2nd-motor | Hd233 | R/W | Same as Hd133 | 1 |
| 62F6h | 62F5h | IMPE detect wait number for Sync. M, 2nd-motor | Hd234 | R/W | Same as Hd134 | 1 |
| 62F7h | 62F6h | IMPE detect number for Sync. M, 2nd-motor | Hd235 | R/W | Same as Hd135 | 1 |
| 62F8h | 62F7h | IMPE voltage gain for Sync. M, 2nd-motor | Hd236 | R/W | Same as Hd136 | 1(%) |
| 62F9h | 62F8h | IMPE Mg-pole position offset, 2nd-motor | Hd237 | R/W | Same as Hd137 | 1(deg) |

9-5-8 Group P Register List



Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|------------|
| 4269h | 4268h | Mode selection for Emergency-force drive | PA-01 | R/W | 00: Disabled 01: Enabled | - |
| 426Ah | 4269h | Frequency reference setting at Emergency-force drive | PA-02 | R/W | 0 to 59000 | 0.01(Hz) |
| 426Bh | 426Ah | Direction command at Emergency-force drive | PA-03 | R/W | 00: Normal rotation 01: Reverse rotation | - |
| 426Ch | 426Bh | Commercial power supply bypass function selection | PA-04 | R/W | 00: Disabled 01: Enabled | - |
| 426Dh | 426Ch | Delay time of Bypass function | PA-05 | R/W | 0 to 10000 | 0.1(s) |
| 427Ch | 427Bh | Simulation mode enable | PA-20 | R/W | 00: Disabled 01: Enabled | - |
| 427Dh | 427Ch | Error code selection for Alarm test | PA-21 | R/W | 0 to 255 | 1 |
| 427Eh | 427Dh | Output current monitor optional output enable | PA-22 | R/W | 00: Disabled 01: Enabled: parameter setting [PA-23] 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved) | - |
| 427Fh | 427Eh | Output current monitor optional output value setting | PA-23 | R/W | 0.0 to 3.0 × Inverter rated current ^{*1} | 0.1(A) |
| 4280h | 427Fh | DC-bus voltage monitor optional output enable | PA-24 | R/W | 00: Disabled 01: Enabled: parameter setting [PA-25] 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved) | - |
| 4281h | 4280h | DC-bus voltage monitor optional value output | PA-25 | R/W | 200V class: 0 to 4500 400V class: 0 to 9000 | 0.1(Vdc) |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|---|---------------|-----|---|------------|
| 4282h | 4281h | Output voltage monitor optional output enable | PA-26 | R/W | 00: Disabled 01: Enabled: parameter setting [PA-27] 02: (Enabled: set from [Ai1]) 03: Enabled: set from [Ai2] 04: (Enabled: set from [Ai3]) 05: (Reserved) 06: (Reserved) 07: (Reserved) | - |
| 4283h | 4282h | Output voltage monitor optional output value setting | PA-27 | R/W | 200V class: 0-3000 400V class: 0-6000 | 0.1(V) |
| 4284h | 4283h | Output torque monitor optional output enable | PA-28 | R/W | 00: Disabled 01: Enabled: parameter setting [PA-29] 02: (Enabled: set from [Ai1]) 03: Enabled: set from [Ai2] 04: (Enabled: set from [Ai3]) 05: (Reserved) 06: (Reserved) 07: (Reserved) | - |
| 4285h | 4284h | Output torque monitor optional output value setting | PA-29 | R/W | -5000 to 5000 | 0.1(%) |
| 4286h | 4285h | Start with frequency matching optional Setting enable | PA-30 | R/W | 00: Disabled 01: Enabled: parameter setting [PA-31] 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved) | - |
| 4287h | 4286h | Start with frequency matching optional value setting | PA-31 | R/W | 0 to 59000 | 0.01(Hz) |

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
- 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- 3) Drive programming: 0.01% (Rated ratio)

9-5-9 Group U Register List



Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
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This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|---|------------|
| - | - | Password input for display selection | UA-01 | - | - | - |
| - | - | Soft-lock password input | UA-02 | - | - | - |
| 465Ah | 4659h | Display restriction selection | UA-10 | R/W | 00: Full display 01: By function 02: User setting 03: Conveyor display 04: Only monitor display | - |
| 465Ch | 465Bh | Accumulation input power monitor clear | UA-12 | R/W | 00: Disabled 01: Clear | - |
| 465Dh | 465Ch | Display gain for Accumulation input power monitor | UA-13 | R/W | 1 to 1000 | 1 |
| 465Eh | 465Dh | Accumulation output power monitor clear | UA-14 | R/W | 00: Disabled 01: Clear | - |
| 465Fh | 465Eh | Display gain for Accumulation output power monitor | UA-15 | R/W | 1 to 1000 | 1 |
| 4660h | 465Fh | Soft Lock selection | UA-16 | R/W | 00: [SFT] terminal 01: Always enabled | - |
| 4661h | 4660h | Soft Lock target selection | UA-17 | R/W | 00: All data cannot be changed 01: Data other than set frequency cannot be changed | - |
| 4662h | 4661h | Data R/W selection | UA-18 | R/W | 00: R/W enabled 01: R/W disabled | - |
| 4663h | 4662h | Low battery warning enable | UA-19 | R/W | 00: Disabled 01: Warning 02: Error | - |
| 4664h | 4663h | Action selection at Keypad disconnection | UA-20 | R/W | 00: Error 01: Error after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop | - |
| 4665h | 4664h | 2nd-motor parameter display selection | UA-21 | R/W | 00: Not display 01: Display | - |
| 4666h | 4665h | Option parameter display selection | UA-22 | R/W | 00: Not display 01: Display | 1 |
| 466Eh | 466Dh | User parameter auto setting function enable | UA-30 | R/W | 00: Disabled 01: Enabled | - |
| 466Fh | 466Eh | User parameter 1 selection | UA-31 | R/W | no/***** (select a parameter) | 1 |
| 4670h | 466Fh | User parameter 12 selection | UA-42 | R/W | no/***** (select a parameter) | 1 |
| 4671h | 4670h | User parameter 2 selection | UA-32 | R/W | no/***** (select a parameter) | 1 |
| 4672h | 4671h | User parameter 3 selection | UA-33 | R/W | no/***** (select a parameter) | 1 |
| 4673h | 4672h | User parameter 4 selection | UA-34 | R/W | no/***** (select a parameter) | 1 |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|-----------------------------|---------------|-----|--|------------|
| 4674h | 4673h | User parameter 5 selection | UA-35 | R/W | no/***** (select a parameter) | 1 |
| 4675h | 4674h | User parameter 6 selection | UA-36 | R/W | no/***** (select a parameter) | 1 |
| 4676h | 4675h | User parameter 7 selection | UA-37 | R/W | no/***** (select a parameter) | 1 |
| 4677h | 4676h | User parameter 8 selection | UA-38 | R/W | no/***** (select a parameter) | 1 |
| 4678h | 4677h | User parameter 9 selection | UA-39 | R/W | no/***** (select a parameter) | 1 |
| 4679h | 4678h | User parameter 10 selection | UA-40 | R/W | no/***** (select a parameter) | 1 |
| 467Ah | 4679h | User parameter 11 selection | UA-41 | R/W | no/***** (select a parameter) | 1 |
| 467Bh | 467Ah | User parameter 13 selection | UA-43 | R/W | no/***** (select a parameter) | 1 |
| 467Ch | 467Bh | User parameter 14 selection | UA-44 | R/W | no/***** (select a parameter) | 1 |
| 467Dh | 467Ch | User parameter 15 selection | UA-45 | R/W | no/***** (select a parameter) | 1 |
| 467Eh | 467Dh | User parameter 16 selection | UA-46 | R/W | no/***** (select a parameter) | 1 |
| 467Fh | 467Eh | User parameter 17 selection | UA-47 | R/W | no/***** (select a parameter) | 1 |
| 4680h | 467Fh | User parameter 18 selection | UA-48 | R/W | no/***** (select a parameter) | 1 |
| 4681h | 4680h | User parameter 19 selection | UA-49 | R/W | no/***** (select a parameter) | 1 |
| 4682h | 4681h | User parameter 20 selection | UA-50 | R/W | no/***** (select a parameter) | 1 |
| 4683h | 4682h | User parameter 21 selection | UA-51 | R/W | no/***** (select a parameter) | 1 |
| 4684h | 4683h | User parameter 22 selection | UA-52 | R/W | no/***** (select a parameter) | 1 |
| 4685h | 4684h | User parameter 23 selection | UA-53 | R/W | no/***** (select a parameter) | 1 |
| 4686h | 4685h | User parameter 24 selection | UA-54 | R/W | no/***** (select a parameter) | 1 |
| 4687h | 4686h | User parameter 25 selection | UA-55 | R/W | no/***** (select a parameter) | 1 |
| 4688h | 4687h | User parameter 26 selection | UA-56 | R/W | no/***** (select a parameter) | 1 |
| 4689h | 4688h | User parameter 27 selection | UA-57 | R/W | no/***** (select a parameter) | 1 |
| 468Ah | 4689h | User parameter 28 selection | UA-58 | R/W | no/***** (select a parameter) | 1 |
| 468Bh | 468Ah | User parameter 29 selection | UA-59 | R/W | no/***** (select a parameter) | 1 |
| 468Ch | 468Bh | User parameter 30 selection | UA-60 | R/W | no/***** (select a parameter) | 1 |
| 468Dh | 468Ch | User parameter 31 selection | UA-61 | R/W | no/***** (select a parameter) | 1 |
| 468Eh | 468Dh | User parameter 32 selection | UA-62 | R/W | no/***** (select a parameter) | 1 |
| 46B5h | 46B4h | Initialize Mode selection | Ub-01 | R/W | 00: Disabled 01: Trip history 02: Parameter initialization 03: Trip history + parameters 04: Trip history + parameters + DriveProgramming 05: Other than terminal function 06: Other than communication function 07: Other than terminal&communication functions 08: Only DriveProgramming | - |
| 46B6h | 46B5h | Initialize Data selection | Ub-02 | R/W | 00: Mode 0 01: Mode 1 02: Mode 2 03: Mode 3 | - |
| 46B7h | 46B6h | Load type selection | Ub-03 | R/W | 00: VLD 01: LD 02: ND | - |
| 46B9h | 46B8h | Initialize Enable | Ub-05 | R/W | 00: Disabled 01: Start initialization | - |
| 4719h | 4718h | Debug mode enable | UC-01 | R/W | (do not change) | 1 |
| 47E1h | 47E0h | EzSQ operation cycle | UE-01 | R/W | 00: 1ms 01: 2ms | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|----------------------------|---------------|-----|--|------------|
| 47E2h | 47E1h | EzSQ function enable | UE-02 | R/W | 00: Disabled 01: [PRG] terminal 02: Always | - |
| 47EAh | 47E9h | EzSQ user parameter U (00) | UE-10 | R/W | 0 to 65535 | 1 |
| 47EBh | 47EAh | EzSQ user parameter U (01) | UE-11 | R/W | 0 to 65535 | 1 |
| 47ECh | 47EBh | EzSQ user parameter U (02) | UE-12 | R/W | 0 to 65535 | 1 |
| 47EDh | 47ECh | EzSQ user parameter U (03) | UE-13 | R/W | 0 to 65535 | 1 |
| 47EEh | 47EDh | EzSQ user parameter U (04) | UE-14 | R/W | 0 to 65535 | 1 |
| 47EFh | 47EEh | EzSQ user parameter U (05) | UE-15 | R/W | 0 to 65535 | 1 |
| 47F0h | 47EFh | EzSQ user parameter U (06) | UE-16 | R/W | 0 to 65535 | 1 |
| 47F1h | 47F0h | EzSQ user parameter U (07) | UE-17 | R/W | 0 to 65535 | 1 |
| 47F2h | 47F1h | EzSQ user parameter U (08) | UE-18 | R/W | 0 to 65535 | 1 |
| 47F3h | 47F2h | EzSQ user parameter U (09) | UE-19 | R/W | 0 to 65535 | 1 |
| 47F4h | 47F3h | EzSQ user parameter U (10) | UE-20 | R/W | 0 to 65535 | 1 |
| 47F5h | 47F4h | EzSQ user parameter U (11) | UE-21 | R/W | 0 to 65535 | 1 |
| 47F6h | 47F5h | EzSQ user parameter U (12) | UE-22 | R/W | 0 to 65535 | 1 |
| 47F7h | 47F6h | EzSQ user parameter U (13) | UE-23 | R/W | 0 to 65535 | 1 |
| 47F8h | 47F7h | EzSQ user parameter U (14) | UE-24 | R/W | 0 to 65535 | 1 |
| 47F9h | 47F8h | EzSQ user parameter U (15) | UE-25 | R/W | 0 to 65535 | 1 |
| 47FAh | 47F9h | EzSQ user parameter U (16) | UE-26 | R/W | 0 to 65535 | 1 |
| 47FBh | 47FAh | EzSQ user parameter U (17) | UE-27 | R/W | 0 to 65535 | 1 |
| 47FCh | 47FBh | EzSQ user parameter U (18) | UE-28 | R/W | 0 to 65535 | 1 |
| 47FDh | 47FCh | EzSQ user parameter U (19) | UE-29 | R/W | 0 to 65535 | 1 |
| 47FEh | 47FDh | EzSQ user parameter U (20) | UE-30 | R/W | 0 to 65535 | 1 |
| 47FFh | 47FEh | EzSQ user parameter U (21) | UE-31 | R/W | 0 to 65535 | 1 |
| 4800h | 47FFh | EzSQ user parameter U (22) | UE-32 | R/W | 0 to 65535 | 1 |
| 4801h | 4800h | EzSQ user parameter U (23) | UE-33 | R/W | 0 to 65535 | 1 |
| 4802h | 4801h | EzSQ user parameter U (24) | UE-34 | R/W | 0 to 65535 | 1 |
| 4803h | 4802h | EzSQ user parameter U (25) | UE-35 | R/W | 0 to 65535 | 1 |
| 4804h | 4803h | EzSQ user parameter U (26) | UE-36 | R/W | 0 to 65535 | 1 |
| 4805h | 4804h | EzSQ user parameter U (27) | UE-37 | R/W | 0 to 65535 | 1 |
| 4806h | 4805h | EzSQ user parameter U (28) | UE-38 | R/W | 0 to 65535 | 1 |
| 4807h | 4806h | EzSQ user parameter U (29) | UE-39 | R/W | 0 to 65535 | 1 |
| 4808h | 4807h | EzSQ user parameter U (30) | UE-40 | R/W | 0 to 65535 | 1 |
| 4809h | 4808h | EzSQ user parameter U (31) | UE-41 | R/W | 0 to 65535 | 1 |
| 480Ah | 4809h | EzSQ user parameter U (32) | UE-42 | R/W | 0 to 65535 | 1 |
| 480Bh | 480Ah | EzSQ user parameter U (33) | UE-43 | R/W | 0 to 65535 | 1 |
| 480Ch | 480Bh | EzSQ user parameter U (34) | UE-44 | R/W | 0 to 65535 | 1 |
| 480Dh | 480Ch | EzSQ user parameter U (35) | UE-45 | R/W | 0 to 65535 | 1 |
| 480Eh | 480Dh | EzSQ user parameter U (36) | UE-46 | R/W | 0 to 65535 | 1 |
| 480Fh | 480Eh | EzSQ user parameter U (37) | UE-47 | R/W | 0 to 65535 | 1 |
| 4810h | 480Fh | EzSQ user parameter U (38) | UE-48 | R/W | 0 to 65535 | 1 |
| 4811h | 4810h | EzSQ user parameter U (39) | UE-49 | R/W | 0 to 65535 | 1 |
| 4812h | 4811h | EzSQ user parameter U (40) | UE-50 | R/W | 0 to 65535 | 1 |
| 4813h | 4812h | EzSQ user parameter U (41) | UE-51 | R/W | 0 to 65535 | 1 |
| 4814h | 4813h | EzSQ user parameter U (42) | UE-52 | R/W | 0 to 65535 | 1 |
| 4815h | 4814h | EzSQ user parameter U (43) | UE-53 | R/W | 0 to 65535 | 1 |
| 4816h | 4815h | EzSQ user parameter U (44) | UE-54 | R/W | 0 to 65535 | 1 |
| 4817h | 4816h | EzSQ user parameter U (45) | UE-55 | R/W | 0 to 65535 | 1 |
| 4818h | 4817h | EzSQ user parameter U (46) | UE-56 | R/W | 0 to 65535 | 1 |
| 4819h | 4818h | EzSQ user parameter U (47) | UE-57 | R/W | 0 to 65535 | 1 |
| 481Ah | 4819h | EzSQ user parameter U (48) | UE-58 | R/W | 0 to 65535 | 1 |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------|---------------------------|-----------------------------|---------------|-----|---------------------------|------------|-------|-------|-----------------------------|--------------|-----|---------------------------|---|-------|-------|-------------|-----|-------|-------|-----------------------------|--------------|-----|---------------------------|---|-------|-------|-------------|-----|-------|-------|-----------------------------|--------------|-----|---------------------------|---|-------|-------|-------------|-----|-------|-------|-----------------------------|--------------|-----|---------------------------|---|-------|-------|-------------|-----|-------|-------|-----------------------------|--------------|-----|---------------------------|---|-------|-------|-------------|-----|-------|-------|-----------------------------|--------------|-----|---------------------------|---|-------|-------|-------------|-----|-------|-------|-----------------------------|--------------|-----|---------------------------|---|-------|-------|-------------|-----|-------|-------|-----------------------------|--------------|-----|---------------------------|---|-------|
| 481Bh | 481Ah | EzSQ user parameter U (49) | UE-59 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 481Ch | 481Bh | EzSQ user parameter U (50) | UE-60 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 481Dh | 481Ch | EzSQ user parameter U (51) | UE-61 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 481Eh | 481Dh | EzSQ user parameter U (52) | UE-62 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 481Fh | 481Eh | EzSQ user parameter U (53) | UE-63 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4820h | 481Fh | EzSQ user parameter U (54) | UE-64 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4821h | 4820h | EzSQ user parameter U (55) | UE-65 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4822h | 4821h | EzSQ user parameter U (56) | UE-66 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4823h | 4822h | EzSQ user parameter U (57) | UE-67 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4824h | 4823h | EzSQ user parameter U (58) | UE-68 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4825h | 4824h | EzSQ user parameter U (59) | UE-69 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4826h | 4825h | EzSQ user parameter U (60) | UE-70 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4827h | 4826h | EzSQ user parameter U (61) | UE-71 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4828h | 4827h | EzSQ user parameter U (62) | UE-72 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4829h | 4828h | EzSQ user parameter U (63) | UE-73 | R/W | 0 to 65535 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4846h | 4845h | EzSQ user parameter UL (00) | UF-02 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4847h | 4846h | | UF-03 (LOW) | R/W | | | 4848h | 4847h | EzSQ user parameter UL (01) | UF-04 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4849h | 4848h | UF-05 (LOW) | R/W | 484Ah | 4849h | EzSQ user parameter UL (02) | UF-06 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 484Bh | 484Ah | UF-07 (LOW) | R/W | 484Ch | 484Bh | EzSQ user parameter UL (03) | UF-08 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 484Dh | 484Ch | UF-09 (LOW) | R/W | 484Eh | 484Dh | EzSQ user parameter UL (04) | UF-10 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 484Fh | 484Eh | UF-11 (LOW) | R/W | 4850h | 484Fh | EzSQ user parameter UL (05) | UF-12 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4851h | 4850h | UF-13 (LOW) | R/W | 4852h | 4851h | EzSQ user parameter UL (06) | UF-14 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4853h | 4852h | UF-15 (LOW) | R/W | 4854h | 4853h | EzSQ user parameter UL (07) | UF-16 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4855h | 4854h | UF-17 (LOW) | R/W | 4856h | 4855h | EzSQ user parameter UL (08) | UF-18 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4857h |
| 4848h | 4847h | EzSQ user parameter UL (01) | UF-04 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4849h | 4848h | | UF-05 (LOW) | R/W | | | 484Ah | 4849h | EzSQ user parameter UL (02) | UF-06 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 484Bh | 484Ah | UF-07 (LOW) | R/W | 484Ch | 484Bh | EzSQ user parameter UL (03) | UF-08 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 484Dh | 484Ch | UF-09 (LOW) | R/W | 484Eh | 484Dh | EzSQ user parameter UL (04) | UF-10 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 484Fh | 484Eh | UF-11 (LOW) | R/W | 4850h | 484Fh | EzSQ user parameter UL (05) | UF-12 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4851h | 4850h | UF-13 (LOW) | R/W | 4852h | 4851h | EzSQ user parameter UL (06) | UF-14 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4853h | 4852h | UF-15 (LOW) | R/W | 4854h | 4853h | EzSQ user parameter UL (07) | UF-16 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4855h | 4854h | UF-17 (LOW) | R/W | 4856h | 4855h | EzSQ user parameter UL (08) | UF-18 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4857h | 4856h | UF-19 (LOW) | R/W | | | | | | | | |
| 484Ah | 4849h | EzSQ user parameter UL (02) | UF-06 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 484Bh | 484Ah | | UF-07 (LOW) | R/W | | | 484Ch | 484Bh | EzSQ user parameter UL (03) | UF-08 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 484Dh | 484Ch | UF-09 (LOW) | R/W | 484Eh | 484Dh | EzSQ user parameter UL (04) | UF-10 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 484Fh | 484Eh | UF-11 (LOW) | R/W | 4850h | 484Fh | EzSQ user parameter UL (05) | UF-12 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4851h | 4850h | UF-13 (LOW) | R/W | 4852h | 4851h | EzSQ user parameter UL (06) | UF-14 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4853h | 4852h | UF-15 (LOW) | R/W | 4854h | 4853h | EzSQ user parameter UL (07) | UF-16 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4855h | 4854h | UF-17 (LOW) | R/W | 4856h | 4855h | EzSQ user parameter UL (08) | UF-18 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4857h | 4856h | UF-19 (LOW) | R/W | | | | | | | | | | | | | | | | | | | |
| 484Ch | 484Bh | EzSQ user parameter UL (03) | UF-08 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 484Dh | 484Ch | | UF-09 (LOW) | R/W | | | 484Eh | 484Dh | EzSQ user parameter UL (04) | UF-10 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 484Fh | 484Eh | UF-11 (LOW) | R/W | 4850h | 484Fh | EzSQ user parameter UL (05) | UF-12 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4851h | 4850h | UF-13 (LOW) | R/W | 4852h | 4851h | EzSQ user parameter UL (06) | UF-14 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4853h | 4852h | UF-15 (LOW) | R/W | 4854h | 4853h | EzSQ user parameter UL (07) | UF-16 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4855h | 4854h | UF-17 (LOW) | R/W | 4856h | 4855h | EzSQ user parameter UL (08) | UF-18 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4857h | 4856h | UF-19 (LOW) | R/W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 484Eh | 484Dh | EzSQ user parameter UL (04) | UF-10 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 484Fh | 484Eh | | UF-11 (LOW) | R/W | | | 4850h | 484Fh | EzSQ user parameter UL (05) | UF-12 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4851h | 4850h | UF-13 (LOW) | R/W | 4852h | 4851h | EzSQ user parameter UL (06) | UF-14 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4853h | 4852h | UF-15 (LOW) | R/W | 4854h | 4853h | EzSQ user parameter UL (07) | UF-16 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4855h | 4854h | UF-17 (LOW) | R/W | 4856h | 4855h | EzSQ user parameter UL (08) | UF-18 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4857h | 4856h | UF-19 (LOW) | R/W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4850h | 484Fh | EzSQ user parameter UL (05) | UF-12 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4851h | 4850h | | UF-13 (LOW) | R/W | | | 4852h | 4851h | EzSQ user parameter UL (06) | UF-14 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4853h | 4852h | UF-15 (LOW) | R/W | 4854h | 4853h | EzSQ user parameter UL (07) | UF-16 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4855h | 4854h | UF-17 (LOW) | R/W | 4856h | 4855h | EzSQ user parameter UL (08) | UF-18 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4857h | 4856h | UF-19 (LOW) | R/W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4852h | 4851h | EzSQ user parameter UL (06) | UF-14 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4853h | 4852h | | UF-15 (LOW) | R/W | | | 4854h | 4853h | EzSQ user parameter UL (07) | UF-16 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4855h | 4854h | UF-17 (LOW) | R/W | 4856h | 4855h | EzSQ user parameter UL (08) | UF-18 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4857h | 4856h | UF-19 (LOW) | R/W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4854h | 4853h | EzSQ user parameter UL (07) | UF-16 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4855h | 4854h | | UF-17 (LOW) | R/W | | | 4856h | 4855h | EzSQ user parameter UL (08) | UF-18 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | 4857h | 4856h | UF-19 (LOW) | R/W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4856h | 4855h | EzSQ user parameter UL (08) | UF-18 (HIGH) | R/W | -2147483647 to 2147483647 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4857h | 4856h | | UF-19 (LOW) | R/W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|-----------------------------|---------------|-----|---------------------------|------------|
| 4858h | 4857h | EzSQ user parameter UL (09) | UF-20 (HIGH) | R/W | -2147483647 to 2147483647 | 1 |
| 4859h | 4858h | | UF-21 (LOW) | R/W | | |
| 485Ah | 4859h | EzSQ user parameter UL (10) | UF-22 (HIGH) | R/W | -2147483647 to 2147483647 | 1 |
| 485Bh | 485Ah | | UF-23 (LOW) | R/W | | |
| 485Ch | 485Bh | EzSQ user parameter UL (11) | UF-24 (HIGH) | R/W | -2147483647 to 2147483647 | 1 |
| 485Dh | 485Ch | | UF-25 (LOW) | R/W | | |
| 485Eh | 485Dh | EzSQ user parameter UL (12) | UF-26 (HIGH) | R/W | -2147483647 to 2147483647 | 1 |
| 485Fh | 485Eh | | UF-27 (LOW) | R/W | | |
| 4860h | 485Fh | EzSQ user parameter UL (13) | UF-28 (HIGH) | R/W | -2147483647 to 2147483647 | 1 |
| 4861h | 4860h | | UF-29 (LOW) | R/W | | |
| 4862h | 4861h | EzSQ user parameter UL (14) | UF-30 (HIGH) | R/W | -2147483647 to 2147483647 | 1 |
| 4863h | 4862h | | UF-31 (LOW) | R/W | | |
| 4864h | 4863h | EzSQ user parameter UL (15) | UF-32 (HIGH) | R/W | -2147483647 to 2147483647 | 1 |
| 4865h | 4864h | | UF-33 (LOW) | R/W | | |

9-5-10 Group o Register List



Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 3E8Ah | 3E89h | Operation mode on option card error (SLOT-1) | oA-10 | R/W | 00: Error 01: Continue operation | - |
| 3E8Bh | 3E8Ah | Communication Watch Dog Timer | oA-11 | R/W | 0 to 10000 | 0.01(s) |
| 3E8Ch | 3E8Bh | Action selection at communication error | oA-12 | R/W | 00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop | - |

| Register No. | Modbus register spec. No. | Function name | Parameter No. | R/W | Monitor or setting data | Resolution |
|--------------|---------------------------|--|---------------|-----|--|------------|
| 3E8Dh | 3E8Ch | run command enable option during the option card (SLOT-1) start-up | oA-13 | R/W | 00: Operation command disabled 01: Operation command enabled | - |
| 3E94h | 3E93h | Operation mode on option card error (SLOT-2) | oA-20 | R/W | 00: Error 01: Continue operation | - |
| 3E95h | 3E94h | Communication Watch Dog Timer | oA-21 | R/W | 0 to 10000 | 0.01(s) |
| 3E96h | 3E95h | Action selection at communication error | oA-22 | R/W | 00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop | - |
| 3E97h | 3E96h | run command enable option during the option card (SLOT-2) start-up | oA-23 | R/W | 00 (Operation command disabled)/ 01 (Operation command enabled) | - |
| 3E9Eh | 3E9Dh | Operation mode on option card error (SLOT-3) | oA-30 | R/W | 00: Error 01: Continue operation | - |
| 3E9Fh | 3E9Eh | Communication Watch Dog Timer | oA-31 | R/W | 0 to 10000 | 0.01(s) |
| 3EA0h | 3E9Fh | Action selection at communication error | oA-32 | R/W | 00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop | - |
| 3EA1h | 3EA0h | run command enable option during the option card (SLOT-3) start-up | oA-33 | R/W | 00: Operation command disabled 01: Operation command enabled | - |
| 3EE5h | 3EE4h | Encoder constant setting | ob-01 | R/W | 32 to 65535 | 1(pls) |
| 3EE6h | 3EE5h | Encoder position selection | ob-02 | R/W | 00: Phase-A is leading 01: Phase-B is leading | - |
| 3EE7h | 3EE6h | Motor gear ratio Numerator | ob-03 | R/W | 1 to 10000 | 1 |
| 3EE8h | 3EE7h | Motor gear ratio Denominator | ob-04 | R/W | 1 to 10000 | 1 |
| 3EEEh | 3EEDh | Pulse train detection object selection | ob-10 | R/W | 00: Command 01: Pulse string position command | - |
| 3EEFh | 3EEEh | Mode selection of pulse train input | ob-11 | R/W | 00: 90° phase difference 01: forward/reverse rotation command and rotation direction 02: forward/reverse rotation pulse string | - |
| 3EF0h | 3EEFh | Pulse train frequency Scale | ob-12 | R/W | 5 to 20000 | 0.01 (kHz) |
| 3EF1h | 3EF0h | Pulse train frequency Filter time constant | ob-13 | R/W | 1 to 200 | 0.01(s) |
| 3EF2h | 3EF1h | Pulse train frequency Bias value | ob-14 | R/W | -1000 to 1000 | 0.1(%) |
| 3EF3h | 3EF2h | Pulse train frequency High Limit | ob-15 | R/W | 0 to 1000 | 0.1(%) |
| 3EF4h | 3EF3h | Pulse train frequency detection low level | ob-16 | R/W | 0 to 1000 | 0.1(%) |

9-6 Inter-inverter Communication

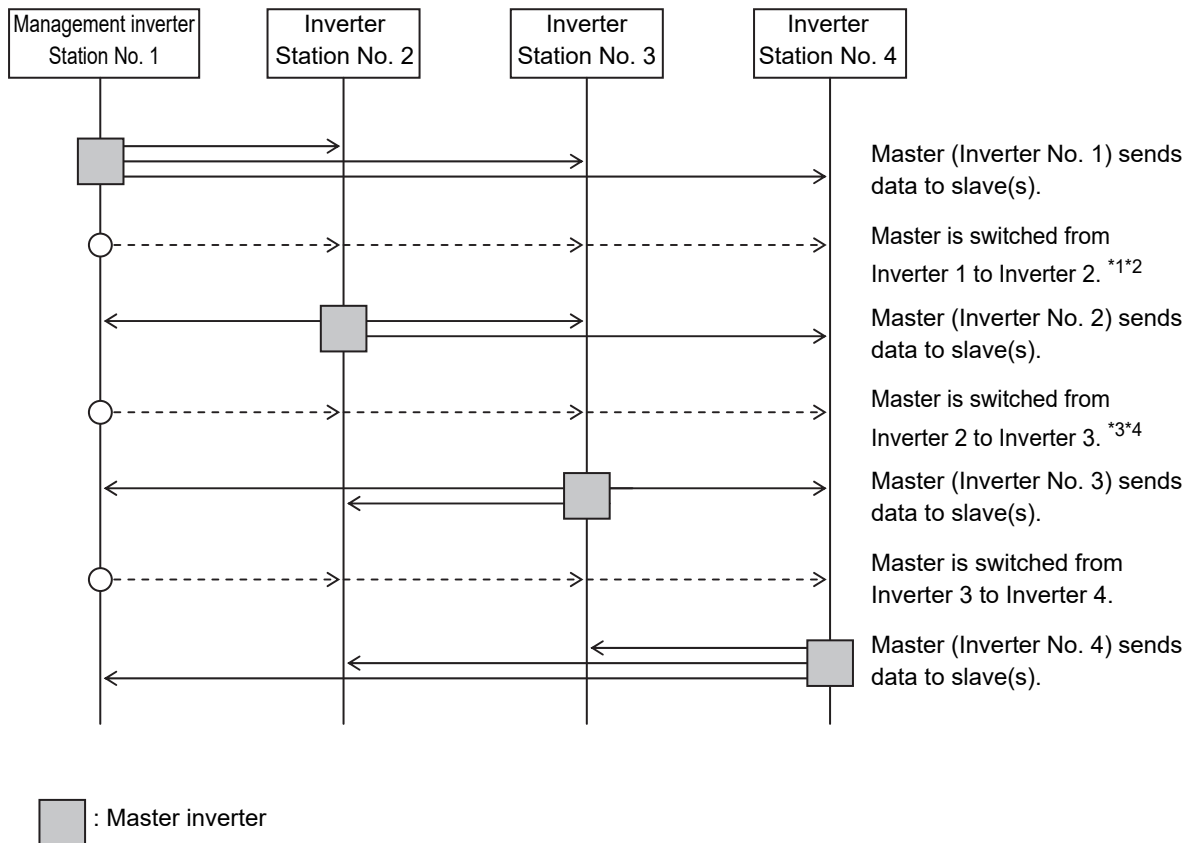
In addition to the standard Modbus communication (slave), the 3G3RX2 Series Inverter provides the co-inverter communication function, which enables more than one 3G3RX2 Series Inverter to communicate mutually without master equipment such as a computer or PLC.

In Inter-inverter Communication, the inverters are assigned as “management inverter,” “master inverter,” and “slave inverter”. The master inverter is specified by the management inverter according to the user settings. The others are slave inverters. The management inverter is always fixed, but the master inverter is switched sequentially. Therefore, the management inverter may serve as the master or a slave inverter. Other conditions are as follows.

- One management inverter is required within a network.
- Up to 11 inverters can serve as the master inverter.
- Up to 247 inverters can be connected within the entire network (32 inverters without repeaters in compliance with the RS485 specifications).

In co-inverter communication, be sure to assign the station No. 1, which serves as the management inverter.

The master inverter can write data to the holding registers on any slave inverter. At this time, up to five different station numbers and holding registers can be specified at once. On completion of each data transmission session between the master and a slave (or slaves), the master inverter is switched to the next in a sequential manner. In this way, data transmission is repeated according to the settings for each master inverter.



*1. Switching of the master is performed automatically by the management inverter.

- *2. The management inverter sends the master switching command from Inverter No. 01 to 02 after data is sent from Inverter 01 (master) to a slave (or slaves), with a wait time of "silent interval + Communication Wait Time.
- *3. After receiving data from the master inverter, the management inverter sends the next master switching command with a wait time of "silent interval + Communication Wait Time. If the management inverter cannot receive the data sent from the master inverter within the Communication Error Timeout Time, a communication timeout occurs and the management inverter follows the operation set in the Operation Selection on Communication Error.
- *4. Be sure to enable the Communication Error Timeout Time setting (= 0.01 to 99.99) on the management inverter. When this setting is disabled (= 0), the co-inverter communication will stop if the management inverter cannot receive data from the master. In this case, cycle the power supply for the management inverter, or reset the management inverter (by turning ON/OFF the terminal RS).

9-6-1 Inter-inverter Communication Parameters

The parameters required to establish Inter-inverter communication are shown in the table below.

| Parameter No. | Function name | Data | Default data | Unit | Setting target ^{*1} |
|---------------------|---|--|--------------|------|------------------------------|
| CF-02 ^{*2} | Communication Station No. Selection | 1 to 247 ^{*3} | 1 | – | ALL ^{*4} |
| CF-05 ^{*5} | Operation Selection on Communication Error | 00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop | 02 | – | ALL |
| CF-06 | Communication Error Timeout Time | 0.00: Timeout disabled 0.01 to 99.99 | 0.00 | s | ALL |
| CF-07 | Communication Wait Time | 0 to 1000 | 0 | ms | ALL |
| CF-08 ^{*2} | Communication Selection | 00: Modbus communication 01: EzCom communication 02: EzCom communication (management inverter) | 00 | – | – |
| | | | | | B |
| | | | | | A |
| CF-20 ^{*2} | EzCom Communication Starting Station Number | 1 to 8 Setting required only for management inverter ^{*6} | 1 | – | A |
| CF-21 ^{*2} | EzCom Communication Ending Station Number | 1 to 8 Setting required only for management inverter ^{*6} | 1 | – | A |
| CF-22 ^{*2} | EzCom Communication Start Selection | 00: Start via input terminal ^{*7} 01: Constant communication ^{*8} | 00 | – | A |
| | | | | | A |
| CF-23 | Number of Sent Data of All Stations in EzCom Communication | 1 to 5 | 5 | – | M |
| CF-24 | Recipient Station Number of All Stations in EzCom Communication 1 | 1 to 247 ^{*9} | 1 | – | M |
| CF-25 | Recipient Register of All Stations in EzCom Communication 1 | 0000 to FFFF | 0 | – | M |

| Parameter No. | Function name | Data | Default data | Unit | Setting target*1 |
|----------------|---|-------------------|--------------|------|------------------|
| CF-26 | Sender Register of All Stations in EzCom Communication 1 | 0000 to FFFF | 0000 | – | M |
| CF-27 | Recipient Station Number of All Stations in EzCom Communication 2 | 1 to 247 | 2 | – | M |
| CF-28 | Recipient Register of All Stations in EzCom Communication 2 | 0000 to FFFF | 0000 | – | M |
| CF-29 | Sender Register of All Stations in EzCom Communication 2 | 0000 to FFFF | 0000 | – | M |
| CF-30 | Recipient Station Number of All Stations in EzCom Communication 3 | 1 to 247 | 3 | – | M |
| CF-31 | Recipient Register of All Stations in EzCom Communication 3 | 0000 to FFFF | 0000 | – | M |
| CF-32 | Sender Register of All Stations in EzCom Communication 3 | 0000 to FFFF | 0000 | – | M |
| CF-33 | Recipient Station Number of All Stations in EzCom Communication 4 | 1 to 247 | 4 | – | M |
| CF-34 | Recipient Register of All Stations in EzCom Communication 4 | 0000 to FFFF | 0000 | – | M |
| CF-35 | Sender Register of All Stations in EzCom Communication 4 | 0000 to FFFF | 0000 | – | M |
| CF-36 | Recipient Station Number of All Stations in EzCom Communication 5 | 1 to 247 | 5 | – | M |
| CF-37 | Recipient Register of All Stations in EzCom Communication 5 | 0000 to FFFF | 0000 | – | M |
| CF-38 | Sender Register of All Stations in EzCom Communication 5 | 0000 to FFFF | 0000 | – | M |
| CA-01 to CA-07 | Input terminal 1 to 9, A, B | 98: EzCom start*7 | – | – | A |

*1. Below are the details of the setting target.

ALL: Setting required for all connected inverters

A: Setting required only for management inverter (Station No. 1)

B: Setting required for inverters other than management inverter (Station No. 1)

M: Setting required only for inverters set in CF-20 to CF-21 (= Inverters assigned with master role)

*2. After changing any of the CF-02, CF-08, and CF-20 to CF-22 data on the management inverter, be sure to cycle the power supply to apply the changes. For inverters other than the management inverter, these changes will be applied immediately.

- *3. To switch the master inverter among more than one inverter, be sure to set sequential station numbers. If the set station numbers include any skipped number, communications cannot be established.
- *4. For the management inverter, set the station number to 1 (CF-02= 1).
- *5. When the Operation Selection on Communication Error (CF-05) is set to 02 (Ignore) on the management inverter, the co-inverter communication session will stop if a communications timeout error occurs on the management inverter. In this case, cycle the power supply of the management inverter.
- *6. Set these parameters so that CF-20 is equal to or less than CF-21.
- *7. Assign 98 (EzCom start) to any of input terminals 1 to 9, A and B (CA-01 to CA-11) when you set 00 (EzCom terminals) in Inverter Communication Start Selection (CF-22).
- *8. When the Co-inverter Communication Start Selection is set to 01 (Constant communication), the management inverter starts sending data as soon as the power supply is turned on. At this time, if the next master inverter is delayed in the startup and cannot receive the master switching command, the master inverter cannot send the data, which results in a communications timeout error on the management inverter.
When you set CF-22 to 01, check that the startup of the other inverters is completed and power on the management inverter finally.
- *9. Although, in master-to-slave communications, you set recipient slave's station number, actually, data is sent to all stations via broadcast communications (Station No. 00). Slaves that are not specified as the recipient on the master side discard the received data.

9-6-2 Communication Settings

- On each inverter, set the station number in the Communication Station No. Selection so that they do not overlap among the inverters. Do not forget to set the station No. 1, which serves as the management inverter.
- Set Management Inverter Communication Method Selection (CF-08) to 03 (Inter-inverter Communication (Management)). Set Other Management Inverter Communication Method Selection (CF-08) to 02 (Inter-inverter Communication).
- Set a station number 1 to 8 on inverters that serve as the master inverter. To switch the master inverter among more than one inverter, the station numbering must be sequential. On the management inverter, set the smallest master station number in the Co-inverter Communication Starting Station Number (CF-20) and the largest master station number in the Co-inverter Communication Ending Station Number (CF-21).
- In the Co-inverter Communication Start Selection, set how to start inverter communications. When Inter-inverter Communication Start Selection is set to 00 (Start via input terminal), assign 98 (EzCom start) to one of the Multi-function Input S1 to S7 Selection (CA-01 to CA-07).
- In CF-23 to CF-38, set the following parameters, which are required when the master inverter writes data: the number of sent data, recipient station number, recipient register address, and sender register address.

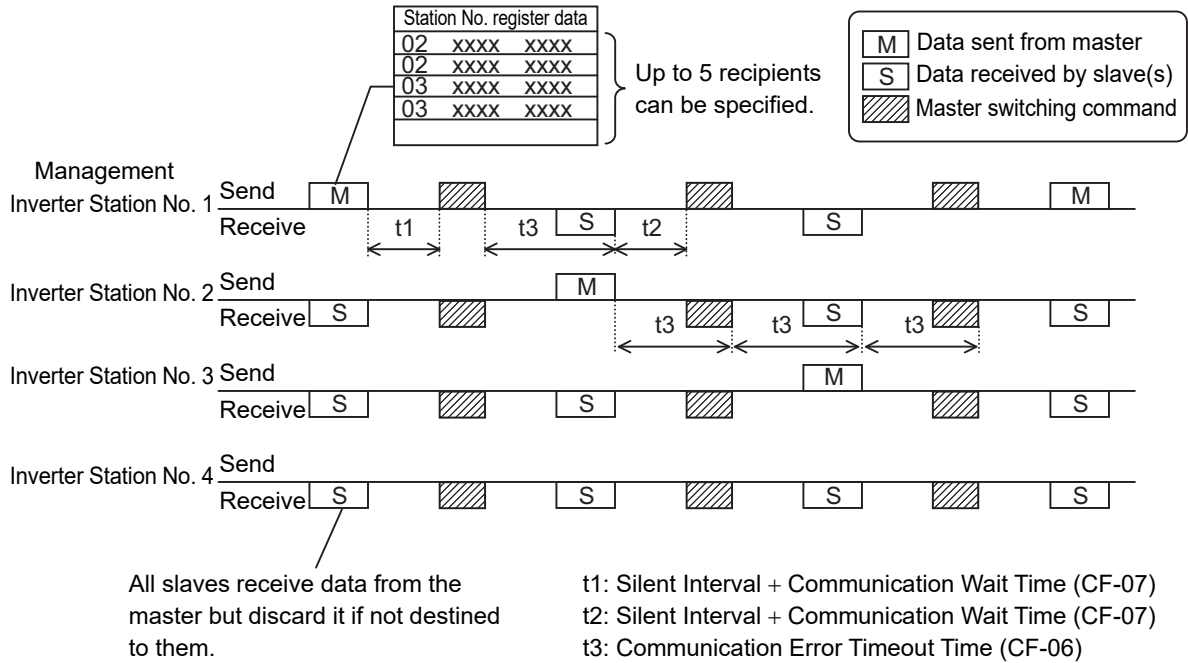
Inter-inverter Communication Operation

- (1) **The master inverter sends data to one or more slave inverters according to the settings for that master inverter.**
(This data is also sent to the management inverter that does not serve as the master inverter.)
- (2) **The management inverter sends the master switching command and the master inverter is switched accordingly.**
- (3) **The next master inverter sends data to one or more slave inverters in the same manner as explained in step (1).**
(This data is also sent to the management inverter that does not serve as the master inverter.)
- (4) **Steps (2) and (3) are followed repeatedly.**

Note Because this inverter is designed to establish co-inverter communication as broadcast communications (Station No. 00), communications data is sent to all stations. Therefore, slaves that are not specified as the recipient on the master side receive the data once, but discard internally the data not addressed to them.

Example of Inter-inverter Communication Sequence

The sequence diagram below shows co-inverter communication among four inverters with station numbers from 1 to 4, where Stations No. 1 to 3 are set as the master inverter.



- Be sure to set the Communication Error Timeout Time (CF-06) to other than 0.00 (1 second or longer is recommended) on the management inverter. When this parameter is set to 0.00, the inverter's communications function will stop if no data is received from the master. If it stops working, cycle the power supply of the management inverter.
- The communications error timeout timer starts when the inverter starts waiting for data reception and times out when it cannot complete data reception within the set time. If a timeout occurs, the inverter performs the operation set in the Operation Selection on Communication Error (CF-05). (t3 in above diagram)
- When the management inverter is the master, the master switching command will be sent with a wait time of "silent interval + Communication Wait Time (CF-07) after the master sends data. (t1 in above diagram)
- When an inverter other than the management inverter is the master, the master switching command will be sent with a wait time of "silent interval + Communication Wait Time (CF-07) after receipt of data sent from the master inverter. (t2 in above diagram)
- When the Co-inverter Communication Start Selection (C100) is set to 01 (Constant communication), the management inverter starts sending data as soon as the power supply is turned on. Therefore, if the power-on timing of any other inverter is delayed, the communications cannot be established normally, which results in a communications timeout error on the management inverter. When you set this to 01 (Constant communication), check that the startup of the other inverters is completed and power on the management inverter finally.
- Do not set (EEPROM Write) or (EEPROM Write Mode Selection) in the recipient registers. Doing so causes the co-inverter communication session to stop in the EEPROM write process.
- After changing any of the CF-08, CF-20 to CF-22 data, be sure to cycle the power supply to apply the changes.

10

DriveProgramming

This section describes the features of the DriveProgramming.

| | |
|--|-------------|
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|--|-------------|

10-1 Overview of DriveProgramming

The 3G3RX2 Series Inverter has the built-in simple sequence function (DriveProgramming), which enables a stand-alone inverter to perform simple sequence control.

You can create programs easily by using the CX-Drive. The user programs you created can be downloaded onto the inverter for programmed inverter operation.

Features of DriveProgramming

- The DriveProgramming supports both flowchart and text language method programming.
- Five tasks can be processed in parallel.
- ON/OFF by input terminals enables a start of user programs.
- The user programs enable the input terminals and output terminals to use reading and writing functions.
- The LCD Operator enables you to change the settings of the output frequency, acceleration/deceleration time, and other parameters that require on-site adjustment by specifying the user parameters (UE-10 to UE-73), without connecting the computer.
- Because user programs are stored in the internal EEPROM of the inverter, you can start a program immediately after the inverter power supply is turned on.
- Connecting the optional LCD Operator enables the control of the inverter by using the LCD Operator's clock command.



Precautions for Safe Use

- If the clock command is used in DriveProgramming, an unexpected operation may occur due to weak battery. Take measures such as detecting a weak battery by [E042] RTC Error and stopping the inverter or programs. When the LCD Operator is removed or disconnected, DriveProgramming is in a waiting status by the clock command.
 - If the DriveProgramming stops during multi-function output, the output status is held. Take safety precautions such as stopping peripheral devices.
-

DriveProgramming Function

The details of the main DriveProgramming function are as follows.

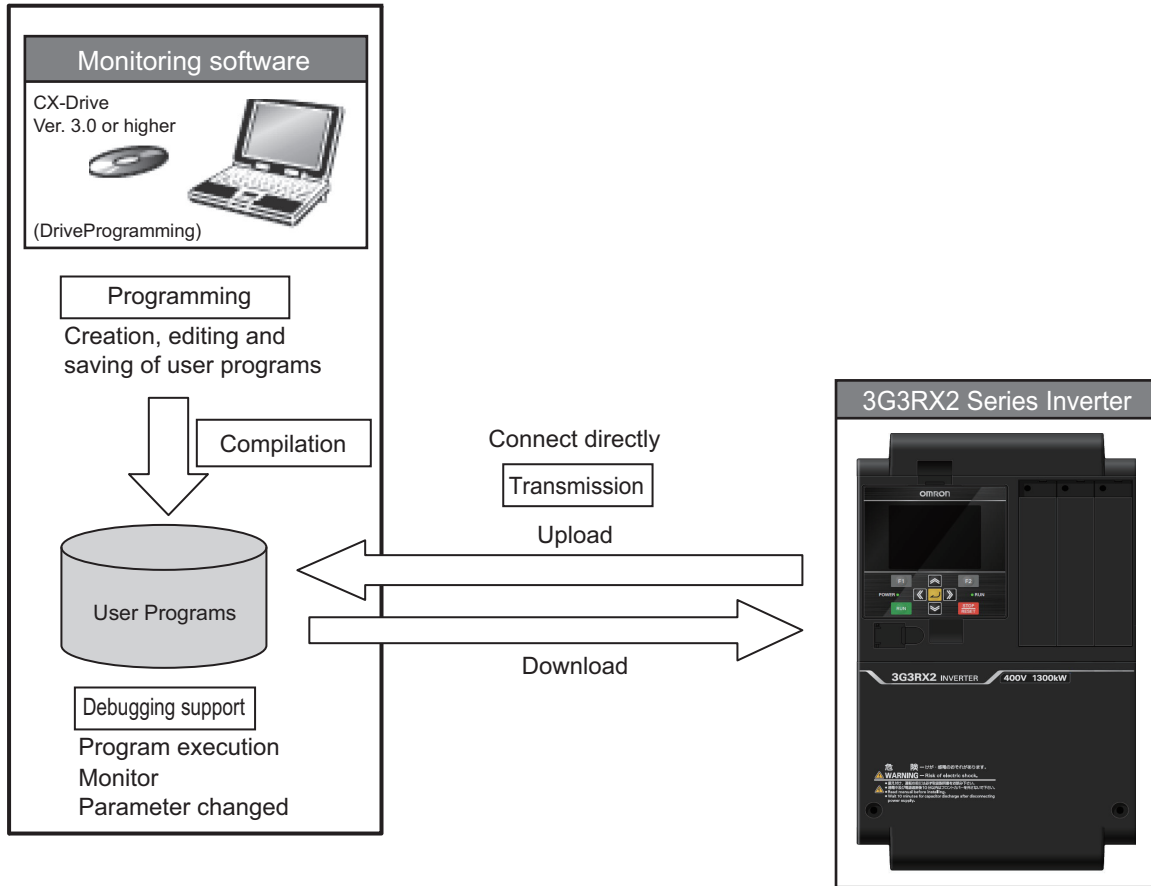
| Item | | Specifications |
|------------------------|------------------------------|--|
| Program specifications | Programming language | Flowchart and text language method |
| | Input device | Windows Personnel Computer (As for supported operation system, refer to the <i>CX-One User's Manual</i> (Cat. No. W463). |
| | Program capacity | 1024 steps max.: 6 KB (1024 steps max. for a total of 5 tasks) |
| | Programming support function | Functions supported in Inverter/Servo support tool CX-Drive <ul style="list-style-type: none"> • Program editing and display • Program compilation (Program syntax check) • Program downloading, uploading, and all clear |
| | Execution format | <ul style="list-style-type: none"> • Execution by interpreter • Execution cycle: 2 ms/step (5 commands executable through 5-task parallel processing) • Subroutine call supported (Nesting in 8 levels max.) |

The main functions of the DriveProgramming Editor available in CX-Drive are as shown below.

| Function | Description |
|-------------------|--|
| Programming | Supports the creation, editing, saving, reading, and printing of user programs. |
| Compilation | Compiles a user programs.*1 |
| Transfer | Downloads a user program to the inverter, or uploads a user program from the inverter. |
| Debugging support | Starts and stops the execution of a program. This allows the user to check the inverter status monitor etc. |

*1. Compilation is the process to generate an intermediate code after a program check.

For details, refer to the *DriveProgramming User's Manual* (Cat. No. I622).



Options

This section describes the specifications and external dimension of peripheral equipment.

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11-1 Overview of Optional Equipment

This section provides an overview of the optional equipment available with the 3G3RX2 Series Inverter. For details, refer to the manual for each optional product.

11-1-1 Part Names and Descriptions

Regenerative Braking Unit (Model: 3G3AX-RBU□□)/ Braking Resistor (Model: 3G3AX-RBA/RBB/RBC□□□□)

These products absorb the regenerative energy generated when a load decelerates or an elevating axis descends to prevent overvoltage trip of the inverter.

For details, refer to *External Braking Resistor Connection Terminal (P, RB)/ Regenerative Braking Unit Connection Terminal (P, N)* on page 2-55.

DC Reactor (Model: 3G3AX-DL□□□□)/ AC Reactor (Model: 3G3AX-AL□□□□)

Use these reactors to suppress harmonics generated from the inverter.

The AC reactor is used when the power supply voltage unbalance factor is 3% or more, the inverter capacity is 500 kVA or more, or rapid change in the power supply voltage occurs to reduce its effect.

The DC/AC reactor also has an effect of improving the power factor.

For details, refer to *2-3-4 Wiring for Main Circuit Terminals* on page 2-32 and *Harmonic Current Measures and DC/AC Reactor Wiring (PD, P)* on page 2-49.

Input Noise Filter (Model: 3G3AX-NFI□□)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to power supply lines.

For details, refer to *Installing Input Noise Filter* on page 2-48.

Output Noise Filter (Model: 3G3AX-NFO□□)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to the motor side wires.

For details, refer to *Installing Output Noise Filter* on page 2-53.

Radio Noise Filter (Model: 3G3AX-ZCL□)

Use this filter to reduce the radiated noise generated in the inverter and emitted from the power-supply line side and motor side wires.

For details, refer to *Measures against Radio Noise* on page 2-53.

EMC Noise Filter (Model: 3G3AX-EFI□□)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to power supply lines for compliance with European EC Directives.

For details, refer to *2-3-10 Conditions of Conformity of EU Directives* on page 2-75.

11-2 Regenerative Braking Unit (Model: 3G3AX-RBU□□)

11-2-1 Specifications

Built-in Resistor Type (Model: 3G3AX-RBU21/RBU22/RBU41)

| Applicable voltage class | | 3-phase 200-V class | | 3-phase 400-V class |
|---|--|---|---|--|
| Model | | 3G3AX-RBU21 | 3G3AX-RBU22 | 3G3AX-RBU41*1 |
| Connection resistance | | 17 Ω min. | 17 Ω min. | 34 Ω min. |
| Operating voltage (ON/OFF) | | ON: 362.5 ± 5 V OFF: 355 ± 5 V (-5% or -10% setting available) | | ON: 725 ± 5 V OFF: 710 ± 5 V (-5% or -10% setting available) |
| Operation indication | | LED ON (Lit) | | |
| Maximum number of units for parallel interlocking operation*2 | | 5 units | | |
| Built-in resistor | Internal resistance | 120 W, 180 Ω | 120 W, 20 Ω | 120 W, 180 Ω x 2 in series |
| | Allowable continuous ON time | 10 s max. | 0.5 s max. | 10 s max. |
| | Allowable operation cycle | Cycle 1/10 (ON for 10 s/OFF for 90 s) | Cycle 1/80 (ON for 0.5 s/OFF for 40 s) | Cycle 1/10 (ON for 10 s/OFF for 90 s) |
| | Power consumption | Instantaneous: 0.73 kW Short-time rating: 120 W | Instantaneous: 6.6 kW Short-time rating: 120 W | Instantaneous: 1.46 kW Short-time rating: 240 W |
| Protective function | Built-in resistor over-heat protection | Built-in relay specifications · Built-in resistor temperature: Relay is activated at approximately 200°C or higher and reset at approximately 170°C or lower. · Built-in thermal fuse (No resetting)*3 · Contact rating: 250 VAC 200 mA (R load) 12 VAC 500 mA (R load) 42 VDC 200 mA (R load) · Minimum load: 1 mA | | |
| Operating environment | Operating ambient temperature | -10 to 50°C | | |
| | Storage ambient temperature | -20 to 65°C | | |
| | Operating ambient humidity | 20% to 90% (with no condensation) | | |
| | Vibration resistance | 5.9 m/s ² (0.6 G) 10 to 55 Hz | | |
| | Location | At a maximum altitude of 1,000 m (without corrosive gases or dust) | | |
| Paint color | | Munselle 5Y7/1 (except for cooling fan with aluminum base color) | | |

*1. To use the braking resistor (Model: 3G3AX-RAB/RBB/RBC) for the 400-V class regenerative braking unit, be sure to remove the built-in resistor and connect two resistors of the same model in series. Using a 400-V class regenerative braking unit with only a single braking resistor connected may cause damage to the braking resistor.

*2. Use DIP switches to set the number of connected units.

*3. The built-in resistor has a thermal fuse. If the alarm terminals are not connected, the fuse may blow out in order to prevent the resistor from burning due to overheating. If the fuse blows out, the built-in resistor must be replaced.

External Resistor Type (Model: 3G3AX-RBU23/RBU24/RBU42/RBU43)

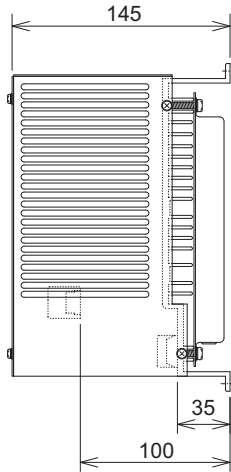
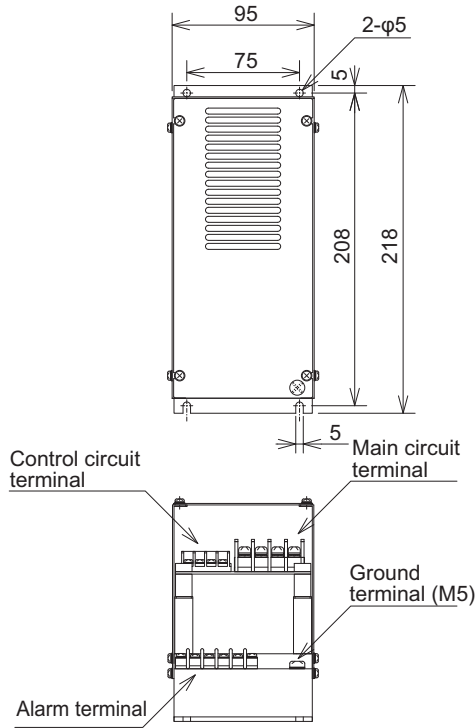
| Applicable voltage class | | 3-phase 200-V class | | 3-phase 400-V class | |
|---|---|---|--|---|--|
| Model | | 3G3AX-RBU23 | 3G3AX-RBU24 | 3G3AX-RBU42 ^{*1} | 3G3AX-RBU43 ^{*1} |
| Connection resistance | Continuous operation | 6 Ω min. | 4 Ω min. | 24 Ω min. | 12 Ω min. |
| | Short-time operation/ Allowable operation cycle/ Allowable continuous ON time | 4 Ω min. Cycle 1/5 (ON for 2 min/ OFF for 8 min) 2 min | 2 Ω min. Cycle 1/5 (ON for 2 min/ OFF for 8 min) 2 min | 10 Ω min. Cycle 1/10 (ON for 10 s/ OFF for 90 s) 10 s | 6 Ω min. Cycle 1/5 (ON for 2 min/ OFF for 8 min) 2 min |
| | Operating voltage (ON/OFF) | ON: 362.5 ± 5 V, OFF: 355 ± 5 V (-5% or -10% setting available) | | ON: 725 ± 5 V, OFF: 710 ± 5 V (-5% or -10% setting available) | |
| | Operation indication | LED ON (Lit) | | | |
| Maximum number of units for parallel interlocking operation ^{*2} | | 2 units | | | |
| Protective function | Internal power module overheat protection | Built-in relay specifications · Cooling fin temperature: Relay operates at approximately 100°C or higher. · Contact rating: 240 VAC 3A (R load) 36 VDC 2A (R load) · Minimum load: 5 VDC 50 mA (R load) | | | |
| Operating environment | Operating ambient temperature | -10 to 50°C | | | |
| | Storage ambient temperature | -20 to 65°C | | | |
| | Operating ambient humidity | 20% to 90% (with no condensation) | | | |
| | Vibration resistance | 4.9 m/s ² (0.5 G), 10 to 55 Hz | | | |
| | Location | At a maximum altitude of 1,000 m (without corrosive gases or dust) | | | |
| Paint color | | Munselle 5Y7/1 (except for cooling fan with aluminum base color) | | | |

*1. To use the braking resistor (3G3AX-RAB/RBB/RBC) for the 400-V class regenerative braking unit, be sure to remove the built-in resistor and connect two resistors of the same model in series. Using a 400-V class regenerative braking unit with only a single braking resistor connected may cause damage to the braking resistor.

*2. Use DIP switches to set the number of connected units.

11-2-2 External Dimensions

3G3AX-RBU21/RBU22/RBU41



Main circuit terminal
Terminal width 9, M4 screw

| | | | |
|---|----|---|---|
| N | RB | P | P |
|---|----|---|---|

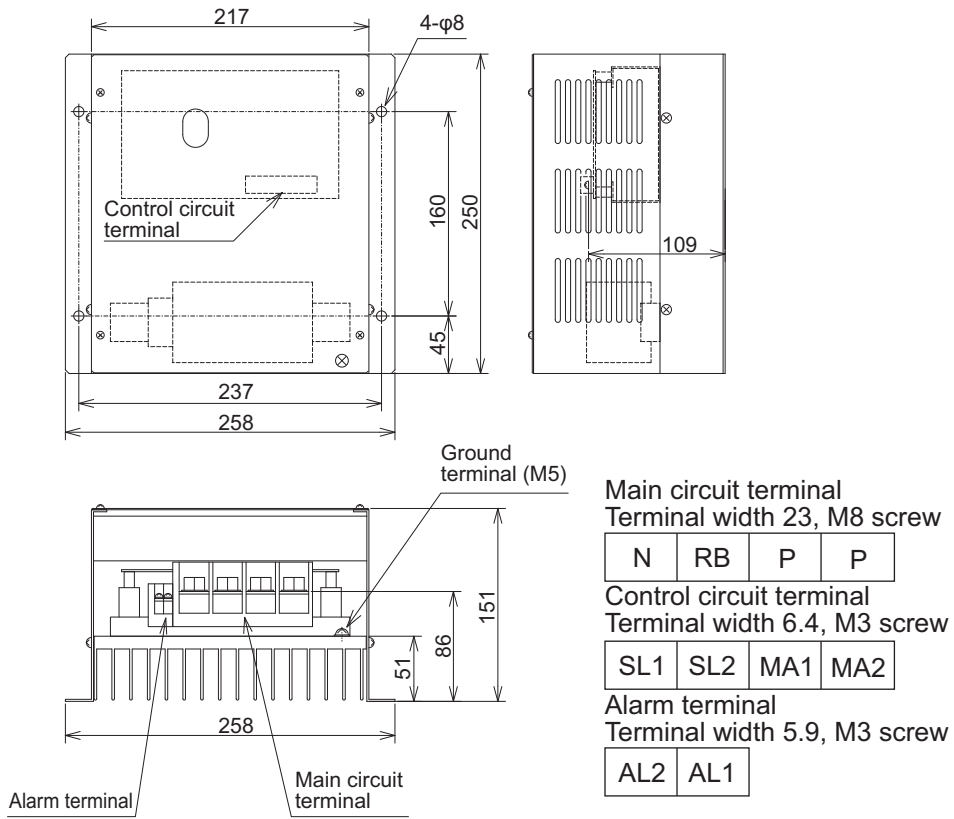
Control circuit terminal
Terminal width 6, M3 screw

| | | | |
|-----|-----|-----|-----|
| SL1 | SL2 | MA1 | MA2 |
|-----|-----|-----|-----|

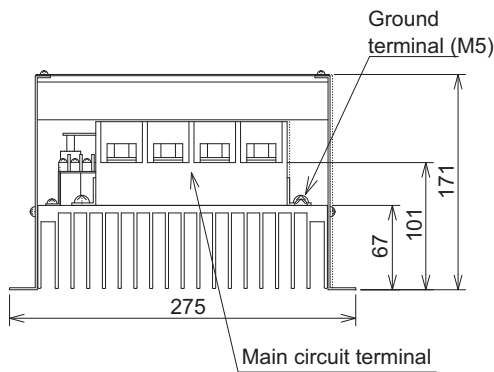
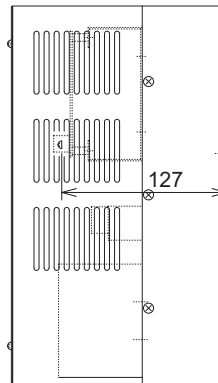
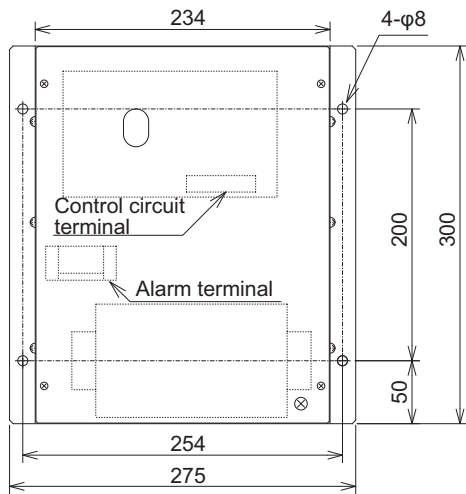
Ground terminal
Terminal width 7, M3 screw

| | | | |
|-----|-----|----|----|
| AL1 | AL2 | R1 | R2 |
|-----|-----|----|----|

3G3AX-RBU23



3G3AX-RBU24



Main circuit terminal
Terminal width 33, M10 screw

| | | | |
|---|----|---|---|
| N | RB | P | P |
|---|----|---|---|

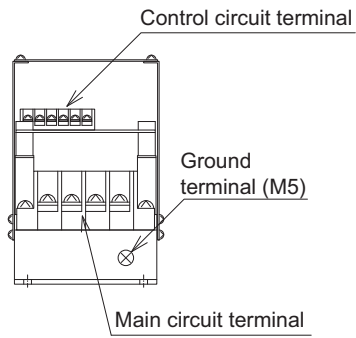
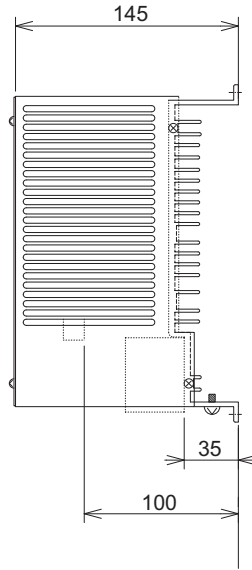
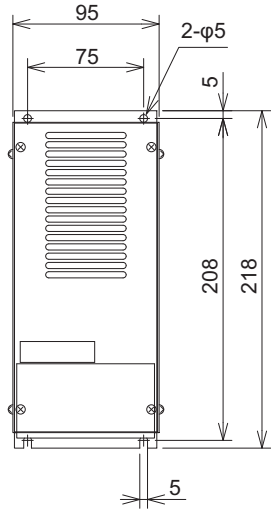
Control circuit terminal
Terminal width 6.4, M3 screw

| | | | |
|-----|-----|-----|-----|
| SL1 | SL2 | MA1 | MA2 |
|-----|-----|-----|-----|

Alarm terminal
Terminal width 7.5, M3 screw

| | |
|-----|-----|
| AL2 | AL1 |
|-----|-----|

3G3AX-RBU42



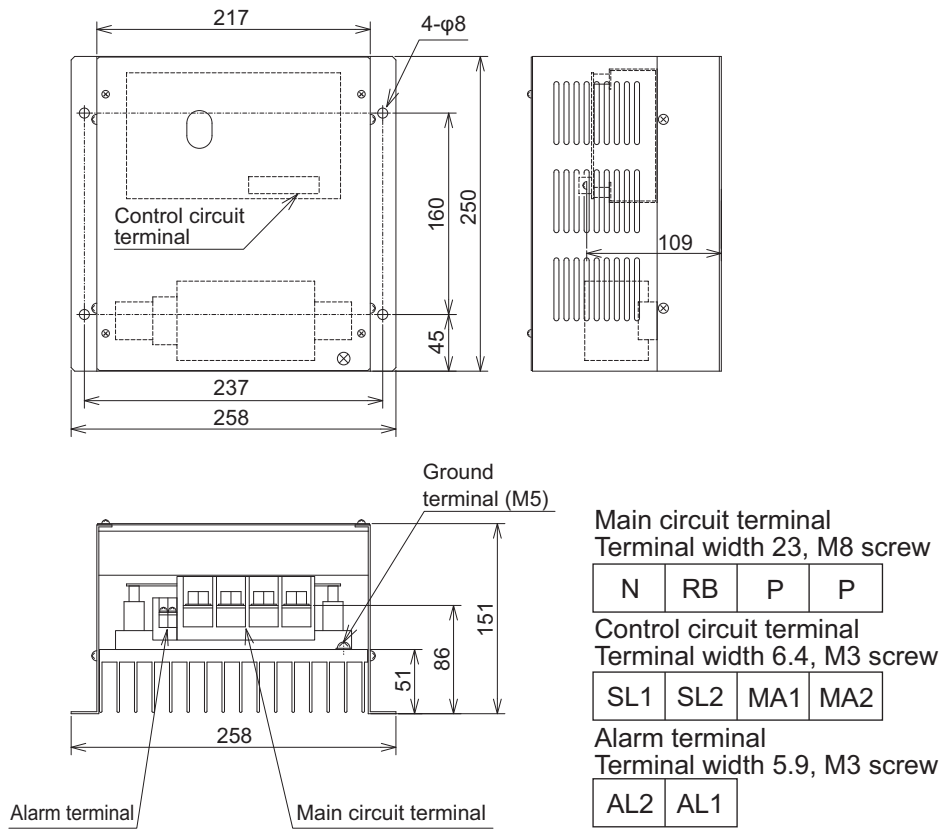
Main circuit terminal
Terminal width 13, M5 screw

| | | | |
|---|----|---|---|
| N | RB | P | P |
|---|----|---|---|

Control circuit terminal
Terminal width 6, M3 screw

| | | | | | |
|-----|-----|-----|-----|-----|-----|
| SL1 | SL2 | MA1 | MA2 | AL1 | AL2 |
|-----|-----|-----|-----|-----|-----|

3G3AX-RBU43

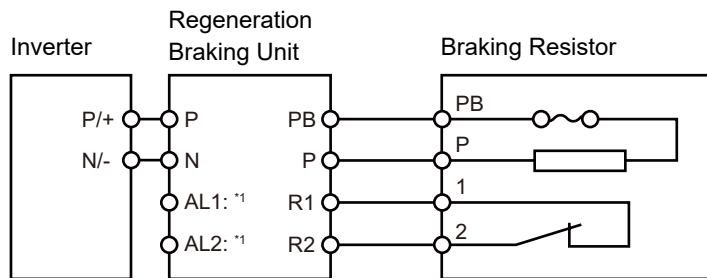


11-2-3 Connection Examples

For how to connect regenerative braking unit(s), refer to *External Braking Resistor Connection Terminal (P, RB)/ Regenerative Braking Unit Connection Terminal (P, N)* on page 2-55 in this manual.

When you desire to shorten a motor deceleration time, use an inverter combined with a braking resistor.

Example of Connection



*1. Alarm output terminal for the regeneration braking unit

When a thermal relay for its built-in resistor or the braking resistor as an option is operated, set a circuit to shut the power supply of the inverter at the primary side.



Precautions for Correct Use

A thermal fuse is built in the braking resistor (RBA, RBB and RBC). After an alarm is issued from the thermal relay between terminals 1 and 2, overheat may result in a breakage of the thermal fuse. If the fuse is broken, the braking resistor can't be restored. Replace the braking resistor with new one.

Wire the alarm output terminals properly. When thermal abnormality is detected, stop the inverter operation and cool the braking resistor thoroughly. After that, start the inverter.

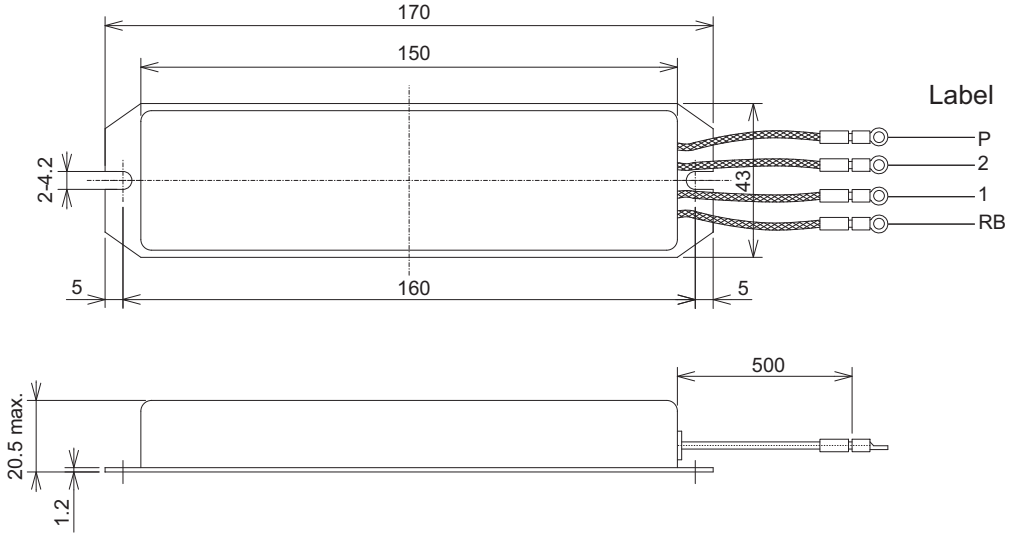
11-3 Braking Resistor (Model: 3G3AX-RBA/RBB/RBC□□□□)

11-3-1 Specifications

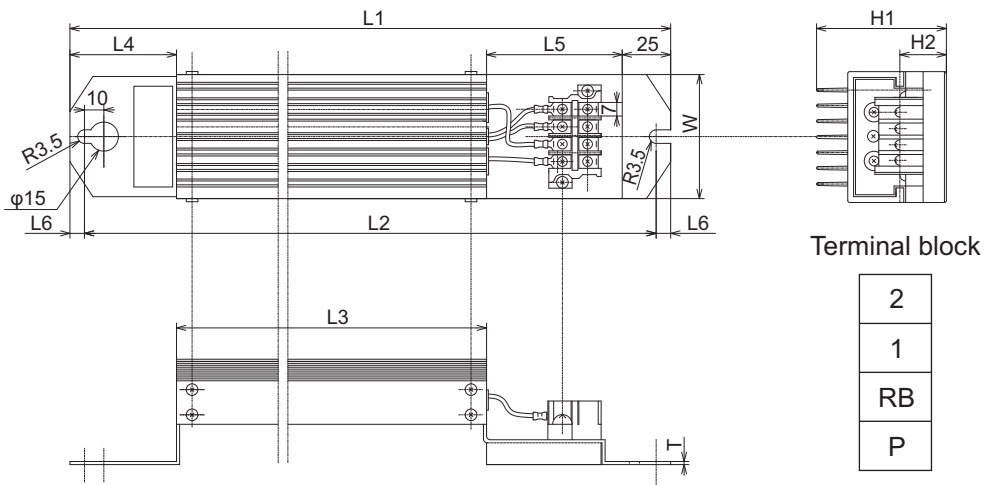
| Model | | Compact type (Model: 3G3AX-RBA□□□□) | | | | Standard type (Model: 3G3AX-RBB□□□□) | | | | Medium capacity type (Model: 3G3AX-RBC□□□□) | | | | |
|---------------------------------------|-------------------------------|---|------|------|------|---|------|------|------|---|-------|-------|-------|--------|
| | | 1201 | 1202 | 1203 | 1204 | 2001 | 2002 | 3001 | 4001 | 4001 | 6001 | 12001 | | |
| Resistance | Capacity | 120 W | | | | 200 W | | | | 300 W | 400 W | 400 W | 600 W | 1200 W |
| | Resistance [Ω] | 180 | 100 | 50 | 35 | 180 | 100 | 50 | 35 | 50 | 35 | 17 | | |
| Allowable braking frequency [%] | | 5 | 2.5 | 1.5 | 1.0 | 10 | 7.5 | 7.5 | 7.5 | 10 | | | | |
| Allowable continuous braking time [s] | | 20 | 12 | 5 | 3 | 30 | | | | 20 | 10 | | | |
| Weight [kg] | | 0.27 | | | | 0.97 | | 1.68 | 2.85 | 2.5 | 3.6 | 6.5 | | |
| Error detection function | | Built-in thermal (Contact capacity: 240 VAC 2A max., minimum current: 5 mA) Normally ON (NC contact) Built-in thermal fuse (No resetting) | | | | | | | | Built-in thermal relay: Normally ON (NC contact) Contact capacity: 240 VAC 3 A (resistance load) 0.2 A (L load), 36 VDC 2 A (resistance load) | | | | |
| General specifications | Operating ambient temperature | -10 to 50°C | | | | | | | | | | | | |
| | Storage ambient temperature | -20 to 65°C | | | | | | | | | | | | |
| | Operating ambient humidity | 20% to 90% (with no condensation) | | | | | | | | | | | | |
| | Vibration resistance | 5.9 m/s ² (0.6 G) 10 to 55 Hz | | | | | | | | | | | | |
| | Location | At a maximum altitude of 1,000 m (without corrosive gases or dust) | | | | | | | | | | | | |
| | Cooling method | Self-cooling | | | | | | | | | | | | |

11-3-2 External Dimensions

3G3AX-RBA□□□□

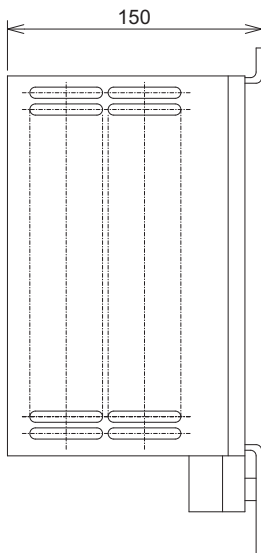
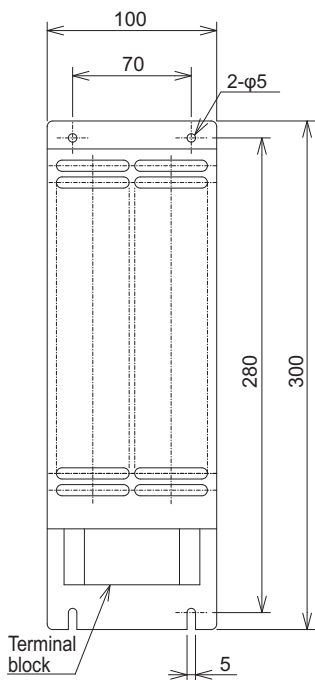


3G3AX-RBB□□□□



| Model | Rated capacity [W] | Resistance [Ω] | Dimensions [mm] | | | | | | | | | | Weight [kg] | Terminal screw | |
|---------------|--------------------|-------------------------|-----------------|-----|-----|----|----|-----|----|----|----|-----|-------------|----------------|------|
| | | | L1 | L2 | L3 | L4 | L5 | L6 | H1 | H2 | W | T | | | |
| 3G3AX-RBB2001 | 200 | 180 | 310 | 295 | 160 | 55 | 70 | 7.5 | 67 | 12 | 64 | 1.6 | 0.97 | M3.5 | |
| 3G3AX-RBB2002 | 200 | 100 | 310 | 295 | 160 | 55 | 70 | 7.5 | 67 | 12 | 64 | 1.6 | | | |
| 3G3AX-RBB3001 | 300 | 50 | 470 | 455 | 320 | 55 | 70 | 7.5 | 67 | 12 | 64 | 1.6 | | | 1.68 |
| 3G3AX-RBB4001 | 400 | 35 | 435 | 422 | 300 | 50 | 60 | 6.5 | 94 | 15 | 76 | 2 | | | 2.85 |

3G3AX-RBC4001

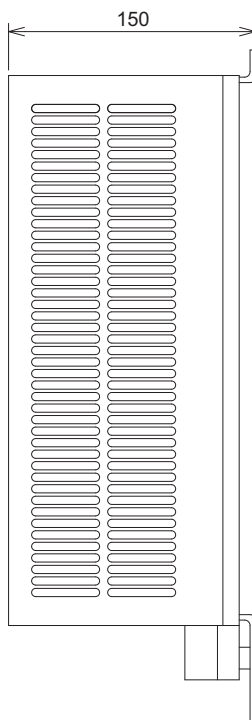
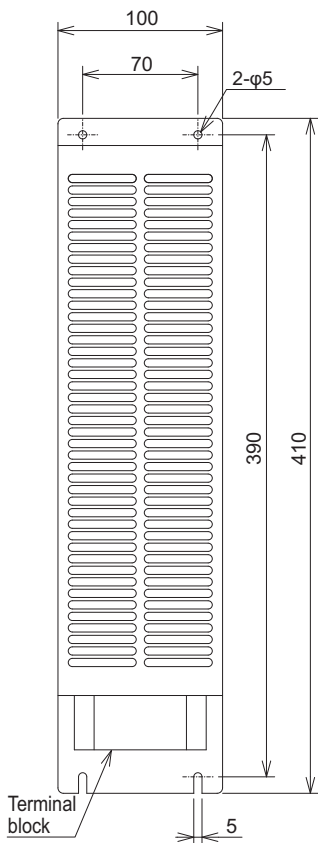


Terminal block

| | | | |
|---|----|-----|-----|
| P | RB | AL1 | AL2 |
|---|----|-----|-----|

Terminal width 9 mm
Screw M4

3G3AX-RBC6001

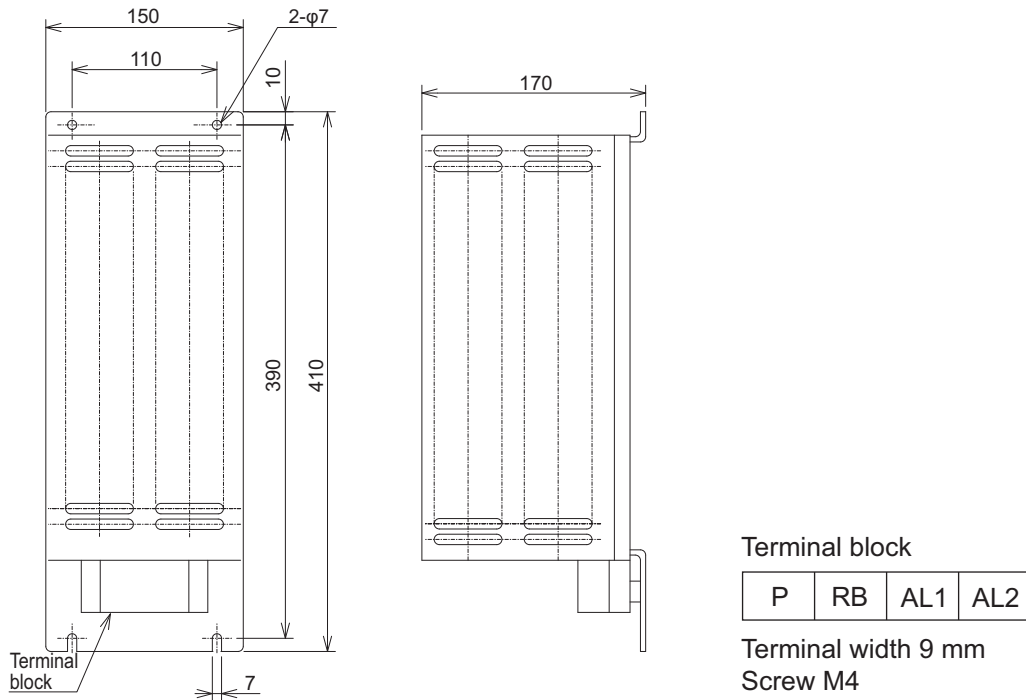


Terminal block

| | | | |
|---|----|-----|-----|
| P | RB | AL1 | AL2 |
|---|----|-----|-----|

Terminal width 9 mm
Screw M4

3G3AX-RBC12001



11-3-3 Connection Example

For how to connect regenerative braking unit(s), refer to *External Braking Resistor Connection Terminal (P, RB)/ Regenerative Braking Unit Connection Terminal (P, N)* on page 2-55 in this manual.

11-4 Regenerative Braking Unit and Braking Resistor Combination Selection Table

Select the combination of the regenerative braking unit(s) and the braking resistor(s) as follows, according to your inverter.

If the usage rate exceeds 10% ED, or if you need a torque larger than the approximate braking torque, you need to follow the instruction provided in *A-3 Overview of Inverter Selection* on page A-25.

- Inverter:
Select the model of your inverter.
The table below assumes that your inverter is used in the heavy load mode and connected to a single motor with the same capacity.
Make sure that the approximate braking torque in the table shows the assumed value per a motor with the same capacity at ND mode. When using this inverter at LD or VLD mode, you need to calculate the torque value by dividing VLD by ND.
- Operating conditions:
Show the torque during deceleration and the deceleration time (in % ED) calculated as a percentage of the cycle time for 1 cycle of operation including the stop time.
- Braking unit/Braking resistor:
Show the required model and number of units.
- Connection form:
Shows the configuration of the regenerative braking unit(s) and braking resistor(s) illustrated in the connection form table below.
- Restrictions:
Show the maximum deceleration time allowable for the combination shown here and the minimum resistance that can be connected to the inverter's built-in regenerative braking circuit or external regenerative braking unit(s).

| Inverter | | | Operating conditions | | Braking unit | | Braking resistor | | Connection form | Restrictions | |
|---------------|-------------------------------------|--------------|----------------------|--------------------------------|-----------------|--------------|------------------|--------------|-----------------|----------------------------------|---|
| Voltage class | Max. applicable motor capacity [kW] | Model | %ED [%] | Approximate braking torque [%] | Model | No. of units | Model | No. of units | | Allowable continuous ON time [s] | Min. connection resistance [Ω] |
| 200-V class | 0.4 | 3G3RX2-A2004 | 3% | 220% | Built into unit | – | 3G3AX-RBA1201 | 1 | 1 | 20 | 50 |
| | | | 10.0% | 220% | | – | 3G3AX-RBB2001 | 1 | 1 | 30 | 50 |
| | 0.75 | 3G3RX2-A2007 | 3.0% | 120% | Built into unit | – | 3G3AX-RBA1201 | 1 | 1 | 20 | 50 |
| | | | 10.0% | 120% | | – | 3G3AX-RBB2001 | 1 | 1 | 30 | 50 |
| | 1.5 | 3G3RX2-A2015 | 2.5% | 110% | Built into unit | – | 3G3AX-RBA1202 | 1 | 1 | 12 | 35 |
| | | | 10.0% | 215% | | – | 3G3AX-RBC4001 | 1 | 1 | 10 | 35 |
| | 2.2 | 3G3RX2-A2022 | 3.0% | 150% | Built into unit | – | 3G3AX-RBB3001 | 1 | 1 | 30 | 35 |
| | | | 10.0% | 150% | | – | 3G3AX-RBC4001 | 1 | 1 | 10 | 35 |

| Inverter | | | Operating conditions | | Braking unit | | Braking resistor | | Connection form | Restrictions | |
|---------------|-------------------------------------|--------------|----------------------|--------------------------------|-----------------|----------------|------------------|--------------|-----------------|----------------------------------|---|
| Voltage class | Max. applicable motor capacity [kW] | Model | %ED [%] | Approximate braking torque [%] | Model | No. of units | Model | No. of units | | Allowable continuous ON time [s] | Min. connection resistance [Ω] |
| 200-V class | 3.7 | 3G3RX2-A2037 | 3.0% | 125% | Built into unit | – | 3G3AX-RBB4001 | 1 | 1 | 20 | 35 |
| | | | 10.0% | 125% | | – | 3G3AX-RBC6001 | 1 | 1 | 10 | 35 |
| | 5.5 | 3G3RX2-A2055 | 3% | 120% | Built into unit | – | 3G3AX-RBB3001 | 2 | 2 | 30 | 16 |
| | | | 10.0% | 120% | | – | 3G3AX-RBC4001 | 2 | 2 | 10 | 16 |
| | 7.5 | 3G3RX2-A2075 | 3.0% | 125% | Built into unit | – | 3G3AX-RBB4001 | 2 | 2 | 20 | 10 |
| | | | 10.0% | 125% | | – | 3G3AX-RBC6001 | 2 | 2 | 10 | 10 |
| | 11 | 3G3RX2-A2110 | 3.0% | 125% | Built into unit | – | 3G3AX-RBB4001 | 3 | 4 | 20 | 10 |
| | | | 10.0% | 125% | | – | 3G3AX-RBC6001 | 3 | 4 | 10 | 10 |
| | 15 | 3G3RX2-A2150 | 3.0% | 130% | Built into unit | – | 3G3AX-RBC12001 | 2 | 2 | 10 | 7.5 |
| | | | 10.0% | 130% | | – | 3G3AX-RBC12001 | 2 | 2 | 10 | 7.5 |
| | 18.5 | 3G3RX2-A2185 | 3.0% | 105% | Built into unit | – | 3G3AX-RBC12001 | 2 | 2 | 10 | 7.5 |
| | | | 10.0% | 105% | | – | 3G3AX-RBC12001 | 2 | 2 | 10 | 7.5 |
| | 22 | 3G3RX2-A2220 | 3.0% | 130% | Built into unit | – | 3G3AX-RBC12001 | 3 | 4 | 10 | 5 |
| | | | 10.0% | 130% | | – | 3G3AX-RBC12001 | 3 | 4 | 10 | 5 |
| | 30 | 3G3RX2-A2300 | 3.0% | 160% | 3G3AX-RBU24 | 1 | 3G3AX-RBC12001 | 5 | 11 | 10 | 2 |
| | | | 10.0% | 160% | 3G3AX-RBU24 | 1 | 3G3AX-RBC12001 | 5 | 11 | 10 | 2 |
| | 37 | 3G3RX2-A2370 | 3.0% | 130% | 3G3AX-RBU24 | 1 | 3G3AX-RBC12001 | 5 | 11 | 10 | 2 |
| | | | 10.0% | 130% | 3G3AX-RBU24 | 1 | 3G3AX-RBC12001 | 5 | 11 | 10 | 2 |
| 45 | 3G3RX2-A2450 | 3.0% | 130% | 3G3AX-RBU24 | 1 | 3G3AX-RBC12001 | 6 | 12 | 10 | 2 | |
| | | 10.0% | 130% | 3G3AX-RBU24 | 1 | 3G3AX-RBC12001 | 6 | 12 | 10 | 2 | |
| 55 | 3G3RX2-A2550 | 3.0% | 120% | 3G3AX-RBU24 | 1 | 3G3AX-RBC12001 | 7 | 13 | 10 | 2 | |
| | | 10.0% | 120% | 3G3AX-RBU24 | 1 | 3G3AX-RBC12001 | 7 | 13 | 10 | 2 | |

| Inverter | | | Operating conditions | | Braking unit | | Braking resistor | | Connection form | Restrictions | |
|---------------|-------------------------------------|--------------|----------------------|--------------------------------|-----------------|----------------|------------------|--------------|-----------------|----------------------------------|---|
| Voltage class | Max. applicable motor capacity [kW] | Model | %ED [%] | Approximate braking torque [%] | Model | No. of units | Model | No. of units | | Allowable continuous ON time [s] | Min. connection resistance [Ω] |
| 400-V class | 0.75 | 3G3RX2-A4007 | 3.0% | 220% | Built into unit | – | 3G3AX-RBA1201 | 2 | 3 | 20 | 100 |
| | | | 10.0% | 220% | | – | 3G3AX-RBB2001 | 2 | 3 | 30 | 100 |
| | 1.5 | 3G3RX2-A4015 | 3.0% | 120% | Built into unit | – | 3G3AX-RBA1201 | 2 | 3 | 20 | 100 |
| | | | 10.0% | 120% | | – | 3G3AX-RBB2001 | 2 | 3 | 30 | 100 |
| | 2.2 | 3G3RX2-A4022 | 2.5% | 150% | Built into unit | – | 3G3AX-RBA1202 | 2 | 3 | 12 | 100 |
| | | | 10.0% | 220% | | – | 3G3AX-RBC4001 | 2 | 3 | 10 | 100 |
| | 3.7 | 3G3RX2-A4037 | 3.0% | 175% | Built into unit | – | 3G3AX-RBB3001 | 2 | 3 | 30 | 70 |
| | | | 10.0% | 175% | | – | 3G3AX-RBC4001 | 2 | 3 | 10 | 70 |
| | 5.5 | 3G3RX2-A4055 | 3.0% | 120% | Built into unit | – | 3G3AX-RBB3001 | 2 | 3 | 30 | 70 |
| | | | 10.0% | 120% | | – | 3G3AX-RBC4001 | 2 | 3 | 10 | 70 |
| | 7.5 | 3G3RX2-A4075 | 3.0% | 125% | Built into unit | – | 3G3AX-RBB4001 | 2 | 3 | 20 | 35 |
| | | | 10.0% | 125% | | – | 3G3AX-RBC6001 | 2 | 3 | 10 | 35 |
| | 11 | 3G3RX2-A4110 | 3.0% | 120% | Built into unit | – | 3G3AX-RBB3001 | 4 | 5 | 30 | 35 |
| | | | 10.0% | 120% | | – | 3G3AX-RBC4001 | 4 | 5 | 10 | 35 |
| | 15 | 3G3RX2-A4150 | 3.0% | 125% | Built into unit | – | 3G3AX-RBB4001 | 4 | 5 | 20 | 24 |
| | | | 10.0% | 125% | | – | 3G3AX-RBC6001 | 4 | 5 | 10 | 24 |
| | 18.5 | 3G3RX2-A4185 | 3.0% | 140% | Built into unit | – | 3G3AX-RBB3001 | 8 | 6 | 30 | 24 |
| | | | 10.0% | 140% | | – | 3G3AX-RBC4001 | 8 | 6 | 10 | 24 |
| | 22 | 3G3RX2-A4220 | 3.0% | 120% | Built into unit | – | 3G3AX-RBB3001 | 8 | 6 | 30 | 20 |
| | | | 10.0% | 120% | | – | 3G3AX-RBC4001 | 8 | 6 | 10 | 20 |
| 30 | 3G3RX2-A4300 | 10.0% | 100% | Built into unit | 1 | 3G3AX-RBC12001 | 4 | 5 | 10 | 15 | |
| | | 10.0% | 150% | 3G3AX-RBU42 | 1 | 3G3AX-RBC12001 | 6 | 9 | 10 | 10 | |
| 37 | 3G3RX2-A4370 | 3.0% | 100% | Built into unit | 1 | 3G3AX-RBC12001 | 4 | 5 | 10 | 15 | |
| | | 10.0% | 155% | 3G3AX-RBU43 | 1 | 3G3AX-RBC12001 | 6 | 9 | 10 | 6 | |

| Inverter | | | Operating conditions | | Braking unit | | Braking resistor | | Connection form | Restrictions | |
|---------------|-------------------------------------|--------------|----------------------|--------------------------------|--------------|--------------|------------------|--------------|-----------------|----------------------------------|---|
| Voltage class | Max. applicable motor capacity [kW] | Model | %ED [%] | Approximate braking torque [%] | Model | No. of units | Model | No. of units | | Allowable continuous ON time [s] | Min. connection resistance [Ω] |
| 400-V class | 45 | 3G3RX2-A4450 | 3.0% | 130% | 3G3AX-RBU43 | 1 | 3G3AX-RBC12001 | 6 | 9 | 10 | 6 |
| | | | 10.0% | 130% | 3G3AX-RBU43 | 1 | 3G3AX-RBC12001 | 6 | 9 | 10 | 6 |
| | 55 | 3G3RX2-A4550 | 3.0% | 140% | 3G3AX-RBU43 | 1 | 3G3AX-RBC12001 | 8 | 10 | 10 | 6 |
| | | | 10.0% | 140% | 3G3AX-RBU43 | 1 | 3G3AX-RBC12001 | 8 | 10 | 10 | 6 |
| | 75 | 3G3RX2-B4750 | 3.0% | 130% | 3G3AX-RBU43 | 1 | 3G3AX-RBC12001 | 10 | 14 | 10 | 6 |
| | | | 10.0% | 130% | 3G3AX-RBU43 | 1 | 3G3AX-RBC12001 | 10 | 14 | 10 | 6 |
| | 90 | 3G3RX2-B4900 | 3.0% | 105% | 3G3AX-RBU43 | 1 | 3G3AX-RBC12001 | 10 | 14 | 10 | 6 |
| | | | 10.0% | 105% | 3G3AX-RBU43 | 1 | 3G3AX-RBC12001 | 10 | 14 | 10 | 6 |
| | 110 | 3G3RX2-B411K | 3.0% | 105% | 3G3AX-RBU43 | 2 | 3G3AX-RBC12001 | 12 | 15 | 10 | 6 |
| | | | 10.0% | 105% | 3G3AX-RBU43 | 2 | 3G3AX-RBC12001 | 12 | 15 | 10 | 6 |
| | 132 | 3G3RX2-B413K | 3.0% | 115% | 3G3AX-RBU43 | 2 | 3G3AX-RBC12001 | 16 | 16 | 10 | 6 |
| | | | 10.0% | 115% | 3G3AX-RBU43 | 2 | 3G3AX-RBC12001 | 16 | 16 | 10 | 6 |

Connection Form Table

| No. | Connection form | |
|-----|--|--|
| 1 | 1 resistor unit | |
| 2 | 2 resistor units connected in parallel | |
| 3 | 2 resistor units series-connected | |
| 4 | 3 resistor units connected in parallel | |
| 5 | 2 groups of 2 parallel resistor units are series-connected | |
| 6 | 2 groups of 4 parallel resistor units are series-connected | |
| 7 | 1 braking unit and 3 resistor units connected in parallel | |

| No. | Connection form | |
|-----|--|--|
| 8 | <p>1 Braking unit and 2 groups of 2 parallel resistor units are series-connected</p> | |
| 9 | <p>1 Braking unit and 2 groups of 3 parallel resistor units are series-connected</p> | |
| 10 | <p>1 Braking unit and 2 groups of 4 parallel resistor units are series-connected</p> | |
| 11 | <p>1 Braking unit and 5 resistor units connected in parallel</p> | |
| 12 | <p>1 Braking unit and 6 resistor units connected in parallel</p> | |

| No. | Connection form | |
|-----|---|--|
| 13 | 1 Braking unit and 7 resistor units connected in parallel | |
| 14 | 1 Braking unit and 2 groups of 5 parallel resistor units are series-connected | |
| 15 | 2 Braking units and 2 groups of 3 parallel resistor units are each series-connected | |
| 16 | 2 Braking units and 2 groups of 4 parallel resistor units are each series-connected | |

11-5 DC Reactor (Model: 3G3AX-DL□□□□)

11-5-1 Specifications

| Voltage class | Inverter | | | | | DC reactor specifications | | | | |
|---------------|-------------------------------------|--------------|------------------------------|-------------------------------------|-------------------------|---------------------------|-----------------|---------------------|--|---|
| | Max. applicable motor capacity [kW] | Model | Load specification selection | Max. applicable motor capacity [kW] | Rated input current [A] | Model | Inductance [mH] | Heat generation [W] | Operating ambient temperature/humidity | Location |
| 200-V class | 0.4 | 3G3RX2-A2004 | ND | 0.4 | 3.3 | 3G3AX-DL2004 | 10.7 | 8 | -10 to 50°C 20% to 90% | At an altitude of 1,000 m max.; indoors (without corrosive gases or dust) |
| | | | LD | 0.75 | 3.9 | 3G3AX-DL2007 | 6.75 | 15 | | |
| | | | VLD | 0.75 | 3.9 | | | | | |
| | 0.75 | 3G3RX2-A2007 | ND | 0.75 | 5.5 | 3G3AX-DL2015 | 3.51 | 25 | | |
| | | | LD | 1.5 | 7.2 | | | | | |
| | | | VLD | 1.5 | 7.2 | | | | | |
| | 1.5 | 3G3RX2-A2015 | ND | 1.5 | 8.3 | 3G3AX-DL2022 | 2.51 | 35 | | |
| | | | LD | 2.2 | 10.8 | | | | | |
| | | | VLD | 2.2 | 10.8 | | | | | |
| | 2.2 | 3G3RX2-A2022 | ND | 2.2 | 12 | 3G3AX-DL2037 | 1.60 | 45 | | |
| | | | LD | 3.7 | 13.9 | | | | | |
| | | | VLD | 3.7 | 13.9 | | | | | |
| | 3.7 | 3G3RX2-A2037 | ND | 3.7 | 18 | 3G3AX-DL2055 | 1.11 | 55 | | |
| | | | LD | 5.5 | 23 | | | | | |
| | | | VLD | 5.5 | 23 | | | | | |
| | 5.5 | 3G3RX2-A2055 | ND | 5.5 | 26 | 3G3AX-DL2075 | 0.84 | 95 | | |
| | | | LD | 7.5 | 37 | | | | | |
| | | | VLD | 7.5 | 37 | | | | | |
| | 7.5 | 3G3RX2-A2075 | ND | 7.5 | 35 | 3G3AX-DL2110 | 0.59 | 80 | | |
| | | | LD | 11 | 48 | | | | | |
| | | | VLD | 11 | 48 | | | | | |
| | 11 | 3G3RX2-A2110 | ND | 11 | 51 | 3G3AX-DL2150 | 0.44 | 135 | | |
| | | | LD | 15 | 64 | | | | | |
| | | | VLD | 15 | 64 | | | | | |
| 15 | 3G3RX2-A2150 | ND | 15 | 70 | 3G3AX-DL2220 | 0.30 | 200 | | | |
| | | LD | 18.5 | 80 | | | | | | |
| | | VLD | 18.5 | 80 | | | | | | |
| 18.5 | 3G3RX2-A2185 | ND | 18.5 | 84 | 3G3AX-DL2300 | 0.23 | 220 | | | |
| | | LD | 22 | 94 | | | | | | |
| | | VLD | 22 | 94 | | | | | | |
| 22 | 3G3RX2-A2220 | ND | 22 | 105 | 3G3AX-DL2370 | 0.19 | 275 | | | |
| | | LD | 30 | 120 | | | | | | |
| | | VLD | 30 | 120 | | | | | | |
| 30 | 3G3RX2-A2300 | ND | 30 | 133 | 3G3AX-DL2450 | 0.16 | 335 | | | |
| | | LD | 37 | 150 | | | | | | |
| | | VLD | 37 | 150 | | | | | | |
| 37 | 3G3RX2-A2370 | ND | 37 | 160 | 3G3AX-DL2550 | 0.13 | 360 | | | |
| | | LD | 45 | 186 | | | | | | |
| | | VLD | 45 | 186 | | | | | | |
| 45 | 3G3RX2-A2450 | ND | 45 | 200 | - | - | - | | | |
| | | LD | 55 | 240 | | | | | | |
| | | VLD | 55 | 240 | | | | | | |
| 55 | 3G3RX2-A2550 | ND | 55 | 242 | - | - | - | | | |
| | | LD | 75 | 280 | | | | | | |
| | | VLD | 75 | 280 | | | | | | |

| Inverter | | | | | | DC reactor specifications | | | | |
|---------------|-------------------------------------|--------------|------------------------------|-------------------------------------|-------------------------|---------------------------|-----------------|---------------------|--|---|
| Voltage class | Max. applicable motor capacity [kW] | Model | Load specification selection | Max. applicable motor capacity [kW] | Rated input current [A] | Model | Inductance [mH] | Heat generation [W] | Operating ambient temperature/humidity | Location |
| 400-V class | 0.75 | 3G3RX2-A4007 | LD | 1.5 | 4.3 | 3G3AX-DL4015 | 14.0 | 25 | -10 to 50°C 20% to 90% | At an altitude of 1,000 m max.; indoors (without corrosive gases or dust) |
| | | | VLD | 1.5 | 4.3 | | | | | |
| | 1.5 | 3G3RX2-A4015 | ND | 1.5 | 4.2 | 3G3AX-DL4022 | 10.1 | 35 | | |
| | | | LD | 2.2 | 5.9 | | | | | |
| | 2.2 | 3G3RX2-A4022 | VLD | 2.2 | 5.9 | 3G3AX-DL4037 | 6.4 | 45 | | |
| | | | ND | 2.2 | 5.8 | | | | | |
| | 3.7 | 3G3RX2-A4037 | LD | 3.7 | 8.1 | 3G3AX-DL4055 | 4.41 | 55 | | |
| | | | VLD | 3.7 | 8.1 | | | | | |
| | 5.5 | 3G3RX2-A4055 | ND | 3.7 | 9.8 | 3G3AX-DL4075 | 3.35 | 95 | | |
| | | | LD | 5.5 | 13.3 | | | | | |
| | 7.5 | 3G3RX2-A4075 | VLD | 5.5 | 13.3 | 3G3AX-DL4110 | 2.33 | 80 | | |
| | | | ND | 5.5 | 15 | | | | | |
| | 11 | 3G3RX2-A4110 | LD | 7.5 | 20 | 3G3AX-DL4150 | 1.75 | 135 | | |
| | | | VLD | 7.5 | 20 | | | | | |
| | 15 | 3G3RX2-A4150 | ND | 7.5 | 21 | 3G3AX-DL4220 | 1.20 | 200 | | |
| | | | LD | 11 | 24 | | | | | |
| | 18.5 | 3G3RX2-A4185 | VLD | 11 | 24 | 3G3AX-DL4300 | 0.92 | 230 | | |
| | | | ND | 11 | 28 | | | | | |
| | 22 | 3G3RX2-A4220 | LD | 15 | 32 | 3G3AX-DL4370 | 0.74 | 275 | | |
| | | | VLD | 15 | 32 | | | | | |
| | 30 | 3G3RX2-A4300 | ND | 15 | 35 | 3G3AX-DL4450 | 0.61 | 340 | | |
| | | | LD | 18.5 | 41 | | | | | |
| | 37 | 3G3RX2-A4370 | VLD | 18.5 | 41 | 3G3AX-DL4550 | 0.5 | 400 | | |
| | | | ND | 18.5 | 42 | | | | | |
| 45 | 3G3RX2-A4450 | LD | 18.5 | 47 | - | - | - | | | |
| | | VLD | 22 | 47 | | | | | | |
| 55 | 3G3RX2-A4550 | ND | 22 | 53 | - | - | - | | | |
| | | LD | 30 | 63 | | | | | | |
| | | VLD | 30 | 63 | | | | | | |

11-5-2 External Dimensions

| Inverter input power supply | Model | Fig. No. | Applicable motor capacity [kW] | Dimensions [mm] | | | | | | | | | Weight [kg] | Standard applicable wire |
|-----------------------------|--------------|----------|--------------------------------|-----------------|-----|-----|-----|-----|-----|-----|---------|-----|-------------|-----------------------------|
| | | | | W | D | H | A | B | X | Y | C | K | | |
| 3/1-phase 200 VAC | 3G3AX-DL2002 | Fig. 1 | 0.2 | 66 | 90 | 98 | — | 85 | 56 | 72 | 5.2 × 8 | M4 | 0.8 | 1.25 mm ² min. |
| | 3G3AX-DL2004 | | 0.4 | 66 | 90 | 98 | — | 95 | 56 | 72 | 5.2 × 8 | M4 | 1.0 | 1.25 mm ² min. |
| | 3G3AX-DL2007 | | 0.75 | 66 | 90 | 98 | — | 105 | 56 | 72 | 5.2 × 8 | M4 | 1.3 | 2 mm ² min. |
| | 3G3AX-DL2015 | | 1.5 | 66 | 90 | 98 | — | 115 | 56 | 72 | 5.2 × 8 | M4 | 1.6 | 2 mm ² min. |
| | 3G3AX-DL2022 | | 2.2 | 86 | 100 | 116 | — | 105 | 71 | 80 | 6 × 9 | M4 | 2.1 | 2 mm ² min. |
| | 3G3AX-DL2037 | | 3.7 | 86 | 100 | 118 | — | 120 | 71 | 80 | 6 × 9 | M4 | 2.6 | 3.5 mm ² min. |
| | 3G3AX-DL2055 | Fig. 2 | 5.5 | 111 | 100 | 210 | — | 110 | 95 | 80 | 7 × 11 | M5 | 3.6 | 8 mm ² min. |
| | 3G3AX-DL2075 | | 7.5 | 111 | 100 | 212 | — | 120 | 95 | 80 | 7 × 11 | M6 | 3.9 | 14 mm ² min. |
| | 3G3AX-DL2110 | | 11 | 146 | 120 | 252 | — | 110 | 124 | 96 | 7 × 11 | M6 | 6.5 | 22 mm ² min. |
| | 3G3AX-DL2150 | | 15 | 146 | 120 | 256 | — | 120 | 124 | 96 | 7 × 11 | M8 | 7.0 | 38 mm ² min. |
| | 3G3AX-DL2220 | Fig. 3 | 18.5, 22 | 120 | 175 | 356 | 140 | 145 | 98 | 151 | 7 × 11 | M8 | 9.0 | 60 mm ² min. |
| | 3G3AX-DL2300 | | 30 | 120 | 175 | 386 | 155 | 150 | 98 | 151 | 7 × 11 | M8 | 13.0 | 38 mm ² x 2 min. |
| | 3G3AX-DL2370 | | 37 | 120 | 175 | 390 | 155 | 150 | 98 | 151 | 7 × 11 | M10 | 13.5 | 38 mm ² x 2 min. |
| | 3G3AX-DL2450 | | 45 | 160 | 190 | 420 | 180 | 150 | 120 | 168 | 7 × 11 | M10 | 19.0 | 60 mm ² x 2 min. |
| | 3G3AX-DL2550 | | 55 | 160 | 190 | 424 | 180 | 180 | 120 | 168 | 7 × 11 | M12 | 24.0 | 80 mm ² x 2 min. |
| 3-phase 400 VAC | 3G3AX-DL4007 | Fig. 1 | 0.75 | 66 | 90 | 98 | — | 95 | 56 | 72 | 5.2 × 8 | M4 | 1.1 | 1.25 mm ² min. |
| | 3G3AX-DL4015 | | 1.5 | 66 | 90 | 98 | — | 115 | 56 | 72 | 5.2 × 8 | M4 | 1.6 | 2 mm ² min. |
| | 3G3AX-DL4022 | | 2.2 | 86 | 100 | 116 | — | 105 | 71 | 80 | 6 × 9 | M4 | 2.1 | 2 mm ² min. |
| | 3G3AX-DL4037 | | 3.7 | 86 | 100 | 116 | — | 120 | 71 | 80 | 6 × 9 | M4 | 2.6 | 2 mm ² min. |
| | 3G3AX-DL4055 | | 5.5 | 111 | 100 | 138 | — | 110 | 95 | 80 | 7 × 11 | M4 | 3.6 | 3.5 mm ² min. |
| | 3G3AX-DL4075 | | 7.5 | 111 | 100 | 138 | — | 115 | 95 | 80 | 7 × 11 | M4 | 3.9 | 3.5 mm ² min. |

| Inverter input power supply | Model | Fig. No. | Applicable motor capacity [kW] | Dimensions [mm] | | | | | | | | | Weight [kg] | Standard applicable wire |
|-----------------------------|--------------|----------|--------------------------------|-----------------|-----|-----|-----|-----|-----|-----|--------|----|-------------|-----------------------------|
| | | | | W | D | H | A | B | X | Y | C | K | | |
| 3-phase 400 VAC | 3G3AX-DL4110 | Fig. 2 | 11 | 146 | 120 | 250 | – | 105 | 124 | 96 | 7 × 11 | M5 | 5.2 | 5.5 mm ² min. |
| | 3G3AX-DL4150 | | 15 | 146 | 120 | 252 | – | 120 | 124 | 96 | 7 × 11 | M6 | 7.0 | 14 mm ² min. |
| | 3G3AX-DL4220 | Fig. 3 | 18.5, 22 | 120 | 175 | 352 | 140 | 145 | 98 | 151 | 7 × 11 | M6 | 9.5 | 22 mm ² min. |
| | 3G3AX-DL4300 | | 30 | 120 | 175 | 356 | 140 | 145 | 98 | 151 | 7 × 11 | M8 | 9.5 | 30 mm ² min. |
| | 3G3AX-DL4370 | | 37 | 120 | 175 | 386 | 155 | 150 | 98 | 151 | 7 × 11 | M8 | 13.5 | 38 mm ² min. |
| | 3G3AX-DL4450 | | 45 | 160 | 190 | 416 | 180 | 145 | 120 | 168 | 7 × 11 | M8 | 16.5 | 60 mm ² min. |
| | 3G3AX-DL4550 | | 55 | 160 | 190 | 416 | 190 | 170 | 120 | 168 | 7 × 11 | M8 | 23.0 | 38 mm ² x 2 min. |

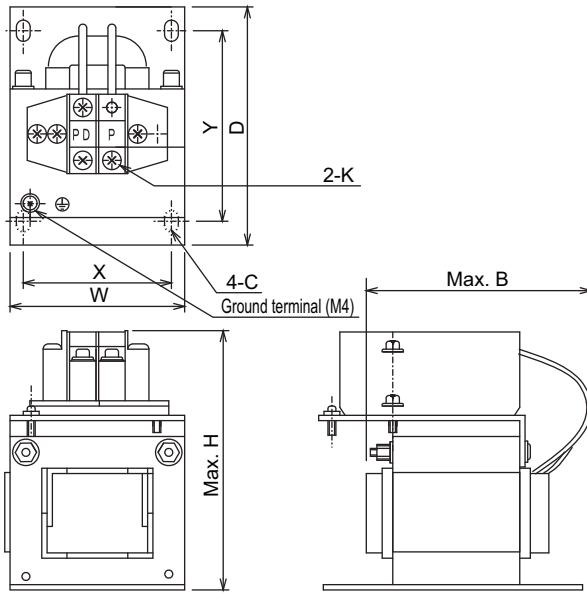


Fig. 1

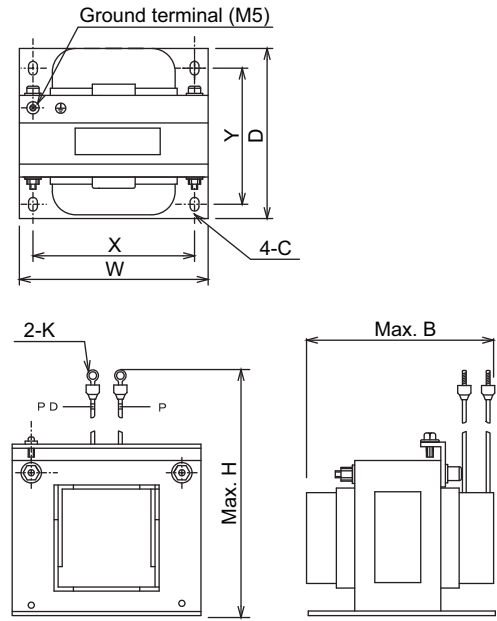


Fig. 2

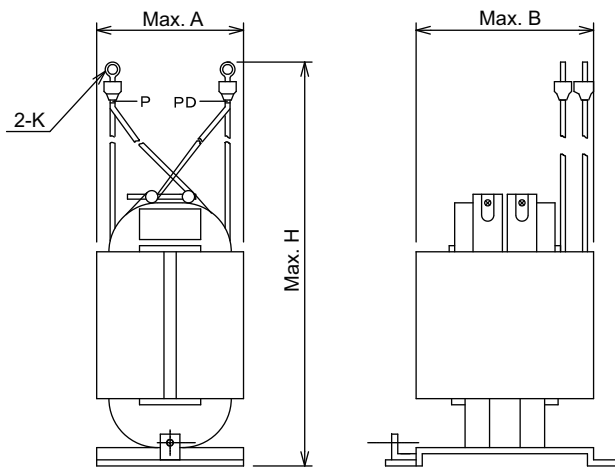
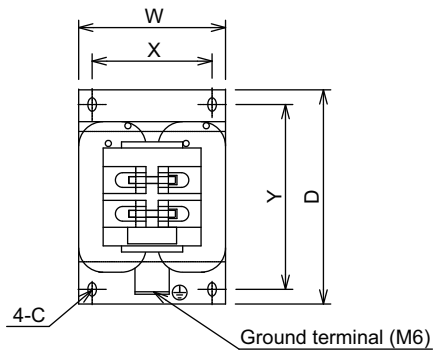
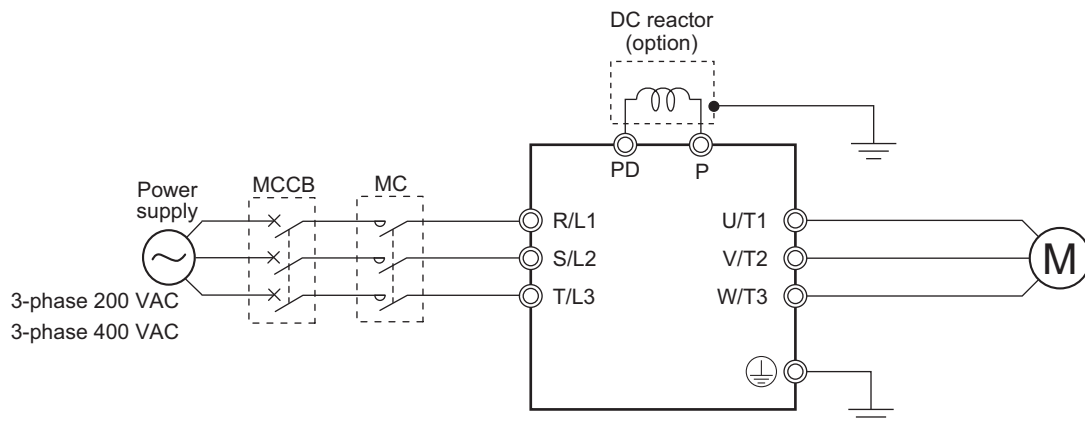


Fig. 3

11-5-3 Connection Examples



DC Reactor Connection Terminals (PD, P)

- These terminals are used to connect the optional DC reactor for power factor improvement. By factory setting, a short-circuit bar is connected between the terminals PD and P. Before connecting the DC reactor, remove this short-circuit bar.
- The length of the DC reactor connection cable must be 5 m or shorter.
- The DC reactor has no polarity.



Precautions for Correct Use

Remove the short-circuit bar only if you connect the DC reactor for use.

If you remove the short-circuit bar with the DC reactor unconnected, the inverter cannot operate because no power is supplied to its main circuit.

11-6 AC Reactor (Model: 3G3AX-AL□□□□)

11-6-1 Specifications

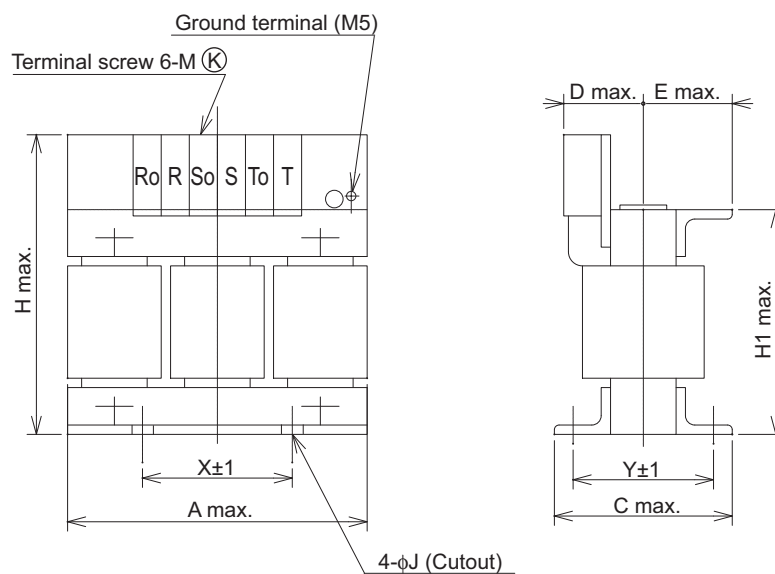
| Voltage class | Inverter | | | | | AC reactor specifications | | | | | | | |
|---------------|-------------------------------------|--------------|------------------------------|-------------------------------------|-------------------------|---------------------------|-----------------|---------------------|--|---|--------------|------|----|
| | Max. applicable motor capacity [kW] | Model | Load specification selection | Max. applicable motor capacity [kW] | Rated input current [A] | Model | Inductance [mH] | Heat generation [W] | Operating ambient temperature/humidity | Location | | | |
| 200-V class | 0.4 | 3G3RX2-A2004 | ND | 0.4 | 3.3 | 3G3AX-AL2025 | 2.8 | 12 | -10 to 50°C 20% to 90% | At an altitude of 1,000 m max.; indoors (without corrosive gases or dust) | | | |
| | | | LD | 0.75 | 3.9 | | | | | | | | |
| | | | VLD | 0.75 | 3.9 | | | | | | | | |
| | 0.75 | 3G3RX2-A2007 | ND | 0.75 | 5.5 | | | | | | | | |
| | | | LD | 1.5 | 7.2 | | | | | | | | |
| | | | VLD | 1.5 | 7.2 | | | | | | | | |
| | 1.5 | 3G3RX2-A2015 | ND | 1.5 | 8.3 | | | | | | 3G3AX-AL2055 | 0.88 | 25 |
| | | | LD | 2.2 | 10.8 | | | | | | | | |
| | | | VLD | 2.2 | 10.8 | | | | | | | | |
| | 2.2 | 3G3RX2-A2022 | ND | 2.2 | 12 | | | | | | | | |
| | | | LD | 3.7 | 13.9 | | | | | | | | |
| | | | VLD | 3.7 | 13.9 | | | | | | | | |
| | 3.7 | 3G3RX2-A2037 | ND | 3.7 | 18 | 3G3AX-AL2110 | 0.35 | 50 | | | | | |
| | | | LD | 5.5 | 23 | | | | | | | | |
| | | | VLD | 5.5 | 23 | | | | | | | | |
| | 5.5 | 3G3RX2-A2055 | ND | 5.5 | 26 | | | | | | | | |
| | | | LD | 7.5 | 37 | | | | | | | | |
| | | | VLD | 7.5 | 37 | | | | | | | | |
| | 7.5 | 3G3RX2-A2075 | ND | 7.5 | 35 | | | | | | 3G3AX-AL2220 | 0.18 | 50 |
| | | | LD | 11 | 48 | | | | | | | | |
| | | | VLD | 11 | 48 | | | | | | | | |
| | 11 | 3G3RX2-A2110 | ND | 11 | 51 | | | | | | | | |
| | | | LD | 15 | 64 | | | | | | | | |
| | | | VLD | 15 | 64 | | | | | | | | |
| 15 | 3G3RX2-A2150 | ND | 15 | 70 | 3G3AX-AL2330 | 0.09 | 85 | | | | | | |
| | | LD | 18.5 | 80 | | | | | | | | | |
| | | VLD | 18.5 | 80 | | | | | | | | | |
| 18.5 | 3G3RX2-A2185 | ND | 18.5 | 84 | | | | | | | | | |
| | | LD | 22 | 94 | | | | | | | | | |
| | | VLD | 22 | 94 | | | | | | | | | |
| 22 | 3G3RX2-A2220 | ND | 22 | 105 | | | | 3G3AX-AL2500 | 0.071 | 95 | | | |
| | | LD | 30 | 120 | | | | | | | | | |
| | | VLD | 30 | 120 | | | | | | | | | |
| 30 | 3G3RX2-A2300 | ND | 30 | 133 | | | | | | | | | |
| | | LD | 37 | 150 | | | | | | | | | |
| | | VLD | 37 | 150 | | | | | | | | | |
| 37 | 3G3RX2-A2370 | ND | 37 | 160 | 3G3AX-AL2750 | 0.046 | 100 | | | | | | |
| | | LD | 45 | 186 | | | | | | | | | |
| | | VLD | 45 | 186 | | | | | | | | | |
| 45 | 3G3RX2-A2450 | ND | 45 | 200 | | | | | | | | | |
| | | LD | 55 | 240 | | | | | | | | | |
| | | VLD | 55 | 240 | | | | | | | | | |
| 55 | 3G3RX2-A2550 | ND | 55 | 242 | | | | - | - | - | | | |
| | | LD | 75 | 280 | | | | | | | | | |
| | | VLD | 75 | 280 | | | | | | | | | |

| Inverter | | | | | | AC reactor specifications | | | | |
|---------------|-------------------------------------|--------------|------------------------------|-------------------------------------|-------------------------|---------------------------|-----------------|---------------------|--|---|
| Voltage class | Max. applicable motor capacity [kW] | Model | Load specification selection | Max. applicable motor capacity [kW] | Rated input current [A] | Model | Inductance [mH] | Heat generation [W] | Operating ambient temperature/humidity | Location |
| 400-V class | 0.75 | 3G3RX2-A4007 | ND | 0.75 | 2.8 | 3G3AX-AL4025 | 7.7 | 12 | -10 to 50°C 20% to 90% | At an altitude of 1,000 m max.; indoors (without corrosive gases or dust) |
| | | | LD | 1.5 | 4.3 | | | | | |
| | | | VLD | 1.5 | 4.3 | | | | | |
| | 1.5 | 3G3RX2-A4015 | ND | 1.5 | 4.2 | 3G3AX-AL4055 | 3.5 | 25 | | |
| | | | LD | 2.2 | 5.9 | | | | | |
| | | | VLD | 2.2 | 5.9 | | | | | |
| | 2.2 | 3G3RX2-A4022 | ND | 2.2 | 5.8 | 3G3AX-AL4110 | 1.3 | 50 | | |
| | | | LD | 3.7 | 8.1 | | | | | |
| | | | VLD | 3.7 | 8.1 | | | | | |
| | 3.7 | 3G3RX2-A4037 | ND | 3.7 | 9.8 | 3G3AX-AL4220 | 0.74 | 60 | | |
| | | | LD | 5.5 | 13.3 | | | | | |
| | | | VLD | 5.5 | 13.3 | | | | | |
| | 5.5 | 3G3RX2-A4055 | ND | 5.5 | 15 | 3G3AX-AL4330 | 0.36 | 90 | | |
| | | | LD | 7.5 | 20 | | | | | |
| | | | VLD | 7.5 | 20 | | | | | |
| | 7.5 | 3G3RX2-A4075 | ND | 7.5 | 21 | 3G3AX-AL4500 | 0.29 | 95 | | |
| | | | LD | 11 | 24 | | | | | |
| | | | VLD | 11 | 24 | | | | | |
| | 11 | 3G3RX2-A4110 | ND | 11 | 28 | 3G3AX-AL4750 | 0.19 | 100 | | |
| | | | LD | 15 | 32 | | | | | |
| | | | VLD | 15 | 32 | | | | | |
| | 15 | 3G3RX2-A4150 | ND | 15 | 35 | - | - | - | | |
| | | | LD | 18.5 | 41 | | | | | |
| | | | VLD | 18.5 | 41 | | | | | |
| 18.5 | 3G3RX2-A4185 | ND | 18.5 | 42 | - | - | - | | | |
| | | LD | 22 | 47 | | | | | | |
| | | VLD | 22 | 47 | | | | | | |
| 22 | 3G3RX2-A4220 | ND | 22 | 53 | - | - | - | | | |
| | | LD | 30 | 63 | | | | | | |
| | | VLD | 30 | 63 | | | | | | |
| 30 | 3G3RX2-A4300 | ND | 30 | 64 | - | - | - | | | |
| | | LD | 37 | 77 | | | | | | |
| | | VLD | 37 | 77 | | | | | | |
| 37 | 3G3RX2-A4370 | ND | 37 | 83 | - | - | - | | | |
| | | LD | 45 | 94 | | | | | | |
| | | VLD | 45 | 94 | | | | | | |
| 45 | 3G3RX2-A4450 | ND | 45 | 100 | - | - | - | | | |
| | | LD | 55 | 116 | | | | | | |
| | | VLD | 55 | 116 | | | | | | |
| 55 | 3G3RX2-A4550 | ND | 55 | 121 | - | - | - | | | |
| | | LD | 75 | 149 | | | | | | |
| | | VLD | 75 | 149 | | | | | | |

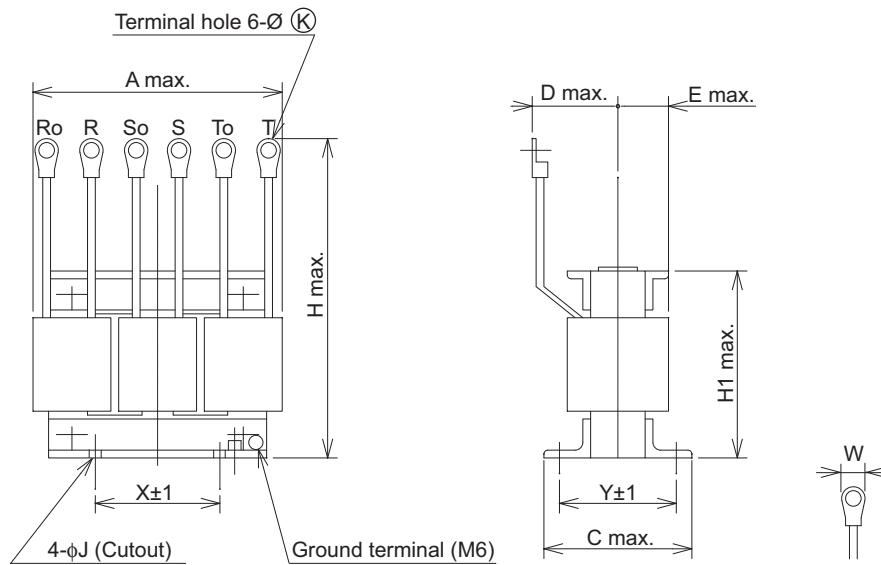
11-6-2 External Dimensions

| Inverter input power supply | Model | Applicable motor capacity [kW] | Dimensions [mm] | | | | | | | | | | | Weight [kg] |
|-----------------------------|--------------|--------------------------------|-----------------|-----|-----|----|-----|-----|-----|-----|---|-----|------|-------------|
| | | | A | C | D | E | H | H1 | X | Y | J | K | W | |
| 3-phase 200 VAC | 3G3AX-AL2025 | 0.2 to 1.5 | 120 | 82 | 60 | 40 | 150 | 94 | 50 | 67 | 6 | 4.0 | 9.5 | 2.8 |
| | 3G3AX-AL2055 | 2.2, 3.7 | 120 | 98 | 60 | 40 | 150 | 94 | 50 | 75 | 6 | 4.0 | 9.5 | 4.0 |
| | 3G3AX-AL2110 | 5.5, 7.5 | 150 | 103 | 70 | 55 | 170 | 108 | 60 | 80 | 6 | 5.3 | 12.0 | 5.0 |
| | 3G3AX-AL2220 | 11, 15 | 180 | 113 | 75 | 55 | 190 | 140 | 90 | 90 | 6 | 8.4 | 16.5 | 10.0 |
| | 3G3AX-AL2330 | 18.5, 22 | 180 | 113 | 85 | 60 | 230 | 140 | 125 | 90 | 6 | 8.4 | 22.0 | 11.0 |
| | 3G3AX-AL2500 | 30, 37 | 260 | 113 | 85 | 60 | 290 | 202 | 100 | 90 | 7 | 8.4 | 27.0 | 19.0 |
| | 3G3AX-AL2750 | 45, 55 | 260 | 144 | 110 | 80 | 290 | 207 | 125 | 112 | 7 | 8.4 | 28.5 | 25.0 |
| 3-phase 400 VAC | 3G3AX-AL4025 | 0.4 to 1.5 | 130 | 82 | 60 | 40 | 150 | 94 | 50 | 67 | 6 | 4 | 9.5 | 2.7 |
| | 3G3AX-AL4055 | 2.2, 3.7 | 130 | 98 | 60 | 40 | 150 | 94 | 50 | 75 | 6 | 5 | 12.5 | 4.0 |
| | 3G3AX-AL4110 | 5.5, 7.5 | 150 | 116 | 75 | 55 | 170 | 106 | 60 | 98 | 6 | 5 | 12.5 | 6.0 |
| | 3G3AX-AL4220 | 11, 15 | 180 | 103 | 75 | 55 | 190 | 140 | 100 | 80 | 6 | 5.3 | 12.0 | 10.0 |
| | 3G3AX-AL4330 | 18.5, 22 | 180 | 123 | 85 | 60 | 230 | 140 | 100 | 100 | 6 | 6.4 | 16.5 | 11.5 |
| | 3G3AX-AL4500 | 30, 37 | 260 | 113 | 85 | 60 | 290 | 202 | 100 | 90 | 7 | 8.4 | 22.0 | 19.0 |
| | 3G3AX-AL4750 | 45, 55 | 260 | 146 | 110 | 80 | 290 | 207 | 125 | 112 | 7 | 8.4 | 22.0 | 25.0 |

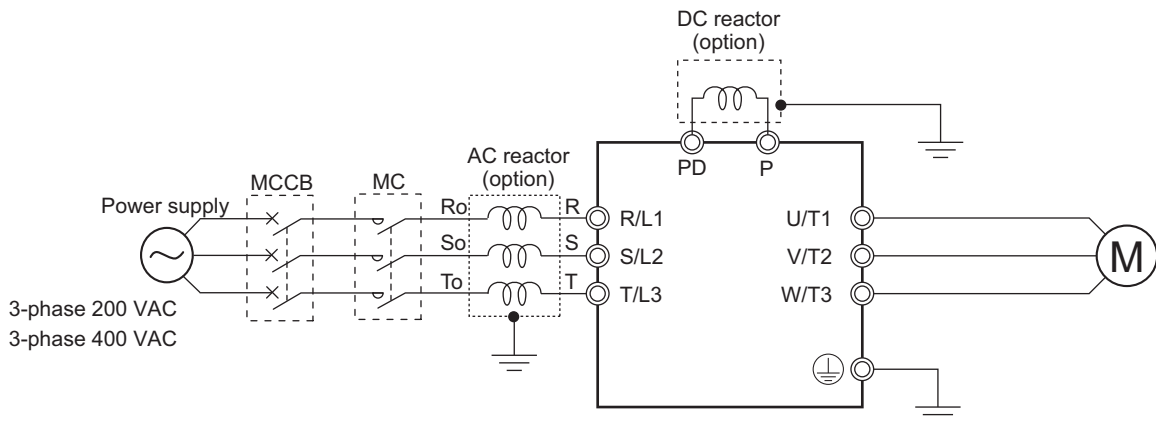
3G3AX-AL2025/AL2055/AL4025/AL4055/AL4110



**3G3AX-AL2110/AL2220/AL2330/AL2500/AL2750/AL4220/
AL4330/AL4500/AL4750**



11-6-3 Connection Examples



11-7 Input Noise Filter (Model: 3G3AX-NFI□□)

11-7-1 Specifications

| Inverter | | | | | | Input noise filter specifications | | | | |
|---------------|-------------------------------------|--------------|------------------------------|-------------------------------------|-------------------------|-----------------------------------|--------------------|-------------------------------|---------------------|----------------------------|
| Voltage class | Max. applicable motor capacity [kW] | Model | Load specification selection | Max. applicable motor capacity [kW] | Rated input current [A] | Model | Max. input voltage | Rated input current (at 50°C) | Heat generation [W] | Leakage current (at 60 Hz) |
| 200-V class | 0.4 | 3G3RX2-A2004 | ND | 0.4 | 3.3 | 3G3AX-NFI21 | 250 VAC +10% | 6A | 3 | 1.5 mA max. (250 VAC) |
| | | | LD | 0.75 | 3.9 | | | | | |
| | | | VLD | 0.75 | 3.9 | | | | | |
| | 0.75 | 3G3RX2-A2007 | ND | 0.75 | 5.5 | 3G3AX-NFI22 | | 10A | 4 | |
| | | | LD | 1.5 | 7.2 | | | | | |
| | | | VLD | 1.5 | 7.2 | | | | | |
| | 1.5 | 3G3RX2-A2015 | ND | 1.5 | 8.3 | 3G3AX-NFI23 | | 20A | 6 | |
| | | | LD | 2.2 | 10.8 | | | | | |
| | | | VLD | 2.2 | 10.8 | | | | | |
| | 2.2 | 3G3RX2-A2022 | ND | 2.2 | 12 | 3G3AX-NFI23 | | 20A | 6 | |
| | | | LD | 3.7 | 13.9 | | | | | |
| | | | VLD | 3.7 | 13.9 | | | | | |
| | 3.7 | 3G3RX2-A2037 | ND | 3.7 | 18 | 3G3AX-NFI24 | | 30A | 9 | |
| | | | LD | 5.5 | 23 | | | | | |
| | | | VLD | 5.5 | 23 | | | | | |
| | 5.5 | 3G3RX2-A2055 | ND | 5.5 | 26 | 3G3AX-NFI25 | | 40A | 12 | |
| | | | LD | 7.5 | 37 | | | | | |
| | | | VLD | 7.5 | 37 | | | | | |
| | 7.5 | 3G3RX2-A2075 | ND | 7.5 | 35 | 3G3AX-NFI26 | | 60A | 17 | |
| | | | LD | 11 | 48 | | | | | |
| | | | VLD | 11 | 48 | | | | | |
| | 11 | 3G3RX2-A2110 | ND | 11 | 51 | 3G3AX-NFI27 | | 80A | 21 | |
| | | | LD | 15 | 64 | | | | | |
| | | | VLD | 15 | 64 | | | | | |
| 15 | 3G3RX2-A2150 | ND | 15 | 70 | 3G3AX-NFI28 | 100A | 23 | | | |
| | | LD | 18.5 | 80 | | | | | | |
| | | VLD | 18.5 | 80 | | | | | | |
| 18.5 | 3G3RX2-A2185 | ND | 18.5 | 84 | 3G3AX-NFI29 | 150A | 45 | | | |
| | | LD | 22 | 94 | | | | | | |
| | | VLD | 22 | 94 | | | | | | |
| 22 | 3G3RX2-A2220 | ND | 22 | 105 | 3G3AX-NFI29 | 150A | 45 | | | |
| | | LD | 30 | 120 | | | | | | |
| | | VLD | 30 | 120 | | | | | | |
| 30 | 3G3RX2-A2300 | ND | 30 | 133 | 3G3AX-NFI2A | 200A | 50 | | | |
| | | LD | 37 | 150 | | | | | | |
| | | VLD | 37 | 150 | | | | | | |
| 37 | 3G3RX2-A2370 | ND | 37 | 160 | 3G3AX-NFI2B | 250A | 68 | | | |
| | | LD | 45 | 186 | | | | | | |
| | | VLD | 45 | 186 | | | | | | |
| 45 | 3G3RX2-A2450 | ND | 45 | 200 | 3G3AX-NFI2C | 300A | 56 | | | |
| | | LD | 55 | 240 | | | | | | |
| | | VLD | 55 | 240 | | | | | | |
| 55 | 3G3RX2-A2550 | ND | 55 | 242 | - | - | - | | | |
| | | LD | 75 | 280 | | | | | | |
| | | VLD | 75 | 280 | | | | | | |

| Inverter | | | | | | Input noise filter specifications | | | | | | |
|---------------|-------------------------------------|--------------|------------------------------|-------------------------------------|-------------------------|-----------------------------------|--------------------|-------------------------------|---------------------|----------------------------|-------------|-------------|
| Voltage class | Max. applicable motor capacity [kW] | Model | Load specification selection | Max. applicable motor capacity [kW] | Rated input current [A] | Model | Max. input voltage | Rated input current (at 50°C) | Heat generation [W] | Leakage current (at 60 Hz) | | |
| 400-V class | 0.75 | 3G3RX2-A4007 | ND | 0.75 | 2.8 | 3G3AX-NFI41 | 480 VAC +10% | 7A | 2 | 7.5 mA max. (480 VAC) | | |
| | | | LD | 1.5 | 4.3 | | | | | | | |
| | | | VLD | 1.5 | 4.3 | | | | | | | |
| | 1.5 | 3G3RX2-A4015 | ND | 1.5 | 4.2 | | | | | | 3G3AX-NFI42 | |
| | | | LD | 2.2 | 5.9 | | | | | | | |
| | | | VLD | 2.2 | 5.9 | | | | | | | |
| | 2.2 | 3G3RX2-A4022 | ND | 2.2 | 5.8 | | | | | | | 3G3AX-NFI43 |
| | | | LD | 3.7 | 8.1 | | | | | | | |
| | | | VLD | 3.7 | 8.1 | | | | | | | |
| | 3.7 | 3G3RX2-A4037 | ND | 3.7 | 9.8 | 3G3AX-NFI44 | | | | | | |
| | | | LD | 5.5 | 13.3 | | | | | | | |
| | | | VLD | 5.5 | 13.3 | | | | | | | |
| | 5.5 | 3G3RX2-A4055 | ND | 5.5 | 15 | | | 3G3AX-NFI45 | | | | |
| | | | LD | 7.5 | 20 | | | | | | | |
| | | | VLD | 7.5 | 20 | | | | | | | |
| | 7.5 | 3G3RX2-A4075 | ND | 7.5 | 21 | | | | 3G3AX-NFI46 | | | |
| | | | LD | 11 | 24 | | | | | | | |
| | | | VLD | 11 | 24 | | | | | | | |
| | 11 | 3G3RX2-A4110 | ND | 11 | 28 | 3G3AX-NFI47 | | | | | | |
| | | | LD | 15 | 32 | | | | | | | |
| | | | VLD | 15 | 32 | | | | | | | |
| | 15 | 3G3RX2-A4150 | ND | 15 | 35 | | | 3G3AX-NFI48 | | | | |
| | | | LD | 18.5 | 41 | | | | | | | |
| | | | VLD | 18.5 | 41 | | | | | | | |
| | 18.5 | 3G3RX2-A4185 | ND | 18.5 | 42 | | | | 3G3AX-NFI49 | | | |
| | | | LD | 22 | 47 | | | | | | | |
| | | | VLD | 22 | 47 | | | | | | | |
| 22 | 3G3RX2-A4220 | ND | 22 | 53 | 3G3AX-NFI4A | | | | | | | |
| | | LD | 30 | 63 | | | | | | | | |
| | | VLD | 30 | 63 | | | | | | | | |
| 30 | 3G3RX2-A4300 | ND | 30 | 64 | | - | | | | | | |
| | | LD | 37 | 77 | | | | | | | | |
| | | VLD | 37 | 77 | | | | | | | | |
| 37 | 3G3RX2-A4370 | ND | 37 | 83 | | | - | | | | | |
| | | LD | 45 | 94 | | | | | | | | |
| | | VLD | 45 | 94 | | | | | | | | |
| 45 | 3G3RX2-A4450 | ND | 45 | 100 | - | | | | | | | |
| | | LD | 55 | 116 | | | | | | | | |
| | | VLD | 55 | 116 | | | | | | | | |
| 55 | 3G3RX2-A4550 | ND | 55 | 121 | | - | | | | | | |
| | | LD | 75 | 149 | | | | | | | | |
| | | VLD | 75 | 149 | | | | | | | | |

11-7 Input Noise Filter
(Model: 3G3AX-NFI□□)

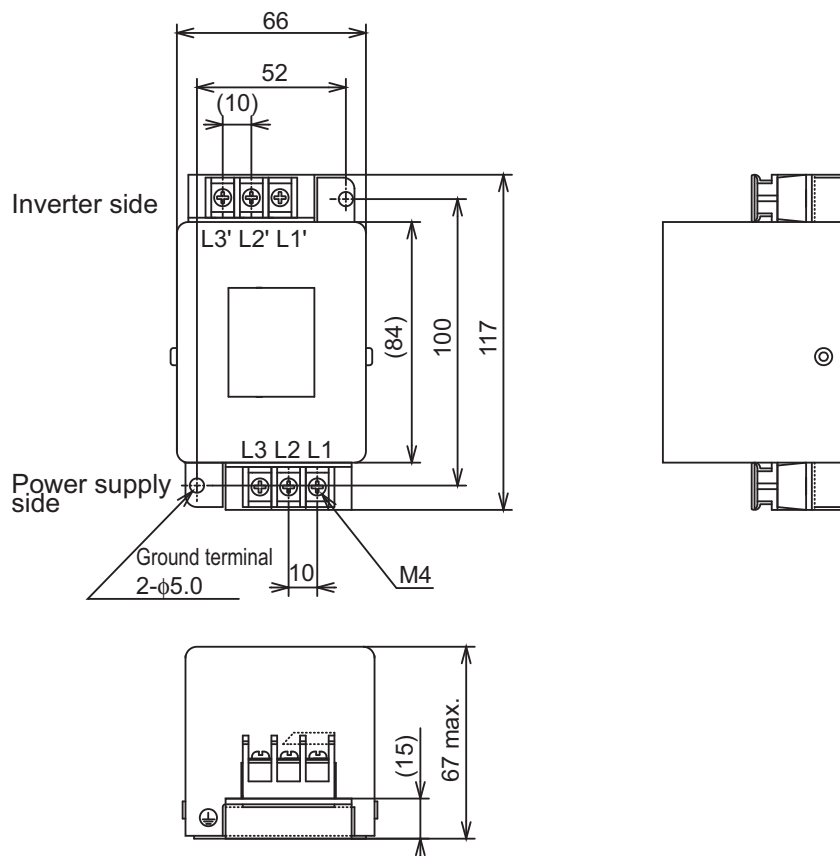
11

11-7-1 Specifications

11-7-2 External Dimensions

| Model | Case, enclosure rating | Terminal size | Wire diameter | Weight [kg] |
|-------------|------------------------|---------------|--|-------------|
| G3AX-NFI21 | Plastic, IP00 | M4 | 1.25 mm ² | 0.5 |
| 3G3AX-NFI22 | Plastic, IP00 | M4 | 2 mm ² | 0.6 |
| 3G3AX-NFI23 | Plastic, IP00 | M4 | 2 mm ² , 3.5 mm ² | 0.7 |
| 3G3AX-NFI24 | Plastic, IP00 | M4 | 5.5 mm ² | 0.8 |
| 3G3AX-NFI25 | Plastic, IP00 | M5 | 8 mm ² | 1.4 |
| 3G3AX-NFI26 | Plastic, IP00 | M5 | 14 mm ² | 1.8 |
| 3G3AX-NFI27 | Metal, IP00 | M6 | 22 mm ² | 3.6 |
| 3G3AX-NFI28 | Metal, IP00 | M8 | 30 mm ² | 4.6 |
| 3G3AX-NFI29 | Metal, IP00 | M8 | 38 mm ² , 60 mm ² | 9.0 |
| 3G3AX-NFI2A | Metal, IP00 | M10 | 100 mm ² or 38 mm ² , 2 wires parallel | 16 |
| 3G3AX-NFI2B | Metal, IP00 | M10 | 100 mm ² or 38 mm ² , 2 wires parallel | 16 |
| 3G3AX-NFI2C | Metal, IP00 | M10 | 150 mm ² or 60 mm ² , 2 wires parallel | 23 |
| 3G3AX-NFI41 | Plastic, IP00 | M4 | 1.25 mm ² , 2 mm ² | 0.7 |
| 3G3AX-NFI42 | Plastic, IP00 | M4 | 2 mm ² | 0.7 |
| 3G3AX-NFI43 | Plastic, IP00 | M4 | 2 mm ² , 3.5 mm ² | 0.7 |
| 3G3AX-NFI44 | Plastic, IP00 | M4 | 5.5 mm ² | 0.8 |
| 3G3AX-NFI45 | Plastic, IP00 | M5 | 8 mm ² | 1.4 |
| 3G3AX-NFI46 | Plastic, IP00 | M5 | 14 mm ² | 1.6 |
| 3G3AX-NFI47 | Plastic, IP00 | M5 | 14 mm ² | 1.8 |
| 3G3AX-NFI48 | Metal, IP00 | M6 | 22 mm ² | 3.6 |
| 3G3AX-NFI49 | Metal, IP00 | M8 | 38 mm ² | 4.6 |
| 3G3AX-NFI4A | Metal, IP00 | M8 | 38 mm ² , 60 mm ² | 9.0 |

3G3AX-NFI21/NFI22

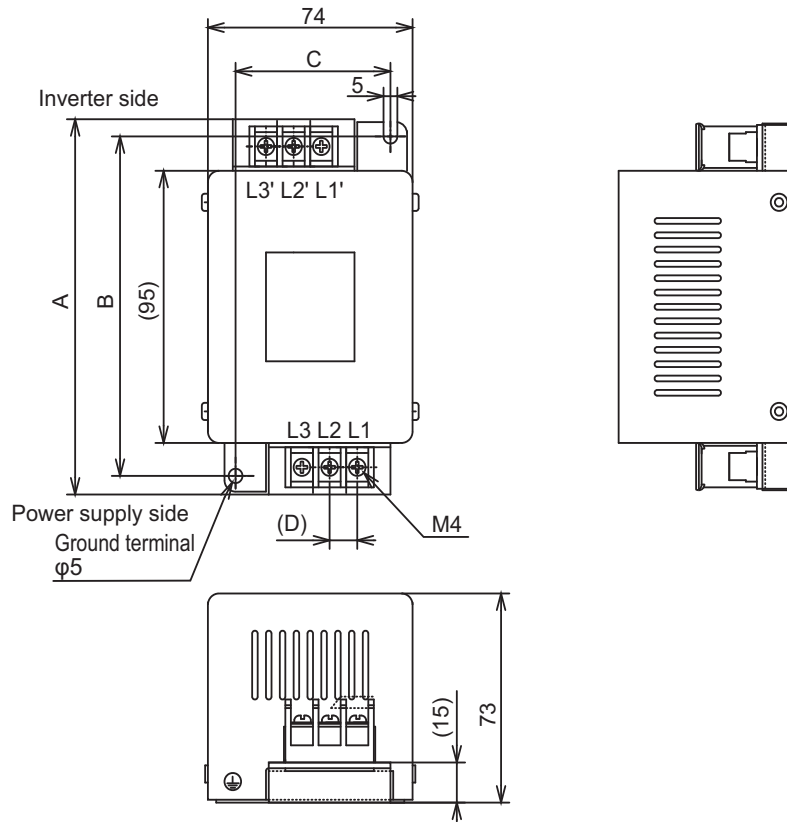


11-7 Input Noise Filter
(Model: 3G3AX-NFI□□)

11

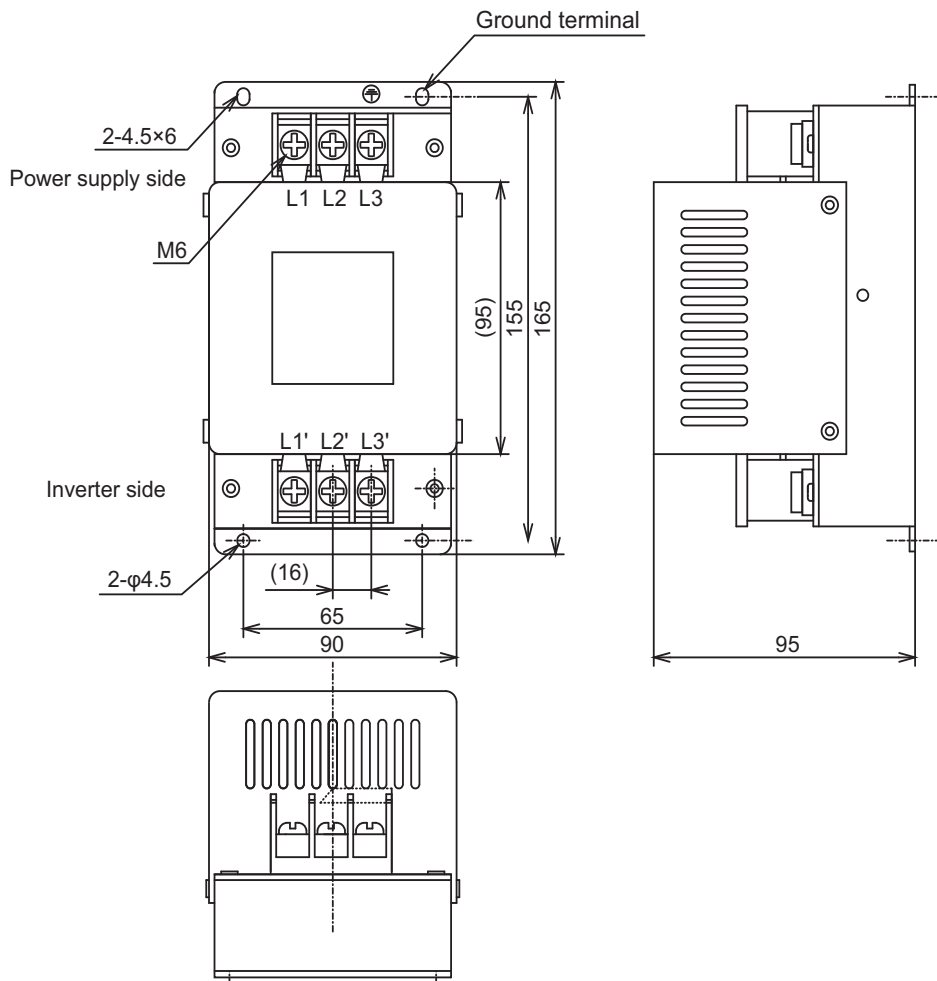
11-7-2 External Dimensions

3G3AX-NFI23/NFI24/NFI41/NFI42/NFI43/NFI44



| Model | Dimensions [mm] | | | |
|-------------|-----------------|-----|----|----|
| | A | B | C | D |
| 3G3AX-NFI23 | 128 | 118 | 56 | 10 |
| 3G3AX-NFI24 | 144 | 130 | 56 | 11 |
| 3G3AX-NFI41 | 144 | 130 | 56 | 11 |
| 3G3AX-NFI42 | 144 | 130 | 56 | 11 |
| 3G3AX-NFI43 | 144 | 130 | 56 | 11 |
| 3G3AX-NFI44 | 144 | 130 | 56 | 11 |

3G3AX-NFI25/NFI26/NFI45/NFI46/NFI47

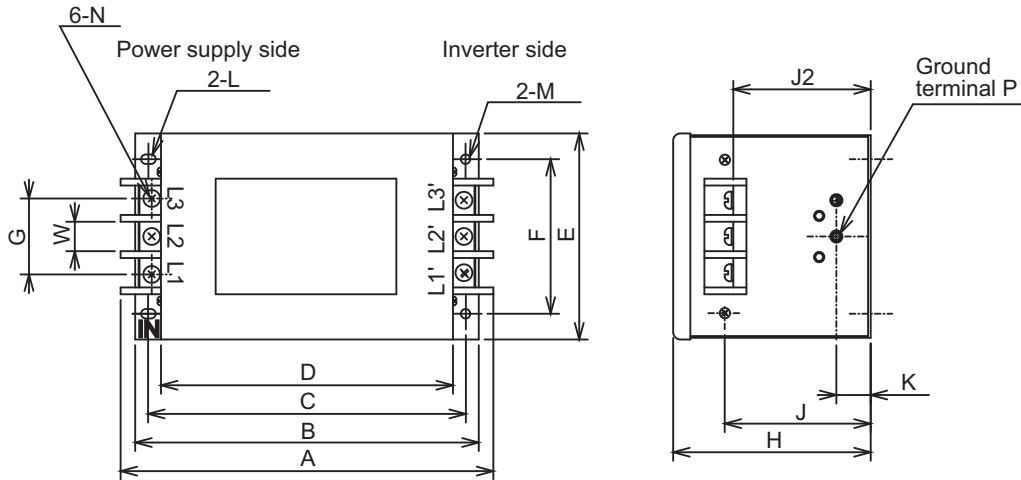


11-7 Input Noise Filter
(Model: 3G3AX-NFI□□)

11

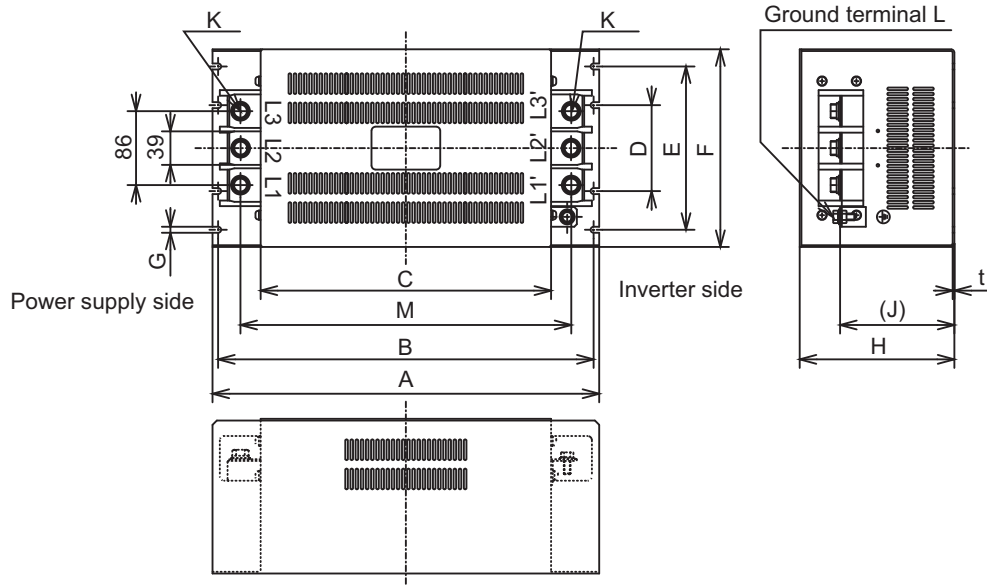
11-7-2 External Dimensions

3G3AX-NFI27/NFI28/NFI29/NFI48/NFI49/NFI4A



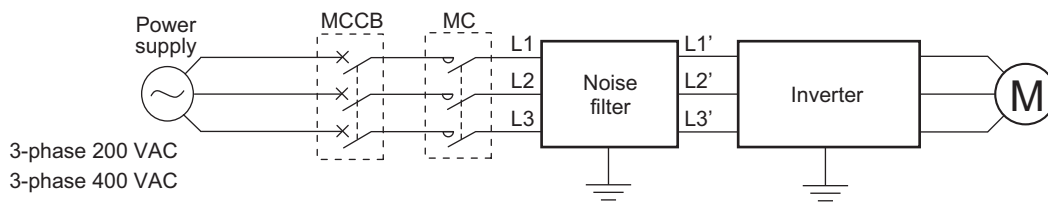
| Model | Dimensions [mm] | | | | | | | | | | | | | | | |
|-------------|-----------------|-----|-----|-----|-----|-----|----|-----|----|----|----|-------------------|-------------|----|----|----|
| | A | B | C | D | E | F | G | H | J | J2 | K | L | M | N | P | W |
| 3G3AX-NFI27 | 217 | 200 | 185 | 170 | 120 | 90 | 44 | 115 | 85 | 82 | 20 | R2.75 Length 7 | 5.5 dia. | M6 | M4 | 17 |
| 3G3AX-NFI28 | 254 | 230 | 215 | 200 | 150 | 120 | 57 | 115 | 80 | 75 | 30 | R3.75 Length 8 | 6.5 dia. | M8 | M6 | 23 |
| 3G3AX-NFI29 | 314 | 300 | 280 | 260 | 200 | 170 | 57 | 130 | 90 | 85 | 35 | R3.75 Length 8 | 6.5 dia. | M8 | M6 | 23 |
| 3G3AX-NFI48 | 217 | 200 | 185 | 170 | 120 | 90 | 44 | 115 | 85 | 85 | 20 | R2.75 Length 7 | 5.5 dia. | M6 | M4 | 17 |
| 3G3AX-NFI49 | 254 | 230 | 215 | 200 | 150 | 120 | 57 | 115 | 80 | 75 | 30 | R3.75 Length 8 | 6.5 dia. | M8 | M6 | 23 |
| 3G3AX-NFI4A | 314 | 300 | 280 | 260 | 200 | 170 | 57 | 130 | 90 | 85 | 35 | R3.75 Length 8 | 6.5 dia. | M8 | M6 | 23 |

3G3AX-NFI2A/NFI2B/NFI2C



| Model | Dimensions [mm] | | | | | | | | | | | | |
|-------------|-----------------|-----|-----|-----|-----|-----|----|-----|-------|-----|----|-----|-----|
| | A | B | C | D | E | F | G | H | J | K | L | M | t |
| 3G3AX-NFI2A | 450 | 430 | 338 | 100 | 190 | 230 | 7 | 180 | (133) | M10 | M8 | 385 | 1.0 |
| 3G3AX-NFI2B | | | | | | | | | | | | | |
| 3G3AX-NFI2C | 500 | 475 | 400 | — | 160 | 200 | 12 | 180 | (133) | M10 | M8 | 445 | 1.2 |

11-7-3 Connection Examples



11-8 Output Noise Filter (Model: 3G3AX-NFO□□)

11-8-1 Specifications

| Inverter | | | | | | Output noise filter specifications | | | |
|---------------|-------------------------------------|--------------|------------------------------|-------------------------------------|--------------------------|------------------------------------|---------------|-------------------------|-------------|
| Voltage class | Max. applicable motor capacity [kW] | Model | Load specification selection | Max. applicable motor capacity [kW] | Rated output current [A] | Model | Rated voltage | Rated input current [A] | Weight [kg] |
| 200-V class | 0.4 | 3G3RX2-A2004 | ND | 0.4 | 3.0 | 3G3AX-NFO01 | 500 VAC | 6 | 0.7 |
| | | | LD | 0.75 | 3.7 | | | | |
| | | | VLD | 0.75 | 3.7 | | | | |
| | 0.75 | 3G3RX2-A2007 | ND | 0.75 | 5.0 | 3G3AX-NFO02 | | 12 | 0.9 |
| | | | LD | 1.5 | 6.3 | | | | |
| | | | VLD | 1.5 | 6.3 | | | | |
| | 1.5 | 3G3RX2-A2015 | ND | 1.5 | 7.5 | 3G3AX-NFO03 | | 25 | 2.1 |
| | | | LD | 2.2 | 9.4 | | | | |
| | | | VLD | 2.2 | 9.4 | | | | |
| | 2.2 | 3G3RX2-A2022 | ND | 2.2 | 10.5 | 3G3AX-NFO04 | | 50 | 3.7 |
| | | | LD | 3.7 | 12 | | | | |
| | | | VLD | 3.7 | 12 | | | | |
| | 3.7 | 3G3RX2-A2037 | ND | 3.7 | 16.5 | 3G3AX-NFO05 | | 75 | 5.7 |
| | | | LD | 5.5 | 19.6 | | | | |
| | | | VLD | 5.5 | 19.6 | | | | |
| | 5.5 | 3G3RX2-A2055 | ND | 5.5 | 24 | 3G3AX-NFO06 | | 100 | 8.4 |
| | | | LD | 7.5 | 30 | | | | |
| | | | VLD | 7.5 | 30 | | | | |
| | 7.5 | 3G3RX2-A2075 | ND | 7.5 | 32 | 3G3AX-NFO07 | | 150 | 9.0 |
| | | | LD | 11 | 44 | | | | |
| | | | VLD | 11 | 44 | | | | |
| | 11 | 3G3RX2-A2110 | ND | 11 | 46 | - | | - | - |
| | | | LD | 15 | 58 | | | | |
| | | | VLD | 15 | 58 | | | | |
| 15 | 3G3RX2-A2150 | ND | 15 | 64 | - | - | - | | |
| | | LD | 18.5 | 73 | | | | | |
| | | VLD | 18.5 | 73 | | | | | |
| 18.5 | 3G3RX2-A2185 | ND | 18.5 | 76 | - | - | - | | |
| | | LD | 22 | 85 | | | | | |
| | | VLD | 22 | 85 | | | | | |
| 22 | 3G3RX2-A2220 | ND | 22 | 95 | - | - | - | | |
| | | LD | 30 | 113 | | | | | |
| | | VLD | 30 | 113 | | | | | |
| 30 | 3G3RX2-A2300 | ND | 30 | 121 | - | - | - | | |
| | | LD | 37 | 140 | | | | | |
| | | VLD | 37 | 140 | | | | | |
| 37 | 3G3RX2-A2370 | ND | 37 | 145 | - | - | - | | |
| | | LD | 45 | 169 | | | | | |
| | | VLD | 45 | 169 | | | | | |

| Inverter | | | | | | Output noise filter specifications | | | | | | |
|---------------|-------------------------------------|--------------|------------------------------|-------------------------------------|--------------------------|------------------------------------|---------------|-------------------------|-------------|-------------|----|-----|
| Voltage class | Max. applicable motor capacity [kW] | Model | Load specification selection | Max. applicable motor capacity [kW] | Rated output current [A] | Model | Rated voltage | Rated input current [A] | Weight [kg] | | | |
| 400-V class | 0.75 | 3G3RX2-A4007 | ND | 0.75 | 2.5 | 3G3AX-NFO01 | 500 VAC | 6 | 0.7 | | | |
| | | | LD | 1.5 | 3.1 | | | | | | | |
| | | | VLD | 1.5 | 3.1 | | | | | | | |
| | 1.5 | 3G3RX2-A4015 | ND | 1.5 | 3.8 | | | | | | | |
| | | | LD | 2.2 | 4.8 | | | | | | | |
| | | | VLD | 2.2 | 4.8 | | | | | | | |
| | 2.2 | 3G3RX2-A4022 | ND | 2.2 | 5.3 | | | | | 3G3AX-NFO02 | 12 | 0.9 |
| | | | LD | 3.7 | 6.7 | | | | | | | |
| | | | VLD | 3.7 | 6.7 | | | | | | | |
| | 3.7 | 3G3RX2-A4037 | ND | 3.7 | 9.0 | 3G3AX-NFO03 | | 25 | 2.1 | | | |
| | | | LD | 5.5 | 11.1 | | | | | | | |
| | | | VLD | 5.5 | 11.1 | | | | | | | |
| | 5.5 | 3G3RX2-A4055 | ND | 5.5 | 14 | | | | | | | |
| | | | LD | 7.5 | 16 | | | | | | | |
| | | | VLD | 7.5 | 16 | | | | | | | |
| | 7.5 | 3G3RX2-A4075 | ND | 7.5 | 19 | | | | | | | |
| | | | LD | 11 | 22 | | | | | | | |
| | | | VLD | 11 | 22 | | | | | | | |
| | 11 | 3G3RX2-A4110 | ND | 11 | 25 | 3G3AX-NFO04 | | 50 | 3.7 | | | |
| | | | LD | 15 | 29 | | | | | | | |
| | | | VLD | 15 | 29 | | | | | | | |
| | 15 | 3G3RX2-A4150 | ND | 15 | 32 | | | | | | | |
| | | | LD | 18.5 | 37 | | | | | | | |
| | | | VLD | 18.5 | 37 | | | | | | | |
| | 18.5 | 3G3RX2-A4185 | ND | 18.5 | 38 | | | | | | | |
| | | | LD | 22 | 43 | | | | | | | |
| | | | VLD | 22 | 43 | | | | | | | |
| 22 | 3G3RX2-A4220 | ND | 22 | 48 | 3G3AX-NFO05 | 75 | 5.7 | | | | | |
| | | LD | 30 | 57 | | | | | | | | |
| | | VLD | 30 | 57 | | | | | | | | |
| 30 | 3G3RX2-A4300 | ND | 30 | 58 | | | | | | | | |
| | | LD | 37 | 70 | | | | | | | | |
| | | VLD | 37 | 70 | | | | | | | | |
| 37 | 3G3RX2-A4370 | ND | 37 | 75 | | | | 3G3AX-NFO06 | 100 | 8.4 | | |
| | | LD | 45 | 85 | | | | | | | | |
| | | VLD | 45 | 85 | | | | | | | | |
| 45 | 3G3RX2-A4450 | ND | 45 | 91 | 3G3AX-NFO07 | 150 | 9.0 | | | | | |
| | | LD | 55 | 105 | | | | | | | | |
| | | VLD | 55 | 105 | | | | | | | | |
| 55 | 3G3RX2-A4550 | ND | 55 | 112 | | | | | | | | |
| | | LD | 75 | 135 | | | | | | | | |
| | | VLD | 75 | 135 | | | | | | | | |
| 75 | 3G3RX2-A4750 | ND | 75 | 149 | | | | - | - | - | | |
| | | LD | 90 | 160 | | | | | | | | |
| | | VLD | 90 | 160 | | | | | | | | |

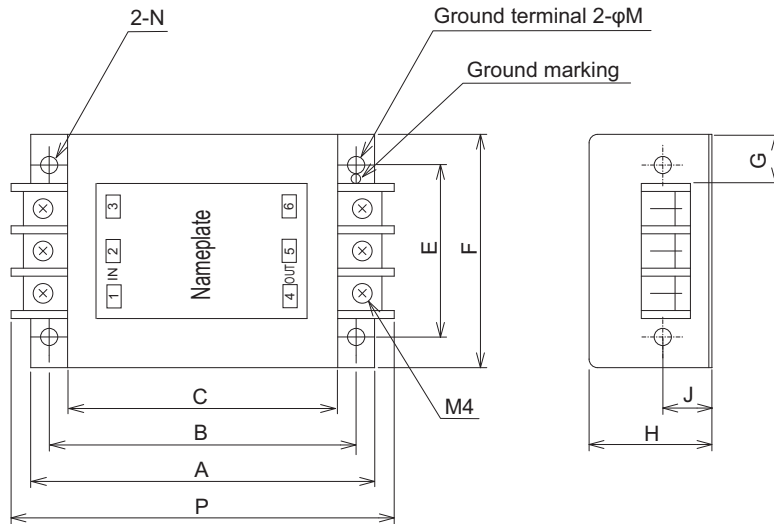
11-8 Output Noise Filter
(Model: 3G3AX-NFO□□)

11

11-8-1 Specifications

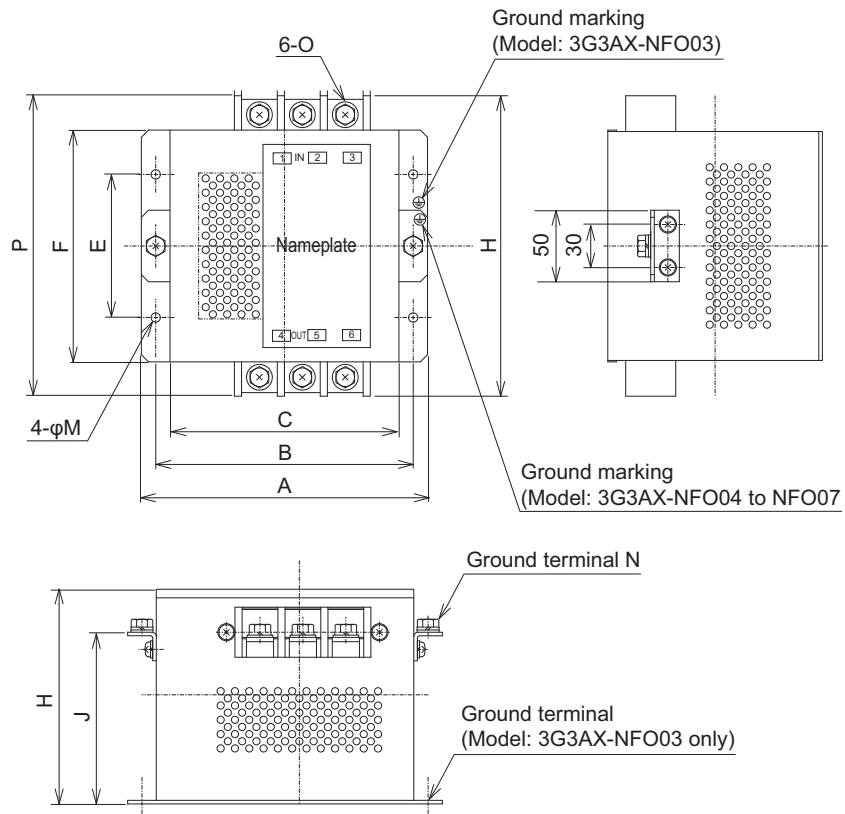
11-8-2 External Dimensions

3G3AX-NFO01/NFO02



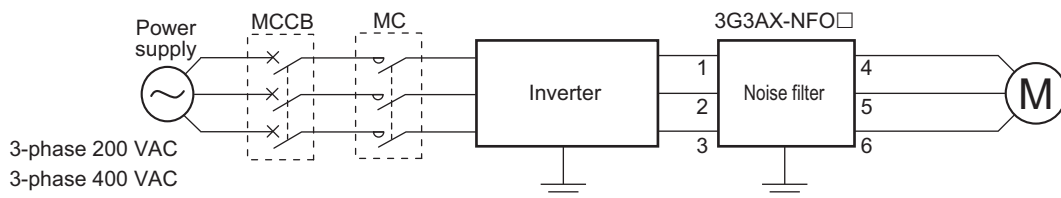
| Model | Dimensions [mm] | | | | | | | | | | |
|-------------|-----------------|-----|-----|----|-----|----|----|----|-----|-----|------------------|
| | A | B | C | E | F | G | H | J | M | P | N |
| 3G3AX-NFO01 | 140 | 125 | 110 | 70 | 95 | 22 | 50 | 20 | 4.5 | 156 | 2-R2.25 Length 6 |
| 3G3AX-NFO02 | 160 | 145 | 130 | 80 | 110 | 30 | 70 | 25 | 5.5 | 176 | 2-R2.75 Length 7 |

3G3AX-NFO03/NFO04/NFO05/NFO06/NFO07



| Model | Dimensions [mm] | | | | | | | | | | |
|-------------|-----------------|-----|-----|-----|-----|-----|-----|----------|----|----|-----|
| | A | B | C | E | F | H | J | M | N | O | P |
| 3G3AX-NFO03 | 160 | 145 | 130 | 80 | 112 | 120 | – | 6.5 dia. | – | M4 | 154 |
| 3G3AX-NFO04 | 200 | 180 | 160 | 100 | 162 | 150 | 120 | 6.5 dia. | M5 | M5 | 210 |
| 3G3AX-NFO05 | 220 | 200 | 180 | 100 | 182 | 170 | 140 | 6.5 dia. | M6 | M6 | 230 |
| 3G3AX-NFO06 | 220 | 200 | 180 | 100 | 182 | 170 | 140 | 6.5 dia. | M8 | M8 | 237 |
| 3G3AX-NFO07 | 240 | 220 | 200 | 150 | 202 | 170 | 140 | 6.5 dia. | M8 | M8 | 257 |

11-8-3 Connection Example



11-9 Radio Noise Filter (Model: 3G3AX-ZCL□)

11-9-1 Specifications

Select the radio noise filter according to the applicable motor capacity for the heavy/light load mode of the inverter.

When using at ND mode, you need to select the maximum motor capacity; at LD or VLD mode, select one larger in capacity to meet with the motor capacity (kW).

3G3AX-ZCL1

| Applicable motor capacity [kW] | 200-V class | | | | 400-V class | | | |
|--------------------------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| | Input side | | Output side | | Input side | | Output side | |
| | Quantity | No. of turns | Quantity | No. of turns | Quantity | No. of turns | Quantity | No. of turns |
| 0.2 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 0.4 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 0.75 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 1.5 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 2.2 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 3.0 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 3.7 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 4.0 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 5.5 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 7.5 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 11 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 15 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |

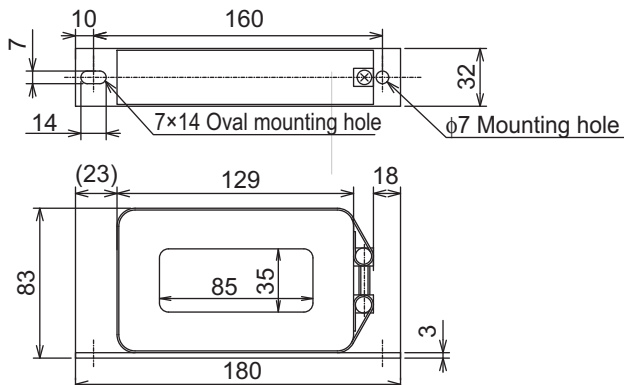
3G3AX-ZCL2

| Applicable motor capacity [kW] | 200-V class | | | | 400-V class | | | |
|--------------------------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| | Input side | | Output side | | Input side | | Output side | |
| | Quantity | No. of turns | Quantity | No. of turns | Quantity | No. of turns | Quantity | No. of turns |
| 0.1 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 0.2 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 0.4 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 0.75 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 1.5 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 2.2 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 3.0 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 3.7 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 4.0 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 5.5 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |
| 7.5 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 4 |

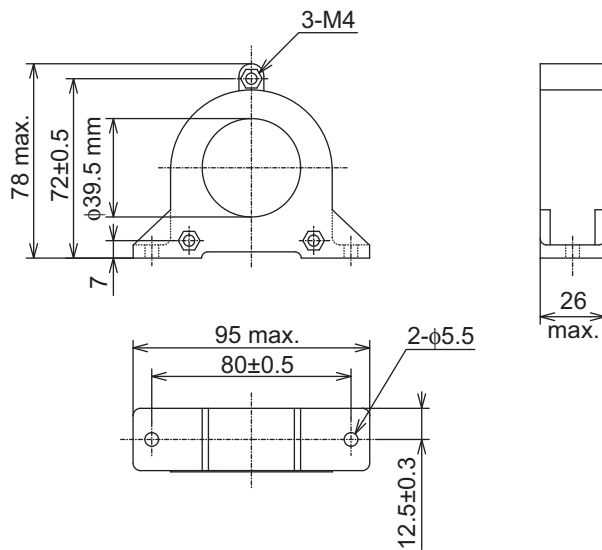
At LD or VLD mode, select one larger in capacity to meet with the motor capacity (kW).

11-9-2 External Dimensions

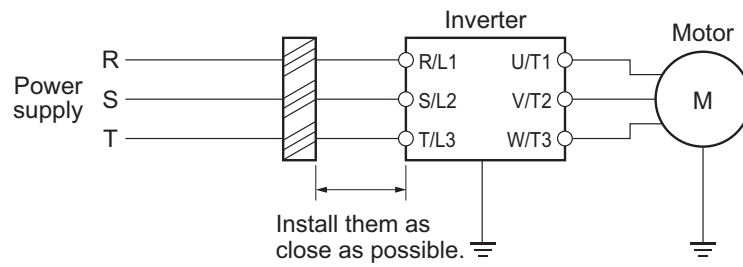
3G3AX-ZCL1



3G3AX-ZCL2



11-9-3 Connection Example



Precautions for Correct Use

- Wind the phase R/S/T wire in the same direction.
- This noise filter can be used in the same manner on both the input and output side of the inverter.

11-10 EMC Noise Filter (Model: 3G3AX-EFI□□)

11-10-1 Specifications

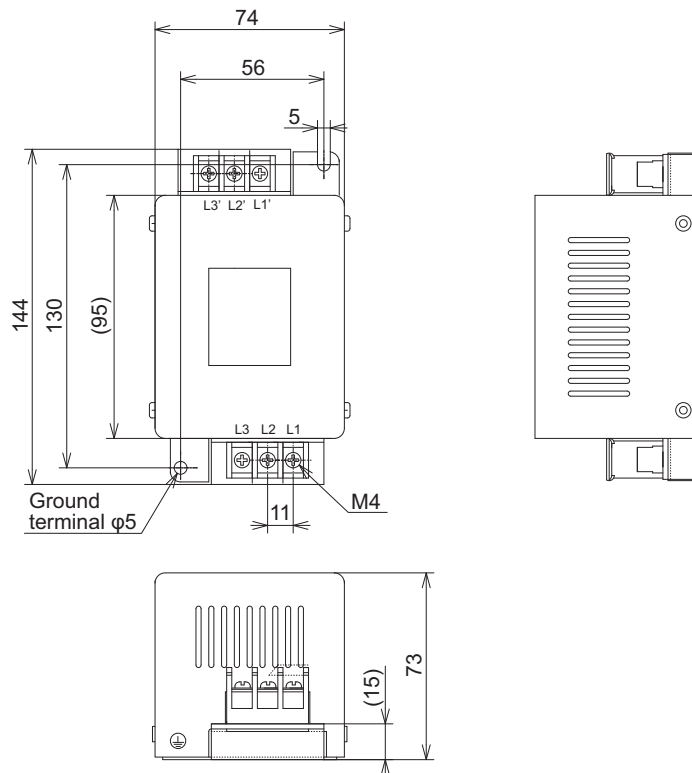
| Voltage class | Inverter | | | | | EMC noise filter specifications | | | | | Class |
|---------------|-------------------------------------|--------------|------------------------------|-------------------------------------|-------------------------|---------------------------------|--------------------|-------------------------|---------------------|------------------------------------|-------|
| | Max. applicable motor capacity [kW] | Model | Load specification selection | Max. applicable motor capacity [kW] | Rated input current [A] | Model | Max. input voltage | Rated input current [A] | Heat generation [W] | Leakage current (at 480 VAC 60 Hz) | |
| 200-V class | 0.4 | 3G3RX2-A2004 | ND | 0.4 | 3.3 | 3G3AX-EFI41 | 480 VAC +10% | 7 | 4 | 150 mA max. | A |
| | | | LD | 0.75 | 3.9 | | | | | | |
| | | | VLD | 0.75 | 3.9 | | | | | | |
| | 0.75 | 3G3RX2-A2007 | ND | 0.75 | 5.5 | 3G3AX-EFI42 | | 10 | 4 | 150 mA max. | |
| | | | LD | 1.5 | 7.2 | | | | | | |
| | | | VLD | 1.5 | 7.2 | | | | | | |
| | 1.5 | 3G3RX2-A2015 | ND | 1.5 | 8.3 | 3G3AX-EFI43 | | 20 | 8 | 170 mA max. | |
| | | | LD | 2.2 | 10.8 | | | | | | |
| | | | VLD | 2.2 | 10.8 | | | | | | |
| | 2.2 | 3G3RX2-A2022 | ND | 2.2 | 12 | 3G3AX-EFI43 | | 20 | 8 | 170 mA max. | |
| | | | LD | 3.7 | 13.9 | | | | | | |
| | | | VLD | 3.7 | 13.9 | | | | | | |
| | 3.7 | 3G3RX2-A2037 | ND | 3.7 | 18 | 3G3AX-EFI44 | | 30 | 9 | 170 mA max. | |
| | | | LD | 5.5 | 23 | | | | | | |
| | | | VLD | 5.5 | 23 | | | | | | |
| | 5.5 | 3G3RX2-A2055 | ND | 5.5 | 26 | 3G3AX-EFI45 | | 40 | 15 | 170 mA max. | |
| | | | LD | 7.5 | 37 | | | | | | |
| | | | VLD | 7.5 | 37 | | | | | | |
| | 7.5 | 3G3RX2-A2075 | ND | 7.5 | 35 | 3G3AX-EFI47 | | 60 | 15 | 250 mA max. | |
| | | | LD | 11 | 48 | | | | | | |
| | | | VLD | 11 | 48 | | | | | | |
| | 11 | 3G3RX2-A2110 | ND | 11 | 51 | 3G3AX-EFI48 | | 80 | 21 | 250 mA max. | |
| | | | LD | 15 | 64 | | | | | | |
| | | | VLD | 15 | 64 | | | | | | |
| 15 | 3G3RX2-A2150 | ND | 15 | 70 | 3G3AX-EFI49 | 100 | 23 | 250 mA max. | | | |
| | | LD | 18.5 | 80 | | | | | | | |
| | | VLD | 18.5 | 80 | | | | | | | |
| 18.5 | 3G3RX2-A2185 | ND | 18.5 | 84 | 3G3AX-EFI4A | 150 | 45 | 250 mA max. | | | |
| | | LD | 22 | 94 | | | | | | | |
| | | VLD | 22 | 94 | | | | | | | |
| 22 | 3G3RX2-A2220 | ND | 22 | 105 | 3G3AX-EFI4B | 200 | 50 | 250 mA max. | | | |
| | | LD | 30 | 120 | | | | | | | |
| | | VLD | 30 | 120 | | | | | | | |
| 30 | 3G3RX2-A2300 | ND | 30 | 133 | - | - | - | - | | | |
| | | LD | 37 | 150 | | | | | | | |
| | | VLD | 37 | 150 | | | | | | | |
| 37 | 3G3RX2-A2370 | ND | 37 | 160 | - | - | - | - | | | |
| | | LD | 45 | 186 | | | | | | | |
| | | VLD | 45 | 186 | | | | | | | |

| Inverter | | | | | | EMC noise filter specifications | | | | | | | | | | |
|---------------|-------------------------------------|--------------|------------------------------|-------------------------------------|-------------------------|---------------------------------|--------------------|-------------------------|---------------------|------------------------------------|-------|-------------|-------------|-------------|----|-------------|
| Voltage class | Max. applicable motor capacity [kW] | Model | Load specification selection | Max. applicable motor capacity [kW] | Rated input current [A] | Model | Max. input voltage | Rated input current [A] | Heat generation [W] | Leakage current (at 480 VAC 60 Hz) | Class | | | | | |
| 400-V class | 0.75 | 3G3RX2-A4007 | LD | 1.5 | 4.3 | 3G3AX-EFI41 | 480 VAC +10% | 7 | 4 | 150 mA max. | A | | | | | |
| | | | VLD | 1.5 | 4.3 | | | | | | | | | | | |
| | 1.5 | 3G3RX2-A4015 | ND | 1.5 | 4.2 | | | | | | | | | | | |
| | | | LD | 2.2 | 5.9 | | | | | | | | | | | |
| | | | VLD | 2.2 | 5.9 | | | | | | | | | | | |
| | 2.2 | 3G3RX2-A4022 | ND | 2.2 | 5.8 | | | | | | | 3G3AX-EFI42 | | | | |
| | | | LD | 3.7 | 8.1 | | | | | | | | | | | |
| | 3.7 | 3G3RX2-A4037 | VLD | 3.7 | 8.1 | 3G3AX-EFI43 | | | | | | | | | | |
| | | | ND | 3.7 | 9.8 | | | | | | | | | | | |
| | 5.5 | 3G3RX2-A4055 | LD | 5.5 | 13.3 | | | | | | | | | | | |
| | | | VLD | 5.5 | 13.3 | | | | | | | | | | | |
| | | | ND | 5.5 | 15 | | | | | | | | | | | |
| | 7.5 | 3G3RX2-A4075 | LD | 7.5 | 20 | | | 3G3AX-EFI44 | | | | | | | | |
| | | | VLD | 7.5 | 20 | | | | | | | | | | | |
| | | | ND | 7.5 | 21 | | | | | | | | | | | |
| | 11 | 3G3RX2-A4110 | LD | 11 | 24 | 3G3AX-EFI45 | | | | | | | | | | |
| | | | VLD | 11 | 24 | | | | | | | | | | | |
| | | | ND | 11 | 28 | | | | | | | | | | | |
| | 15 | 3G3RX2-A4150 | LD | 15 | 32 | | | 480 VAC +10% | 40 | 15 | | 170 mA max. | | | | |
| | | | VLD | 15 | 32 | | | | | | | | | | | |
| | | | ND | 15 | 35 | | | | | | | | | | | |
| | 18.5 | 3G3RX2-A4185 | LD | 15 | 35 | 3G3AX-EFI46 | | | | | | | | | | |
| | | | VLD | 18.5 | 41 | | | | | | | | | | | |
| | | | ND | 18.5 | 42 | | | | | | | | | | | |
| | 22 | 3G3RX2-A4220 | LD | 18.5 | 42 | 3G3AX-EFI47 | | | 50 | 15 | | 250 mA max. | | | | |
| | | | VLD | 22 | 47 | | | | | | | | | | | |
| | | | ND | 22 | 53 | | | | | | | | | | | |
| | 30 | 3G3RX2-A4300 | LD | 22 | 47 | 3G3AX-EFI48 | | | | | | | | | | |
| | | | VLD | 22 | 47 | | | | | | | | | | | |
| | | | ND | 22 | 53 | | | | | | | | | | | |
| | 37 | 3G3RX2-A4370 | LD | 30 | 63 | 480 VAC +10% | | | 60 | 15 | | 250 mA max. | | | | |
| | | | VLD | 30 | 63 | | | | | | | | | | | |
| | | | ND | 30 | 64 | | | | | | | | | | | |
| | 45 | 3G3RX2-A4450 | LD | 30 | 64 | | | | | | | | 3G3AX-EFI49 | 80 | 21 | 250 mA max. |
| | | | VLD | 37 | 77 | | | | | | | | | | | |
| | | | ND | 37 | 83 | | | | | | | | | | | |
| 55 | 3G3RX2-A4550 | LD | 37 | 77 | 3G3AX-EFI4A | | 100 | | 23 | 250 mA max. | | | | | | |
| | | VLD | 37 | 77 | | | | | | | | | | | | |
| | | ND | 37 | 83 | | | | | | | | | | | | |
| 75 | 3G3RX2-A4750 | LD | 45 | 94 | 480 VAC +10% | | | | | | 150 | 45 | 250 mA max. | | | |
| | | VLD | 45 | 94 | | | | | | | | | | | | |
| | | ND | 45 | 100 | | | | | | | | | | | | |
| 90 | 3G3RX2-A4900 | LD | 55 | 116 | | | 3G3AX-EFI4B | | 200 | 50 | | | | 250 mA max. | | |
| | | VLD | 55 | 116 | | | | | | | | | | | | |
| | | ND | 55 | 121 | | | | | | | | | | | | |
| 90 | 3G3RX2-A4900 | LD | 75 | 149 | | | - | | | | - | - | - | | | |
| | | VLD | 75 | 149 | | | | | | | | | | | | |
| | | ND | 75 | 164 | | | | | | | | | | | | |
| 90 | 3G3RX2-A4900 | LD | 90 | 176 | | | | | - | - | | | | - | - | |
| | | VLD | 90 | 176 | | | | | | | | | | | | |
| | | ND | 90 | 194 | | | | | | | | | | | | |
| 90 | 3G3RX2-A4900 | LD | 90 | 194 | | | - | | | | - | - | - | | | |
| | | VLD | 110 | 199 | | | | | | | | | | | | |
| | | ND | 110 | 199 | | | | | | | | | | | | |

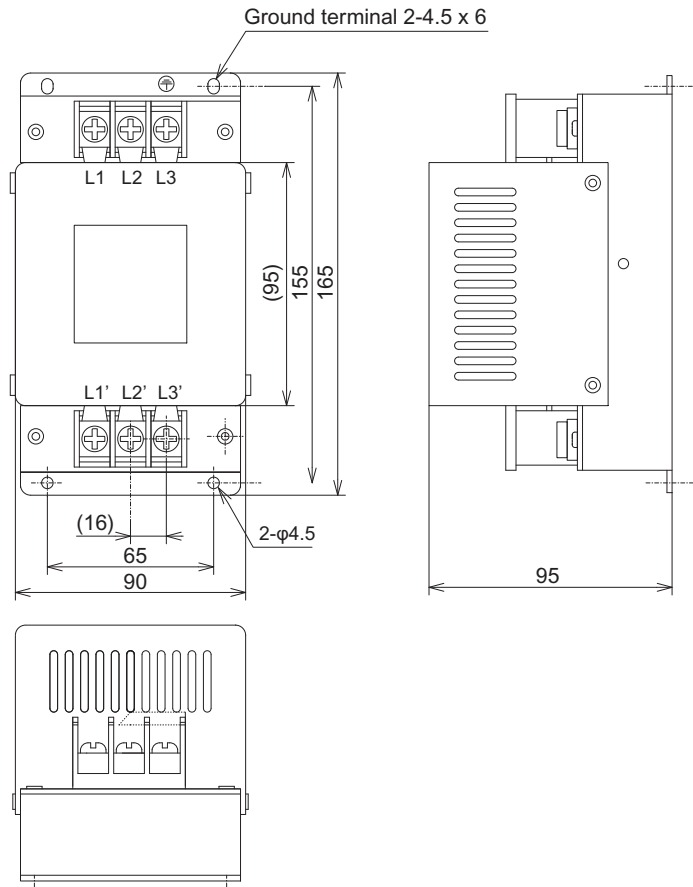
11-10-2 External Dimensions

3G3AX-EFI41/EFI42

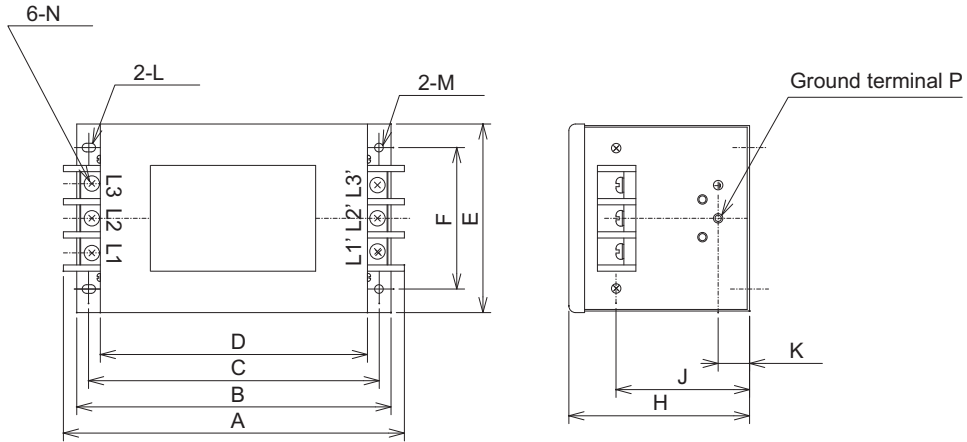
| Model | Case, enclosure rating | Screw size | Wire size | Weight [kg] |
|-------------|------------------------|------------|--|--|
| 3G3AX-EFI41 | Plastic, IP00 | M4 | 1.25 mm ² , 2 mm ² | 0.7 |
| 3G3AX-EFI42 | | | 2 mm ² | 0.7 |
| 3G3AX-EFI43 | | M5 | 2 mm ² , 3.5 mm ² | 1.0 |
| 3G3AX-EFI44 | | | 5.5 mm ² | 1.3 |
| 3G3AX-EFI45 | | | 8 mm ² | 1.4 |
| 3G3AX-EFI46 | Metal, IP00 | M6 | 14 mm ² | 2.9 |
| 3G3AX-EFI47 | | | 14 mm ² | 3.0 |
| 3G3AX-EFI48 | | | 22 mm ² | 3.6 |
| 3G3AX-EFI49 | | M8 | 30 mm ² , 38 mm ² | 4.3 |
| 3G3AX-EFI4A | | | 38 mm ² , 60 mm ² | 9.0 |
| 3G3AX-EFI4B | | | M10 | 100 mm ² or 38 mm ² , 2 wires parallel |



3G3AX-EFI43/EFI44/EFI45

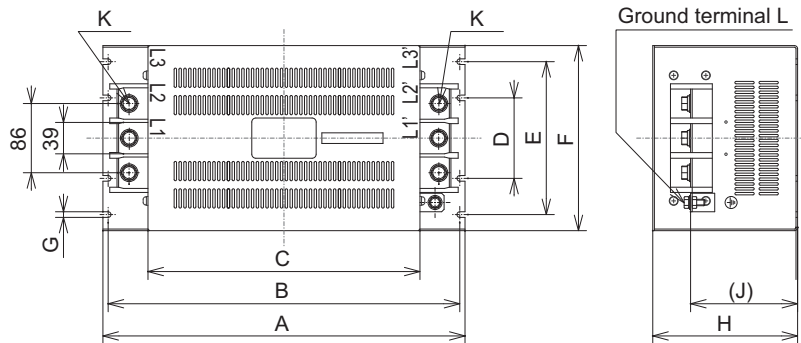


3G3AX-EFI46/EFI47/EFI48/EFI49/EFI4A



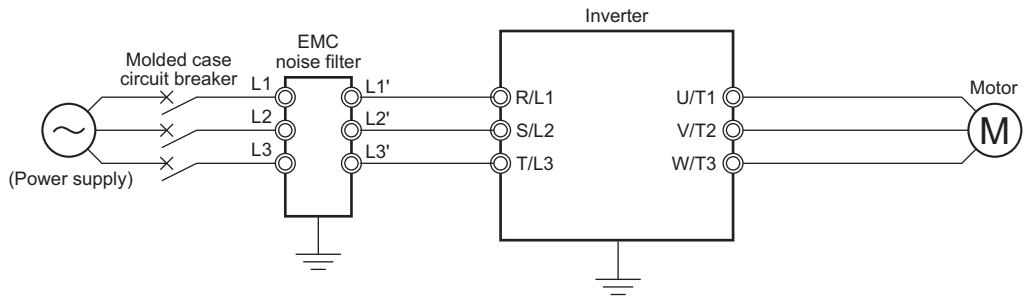
| Model | Dimensions [mm] | | | | | | | | | | | | |
|-------------|-----------------|-----|-----|-----|-----|-----|-----|----|----|-----------------|----------|----|----|
| | A | B | C | D | E | F | H | J | K | L | M | N | P |
| 3G3AX-EFI46 | 217 | 220 | 185 | 170 | 120 | 90 | 115 | 85 | 20 | R2.75, Length 7 | 5.5 dia. | M6 | M4 |
| 3G3AX-EFI47 | | | | | | | | | | | | | |
| 3G3AX-EFI48 | | | | | | | | | | | | | |
| 3G3AX-EFI49 | 254 | 230 | 215 | 200 | 150 | 120 | 115 | 80 | 30 | R3.25, Length 8 | 6.5 dia. | M8 | M6 |
| 3G3AX-EFI4A | 314 | 300 | 280 | 260 | 200 | 170 | 130 | 90 | 35 | R3.25, Length 8 | 6.5 dia. | M8 | M6 |

3G3AX-EFI4B



| Model | Dimensions [mm] | | | | | | | | | | |
|-------------|-----------------|-----|-----|-----|-----|-----|---|-----|-------|-----|----|
| | A | B | C | D | E | F | G | H | J | K | L |
| 3G3AX-EFI4B | 450 | 430 | 338 | 100 | 190 | 230 | 7 | 180 | (133) | M10 | M8 |

11-10-3 Connection Example



11-11 Digital Operator Cable (Model: 3G3AX-OPCN□)

11-11-1 Specifications

| Item | Model | |
|------------------|---|-------------|
| | 3G3AX-OPCN1 | 3G3AX-OPCN3 |
| Connector | RJ45 connector | |
| Cable | EIA568-compliant cable (UTP category 5) | |
| Cable length [m] | 1 | 3 |

12

Troubleshooting

| | |
|--|--------------|
| 12-1 Checking Alarm Display | 12-2 |
| 12-1-1 Checking Trip Information | 12-2 |
| 12-1-2 Checking Retry Information | 12-3 |
| 12-1-3 Procedure for Resetting Trip State | 12-4 |
| 12-2 Error No. and Its Measure | 12-5 |
| 12-2-1 Error No. Table | 12-5 |
| 12-2-2 Details about Errors | 12-7 |
| 12-3 Alarm Display and Its Measures | 12-23 |
| 12-3-1 Checking Alarm Display | 12-23 |
| 12-3-2 Checking Inconsistent Settings | 12-29 |
| 12-3-3 Checking Message | 12-30 |
| 12-4 Troubleshooting | 12-32 |

12-1 Checking Alarm Display

12-1-1 Checking Trip Information

Up to 10 trips in the past is displayed as the trip history.

The latest trip history is displayed on the trip monitor 1.

The following data items are displayed on the monitor:

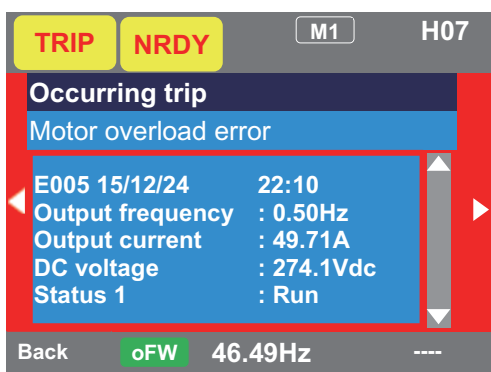
- (a) Error factor for trip
- (b) Output frequency (Hz) at trip
- (c) Output current (A) at trip
- (d) Main circuit DC voltage (V) at trip
- (e) Operation state at trip
- (f) Cumulative inverter operating time (h) before trip
- (g) Cumulative inverter power-on time (h) before trip



Precautions for Correct Use

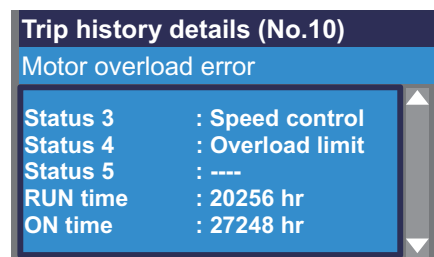
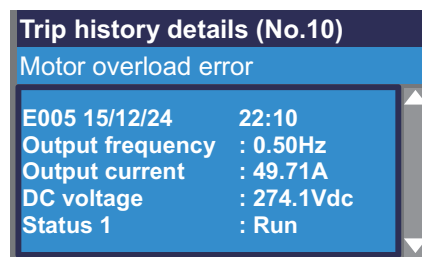
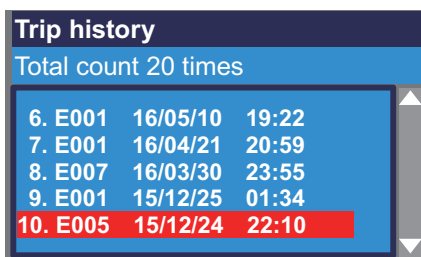
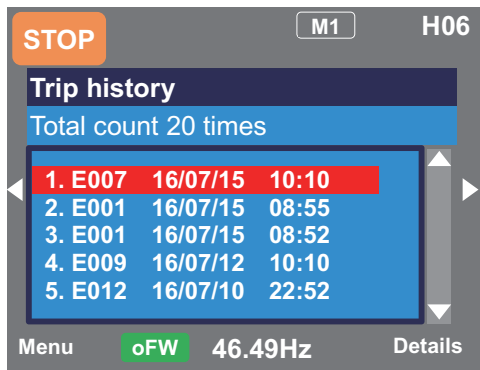
- The information of the moment of error occurrence may not be fetched properly if the inverter is forcibly turned OFF by its hardware.
- Values of respective data items may be reset to 0 when an error occurred and the inverter entered the trip condition.
- For a ground fault or a momentary overcurrent event, the current may be recorded in a value lower than the actual value.
- The trip monitor and the trip count monitor can be cleared by initialization of the trip history.

Display of Occurring Trip



Checking Trip History

You can look through the history with the arrow Enter keys.



12-1-2 Checking Retry Information

The last 10 retry histories are displayed.

The latest retry history is displayed on the retry monitor 1.

The following data items are displayed on the monitor:

- Error factor for retry
- Output frequency (Hz) at retry
- Output current (A) at retry
- Main circuit DC voltage (V) at retry
- Operation state at retry
- Cumulative inverter operating time (h) before retry
- Cumulative inverter power-on time (h) before retry

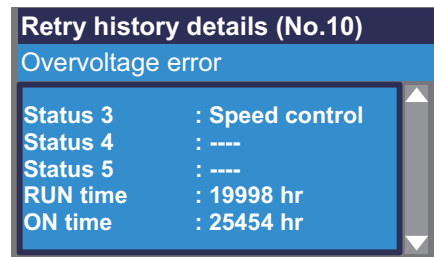
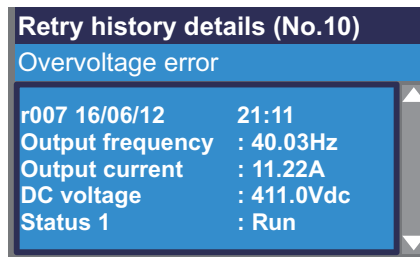
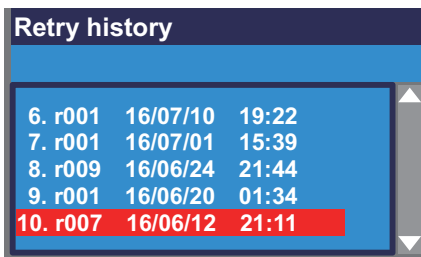
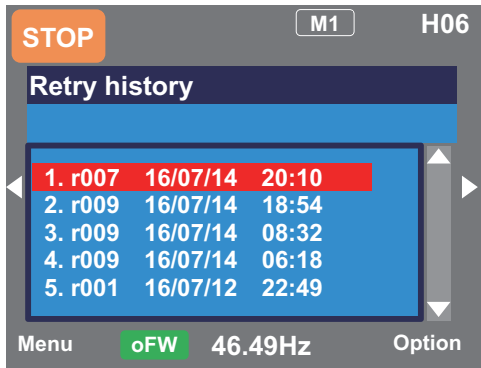


Precautions for Correct Use

- While a retry is underway, the inverter tries to continue running. For a trip after a retry, the trip information is recorded on the trip history.
- The information of the moment of error occurrence may not be fetched properly if the inverter is forcibly turned OFF by its hardware.
- For a momentary overcurrent event, the current may be recorded in a value lower than the actual value.
- To display time in retry history, you need to configure clock settings.
- To use the clock function, you need an optional battery that is separately sold (CR2032, 3V). See 3-1-5 *How to Set Battery and the Time Setting* on page 3-12 for details.

Checking the Retry History

You can look through the history with the arrow Enter keys.



12-1-3 Procedure for Resetting Trip State

Press Stop/Reset key of a panel or turn [RS] reset terminal ON to reset a trip. When the reset terminal is used, assign 028 [RS] to an input terminal function. Note that the reset terminal at that time is NO contact whatever the settings are.

For Reset Selection (CA-72), you can select a timing for resetting a trip state by RS terminal.

Only at the timing of the resetting when an error occurs, the RS terminal can be enabled.

Some trips cannot be reset. It depends on the factors of the trip.

In such case, turn a power supply OFF, and then cycle the power supply.



Precautions for Correct Use

- Do not use RS terminals to shut off the inverter output.
When you cut off the inverter output with signals, use Free-run Stop (FRS) terminal, which is an input terminal function.
- Even if the reset signal is input, internal data is not removed.
- When the reset signal is input while waiting for retry, the resetting starts without removal of frequency of shutoff time.

12-2 Error No. and Its Measure

12-2-1 Error No. Table

You need to take a measure according to the error number and the type of error.

Refer to the explanation pages shown in the table below.

| Error No. | Error Name | Explanation Page |
|-----------|---|------------------|
| E001 | Overcurrent error | P. 12-7 |
| E005 | Motor overload error *2 | P. 12-8 |
| E006 | Braking resistor overload error | P. 12-9 |
| E007 | Overvoltage error | P. 12-10 |
| E008 | Memory error | P. 12-10 |
| E009 | Undervoltage error | P. 12-11 |
| E010 | Current detector error *1 | P. 12-11 |
| E011 | CPU error *1 | P. 12-11 |
| E012 | External trip error | P. 12-12 |
| E013 | USP error | P. 12-12 |
| E014 | Ground fault error *1 | P. 12-12 |
| E015 | Incoming overvoltage error | P. 12-13 |
| E016 | Instantaneous power failure error | P. 12-13 |
| E019 | Temperature detector error *1 | P. 12-13 |
| E020 | Cooling fan rotation speed reduction temperature error *1 | P. 12-14 |
| E021 | Temperature error | P. 12-14 |
| E024 | Input open-phase error | P. 12-14 |
| E030 | IGBT error | P. 12-15 |
| E034 | Output open-phase error | P. 12-15 |
| E035 | Thermistor error | P. 12-16 |
| E036 | Brake error | P. 12-16 |
| E038 | Low-speed range overload error | P. 12-16 |
| E039 | Controller overload error *2 | P. 12-17 |
| E040 | Operator keypad disconnection error | P. 12-17 |
| E041 | RS485 communication error | P. 12-18 |
| E042 | RTC error | P. 12-18 |
| E043 | EzSQ illegal instruction error | P. 12-18 |
| E044 | EzSQ nest count error | P. 12-18 |
| E045 | Executive instruction error | P. 12-19 |
| E050 | EzSQ user-assigned error 0 | P. 12-19 |
| E051 | EzSQ user-assigned error 1 | P. 12-19 |
| E052 | EzSQ user-assigned error 2 | P. 12-19 |
| E053 | EzSQ user-assigned error 3 | P. 12-19 |
| E054 | EzSQ user-assigned error 4 | P. 12-19 |
| E055 | EzSQ user-assigned error 5 | P. 12-19 |
| E056 | EzSQ user-assigned error 6 | P. 12-19 |
| E057 | EzSQ user-assigned error 7 | P. 12-19 |

*1. When a serious fault error occurred, it cannot be released by a reset operation.

*2. When a controller overload error occurred, or a motor overload error occurred in the condition that [bC112] had been set to 00, the inverter does not accept a reset input for 10 seconds. Wait for a while before performing a reset operation.

| Error No. | Error Name | Explanation Page |
|------------------|---------------------------------|-------------------------|
| E058 | EzSQ user-assigned error 8 | P. 12-19 |
| E059 | EzSQ user-assigned error 9 | P. 12-19 |
| E060 | Option 1 error 0 | P. 12-19 |
| E061 | Option 1 error 1 | P. 12-19 |
| E062 | Option 1 error 2 | P. 12-19 |
| E063 | Option 1 error 3 | P. 12-19 |
| E064 | Option 1 error 4 | P. 12-19 |
| E065 | Option 1 error 5 | P. 12-19 |
| E066 | Option 1 error 6 | P. 12-19 |
| E067 | Option 1 error 7 | P. 12-19 |
| E068 | Option 1 error 8 | P. 12-19 |
| E069 | Option 1 error 9 | P. 12-19 |
| E070 | Option 2 error 0 | P. 12-19 |
| E071 | Option 2 error 1 | P. 12-19 |
| E072 | Option 2 error 2 | P. 12-19 |
| E073 | Option 2 error 3 | P. 12-19 |
| E074 | Option 2 error 4 | P. 12-19 |
| E075 | Option 2 error 5 | P. 12-19 |
| E076 | Option 2 error 6 | P. 12-19 |
| E077 | Option 2 error 7 | P. 12-19 |
| E078 | Option 2 error 8 | P. 12-19 |
| E079 | Option 2 error 9 | P. 12-19 |
| E080 | Option 3 error 0 | P. 12-20 |
| E081 | Option 3 error 1 | P. 12-20 |
| E082 | Option 3 error 2 | P. 12-20 |
| E083 | Option 3 error 3 | P. 12-20 |
| E084 | Option 3 error 4 | P. 12-20 |
| E085 | Option 3 error 5 | P. 12-20 |
| E086 | Option 3 error 6 | P. 12-20 |
| E087 | Option 3 error 7 | P. 12-20 |
| E088 | Option 3 error 8 | P. 12-20 |
| E089 | Option 3 error 9 | P. 12-20 |
| E090 | STO shutoff error | P. 12-20 |
| E091 | STO internal error | P. 12-20 |
| E092 | STO path 1 error | P. 12-20 |
| E093 | STO path 2 error | P. 12-20 |
| E100 | Encoder disconnection error | P. 12-20 |
| E104 | Position control range error | P. 12-21 |
| E105 | Speed deviation error | P. 12-21 |
| E106 | Position deviation error | P. 12-21 |
| E107 | Over-speed error | P. 12-22 |
| E110 | Contact error | P. 12-22 |
| E112 | PG option unit connection error | P. 12-22 |
| E120 | PID Abnormal Start Error | P. 12-22 |

12-2-2 Details about Errors

E001 Overcurrent Error

A large current flowing in the inverter results in a failure. To prevent this, the inverter turns OFF its output. By setting the parameter, you can perform retries for a fixed number of times without generating an error. Overcurrent level can be set in the [bb160].

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|---|---|
| Error occurred abruptly during operation. | A steep load change occurred. | <ul style="list-style-type: none"> Overcurrent suppression function and Overload limit function are effective to suppress overcurrent. When the vector control is used, the situation may be improved by adjusting the response to control in [HA115]. |
| | Hunting of motor | <ul style="list-style-type: none"> The situation may be improved by setting the IM motor capacity in [Hb102], the number of IM poles in [Hb103], or the auto-tuning selection in [HA-01]. The situation may be improved by adjusting stabilization control gain in [HA110]. |
| Error occurred during acceleration. | <ul style="list-style-type: none"> Insufficient acceleration time Insufficient acceleration torque Load inertia is large. Friction torque is large. | <ul style="list-style-type: none"> Setting longer acceleration time in [FA-10] can ease the insufficient acceleration torque. When acceleration torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and making adjustments with control method in [AA121]. Re-examination of load condition may improve the situation. |
| Error occurred during deceleration. | <ul style="list-style-type: none"> Insufficient deceleration time Insufficient regenerative torque Load inertia is large. | <ul style="list-style-type: none"> Setting longer deceleration time in [FA-12] can ease the insufficient regenerative torque. When regenerative torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and making adjustments with control method in [AA121]. Re-examination of load condition may improve the situation. |
| Error occurred right after an operation command input. | <ul style="list-style-type: none"> A ground fault has occurred. Output line is short-circuited or in open phase. Output element failure | <ul style="list-style-type: none"> The inverter may be broken if the error persists even when the power of inverter only is turned ON again after the power was turned OFF and the output line to the motor was removed. If the issue is solved when the output line to the motor is removed, you need to check the wiring and/or motor. |
| | <ul style="list-style-type: none"> Motor is locked. Load inertia is large. | <ul style="list-style-type: none"> Error may occur when the motor rotation is locked. The situation may be improved by taking a measure for the case "Error occurred during acceleration". |
| Error occurred right after power was turned ON. | <ul style="list-style-type: none"> Output element failure Current detector failure | Failure output element or current detector may be the cause. An investigation and repair are required. |
| Error occurred after long hours of use. | System environment changes | The situation may be improved by reducing the motor load, or performing a system maintenance (e.g., cleaning the fan to be driven and removing clogging in the duct). |
| | Aging deterioration | If the issue is not solved by reduction of the load and system maintenance, aging deterioration of a life-limited component may be the cause. A repair is required. |

E005 Motor Overload Error

The built-in electronic thermal function monitors the output current of the inverter and when a motor overload is detected, the inverter turns OFF its output. The inverter trips according to the setting of the motor electronic thermal function.

When a motor overload error occurred, the inverter does not accept a reset input for 10 seconds.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|---|---|
| Error occurred after a fixed period of operation. | Operation under heavy load condition has continued. | Re-examination of operation condition or correction of load condition may improve the situation. |
| | Thermal level is set high. | When the motor thermal level setting in [bC110] is not appropriate, re-examination of the setting may improve the situation. |
| Error occurred during acceleration. | <ul style="list-style-type: none"> • Insufficient acceleration torque • Load inertia is large. • Friction torque is large. | <ul style="list-style-type: none"> • Setting longer acceleration time in [FA-10] can ease the insufficient acceleration torque. • When acceleration torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and making adjustments with control method in [AA121]. • Re-examination of load condition may improve the situation. |
| | A function to suppress overcurrent is at work. | A factor for overcurrent may have been occurred. Re-examination of acceleration time or load condition is required. |
| Error occurred during deceleration. | Load inertia is large. | <ul style="list-style-type: none"> • Setting longer deceleration time in [FA-12] can ease the insufficient regenerative torque. • When regenerative torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and adjusting with control method in [AA121]. • Re-examination of load condition may improve the situation. |
| | A function to suppress overvoltage is at work. | Current may increase as a result of suppressing overvoltage. Re-examination of deceleration time or load condition in [FA-12] is required. |
| Error occurred after long hours of use. | System environment changes | The situation may be improved by reducing the motor load, or performing a system maintenance (e.g., cleaning the fan to be driven and removing clogging in the duct). |
| | Aging deterioration | If the issue is not solved by reduction of the load and system maintenance, aging deterioration of a life-limited component may be the cause. A repair is required. |

E006 Braking Resistor Overload Error

When the use rate of inverter's braking resistor operation circuit (BRD) exceeds the use rate set beforehand in [bA-60], the inverter turns OFF its output.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|--|---|
| Error occurred during deceleration. | <ul style="list-style-type: none"> Insufficient deceleration time Load inertia is large. Capacity of braking resistor is small. | Setting longer deceleration time in [FA-12] may improve the situation that the motor is rapidly decelerated. If deceleration time cannot be shortened, choice of resistor must be re-examined. |
| Error occurred during operation. | <ul style="list-style-type: none"> Continuous regenerative operation Capacity of braking resistor is small. | The resistor may not be able to fully consume the power because the regenerative power returned from the motor is high. Load condition or choice of resistor must be re-examined. |
| | Rotated by external force. | The resistor may not be able to fully consume the power because the fan is rotated by a strong wind, or because the regenerative power returned from the motor increases when loads are lowered by a crane or the like. Load condition or choice of resistor must be re-examined. |
| Error occurred during repetitive operations. | Repetition cycle of operation is high. | Reduction of repetition cycle of operation may improve the situation. Adjustment of deceleration time in [FA-12] and re-examination of choice of resistor may also improve the situation. |

E007 Overvoltage Error

Too high P-N voltage results in a failure. To prevent this, the inverter turns OFF its output. When P-N voltage exceeds approx. 410 Vdc (200 V class) or approx. 820 Vdc (400 V class), the output is turned OFF. By setting the parameter, you can perform retries for a fixed number of times without generating an error.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|--|--|
| Error occurred during deceleration. | <ul style="list-style-type: none"> Insufficient deceleration time Load inertia is large. | Setting longer deceleration time in [FA-12] may improve the situation that the motor is rapidly decelerated. If deceleration time cannot be shortened, you need to re-examine load condition, activate overvoltage suppression function, or use a braking resistor, braking unit, or regenerative converter. |
| Error occurred during operation. | Load inertia is large. | If load inertia is large, high regenerative power returns from the motor; hence an overvoltage is likely to occur. You need to re-examine load condition, activate overvoltage suppression function, or use a braking resistor, braking unit, or regenerative converter. |
| | Rotated by external force (fan, crane). | An overvoltage is likely to occur if motor rotation speed exceeds the output frequency (rotation speed) of inverter. You need to re-examine load condition, activate overvoltage suppression function, or use a braking resistor, braking unit, or regenerative converter. |
| Error occurred during stop. | Abnormality of PS voltage | Power supply voltage may be raised or fluctuated. Re-examination of power supply environment or use of an AC reactor may improve the situation. |
| Error occurred during drooping control | Mutual interference caused by 2 inverters trying to control motors strictly. | When 2 motors driving a same shaft are controlled by 2 inverters, both the inverters attempt to generate torques, which may result in control divergence. The situation may be improved by setting one of the inverters to P control. See 7-3-3 <i>P/PI Switching Function</i> on page 7-46. |

E008 Memory Error

If the built-in memory has problems, the inverter turns OFF its output. CPU error may be issued instead. The inverter recovers by re-turning ON the power; however, you need to check that there is no problem in parameters. The data which has been backed up on the operator keypad beforehand may be restored.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|--------------------------------|---|
| Error occurred some time after the power was turned ON. | Noise is mixed. | A physical countermeasure such as placing a shielding plate may be required to avoid external noises. |
| Power has been unintentionally turned OFF before. | Power-off during memory access | You need to restore the data by using the data which has been backed up on the operator keypad beforehand. If the data cannot be restored, initialization is required. See 6-1-2 <i>Inverter Initialization</i> on page 6-5. If the data cannot be restored by initialization, a repair is required. |

E009 Undervoltage Error

A decrease of the main power supply of inverter results in a circuit breakage. To prevent this, the inverter turns OFF its output. When P-N voltage falls below approx. 160Vdc (200V class) or approx. 320VDC (400V class), the output is turned OFF. By setting the parameter, you can perform retries for a fixed number of times without generating an error. Furthermore, undervoltage error during stop can be disabled by setting.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|--|---|
| There was a power failure. | PS voltage decreased. | If the internal power supply hasn't been fully turned OFF, it is possible to re-start the inverter after the power supply is recovered, by setting the retry function while it is still on. |
| Error occurred with the start of operation. | <ul style="list-style-type: none"> PS voltage decreased. PS capacity is insufficient. | When power supply voltage decreases or power supply capacity is insufficient, re-examination of power supply environment is required. |
| The inverter doesn't start. | PS voltage is insufficient. | Perform power supplying in accordance with the inverter voltage class. |
| Error occurred after long hours of use. | <ul style="list-style-type: none"> System environment changes Capacitor deterioration Circuit failure | If an undervoltage occurs frequently, the inverter may have reached its end of life or be broken down. A repair is required. |

E010 Current Detector Error

If the built-in current detector has problems, the inverter turns OFF its output.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|-------------------------------------|---|
| Error occurred after power was turned ON. | Current detector circuit is broken. | If the error recurs after a reset operation, the current detector circuit may be broken down. A repair is required. |
| | A noise source is nearby. | When there is a noise source nearby, the situation may be improved by taking a noise countermeasure such as keeping the noise source away or placing a shielding plate. |
| Error occurred after long hours of use. | Current detector circuit is broken. | If the error recurs after a reset operation, the current detector circuit may be broken down. A repair is required. |

E011 CPU Error

When a malfunction or problem occurs in the built-in CPU, the inverter turns OFF its output and then displays the error.

If the inverter doesn't recover by re-turning ON the power, the CPU is likely to be broken.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|-------------------------------------|-----------------------------|---|
| Error occurred abruptly. | The internal CPU is broken. | <ul style="list-style-type: none"> The inverter may recover by a reset operation, re-turning ON the power, or initialization operation. When the inverter recovered, an initialization must be executed. If the inverter doesn't recover, the CPU may be broken down. A repair is required. |
| | A noise source is nearby. | Where there is a noise source nearby, the situation may be improved by taking a noise countermeasure such as keeping the noise source away or placing a shielding plate. |
| Error occurred during data writing. | Data is inconsistent. | The inverter may recover by a reset operation, re-turning ON the power, or initialization operation. When the inverter recovered, an initialization must be executed. See 6-1-2 <i>Inverter Initialization</i> on page 6-5. |

E012 External Trip Error

When the inverter accepted a signal commanded by an external device or equipment, the inverter turns OFF its output. (When external trip function is selected.)

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---------------------------------|---|---|
| Error occurred unintentionally. | <ul style="list-style-type: none"> Terminal logics are reversed. Wiring is wrong. | <ul style="list-style-type: none"> You need to check the state of operations related to external devices or external equipment, and re-examine the assignment of external trip terminal to the inverter input terminal, the setting of a/b contact, the external trip command via communication, etc. A/b contact of terminal can be changed by inverter setting. |

E013 USP Error

This error occurs if an operation command has been input to the inverter when the power supply is turned ON. Operation command detection is carried out for 1 second after the power supply is turned ON. (When USP function is selected.)

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---------------------------------|--|---|
| Error occurred unintentionally. | Operation command was entered too early. | Re-examination of the sequence to enter operation command is required. You need to wait for 2 seconds or longer to enter operation command after turning ON the power supply. |
| | Operation command isn't released. | You need to release an operation command when turning ON the power supply. |
| | You tried to operate with commands other than terminal commands. | When USP is enabled, commands of the operator keypad and communication commands are treated as errors. You need to wait for 2 seconds or longer to enter operation command after turning ON the power supply. |

E014 Ground Fault Error

This is a function to protect the inverter by the detection of ground faults between the inverter output and the motor at power-on.

The function doesn't work when there is a voltage induced in the motor due to idling or when the inverter trips.

When the control circuit power (R0, T0, or 24 V power supply) has been turned ON prior to the main circuit power R, S, or T, the function is activated at the time the main circuit power is turned ON.

Setting the ground fault detection selection [bb-64] to 00 disables the ground fault function. Setting it to 01 enables the function.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|---|---|
| Error occurred as the power supply was turned ON. | <ul style="list-style-type: none"> Ground faults of wires or the motor Motor insulation deterioration | <ul style="list-style-type: none"> Turn OFF the power, remove the wires connected to the motor, and then check the motor and the wires. A ground fault may have been occurred. Turning ON the power supply in a ground fault state results in a failure. Do not turn ON the power when you check the motor and motor wires. |

E015 Incoming Overvoltage Error

This error occurs if high incoming voltage level is held for 100 seconds continuously while the inverter output is stopped when incoming overvoltage level [bb-61] is set to 01. It occurs when the P-N voltage exceeds the voltage level set in the incoming overvoltage level selection [bb-62] due to incoming voltage.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|-----------------------------------|--|
| Error occurred after power was turned ON. | Incoming voltage is high. | Re-examination of the power supply environment is required. |
| Error occurred after long hours of use. | Power supply has become unstable. | The power supply environment may have been changed due to facility replacement or the like. Re-examination of the power supply environment is required. |

E016 Instantaneous Power Failure Error

At the time of an instantaneous power failure, the inverter turns OFF its output. If the power failure continues, the event is regarded as a normal power-off.

Decrease in the main power R, S, or T generates this error. Decrease in the voltage of control circuit power supply R0 or T0 doesn't generate the error if the J51 connector has been removed and the R0 and T0 are input via a separate system.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|---|--|
| Error occurred after long hours of use. | PS voltage decreased. | If the power is turned OFF due to an external factor such as power failure, the inverter can be restarted by using the retry function when the power is restored. |
| | There was a contact fault in circuit breaker. | Failure of magnetic contactor or earth-leakage breaker may be the cause. Although the inverter may recover, a repair is required. |
| Error occurred with the start of operation. | PS voltage decreased. | If an instantaneous power failure hasn't occurred, insufficient capacity of power supply may be the cause. Re-examination of the power supply environment is required. |

E019 Temperature Detector Error

This error occurs if there is a problem in the temperature detector circuit such as disconnection.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---------------------------|--|--|
| Error occurred after use. | The temperature detector circuit is disconnected or broken down. | The temperature detector circuit is broken down. A repair is required. |

E020 Temperature Error from Cooling Fan Rotation Speed Reduction

If the temperature of inverter gets high due to deterioration of cooling ability resulted from decrease in fan rotation speed, the inverter turns OFF its output. Refer to E021 also.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|-----------------------------|---|---|
| Cooling fan stopped. | A foreign object is stuck. | If there is a foreign object stuck in the fan, the inverter may recover by removing it. |
| | It is the end of cooling fan life. | The cooling fan needs to be replaced. |
| The cooling fan is working. | Cooling fan is approaching the end of its life. | The cooling ability has been deteriorated. The cooling fan needs to be replaced. |

E021 Temperature Error

When the temperature of inverter gets high, the inverter turns OFF its output.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|----------------------------------|---|---|
| Error occurred during operation. | Carrier frequency is high. | The higher the carrier frequency is, the more the temperature inside the inverter tends to increase. Lower the carrier frequency setting. |
| | There is clogging in the fin. | The cooling ability is deteriorated. Cleaning the fin may improve the situation. |
| | <ul style="list-style-type: none"> Used in high temperature environment. Cooling of the surroundings is insufficient. | Enhancing the use environment or cooling environment may improve the situation. |
| | The formal installation condition is not satisfied. | Improper installation of the inverter may results in the inverter failure. Install the inverter properly in accordance with the instruction manual. |
| Error occurred during stop. | The temperature detector circuit broke down. | The temperature detector circuit is broken down if the error is generated consecutively even after a reset. A repair is required. |

E024 Input Open-phase Error

When [bb-65] input phase loss selection is set to 01, when a missing phase is detected in input line, the inverter turns OFF its output.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|---|---|
| Error occurred after power was turned ON. | An input line or the motor has a loose connection or is disconnected. | You need to turn OFF the power supply and check the input lines and the wiring condition of breaker. This error may also occur due to PS voltage defect, contact defect, screw tightening failure, etc. |
| | Single-phase input is used. | For input lines, use three-phase connection. |
| Error occurred after long hours of use. | An input line or breaker has a loose connection or is disconnected. | The situation may be improved by mending loose connections due to loosening of screws or the breaker problems. |

E030 IGBT Error

At the time of an instantaneous overcurrent or the main element failure, the inverter turns OFF its output to protect the main element.

Overcurrent error may be issued instead.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|---|---|
| Error occurred right after the operation started. | <ul style="list-style-type: none"> A ground fault has occurred. Output line is short-circuited. | After the power is turned OFF, you need to check the wires connected to the motor, motor disconnection, and the like. If the error occurs after removal of the motor wires, the inverter is broken down. It needs to be repaired. |
| | Motor rotation is locked. | A large current may flow when the motor rotation is locked during operation. The cause needs to be removed. |
| | Output element is broken down. | If output element is broken down, it needs to be repaired. |
| Error occurred right after power was turned ON. | Output element is broken down. | If output element is broken down, it needs to be repaired. |
| Error occurred during operation. | Motor rotation is locked. | A large current may flow when the motor rotation is locked during operation. The cause needs to be removed. |

E034 Output Open-phase Error

When the output phase loss selection [bb-66] is set to 01, when a loose connection or disconnection of output line, disconnection inside the motor, etc. is detected, the inverter turns OFF its output. Detection of phase loss state is executed in the section between 5 Hz to 100 Hz.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|--|--|
| Error occurred right after the operation started. | An output line or the motor has a loose connection or is disconnected. | You need to turn OFF the power supply and check the output lines and the wiring condition of motor. This error can also occur due to motor insulation breakdown or screw tightening failure. |
| | Single-phase output is used. | For output lines, use three-phase connection. |
| Error occurred after long hours of operation. | An output line or the motor has a loose connection or is disconnected. | You need to turn OFF the power supply and check the output lines and the wiring condition of motor. If there is a loosened screw, the situation may be improved by re-tightening the screw. |

E035 Thermistor Error

If an abnormal temperature is observed during detection of resistor level change in an external thermistor, the inverter turns OFF its output. (When thermistor function is enabled.)

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|----------------------|--|---|
| Motor is heated. | The motor hasn't been cooled sufficiently. | The cooling environment needs to be improved. |
| | Heavy load has been applied for a long time. | The motor's driving environment needs to be re-examined. |
| Motor is not heated. | Inadequate thermistor function setting | Re-examination of the thermistor function setting may improve the situation. |
| | The thermistor is broken down. | The thermistor needs to be repaired. |
| | Malfunction due to noise | The situation may be improved by taking a noise countermeasure such as wiring separation. |

E036 Brake Error

This error occurs when the inverter can not detect whether the brake check signal is ON or OFF during waiting time after the inverter has output a brake releasing signal. (When brake function is enabled.)

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---------------------------------|-------------------------------|---|
| Error occurred after operation. | Disconnection of signal line. | Check the wiring of brake check signal and whether the signal is ON or OFF. |
| | Brake function setting | The situation may be improved by re-examination of brake check waiting time or input terminal logics according to the sequence of the signal. |

E038 Low-speed Range Overload Error

This error occurs to protect the main element if the inverter has output at a low frequency of 0.2 Hz or below.

When such a low frequency is detected by the built-in electronic thermal function, the inverter turns OFF its output.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|--------------------------|---|
| Error occurred during output at low speed. | The motor load is heavy. | Load at low-speed range needs to be reduced. If the error occurs frequently, you need to select an inverter with a capacity large enough for the motor. |

E039 Controller (Inverter) Overload Error

The built-in electronic thermal function monitors the output current of the inverter (controller) and when inverter overload is detected, the inverter turns OFF its output.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|---|--|
| Error occurred after a fixed period of operation. | Operation under heavy load condition has continued. | Re-examination of operation condition or correction of load condition may improve the situation. |
| Error occurred during acceleration. | <ul style="list-style-type: none"> Insufficient acceleration torque Load inertia is large. Friction torque is large. | <ul style="list-style-type: none"> Setting longer acceleration time in [FA-10] can ease the insufficient acceleration torque. When acceleration torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and making adjustments with control method in [AA121]. Re-examination of load condition may improve the situation. |
| | A function to suppress overvoltage is at work. | A factor for overcurrent may have been occurred. Re-examination of acceleration time or load condition is required. |
| Error occurred during deceleration. | Load inertia is large. | <ul style="list-style-type: none"> Insufficient rotation regeneration torque can be eased by setting longer deceleration time in [FA-12]. When regenerative torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and adjusting with control method in [AA121]. Re-examination of load condition may improve the situation. |
| | A function to suppress overcurrent is at work. | Current may increase as a result of suppressing overvoltage. Re-examination of deceleration time or load condition is required. |
| Error occurred after long hours of use. | System environment changes | The situation may be improved by reducing the motor load, or performing a system maintenance (e.g., cleaning the fan to be driven and removing clogging in the duct). |
| | Aging deterioration | If the issue is not solved by reduction of the load and system maintenance, aging deterioration of a life-limited component may be the cause. A repair is required. |

E040 Keypad Communication Error

The inverter displays this error when timeout occurs because of a malfunction due to noises, loose connection or disconnection of circuit for communication with the LCD Operator.

This error function can be enabled and disabled by setting of the operation selection at disconnection of operator keypad [UA-20].

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|---|---|
| Error occurred after communication is started. | <ul style="list-style-type: none"> Loose connection Disconnection | Check the wiring to see whether the connection is properly made. |
| | Noise is mixed. | The situation may be improved by taking a noise countermeasure such as wiring separation. |

E041 RS485 Communication Error

The inverter displays this error only when timeout occurs because of a malfunction due to noises, loose connection or disconnection of circuit for RS485 communication (such as Modbus-RTU).

This error function can be enabled and disabled by setting of the communication error selection [CF-05].

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|---|---|
| Error occurred after communication is started. | <ul style="list-style-type: none"> • Loose connection • Disconnection | Check the wiring to see whether or not the connection is properly made. |
| | Noise is mixed. | The situation may be improved by taking a noise countermeasure such as wiring separation. |

E042 RTC Error

The error is generated if the data of RTC incorporated in the operator keypad is returned to the initial data.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|-----------------------------|-------------------------------------|--|
| Error occurred at power-on. | A battery in the operator runs out. | <p>Replacement of the battery and setting of the date solve the issue.</p> <p>The error occurs when the power supply is turned ON with a dead battery.</p> |

E043 EzSQ Illegal Instruction Error

This error is output when an invalid instruction is detected in operation of a program which is downloaded to the inverter while the programing function EzSQ is used.

The error is also output if the program is put into action in the condition that the program hasn't been written.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|------------------------------|---|
| Error occurred when the program was about to put into action. | Writing error due to noise | There is a possibility of EzSQ program writing error and if there is a noise source nearby, the situation may be improved by taking a noise countermeasure such as keeping the noise source away and writing the program. |
| | Program hasn't been entered. | EzSQ program needs to be written in the factory default setting condition and after initialization. Write in the program. |

E044 EzSQ Nest Count Error

This error is output when the nesting frequency of a subroutine, "for" statement, "next" statement, etc. on a program exceeds 8 times while the programing function EzSQ is used.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|---------------------------------------|--|
| Error occurred when the program was put into action. | Program structure is too complicated. | The program has deep nesting of a subroutine, "for" statement, "next" statement, etc., with its nesting frequency exceeding 8 times. Improvement of the program structure is required. |

E045 EzSQ Executive Instruction Error

During operation of a program which is downloaded to the inverter while the programming function EzSQ is used, if execution of the program is turned OFF due to an error, the inverter generates E045 error.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|---------------------------------|--|
| Error occurred when the program was put into action. | Program flow is inadequate. | This error is output if there is no nest starting statement such as "for" at the point when "goto" statement refers to, or if a nest ending statement such as "next" precedes the nest starting statement. Check the structure of "for" statement and "next" statement and make amendments as needed. |
| | There is a problem in the data. | There may be an overflow, underflow, or division by zero in four arithmetic operations. Check the result of operations and amend the operations as needed. This error is output if a non-existing parameter is referred to or a setting is made beyond the setting range in "chg param" or "mon param" instruction. Check the content of instruction and make amendments as needed. |

E050 to E059 EzSQ User-assigned Errors 0 to 9

The inverter generates these errors when the corresponding user-assigned tripping programs are executed during operation of a program which is downloaded to the inverter while the programming function EzSQ is used.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|---------------------------------------|--|
| Error occurred when the program was put into action. | The program has an error instruction. | If a user-assigned error occurs unintentionally, check the content of trip instruction of the program and make amendments as needed. |

E060 to E069 Option 1 Errors 0 to 9

Errors occurring in an option mounted in the option slot 1 (to the observer's left) are detected.

For details, refer to the instruction manual provided together with the option mounted.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|--------------------------------------|---|
| Error occurred when an option is mounted. | The option isn't securely mounted. | The option may not be securely mounted. Check the mounting state. |
| | The option is used in the wrong way. | The type of error varies depending on options. For details, refer to the instruction manuals provided together with the respective options. |

E070 to E079 Option 2 Errors 0 to 9

Errors occurring in an option mounted in the option slot 2 (to the observer's center) are detected.

For details, refer to the instruction manual provided together with the option mounted.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|--------------------------------------|---|
| Error occurred when an option is mounted. | The option isn't securely mounted. | The option may not be securely mounted. Check the mounting state. |
| | The option is used in the wrong way. | The type of error varies depending on options. For details, refer to the instruction manuals provided together with the respective options. |

E080 to E089 Option 3 Errors 0 to 9

Errors occurring in an option mounted in the option slot 3 (to the observer's right) are detected.

For details, refer to the instruction manual provided together with the option mounted.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|--------------------------------------|---|
| Error occurred when an option is mounted. | The option isn't securely mounted. | The option may not be securely mounted. Check the mounting state. |
| | The option is used in the wrong way. | The type of error varies depending on options. For details, refer to the instruction manuals provided together with the respective options. |

E090 to E093 STO Error FS Option Error

When there is a path error in functional safety circuit, an inverter outputs the error.

For details about E090 to E093, refer to *Section B Appendices B STO Function*.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|------------------------------|--|---|
| The safety function is used. | The safety function system has problems. | Refer to <i>Section B Appendices B STO Function</i> . |

E100 Encoder Disconnection Error

This is an error related to feedback options.

When you set a switch on the PG option unit of feedback options, [E100] encoder disconnection error can generate the inverter trip.

For the setting procedure, refer to *2-3-6 Wiring for PG Option Unit* on page 2-63.

| Error cases | Cause | Examples of Measures |
|---|--|--|
| This error occurred when turning a power supply ON. | Error on encoder wiring or encoder | <ul style="list-style-type: none"> Check encoder signal and the wiring. Check that there is not any delay when the encoder power supply rather than inverter one is turned ON and the power is supplied. |
| This error suddenly occurred during the operation. | Error on encoder wiring or encoder | Check encoder signals and the wiring. |
| This error occurred when cutting off the power supply. Or whenever the power supply was turned ON, this error history was added. | Error on a power supply inside inverter or an encoder power supply | <ul style="list-style-type: none"> Check that inverter failure or overload of the encoder power supply. Check that there is not power loss on the encoder power supply rather than the inverter one when you use the encoder power supply. |

E104 Position Control Range Error

When the current position counter exceeds the position control ranges for normal/reverse rotation in the setting of [AE-52] position range (normal) or [AE-54] position range (reverse), the inverter turns OFF its output and displays the error.

Related pages found herein: P. 8-110

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|----------------------------------|--|--|
| Error occurred during operation. | Recheck the setting of electronic gear. | Re-examination of operation condition or correction of load condition may improve the situation. |
| | A slip occurs due to improper encoder setting. | Check the encoder mounting state. If any, re-examine factors for slipping. |
| | Improper encoder setting | Check the setting of encoder constant and the like. |
| | Improper electronic gear setting | Recheck the setting of electronic gear. |

E105 Speed Deviation Error

When the deviation between the frequency command and the feedback speed exceeds the [bb-83] speed deviation error detection level setting, the inverter judges it as an error. If "01: Error" is specified for [bb-82] Operation for speed deviation error, the inverter turns ON the output terminal function 041 [DSE] with a speed deviation error, turns OFF the inverter output, and displays this error.

Related pages found herein: P. 8-78

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|----------------------------------|--|--|
| Error occurred during operation. | Recheck the setting of electronic gear. | Re-examination of operation condition or correction of load condition may improve the situation. |
| | A slip occurs due to improper encoder setting. | Check the encoder mounting state. If any, re-examine factors for slipping. |
| | Improper encoder setting | Check the setting of encoder constant and the like. |
| | Improper electronic gear setting | Recheck the setting of electronic gear. |

E106 Position Deviation Error

When the [bb-87] abnormal position deviation time passes with the deviation of the position feedback against the position command exceeding the [bb-86] abnormal position deviation detection level, it is determined to be abnormal. When the behavior of the abnormal position deviation [bb-85] has been set to 01, the output terminal [PDD] is turned ON, the output is turned OFF, and the error is displayed.

Related pages found herein: P. 8-100

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|----------------------------------|--|--|
| Error occurred during operation. | Recheck the setting of electronic gear. | Re-examination of operation condition or correction of load condition may improve the situation. |
| | A slip occurs due to improper encoder setting. | Check the encoder mounting state. If any, re-examine factors for slipping. |
| | Improper encoder setting | Check the setting of encoder constant and the like. |
| | Improper electronic gear setting | Recheck the setting of electronic gear. |

E107 Over-speed Error

When the speed has exceeded [bb-80] Over-speed error detection level and [bb-81] Over-speed error detection time has elapsed, the output is turned OFF and the error is displayed.

Related pages found herein: P. 8-79

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|----------------------------------|---|--|
| Error occurred during operation. | Recheck the setting of electronic gear. | Re-examination of operation condition or correction of load condition may improve the situation. |
| | Improper encoder setting | Check the setting of encoder constant and the like. |
| | Improper electronic gear setting | Recheck the setting of electronic gear. |

E110 Contactor Error

When an error occurs in the contactor sequence, the output is turned OFF.

Related pages found herein: P. 8-91

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|---------------------------|---|
| [COK] was not turned ON within the contactor check time at start-up. | Wiring defect | Check the setting and wiring of input terminal function. |
| | Contactor response defect | Check the operation of contactor including its response time. |
| [COK] was not turned OFF within the contactor check time at stop. | Wiring defect | Check the setting and wiring of input terminal function. |
| | Contactor response defect | Check the operation of contactor including its response time. |

E112 PG Option Unit Connection Error

This is an error related to feedback options.

When the PG option unit is taken off the slot after being set, [E112] PG option unit connection error can generate inverter trip.

| Error cases | Cause | Examples of Measures |
|--|---|--|
| This error suddenly occurred during the operation. | There is a possibility that a connector was taken off the PG option unit. | <ul style="list-style-type: none"> • Check that the screw fixed in the PG option unit was not loosen. • Check the connector to be fit into PG option unit and to have no dust. |

E120 PID Abnormal Start Error

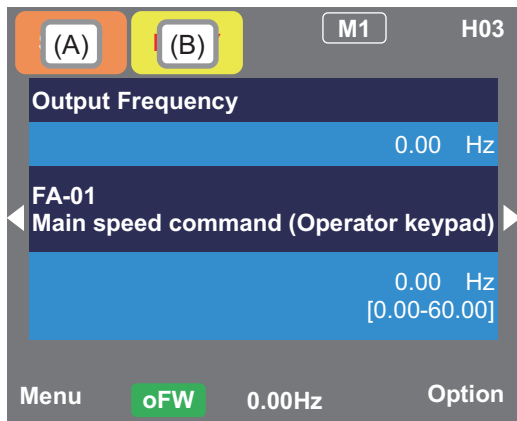
If PID is performed while the operation is started when [AH-75] PID soft-start function selection and [AH-81] PID start abnormal judgment implement selection are set to 01, this error occurs when the PID feedback value does not reach [AH-82] PID start abnormality judgment level after the elapse of [AH-80] soft-start time.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|----------------------------------|------------------------------|---|
| Error occurred during operation. | The target value is too low. | Re-examination of [AH-76] PID soft-start target level may improve the situation. |
| | Wires are disconnected. | Input PID feedback data may not be appropriate. Check the wiring and [db-44] PID1 feedback monitor. |








12-3 Alarm Display and Its Measures

12-3-1 Checking Alarm Display

The status of the inverter is shown in the following table for LCD operator.



Indication (A) Main Operating Status Display

| No. | Indication | Description |
|-----|---|--|
| A1 |  | Icon shown during normal rotation operation. Some parameters cannot be changed while the inverter is running. |
| A2 |  | Icon shown during reverse rotation operation. Some parameters cannot be changed while the inverter is running. |
| A3 |  | Icon shown during outputting under a zero-Hz command. It is also shown while DB, FOC, SON function is working. Some parameters cannot be changed while the inverter is running. |
| A4 |  | Icon shown when an error occurred and the inverter is in trip state. Releasable errors can be released by a reset operation. ⇒ 12-1 Checking Alarm Display on page 12-2 |
| A5 |  | Icon shown when a setting inconsistency exists. Eliminate the inconsistency. ⇒ 12-3-2 Checking Inconsistent Settings on page 12-29 |
| A6 |  | Icon shown while the inverter is forced stop by the following functions although operation command is entered. <ul style="list-style-type: none"> An operation command was entered under 0Hz frequency command. Operation command was entered from a source other than the operation keypad and the operation was stopped with STOP key on the operation keypad. The inverter stops by instantaneous power failure non-stop function. RUN lamp flashes during this. |
| A7 |  | Inverter is stopped because no operation command is given. The inverter cannot be operated if the input terminal functions such as [RS] and [FRS] or the STO function is ON. |

Indication (B) Warning Status Display

| No. | Indication | Description |
|-----|------------|---|
| B1 | LIM | Icon shown while the following functions are working. [dC-37] <ul style="list-style-type: none"> • Under overload limit. • Under torque limit. • Under overcurrent suppression. • Under overvoltage suppression. • Under upper/lower limit operation. • Under jump frequency operation. • Under minimum frequency limit. |
| B2 | ALT | Icon shown while the following functions are working. [dC-38] <ul style="list-style-type: none"> • Overload advance notice • Motor thermal advance notice • Inverter thermal advance notice • Motor overheat advance notice |
| B3 | RETRY | Icon shown during retry standby or restart standby. [dC-39] |
| B4 | NRDY | The inverter cannot be operated even when the operation command is entered. [dC-40] <ul style="list-style-type: none"> • The main power is under insufficient voltage supply. • The inverter is operating only with 24V power supply. • Under reset operation. • The inverter is OFF as the [REN] terminal function is enabled. |
| B5 | FAN | Icon shown in fan life advance notice state. |
| B6 | C | Icon shown in on-board capacitor life advance notice state. |
| B7 | F/C | Icon shown in fan life advance notice and on-board capacitor life advance notice state. |
| B8 | (None) | A state other than those above. |

You can see the detailed warning by pressing UP key on the three-lined monitor screen.

STOP (in red)

When “Stop” is indicated in red, the state goes into the followings.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|--|--|
| RUN key on the keypad was pressed. [FW] terminal was turned ON. | If LIM icon is lit, the command is below the minimum frequency and the following reasons are conceivable. <ul style="list-style-type: none"> • Operation command is entered but not frequency command. • Frequency command destination selection is wrong. | <ul style="list-style-type: none"> • Check that [FA-01] main speed command is not set to 0.00Hz. • Check whether the command is entered from the command destination indicated on the right of the main speed command [FA-01]. • Check [AA101] Main speed input source selection. |
| Operation command was entered. | | |
| After STOP key on keypad is pressed, inverter doesn't operate with RUN key. | STOP key on the LCD Operator was pressed when the operation command had been entered from a source other than the operation keypad. | Cancel the command entered to the operation command destination. |
| Instantaneous power failure occurred. | The inverter stopped by the instantaneous power failure non-stop function. | To start operation, turn off the command entered to the operation command destination and turn on again. |

WARN

When “WARN” is indicated, the state goes into the followings.

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---------------------------|--|--|
| A setting was configured. | There is an inconsistency in the parameter setting | Refer to <i>12-3-2 Checking Inconsistent Settings</i> on page 12-29. |

Icon 2 LIM

When LIM is shown, the inverter is in the following condition(s).

You can see the status of LIM by pressing UP key on the three-lined monitor or on [dC-37].

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|--|---|
| Output current was high, and [dC-37] LIM was set to 01. | [bA120] overcurrent suppression function was enabled and the current increased due to the load or other factors. | Remove the factor for the increased load. (E.g., by cleaning a clogged channel, re-examining the load) |
| | The current was increased by the high ratio of motor rotation during DC braking that was caused by the selection of [DB] terminal or [AF101] DC braking. | <ul style="list-style-type: none"> Reduce the DC braking force in [AF105] or [AF108]. For stopping, set longer time for [AF106] DC braking delay time at the time of the stop. For retry operation at the start, set longer delay time according to the factors. [bb-26] [bb-29] [bb-31] |
| | [FA-10] acceleration time is too short. | Make the acceleration time longer in [FA-10]. |
| Output current was high, and [dC-37] LIM was set to 02. | [bA122] overload limit function or similar function was enabled and the current increased due to the load or other factors. | Remove the factor for the increased load. (E.g., by cleaning a clogged channel, re-examining the load) |
| | [bA122] overload limit function or similar function was enabled and [FA-10] acceleration time was too short. | Make the acceleration time longer in [FA-10]. |
| Error occurred during deceleration. [dC-37] LIM was set to 03. | [bA140] overvoltage suppression function was enabled and P-N voltage increased due to regenerative load or the like. | Remove the factor for the increased regenerative load. (E.g., by re-examining the state of the motor being rotated by external force, and by re-examining the load) |
| | [bA122] overload limit function or similar function was enabled and [FA-12] deceleration time was too short. | Make the deceleration time longer in [FA-12]. |
| Error occurred during sudden acceleration. [dC-37] LIM was set to 03. | [bA140] overvoltage suppression function was enabled and P-N voltage increased due to regenerative load or the like. | Remove the factor for the increased regenerative load. (E.g., by re-examining the state of the motor being rotated by external force, and by re-examining the load) |
| Output current was high, and [dC-37] LIM was set to 04. | [bA110] torque limit function or similar function was enabled and the current increased due to the load or other factors. | Remove the factor for the increased load. (E.g., by cleaning a clogged channel, re-examining the load) |
| | [bA110] torque limit function or similar function was enabled and [FA-10] acceleration time was too short. | Make the acceleration time longer in [FA-10]. |
| Error occurred during operation. [dC-37] LIM was set to 05. | The normal limiting was performed according to the settings of [bA102] upper limiter, [bA103] lower limiter, and [AG101] and other jump frequencies. | Re-examine the settings of the upper/lower limiter or jump frequencies if necessary. |
| Error occurred during operation. [dC-37] LIM was set to 06. | The frequency command at below the minimum frequency [Hb130] has been input. | Set the frequency command at the minimum frequency or higher in [FA-01]. |

Icon 2 ALT

When ALT is shown, the inverter is in the following condition(s).

You can see the status of ALT by pressing UP key on the three-lined monitor or on [dC-38].

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|---|---|
| Output current was high, and [dC-38] ALT was set to 01. | The current increased due to load or other factors, exceeding the overload prewarning levels set in [CE106] or the similar parameter. | <ul style="list-style-type: none"> Remove the factor for the increased load. (E.g., by cleaning a clogged channel) Enable overload limit function or similar function. |
| Output current was high, and [dC-38] ALT was set to 02. | The electronic thermal function of motor was activated due to increase in current and the load exceeded the electronic thermal warning level (MTR) set in [CE-30]. | <ul style="list-style-type: none"> Remove the factor for the increased load. (E.g., by cleaning a clogged channel) Re-examine the electric thermal settings or the similar parameter. |
| Output current was high, and [dC-38] ALT was set to 03. | The electronic thermal function of inverter was activated due to increase in current and the load exceeded the electronic thermal warning level (CTL) set in [CE-31]. | Remove the factor for the increased load. (E.g., by cleaning a clogged channel) |

Icon 2 RETRY

When RETRY is shown, the inverter is in the following condition(s).

You can see the status of RETRY by pressing UP key on the three-lined monitor or on [dC-39].

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|---|--|
| Output was turned OFF and [dC-39] RETRY was set to 01. | The inverter is in the waiting mode after a trip retry operation due to increased current or P-N voltage fluctuation. | <ul style="list-style-type: none"> If the wait time become longer, the following delay time become shorter. [bb-26] [bb-29] [bb-31] If this error is generated consecutively, make the wait time longer. [bb-26] [bb-29] [bb-31] |
| Output was turned OFF and [dC-39] RETRY was set to 02. | The inverter is in the waiting mode before restart after power-off by [RS], [FRS], or [CS] terminal. | If the wait time become longer, the following delay time become shorter. [bb-26] |

Icon 2 NRDY

When NRDY is shown, the inverter is in the following condition(s).

You can see the status of NRDY by pressing UP key on the three-lined monitor or on [dC-40].

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|---|--|
| TRIP display was shown and [dC-40] NRDY was set to 01. | There was an error factor, which caused the inverter to trip. | Remove the error factor. Consult this chapter. |
| The CTRL icon was shown and [dC-40] NRDY was set to 02. | The control power supply (R0, T0) has been input, whereas the main circuit power supply R-S-T hasn't been input. | Check the input of main circuit power supply and examine the breaker, wiring, and so on. |
| The 24V icon was shown and [dC-40] NRDY was set to 02. | Only 24V has been input to the backup power supply P+-P-. | Check the input of main circuit power supply and the control power supply, and examine the breaker, wiring, and so on. |
| [dC-40] NRDY was set to 03. | [RS] terminal is ON and the inverter is under reset operation. | Check the wiring and operation state of [RS] terminal. |
| [dC-40] NRDY was set to 04. | The STO circuit is turned OFF or broken. | Check ST1/ST2 terminals. |
| [dC-40] NRDY was set to 05. | The inverter is checking the internal circuit, operator keypad, options, etc. | If this error is not released, check the operator keypad for contact failure or other problem. |
| [dC-40] NRDY was set to 06. | There is an inconsistency in the setting | Although [AA121] is set to 10 (Vector control with sensor), the option RX2-PG01 is not attached. Refer to <i>12-3-2 Checking Inconsistent Settings</i> on page 12-29. |
| [dC-40] NRDY was set to 07. | There is a sequence operation problem in the brake control. | Check the setting and signal operation of [AF130] brake control or the similar parameter. |
| [dC-40] NRDY was set to 08. | <ul style="list-style-type: none"> • [FRS] terminal or [CS] terminal was turned ON. • [FRS] or [CS] command was entered from the communication. | Check the signal operation of input terminal for [FRS] or [CS]. |
| [dC-40] NRDY was set to 09. | Operation command isn't permitted. | The [REN] terminal has been assigned and is turned OFF. |
| | Forced stop is being issued. (Deceleration stop behavior) | STOP key was pressed when commands had been entered from a source other than the operation keypad. |

12-3-2 Checking Inconsistent Settings

You need to take a measure according to the warning number and the type of warning. Refer to the table below.

The induction motor (IM) control and synchronous motor (permanent magnetic motor) (SM (PMM)) control can be switched in [AA121].

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|-----------------------------|--|---|
| Warning was generated - 102 | (First Max. frequency) < (first upper limiter) IM: [Hb105] < [bA102] SM (PMM): [Hd105] < [bA102] | <ul style="list-style-type: none"> • Increase the Max. frequency [Hb105]/[Hd105]. • Decrease the upper limiter [bA102]. |
| Warning was generated - 103 | (First Max. frequency) < (first lower limiter) IM: [Hb105] < [bA103] SM (PMM): [Hd105] < [bA103] | <ul style="list-style-type: none"> • Increase the Max. frequency [Hb105]/[Hd105]. • Decrease the lower limiter [bA103]. |
| Warning was generated - 106 | (First Max. frequency) < (first main speed command) IM: [Hb105] < [Ab110] SM (PMM): [Hd105] < [Ab110] | <ul style="list-style-type: none"> • Increase the Max. frequency [Hb105]/[Hd105]. • Decrease the main speed command [Ab110]. |
| Warning was generated - 107 | (First Max. frequency) < (first auxiliary speed command) IM: [Hb105] < [AA104] SM (PMM): [Hd105] < [AA104] | <ul style="list-style-type: none"> • Increase the Max. frequency [Hb105]/[Hd105]. • Decrease the auxiliary speed command [AA104]. |
| Warning was generated - 202 | (Second Max. frequency) < (second upper limiter) IM: [Hb205] < [bA202] SM (PMM): [Hd205] < [bA202] | <ul style="list-style-type: none"> • Increase the Max. frequency [Hb205]/[Hd205]. • Decrease the upper limiter [bA202]. |
| Warning was generated - 203 | (Second Max. frequency) < (second lower limiter) IM: [Hb205] < [bA203] SM (PMM): [Hd205] < [bA203] | <ul style="list-style-type: none"> • Increase the Max. frequency [Hb105]/[Hd105]. • Decrease the lower limiter [bA103]. |
| Warning was generated - 206 | (Second Max. frequency) < (second main speed command) IM: [Hb205] < [Ab210] SM (PMM): [Hd205] < [Ab210] | <ul style="list-style-type: none"> • Increase the Max. frequency [Hb205]/[Hd205]. • Decrease the main speed command [Ab210]. |
| Warning was generated - 207 | (Second Max. frequency) < (second auxiliary speed command) IM: [Hb205] < [AA204] SM (PMM): [Hd205] < [AA204] | <ul style="list-style-type: none"> • Increase the Max. frequency [Hb205]/[Hd205]. • Decrease the auxiliary speed command [AA204]. |

12-3-3 Checking Message

A message appears in an event like communication error, insufficient voltage, or result of auto-tuning. Even when there is an error, you can exit the error screen with the Enter key; however, you still need to remove the error factor separately.







“XX key” in the table is the ENTER key of the LCD operator.








| Message | Estimated cause(s) | Exemplar measures to be taken |
|--|---|---|
| Warning xxxxxxxxxxxxxx Press the XX key. | Warning of setting inconsistency was generated. There is inconsistency of setting shown in the warning message. | The warning will be canceled by amending the indicated parameter setting. |
| Auto-tuning (non-revolving) completed. xxxxxxxxxxxxxx Press the XX key. | Non-revolving auto-tuning process is finished. | See 6-2-3 <i>Auto-tuning of Motor</i> on page 6-14. |
| Auto-tuning (revolving) completed. xxxxxxxxxxxxxx Press the XX key. | Revolving auto-tuning process is finished. | See 6-2-3 <i>Auto-tuning of Motor</i> on page 6-14. |
| Auto-tuning failed. Re-examine the setting and wiring. Press the XX key. | Revolving auto-tuning process is disturbed and not finished. | See 6-2-3 <i>Auto-tuning of Motor</i> on page 6-14 for troubleshooting. |
| Initializing... Please wait. | The inverter is being initialized. | The initialization completion screen will appear after a while. |
| Clearing history... Please wait. | The inverter is being initialized. | The history clearance completion screen will appear after a while. |
| Initialization completed !! Target#:xxxxxxxxxx Selection of initial values (Ub-02) xxxxxxxxxxxxxx Load type selection Ub-03 xxxxxxxxxxxxxx Press the XX key. | The initialization is completed. | Press Enter key to exit the initialization completion screen. |
| History clearance completed !! Trip history cleared. Press the XX key. | The history clearance is completed. | Press Enter key to exit the history clearance completion screen. |
| Operation command is limited. Please check operation command. | <ul style="list-style-type: none"> • Operation command of command direction is limited by the setting of [AA114] operation direction limit. • The rotation direction is reversed from the command direction limited according to the setting of [AA114] operation direction limit because the frequency command is turned negative due to calculation of main speed or auxiliary speed. | <ul style="list-style-type: none"> • Check the setting of [AA114] operation direction limit. • Check the terminal command FW/RW and the command direction of communication command. • Check whether the calculated frequency command is negative or not. |
| Resetting. Inverter is being reset. Press the XX key. | <ul style="list-style-type: none"> • [RS] terminal is ON. • Trip reset was performed. (The screen is transited automatically at trip reset.) | The inverter is in the condition that [RS] terminal is ON. Re-examine the state of input terminal. |





| Message | Estimated cause(s) | Exemplar measures to be taken |
|---|---|---|
| Retrying. Retrying and restarting. Press the XX key. | <ul style="list-style-type: none"> The inverter is waiting for restart. (This mode is released after the set wait time has elapsed.) The inverter may not start if the incoming voltage is low. | <ul style="list-style-type: none"> If the wait time for restart is long, the message will continue to be indicated. See 7-5 Start Conditions on page 7-63. If the incoming voltage is low, check the input voltage. |
| Main circuit under instantaneous power failure. Power of main circuit is turned OFF. Press the XX key. | The main circuit power supply (R, S, T) is turned OFF due to lightning strikes, power supply environment, or other factors. | <ul style="list-style-type: none"> Check the state of input power supply. The inverter will recover when the power supply returns. |
| Main circuit under insufficient voltage. Please check the main circuit power. Press the XX key. | The control circuit power supply (R0, T0) has been input, whereas the main circuit power supply (R, S, T) has been cut. | <ul style="list-style-type: none"> Check the state of input power supply. The inverter will recover when the power supply of main circuit returns. |
| POWER OFF POWER OFF Press the XX key. | The power supply to the inverter is turned OFF. | <ul style="list-style-type: none"> Check the state of input power supply. The inverter will recover when the power supply returns. |
| Control power under insufficient voltage. Please check the control power supply. Press the XX key. | The control circuit power supply (R0, T0) is turned OFF. | <ul style="list-style-type: none"> Check the state of input power supply. The inverter will recover when the power supply of control circuit returns. |
| Power feeding by external 24 Vdc. Only external 24 Vdc is feeding power. Press the XX key. | The inverter is operating only with 24V power supply input to P+ and P- terminals. | If the input power supply is input, check its state. |
| Changing load type... Please wait. | The load type of inverter is being changed. | The load type change completion screen will appear after a while. |
| Load type change completion !! Load type selection Ub-03 Rated current value changed. Check current-related parameters. Press the XX key. | The load type change is completed. | Press Enter key to exit the load type change completion screen. |





12-4 Troubleshooting








When there are failures or errors on operations, conduct the survey of the causes and take the appropriate measures.







| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|--|---|
| LCD Operator doesn't turn ON | The power supply is not turned ON. | <ul style="list-style-type: none"> • Check that the power supply which satisfies the specification is turned ON. • When different powers are supplied to the control power supplies R0 and T0, and to P+ and P- terminals, check that R0, T0, or 24V power supply is turned ON. |
| |  | |
| | LCD Operator is about to come off. | The issue will be solved by remounting the LCD Operator. |
| |  | |
| | The J51 connector is disconnected. | The J51 connector supplies power to the control power supplies R0 and T0 from the main power supplies R, S, and T. Keep the connector connected if you do not supply power to the control power supply with a different system. |
|  | | |
| <ul style="list-style-type: none"> • The power supply input path is disconnected. • 200V power is supplied to R0 and T0 for 400V class. | <ul style="list-style-type: none"> • The breaker or wires may be disconnected. You need to re-examine the wiring. • When different power is supplied to the control power supplies R0 and T0, you also need to re-examine R0 and T0. | |
| LCD Operator doesn't turn ON | LCD Operator is in the automatic extinction mode. | <ul style="list-style-type: none"> • The screen is lit by pressing a key on the LCD Operator. • The automatic extinction function can be disabled in the LCD Operator system setting. |
| |  | |
| | The brightness of LCD Operator display is set to low. | The brightness of the display is adjustable by changing the light control setting in the LCD Operator system setting. |
| |  | |
| | LCD Operator is about to come off. | The issue will be solved by remounting the LCD Operator. (Check the RJ45 connector.) |
|  | | |
| The liquid crystal has reached the end of its life. | Replacement of the LCD Operator is required. | |








| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|--|---|
| The motor doesn't rotate although an operation command was entered. | The inverter is tripping. | <ul style="list-style-type: none"> When the inverter trips due to an error, you need to remove the error factor and reset the inverter. See 12-2 <i>Error No. and Its Measure</i> on page 12-5 in this chapter. |
| | |  |
| | A warning is issued. | <ul style="list-style-type: none"> If a warning is issued, you need to eliminate the data inconsistency. See 12-3-2 <i>Checking Inconsistent Settings</i> on page 12-29 in this chapter. |
| | |  |
| | The operation command isn't entered. | The operation command destination may be wrong, or the operation command may not be accepted. ⇒ Proceed to Operation command destination or operation command is wrong. |
| | |  |
| | The frequency command destination isn't entered. | The frequency command destination may be wrong, or the frequency command may be 0. ⇒ Proceed to Frequency command destination or frequency command is wrong. |
| | |  |
| | A shutoff function is at work. | The function safety terminal, terminal function [RS], or [FRS] terminal may be enabled, or [ROK] terminal may be disabled. ⇒ Proceed to A shutoff function is at work. |
| | |  |
| | A limit function is at work. | The command direction may be limited by the rotation direction limit function. ⇒ Proceed to A limit function is at work. |
| | |  |
| Motor is locked. | If the motor shaft is locked by something which hinders the brake or the motor revolution (e.g., clogging), the cause needs to be removed. | |
| |  | |
| Wiring or the like is disconnected. | Check for abnormalities such as disconnection of the output line to the motor or disconnection within the motor. | |





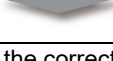

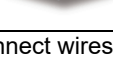

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|---|---|
| Operation command destination or operation command is wrong. | Even though the operation command is entered, the motor does not drive. | If the LED for RUN on the LCD Operator is lit or the operation display appears, the operation command has been entered normally. There is another factor for why the motor is not driven. ⇒ Return to The motor doesn't rotate although an operation command was entered. |
| |  | |
| | The operation command destination and the operation command input are not the same. | Check the operation command destination. Check [AA111] and the terminal function. See 6-3 <i>Operation Command Settings</i> on page 6-19 for details. |
| |  | |
| | You want to make operation from the LCD Operator but had made the different setting. | Confirm that "oFW" or "oRV" is shown on the LCD Operator. If it is not shown, then confirm that the operation command selection [AA111] is set to 02 RUN key on operator keypad. If it is shown, the terminal function needs to be checked. |
| |  | |
| You want to make operation from the [FW] terminal but had made the different setting. | Set the operation command selection [AA111] to 00 [FW/RV] terminal. If RUN is not shown when the [FW] terminal is turned ON, other terminal functions need to be checked. | |
|  | | |
| There is a cause other than the operation command. | <ul style="list-style-type: none"> • If the LCD Operator doesn't show RUN, a shutoff function or the main power supply may not be turned ON. • There is another factor for why the motor is not driven. ⇒ Return to The motor doesn't rotate although an operation command was entered. | |

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|--|--|
| Frequency command destination or frequency command is wrong. | <ul style="list-style-type: none"> Frequency command is 0. [dA-04] has been 0. | The frequency command destination may be wrong, or the setting of the command destination or the input voltage of frequency setter may be 0. Set the value other than 0 for the setting destination. |
| |  | |
| | Frequency command destination is wrong. | Check the frequency command destination. Check [AA101] and the terminal function. See 6-4 <i>Frequency Command Settings</i> on page 6-25 for details. |
| |  | |
| | You want to set the frequency command but [FA-01] has been 0. | Set the operation command selection [AA101] to 02: Key on LCD Operator, and then change the setting of [Ab110]. |
| |  | |
| | [FA-01] has been 0 even though the frequency setter is operated. | Set the main speed command selection [AA101] to 07: Parameter setting, and change [FA-01] from the LCD Operator. |
|  | | |
| [FA-01] is not 0, and there is a cause other than the frequency command. | <ul style="list-style-type: none"> If data appears in [FA-01], the frequency command is normal. There is another factor for why the motor is not driven. ⇒ Return to The motor doesn't rotate although an operation command was entered. | |

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|---|--|
| A shutoff function is at work. | The main power supply is not turned ON. | When the power supply is separated to R, S, T and R0, T0 (J51 connector section), the inverter can not be operated if the R, S, T, side power is down. The power supply check is required. |
| |  | |
| | [RS] terminal is ON. | If the [RS] terminal is ON, the inverter enters the reset mode and does not accept operation commands. The [RS] terminal needs to be turned OFF. |
| |  | |
| | [FRS] terminal is ON. | If the [FRS] terminal is ON, the inverter enters the free-run stop mode and does not accept operation commands. The [FRS] terminal needs to be turned OFF. |
| |  | |
| | [CS] terminal is ON. | If the [CS] terminal is ON, the inverter enters the mode switched to commercial power supply shutoff and does not accept operation commands. Check the commercial switching function. |
| |  | |
| | The [ROK] terminal has been assigned and is turned OFF. | When the [ROK] terminal is used, if the terminal function is OFF, the inverter does not accept operation commands. Check the operation permission signal. |
| |  | |
| | STO terminal is not wired or is in OFF state. | If you do not use the function of STO terminal, you need to attach a short-circuit wire to it. |
| |  | |
| The inverter is tripping. | When the inverter is tripping, it does not accept operation commands. Identify the factors for trip. | |
|  | | |
| Shutoff functions are not on. | If shutoff functions are not on and the motor is not driven, there is another factor. ⇒ Return to The motor doesn't rotate although an operation command was entered. | |

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|--|--|
| A limit function is at work. | The operation permission signal has been assigned to the input terminal function and the signal is turned OFF. | When the operation permission signal has been assigned, the operation permission signal needs to be turned ON. |
| |  | |
| | The command is given to the direction the operation is limited. | Check the operation command direction limit. |
| |  | |
| Motor speed doesn't rise. | Both [FW] terminal and [RV] terminals are turned ON by operation command from input terminal. | If both [FW] terminal and [RV] terminal are turned ON, input inconsistency is generated and the inverter stops. Use only either one of them to operate the inverter. |
| | The overload limit function is at work. | <ul style="list-style-type: none"> The overload limit function suppresses the current by dropping the frequency when the output current exceeds the overload limit level. Raising the setting level may improve the situation. |
| |  | |
| | The frequency command is limited. | If the upper limiter and the maximum frequency is set to low level, the situation will be improved by setting them to higher level. To limit frequencies, use the upper limiter function instead of the maximum frequency. |
| |  | |
| | The frequency command is low. | The command becomes lower when a more prioritized frequency command such as for jogging or multi-speed command is entered. Re-examination of the terminal function and frequency command destination are required. |
| |  | |
| The parameter you are looking for is not shown. | Acceleration time is long. | If the acceleration time is set long, acceleration becomes slow. Set the acceleration time short. |
| | The display limit has been set. | Display limit function may be working. Cancel the display limit selection [UA-10]. |
| |  | |
| Keypad operator cannot be operated. | The display is fixed. | Operation on the LCD Operator isn't accepted if the input terminal function 102 [DISP] is ON. Turn OFF the terminal. |
| | The display is fixed. | Operation on the LCD Operator isn't accepted if the input terminal function 102 [DISP] is ON. Turn OFF the terminal. |
| Setting cannot be made. | Inverter is running. | Some parameters cannot be changed while the inverter is running. If that is the case, turn OFF the inverter once. |

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|---|---|--|
| Motor rotates in a reverse direction. | The wires connected to the motor are in wrong phase sequence. | Swapping two phases of wires connected to the motor changes the direction of rotation. |
| |  | |
| | When the RUN key on the LCD Operator is used, the rotation direction setting is wrong. | [AA-12] RUN key direction needs to be switched. |
| |  | |
| | When the 3-wire function is used, the input of input terminal function F/R is reversed. | Check the logic of 3-wire normal rotation / reverse rotation terminal (018[F/R]). |
| Noises of motor and machines are noisy. | Carrier frequency is set low. | Raise the carrier frequency setting [bb101]. However, this may increase noise generated in the inverter and leakage currents from the inverter. In addition, derating is required to the output current depending on the models. |
| |  | |
| | The revolution frequency of motor and the natural frequency of machines resonate. | Change the set frequency. If a resonance occurs during acceleration/deceleration, avoid the resonance frequency in settings of the frequency jump functions [AG101] to [AG106]. |
| Output frequency becomes unstable. | Inadequate parameters are used. | Find out the basic parameter settings for motor and set them accordingly. |
| |  | |
| | Load fluctuates significantly. | Re-examination of capacity of both motor and inverter may be required. |
| |  | |
| | PS voltage fluctuates. | Use of the optional reactor ALI or DCL, or a noise filter on the input side to minimize the power fluctuation may improve the situation. |
| Torque is not generated. | V/f control is used. | Use torque boost, sensorless vector control, or other control instead. |
| |  | |
| | The inverter is used for lowering. | Use a braking resistor or regenerative braking unit if the torque is not sufficient for regenerative operation. |
| |  | |
| | The load is too heavy. | Re-examination of capacity of both motor and inverter may be required. |
| LCD operator disconnection error is issued. | Operation selection at disconnection of operator is inappropriate. | Set the operation selection at disconnection of operator to 02 (Ignore). |

| Occurrence | Estimated cause(s) | Exemplar measures to be taken |
|--|--|--|
| Operation/setting of Modbus communication cannot be made. | Changes made to communication parameters haven't been reflected. | If you changed [CF-01] to [CF-38], turn OFF the control power supply and restart. |
| |  | |
| | The operation command selection is not set to RS485. | Check that operation command selection [AA111] is set to 03 (RS485). |
| |  | |
| | The frequency command selection is not set to RS485. | Check that the main speed command selection [AA111] is set to 03 (RS485). |
| |  | |
| | The communication speed setting is wrong. | Set the correct value in [CF-01], then turn OFF the control power supply and restart. |
| |  | |
| | Station numbers are wrongly set or overlapping each other. | Set the correct value in [CF-02], then turn OFF the control power supply and restart. |
| |  | |
| | The communication parity setting is wrong. | Set the correct value in [CF-03], then turn OFF the control power supply and restart. |
| |  | |
| | The communication stop bit setting is wrong. | Set the correct value in [CF-04], then turn OFF the control power supply and restart. |
|  | | |
| | Wiring is wrong. | Connect wires properly to the SP and SN terminals on the control circuit terminal block. |
| The earth leakage circuit breaker is activated as the inverter is operated. | Leakage currents in the inverter are large. | <ul style="list-style-type: none"> Lower the carrier frequency [bb101]. Raise the sensitivity current in the earth leakage circuit breaker, or replace the breaker with the one with higher sensitivity current. |
| DC braking is disabled. | The DC braking force is not set. | Set DC braking force at the time of the stop [AF105] and DC braking force at the start [AF108]. |
| |  | |
| | The DC braking time is not set. | Set DC braking time at the time of the stop [AF106] and DC braking time at the start [AF109]. |
| Noises enter a TV and radio near the inverter. | Radiation noise from the inverter | <ul style="list-style-type: none"> Locate the inverter wires as far as possible from a TV and radio. Install ZCL to the main power supply input of the inverter and the inverter output. |

13

Maintenance and Inspection

| | |
|--|-------------|
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| 13-4 Cleaning | 13-8 |
| 13-5 Test Methods | 13-9 |
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| 13-5-6 Life Alarming Output | 13-14 |

13-1 Daily Inspection

Check the followings while the inverter is running.

| No. | Description | Check |
|-----|---|--------------------------|
| 1 | The motor operates according to the settings | <input type="checkbox"/> |
| 2 | There is no abnormality in the environment where the device is installed. | <input type="checkbox"/> |
| 3 | There is no abnormality in the cooling system. | <input type="checkbox"/> |
| 4 | No abnormal vibration or sound is observed. | <input type="checkbox"/> |
| 5 | No abnormal overheat or discoloration is observed. | <input type="checkbox"/> |
| 6 | No abnormal smell is observed. | <input type="checkbox"/> |

While the inverter is running, check the input voltage of inverter using a tester, etc.

| No. | Description | Check |
|-----|---|--------------------------|
| 1 | There is no frequent occurrence of variation of power supply voltage. | <input type="checkbox"/> |
| 2 | Line voltage keeps a good balance. | <input type="checkbox"/> |

13-2 Periodic Inspection

Check sections that cannot be inspected unless operation is stopped and sections requiring periodic inspection.

| No. | Description | Check |
|-----|---|--------------------------|
| 1 | There is no abnormality in the cooling system. Cleaning of the air filter and other components | <input type="checkbox"/> |
| 2 | Checking tightness and re-tightening Due to effects of vibration or temperature change, tightened portions of screws or bolts may loosen. Make sure to carefully check and perform the work. | <input type="checkbox"/> |
| 3 | No corrosion or damage is observed on the conductors and insulators. | <input type="checkbox"/> |
| 4 | Measurement of insulation resistance | <input type="checkbox"/> |
| 5 | Checking and replacing the cooling fan, smoothing capacitor, and relay | <input type="checkbox"/> |

13-3 Inspection Items

| Target section | Item | Details | Interval | | | Method | Criteria | Measurement instrument |
|----------------|----------------------|---|----------|----------|---------|---|---|---------------------------------------|
| | | | Daily | Periodic | | | | |
| | | | | 1 year | 2 years | | | |
| General | Ambient environment | Check the ambient temperature, humidity, dust, etc. | ○ | | | See the installation method. | The ambient temperature and humidity are within the usable range. No freezing, condensation, dust, corrosive gas, explosive gas, flammable gas, mist of grinding fluid, hydrogen sulfide, and salts are permissible | Thermometer Hydrometer Recorder |
| | Entire device | No abnormal vibration or sound is observed. | ○ | | | By visual check and hearing | There must be no abnormality. | |
| | Power supply voltage | The main circuit voltage is normal. | ○ | | | Measure line voltage between inverter main circuit terminals R, S, and T. | They are within the allowable variation range of AC voltage. | Tester and digital multimeter |

| Target section | Item | Details | Interval | | | Method | Criteria | Measurement instrument |
|----------------|---|---|----------|----------|---------|---|---|------------------------|
| | | | Daily | Periodic | | | | |
| | | | | 1 year | 2 years | | | |
| Main circuit | General | (1) Megger check (between the main circuit terminals and earth terminals) | | ○ | | Remove the input/output wires of main circuit terminal block of the inverter, remove the control terminal block board, then, remove the short bar for switching the functions of filter included in the inverter. Then, using a megger, perform measurement between each portion where R, S, T, U, V, W, P, PD, N, RB, R0, and T0 terminals are shorted and earth terminal. | The measured value shall be 5 MΩ or above. | 500-VDC class megger |
| | | (2) Fastened portions are not loosened. | | ○ | | Re-tighten the portion. | There must be no abnormality. | |
| | | (3) No residual mark of overheat is observed on each component. | | ○ | | By visual check. | There must be no abnormality. | |
| | Connected conductor and wire | (1) The conductor is not distorted. | | ○ | | By visual check. | There must be no abnormality. | |
| | | (2) The coatings of wires are not torn. | | ○ | | | | |
| | Terminal block | It is not damaged. | | ○ | | By visual check. | There must be no abnormality. | |
| | Inverter Converter (including resistor) | Check resistance between each terminal | | | ○ | Remove the wires of the main circuit terminal block of inverter, and perform measurement between terminals R, S, T and terminals P, N, and between terminals U, V, W and terminals P, N at the range of tester ×1 Ω. | See 13-5-3 <i>Checking Method of Inverter and Converter</i> on page 13-10. Appropriate replacement interval of inverter, converter, and thyristor Start/stop: 10 ⁶ cycles *1 | Analog tester |
| | Smoothing capacitor | (1) There is no leakage of fluid. | | ○ | | By visual check. | There must be no abnormality. Appropriate service years for replacement: 10 years *1 *2 *3 | |
| | | (2) The belly (safety valve) shall not stick and there shall be no bump. | | | ○ | | | |
| | Relay | (1) There shall be no beat noise during operation. | | | ○ | By hearing. | There must be no abnormality. | |
| | | (2) There are no worn contacts. | | | ○ | By visual check. | There must be no abnormality. | |

| Target section | Item | Details | Interval | | | Method | Criteria | Measurement instrument |
|------------------------------------|-----------------------|--|----------|----------|---------|--|---|--|
| | | | Daily | Periodic | | | | |
| | | | | 1 year | 2 years | | | |
| Control circuit Protective circuit | Operation check | (1) Through unit operation of inverter, check balance of output voltage between each phase. | | ○ | | Measure line voltage between inverter main circuit terminals U, T, and W. | Inter-phase voltage balance 200 V class: To be within 4 V. 400 V class: To be within 8 V. | Digital multimeter Flowmeter Voltmeter |
| | | (2) By conducting the sequence protective operation test, check there is no abnormality in protective operation and display circuit. | | ○ | | Simulate short or open condition of the protective circuit output of inverter. | The error is generated on the sequence. | |
| Cooling system | Cooling fan | (1) No abnormal vibration or sound is observed. | ○ | | | By hearing and visual check. (Warning indication on the operator keypad) | To rotate smoothly. There must be no abnormality. Wind brows in upper section. | |
| | | (2) Connections are not loosened. | | ○ | | By visual check. | Appropriate service years for replacement: 10 years *1 *4 *5 | |
| | Cooling fin | There is no clogging. | | ○ | | By visual check. | There is no clogging. | |
| Indication | Indication | (1) The LED lamp and screen display are normal. | ○ | | | By visual check. | Check the lamp/display lights up. | |
| | | (2) Cleaning. | | ○ | | Clean with a waste cloth. | | |
| | External meter | The indicated values are normal. | ○ | | | Check indicated values of the meters on the boards. | Satisfy the specification values and control values. | Voltmeter, ammeter, etc. |
| Motor | General | (1) No abnormal vibration or sound is observed. | ○ | | | By hearing, sensing, and visual check. | There must be no abnormality. | |
| | | (2) No abnormal smell is observed. | ○ | | | Check for abnormal smell due to overheat, damage, etc. | There must be no abnormality. | |
| | Insulation resistance | Megger check (between the main circuit terminals and earth terminals) | | | *6 | Disconnect U, V, and W inverter main circuit terminals, short the motor line (for three phases), and perform measurement between the motor wire and earth terminal using a megger. | The measured value shall be 5 MΩ or above. | 500-VDC class megger |

*1. The replacement period (number of years/cycles) and 13-5-5 Smoothing Capacitor Life Curve on page 13-13 are based on the designed expected life, which is not a guaranteed value.

*2. The service life of smoothing capacitor is affected by the ambient temperature. See 13-5-5 Smoothing Capacitor Life Curve on page 13-13 to determine replacement period.

- *3. When you replace with a capacitor that has passed storage period more than three years, perform aging in the following conditions before using it.
 - Initially apply 80% of rated voltage of capacitor for one hour in normal temperature
 - Then, increase the voltage to 90% and apply for one hour
 - Lastly, apply rated voltage for five hours in normal temperature
- *4. The life of cooling fan varies depending on the environment conditions such as ambient temperature and dust. Check operating conditions by daily inspection.
- *5. If the cooling fan is locked due to dust, etc., it takes about 5 to 10 seconds until re-rotation is enabled even if dust is removed.
- *6. Perform inspection in accordance with the instruction manual of motor.

13-4 Cleaning

Make sure to always keep the inverter clean for operation.

| No. | Description | Check |
|-----|--|--------------------------|
| 1 | For cleaning, lightly wipe off dirt with a soft cloth dampened with neutral detergent. | <input type="checkbox"/> |
| 2 | Solvents such as acetone, benzene, toluene, and alcohol may cause the inverter surface to dissolve or its coating to peel off, therefore, do not use them. | <input type="checkbox"/> |
| 3 | Do not clean the display section including the operator keypad using a detergent or alcohol. | <input type="checkbox"/> |

13-5 Test Methods

13-5-1 Megger Test

When conducting megger test on the external circuit, remove all terminals of the inverter to avoid applying the test voltage is not applied to the inverter.

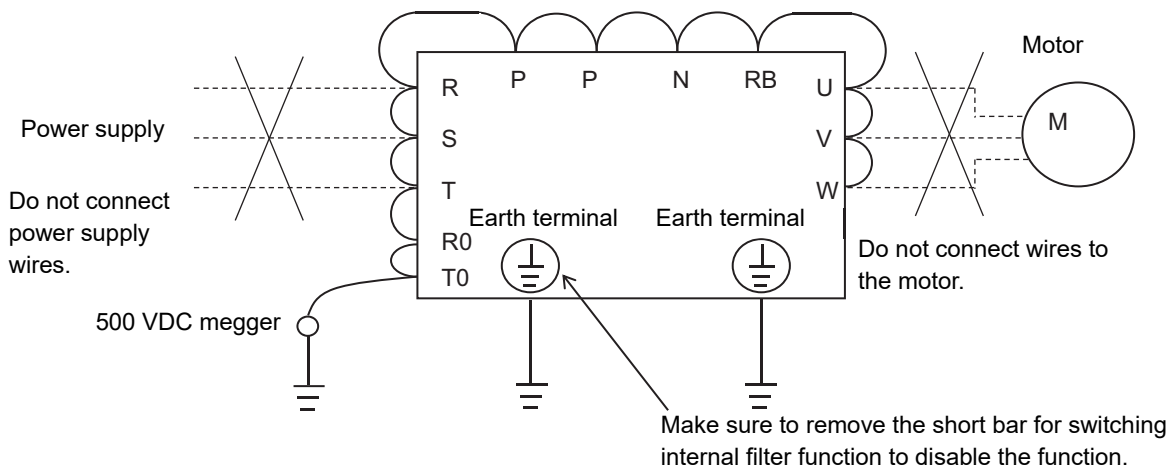
For energization test on the control circuit, use a tester (high-resistance range), and do not use a megger or buzzer.

Conduct megger test for the inverter itself only on the main circuit, and do not perform megger test on the control circuit.

For megger test, use a 500 VDC megger.

Before conducting a megger test on the inverter main circuit, make sure to remove the short bar for switching the filtering function included in the inverter, and short terminals R, S, T, U, V, W, P, PD, N, RB, R0, and T0 as shown in the figure below.

After megger test, remove the wires on which R, S, T, U, V, W, P, PD, N, RB, R0, and T0 terminals that are shorted, and connect the short bar for switching the filter function included in the inverter to the original position.



13-5-2 Pressure Test

Do not perform pressure test.

If pressure test is conducted, it is dangerous because the components inside the inverter may be damaged or deteriorated.

13-5-3 Checking Method of Inverter and Converter

Using a tester, you can check the condition of inverter and converter if it is good or bad.

(preparation)

- 1** Remove the power lines connected from an external source (R, S, T), wires connecting to the motor (U, V, W), and regenerative braking resistor (P, RB).
- 2** Prepare a tester. (The range used is 1Ω resistance measurement range.)

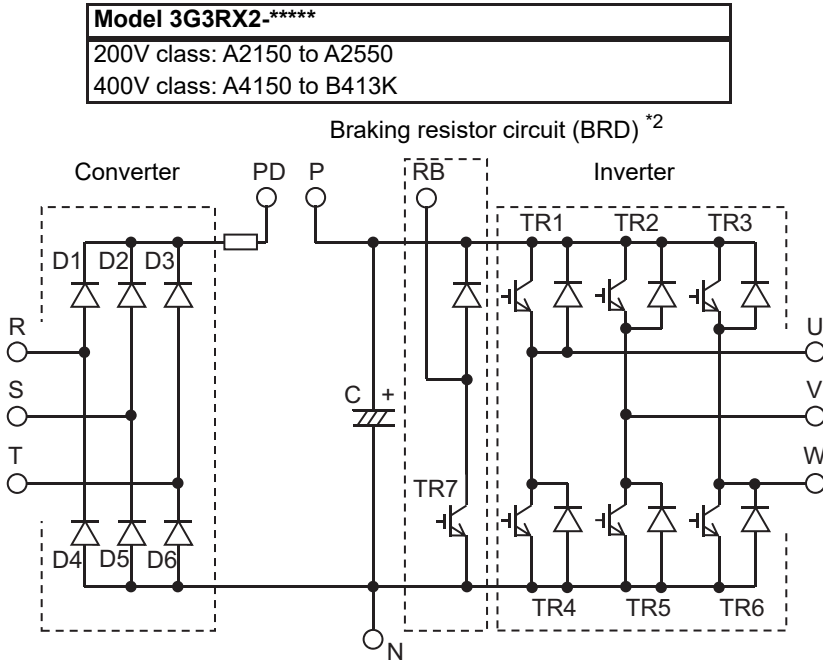
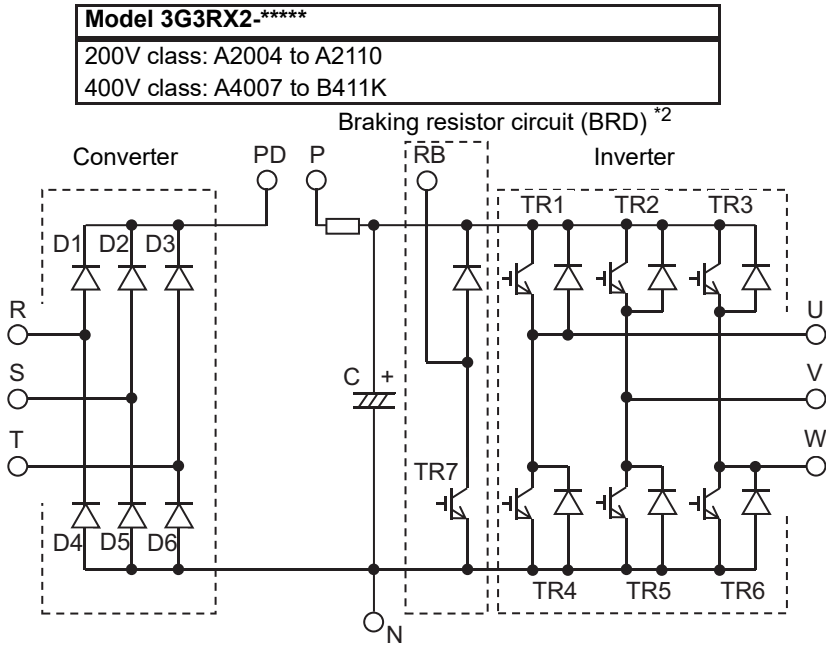
(Checking method) *1

You can determine the good-or-bad condition of conduction status of terminals on the inverter main circuit terminal block R, S, T, U, V, W, RB, P, and N by alternately changing the polarity of tester for measurement.

*1. By measuring the voltage between P and N in the DC voltage range, check that electricity is fully discharged from the smoothing capacitor before performing check.

| | | Tester polarity | | Measured value *1 |
|-----------|-----|-----------------|-----------|-------------------|
| | | ⊕ (Red) | ⊖ (Black) | |
| Converter | D1 | R | PD | Non-conductive |
| | | PD | R | Conductive |
| | D2 | S | PD | Non-conductive |
| | | PD | S | Conductive |
| | D3 | T | PD | Non-conductive |
| | | PD | T | Conductive |
| | D4 | R | N | Conductive |
| | | N | R | Non-conductive |
| | D5 | S | N | Conductive |
| | | N | S | Non-conductive |
| | D6 | T | N | Conductive |
| | | N | T | Non-conductive |
| Inverter | TR1 | U | P | Non-conductive |
| | | P | U | Conductive |
| | TR2 | V | P | Non-conductive |
| | | P | V | Conductive |
| | TR3 | W | P | Non-conductive |
| | | P | W | Conductive |
| | TR4 | U | N | Conductive |
| | | N | U | Non-conductive |
| | TR5 | V | N | Conductive |
| | | N | V | Non-conductive |
| | TR6 | W | N | Conductive |
| | | N | W | Non-conductive |
| BRD | TR7 | RB | P | Non-conductive |
| | | P | RB | Conductive |
| | | RB | N | Non-conductive |

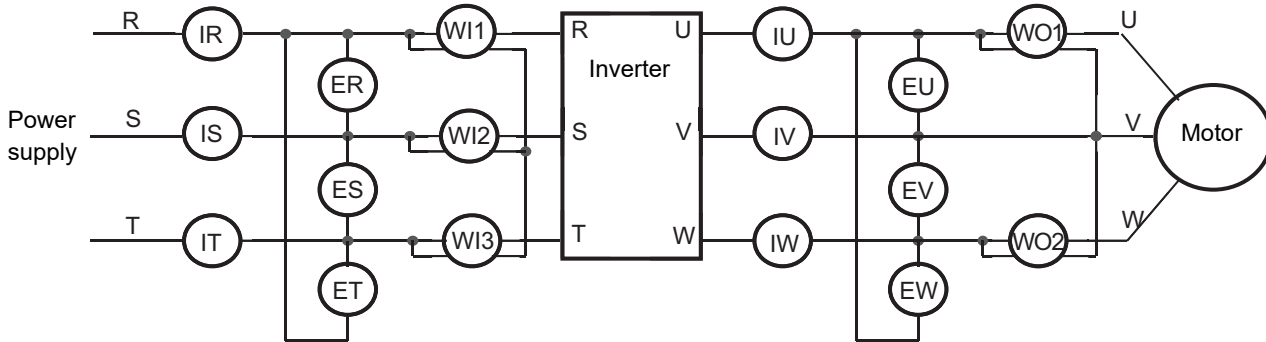
*1. When electricity is not conducted, a nearly infinite value is demonstrated. Due to effects of the smoothing capacitor, electricity may be conducted instantly, not showing an infinite value. When electricity is conducted, a numeric value range will be indicated from some to dozens in a unit of Ω. The values vary depending on the element type, tester, type, etc. However, it is acceptable if numeric values obtained for each item are nearly the same. The measured value may be varied some degree in Ω by the reason of the preventing inrush current of current limiting resistor.



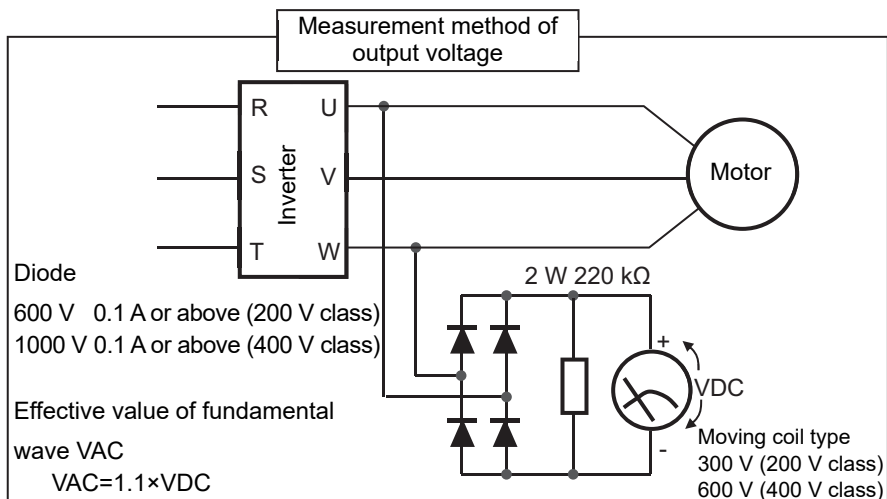
*2. The braking circuit (BRD) section is equipped as standard on the following models:
 3G3RX2-A2004 to 3G3RX2-A2220
 3G3RX2-A4007 to 3G3RX2-A4370

13-5-4 Measurement Method of I/O Voltage, Current, and Power

The following shows general measurement instruments used for measurement of input/output voltage, current, and power.



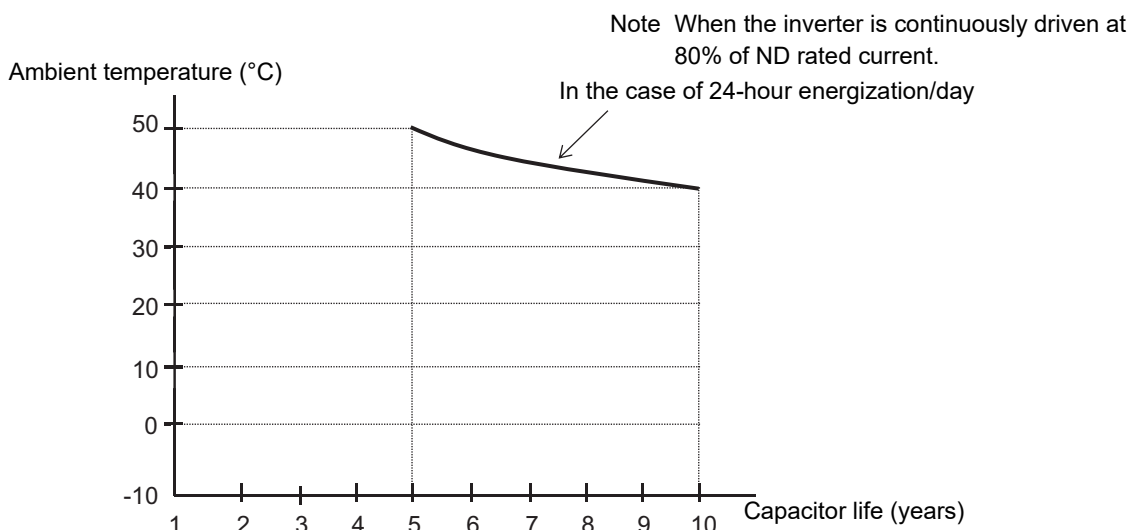
| Measurement item | Target section | Measurement instrument | Remarks | Criteria |
|--------------------------------------|--|---|-------------------------------------|--|
| Power supply voltage E_{IN} | Between R-S, S-T, and T-R (E_R), (E_S), (E_T) | Moving iron voltmeter or Rectifier type voltmeter | All effective values | 200 V class: 200-240 V 50/60 Hz 400 V class: 380-500 V 50/60 Hz |
| Power supply current I_{IN} | Current of R, S, and T (I_R), (I_S), (I_T) | Moving iron ammeter | All effective values | If input current is imbalanced $I_{IN} = (I_R + I_S + I_T) / 3$ |
| Power from power supply W_{IN} | Between R-S, S-T, and T-R (W_{I1})+(W_{I2})+(W_{I3}) | Electrodynamometer type wattmeter | All effective values | Three wattmeter method |
| Power rate of power supply P_{fIN} | This value is calculated using measurement values of power supply voltage E_{IN} , power supply current I_{IN} , and power supply power W_{IN} . $P_{fIN} = \frac{W_{IN}}{\sqrt{3} \cdot E_{IN} \cdot I_{IN}} \times 100$ | | | |
| Output voltage E_{OUT} | Between U-V, V-W, and W-U (E_U), (E_V), (E_W) | See the figure below or Rectifier type voltmeter | Effective value of fundamental wave | |
| Output current I_{OUT} | Current of U, V, and W (I_U), (I_V), (I_W) | Moving iron ammeter | All effective values | |
| Output power W_{OUT} | Between U-V and V-W (W_{O1})+(W_{O2}) | Electrodynamometer type wattmeter | All effective values | Two wattmeter method (or three wattmeter method) |
| Output power factor P_{fOUT} | This value is calculated using measurement values of output voltage E_{OUT} , output current I_{OUT} , and output power W_{OUT} . $P_{fOUT} = \frac{W_{OUT}}{\sqrt{3} \cdot E_{OUT} \cdot I_{OUT}} \times 100$ | | | |



- Note 1. Use an instrument that indicates effective values of fundamental wave for output voltage, and use instruments that indicate all effective values for current and power.
2. The output waveform of inverter generates errors especially at low frequency because it is a waveform control by PWM. Take care because a tester (general-purpose product) may not be adapted due to noise.

13-5 Test Methods

13-5-5 Smoothing Capacitor Life Curve

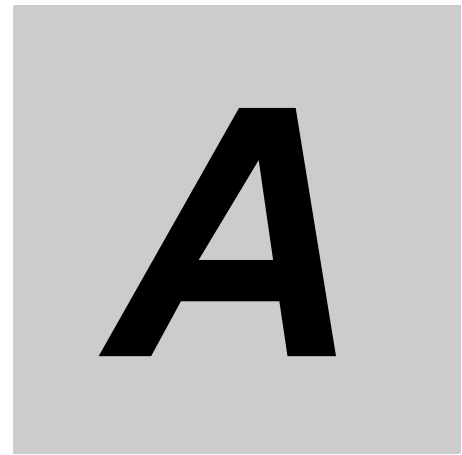


- Note 1. The ambient temperature is a temperature measured at a position about 5 cm from the bottom center of the inverter. (atmospheric temperature)
 If the inverter is stored inside the panel, it is in-panel temperature.
2. The smoothing capacitor is a finite life component which occurs chemical reaction inside, replacement is required after 10 years of use (It is a designed expected life, not a guaranteed value).
 However, if the inverter is used in an environment at high temperature or in a heavy-load environment where the its rated current is exceeded, the life is significantly shortened.

13-5-5 Smoothing Capacitor Life Curve

13-5-6 Life Alarming Output

When the life a component (smoothing capacitor or cooling fan on the board, excluding the main circuit smoothing capacitor) is near its end, an alarm can be generated based on self-diagnosis. Use this alarm as a sign of part replacement period. For details, see the life diagnosis monitor [dC-16] and output terminal function selection [CC-01] to [CC-07]. Note that alarms are generated based on diagnosis of designed expected life (not a guaranteed value). There will be differences due to use environments, operating conditions, etc. Please conduct maintenance in advance.



Appendices A

Technical Information

| | |
|---|------|
| A-1 Comparison of External Dimensions | A-2 |
| A-2 Parameter Comparison | A-10 |
| A-3 Overview of Inverter Selection | A-25 |

A

A-1 Comparison of External Dimensions

- A pitch for 3G3RX series V1 is compatible with one for 3G3RX2 series. When replacing, the pitch installation is available without the change of dimension.
- When installing 3G3RX2 series, refer to 1-3-4 External Dimensions on page 1-13.

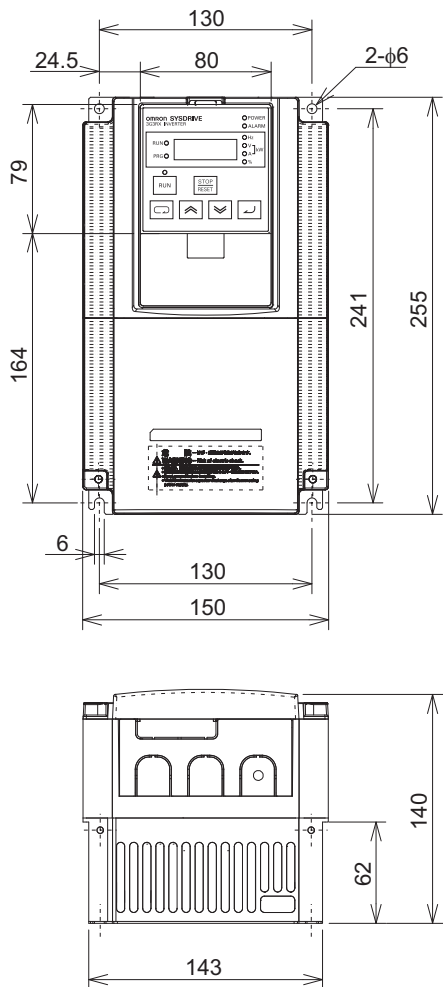


Precautions for Correct Use

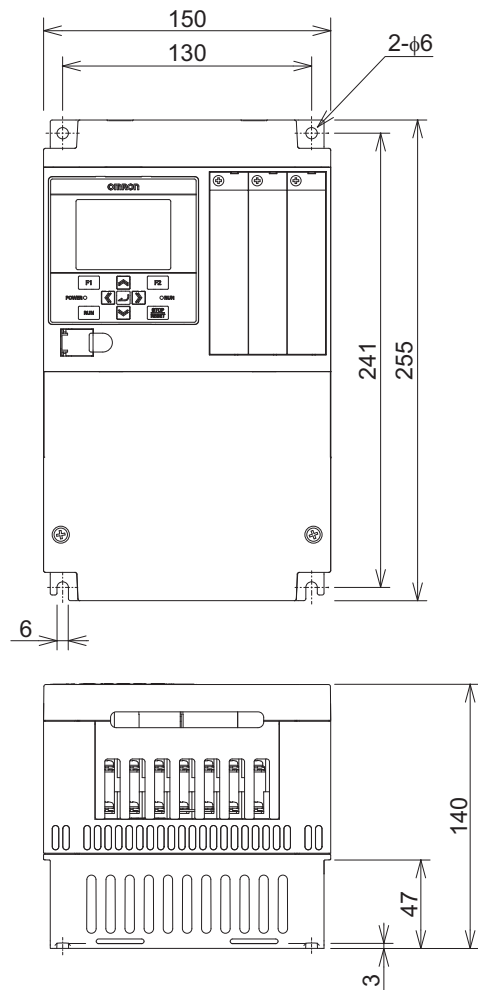
You can change the duty rating (ND/LD/VLD) on [Ub-03] Duty type selection.

3G3RX-series V1 and 3G3RX2-series

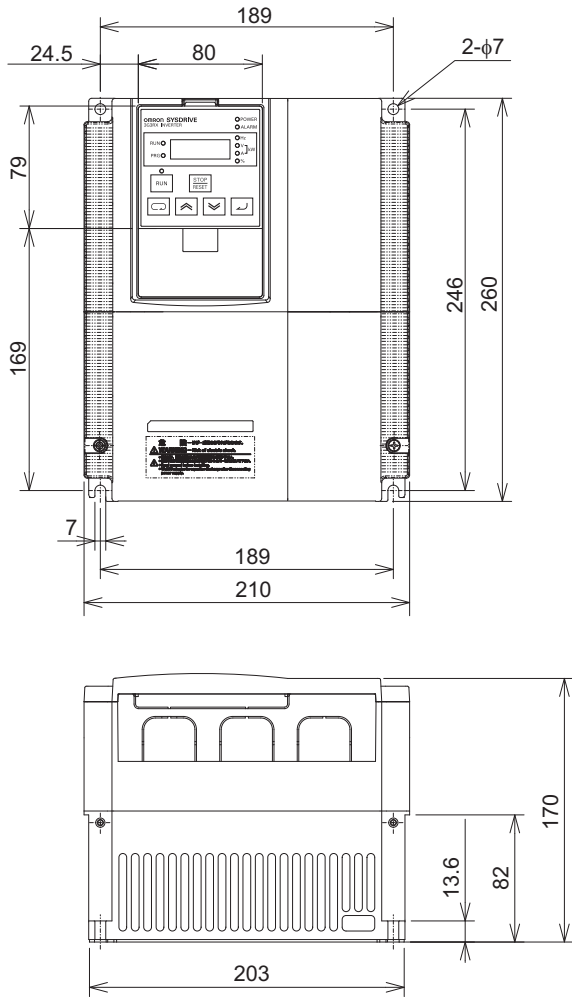
| 3G3RX-series V1 type | → | 3G3RX2-series |
|----------------------|---|---------------|
| 3G3RX-A2004- V1 | → | 3G3RX2-A2004 |
| 3G3RX-A2007- V1 | → | 3G3RX2-A2007 |
| 3G3RX-A2015- V1 | → | 3G3RX2-A2015 |
| 3G3RX-A2022- V1 | → | 3G3RX2-A2022 |
| 3G3RX-A2037- V1 | → | 3G3RX2-A2037 |
| 3G3RX-A4007- V1 | → | 3G3RX2-A4007 |
| 3G3RX-A4015- V1 | → | 3G3RX2-A4015 |
| 3G3RX-A4022- V1 | → | 3G3RX2-A4022 |
| 3G3RX-A4037- V1 | → | 3G3RX2-A4037 |



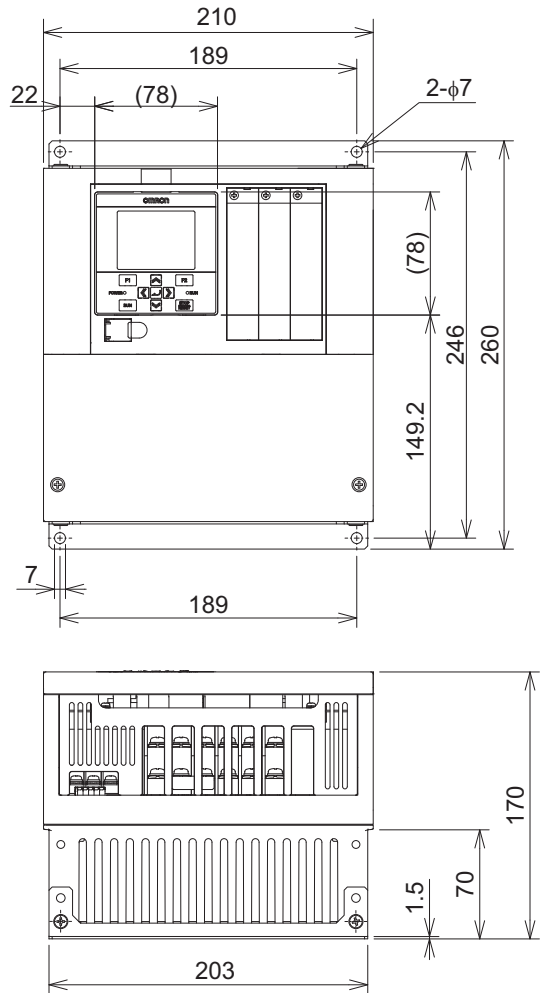
→



| 3G3RX-series V1 type | → | 3G3RX2-series |
|----------------------|---|----------------|
| 3G3RX-A2055- V1 | → | 3G3RX2-A2055 |
| 3G3RX-A2075- V1 | → | 3G3RX2-A2075 |
| 3G3RX-A2110- V1 | → | 3G3RX2-A2110*1 |
| 3G3RX-A4055- V1 | → | 3G3RX2-A4055 |
| 3G3RX-A4075- V1 | → | 3G3RX2-A4075 |
| 3G3RX-A4110- V1 | → | 3G3RX2-A4110 |



↓

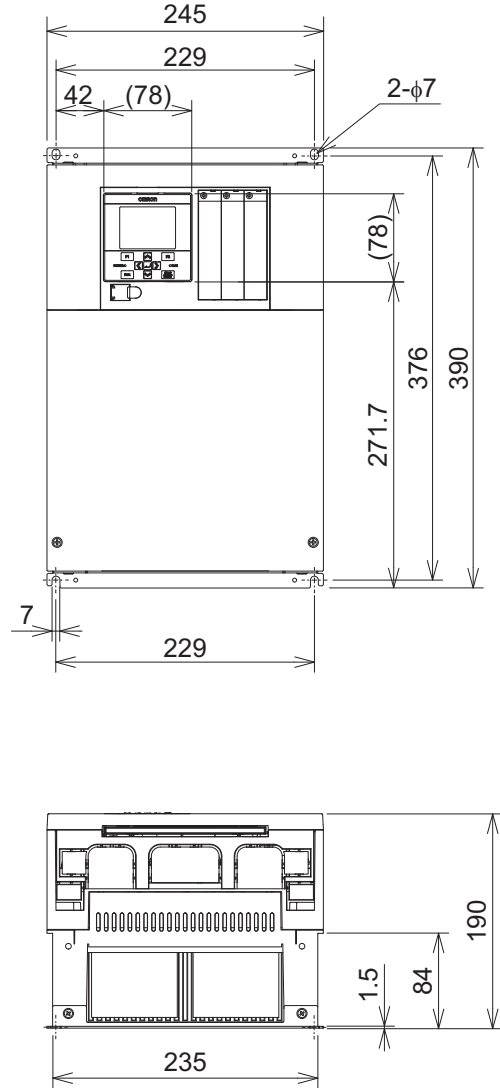
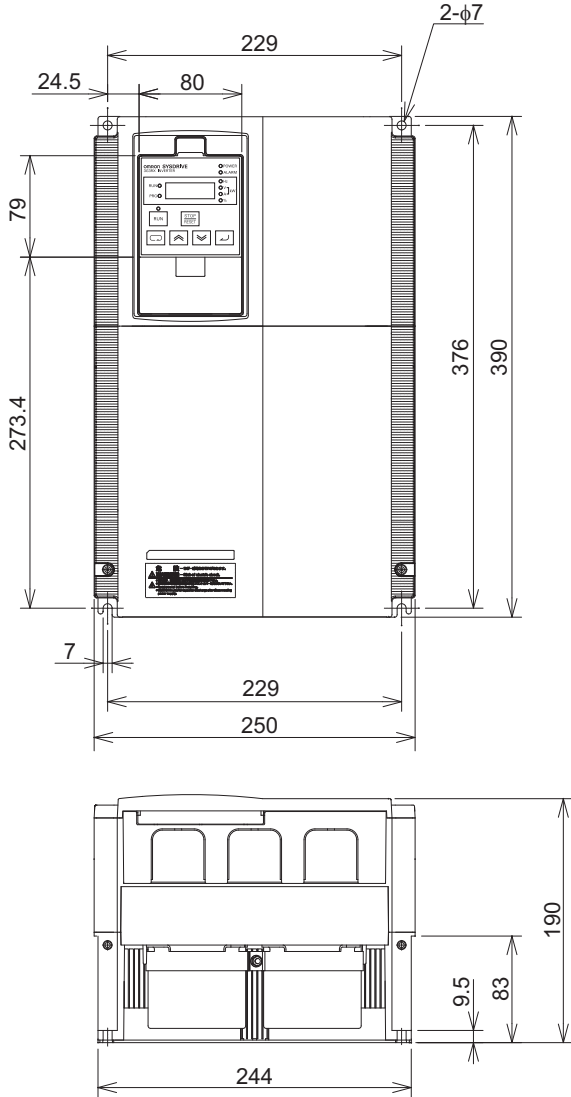


A-1 Comparison of External Dimensions

A

*1. When these series are used with 3G3RX2-A2110(LD)(VLD), the depth dimension gets large. As for the detail, refer to 2-1-2 Precaution for Installation on page 2-4.

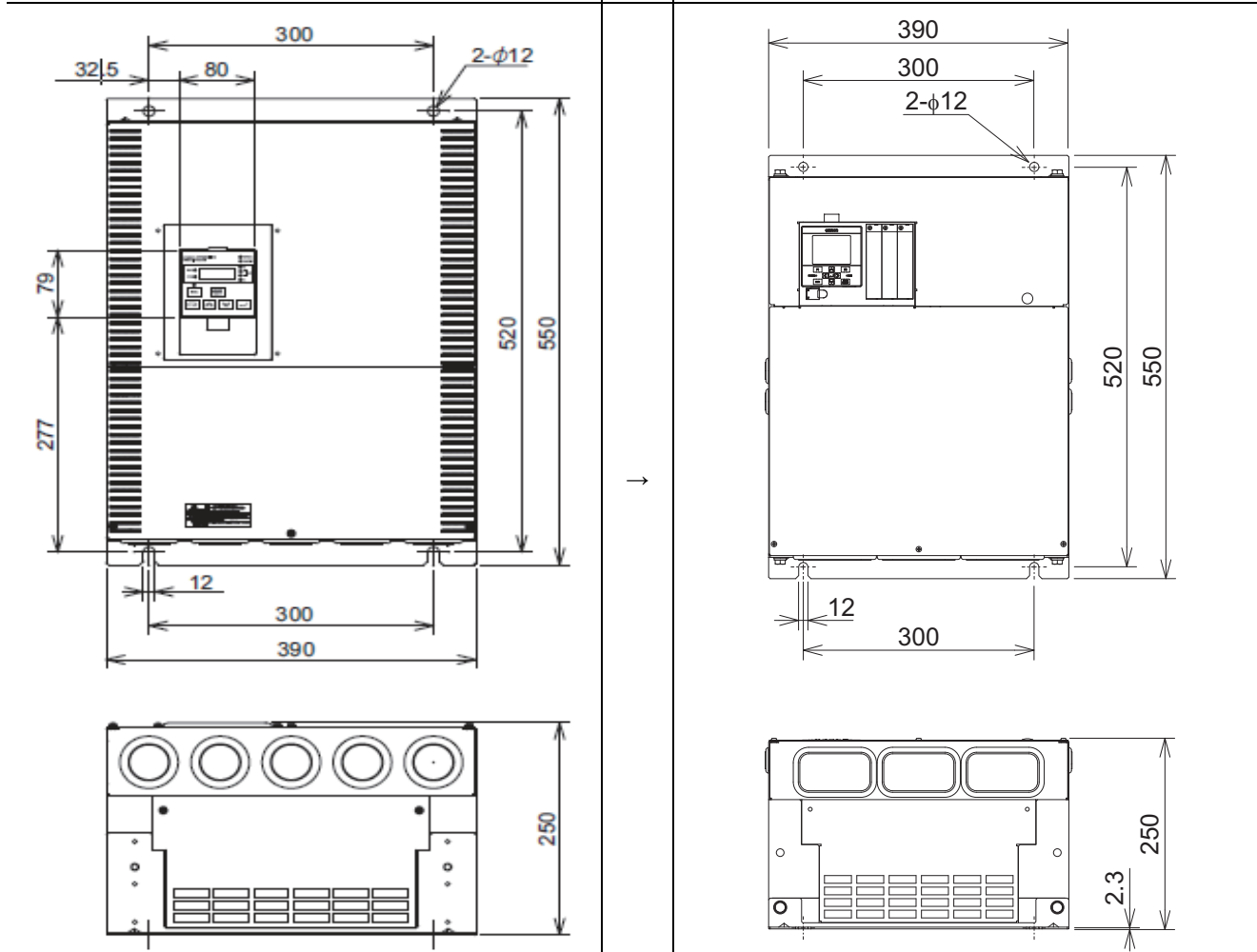
| 3G3RX-series V1 type | → | 3G3RX2-series |
|----------------------|---|----------------|
| 3G3RX-A2150- V1 | → | 3G3RX2-A2150 |
| 3G3RX-A2185- V1 | → | 3G3RX2-A2185 |
| 3G3RX-A2220- V1 | → | 3G3RX2-A2220*1 |
| 3G3RX-A4150- V1 | → | 3G3RX2-A4150 |
| 3G3RX-A4185- V1 | → | 3G3RX2-A4185 |
| 3G3RX-A4220- V1 | → | 3G3RX2-A4220 |



*1. When these series are used with 3G3RX2-A2220(VLD), the depth dimension gets large. As for the detail, refer to 2-1-2 Precaution for Installation on page 2-4.

| 3G3RX-series V1 type | → | 3G3RX2-series |
|--|--------------------------------------|--|
| 3G3RX-A2300 - V1 | → | 3G3RX2-A2300 |
| 3G3RX-A4300 - V1 | → | 3G3RX2-A4300 |
| <p>Technical drawing of the 3G3RX-series V1 type inverter. The front view shows a total width of 310 mm and a total height of 540 mm. The main body height is 510 mm. The top panel has a width of 265 mm and a height of 79 mm. There are two mounting holes of diameter 10 mm, spaced 80 mm apart from the center. The bottom panel has a height of 10 mm. The top view shows a total width of 310 mm and a total depth of 195 mm.</p> | <p style="text-align: center;">↓</p> | <p>Technical drawing of the 3G3RX2-series inverter. The front view shows a total width of 265 mm and a total height of 540 mm. The main body height is 510 mm. The top panel has a width of 300 mm and a height of 15 mm. There are two mounting holes of diameter 10 mm, spaced 265 mm apart from the center. The bottom panel has a height of 10 mm. The top view shows a total width of 265 mm and a total depth of 195 mm.</p> |

| 3G3RX-series V1 type | → | 3G3RX2-series |
|----------------------|---|---------------|
| 3G3RX-A2370- V1 | → | 3G3RX2-A2370 |
| 3G3RX-A2450- V1 | → | 3G3RX2-A2450 |
| 3G3RX-A4370- V1 | → | 3G3RX2-A4370 |
| 3G3RX-A4450- V1 | → | 3G3RX2-A4450 |
| 3G3RX-A4550- V1 | → | 3G3RX2-A4550 |



| 3G3RX-series V1 type | → | 3G3RX2-series |
|--|---|---|
| 3G3RX-A2550- V1 | → | 3G3RX2-A2550 |
| <p>Technical drawing of the 3G3RX-A2550- V1 inverter. The front view shows a width of 380 mm and a height of 700 mm. The top view shows a width of 480 mm and a height of 250 mm. Specific dimensions include 72.5 mm and 80 mm for the top panel, 79 mm for the top section height, 352 mm for the main body height, 12 mm for the bottom flange, and 2-φ12 for mounting holes.</p> | ↓ | <p>Technical drawing of the 3G3RX2-A2550 inverter. The front view shows a width of 480 mm and a height of 700 mm. The top view shows a width of 380 mm and a height of 250 mm. Specific dimensions include 380 mm for the top panel width, 2-φ12 for mounting holes, 670 mm for the main body height, 12 mm for the bottom flange, and 2.3 mm for the bottom panel thickness.</p> |

A-1 Comparison of External Dimensions

A

| 3G3RX-series V1 type | → | 3G3RX2-series |
|----------------------|---|---------------|
| 3G3RX-B4750- V1 | → | 3G3RX2-B4750 |
| 3G3RX-B4900- V1 | → | 3G3RX2-B4900 |

→

| 3G3RX-series V1 type | → | 3G3RX2-series |
|----------------------|---|---------------|
| 3G3RX-B411K- V1 | → | 3G3RX2-B411K |
| 3G3RX-B413K- V1 | → | 3G3RX2-B413K |

| | | |
|--|--------------------------------------|--|
| | <p style="text-align: center;">↓</p> | |
|--|--------------------------------------|--|

A-2 Parameter Comparison

In some cases, contents about parameters are different between 3G3RX-series V1 and 3G3RX2-series. After checking the descriptions about functions, set the parameters.

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|---|----------------|--|
| Display code | Function name | New code | |
| d001 | Output frequency monitor | dA-01 | |
| d002 | Output current monitor | dA-02 | |
| d003 | Operation direction monitor | dA-03 | |
| d004 | PID feedback monitor | dB-30 | |
| d005 | Intelligent input monitor | dA-51 | |
| d006 | Intelligent output monitor | dA-54 | |
| d007 | Frequency conversion monitor | dA-06 | |
| d008 | Real frequency monitor | dA-08 | |
| d009 | Torque command monitor | FA-15 | |
| d010 | Torque bias monitor | FA-16 | |
| d012 | Output torque monitor | dA-17 | |
| d013 | Output voltage monitor | dA-18 | |
| d014 | Input power monitor | dA-30 | |
| d015 | Integrated power monitor | dA-32 | |
| d016 | Cumulative operating hours monitor during RUN | dC-22 | |
| d017 | Cumulative power-on time | dC-24 | |
| d018 | Cooling fin temperature monitor | dC-15 | |
| d019 | Motor temperature monitor | dA-38 | |
| d022 | Life diagnostic monitor | dC-16 | |
| d023 | Program counter | dB-03 | |
| d024 | Program number monitor | dB-02 | |
| d025 | User monitor 0 | dB-08 | |
| d026 | User monitor 1 | dB-10 | |
| d027 | User monitor 2 | dB-12 | |
| d028 | Pulse counter monitor | dA-28 | |
| d029 | Position command monitor | FA-20 | |
| d030 | Current position monitor | dA-20 | |
| d060 | Inverter mode monitor | dC-01 dC-45 | The monitor can be checked with dC-01: duty type and dC-45: IM/SM. |
| d080 | Trip frequency monitor | | Display function is equipped on the LCD Operator |
| d081 | Trip history monitor 1 | | Display function is equipped on the LCD Operator |
| d082 | Trip history monitor 2 | | Display function is equipped on the LCD Operator |
| d083 | Trip history monitor 3 | | Display function is equipped on the LCD Operator |
| d084 | Trip history monitor 4 | | Display function is equipped on the LCD Operator |
| d085 | Trip history monitor 5 | | Display function is equipped on the LCD Operator |
| d086 | Trip history monitor 6 | | Display function is equipped on the LCD Operator |
| d090 | Warning monitor | | Display function is equipped on the LCD Operator |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|--|---------------|--|
| Display code | Function name | New code | |
| d102 | DC voltage monitor | dA-40 | |
| d103 | BRD load factor monitor | dA-41 | |
| d104 | BRD thermal load factor monitor | dA-42 | |
| F001 | Output frequency setting | FA-01 | |
| F002 | First acceleration time setting | AC120 | |
| F202 | Second acceleration time setting | AC220 | |
| F302 | Third acceleration time setting | | Abolition of third control |
| F003 | First deceleration time setting | AC122 | |
| F203 | Second deceleration time setting | AC222 | |
| F303 | Third deceleration time setting | | Abolition of third control |
| F004 | Operation direction selection | AA-12 | |
| A001 | Frequency command selection | AA101 | Addition of individual settings for second control |
| A002 | Operation command selection | AA111 | |
| A003 | First base frequency | Hb104/Hd104 | Hb104: IM, Hd104: SM(PMM) |
| A203 | Second base frequency | Hb204/Hd204 | Hb204: IM, Hd204: SM(PMM) |
| A303 | Third base frequency | | Abolition of third control |
| A004 | First maximum frequency | Hb105/Hd105 | Hb105: IM, Hd105: SM(PMM) |
| A204 | Second maximum frequency | Hb205/Hd205 | Hb205: IM, Hd205: SM(PMM) |
| A304 | Third maximum frequency | | Abolition of third control |
| A005 | AT terminal selection | | This function is substituted by the setting of AA101/AA102 and SCHG (input terminal 015) |
| A006 | O2 selection | | This function is substituted by the setting of Cb-22 |
| A011 | 0 start | Cb-03 | For Ai1 |
| A012 | 0 end | Cb-04 | For Ai1 |
| A013 | 0 start ratio | Cb-05 | For Ai1 |
| A014 | 0 end ratio | Cb-06 | For Ai1 |
| A015 | 0 start selection | Cb-07 | For Ai1 |
| A016 | Analog input filter | Cb-01 | For Ai1 (Ai2: Cb-11, Ai3: Cb-21) |
| A017 | Simplified sequence function selection | UE-02 | |
| A019 | Multistep speed selection | Ab-03 | |
| A020 | 0th speed of the 1st multi-step speed | Ab110 | |
| A220 | 0th speed of the 2nd multi-step speed | Ab210 | |
| A320 | 0th speed of the 3rd multi-step speed | | Abolition of third control |
| A021 | 1st speed of the multi-step speed | Ab-11 | |
| A022 | 2nd speed of the multi-step speed | Ab-12 | |
| A023 | 3rd speed of the multi-step speed | Ab-13 | |
| A024 | 4th speed of the multi-step speed | Ab-14 | |
| A025 | 5th speed of the multi-step speed | Ab-15 | |
| A026 | 6th speed of the multi-step speed | Ab-16 | |
| A027 | 7th speed of the multi-step speed | Ab-17 | |
| A028 | 8th speed of the multi-step speed | Ab-18 | |
| A029 | 9th speed of the multi-step speed | Ab-19 | |
| A030 | 10th speed of the multi-step speed | Ab-20 | |
| A031 | 11th speed of the multi-step speed | Ab-21 | |
| A032 | 12th speed of the multi-step speed | Ab-22 | |
| A033 | 13th speed of the multi-step speed | Ab-23 | |
| A034 | 14th speed of the multi-step speed | Ab-24 | |
| A035 | 15th speed of the multi-step speed | Ab-25 | |
| A038 | Jogging frequency | AG-20 | |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|---|---------------|---|
| Display code | Function name | New code | |
| A039 | Jogging selection | AG-21 | |
| A041 | First torque boost selection | AA121 | When A041 is set to 01, select 03: automatic boost for AA121. |
| A241 | Second torque boost selection | AA221 | When A241 is set to 01, select 03: automatic boost for AA221. |
| A042 | First manual torque boost volume | Hb141 | * Re-confirmation is required for setting. |
| A242 | Second manual torque boost volume | Hb241 | * Re-confirmation is required for setting. |
| A342 | Third manual torque boost volume | | Abolition of third control |
| A043 | First manual torque boost break point | Hb142 | * Re-confirmation is required for setting. |
| A243 | Second manual torque boost break point | Hb242 | * Re-confirmation is required for setting. |
| A343 | Third manual torque boost break point | | Abolition of third control |
| A044 | First control mode | AA121 | * Re-confirmation is required for setting. |
| A244 | Second control mode | AA221 | * Re-confirmation is required for setting. |
| A344 | Third control mode | | Abolition of third control |
| A045 | Output voltage gain | Hb180 | Addition of individual settings for second control |
| A046 | First voltage compensation gain for automatic torque boost | HC101 | |
| A246 | Second voltage compensation gain for automatic torque boost | HC201 | |
| A047 | First slip compensation gain for automatic torque boost | HC102 | |
| A247 | Second slip compensation gain for automatic torque boost | HC202 | |
| A051 | DC braking selection | AF101 | Addition of individual settings for second control |
| A052 | DC braking frequency | AF103 | Addition of individual settings for second control |
| A053 | DC braking delay time | AF104 | Addition of individual settings for second control |
| A054 | DC braking force | AF105 | Addition of individual settings for second control |
| A055 | DC braking time | AF106 | Addition of individual settings for second control |
| A056 | DC braking edge/level selection | AF107 | Addition of individual settings for second control |
| A057 | DC braking force at the start | AF108 | Addition of individual settings for second control |
| A058 | DC braking time at the start | AF109 | Addition of individual settings for second control |
| A059 | DC braking carrier frequency | | Integrated into bb101 |
| A061 | First frequency upper limiter | bA102 | |
| A261 | Second frequency upper limiter | bA202 | |
| A062 | First frequency lower limiter | bA103 | |
| A262 | Second frequency lower limiter | bA203 | |
| A063 | Jump frequency 1 | AG101 | Addition of individual settings for second control |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|---|---------------|--|
| Display code | Function name | New code | |
| A064 | Jump frequency width 1 | AG102 | Addition of individual settings for second control |
| A065 | Jump frequency 2 | AG103 | Addition of individual settings for second control |
| A066 | Jump frequency width 2 | AG104 | Addition of individual settings for second control |
| A067 | Jump frequency 3 | AG105 | Addition of individual settings for second control |
| A068 | Jump frequency width 3 | AG106 | Addition of individual settings for second control |
| A069 | Acceleration stop frequency | AG110 | Addition of individual settings for second control |
| A070 | Acceleration stop time | AG111 | Addition of individual settings for second control |
| A071 | PID selection | AH-01 | |
| A072 | PID P gain | AH-61 | |
| A073 | PID I gain | AH-62 | |
| A074 | PID D gain | AH-63 | |
| A075 | PID scale | | Configured with AH-04 - AH-06 |
| A076 | PID feedback selection | AH-51 | |
| A077 | PID deviation reverse output | AH-02 | |
| A078 | PID changeable range | AH-71 | |
| A079 | PID feed forward selection | AH-70 | |
| A081 | AVR selection | bA146 | Second control extension * 00→00, 01→01, 02→02 The same values are used for equivalent operations. |
| A082 | Motor incoming voltage selection | Hb106/Hd106 | Configured with Hb106 (IM)/Hd106 (SM/PMM). |
| A085 | Operation mode selection | Hb145 | Addition of individual settings for second control |
| A086 | Energy-saving response/accuracy adjustment | Hb146 | Addition of individual settings for second control |
| A092 | First acceleration time 2 | AC124 | |
| A292 | Second acceleration time 2 | AC224 | |
| A392 | Second acceleration time 3 | | Abolition of third control |
| A093 | First deceleration time 2 | AC126 | |
| A293 | Second deceleration time 2 | AC226 | |
| A393 | Second deceleration time 3 | | Abolition of third control |
| A094 | First 2-step acceleration/deceleration selection | AC115 | |
| A294 | Second 2-step acceleration/deceleration selection | AC215 | |
| A095 | First 2-stage acceleration frequency | AC116 | |
| A295 | Second 2-stage acceleration frequency | AC216 | |
| A096 | First 2-stage deceleration frequency | AC117 | |
| A296 | Second 2-stage deceleration frequency | AC217 | |
| A097 | Acceleration pattern selection | AC-03 | |
| A098 | Deceleration pattern selection | AC-04 | |
| A101 | OI start | Cb-13 | For Ai2 |
| A102 | OI end | Cb-14 | For Ai2 |
| A103 | OI start ratio | Cb-15 | For Ai2 |
| A104 | OI end ratio | Cb-16 | For Ai2 |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|--|----------------|---|
| Display code | Function name | New code | |
| A105 | O1 start selection | Cb-17 | For Ai2 |
| A111 | O2 start | Cb-23 | For Ai3 |
| A112 | O2 end | Cb-24 | For Ai3 |
| A113 | O2 start ratio | Cb-25 | For Ai3 |
| A114 | O2 end ratio | Cb-26 | For Ai3 |
| A131 | Acceleration curve constant | AC-05 | |
| A132 | Deceleration curve constant | AC-06 | |
| A141 | Operation frequency selection 1 | AA101 | Integrated into main speed/auxiliary speed command. Addition of individual settings for second control |
| A142 | Arithmetic operation frequency selection 2 | AA102 | Integrated into main speed/auxiliary speed command. Addition of individual settings for second control |
| A143 | Arithmetic operation operator selection | AA105 | Addition of individual settings for second control |
| A145 | Additional frequency setting | AA106 | Addition of individual settings for second control |
| A146 | Additional frequency sign selection | | You can change the sign by setting AA106 with \pm . |
| A150 | Curvature 1 for EL-S-shaped acceleration | AC-08 | |
| A151 | Curvature 2 for EL-S-shaped acceleration | AC-09 | |
| A152 | Curvature 1 for EL-S-shaped deceleration | AC-10 | |
| A153 | Curvature 2 for EL-S-shaped deceleration | AC-11 | |
| b001 | Selection of instantaneous power failure/undervoltage restart | bb-24 | Specify b001=00 (trip) with retry count (instantaneous power failure [bb-20]/undervoltage [bb-21]) with zero. |
| b002 | Allowable instantaneous power failure time | bb-25 | |
| b003 | Retry stand-by time for instantaneous power failure and insufficient voltage | bb-26 | |
| b004 | Instantaneous power failure/undervoltage tripping selection during stop | bb-27 | |
| b005 | Selection of instantaneous power failure retry count | bb-20 | 0: trip, 255: infinite |
| b006 | Input phase loss selection | bb-65 | |
| b007 | f matching lower limit frequency setting | bb-42 | |
| b008 | Trip retry selection | bb-28 | Specify b008=00 (trip) with retry count (overvoltage [bb-22]/undercurrent [bb-23]) with zero. |
| b009 | Selection of undervoltage retry count | bb-21 | 0: trip, 255: infinite |
| b010 | Selection of overvoltage/overcurrent retry count | bb-22 bb-23 | Specify overvoltage [bb-22] and overcurrent [bb-23] individually. |
| b011 | Trip retry standby time | bb-29 | |
| b012 | First electronic thermal level | bC110 | |
| b212 | Second electronic thermal level | bC210 | |
| b312 | Third electronic thermal level | | Abolition of third control |
| b013 | Selection of first electronic thermal characteristics | bC111 | |
| b213 | Selection of second electronic thermal characteristics | bC211 | |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|--|---------------|--|
| Display code | Function name | New code | |
| b313 | Selection of third electronic thermal characteristics | | Abolition of third control |
| b015 | Free electronic thermal frequency 1 | bC120 | Addition of individual settings for second control |
| b016 | Free electronic thermal current 1 | bC121 | Addition of individual settings for second control |
| b017 | Free electronic thermal frequency 2 | bC122 | Addition of individual settings for second control |
| b018 | Free electronic thermal current 2 | bC123 | Addition of individual settings for second control |
| b019 | Free electronic thermal frequency 3 | bC124 | Addition of individual settings for second control |
| b020 | Free electronic thermal current 3 | bC125 | Addition of individual settings for second control |
| b021 | Overload limit selection | bA122 | Addition of individual settings for second control |
| b022 | Overload limit level | bA123 | Addition of individual settings for second control |
| b023 | Overload limit constant | bA124 | Addition of individual settings for second control |
| b024 | Overload limit selection 2 | bA126 | Addition of individual settings for second control |
| b025 | Overload limit level 2 | bA127 | Addition of individual settings for second control |
| b026 | Overload limit constant 2 | bA128 | Addition of individual settings for second control |
| b027 | Overcurrent suppression selection | bA120 | Addition of individual settings for second control |
| b028 | Frequency pull-in restart level | bb-43 | |
| b029 | Frequency pull-in restart constant | bb-44 | |
| b030 | Start frequency selection for frequency pull-in restart | bb-47 | |
| b031 | Soft-lock selection | UA-16 | |
| b034 | RUN time/power supply ON time level | CE-36 | |
| b035 | Operation direction limit selection | AA114 | Addition of individual settings for second control |
| b036 | Reduced voltage start selection | Hb131 | Addition of individual settings for second control |
| b037 | Display selection | UA-10 | |
| b038 | Initial screen selection | UA-91 | For the LCD Operator, you can select an initial screen in System settings of LCD Operator. |
| b039 | User parameter automatic setting function | UA-30 | |
| b040 | Torque limit selection | bA110 | Addition of individual settings for second control |
| b041 | Torque limit 1 (Four-quadrant mode normal powered) | bA112 | Addition of individual settings for second control |
| b042 | Torque limit 2 (Four-quadrant mode reverse regenerative) | bA113 | Addition of individual settings for second control |
| b043 | Torque limit 3 (Four-quadrant mode reverse powered) | bA114 | Addition of individual settings for second control |
| b044 | Torque limit 4 (Four-quadrant mode normal regenerative) | bA115 | Addition of individual settings for second control |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|--|---------------|--|
| Display code | Function name | New code | |
| b045 | Torque LADSTOP selection | bA116 | Addition of individual settings for second control |
| b046 | Selection of reversal prevention | HC114 | Addition of individual settings for second control |
| b050 | Instantaneous power failure non-stop selection | bA-30 | |
| b051 | Instantaneous power failure non-stop starting voltage | bA-31 | |
| b052 | Instantaneous power failure non-stop OV-LADSTOP level (target voltage level) | bA-32 | |
| b053 | Instantaneous power failure non-stop deceleration time | bA-34 | |
| b054 | Instantaneous power failure non-stop deceleration start range | bA-36 | |
| b055 | Instantaneous power failure non-stop proportional gain setting | bA-37 | |
| b056 | Instantaneous power failure non-stop integrated time setting | bA-38 | |
| b060 | Window comparator O upper limit | CE-40 | |
| b061 | Window comparator O lower limit | CE-41 | |
| b062 | Window comparator O hysteresis width | CE-42 | |
| b063 | Window comparator OI upper limit level | CE-43 | |
| b064 | Window comparator OI lower limit level | CE-44 | |
| b065 | Window comparator OI hysteresis width | CE-45 | |
| b066 | Window comparator O2 upper limit level | CE-46 | |
| b067 | Window comparator O2 lower limit level | CE-47 | |
| b068 | Window comparator O2 hysteresis width | CE-48 | |
| b070 | O operation level at disconnection | CE-50 | |
| b071 | OI operation level at disconnection | CE-52 | |
| b072 | O2 operation level at disconnection | CE-54 | |
| b078 | Deletion of integrated power | UA-12 | |
| b079 | Integrated power display gain | UA-13 | |
| b082 | Starting frequency | Hb130 | Addition of individual settings for second control |
| b083 | Carrier frequency | bb101 | Addition of individual settings for second control |
| b084 | Selection of initialization | Ub-01 | |
| b085 | Initialization data selection | Ub-02 | |
| b086 | Frequency conversion coefficient | Ab-01 | |
| b087 | Stop key selection | AA-13 | |
| b088 | Free-run stop selection | bb-40 | |
| b089 | Automatic carrier reduction | bb103 | Addition of individual settings for second control |
| b090 | BRD use rate | bA-60 | |
| b091 | Stop mode selection | AA115 | Addition of individual settings for second control |
| b092 | Cooling fan operation selection | bA-70 | |
| b095 | BRD selection | bA-61 | |
| b096 | BRD on level | bA-62 | |
| b098 | Thermistor selection | Cb-40 | |
| b099 | Thermistor error level | bb-70 | |
| b100 | Free V/f frequency 1 | Hb150 | Addition of individual settings for second control |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|---|---------------|--|
| Display code | Function name | New code | |
| b101 | Free V/f voltage 1 | Hb151 | Addition of individual settings for second control |
| b102 | Free V/f frequency 2 | Hb152 | Addition of individual settings for second control |
| b103 | Free V/f voltage 2 | Hb153 | Addition of individual settings for second control |
| b104 | Free V/f frequency 3 | Hb154 | Addition of individual settings for second control |
| b105 | Free V/f voltage 3 | Hb155 | Addition of individual settings for second control |
| b106 | Free V/f frequency 4 | Hb156 | Addition of individual settings for second control |
| b107 | Free V/f voltage 4 | Hb157 | Addition of individual settings for second control |
| b108 | Free V/f frequency 5 | Hb158 | Addition of individual settings for second control |
| b109 | Free V/f voltage 5 | Hb159 | Addition of individual settings for second control |
| b110 | Free V/f frequency 6 | Hb160 | Addition of individual settings for second control |
| b111 | Free V/f voltage 6 | Hb161 | Addition of individual settings for second control |
| b112 | Free V/f frequency 7 | Hb162 | Addition of individual settings for second control |
| b113 | Free V/f voltage 7 | Hb163 | Addition of individual settings for second control |
| b120 | Brake control selection | AF130 | Addition of individual settings for second control |
| b121 | Establishment waiting time | AF131 | Addition of individual settings for second control |
| b122 | Acceleration waiting time | AF132 | Addition of individual settings for second control |
| b123 | Stop waiting time | AF133 | Addition of individual settings for second control |
| b124 | Brake check waiting time | AF134 | Addition of individual settings for second control |
| b125 | Brake release frequency | AF135 | Addition of individual settings for second control |
| b126 | Brake release current | AF136 | Addition of individual settings for second control |
| b127 | Brake apply frequency | AF137 | Addition of individual settings for second control |
| b130 | Overvoltage suppression function selection | bA140 | Addition of individual settings for second control |
| b131 | Overvoltage suppression level | bA141 | Addition of individual settings for second control |
| b132 | Overvoltage suppression constant | bA142 | Addition of individual settings for second control |
| b133 | Overvoltage suppression proportional gain setting | bA144 | Addition of individual settings for second control |
| b134 | Overvoltage suppression integrated time setting | bA145 | Addition of individual settings for second control |
| C001 | Selection of intelligent input terminal 1 | CA-01 | |
| C002 | Selection of intelligent input terminal 2 | CA-02 | |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|--|---------------|---|
| Display code | Function name | New code | |
| C003 | Selection of intelligent input terminal 3 | CA-03 | |
| C004 | Selection of intelligent input terminal 4 | CA-04 | |
| C005 | Selection of intelligent input terminal 5 | CA-05 | |
| C006 | Selection of intelligent input terminal 6 | CA-06 | |
| C007 | Selection of intelligent input terminal 7 | CA-07 | |
| C008 | Selection of intelligent input terminal 8 | CA-08 | |
| C011 | Selection of intelligent input terminal 1a/b (NO/NC) | CA-21 | |
| C012 | Selection of intelligent input terminal 2a/b (NO/NC) | CA-22 | |
| C013 | Selection of intelligent input terminal 3a/b (NO/NC) | CA-23 | |
| C014 | Selection of intelligent input terminal 4a/b (NO/NC) | CA-24 | |
| C015 | Selection of intelligent input terminal 5a/b (NO/NC) | CA-25 | |
| C016 | Selection of intelligent input terminal 6a/b (NO/NC) | CA-26 | |
| C017 | Selection of intelligent input terminal 7a/b (NO/NC) | CA-27 | |
| C018 | Selection of intelligent input terminal 8a/b (NO/NC) | CA-28 | |
| C019 | Selection of FW terminal a/b (NO/NC) | CA-29 | For CA-09 = FW (input terminal 001) |
| C021 | Selection of intelligent output terminal 11 | CC-01 | |
| C022 | Selection of intelligent output terminal 12 | CC-02 | |
| C023 | Selection of intelligent output terminal 13 | CC-03 | |
| C024 | Selection of intelligent output terminal 14 | CC-04 | |
| C025 | Selection of intelligent output terminal 15 | CC-05 | |
| C026 | Selection of intelligent relay terminal | CC-07 | |
| C027 | FM selection | Cd-03 | |
| C028 | AM selection | Cd-04 | |
| C029 | AMI selection | Cd-05 | |
| C030 | Reference value of digital current monitor | | Configured with Cd-02 (settings need to be checked) |
| C031 | Selection of intelligent output terminal 11a/b (NO/NC) | CC-11 | |
| C032 | Selection of intelligent output terminal 12a/b (NO/NC) | CC-12 | |
| C033 | Selection of intelligent output terminal 13a/b (NO/NC) | CC-13 | |
| C034 | Selection of intelligent output terminal 14a/b (NO/NC) | CC-14 | |
| C035 | Selection of intelligent output terminal 15a/b (NO/NC) | CC-15 | |
| C036 | Selection of intelligent relay a/b (NO/NC) | CC-17 | |
| C038 | Low current signal output mode selection | CE101 | Addition of individual settings for second control |
| C039 | Low current detection level | CE102 | Addition of individual settings for second control |
| C040 | Overload advance notice signal output mode selection | CE105 | Addition of individual settings for second control |
| C041 | Overload advance notice level | CE106 | Addition of individual settings for second control |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|--|---------------|--|
| Display code | Function name | New code | |
| C042 | Acceleration reaching frequency | CE-10 | |
| C043 | Deceleration reaching frequency | CE-11 | |
| C044 | PID excessive deviation level | AH-72 | |
| C045 | Acceleration reaching frequency 2 | CE-12 | |
| C046 | Deceleration reaching frequency 2 | CE-13 | |
| C052 | Feedback comparison signal OFF level | AH-73 | |
| C053 | Feedback comparison signal ON level | AH-74 | |
| C055 | Overtorque level (normal rotation powered) | CE120 | Addition of individual settings for second control |
| C056 | Overtorque level (reverse rotation regenerative) | CE121 | Addition of individual settings for second control |
| C057 | Overtorque level (reverse rotation powered) | CE122 | Addition of individual settings for second control |
| C058 | Overtorque level (normal rotation regenerative) | CE123 | Addition of individual settings for second control |
| C061 | Thermal warning level | CE-30 | |
| C062 | Alarm code selection | | This function is enabled when an alarm code (084-087) is set to an input terminal. |
| C063 | 0Hz detection level | CE-33 | |
| C064 | Cooling fin overheat advance notice level | CE-34 | |
| C071 | Communication transmission speed selection | CF-01 | |
| C072 | Communication station number selection | CF-02 | |
| C073 | Communication bit length selection | | Abolished due to Modbus communication |
| C074 | Communication parity selection | CF-03 | |
| C075 | Communication stop bit selection | CF-04 | |
| C076 | Communication error selection | CF-05 | |
| C077 | Communication trip time | CF-06 | |
| C078 | Stop waiting time | CF-07 | |
| C079 | Communication method selection | | Abolished due to Modbus communication |
| C081 | O adjustment | | Adjusted with Cb-30 or Cb-31 |
| C082 | OI adjustment | | Adjusted with Cb-32 or Cb-33 |
| C083 | O2 adjustment | | Adjusted with Cb-34 or Cb-35 |
| C085 | Thermistor adjustment | Cb-41 | |
| C091 | Debug mode selection | UC-01 | |
| C101 | UP/DWN memory selection | CA-61 | |
| C102 | Reset selection | CA-72 | |
| C103 | Reset f matching selection | bb-41 | |
| C105 | FM gain setting | Cd-14 | |
| C106 | AM gain setting | Cd-24 | |
| C107 | AMI gain setting | Cd-34 | |
| C109 | AM bias setting | Cd-23 | |
| C110 | AMI bias setting | Cd-33 | |
| C111 | Overload advance notice level 2 | CE107 | |
| C121 | O zero adjustment | Cb-30/Cb-31 | Adjusted with Cb-30 or Cb-31 |
| C122 | OI zero adjustment | Cb-32/Cb-33 | Adjusted with Cb-32 or Cb-33 |
| C123 | O2 zero adjustment | Cb-34/Cb-35 | Adjusted with Cb-34 or Cb-35 |
| C130 | Output 11 on-delay time | CC-20 | |
| C131 | Output 11 off-delay time | CC-21 | |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|---|---------------|---|
| Display code | Function name | New code | |
| C132 | Output 12 on-delay time | CC-22 | |
| C133 | Output 12 off-delay time | CC-23 | |
| C134 | Output 13 on-delay time | CC-24 | |
| C135 | Output 13 off-delay time | CC-25 | |
| C136 | Output 14 on-delay time | CC-26 | |
| C137 | Output 14 off-delay time | CC-27 | |
| C138 | Output 15 on-delay time | CC-28 | |
| C139 | Output 15 off-delay time | CC-29 | |
| C140 | Output RY on-delay time | CC-32 | |
| C141 | Output RY off-delay time | CC-33 | |
| C142 | Logical output signal 1 selection 1 | CC-40 | |
| C143 | Logical output signal 1 selection 2 | CC-41 | |
| C144 | Logical output signal 1 operator selection | CC-42 | |
| C145 | Logical output signal 2 selection 1 | CC-43 | |
| C146 | Logical output signal 2 selection 2 | CC-44 | |
| C147 | Logical output signal 2 operator selection | CC-45 | |
| C148 | Logical output signal 3 selection 1 | CC-46 | |
| C149 | Logical output signal 3 selection 2 | CC-47 | |
| C150 | Logical output signal 3 operator selection | CC-48 | |
| C151 | Logical output signal 4 selection 1 | CC-49 | |
| C152 | Logical output signal 4 selection 2 | CC-50 | |
| C153 | Logical output signal 4 operator selection | CC-51 | |
| C154 | Logical output signal 5 selection 1 | CC-52 | |
| C155 | Logical output signal 5 selection 2 | CC-53 | |
| C156 | Logical output signal 5 operator selection | CC-54 | |
| C157 | Logical output signal 6 selection 1 | CC-55 | |
| C158 | Logical output signal 6 selection 2 | CC-56 | |
| C159 | Logical output signal 6 operator selection | CC-57 | |
| C160 | Input terminal response time 1 | CA-41 | |
| C161 | Input terminal response time 2 | CA-42 | |
| C162 | Input terminal response time 3 | CA-43 | |
| C163 | Input terminal response time 4 | CA-44 | |
| C164 | Input terminal response time 5 | CA-45 | |
| C165 | Input terminal response time 6 | CA-46 | |
| C166 | Input terminal response time 7 | CA-47 | |
| C167 | Input terminal response time 8 | CA-48 | |
| C168 | Input terminal response time FW | CA-49 | |
| C169 | Multistage speed/position determination time | CA-55 | |
| H001 | Auto-tuning selection | HA-01 | |
| H002 | First motor constant selection | | Abolition of selection (setting of IE3 motor) |
| H202 | Second motor constant selection | | Abolition of selection (setting of IE3 motor) |
| H003 | First motor capacity selection | Hb102 | |
| H203 | Second motor capacity selection | Hb202 | |
| H004 | First selection of the number of motor poles | Hb103 | |
| H204 | Second selection of the number of motor poles | Hb203 | |
| H005 | First speed response | HA115 | * Adjustment may be required. |
| H205 | Second speed response | HA215 | * Adjustment may be required. |
| H006 | First stability constant | HA110 | * Adjustment may be required. |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|---|---------------|--|
| Display code | Function name | New code | |
| H206 | Second stability constant | HA210 | * Adjustment may be required. |
| H306 | Third stability constant | | Abolition of third control |
| H020 | First motor R1 | Hb110 | * Adjustment may be required. |
| H220 | Second motor R1 | Hb210 | * Adjustment may be required. |
| H021 | First motor R2 | Hb112 | * Adjustment may be required. |
| H221 | Second motor R2 | Hb212 | * Adjustment may be required. |
| H022 | First motor L | Hb114 | * Adjustment may be required. |
| H222 | Second motor L | Hb214 | * Adjustment may be required. |
| H023 | First motor I0 | Hb116 | * Adjustment may be required. |
| H223 | Second motor I0 | Hb216 | * Adjustment may be required. |
| H024 | First motor J | Hb118 | * Adjustment may be required. |
| H224 | Second motor J | Hb218 | * Adjustment may be required. |
| H030 | First motor R1 (auto-tuning data) | | Hb110: Integration of setting location |
| H230 | Second motor R1 (auto-tuning data) | | Hb210: Integration of setting location |
| H031 | First motor R2 (auto-tuning data) | | Hb112: Integration of setting location |
| H231 | Second motor R2 (auto-tuning data) | | Hb212: Integration of setting location |
| H032 | First motor L (auto-tuning data) | | Hb114: Integration of setting location |
| H232 | Second motor L (auto-tuning data) | | Hb214: Integration of setting location |
| H033 | First motor I0 (auto-tuning data) | | Hb116: Integration of setting location |
| H233 | Second motor I0 (auto-tuning data) | | Hb216: Integration of setting location |
| H034 | First motor J (auto-tuning data) | | Hb118: Integration of setting location |
| H234 | Second motor J (auto-tuning data) | | Hb218: Integration of setting location |
| H050 | First PI proportional gain | HA125 | * Adjustment may be required. |
| H250 | Second PI proportional gain | HA225 | * Adjustment may be required. |
| H051 | First PI integrated gain | HA126 | * Adjustment may be required. |
| H251 | Second PI integrated gain | HA226 | * Adjustment may be required. |
| H052 | First P proportional gain | HA127 | * Adjustment may be required. |
| H252 | Second P proportional gain | HA227 | * Adjustment may be required. |
| H060 | First 0Hz range limiter | HC110 | |
| H260 | Second 0Hz range limiter | HC210 | |
| H061 | First 0Hz range SLV start boost volume | HC112 | |
| H261 | Second 0Hz range SLV start boost volume | HC212 | |
| H070 | For switching PI proportional gain | HA128 | * Adjustment may be required. |
| H071 | For switching PI integrated gain | HA129 | * Adjustment may be required. |
| H072 | For switching P proportional gain | HA130 | * Adjustment may be required. |
| H073 | Gain switch time | HA121 | |
| P001 | Selection of operation at option 1 error | oA-12 | |
| P002 | Selection of operation at option 2 error | oA-22 | |
| P011 | Number of pulses of encoder | ob-01 | |
| P012 | V2 control mode selection | AA123 | |
| P013 | Pulse string mode selection | ob-11 | |
| P014 | Orientation stop position | AE-11 | |
| P015 | Orientation speed setting | AE-12 | |
| P016 | Orientation direction setting | AE-13 | |
| P017 | Positioning completion range setting | AE-04 | |
| P018 | Positioning completion delay time setting | AE-05 | |
| P019 | Electronic gear installation position selection | AE-01 | |
| P020 | Numerator of electronic gear ratio | AE-02 | |
| P021 | Denominator of electronic gear ratio | AE-03 | |
| P022 | Positioning control feed forward gain | AE-06 | |
| P023 | Position loop gain | AE-07 | |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|--|---------------|--|
| Display code | Function name | New code | |
| P024 | Position bias volume | AE-08 | |
| P025 | Selection of whether a secondary-resistance correction is to be conducted. | HC113 | Addition of individual settings for second control |
| P026 | Overspeed error detection level | bb-80 | |
| P027 | Overspeed deviation error detection level | bb-81 | |
| P028 | Numerator of motor gear ratio | ob-03 | |
| P029 | Denominator of motor gear ratio | ob-04 | |
| P031 | Acceleration or deceleration time input type | AC-01 | |
| P032 | Orientation stop position input type | AE-10 | |
| P033 | Torque command input selection | Ad-01 | |
| P034 | Torque command setting | Ad-02 | |
| P035 | Selection of pole at torque command by O2 | Ad-03 | Not limited to Ai3. |
| P036 | Torque bias mode | Ad-11 | |
| P037 | Torque bias value | Ad-12 | |
| P038 | Torque bias polarity selection | Ad-13 | |
| P039 | Torque control speed limit value (for normal rotation) | Ad-41 | |
| P040 | Torque control speed limit value (for reverse rotation) | Ad-42 | |
| P044 | Timer setting for monitoring of DeviceNet operation command | oA-11 | |
| P045 | Operation setting at the time of communication error | oA-12 | |
| P046 | OUTPUT assembly instance No. setting | (reserved) | |
| P047 | INPUT assembly instance No. setting | (reserved) | |
| P048 | Operation setting at the time of detection of idle mode | (reserved) | |
| P049 | Setting of the number of poles for rotation speed | | Integrated to Hb103 (IM)/Hd103 (SM/PMM) |
| P055 | Pulse string frequency scale | ob-12 | |
| P056 | Pulse string frequency time constant | ob-13 | |
| P057 | Position string bias volume | ob-14 | |
| P058 | Pulse string limit | ob-15 | |
| P060 | Position command 0 | AE-20 | |
| P061 | Position command 1 | AE-22 | |
| P062 | Position command 2 | AE-24 | |
| P063 | Position command 3 | AE-26 | |
| P064 | Position command 4 | AE-28 | |
| P065 | Position command 5 | AE-30 | |
| P066 | Position command 6 | AE-32 | |
| P067 | Position command 7 | AE-34 | |
| P068 | Zero return mode | AE-70 | |
| P069 | Zero return direction selection | AE-71 | |
| P070 | Low speed zero return frequency | AE-72 | |
| P071 | High speed zero return frequency | AE-73 | |
| P072 | Position range designation (forward rotation side) | AE-52 | |
| P073 | Position range designation (reverse rotation side) | AE-54 | |
| P074 | Teaching selection | AE-60 | |
| P100 | Simplified sequence function user parameter U (00) | UE-10 | |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|--|---------------|---------|
| Display code | Function name | New code | |
| P101 | Simplified sequence function user parameter U (01) | UE-11 | |
| P102 | Simplified sequence function user parameter U (02) | UE-12 | |
| P103 | Simplified sequence function user parameter U (03) | UE-13 | |
| P104 | Simplified sequence function user parameter U (04) | UE-14 | |
| P105 | Simplified sequence function user parameter U (05) | UE-15 | |
| P106 | Simplified sequence function user parameter U (06) | UE-16 | |
| P107 | Simplified sequence function user parameter U (07) | UE-17 | |
| P108 | Simplified sequence function user parameter U (08) | UE-18 | |
| P109 | Simplified sequence function user parameter U (09) | UE-19 | |
| P110 | Simplified sequence function user parameter U (10) | UE-20 | |
| P111 | Simplified sequence function user parameter U (11) | UE-21 | |
| P112 | Simplified sequence function user parameter U (12) | UE-22 | |
| P113 | Simplified sequence function user parameter U (13) | UE-23 | |
| P114 | Simplified sequence function user parameter U (14) | UE-24 | |
| P115 | Simplified sequence function user parameter U (15) | UE-25 | |
| P116 | Simplified sequence function user parameter U (16) | UE-26 | |
| P117 | Simplified sequence function user parameter U (17) | UE-27 | |
| P118 | Simplified sequence function user parameter U (18) | UE-28 | |
| P119 | Simplified sequence function user parameter U (19) | UE-29 | |
| P120 | Simplified sequence function user parameter U (20) | UE-30 | |
| P121 | Simplified sequence function user parameter U (21) | UE-31 | |
| P122 | Simplified sequence function user parameter U (22) | UE-32 | |
| P123 | Simplified sequence function user parameter U (23) | UE-33 | |
| P124 | Simplified sequence function user parameter U (24) | UE-34 | |
| P125 | Simplified sequence function user parameter U (25) | UE-35 | |
| P126 | Simplified sequence function user parameter U (26) | UE-36 | |
| P127 | Simplified sequence function user parameter U (27) | UE-37 | |

| 3G3RX-series V1 | | 3G3RX2-series | Remarks |
|-----------------|--|---------------|---------|
| Display code | Function name | New code | |
| P128 | Simplified sequence function user parameter U (28) | UE-38 | |
| P129 | Simplified sequence function user parameter U (29) | UE-39 | |
| P130 | Simplified sequence function user parameter U (30) | UE-40 | |
| P131 | Simplified sequence function user parameter U (31) | UE-41 | |
| U001 | User 1 selection | UA-31 | |
| U002 | User 2 selection | UA-32 | |
| U003 | User 3 selection | UA-33 | |
| U004 | User 4 selection | UA-34 | |
| U005 | User 5 selection | UA-35 | |
| U006 | User 6 selection | UA-36 | |
| U007 | User 7 selection | UA-37 | |
| U008 | User 8 selection | UA-38 | |
| U009 | User 9 selection | UA-39 | |
| U010 | User 10 selection | UA-40 | |
| U011 | User 11 selection | UA-41 | |
| U012 | User 12 selection | UA-42 | |

A-3 Overview of Inverter Selection

Motor Capacity Selection

Before selecting an inverter, first the motor should be chosen. In selecting the motor, calculate the load inertia appropriate to the application, and then calculate the required capacity and torque.

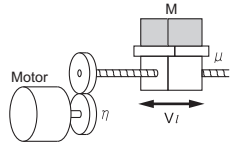
Simplified Selection Method (Required Output Calculation)

This method of calculation helps you select a motor by calculating the output (kW) required by the motor to maintain its steady rotations. To use this method for motor selection, make allowance for the calculated result because it does not include acceleration/deceleration and other transient state calculations. The simplified selection method is suitable for fan, conveyor, mixer, and other applications where a constant state continues for a while.

* The simplified selection method cannot be used for the following applications. For these applications, use the detailed selection method.

- Those requiring rapid startup (acceleration).
- Those that frequently repeat run and stop.
- Those that have a large inertia at the power transfer part.
- Those that have an inefficient power transfer part.

- For linear motion: Steady power P0 [kW]

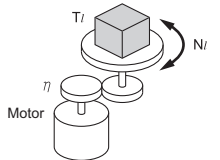


$$P_0 \text{ [kW]} = \frac{\mu \cdot Mg \cdot V_i}{60 \cdot \eta} \times 10^{-3}$$

μ : Friction coefficient
 M : Mass of linear motion part [kg]
 g : Acceleration of gravity ($g \approx 9.8 \text{ [m/s}^2]$)
 V_i : Speed of linear motion part [m/min]
 η : Efficiency of transfer part ($\eta \leq 1$)

* The same calculating formula is applicable to belt conveyors.

- For rotation motion: Steady power P0 [kW]



$$P_0 \text{ [kW]} = \frac{2\pi \cdot T_i \cdot N_i}{60 \cdot \eta} \times 10^{-3}$$

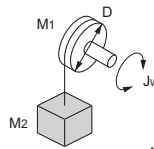
T_i : Load torque (Load shaft) [N·m]
 N_i : Rotation speed of load shaft [r/min]
 η : Efficiency of transfer part ($\eta \leq 1$)

Detailed Selection Method (RMS Calculation)

This method helps you select a motor by calculating the effective torque and maximum torque values required to achieve a certain pattern of operation for the application. It selects a motor that is optimal for a particular operation pattern.

- Calculation of load inertia and motor-shaft conversion inertia
Depending on the type of the motor transfer system, calculate the inertia for all parts and convert it into the motor-shaft inertia.

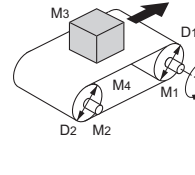
- Example in hoist application



$$J_w \text{ [kg} \cdot \text{m}^2] = J_1 + J_2 = \left(\frac{M_1 \cdot D^2}{8} + \frac{M_2 \cdot D^2}{4} \right) \times 10^{-6}$$

J_w : Shaft conversion inertia [kg·m²]
 J_1 : Inertia of cylinder (Shaft conversion) [kg·m²]
 J_2 : Inertia of workpiece (Shaft conversion) [kg·m²]
 M_1 : Mass of cylinder [kg]
 M_2 : Mass of workpiece [kg]
 D : Diameter of cylinder [mm]

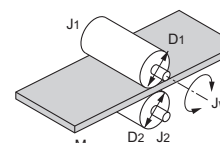
- Example in conveyor application



$$J_w \text{ [kg} \cdot \text{m}^2] = J_1 + J_2 + J_3 + J_4 = \left(\frac{M_1 \cdot D_1^2}{8} + \frac{M_2 \cdot D_2^2}{8} \cdot \frac{D_1^2}{D_2^2} + \frac{M_3 \cdot D_1^2}{4} + \frac{M_4 \cdot D_1^2}{4} \right) \times 10^{-6}$$

J_w : Shaft conversion inertia (Cylinder-1-shaft conversion) [kg·m²]
 J_1 : Inertia of cylinder 1 (Cylinder-1-shaft conversion) [kg·m²]
 J_2 : Inertia of cylinder 2 (Cylinder-1-shaft conversion) [kg·m²]
 J_3 : Inertia of workpiece (Cylinder-1-shaft conversion) [kg·m²]
 J_4 : Inertia of belt (Cylinder-1-shaft conversion) [kg·m²]
 M_1 : Mass of cylinder 1 [kg]
 M_2 : Mass of cylinder 2 [kg]
 M_3 : Mass of workpiece [kg]
 M_4 : Mass of belt [kg]
 D_1 : Diameter of cylinder 1 [mm]
 D_2 : Diameter of cylinder 2 [mm]

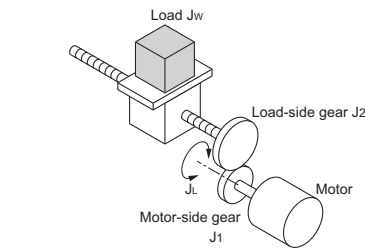
- Example in roller application



$$J_w \text{ [kg} \cdot \text{m}^2] = J_1 + \left(\frac{D_1^2}{D_2^2} \right) J_2 + \frac{M \cdot D_1^2}{4} \times 10^{-6}$$

J_w : Shaft conversion inertia (Roller-1-shaft conversion) [kg·m²]
 J_1 : Inertia of roller 1 (Roller-1-shaft conversion) [kg·m²]
 J_2 : Inertia of roller 2 (Roller-2-shaft conversion) [kg·m²]
 M : Mass of workpiece [kg]
 D_1 : Diameter of roller 1 [mm]
 D_2 : Diameter of roller 2 [mm]

- Example of conversion into motor-shaft inertia



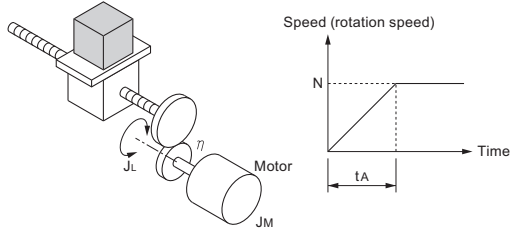
$$J_L \text{ [kg} \cdot \text{m}^2] = J_1 + G^2(J_2 + J_w)$$

- J_L : Motor-shaft conversion inertia [kg·m²]
 J_w : Load inertia (Load-side gear-shaft conversion) [kg·m²]
 J_1 : Inertia of motor-side gear [kg·m²]
 J_2 : Inertia of load-side gear [kg·m²]
 Z_1 : Number of motor-side gear teeth
 Z_2 : Number of load-side gear teeth
 G : Gear ratio (Speed reduction ratio) = Z_1 / Z_2

• Calculation of motor-shaft conversion torque and effective torque

Calculate the acceleration torque from the motor-shaft conversion load inertia, the motor-rotor inertia, and the acceleration. Then, calculate the load torque from the external force (gravity and tension) and friction force applied to the load. Finally, combine these calculation results to calculate the torque required for the motor.

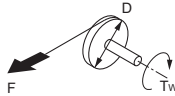
• Calculation of acceleration torque (TA)



$$T_A \text{ [N}\cdot\text{m]} = \frac{2\pi \cdot N}{60 \cdot t_A} \left(J_M + \frac{J_L}{\eta} \right)$$

- TA : Acceleration torque [N·m]
- JL : Motor-shaft conversion load inertia [kg·m²]
- JM : Motor-rotor inertia [kg·m²]
- η : Efficiency of transfer part (η≤1)
- tA : Acceleration time [s]
- N : Motor rotation speed [r/min]

• Calculation of motor-shaft conversion load torque (TL)

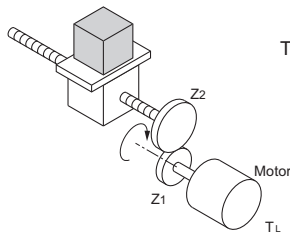


$$T_w \text{ [N}\cdot\text{m]} = F \cdot \frac{D}{2} \times 10^{-3}$$

- Tw : Load torque (Load-shaft conversion) [N·m]
- F : External force [N]
- D : Diameter of cylinder [mm]

(Generally, the friction force can be calculated as:

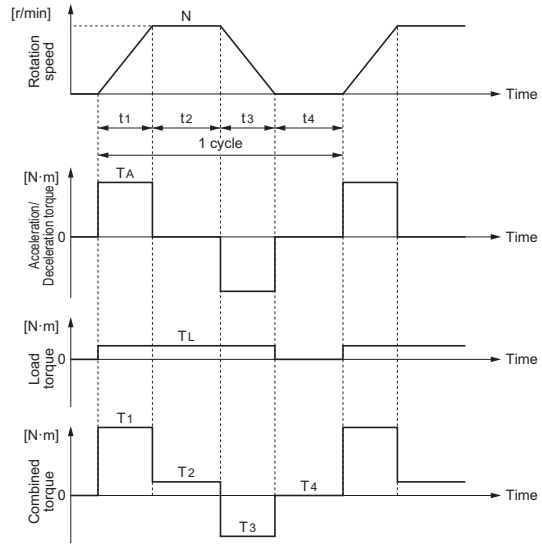
- F = μMg [N], where
- μ : Coefficient of friction
- M : Mass of motion part [kg]
- g : Acceleration of gravity (g≈9.8 [m/s²])



$$T_L \text{ [N}\cdot\text{m]} = T_w \cdot \frac{G}{\eta}$$

- TL : Motor-shaft conversion load torque [N·m]
- Tw : Load torque (Load-shaft conversion) [N·m]
- Z1 : Number of motor-side gear teeth
- Z2 : Number of load-side gear teeth
- G : Gear ratio (Speed reduction ratio) = Z1/Z2

• Calculation of combined torque and effective torque



• Effective torque TRMS [N·m]

$$= \sqrt{\frac{\sum (T_i^2 \cdot t_i)}{\sum t_i}}$$

$$= \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + T_3^2 \cdot t_3 + T_4^2 \cdot t_4}{t_1 + t_2 + t_3 + t_4}}$$

• Maximum torque T MAX [N·m] = T1 = TA + TL

• Motor selection

Based on the above calculation results, select the motor capacity by using the following formulae. Select the larger of the two calculated values as the motor capacity. Also, when selecting a motor, take into consideration the errors in calculation and modeling. Select a motor whose capacity is at least approximately 20% larger.

• Motor capacity conversion to effective torque

$$\text{Motor capacity [kW]} = \frac{2\pi \cdot T_{RMS} \cdot N}{60} \times 10^{-3} \text{ N: Maximum rotation speed [r/min]}$$

• Motor capacity required for maximum torque output

$$\text{Motor capacity [kW]} = \frac{2\pi \cdot T_{MAX} \cdot N}{60 \times 1.5} \times 10^{-3} \text{ N: Maximum rotation speed [r/min]}$$

* The above calculation formulae assume that the maximum motor torque is 150% of the rated torque.

Inverter Capacity Selection

Select an inverter that can be used with the motor you selected based on the result of motor capacity selection. Basically, select an inverter which fits the maximum applicable motor capacity of the selected motor. After selecting an inverter, check if it meets the both of the following conditions. If not, select an inverter that has a one class larger capacity and check again.

**Rated motor current ≤ Rated output current of inverter
Max. continuous torque output time for application ≤ 1 min**

- Note 1. In the light load mode, the overload capacity of the inverter is 150% of the rated torque for 5 seconds. Use the 5-seconds rating when determining the maximum continuous torque.
- Note 2. If you want to use 0-Hz sensorless vector control, need a holding torque at a rotation speed of 0 (r/min), or frequently require 150% of the rated torque or more, use an inverter with a one class larger capacity than the one selected by the above method.

Overview of Braking Resistor Selection

■ Requirement of Braking Resistor

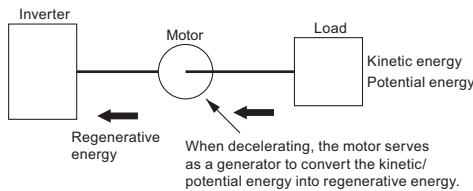
If the regenerative energy generated in deceleration or descent in an application is too great, the main circuit voltage in the inverter may increase, which results in damage to the inverter.

Normally, the inverter has a built-in overvoltage protection function, which detects an overvoltage (0 V) in the main circuit to prevent inverter damage. However, because it detects a fault to cause the motor to stop, stable and continuous operation will be prevented.

Therefore, you need to use one or more braking resistors/ regenerative braking units to absorb this regenerative energy outside the inverter.

• **What is Regenerative Energy?**

The load connected to a motor has kinetic energy when rotating, and potential energy when it is subject to the gravity. When the motor decelerates, or when the load descends, the energy is fed back to an inverter. This phenomenon is known as regeneration, and the energy is called regenerative energy.



• **Preventing an overvoltage (0 V) in main circuit without use of braking resistors**

The following are methods to prevent the occurrence of an overvoltage (0 V) in the main circuit without connection of braking resistors.

Since these methods prolong the deceleration time, check that the selected method will not cause application problems.

• **Enable the Overvoltage Suppression Function during Deceleration**

The Overvoltage Suppression Function during Deceleration is enabled by factory default.

It automatically increases the deceleration time to prevent the occurrence of an overvoltage in the main circuit.

• **Set a longer deceleration time**

Increase the deceleration time to prevent the occurrence of an overvoltage in the main circuit.

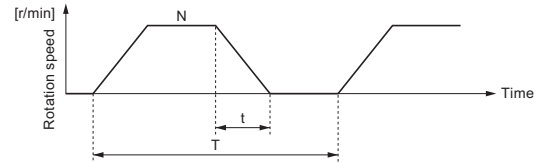
This decreases the amount of regenerative energy per unit time.

• **Select free-run stop**

This prevents the regenerative energy from being fed back to the inverter.

■ Simplified Braking Resistor Selection

This is a simple method to select an appropriate braking resistor based on the percentage of the time in which regenerative energy is produced in a normal operation pattern.



• Usage rate [%ED] = $100 \times t/T$

t: Deceleration time (regenerative time) [s]

T: 1cycle operation time [s]

- For models with built-in regenerative braking circuit (3G3RX2 200 V with a capacity of 22 kW or lower, 3G3RX2 400 V with a capacity of 37 kW or lower)

Select a braking resistor based on the usage rate calculated from the operation pattern.

Connect a braking resistor suitable for your inverter according to the braking resistor list provided in the inverter manual/catalog.

- For models without built-in regenerative braking circuit (3G3RX2 200 V with a capacity of 30 kW or higher, 3G3RX2 400 V with a capacity of 45 kW or higher)

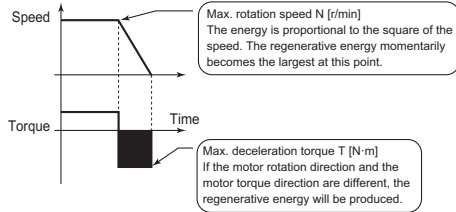
Select an appropriate regenerative braking unit and braking resistor.

Connect a regenerative braking unit and braking resistor suitable for your inverter according to the regenerative braking unit/braking resistor list provided in the inverter manual and catalog.

Detailed Braking Resistor Selection

When the usage rate of the braking resistor selected on the previous page exceeds 10% ED, or when an extremely large braking torque is required, use the method below to calculate a regenerative energy and make your selection.

• Calculation of Required Braking Resistance



$$\text{Resistance of braking resistor: } R \leq \frac{60 \times V^2}{2\pi \cdot (T - 0.2 \times T_m) \cdot N}$$

V : 200-V class inverter 362.5 [V]
400-V class inverter 725 [V]

T : Maximum braking torque [N·m]

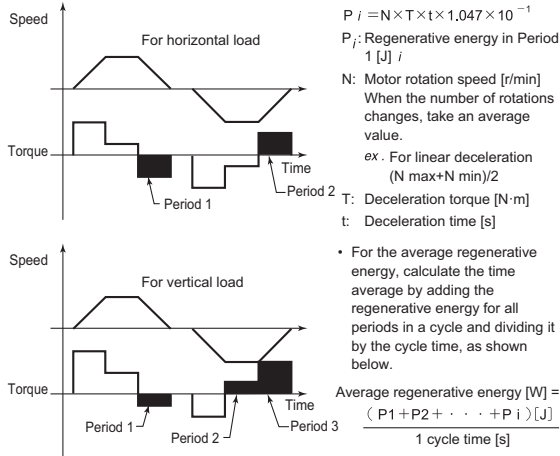
T_m : Motor rating torque [N·m]

N : Maximum rotation speed [r/min]

Note: Calculate a braking torque according to Inverter Capacity Selection in the Motor Capacity Selection section.

• Calculation of average regenerative energy

Regenerative energy is produced when the motor rotation direction and the torque direction are opposite. Use the following formula to calculate the regenerative energy for each period in a cycle.



- Note) 1. For Speed, the forward rotation direction is indicated as positive. For Torque, the torque in the forward rotation direction is indicated as positive.
2. Calculate a braking torque according to Inverter Capacity Selection in the Motor Capacity Selection section.

• Braking Resistor Selection

Select a braking resistor from the required braking resistance and the average regenerative energy on the left.

- Required braking resistance \geq Resistance of braking resistor \geq Min. connection resistance of inverter or regenerative braking unit
- Average regenerative energy \leq Resistance capacity of braking resistor

- Note) 1. Connecting a braking resistor whose resistance is less than the minimum connection resistance value of the inverter or regenerative braking unit results in damage to the internal braking transistor. If the required braking resistance is less than the minimum connection resistance, change the inverter or regenerative braking unit to one having a larger capacity and ensure that the required braking resistance is not less than the minimum connection resistance.
2. Two or more regenerative braking units can be connected in parallel. Refer to the following formula to know the braking resistance value in such a case: Braking resistance [Ω] = (Required braking resistance calculated as above) \times (No. of units)
3. Make allowance for the resistance capacity of the braking resistor. Select a braking resistor whose capacity is at least 20% larger than the calculated value. Otherwise, it may be overheated.



Appendices B STO Function

| | |
|--|-------------|
| B-1 Overview of STO Function | B-2 |
| B-1-1 Response Time | B-3 |
| B-1-2 Self-diagnosis of Internal Path | B-3 |
| B-1-3 STO Input | B-3 |
| B-1-4 Monitoring Output (EDM Output) of STO Status | B-3 |
| B-1-5 Periodic Function Test | B-3 |
| B-1-6 Safety Function | B-3 |
| B-1-7 Response Time | B-3 |
| B-1-8 Safety Related Parameter | B-4 |
| B-2 Procedure for Use of STO Function | B-5 |
| B-2-1 STO Signal Input | B-5 |
| B-2-2 Retaining Requirements of STO Status | B-7 |
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B

B-1 Overview of STO Function

3G3RX2-series is an inverter built-in STO (Safe torque off) function defined in IEC 61800-5-2.

STO Function is used to shut off the motor current with input signals from a safety controller and to stop the motor.

This function is equivalent to stop category 0 defined in EN/IEC60204-1.



Precautions for Correct Use

Design

- The 3G3RX2-series does not feature a function to retain STO status. When STO input is reset, the inverter goes into a state of operation enabled and starts the operation when operation command is input.
- Design a system to disallow hazardous status when STO input is reset with consideration mentioned earlier.
- In default data set before shipment, STO function is disabled by short-circuit wires.

Installment

- Qualified engineers that have enough knowledge about function/safety shall install the inverter.

Wiring

- The 3G3RX2-series does not feature a function to carry out diagnosis of STO input signals. Be sure to design a system that can provide 2 inputs normally. As necessary, carry out error diagnosis for input path with EDM signal output.
- STO input signals via two channels outside the inverter shall be separated and protected appropriately. No interruption shall be made on each signal.
- The cable length for signals connected to ST1/ST2 or EDM terminal shall be each 20m or less.

Test Run

- Be sure to conduct a test run to verify safety system and check the validity. The safety system without this check shall not be regarded as "Safe".

Maintenance

- STO function does not cut off the power supplies for the inverter main circuit and its peripheral circuit. When you make maintenance, be sure to separate a safety system away from the main power supply or devices like permanent magnet motors or capacitors to which voltage is likely supplied.
- Be sure to carry out the followings before the maintenance:
 - Wait for ten minutes or more^{*1} or fifteen minutes or more^{*2} after cutting off power supply.
 - Check that voltage between PN terminals is 45V or less after a charge LED goes out.
- Be sure to conduct periodic function test every year.

Others

- Never modify the inverter. The modified inverter is out of conformity with criteria and product guarantee.

*1 In the case of 3G3RX2-A2004 to -A2220 / -A4007 to -A4220

*2 In the case of 3G3RX2-A2300 to -A2550/ -A4300 to -A4550/ -B4750/ -B4900/ -B411K/ -B413K

B-1-1 Response Time

Response time is defined as duration from input of an operation command for safety function to an activation of the function. In the case of STO function, the response time is duration until the power to the Servomotor is shut off after STO signal is input.

In the case of 3G3RX2-series, the STO response time is 10ms or less.

Design a system to disallow devices that trigger hazardous conditions with consideration of this response time.

B-1-2 Self-diagnosis of Internal Path

The 3G3RX2-series features a function to diagnose errors of internal safety path.

When the function is used to detect the errors internal safety path, it holds a state with outputs to motor being cut off regardless of STO signal status.

B-1-3 STO Input

To input STO signal, the redundant double signals are needed to input. Also, the separated double STO signals are needed to input external inverter. When both inputs are not used, the inputs can not conform to criteria/standard.

B-1-4 Monitoring Output (EDM Output) of STO Status

When you monitor the input status of STO signals or the detection status of errors internal safety path from external devices, use EDM output terminals.

B-1-5 Periodic Function Test

The periodic function test is carried out to verify STO function properly. You need to conduct the test once a year or more in order to keep SIL/PL level prescribed in function safety system.

In this STO function test, check that output status to input ST1/ST2 and EDM signal status comply with Status 1 to Status 4 of Signal Matrix Table in C-2-3 STO Confirmation Signal Output (EDM) Signal.

B-1-6 Safety Function

| Function | Criteria |
|--------------------------|---------------------------------------|
| STO (Safe Torque Off) | IEC61800-5-2:2016 EN61800-5-2:2007 |
| Stop category 0 | EN 60204-1: 2006/A1:2009 |

B-1-7 Response Time

| Function | Value | Notes |
|-------------------|-------|---|
| STO response time | 10ms | Time until the power to Servomotor is shut off after ST1/ST2 signals go into STO status |
| EDM response time | 20ms | Time until EDM signals are turned ON after ST1/ST2 signals go into STO status |

B-1-8 Safety Related Parameter

| Parameter | Data | Criteria |
|-----------|-----------------------|---|
| PL | e | EN ISO 13849-1:2015 |
| CAT. | 4 | |
| MTTFd | 100 years | |
| DCavg | 99.8% | |
| SIL | 3 | IEC61508: 2010 IEC61800-5-2:2016 EN61800-5-2:2007 IEC/EN62061:2012 |
| HFT | 1 | |
| SFF | 99.9% | |
| PFH | 1.18×10^{-9} | |
| PFD | 1.03×10^{-4} | |

B-2 Procedure for Use of STO Function

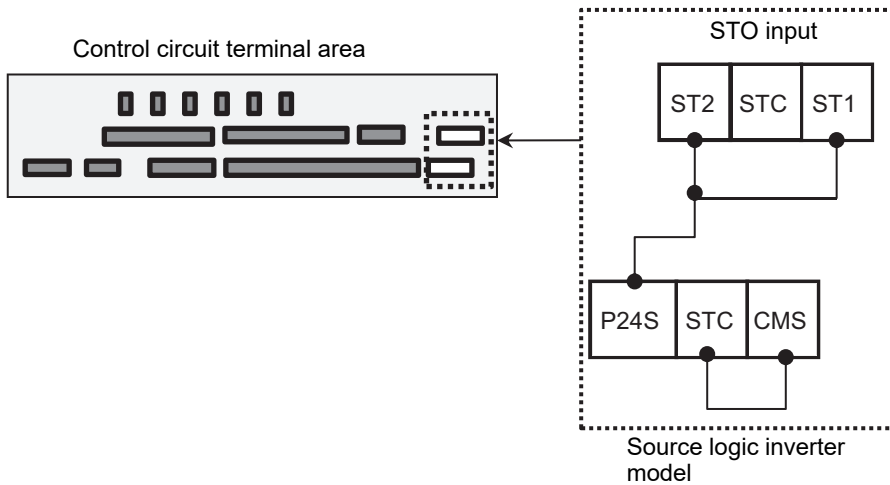
B-2-1 STO Signal Input

STO Input Terminal

Input of STO signal is performed by redundant input of STO terminals ST1 and ST2.

When voltage is applied to each input terminal and current flows, operation of safety path is enabled. When shipped from the factory, the operation status is always enabled with short circuit wiring shown as below.

If voltage is not applied to at least one of the input terminals, the corresponding blocking path shuts off output of the inverter.



Terminal Specifications

| Terminal symbol | Terminal name | Description | Electrical characteristics |
|-----------------|--|---|--|
| P24S | 24 V output terminal (for STO input only) | A 24 VDC power supply for contact signals dedicated for ST1/ST2 terminals. The common terminal is CMS. | Maximum output current: 100 mA |
| CMS | 24 V output terminal common (for STO input only) | A common terminal for 24 VDC power supply for contact signals dedicated for ST1/ST2 terminals. | |
| STC | Input logic switching terminal | A logic switching terminal for STO input. You can change the input logic changing the connecting point of short-circuit line. When an external power supply is used, remove the short-circuit line and use this terminal as the input common for ST1/ST2. | Short-circuit line: Connect between CMS and STC |
| ST1/ST2 | STO input terminal | An input terminal of STO. | Voltage between ST1 and STC/ST1 and STC <ul style="list-style-type: none"> • ON voltage: Min. 15 VDC • OFF voltage Max. 5 VDC • Maximum allowable voltage 27 VDC • Load current 5.8 mA (at 27 VDC) Internal resistance: 4.7 kΩ |
| ED+ | EDM signal output terminal (+) | A plus terminal of EDM signal (STO status monitoring). | Open collector output <ul style="list-style-type: none"> • Between ED+ and ED- • Voltage drop at ON: 4 V or less • Maximum allowable voltage: 27 V • Maximum allowable current: 50 mA |
| ED- | EDM signal output terminal (-) | A minus terminal of EDM signal (STO status monitoring). | |

B-2-2 Retaining Requirements of STO Status

The retention function that retains the blocked status of internal safety path even if STO input is canceled is not implemented as a safety circuit.

Therefore, if an operation command is input after cancellation of STO input or STO input is canceled while it is input, the inverter starts output to the motor.

Hence, to satisfy the requirement about cancellation of emergency stop specified in EN/IEC60204-1, you need to take either of the following measures.

- (a) When STO is enabled, this function is used to stop an operation command given to an inverter. It gives the operation command to the inverter when a user intentionally requires inverter restart.
- (b) Design a system in which STO input is reset when a user intentionally requires inverter restart.



Precautions for Correct Use

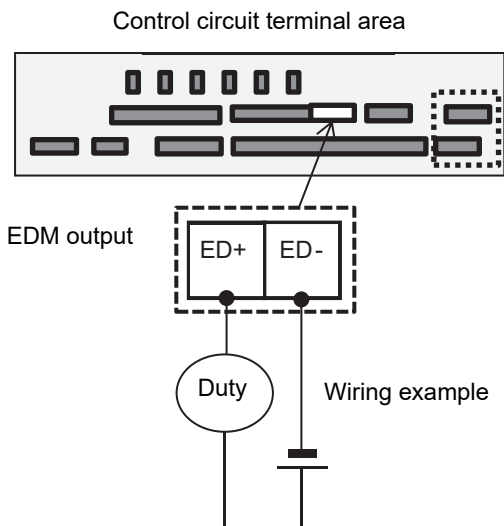
By setting parameters of the main unit, you can select the following operations.

- Trip the inverter by STO input. In this case, the inverter is tripped and output is stopped until power is shut off or the error reset signal for the inverter is input.
- If two STO input systems to the inverter are not input at the same time, the inverter is shut off and enters standby mode until STO input for the two systems is input.

B-2-3 STO Confirmation Signal Output (EDM Signal)

The STO confirmation signal output (EDM output) is the output signal for monitoring the input status of STO signal and failure detection status on the internal safety path.

EDM Output (ED+ / ED-) and Wiring Example



Refer to *Signal Matrix* in the next section when you see output for STO confirmation signal to operations of ST1/ST2 or error detection status. Turn EDM ON only when both ST1 and ST2 are input correctly and internal errors are not detected.

Signal Matrix

| Signal | Status 1 | Status 2 | Status 3 | Status 4 | Status 5 |
|---------------------|----------|---------------------|---------------------|---------------------|----------|
| ST1 *1 | STO | Operation permitted | STO | Operation permitted | *2 |
| ST2 *1 | STO | STO | Operation permitted | Operation permitted | *2 |
| Failure detection | None | None | None | None | Detected |
| EDM | ON | OFF | OFF | OFF | OFF |
| Output to the motor | Cut off | Cut off | Cut off | Output permitted | Cut off |

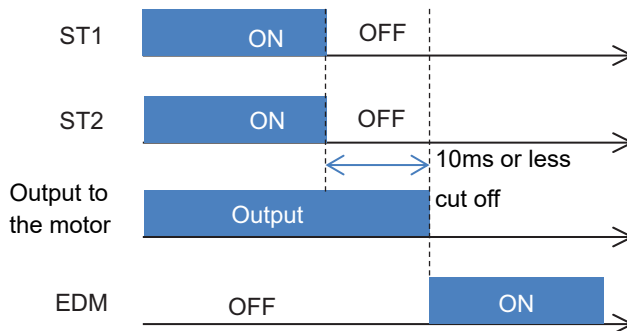
*1. The following table shows the correspondence between the input status of ST1/ST2 described in the table above and status of contact points.

*2. Regardless of signals for ST1/ST2, the status goes into Status 5 when internal errors are detected.

| Input status | Contact point |
|---------------------|---------------|
| STO | OFF |
| Operation permitted | ON |

B-2-4 Timing Chart

The following shows the timing diagram of output to the motor and output of EDM signals for STO inputs ST1/ST2.



B-2-5 Status Indication Function

STO input status can be displayed on LCD operator when you set parameters shown below table. You can also check the status by checking the monitor parameter [dA-45].

Parameters Related to STO Function Indication

| Item | Parameter | Data | Description |
|--|-----------|-------------------|---|
| STO input indication selection | [bd-01] | 00 | If input of both ST1 and ST2 is STO (input contact point is OFF), "STO" is shown on the control panel screen. |
| | | 01 | Also if input of both ST1 and ST2 is STO (input contact point is OFF), "STO" is not shown on the control panel. |
| | | 02 | If input of both ST1 and ST2 is STO (input contact point is OFF), [E090] error occurs.*1 |
| STO allowable input switch time | [bd-02] | 0.00 to 60.00 (s) | Set the allowable time during which input status of ST1 and ST2 is different (e.g., input contact point: ST1=ON, ST2=OFF). If there is a difference between the switching time of ST1 and that of ST2, set the maximum allowable time the difference can be generated. If it is set to 0.00, the determination of allowable time becomes invalid. |
| STO indication selection within allowable input time | [bd-03] | 00 | Displays a warning at the time difference of status occurs between ST1 and ST2 until the STO allowable input switch time configured in [bd-02] has elapsed. |
| | | 01 | Does not display a warning at the time difference of status occurs between ST1 and ST2 until the STO allowable input switch time configured in [bd-02] has elapsed. |
| STO operation selection after allowable input time | [bd-04] | 00 | Displays a warning after the STO allowable input switch time configured in [bd-02] has elapsed. |
| | | 01 | Does not display a warning after the STO allowable input switch time configured in [bd-02] has elapsed. |
| | | 02 | After the STO allowable input switch time configured in [bd-02] has elapsed, [E092] or [E093] error occurs. |

*1. Even if either ST1 and ST2 is set to STO, [E090] error does not occur.

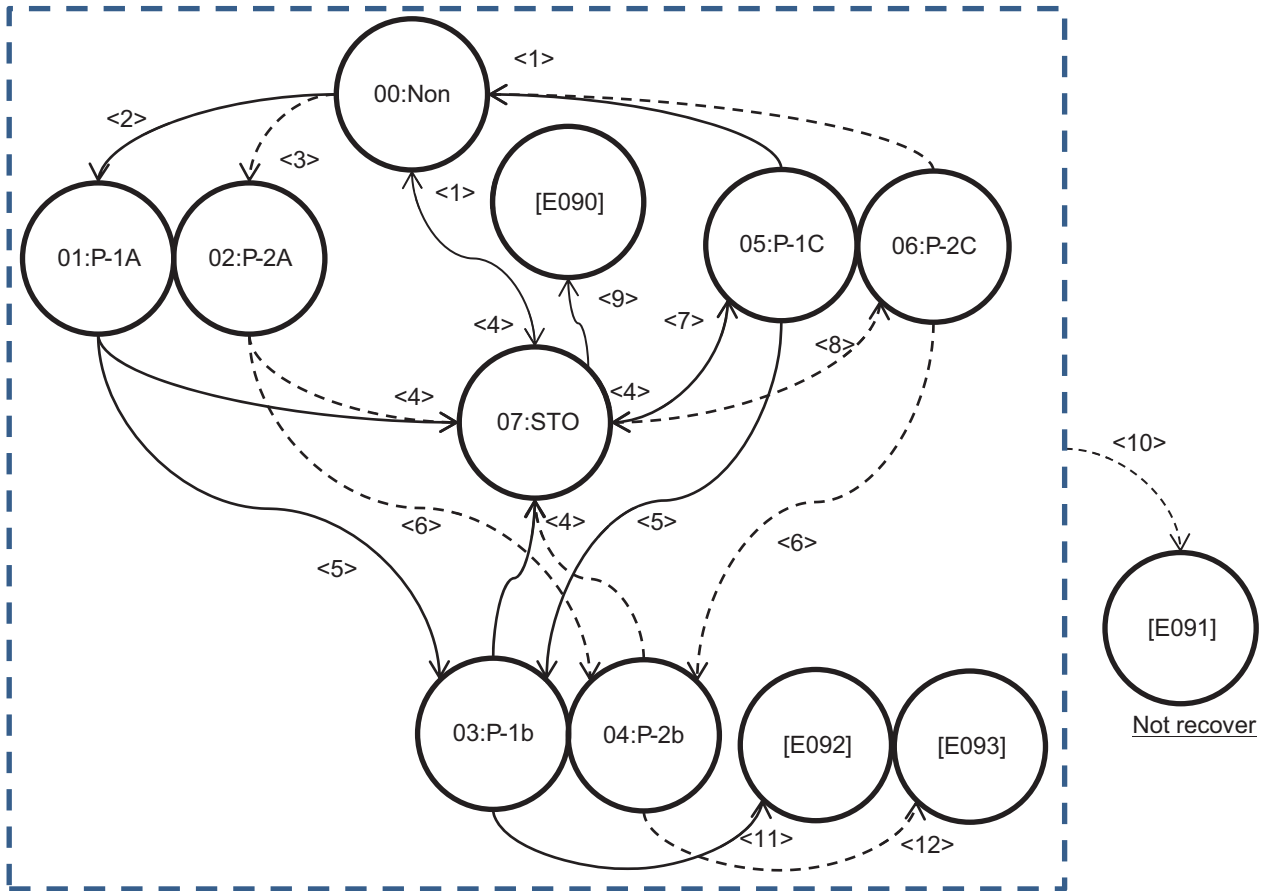
STO Monitor [dA-45] and Status Indication on the Upper Right of the Operator Keypad

| STO monitor [dA-45] data display contents | Status indication on the upper right of the operator keypad | Condition | Description |
|---|---|-----------|---|
| 00:Non | (No indication) | <1> | Operation is permitted on both ST1 and ST2 (contact point is ON) and inverter output is available. |
| 01:P-1A | P-1A | <2> | When operation is permitted on both ST1 and ST2 (contact point is ON), only ST2 changes to STO (contact point is OFF). Then, operation is permitted (contact point is ON) on ST1 again for the entire STO switch allowable time [bd-02]. |
| 02:P-2A | P-2A | <3> | When operation is permitted on both ST1 and ST2 (contact point is ON), only ST1 changes to STO (contact point is OFF). Then, operation is permitted (contact point is ON) on ST1 again for the entire STO switch allowable time [bd-02]. |
| 03:P-1b | P-1b | <5> | (1) The P-1A or P-1b status is kept until the STO switch allowable time [bd-02] has elapsed. (2) When operation is permitted on both ST1 and ST2 (contact point is ON), only ST2 changes to STO (contact point is OFF), and then the operation is permitted (contact point is ON) again. |
| 04:P-2b | P-2b | <6> | (1) The P-12 or P-2b status is kept until the STO switch allowable time [bd-02] has elapsed. (2) When operation is permitted on both ST1 and ST2 (contact point is ON), only ST1 changes to STO (contact point is OFF), and then the operation is permitted (contact point is ON) again. |
| 05:P-1C | P-1C | <7> | From the status that both ST1 and ST2 is STO (contact point is ON), operation is permitted (contact point is ON) only on ST2. Then, ST1 is at STO (contact point is OFF) again for the entire STO switch allowable time [bd-02]. |
| 06:P-2C | P-2C | <8> | From the status that both ST1 and ST2 is STO (contact point is ON), operation is permitted (contact point is ON) only on ST2. Then, ST1 is at STO (contact point is OFF) again for the entire STO switch allowable time [bd-02]. |
| 07:STO | STO | <4> | Both ST1 and ST2 are at STO (contact point is OFF). |

Error Indication

| Item | Error | Condition | Description |
|--------------------|--------|-----------|--|
| STO shut-off error | [E090] | <9> | If [bd-01] is set to 02, the error occurs when both ST1 and ST2 are input. |
| STO internal error | [E091] | <10> | The error occurs when internal failure is found. It cannot be canceled by reset operation. |
| STP path 1 error | [E092] | <11> | If [bd-04] is set to 02, the error occurs at [P-1b]. |
| STP path 2 error | [E093] | <12> | If [bd-04] is set to 02, the error occurs at [P-2b]. |

Status Transition



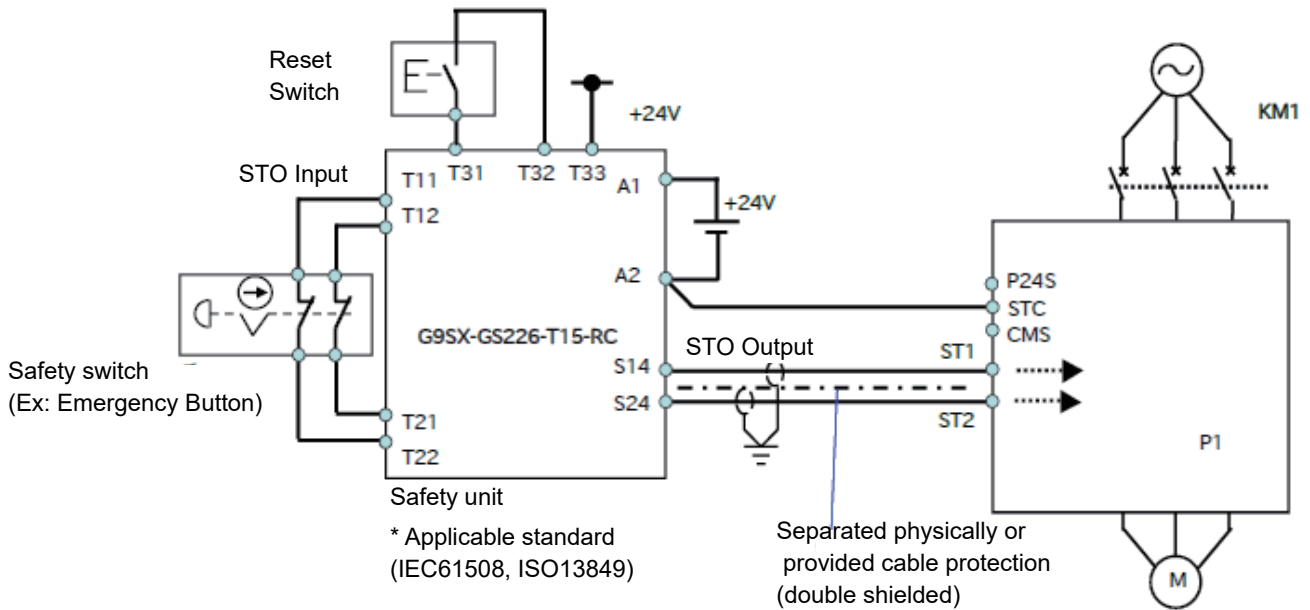
B-3 Example of Use

B-3-1 Example of Wiring

Procedure for connecting STO input to a safety controller is shown as an example.

The condition for use is the followings:

- Use external power supply as one for STO input.
- Never use EDM output.



B-3-2 External Device

Power supply connected to control terminals in 3G3RX2-series is needed to comply with SELV and PELV.

Each ST1/ST2 signal must be separated physically and protected appropriately.

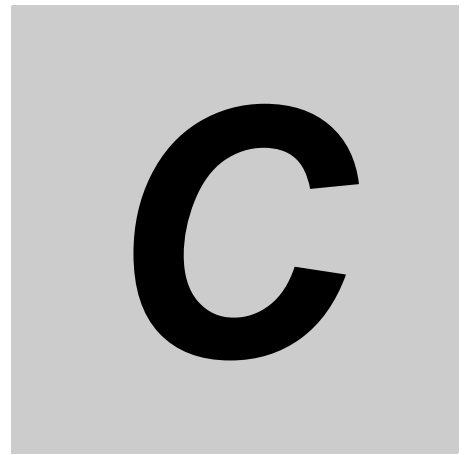
Device for communication of STO signals shall comply with safety standards like ISO13849-1 and IEC61508, etc.

A safety system includes 3G3RX2-series must fulfill CAT.3, PL e /SIL3. Therefore, the 3G3RX2-series must be combined with external safety devices that meet PL e/SIL3.

Test pulse input to ST1/ST2 shall be 300 us or less.

Combination of 3G3RX2-series with external safety devices is shown as below.

| Manufacturer | Product Model | Applicable standard/criteria |
|--------------|-------------------|------------------------------|
| OMRON | G9SA-301 | ISO13849-1 cat4, SIL3 |
| OMRON | G9SX-GS226-T15-RC | IEC61508 SIL1 to 3 |
| OMRON | NE1A-SCPU01-V1 | IEC61508 SIL3 |
| OMRON | G9SP-N□□□ | IEC61508 SIL3 |



Appendices C

Table of Parameters

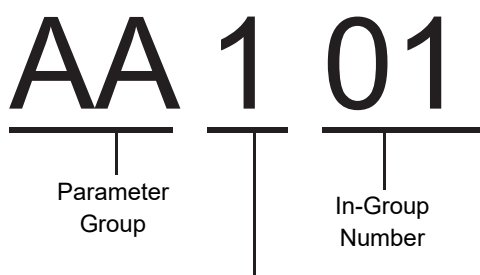
This chapter describes lists of monitors and parameters as well as setting range of each parameter and their initial values.

| | | |
|------------|---------------------------|-------------|
| C-1 | Parameter Notation | C-2 |
| C-2 | Monitor List | C-4 |
| C-3 | Parameter List | C-21 |

C-1 Parameter Notation

Structure of Parameter Number

- A parameter consists of a parameter group, switch recognition number assigned by the 024[SET] terminal function, and an in-group number.
- If the switch recognition number assigned by 024[SET] terminal function is “-”, it is enabled in both first setting and second setting.
- If the 024[SET] function is not set to the input terminal functions [CA-01] to [CA-11], the first setting is valid.



- : Always enabled in both the first setting and second setting
- 1: Enabled in the first setting when the [SET] terminal function is OFF
- 2: Enabled in the second setting when the [SET] terminal function is ON

About Monitor Mode

| Code | Name | Data range |
|-------|--------------|------------|
| XX-01 | Monitor name | Data Range |

About Parameter Mode

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|----------------|--|--------------------------------------|--------------------------------|
| YY101 | - | Parameter name | Data range | Default data Ub-02:01 | (Write down the setting value) |
| YY-02 | ○*1 | Parameter name | (200 V class) data range (400 V class) data range | (200 V class) VV (400 V class) WW | (Write down the setting value) |

*1. Shows that the codes can be changed during operation.

- The voltage class is shown by 200 V/400 V.
- In some cases, a default value depends on Default Value Selection (Ub-02). As for the value, default values to Ub-02 mode are shown.
- Parameters other than those changeable during operation can be changed only when the device is stopped. The user can change the parameter that cannot be changed during operation after the device decelerates and stops and output is stopped. However, it cannot be changed if the soft-lock function is activated.

Notes on Setting Parameters



Precautions for Correct Use

- When setting parameters, we expect you to fully understand various points to be noted.
- Make sure to check and set the following parameters to protect the motor.
 - [Hb102] to [Hb108] (for IM)
 - [Hd102] to [Hd108] (for SM/PMM)
 - [bC110] (electronic thermal level) → for motor overload protection current
 - [bb160] (overcurrent level)

When setting the thermal subtraction characteristics, set a value in accordance with the characteristics of motor. Otherwise, the motor may be burned.

After configuring settings for motor protection, choose the frequency command destination and operation command destination to run the device.

- With [AA101], choose a frequency command destination.
- With [AA111], choose an operation command destination.
- With [FA-01], check that the frequency command is received.

To run the inverter, a frequency command and operation command are required. If commands are sent using V/f control, there is no output if the frequency command is 0 Hz.

C-2 Monitor List

Monitors Related to Output

| Code | Name | Data range |
|-------|---|--|
| dA-01 | Output frequency monitor | 0.00 to 590.00 (Hz) |
| dA-02 | Output current monitor | 0.0 to 655.35 (A) |
| dA-03 | Operation direction monitor | F (Normal rotation in process)/ r (Reverse rotation in process)/ d (0Hz output)/ o (Stopped) |
| dA-04 | Frequency command after calculation | -590.00 to 590.00 (Hz) |
| dA-06 | Output frequency conversion monitor | 0.00 to 59000.00 (Hz) |
| dA-08 | Speed detection value monitor | -590.00 to 590.00 (Hz) |
| dA-12 | Output frequency monitor (with sign) | -590.00 to 590.00 (Hz) |
| dA-14 | Frequency upper limit monitor | 0.00 to 590.00 (Hz) |
| dA-15 | Torque command monitor after calculation | -1000.0 to 1000.0 (%) |
| dA-16 | Torque limit monitor | 0.0 to 500.0 (%) |
| dA-17 | Output torque monitor | -1000.0 to 1000.0 (%) |
| dA-18 | Output voltage monitor | 0.0 to 800.0 (V) |
| dA-20 | Current position monitor | In the case of AA121=10 and AA123=03, data range -2147483648 to 2147483647 (pls) In the case of the condition mentioned above, data range -536870912 to 536870911 (pls) |
| dA-26 | Pulse train position deviation monitor | -2147483647 to +2147483647 (pls) |
| dA-28 | Pulse counter monitor | 0 to 2147483647 (pls) |
| dA-30 | Input power monitor | 0.00 to 600.00 (kW) |
| dA-32 | Integrated input power monitor | 0.0 to 1000000.0 (kW) |
| dA-34 | Output power monitor | 0.00 to 600.00 (kW) |
| dA-36 | Integrated output power monitor | 0.0 to 1000000.0 (kW) |
| dA-38 | Motor temperature monitor | -20.0 to 200.0 (°C) |
| dA-40 | DC voltage monitor | 0.0 to 1000.0 (V) |
| dA-41 | BRD load factor monitor | 0.00 to 100.00 (%) |
| dA-42 | Electronic thermal duty ratio monitor (motor) | 0.00 to 100.00 (%) |
| dA-43 | Electronic thermal duty ratio monitor (controller (inverter)) | 0.00 to 100.00 (%) |

Monitors Related to Control Circuit

| Code | Name | Data range |
|----------------|--|--|
| dA-45 | Integrated output power monitor | 00 (no input)/ 01 (P-1A)/ 02 (P-2A)/ 03 (P-1b)/04 (P-2b)/ 05 (P-1C)/06 (P-2C)/ 07 (STO) |
| dA-50 | Terminal block option mounted state | 00 (STD-TM1 (fixed value)) |
| dA-51 | Input terminal monitor | LLLLLLLLLLL to HHHHHHHHHHH [L:OFF/H:ON] [Left side] (terminal B) (terminal A) (terminal 9) to (terminal 1) [Right side] |
| dA-54 | Output terminal monitor | LLLLLLL to HHHHHHH [L:OFF/H:ON] [Left side] (terminal AL) (terminal 16C) (terminal 15) to (terminal 11) [Right side] |
| dA-60 | Analog I/O selection monitor | AAAAAAA to VVVVVVV [A: current/V: voltage][Left side] (Reserved) (Reserved) (Reserved) (terminal Ai3 (Ii3/Vi3)) (terminal Ao2) (terminal Ao1) (terminal Ai2) (terminal Ai1) [Right side] |
| dA-61 | Analog input [Ai1] monitor | 0.00 to 100.00 (%) |
| dA-62 | Analog input [Ai2] monitor | 0.00 to 100.00 (%) |
| dA-63 | Analog input [Ai3] monitor | -100.00 to 100.00 (%) |
| dA-70 | Pulse string input monitor (main body) | -100.00 to 100.00 (%) |
| dA-71 | Pulse string input monitor (Option) | -100.00 to 100.00 (%) |
| dA-46,47 | Reserved | - |
| dA-64 to dA-66 | Reserved | - |

Option Slot Monitor

| Code | Name | Data range |
|-------|-----------------------------|--|
| dA-81 | Option slot 1 mounted state | 00: (none)/ <hereafter only da-82 is indicated>33: (RX2-PG) |
| dA-82 | Option slot 2 mounted state | |
| dA-83 | Option slot 3 mounted state | |

Monitors Related to the Program Function EzSQ

| Code | Name | Data range |
|----------------|---------------------------|--|
| db-01 | Program download monitor | 00 (Without a program)/01 (With a program) |
| db-02 | Program number monitor | 0000 to 9999 |
| db-03 | Program counter (Task-1) | 1 to 1024 |
| db-04 | Program counter (Task-2) | 1 to 1024 |
| db-05 | Program counter (Task-3) | 1 to 1024 |
| db-06 | Program counter (Task-4) | 1 to 1024 |
| db-07 | Program counter (Task-5) | 1 to 1024 |
| db-08 | User monitor 0 | -2147483647 to 2147483647 |
| db-10 | User monitor 1 | -2147483647 to 2147483647 |
| db-12 | User monitor 2 | -2147483647 to 2147483647 |
| db-14 | User monitor 3 | -2147483647 to 2147483647 |
| db-16 | User monitor 4 | -2147483647 to 2147483647 |
| db-18 | Analog output monitor YA0 | 0 to 10000 |
| db-19 | Analog output monitor YA1 | 0 to 10000 |
| db-20 | Analog output monitor YA2 | 0 to 10000 |
| db-21 to db-23 | Reserved | - |

Monitors Related to PID Function

| Code | Name | Data range |
|-------|---|---|
| db-30 | PID1 feedback data 1 monitor | 0.00 to 100.00 (%) (adjustable in [AH-04][AH-05][AH-06]) |
| db-32 | PID1 feedback data 2 monitor | |
| db-34 | PID1 feedback data 3 monitor | |
| db-36 | PID2 feedback data monitor | 0.00 to 100.00 (%) (adjustable in [AJ-04][AJ-05][AJ-06]) |
| db-38 | PID3 feedback data monitor | 0.00 to 100.00 (%) (adjustable in [AJ-24][AJ-25][AJ-26]) |
| db-40 | PID4 feedback data monitor | 0.00 to 100.00 (%) (adjustable in [AJ-44][AJ-45][AJ-46]) |
| db-42 | PID1 target value monitor after calculation | 0.00 to 100.00 (%) (adjustable in [AH-04][AH-05][AH-06]) |
| db-44 | PID1 feedback data | |
| db-50 | PID1 output monitor | -100.00 to 100.00 (%) |
| db-51 | PID1 deviation monitor | -200.00 to 200.00 (%) |
| db-52 | PID1 deviation 1 monitor | -200.00 to 200.00 (%) |
| db-53 | PID1 deviation 2 monitor | -200.00 to 200.00 (%) |
| db-54 | PID1 deviation 3 monitor | -200.00 to 200.00 (%) |
| db-55 | PID2 output monitor | -100.00 to 100.00 (%) |
| db-56 | PID2 deviation monitor | -200.00 to 200.00 (%) |
| db-57 | PID3 output monitor | -100.00 to 100.00 (%) |
| db-58 | PID3 deviation monitor | -200.00 to 200.00 (%) |
| db-59 | PID4 output monitor | -100.00 to 100.00 (%) |
| db-60 | PID4 deviation monitor | -200.00 to 200.00 (%) |
| db-61 | PID current P gain monitor | 0 to 100.00 (%) |
| db-62 | PID current I gain monitor | 0.0 to 3600.0 (s) |
| db-63 | PID current D gain monitor | 0.00 to 100.00 (s) |
| db-64 | PID feed-forward monitor | -100.00 to 100.00 (%) |

Monitors for Checking Internal Condition

| Code | Name | Data range |
|-------|---|---|
| dC-01 | Inverter load type selection monitor | 00 (very low duty)/01 (low duty)/02 (normal duty) |
| dC-02 | Rated current monitor | 0.0 to 6553.5 (A) |
| dC-07 | Speed command destination monitor (main) | 00 (disabled)/01 (Ai1)/02 (Ai2)/03 (Ai3)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Multistage speed 0)/08 (auxiliary speed)/09 (Multistage speed 1)/10 (Multistage speed 2)/11 (Multistage speed 3)/12 (Multistage speed 4)/13 (Multistage speed 5)/14 (Multistage speed 6)/15 (Multistage speed 7)/16 (Multistage speed 8)/17 (Multistage speed 9)/18 (Multistage speed 10)/19 (Multistage speed 11)/20 (Multistage speed 12)/21 (Multistage speed 13)/22 (Multistage speed 14)/23 (Multistage speed 15)/24 (JG)/25 (RS485)/26 (Option 1)/27 (Option 2)/28 (Option 3)/29 (Pulse array (main unit))/30 (Pulse array (Option))/31 (DriveProgramming)/32 (PID)/33 (Reserved)/34 (AHD retention speed) |
| dC-08 | Speed command destination monitor (auxiliary) | |
| dC-10 | Operation command destination monitor | 00 ([FW]/[RV] terminal)/01 (3 wire)/02 (RUN key on operator keypad)/03 (RS485 setting)/04 (Option 1)/05 (Option 2)/06 (Option 3) |
| dC-15 | Cooling fin temperature monitor | -20.0 to 200.0 (°C) |
| dC-16 | Life diagnostic monitor | LL to HH [L: normal/H: reduction of life] [Left side] (FAN life) (lives of the capacitors on the circuit board) [Right side] |
| dC-20 | Total start-up count | 1 to 65535 (Counts) |
| dC-21 | Power-on count | 1 to 65535 (Counts) |
| dC-22 | Cumulative operating hours monitor during RUN | 1 to 1000000 (hr) |
| dC-24 | Cumulative power-on time | 1 to 1000000 (hr) |
| dC-26 | Cumulative operating time of cooling fan | 1 to 1000000 (hr) |
| dC-37 | Detailed monitor for icon 2LIM | 00 (Condition other than below)/01 (Overcurrent suppression in process)/02 (Overload being limited)/03 (Overvoltage suppression in process)/04 (Torque being limited)/05 (Upper/lower limit and jump frequency setting being limited)/06 (Setting of minimum frequency being limited) |
| dC-38 | Detailed monitor for icon 2ALT | 00 (Condition other than below)/01 (Overload advance notice)/02 (Motor thermal advance notice)/03 (Controller thermal advance notice)/04 (Motor overheat advance notice) |
| dC-39 | Detailed monitor for icon 2RETRY | 00 (Condition other than below)/01 (Retry standby)/02 (Restart standby) |
| dC-40 | Detailed monitor for icon 2NRDY | 00 (Preparation completed condition other than below IRDY=OFF)/01 (Trip occurred)/02 (Power supply abnormality)/03 (Resetting)/04 (STO)/05 (Standby)/06 (Data inconsistency Others (including no FB, consistency of settings of A and B phases, etc.))/07 (Sequence abnormality)/08 (Free run)/09 (Forced stop) |

| Code | Name | Data range |
|-------|--------------------------|--|
| dC-45 | IM/SM (PMM) monitor | 00 (Induction motor IM being selected)/ 01 (Synchronous motor SM (permanent magnet motor PMM) being selected) |
| dC-50 | Firmware version monitor | 0.000 to 99.255 |
| dC-53 | Firmware grade monitor | 00 (Standard) |

Monitor of Trip State

| Code | Name | Data range | |
|---|--|--|---------------------|
| dE-01 | Trip count monitor | 0 to 65535 | |
| dE-11 | Trip monitor 1 Factor | 1 to 255 | |
| | Trip monitor 1 Output frequency(with sign)(HIGT) | -59000 to 59000 | |
| | Trip monitor 1 Output frequency(with sign)(LOW) | | |
| | Trip monitor 1 Output current | 0 to 65535 | |
| | Trip monitor 1 P-N DC voltage | 0 to 10000 | |
| | Trip monitor 1 Inverter state | 0 to 8 ^{*1} | |
| | Trip monitor 1 LAD state | 0 to 5 ^{*1} | |
| | Trip monitor 1 INV control mode | 0 to 11 ^{*1} | |
| | Trip monitor 1 Limit state | 0 to 6 ^{*1} | |
| | Trip monitor 1 Special state | 0 to 6 ^{*1} | |
| | Trip monitor 1 RUN time(HIGH) | 0 to 1000000 | |
| | Trip monitor 1 RUN time(LOW) | | |
| | Trip monitor 1 Power ON time(HIGH) | 0 to 1000000 | |
| | Trip monitor 1 Power ON time(LOW) | | |
| | dE-12 | Trip monitor 1 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | | 01 to 12 (BCD code) |
| Trip monitor 1 Absolute time (day, day of the week) | | 01 to 31 (BCD code) | |
| | | 00 to 06 (BCD code) | |
| Trip monitor 1 Absolute time (hour, minute) | | 00 to 23 (BCD code) | |
| | | 00 to 59 (BCD code) | |
| Trip monitor 2 Factor | | 1 to 255 | |
| Trip monitor 2 Output frequency(with sign)(HIGT) | | -59000 to 59000 | |
| Trip monitor 2 Output frequency(with sign)(LOW) | | | |
| Trip monitor 2 Output current | | 0 to 65535 | |
| Trip monitor 2 P-N DC voltage | | 0 to 10000 | |
| Trip monitor 2 Inverter state | | 0 to 8 ^{*1} | |
| Trip monitor 2 LAD state | | 0 to 5 ^{*1} | |
| Trip monitor 2 INV control mode | | 0 to 11 ^{*1} | |
| Trip monitor 2 Limit state | | 0 to 6 ^{*1} | |
| Trip monitor 2 Special state | | 0 to 6 ^{*1} | |
| Trip monitor 2 RUN time(HIGH) | 0 to 1000000 | | |
| Trip monitor 2 RUN time(LOW) | | | |
| Trip monitor 2 Power ON time(HIGH) | 0 to 2000000 | | |
| Trip monitor 2 Power ON time(LOW) | | | |
| Trip monitor 2 Absolute time (year, month) | 00 to 99 (BCD code) | | |
| | 01 to 12 (BCD code) | | |
| Trip monitor 2 Absolute time (day, day of the week) | 01 to 31 (BCD code) | | |
| | 00 to 06 (BCD code) | | |
| Trip monitor 2 Absolute time (hour, minute) | 00 to 23 (BCD code) | | |
| | 00 to 59 (BCD code) | | |

| Code | Name | Data range |
|---|---|-----------------------|
| dE-13 | Trip monitor 3 Factor | 1 to 255 |
| | Trip monitor 3 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Trip monitor 3 Output frequency(with sign)(LOW) | |
| | Trip monitor 3 Output current | 0 to 65535 |
| | Trip monitor 3 P-N DC voltage | 0 to 10000 |
| | Trip monitor 3 Inverter state | 0 to 8 ^{*1} |
| | Trip monitor 3 LAD state | 0 to 5 ^{*1} |
| | Trip monitor 3 INV control mode | 0 to 11 ^{*1} |
| | Trip monitor 3 Limit state | 0 to 6 ^{*1} |
| | Trip monitor 3 Special state | 0 to 6 ^{*1} |
| | Trip monitor 3 RUN time(HIGH) | 0 to 1000000 |
| | Trip monitor 3 RUN time(LOW) | |
| | Trip monitor 3 Power ON time(HIGH) | 0 to 1000000 |
| | Trip monitor 3 Power ON time(LOW) | |
| | Trip monitor 3 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| | Trip monitor 3 Absolute time (day, day of the week) | 01 to 31 (BCD code) |
| | | 00 to 06 (BCD code) |
| Trip monitor 3 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |
| dE-14 | Trip monitor 4 Factor | 1 to 255 |
| | Trip monitor 4 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Trip monitor 4 Output frequency(with sign)(LOW) | |
| | Trip monitor 4 Output current | 0 to 65545 |
| | Trip monitor 4 P-N DC voltage | 0 to 10000 |
| | Trip monitor 4 Inverter state | 0 to 8 ^{*1} |
| | Trip monitor 4 LAD state | 0 to 5 ^{*1} |
| | Trip monitor 4 INV control mode | 0 to 11 ^{*1} |
| | Trip monitor 4 Limit state | 0 to 6 ^{*1} |
| | Trip monitor 4 Special state | 0 to 6 ^{*1} |
| | Trip monitor 4 RUN time(HIGH) | 0 to 1000000 |
| | Trip monitor 4 RUN time(LOW) | |
| | Trip monitor 4 Power ON time(HIGH) | 0 to 1000000 |
| | Trip monitor 4 Power ON time(LOW) | |
| | Trip monitor 4 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| | Trip monitor 4 Absolute time (day, day of the week) | 01 to 31 (BCD code) |
| | | 00 to 06 (BCD code) |
| Trip monitor 4 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |



| Code | Name | Data range |
|---|--|-----------------------|
| dE-15 | Trip monitor 5 Factor | 1 to 255 |
| | Trip monitor 5 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Trip monitor 5 Output frequency(with sign)(LOW) | |
| | Trip monitor 5 Output current | 0 to 65535 |
| | Trip monitor 5 P-N DC voltage | 0 to 10000 |
| | Trip monitor 5 Inverter state | 0 to 8 ^{*1} |
| | Trip monitor 5 LAD state | 0 to 5 ^{*1} |
| | Trip monitor 5 INV control mode | 0 to 11 ^{*1} |
| | Trip monitor 5 Limit state | 0 to 6 ^{*1} |
| | Trip monitor 5 Special state | 0 to 6 ^{*1} |
| | Trip monitor 5 RUN time(HIGH) | 0 to 1000000 |
| | Trip monitor 5 RUN time(LOW) | |
| | Trip monitor 5 Power ON time(HIGH) | 0 to 1000000 |
| | Trip monitor 5 Power ON time(LOW) | |
| | Trip monitor 5 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| Trip monitor 5 Absolute time (day, day of the week) | 01 to 31 (BCD code) | |
| | 00 to 06 (BCD code) | |
| Trip monitor 5 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |
| dE-16 | Trip monitor 6 Factor | 1 to 255 |
| | Trip monitor 6 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Trip monitor 6 Output frequency(with sign)(LOW) | |
| | Trip monitor 6 Output current | 0 to 65535 |
| | Trip monitor 6 P-N DC voltage | 0 to 10000 |
| | Trip monitor 6 Inverter state | 0 to 8 ^{*1} |
| | Trip monitor 6 LAD state | 0 to 5 ^{*1} |
| | Trip monitor 6 INV control mode | 0 to 11 ^{*1} |
| | Trip monitor 6 Limit state | 0 to 6 ^{*1} |
| | Trip monitor 6 Special state | 0 to 6 ^{*1} |
| | Trip monitor 6 RUN time(HIGH) | 0 to 1000000 |
| | Trip monitor 6 RUN time(LOW) | |
| | Trip monitor 6 Power ON time(HIGH) | 0 to 1000000 |
| | Trip monitor 6 Power ON time(LOW) | |
| | Trip monitor 6 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| Trip monitor 6 Absolute time (day, day of the week) | 01 to 31 (BCD code) | |
| | 00 to 06 (BCD code) | |
| Trip monitor 6 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |

| Code | Name | Data range |
|---|---|-----------------------|
| dE-17 | Trip monitor 7 Factor | 1 to 255 |
| | Trip monitor 7 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Trip monitor 7 Output frequency(with sign)(LOW) | |
| | Trip monitor 7 Output current | 0 to 65535 |
| | Trip monitor 7 P-N DC voltage | 0 to 10000 |
| | Trip monitor 7 Inverter state | 0 to 8 ^{*1} |
| | Trip monitor 7 LAD state | 0 to 5 ^{*1} |
| | Trip monitor 7 INV control mode | 0 to 11 ^{*1} |
| | Trip monitor 7 Limit state | 0 to 6 ^{*1} |
| | Trip monitor 7 Special state | 0 to 6 ^{*1} |
| | Trip monitor 7 RUN time(HIGH) | 0 to 1000000 |
| | Trip monitor 7 RUN time(LOW) | |
| | Trip monitor 7 Power ON time(HIGH) | 0 to 1000000 |
| | Trip monitor 7 Power ON time(LOW) | |
| | Trip monitor 7 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| | Trip monitor 7 Absolute time (day, day of the week) | 01 to 31 (BCD code) |
| | | 00 to 06 (BCD code) |
| Trip monitor 7 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |
| dE-18 | Trip monitor 8 Factor | 1 to 255 |
| | Trip monitor 8 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Trip monitor 8 Output frequency(with sign)(LOW) | |
| | Trip monitor 8 Output current | 0 to 65535 |
| | Trip monitor 8 P-N DC voltage | 0 to 10000 |
| | Trip monitor 8 Inverter state | 0 to 8 ^{*1} |
| | Trip monitor 8 LAD state | 0 to 5 ^{*1} |
| | Trip monitor 8 INV control mode | 0 to 11 ^{*1} |
| | Trip monitor 8 Limit state | 0 to 6 ^{*1} |
| | Trip monitor 8 Special state | 0 to 6 ^{*1} |
| | Trip monitor 8 RUN time(HIGH) | 0 to 1000000 |
| | Trip monitor 8 RUN time(LOW) | |
| | Trip monitor 8 Power ON time(HIGH) | 0 to 1000000 |
| | Trip monitor 8 Power ON time(LOW) | |
| | Trip monitor 8 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| | Trip monitor 8 Absolute time (day, day of the week) | 01 to 31 (BCD code) |
| | | 00 to 06 (BCD code) |
| Trip monitor 8 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |



| Code | Name | Data range |
|--|---|-----------------------|
| dE-19 | Trip monitor 9 Factor | 1 to 255 |
| | Trip monitor 9 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Trip monitor 9 Output frequency(with sign)(LOW) | |
| | Trip monitor 9 Output current | 0 to 65535 |
| | Trip monitor 9 P-N DC voltage | 0 to 10000 |
| | Trip monitor 9 Inverter state | 0 to 8 ^{*1} |
| | Trip monitor 9 LAD state | 0 to 5 ^{*1} |
| | Trip monitor 9 INV control mode | 0 to 11 ^{*1} |
| | Trip monitor 9 Limit state | 0 to 6 ^{*1} |
| | Trip monitor 9 Special state | 0 to 6 ^{*1} |
| | Trip monitor 9 RUN time(HIGH) | 0 to 1000000 |
| | Trip monitor 9 RUN time(LOW) | |
| | Trip monitor 9 Power ON time(HIGH) | 0 to 1000000 |
| | Trip monitor 9 Power ON time(LOW) | |
| | Trip monitor 9 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| Trip monitor 9 Absolute time (day, day of the week) | 01 to 31 (BCD code) | |
| | 00 to 06 (BCD code) | |
| Trip monitor 9 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |
| dE-20 | Trip monitor 10 Factor | 1 to 255 |
| | Trip monitor 10 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Trip monitor 10 Output frequency(with sign)(LOW) | |
| | Trip monitor 10 Output current | 0 to 65535 |
| | Trip monitor 10 P-N DC voltage | 0 to 10000 |
| | Trip monitor 10 Inverter state | 0 to 8 ^{*1} |
| | Trip monitor 10 LAD state | 0 to 5 ^{*1} |
| | Trip monitor 10 INV control mode | 0 to 11 ^{*1} |
| | Trip monitor 10 Limit state | 0 to 6 ^{*1} |
| | Trip monitor 10 Special state | 0 to 6 ^{*1} |
| | Trip monitor 10 RUN time(HIGH) | 0 to 1000000 |
| | Trip monitor 10 RUN time(LOW) | |
| | Trip monitor 10 Power ON time(HIGH) | 0 to 1000000 |
| | Trip monitor 10 Power ON time(LOW) | |
| | Trip monitor 10 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| Trip monitor 10 Absolute time (day, day of the week) | 01 to 31 (BCD code) | |
| | 00 to 06 (BCD code) | |
| Trip monitor 10 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |

*1. Details of Trip Retry

Monitor of Retry State

| Code | Name | Data range |
|--|--|-----------------------|
| dE-31 | Retry monitor 1 Factor | 1 to 255 |
| | Retry monitor 1 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Retry monitor 1 Output frequency(with sign)(LOW) | |
| | Retry monitor 1 Output current | 0 to 65535 |
| | Retry monitor 1 P-N DC voltage | 0 to 10000 |
| | Retry monitor 1 Inverter state | 0 to 8 ^{*1} |
| | Retry monitor 1 LAD state | 0 to 5 ^{*1} |
| | Retry monitor 1 INV control mode | 0 to 11 ^{*1} |
| | Retry monitor 1 Limit state | 0 to 6 ^{*1} |
| | Retry monitor 1 Special state | 0 to 6 ^{*1} |
| | Retry monitor 1 RUN time(HIGT) | 0 to 1000000 |
| | Retry monitor 1 RUN time(LOW) | |
| | Retry monitor 1 Power ON time(HIGT) | 0 to 1000000 |
| | Retry monitor 1 Power ON time(LOW) | |
| | Retry monitor 1 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| | Retry monitor 1 Absolute time (day, day of the week) | 01 to 31 (BCD code) |
| 00 to 06 (BCD code) | | |
| Retry monitor 1 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |
| dE-32 | Retry monitor 2 Factor | 1 to 255 |
| | Retry monitor 2 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Retry monitor 2 Output frequency(with sign)(LOW) | |
| | Retry monitor 2 Output current | 0 to 65535 |
| | Retry monitor 2 P-N DC voltage | 0 to 10000 |
| | Retry monitor 2 Inverter state | 0 to 8 ^{*1} |
| | Retry monitor 2 LAD state | 0 to 5 ^{*1} |
| | Retry monitor 2 INV control mode | 0 to 11 ^{*1} |
| | Retry monitor 2 Limit state | 0 to 6 ^{*1} |
| | Retry monitor 2 Special state | 0 to 6 ^{*1} |
| | Retry monitor 2 RUN time(HIGT) | 0 to 2000000 |
| | Retry monitor 2 RUN time(LOW) | |
| | Retry monitor 2 Power ON time(HIGT) | 0 to 2000000 |
| | Retry monitor 2 Power ON time(LOW) | |
| | Retry monitor 2 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| | Retry monitor 2 Absolute time (day, day of the week) | 01 to 31 (BCD code) |
| 00 to 06 (BCD code) | | |
| Retry monitor 2 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |



| Code | Name | Data range |
|--|---|-----------------------|
| dE-33 | Retry monitor 3 Factor | 1 to 255 |
| | Retry monitor 3 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Retry monitor 3 Output frequency(with sign)(LOW) | |
| | Retry monitor 3 Output current | 0 to 65535 |
| | Retry monitor 3 P-N DC voltage | 0 to 10000 |
| | Retry monitor 3 Inverter state | 0 to 8 ^{*1} |
| | Retry monitor 3 LAD state | 0 to 5 ^{*1} |
| | Retry monitor 3 INV control mode | 0 to 11 ^{*1} |
| | Retry monitor 3 Limit state | 0 to 6 ^{*1} |
| | Retry monitor 3 Special state | 0 to 6 ^{*1} |
| | Retry monitor 3 RUN time(HIGT) | 0 to 1000000 |
| | Retry monitor 3 RUN time(LOW) | |
| | Retry monitor 3 Power ON time(HIGT) | 0 to 1000000 |
| | Retry monitor 3 Power ON time(LOW) | |
| | Retry monitor 3 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| Retry monitor 3 Absolute time (day, day of the week) | 01 to 31 (BCD code) | |
| | 00 to 06 (BCD code) | |
| Retry monitor 3 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |
| dE-34 | Retry monitor 4 Factor | 1 to 255 |
| | Retry monitor 4 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Retry monitor 4 Output frequency(with sign)(LOW) | |
| | Retry monitor 4 Output current | 0 to 65535 |
| | Retry monitor 4 P-N DC voltage | 0 to 10000 |
| | Retry monitor 4 Inverter state | 0 to 8 ^{*1} |
| | Retry monitor 4 LAD state | 0 to 5 ^{*1} |
| | Retry monitor 4 INV control mode | 0 to 11 ^{*1} |
| | Retry monitor 4 Limit state | 0 to 6 ^{*1} |
| | Retry monitor 4 Special state | 0 to 6 ^{*1} |
| | Retry monitor 4 RUN time(HIGT) | 0 to 1000000 |
| | Retry monitor 4 RUN time(LOW) | |
| | Retry monitor 4 Power ON time(HIGT) | 0 to 1000000 |
| | Retry monitor 4 Power ON time(LOW) | |
| | Retry monitor 4 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| Retry monitor 4 Absolute time (day, day of the week) | 01 to 31 (BCD code) | |
| | 00 to 06 (BCD code) | |
| Retry monitor 4 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |

| Code | Name | Data range |
|-------|--|-----------------------|
| dE-35 | Retry monitor 5 Factor | 1 to 255 |
| | Retry monitor 5 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Retry monitor 5 Output frequency(with sign)(LOW) | |
| | Retry monitor 5 Output current | 0 to 65535 |
| | Retry monitor 5 P-N DC voltage | 0 to 10000 |
| | Retry monitor 5 Inverter state | 0 to 8 ^{*1} |
| | Retry monitor 5 LAD state | 0 to 5 ^{*1} |
| | Retry monitor 5 INV control mode | 0 to 11 ^{*1} |
| | Retry monitor 5 Limit state | 0 to 6 ^{*1} |
| | Retry monitor 5 Special state | 0 to 6 ^{*1} |
| | Retry monitor 5 RUN time(HIGT) | 0 to 1000000 |
| | Retry monitor 5 RUN time(LOW) | |
| | Retry monitor 5 Power ON time(HIGT) | 0 to 1000000 |
| | Retry monitor 5 Power ON time(LOW) | |
| | Retry monitor 5 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| | Retry monitor 5 Absolute time (day, day of the week) | 01 to 31 (BCD code) |
| | | 00 to 06 (BCD code) |
| | Retry monitor 5 Absolute time (hour, minute) | 00 to 23 (BCD code) |
| | | 00 to 59 (BCD code) |
| dE-36 | Retry monitor 6 Factor | 1 to 255 |
| | Retry monitor 6 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Retry monitor 6 Output frequency(with sign)(LOW) | |
| | Retry monitor 6 Output current | 0 to 65535 |
| | Retry monitor 6 P-N DC voltage | 0 to 10000 |
| | Retry monitor 6 Inverter state | 0 to 8 ^{*1} |
| | Retry monitor 6 LAD state | 0 to 5 ^{*1} |
| | Retry monitor 6 INV control mode | 0 to 11 ^{*1} |
| | Retry monitor 6 Limit state | 0 to 6 ^{*1} |
| | Retry monitor 6 Special state | 0 to 6 ^{*1} |
| | Retry monitor 6 RUN time(HIGT) | 0 to 1000000 |
| | Retry monitor 6 RUN time(LOW) | |
| | Retry monitor 6 Power ON time(HIGT) | 0 to 1000000 |
| | Retry monitor 6 Power ON time(LOW) | |
| | Retry monitor 6 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| | Retry monitor 6 Absolute time (day, day of the week) | 01 to 31 (BCD code) |
| | | 00 to 06 (BCD code) |
| | Retry monitor 6 Absolute time (hour, minute) | 00 to 23 (BCD code) |
| | | 00 to 59 (BCD code) |



| Code | Name | Data range |
|--|---|-----------------------|
| dE-37 | Retry monitor 7 Factor | 1 to 255 |
| | Retry monitor 7 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Retry monitor 7 Output frequency(with sign)(LOW) | |
| | Retry monitor 7 Output current | 0 to 65535 |
| | Retry monitor 7 P-N DC voltage | 0 to 10000 |
| | Retry monitor 7 Inverter state | 0 to 8 ^{*1} |
| | Retry monitor 7 LAD state | 0 to 5 ^{*1} |
| | Retry monitor 7 INV control mode | 0 to 11 ^{*1} |
| | Retry monitor 7 Limit state | 0 to 6 ^{*1} |
| | Retry monitor 7 Special state | 0 to 6 ^{*1} |
| | Retry monitor 7 RUN time(HIGT) | 0 to 1000000 |
| | Retry monitor 7 RUN time(LOW) | |
| | Retry monitor 7 Power ON time(HIGT) | 0 to 1000000 |
| | Retry monitor 7 Power ON time(LOW) | |
| | Retry monitor 7 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| Retry monitor 7 Absolute time (day, day of the week) | 01 to 31 (BCD code) | |
| | 00 to 06 (BCD code) | |
| Retry monitor 7 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |
| dE-38 | Retry monitor 8 Factor | 1 to 255 |
| | Retry monitor 8 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Retry monitor 8 Output frequency(with sign)(LOW) | |
| | Retry monitor 8 Output current | 0 to 65535 |
| | Retry monitor 8 P-N DC voltage | 0 to 10000 |
| | Retry monitor 8 Inverter state | 0 to 8 ^{*1} |
| | Retry monitor 8 LAD state | 0 to 5 ^{*1} |
| | Retry monitor 8 INV control mode | 0 to 11 ^{*1} |
| | Retry monitor 8 Limit state | 0 to 6 ^{*1} |
| | Retry monitor 8 Special state | 0 to 6 ^{*1} |
| | Retry monitor 8 RUN time(HIGT) | 0 to 1000000 |
| | Retry monitor 8 RUN time(LOW) | |
| | Retry monitor 8 Power ON time(HIGT) | 0 to 1000000 |
| | Retry monitor 8 Power ON time(LOW) | |
| | Retry monitor 8 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| Retry monitor 8 Absolute time (day, day of the week) | 01 to 31 (BCD code) | |
| | 00 to 06 (BCD code) | |
| Retry monitor 8 Absolute time (hour, minute) | 00 to 23 (BCD code) | |
| | 00 to 59 (BCD code) | |

| Code | Name | Data range |
|-------|---|-----------------------|
| dE-39 | Retry monitor 9 Factor | 1 to 255 |
| | Retry monitor 9 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Retry monitor 9 Output frequency(with sign)(LOW) | |
| | Retry monitor 9 Output current | 0 to 65535 |
| | Retry monitor 9 P-N DC voltage | 0 to 10000 |
| | Retry monitor 9 Inverter state | 0 to 8 ^{*1} |
| | Retry monitor 9 LAD state | 0 to 5 ^{*1} |
| | Retry monitor 9 INV control mode | 0 to 11 ^{*1} |
| | Retry monitor 9 Limit state | 0 to 6 ^{*1} |
| | Retry monitor 9 Special state | 0 to 6 ^{*1} |
| | Retry monitor 9 RUN time(HIGT) | 0 to 1000000 |
| | Retry monitor 9 RUN time(LOW) | |
| | Retry monitor 9 Power ON time(HIGT) | 0 to 1000000 |
| | Retry monitor 9 Power ON time(LOW) | |
| | Retry monitor 9 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| | Retry monitor 9 Absolute time (day, day of the week) | 01 to 31 (BCD code) |
| | | 00 to 06 (BCD code) |
| | Retry monitor 9 Absolute time (hour, minute) | 00 to 23 (BCD code) |
| | | 00 to 59 (BCD code) |
| dE-40 | Retry monitor 10 Factor | 1 to 255 |
| | Retry monitor 10 Output frequency(with sign)(HIGT) | -59000 to 59000 |
| | Retry monitor 10 Output frequency(with sign)(LOW) | |
| | Retry monitor 10 Output current | 0 to 65535 |
| | Retry monitor 10 P-N DC voltage | 0 to 10000 |
| | Retry monitor 10 Inverter state | 0 to 8 ^{*1} |
| | Retry monitor 10 LAD state | 0 to 5 ^{*1} |
| | Retry monitor 10 INV control mode | 0 to 11 ^{*1} |
| | Retry monitor 10 Limit state | 0 to 6 ^{*1} |
| | Retry monitor 10 Special state | 0 to 6 ^{*1} |
| | Retry monitor 10 RUN time(HIGT) | 0 to 1000000 |
| | Retry monitor 10 RUN time(LOW) | |
| | Retry monitor 10 Power ON time(HIGT) | 0 to 1000000 |
| | Retry monitor 10 Power ON time(LOW) | |
| | Retry monitor 10 Absolute time (year, month) | 00 to 99 (BCD code) |
| | | 01 to 12 (BCD code) |
| | Retry monitor 10 Absolute time (day, day of the week) | 01 to 31 (BCD code) |
| | | 00 to 06 (BCD code) |
| | Retry monitor 10 Absolute time (hour, minute) | 00 to 23 (BCD code) |
| | | 00 to 59 (BCD code) |

*1. Details of Trip Retry



Details of Trip Retry

| Function name | code | mode | LCD operator |
|------------------|---|---|--------------|
| Inverter state | 0 | During power supply turned ON, reset, customer-initializing | INIT. |
| | 1 | Ground fault detecting | GND fault |
| | 2 | During stop | Stop |
| | 3 | Operation standby (contactor applied) | Run PREP.1 |
| | 4 | Operation ready (magnetic position detecting) | Run PREP.2 |
| | 5 | During RUN (including DB, Servo ON, forcing) | Run |
| | 6 | Stop Standby (contactor open) | Stop PREP. |
| | 7 | Retry waiting | Retry PREP. |
| | 8 | During retry | Retry |
| LAD state | 0 | Zero (output shut off, DB, Servo On, forcing) | - |
| | 1 | At startup, forward/reverse switching, voltage reducing start | MIN. |
| | 2 | During acceleration | ACCEL. |
| | 3 | During deceleration | DECEL. |
| | 4 | During constant speed | CONST. |
| | 5 | During restart | Restart |
| INV control mode | 0 | Power shut off | - |
| | 1 | During speed control | SPD CNTL |
| | 2 | During startup | Starting |
| | 3 | During DB | DB |
| | 4 | During forcing | Forcing |
| | 5 | During Servo ON | Servo ON |
| | 6 | During position control | POS CNTL |
| | 7 | During torque control | TRQ CNTL |
| | 8 | During restart | Restarting |
| | 9 | During detection of magnetic pole position | Axis POS |
| | 10 | During ground fault detection | GND fault |
| 11 | During measurement of auto-tuning R1R2L | Tuning | |
| Limit state | 0 | Not limited status | - |
| | 1 | During overcurrent suppression (priority order of display is high) | OC SUPPR |
| | 2 | During overload suppression | OL SUPPR |
| | 3 | During overvoltage suppression | OV SUPPR |
| | 4 | During torque limit (priority order of display is low) | TRQ Limit |
| | 5 | During setting limitation of upper and lower limit and jump frequency | Freq Limit |
| | 6 | During setting limitation of minimum frequency | Min.Freq |

| Function name | code | mode | LCD operator |
|---------------|------|-----------------------------------|--------------|
| Special state | 0 | Not particular status | - |
| | 1 | During auto-tuning | Tuning |
| | 2 | During simulation mode | Simulation |
| | 3 | (Reserved) | - |
| | 4 | During forced emergency operation | Force Run |
| | 5 | During bypass mode | Bypass |
| | 6 | (Reserved) | - |



Monitors and Parameters for Changing the Current Commands ^{*1}

| Code | Codes that can be changed during operation | Name | Data range | Note |
|-------|--|------------------------------|--|------|
| FA-01 | ○ | Main Speed reference monitor | 0.00 to 590.00 (Hz) | |
| FA-02 | ○ | Sub Speed reference monitor | -590.00 to 590.00 (Hz) (for monitoring) 0.00 to 590.00 (Hz) (for setting) | |
| FA-10 | ○ | Acceleration time monitor | 0.00 to 3600.00 (s) | |
| FA-12 | ○ | Deceleration time monitor | 0.00 to 3600.00 (s) | |
| FA-15 | ○ | Torque reference monitor | -500.0 to 500.0 (%) | |
| FA-16 | ○ | Torque bias monitor | -500.0 to 500.0 (%) | |
| FA-20 | ○ | Position reference monitor | When [AA121]≠10 or [AA123]≠03 -268435455 to +268435455 (pls)/ When [AA121]=10 and [AA123]=03 -1073741823 to +1073741823 (pls) | |
| FA-30 | ○ | PID1 Set Value 1 monitor | 0.00 to 100.00 (%) (adjustable in [AH-04][AH-05][AH-06]) | |
| FA-32 | ○ | PID1 Set Value 2 monitor | | |
| FA-34 | ○ | PID1 Set Value 3 monitor | | |
| FA-36 | ○ | PID2 Set Value monitor | 0.00 to 100.00 (%) (adjustable in [AJ-04][AJ-05][AJ-06]) | |
| FA-38 | ○ | PID3 Set Value monitor | 0.00 to 100.00 (%) (adjustable in [AJ-24][AJ-25][AJ-26]) | |
| FA-40 | ○ | PID4 Set Value monitor | 0.00 to 100.00 (%) (adjustable in [AJ-44][AJ-45][AJ-46]) | |

*1. FA parameter indicates the current command value, and automatically displays data of the command destination that is being adopted.

Example 1: If the command destination is the operator keypad, it can be changed using the arrow keys.

Example 2: If the command destination is the analog input Ai1, it can be changed by changing input to the terminal [Ai1].

C-3 Parameter List

Parameter Mode (Code A)

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|--|------------------|------|
| AA101 | - | Main speed input source selection, 1st-motor | 01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option)/14 (Program function)/15 (PID calculation)/16 (Reserved) | 01 ^{*1} | |
| AA102 | - | Sub frequency input source selection, 1st-motor | 00 (Disabled)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option)/14 (Program function)/15 (PID calculation)/16 (Reserved) | 00 | |
| AA104 | o | Sub speed setting, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AA105 | - | Calculation symbol selection for Speed reference, 1st-motor | 00 (Disabled)/01 (Addition)/02 (Subtraction)/03 (Multiplication) | 00 | |
| AA106 | o | Add frequency setting, 1st-motor | -590.00 to 590.00 (Hz) | 0.00 | |
| AA111 | - | Run-command input source selection, 1st-motor | 00 ([FW]/[RV] terminal)/01 (3 wire)/02 (RUN key on LCD operator)/03 (RS485)/04 (Option 1)/05 (Option 2)/06 (Option 3) | 00 ^{*1} | |
| AA-12 | o | RUN-key Direction of LCD operator, 1st-motor | 00 (Normal rotation)/01 (Reverse rotation) | 00 | |
| AA-13 | - | STOP-key enable at RUN-command from terminal, 1st-motor | 00 (Disabled)/01 (Enabled)/02 (Only reset is enabled) | 01 | |
| AA114 | - | RUN-direction restriction, 1st-motor | 00 (No limitation)/01 (Only normal rotation)/02 (Only reverse rotation) | 00 | |
| AA115 | - | STOP mode selection, 1st-motor | 00 (Deceleration stop)/01 (Free run stop) | 00 | |
| AA121 | - | Control mode selection, 1st-motor | 00 ([V/f] Fixed torque characteristics (IM))/01 ([V/f] Reducing torque characteristics (IM))/02 ([V/f] Free V/f (IM))/03 ([V/f] Auto torque boost (IM))/04 ([V/f with sensor] Fixed torque characteristics (IM))/05 ([V/f with sensor] Reduced torque characteristics (IM))/06 ([V/f with sensor] Free V/f (IM))/07 ([V/f with sensor] Auto torque boost (IM))/08 (Sensorless vector control (IM))/09 (Zero-Hz range sensorless vector control (IM)) ^{*2} /10 (Vector control with sensor (IM)) ^{*2} /11 (Synchronous start type sensorless vector control (SM/PMM))/12 (IVMS start type sensorless vector control (SM/PMM)) ^{*3} | 00 | |
| AA123 | - | Vector control mode selection, 1st-motor | 00 (Speed/torque control mode)/01 (Pulse string position control mode)/02 (Absolute position control mode)/03 (High-resolution absolute position control mode) | 00 | |
| AA201 | - | Main speed input source selection, 2nd-motor | 01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option)/14 (Program function)/15 (PID calculation)/16 (Reserved) | 00 ^{*1} | |



| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|--|---------------|------|
| AA202 | - | Sub speed input source selection, 2nd-motor | 00 (Disabled)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option)/14 (Program function)/15 (PID calculation)/16 (Reserved) | 00 | |
| AA204 | o | Sub speed setting, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AA205 | - | Calculation symbol selection for Speed reference, 2nd-motor | 00 (Disabled)/01 (Addition)/02 (Subtraction)/03 (Multiplication) | 00 | |
| AA206 | o | Add frequency setting, 2nd-motor | -590.00 to 590.00 (Hz) | 0.00 | |
| AA211 | - | Run-command input source selection, 2nd-motor | 00 ([FW]/[RV] terminal)/01 (3 wire)/02 (RUN key on LCD operator)/03 (RS485)/04 (Option 1)/05 (Option 2)/06 (Option 3) | 00*1 | |
| AA214 | - | RUN-direction restriction, 2nd-motor | 00 (No limitation)/01 (Only normal rotation)/02 (Only reverse rotation) | 00 | |
| AA215 | - | STOP mode selection, 2nd-motor | 00 (Deceleration stop)/01 (Free run stop) | 00 | |
| AA221 | - | Control mode selection, 2nd-motor | 00 ([V/f] Fixed torque characteristics (IM))/01 ([V/f] Reducing torque characteristics (IM))/02 ([V/f] Free V/f (IM))/03 ([V/f] Auto torque boost (IM))/04 ([V/f with sensor] Fixed torque characteristics (IM))/05 ([V/f with sensor] Reduced torque characteristics (IM))/06 ([V/f with sensor] Free V/f (IM))/07 ([V/f with sensor] Auto torque boost (IM))/08 (Sensorless vector control (IM))/09 (Zero-Hz range sensorless vector control (IM)) ^{*2} /10 (Vector control with sensor (IM)) ^{*2} /11 (Synchronous start type sensorless vector control (SM/PMM))/12 (IVMS start type sensorless vector control (SM/PMM)) ^{*3} | 00 | |
| AA223 | - | Vector control mode selection, 2nd-motor | 00 (Speed/torque control mode)/01 (Pulse string position control mode)/02 (Absolute position control mode)/03 (High-resolution absolute position control mode) | 00 | |

*1. It is a default value when Default Value Selection (Ub-02) is set to 01.

*2. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 00 (VLD).

*3. Cannot be selected if [Ub-03] duty spec selection is 00 (VLD).

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---------------------------------|---|---------------|------|
| Ab-01 | - | Frequency conversion gain | 0.01 to 100.00 | 1.00 | |
| Ab-03 | - | Multistep speed selection | 00 (16th speed: binary (CF1 to CF4))/ 01 (8th speed: bit (SF1 to SF7)) | 00 | |
| Ab110 | o | Multispeed-0 setting, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-11 | o | Multispeed-1 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-12 | o | Multispeed-2 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-13 | o | Multispeed-3 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-14 | o | Multispeed-4 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-15 | o | Multispeed-5 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-16 | o | Multispeed-6 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-17 | o | Multispeed-7 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-18 | o | Multispeed-8 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-19 | o | Multispeed-9 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-20 | o | Multispeed-10 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-21 | o | Multispeed-11 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-22 | o | Multispeed-12 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-23 | o | Multispeed-13 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-24 | o | Multispeed-14 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab-25 | o | Multispeed-15 setting | 0.00 to 590.00 (Hz) | 0.00 | |
| Ab210 | o | Multispeed-0 setting, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|--|---------------|------|
| AC-01 | - | Acceleration/ Deceleration time input selection | 00 (Parameter setting)/01 (Option 1)/ 02 (Option 2)/03 (Option 3)/04 (DriveProgramming) | 00 | |
| AC-02 | - | Acceleration/ Deceleration Selection | 00 (Common)/ 01 (Multi-stage acceleration/deceleration) | 00 | |
| AC-03 | - | Acceleration curve selection | 00 (Linear)/01 (S-shaped)/02 (U-shaped)/ 03 (Reverse U-shaped)/04 (Elevator S-shaped) | 00 | |
| AC-04 | - | Deceleration curve selection | 00 (Linear)/01 (S-shaped)/02 (U-shaped)/ 03 (Reverse U-shaped)/04 (Elevator S-shaped) | 00 | |
| AC-05 | - | Acceleration curve constant setting | 1 to 10 | 2 | |
| AC-06 | - | Deceleration curve constant setting | 1 to 10 | 2 | |
| AC-08 | - | EL-S-curve ratio @start of acceleration | 0 to 100 | 25 | |
| AC-09 | - | EL-S-curve ratio @end of acceleration | 0 to 100 | 25 | |
| AC-10 | - | EL-S-curve ratio @start of deceleration | 0 to 100 | 25 | |
| AC-11 | - | EL-S-curve ratio @end of deceleration | 0 to 100 | 25 | |
| AC115 | - | Select method to switch to Accel2/Decel2 Profile, 1st-motor | 00 ([2CH] terminal)/01 (Parameter setting)/ 02 (Switching normal/reverse rotation) | 00 | |
| AC116 | o | Accel1 to Accel2 Frequency transition point, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AC117 | o | Decel1 to Decel2 Frequency transition point, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AC120 | o | Acceleration time setting 1, 1st-motor | 0.00 to 3600.00 (s) | 30.00 | |
| AC122 | o | Deceleration time setting 1, 1st-motor | 0.00 to 3600.00 (s) | 30.00 | |
| AC124 | o | Acceleration time setting 2, 1st-motor | 0.00 to 3600.00 (s) | 15.00 | |



Appendices C Table of Parameters

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---------------------|---------------|------|
| AC126 | ○ | Deceleration time setting 2, 1st-motor | 0.00 to 3600.00 (s) | 15.00 | |
| AC-30 | ○ | Acceleration time setting for multi-speed 1 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-32 | ○ | Deceleration time setting for multi-speed 1 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-34 | ○ | Acceleration time setting for multi-speed 2 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-36 | ○ | Deceleration time setting for multi-speed 2 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-38 | ○ | Acceleration time setting for multi-speed 3 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-40 | ○ | Deceleration time setting for multi-speed 3 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-42 | ○ | Acceleration time setting for multi-speed 4 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-44 | ○ | Deceleration time setting for multi-speed 4 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-46 | ○ | Acceleration time setting for multi-speed 5 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-48 | ○ | Deceleration time setting for multi-speed 5 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-50 | ○ | Acceleration time setting for multi-speed 6 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-52 | ○ | Deceleration time setting for multi-speed 6 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-54 | ○ | Acceleration time setting for multi-speed 7 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-56 | ○ | Deceleration time setting for multi-speed 7 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-58 | ○ | Acceleration time setting for multi-speed 8 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-60 | ○ | Deceleration time setting for multi-speed 8 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-62 | ○ | Acceleration time setting for multi-speed 9 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-64 | ○ | Deceleration time setting for multi-speed 9 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-66 | ○ | Acceleration time setting for multi-speed 10 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-68 | ○ | Deceleration time setting for multi-speed 10 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-70 | ○ | Acceleration time setting for multi-speed 11 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-72 | ○ | Deceleration time setting for multi-speed 11 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-74 | ○ | Acceleration time setting for multi-speed 12 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-76 | ○ | Deceleration time setting for multi-speed 12 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-78 | ○ | Acceleration time setting for multi-speed 13 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-80 | ○ | Deceleration time setting for multi-speed 13 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-82 | ○ | Acceleration time setting for multi-speed 14 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-84 | ○ | Deceleration time setting for multi-speed 14 | 0.00 to 3600.00 (s) | 0.00 | |
| AC-86 | ○ | Acceleration time setting for multi-speed 15 | 0.00 to 3600.00 (s) | 0.00 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---|---------------|------|
| AC-88 | ○ | Deceleration time setting for multi-speed 15 | 0.00 to 3600.00 (s) | 0.00 | |
| AC215 | - | Select method to switch to Accel2/Decel2 Profile, 2nd-motor | 00 ([2CH] terminal)/01 (Parameter setting)/02 (Switching normal/reverse rotation) | 00 | |
| AC216 | ○ | Accel1 to Accel2 Frequency transition point, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AC217 | ○ | Decel1 to Decel2 Frequency transition point, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AC220 | ○ | Acceleration time setting 1, 2nd-motor | 0.00 to 3600.00 (s) | 30.00 | |
| AC222 | ○ | Deceleration time setting 1, 2nd-motor | 0.00 to 3600.00 (s) | 30.00 | |
| AC224 | ○ | Acceleration time setting 2, 2nd-motor | 0.00 to 3600.00 (s) | 15.00 | |
| AC226 | ○ | Deceleration time setting 2, 2nd-motor | 0.00 to 3600.00 (s) | 15.00 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|--|---------------|------|
| Ad-01 | - | Torque reference input source selection | 01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option)/15 (PID calculation) | 07 | |
| Ad-02 | ○ | Torque reference value setting | -500.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 0.0 | |
| Ad-03 | - | Polarity selection for torque reference | 00 (As per the sign)/01 (Follow the revolution direction) | 00 | |
| Ad-04 | ○ | Switching time of Speed control to Torque control | 0 to 1000 (ms) | 100 | |
| Ad-11 | - | Torque bias input source selection | 00 (Disabled)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option)/15 (PID calculation) | 00 | |
| Ad-12 | ○ | Torque bias value setting | -500.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 0.0 | |
| Ad-13 | - | Polarity selection for torque bias | 00 (As per the sign)/01 (Follow the revolution direction) | 00 | |
| Ad-14 | - | Terminal [TBS] active | 00 (Disabled)/01 (Enabled) | 00 | |
| Ad-40 | - | Input selection for speed limit at torque control | 01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option) | 07 | |
| Ad-41 | ○ | Speed limit at torque control (at Forward rotation) | 0.00 to 590.00 (Hz) | 0.00 | |
| Ad-42 | ○ | Speed limit at torque control (at Reverse rotation) | 0.00 to 590.00 (Hz) | 0.00 | |



Appendices C Table of Parameters

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|--|---------------|------|
| AE-01 | - | Electronic gear setting point selection | 00 (Feedback side)/01 (Command side) | 00 | |
| AE-02 | - | Electronic gear ratio numerator | 1 to 10000 | 1 | |
| AE-03 | - | Electronic gear ratio denominator | 1 to 10000 | 1 | |
| AE-04 | - | Positioning completion range setting | 0 to 1000 (ms) | 5 | |
| AE-05 | - | Positioning completion delay time setting | 0.00 to 10.00 (s) | 0.00 | |
| AE-06 | - | Position feed-forward gain setting | 0.00 to 655.35 | 0.00 | |
| AE-07 | - | Position loop gain setting | 0.00 to 100.00 | 0.50 | |
| AE-08 | - | Position bias setting | -2048 to 2048 | 0 | |
| AE-10 | - | Stop position selection of Home search function | 00 (Parameter setting)/01 (Option 1)/02 (Option 2)/03 (Option 3) | 00 | |
| AE-11 | ○ | Stop position of Home search function | 0 to 4095 | 0 | |
| AE-12 | ○ | Speed reference of Home search function | 0.00 to 120.00 | 0.00 | |
| AE-13 | - | Direction of Home search function | 00 (Normal rotation)/01 (Reverse rotation) | 00 | |
| AE-20 | ○ | Position reference 0 setting | -268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823 | 0 | |
| AE-22 | ○ | Position reference 1 setting | | 0 | |
| AE-24 | ○ | Position reference 2 setting | | 0 | |
| AE-26 | ○ | Position reference 3 setting | | 0 | |
| AE-28 | ○ | Position reference 4 setting | | 0 | |
| AE-30 | ○ | Position reference 5 setting | | 0 | |
| AE-32 | ○ | Position reference 6 setting | | 0 | |
| AE-34 | ○ | Position reference 7 setting | | 0 | |
| AE-36 | ○ | Position reference 8 setting | | 0 | |
| AE-38 | ○ | Position reference 9 setting | | 0 | |
| AE-40 | ○ | Position reference 10 setting | | 0 | |
| AE-42 | ○ | Position reference 11 setting | | 0 | |
| AE-44 | ○ | Position reference 12 setting | | 0 | |
| AE-46 | ○ | Position reference 13 setting | | 0 | |
| AE-48 | ○ | Position reference 14 setting | 0 | | |
| AE-50 | ○ | Position reference 15 setting | 0 | | |
| AE-52 | ○ | Position control range setting (forward) | 0 to 268435455 In high resolution mode: 0 to 1073741823 | 268435455 | |
| AE-54 | ○ | Position control range setting (reverse) | -268435455 to 0 In high resolution mode: -1073741823 to 0 | -268435455 | |
| AE-56 | - | Position control mode selection | 00 (With limit)/01 (Without limit) | 00 | |
| AE-60 | ○ | Teach-in function target selection | 00 (X00) to 15 (X15) | 00 | |
| AE-61 | - | Current position saving at power-off | 00 (Disabled)/01 (Enabled) | 00 | |
| AE-62 | ○ | Preset position data | -268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823 | 0 | |
| AE-64 | ○ | Deceleration stop distance calculation Gain | 50.00 to 200.00 | 100.00 | |
| AE-65 | ○ | Deceleration stop distance calculation Bias | 0.00 to 655.35 | 0.00 | |
| AE-66 | ○ | Speed Limit in APR control | 0.00 to 100.00 | 1.00 | |
| AE-67 | ○ | APR start speed | 0.00 to 100.00 | 0.20 | |
| AE-70 | - | Homing function selection | 00 (Low speed zero return)/01 (High speed zero return)/02 (High speed zero return 2) | 00 | |
| AE-71 | - | Direction of homing function | 00 (Normal rotation)/01 (Reverse rotation) | 00 | |
| AE-72 | ○ | Low-speed of homing function | 0.00 to 10.00 (Hz) | 0.00 | |
| AE-73 | ○ | High-Speed of homing function | 0.00 to 590.00 (Hz) | 0.00 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---|------------------------------|------|
| AF101 | - | DC braking selection, 1st-motor | 00 (Disabled)/01 (Enabled)/ 02 (Frequency command) | 00 | |
| AF102 | - | Braking type selection, 1st-motor | 00 (DC braking)/01 (Speed servo lock)/ 02 (Position servo lock) | 00 | |
| AF103 | o | DC braking frequency, 1st-motor | 0.00 to 590.00 (Hz) | 0.50 | |
| AF104 | o | DC braking delay time, 1st-motor | 0.00 to 5.00 (s) | 0.00 | |
| AF105 | o | DC braking force setting, 1st-motor | 0 to 100 (%) (with internal limitation) | 30 | |
| AF106 | o | DC braking active time at stop, 1st-motor | 0.00 to 60.00 (s) | 0.00 | |
| AF107 | o | DC braking operation method selection, 1st-motor | 00 (Edge mode)/01 (Level mode) | 01 | |
| AF108 | o | DC braking force at start, 1st-motor | 0 to 100 (%) (with internal limitation) | 30 | |
| AF109 | o | DC braking active time at start, 1st-motor | 0.00 to 60.00 (s) | 0.00 | |
| AF120 | - | ContactControl Enable, 1st-motor | 00 (Disabled)/01 (Enabled: primary side)/ 02 (Enabled: secondary side) | 00 | |
| AF121 | o | Run delay time, 1st-motor | 0.00 to 2.00 (s) | 0.20 | |
| AF122 | o | Contact off delay time, 1st-motor | 0.00 to 2.00 (s) | 0.10 | |
| AF123 | o | Contact answer back check time, 1st-motor | 0.00 to 5.00 (s) | 0.10 | |
| AF130 | - | Brake Control Enable, 1st-motor | 00 (Disabled)/ 01 (Brake control 1 common in forward/ reverse rotation)/ 02 (Brake control 1 forward/reverse set individu- ally)/ 03 (Brake control 2) | 00 | |
| AF131 | o | Brake Wait Time for Release, 1st-motor (Forward side) | 0.00 to 5.00 (s) | 0.00 | |
| AF132 | o | Brake Wait Time for Accel. , 1st-motor (Forward side) | 0.00 to 5.00 (s) | 0.00 | |
| AF133 | o | Brake Wait Time for Stopping, 1st-motor (Forward side) | 0.00 to 5.00 (s) | 0.00 | |
| AF134 | o | Brake Wait Time for Confirmation, 1st-motor (Forward side) | 0.00 to 5.00 (s) | 0.00 | |
| AF135 | o | Brake Release Frequency Setting, 1st-motor (Forward side) | 0.00 to 590.00 (Hz) | 0.00 | |
| AF136 | o | Brake Release Current Setting, 1st-motor (Forward side) | (0.0 to 2.0) × Inverter rated current (A) ^{*1} | 1.0 × Inverter rated current | |
| AF137 | o | Braking Frequency, 1st-motor (Forward side) | 0.00 to 590.00 (Hz) | 0.00 | |
| AF138 | o | Brake Wait Time for Release, 1st-motor (Reverse side) | 0.00 to 5.00 (s) | 0.00 | |
| AF139 | o | Brake Wait Time for Accel. , 1st-motor (Reverse side) | 0.00 to 5.00 (s) | 0.00 | |
| AF140 | o | Brake Wait Time for Stopping, 1st-motor (Reverse side) | 0.00 to 5.00 (s) | 0.00 | |
| AF141 | o | Brake Wait Time for Confirmation, 1st-motor (Reverse side) | 0.00 to 5.00 (s) | 0.00 | |
| AF142 | o | Brake Release Frequency Setting, 1st-motor (Reverse side) | 0.00 to 590.00 (Hz) | 0.00 | |
| AF143 | o | Brake Release Current Setting, 1st-motor (Reverse side) | (0.0 to 2.0) × Inverter rated current (A) ^{*1} | 1.0 × Inverter rated current | |
| AF144 | o | Braking Frequency, 1st-motor (Reverse side) | 0.00 to 590.00 (Hz) | 0.00 | |
| AF150 | o | Brake open delay time, 1st-motor | 0.00 to 2.00 (s) | 0.20 | |
| AF151 | o | Brake close delay time, 1st-motor | 0.00 to 2.00 (s) | 0.20 | |



Appendices C Table of Parameters

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---|------------------------------|------|
| AF152 | ○ | Brake answer back check time, 1st-motor | 0.00 to 5.00 (s) | 0.10 | |
| AF153 | ○ | Servo lock/ DC injection time at start, 1st-motor | 0.00 to 10.00 (s) | 0.60 | |
| AF154 | ○ | Servo lock/ DC injection time at stop, 1st-motor | 0.00 to 10.00 (s) | 0.60 | |
| AF201 | - | DC braking selection, 2nd-motor | 00 (Disabled)/01 (Enabled)/ 02 (Frequency command) | 00 | |
| AF202 | - | Braking type selection, 2nd-motor | 00 (DC braking)/01 (Speed servo lock)/ 02 (Position servo lock) | 00 | |
| AF203 | ○ | DC braking frequency, 2nd-motor | 0.00 to 590.00 (Hz) | 0.50 | |
| AF204 | ○ | DC braking delay time, 2nd-motor | 0.00 to 5.00 (s) | 0.00 | |
| AF205 | ○ | DC braking force setting, 2nd-motor | 0 to 100 (%) (with internal limitation) | 30 | |
| AF206 | ○ | DC braking active time at stop, 2nd-motor | 0.00 to 60.00 (s) | 0.00 | |
| AF207 | ○ | DC braking operation method selection, 2nd-motor | 00 (Edge mode)/01 (Level mode) | 01 | |
| AF208 | ○ | DC braking force at start, 2nd-motor | 0 to 100 (%) (with internal limitation) | 30 | |
| AF209 | ○ | DC braking active time at start, 2nd-motor | 0.00 to 60.00 (s) | 0.00 | |
| AF220 | - | ContactControl Enable, 2nd-motor | 00 (Disabled)/01 (Enabled: primary side)/ 02 (Enabled: secondary side) | 00 | |
| AF221 | ○ | Run delay time, 2nd-motor | 0.00 to 2.00 (s) | 0.20 | |
| AF222 | ○ | Contact off delay time, 2nd-motor | 0.00 to 2.00 (s) | 0.10 | |
| AF223 | ○ | Contact answer back check time, 2nd-motor | 0.00 to 5.00 (s) | 0.10 | |
| AF230 | - | Brake Control Enable, 2nd-motor | 00 (Disabled)/ 01 (Brake control common in forward/ reverse rotation)/ 02 (Brake control 1 forward/reverse set individually) | 00 | |
| AF231 | ○ | Brake Wait Time for Release, 2nd-motor (Forward side) | 0.00 to 5.00 (s) | 0.00 | |
| AF232 | ○ | Brake Wait Time for Accel. , 2nd-motor (Forward side) | 0.00 to 5.00 (s) | 0.00 | |
| AF233 | ○ | Brake Wait Time for Stopping, 2nd-motor (Forward side) | 0.00 to 5.00 (s) | 0.00 | |
| AF234 | ○ | Brake Wait Time for Confirmation, 2nd-motor (Forward side) | 0.00 to 5.00 (s) | 0.00 | |
| AF235 | ○ | Brake Release Frequency Setting, 2nd-motor (Forward side) | 0.00 to 590.00 (Hz) | 0.00 | |
| AF236 | ○ | Brake Release Current Setting, 2nd-motor (Forward side) | (0.0 to 2.0) × Inverter rated current (A) ^{*1} | 1.0 × Inverter rated current | |
| AF237 | ○ | Braking Frequency, 2nd-motor (Forward side) | 0.00 to 590.00 (Hz) | 0.00 | |
| AF238 | ○ | Brake Wait Time for Release, 2nd-motor (Reverse side) | 0.00 to 5.00 (s) | 0.00 | |
| AF239 | ○ | Brake Wait Time for Accel. , 2nd-motor (Reverse side) | 0.00 to 5.00 (s) | 0.00 | |
| AF240 | ○ | Brake Wait Time for Stopping, 2nd-motor (Reverse side) | 0.00 to 5.00 (s) | 0.00 | |
| AF241 | ○ | Brake Wait Time for Confirmation, 2nd-motor (Reverse side) | 0.00 to 5.00 (s) | 0.00 | |
| AF242 | ○ | Brake Release Frequency Setting, 2nd-motor (Reverse side) | 0.00 to 590.00 (Hz) | 0.00 | |
| AF243 | ○ | Brake Release Current Setting, 2nd-motor (Reverse side) | (0.0 to 2.0) × Inverter rated current (A) ^{*1} | 1.0 × Inverter rated current | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---------------------|---------------|------|
| AF244 | ○ | Braking Frequency, 2nd-motor (Reverse side) | 0.00 to 590.00 (Hz) | 0.00 | |
| AF250 | ○ | Brake open delay time, 2nd-motor | 0.00 to 2.00 (s) | 0.20 | |
| AF251 | ○ | Brake close delay time, 2nd-motor | 0.00 to 2.00 (s) | 0.20 | |
| AF252 | ○ | Brake answer back check time, 2nd-motor | 0.00 to 5.00 (s) | 0.10 | |
| AF253 | ○ | Servo lock/ DC injection time at start, 2nd-motor | 0.00 to 10.00 (s) | 0.60 | |
| AF254 | ○ | Servo lock/ DC injection time at stop, 2nd-motor | 0.00 to 10.00 (s) | 0.60 | |

- *1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.
- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
 - 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
 When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
 When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
 - 3) Drive programming: 0.01% (Rated ratio)

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|--|---------------|------|
| AG101 | ○ | Jump frequency 1, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AG102 | ○ | Jump frequency width 1, 1st-motor | 0.00 to 10.00 (Hz) | 0.00 | |
| AG103 | ○ | Jump frequency 2, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AG104 | ○ | Jump frequency width 2, 1st-motor | 0.00 to 10.00 (Hz) | 0.00 | |
| AG105 | ○ | Jump frequency 3, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AG106 | ○ | Jump frequency width 3, 1st-motor | 0.00 to 10.00 (Hz) | 0.00 | |
| AG110 | ○ | Acceleration stop frequency setting, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AG111 | ○ | Acceleration stop time setting, 1st-motor | 0.0 to 60.0 (s) | 0.0 | |
| AG112 | ○ | Deceleration stop frequency setting, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AG113 | ○ | Deceleration stop time setting, 1st-motor | 0.0 to 60.0 (s) | 0.0 | |
| AG-20 | ○ | Jogging frequency | 0.00 to 10.00 (Hz) | 6.00 | |
| AG-21 | - | Jogging stop mode selection | 00 (Disabled during FRS operation at stop)/ 01 (Disabled during deceleration stop operation)/ 02 (Disabled during DB operation at stop)/ 03 (Enabled during FRS operation at stop)/ 04 (Enabled during deceleration stop operation)/ 05 (Enabled during DB operation at stop) | 00 | |
| AG201 | ○ | Jump frequency 1, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AG202 | ○ | Jump frequency width 1, 2nd-motor | 0.00 to 10.00 (Hz) | 0.00 | |
| AG203 | ○ | Jump frequency 2, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AG204 | ○ | Jump frequency width 2, 2nd-motor | 0.00 to 10.00 (Hz) | 0.00 | |
| AG205 | ○ | Jump frequency 3, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AG206 | ○ | Jump frequency width 3, 2nd-motor | 0.00 to 10.00 (Hz) | 0.00 | |
| AG210 | ○ | Acceleration stop frequency setting, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| AG211 | ○ | Acceleration stop time setting, 2nd-motor | 0.0 to 60.0 (s) | 0.0 | |
| AG212 | ○ | Deceleration stop frequency setting, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |



| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|-----------------|---------------|------|
| AG213 | ○ | Deceleration stop time setting, 2nd-motor | 0.0 to 60.0 (s) | 0.0 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---|---------------|------|
| AH-01 | - | PID1 enable | 00 (Disabled)/ 01 (Enabled Without reverse output)/ 02 (Enabled With reverse output) | 00 | |
| AH-02 | - | PID1 deviation inverse | 00 (Disabled)/01 (Enabled) | 00 | |
| AH-03 | - | Unit selection for PID1 | See <Unit options> on page C-70 at the end of Appendices C | 01 | |
| AH-04 | ○ | PID1 scale adjustment (0%) | -10000 to 10000 | 0 | |
| AH-05 | ○ | PID1 scale adjustment (100%) | -10000 to 10000 | 10000 | |
| AH-06 | ○ | PID1 scale adjustment (point position) | 0 to 4 | 2 | |
| AH-07 | - | Input source selection of Set-point for PID1 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option) | 07 | |
| AH-10 | ○ | Set-point-1 setting for PID1 | -100.00 to 100.00 *1 | 0.00 | |
| AH-12 | ○ | PID1 Multi stage set-point 1 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-14 | ○ | PID1 Multi stage set-point 2 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-16 | ○ | PID1 Multi stage set-point 3 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-18 | ○ | PID1 Multi stage set-point 4 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-20 | ○ | PID1 Multi stage set-point 5 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-22 | ○ | PID1 Multi stage set-point 6 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-24 | ○ | PID1 Multi stage set-point 7 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-26 | ○ | PID1 Multi stage set-point 8 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-28 | ○ | PID1 Multi stage set-point 9 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-30 | ○ | PID1 Multi stage set-point 10 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-32 | ○ | PID1 Multi stage set-point 11 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-34 | ○ | PID1 Multi stage set-point 12 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-36 | ○ | PID1 Multi stage set-point 13 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-38 | ○ | PID1 Multi stage set-point 14 setting | -100.00 to 100.00 *1 | 0.00 | |
| AH-40 | ○ | PID1 Multi stage set-point 15 setting | -100.00 to 100.00 *1 | 0.00 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---|---------------|------|
| AH-42 | - | Input source selection of Set-point 2 for PID1 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option) | 00 | |
| AH-44 | o | Set-point 2 setting for PID1 | -100.00 to 100.00 (%) *1 | 0.00 | |
| AH-46 | - | Input source selection of Set-point 3 for PID1 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option) | 00 | |
| AH-48 | o | Set-point 3 setting for PID1 | -100.00 to 100.00 (%) *1 | 0.00 | |
| AH-50 | - | Calculation symbol selection of Set-point 1 for PID1 | 01 (Addition)/02 (Subtraction)/03 (Multiplication)/04 (Division)/05 (Minimum deviation)/06 (Maximum deviation) | 01 | |
| AH-51 | - | Input source selection of Process data 1 for PID1 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option) | 01 | |
| AH-52 | - | Input source selection of Process data 2 for PID1 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option) | 00 | |
| AH-53 | - | Input source selection of Process data 3 for PID1 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option) | 00 | |
| AH-54 | - | Calculation symbol selection of Process data for PID1 | 01 (Addition)/02 (Subtraction)/03 (Multiplication)/04 (Division)/05 (Square root of FB1)/06 (Square root of FB2)/07 (Square root of (FB1-FB2))/08 (Average of PV-1 to PV-3)/09 (Minimum data of PV-1 to PV-3)/10 (Maximum data of PV-1 to PV-3) | 01 | |
| AH-60 | - | PID1 gain change method selection | 00 (Only gain 1)/01 ([PRO] terminal switch) | 00 | |
| AH-61 | o | PID1 proportional gain 1 | 0.0 to 100.0 | 1.0 | |
| AH-62 | o | PID1 integral time constant 1 | 0.0 to 3600.0 (s) | 1.0 | |
| AH-63 | o | PID1 derivative gain 1 | 0.00 to 100.00 (s) | 0.00 | |
| AH-64 | o | PID1 proportional gain 2 | 0.0 to 100.0 | 0.0 | |
| AH-65 | o | PID1 integral time constant 2 | 0.00 to 3600.0 (s) | 0.0 | |
| AH-66 | o | PID1 derivative gain 2 | 0.00 to 100.00 (s) | 0.00 | |
| AH-67 | o | PID1 gain change time | 0 to 10000 (ms) | 100 | |
| AH-70 | - | PID feed-forward selection | 00 (Disabled)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved) | 00 | |
| AH-71 | o | PID1 output range | 0.00 to 100.00 (%) | 0.00 | |
| AH-72 | o | PID1 deviation over level | 0.00 to 100.00 (%) | 3.00 | |
| AH-73 | o | PID1 feedback compare signal turn-off level | 0.00 to 100.00 (%) | 100.00 | |
| AH-74 | o | PID1 feedback compare signal turn-on level | 0.00 to 100.00 (%) | 0.00 | |
| AH-75 | - | PID soft-start function enable | 00 (Disabled)/01 (Enabled) | 00 | |
| AH-76 | o | PID soft-start target level | 0.00 to 100.00 (%) | 100.00 | |
| AH-78 | o | Acceleration time setting for PID soft-start function | 0.00 to 3600.00 (s) | 30.00 | |
| AH-80 | o | PID soft-start time | 0.00 to 100.00 (s) | 0.00 | |
| AH-81 | - | PID soft start error detection enable | 00 (Disabled)/01 (Enabled: error output)/02 (Enabled: warning) | 00 | |
| AH-82 | o | PID soft start error detection level | 0.00 to 100.00 (%) | 0.00 | |
| AH-85 | - | PID sleep trigger selection | 00 (Disabled)/01 (Low output)/02 ([SLEP] terminal) | 00 | |
| AH-86 | o | PID sleep start level | 0.00 to 590.00 (Hz) | 0.00 | |
| AH-87 | o | PID sleep active time | 0.00 to 100.00 (s) | 0.00 | |
| AH-88 | - | Setpoint boost before PID sleep enable | 00 (Disabled)/01 (Enabled) | 00 | |



| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|-----------------------------------|--|---------------|------|
| AH-89 | ○ | Setpoint boost time | 0.00 to 100.00 (s) | 0.00 | |
| AH-90 | ○ | Setpoint boost value | 0.00 to 100.00 (%) | 0.00 | |
| AH-91 | ○ | Minimum RUN time before PID sleep | 0.00 to 100.00 (s) | 0.00 | |
| AH-92 | ○ | Minimum active time of PID sleep | 0.00 to 100.00 (s) | 0.00 | |
| AH-93 | - | PID sleep trigger selection | 01 (Deviation amount)/02 (Low feedback)/03 ([WAKE] terminal) | 01 | |
| AH-94 | ○ | PID wake start level | 0.00 to 100.00 (%) | 0.00 | |
| AH-95 | ○ | PID wake start time | 0.00 to 100.00 (s) | 0.00 | |
| AH-96 | ○ | PID wake start deviation value | 0.00 to 100.00 (%) | 0.00 | |

*1. Data range differs depending on [AH-04] to [AH-06].

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|--|---------------|------|
| AJ-01 | - | PID2 enable | 00 (Disabled)/01 (Enabled Without reverse output)/02 (Enabled With reverse output) | 00 | |
| AJ-02 | - | PID2 deviation inverse | 00 (Disabled)/01 (Enabled) | 00 | |
| AJ-03 | - | PID2 unit selection | See <Unit options> on page C-70 at the end of Appendices C | 01 | |
| AJ-04 | ○ | PID2 scale adjustment (0%) | -10000 to 10000 | 0 | |
| AJ-05 | ○ | PID2 scale adjustment (100%) | -10000 to 10000 | 10000 | |
| AJ-06 | ○ | PID2 scale adjustment (point position) | 0 to 4 | 2 | |
| AJ-07 | - | Input source selection of Set-point for PID2 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option)/15 (PID1 output) | 07 | |
| AJ-10 | ○ | Set-point setting for PID2 | -100.00 to 100.00 (%) *1 | 0.00 | |
| AJ-12 | - | Input source selection of Process data for PID2 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option) | 02 | |
| AJ-13 | ○ | PID2 proportional gain | 0.0 to 100.0 | 1.0 | |
| AJ-14 | ○ | PID2 integral time constant | 0.0 to 3600.0 (s) | 1.0 | |
| AJ-15 | ○ | PID2 derivative gain | 0.00 to 100.00 (s) | 0.00 | |
| AJ-16 | ○ | PID2 output range | 0.00 to 100.00 (%) | 0.00 | |
| AJ-17 | ○ | PID2 deviation over level | 0.00 to 100.00 (%) | 3.00 | |
| AJ-18 | ○ | PID2 feedback compare signal turn-OFF level | 0.00 to 100.00 (%) | 100.00 | |
| AJ-19 | ○ | PID2 feedback compare signal turn-ON level | 0.00 to 100.00 (%) | 0.00 | |
| AJ-21 | - | PID3 enable | 00 (Disabled)/01 (Enabled Without reverse output)/02 (Enabled With reverse output) | 00 | |
| AJ-22 | - | PID3 deviation inverse | 00 (Disabled)/01 (Enabled) | 00 | |
| AJ-23 | - | PID3 unit selection | See <Unit options> on page C-70 at the end of Appendices C | 01 | |
| AJ-24 | ○ | PID3 scale adjustment (0%) | -10000 to 10000 | 0 | |
| AJ-25 | ○ | PID3 scale adjustment (100%) | -10000 to 10000 | 10000 | |
| AJ-26 | ○ | PID3 scale adjustment (point position) | 0 to 4 | 2 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---|---------------|------|
| AJ-27 | - | Input source selection of Set-point for PID3 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option) | 07 | |
| AJ-30 | o | Set-point setting for PID3 | -100.00 to 100.00 (%) *2 | 0.00 | |
| AJ-32 | - | Input source selection of Process data for PID3 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option) | 01 | |
| AJ-33 | o | PID3 proportional gain | 0.0 to 100.0 | 1.0 | |
| AJ-34 | o | PID3 integral time constant | 0.00 to 3600.0 (s) | 1.0 | |
| AJ-35 | o | PID3 derivative gain | 0.0 to 100.00 (s) | 0.00 | |
| AJ-36 | o | PID3 output range | 0.00 to 100.00 (%) | 0.00 | |
| AJ-37 | o | PID3 deviation over level | 0.00 to 100.00 (%) | 3.00 | |
| AJ-38 | o | PID3 feedback compare signal turn-OFF level | 0.00 to 100.00 (%) | 100.00 | |
| AJ-39 | o | PID3 feedback compare signal turn-ON level | 0.00 to 100.00 (%) | 0.00 | |
| AJ-41 | - | PID4 enable | 00 (Disabled)/01 (Enabled Without reverse output)/02 (Enabled With reverse output) | 00 | |
| AJ-42 | - | PID4 deviation inverse | 00 (Disabled)/01 (Enabled) | 00 | |
| AJ-43 | - | PID4 unit selection | See <Unit options> on page C-70 at the end of Appendices C | 01 | |
| AJ-44 | o | PID4 scale adjustment (0%) | -10000 to 10000 | 0 | |
| AJ-45 | o | PID4 scale adjustment (100%) | -10000 to 10000 | 10000 | |
| AJ-46 | o | PID4 scale adjustment (point position) | 0 to 4 | 2 | |
| AJ-47 | - | Input source selection of Set-point for PID4 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option) | 07 | |
| AJ-50 | o | Set-point setting for PID4 | -100.00 to 100.00 (%) *3 | 0.00 | |
| AJ-52 | - | Input source selection of Process data for PID4 | 00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/06 (Reserved)/07 (Parameter setting)/08 (RS 485)/09 (Option 1)/10 (Option 2)/11 (Option 3)/12 (Pulse string input: main unit)/13 (Pulse string input: Option) | 01 | |
| AJ-53 | o | PID4 proportional gain | 0.0 to 100.0 | 1.0 | |
| AJ-54 | o | PID4 integral time constant | 0.00 to 3600.0 (s) | 1.0 | |
| AJ-55 | o | PID4 derivative gain | 0.0 to 100.00 (s) | 0.00 | |
| AJ-56 | o | PID4 output range | 0.00 to 100.00 (%) | 0.00 | |
| AJ-57 | o | PID4 deviation over level | 0.00 to 100.00 (%) | 3.00 | |
| AJ-58 | o | PID4 feedback compare signal turn-OFF level | 0.00 to 100.00 (%) | 100.00 | |
| AJ-59 | o | PID4 feedback compare signal turn-ON level | 0.00 to 100.00 (%) | 0.00 | |

*1. Data range differs depending on [AJ-04] to [AJ-06].

*2. Data range differs depending on [AJ-24] to [AJ-26].

*3. Data range differs depending on [AJ-44] to [AJ-46].



Parameter Mode (Code B)

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---|---------------|------|
| bA101 | - | Frequency limit selection, 1st-motor | 00 (Disabling)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS485)/09 (Option 1)/ 10 (Option 2)/11 (Option 3)/ 12 (Pulse string input (main body))/ 13 (Pulse string input Option) | 00 | |
| bA102 | ○ | Upper Frequency limit, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| bA103 | ○ | Lower Frequency limit, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| bA110 | - | Torque limit selection, 1st-motor | 00 (Disable)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3) | 07 | |
| bA111 | - | Torque limit parameter mode selection, 1st-motor | 00 (Four quadrant specific)/ 01 ([TRQ] terminal switch) | 00 | |
| bA112 | ○ | Torque limit 1 (Forward driving), 1st-motor | 0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 150.0 | |
| bA113 | ○ | Torque limit 2 (Reverse regenerative), 1st-motor | 0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 150.0 | |
| bA114 | ○ | Torque limit 3 (Reverse driving), 1st-motor | 0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 150.0 | |
| bA115 | ○ | Torque limit 4 (Forward regenerative), 1st-motor | 0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating) | 150.0 | |
| bA116 | - | Torque limit LADSTOP selection, 1st-motor | 00 (Disabled)/01 (Enabled) | 00 | |
| bA120 | - | Over current suppress enable, 1st-motor | 00 (Disabled)/01 (Enabled) | 01 | |
| bA121 | - | Over current suppress Level, 1st-motor | (0.0 to 2.0) × Inverter rated current (A) ^{*1} | *2 | |
| bA122 | - | Overload restriction 1 mode selection, 1st-motor | 00 (Disabled)/ 01 (Accelerate at constant speed)/ 02 (Only constant speed)/ 03 (Accelerate at constant speed/Increase speed at regeneration) | 01 | |
| bA123 | ○ | Overload restriction 1 active level, 1st-motor | (0.2 to 2.0) × Inverter rated current (A) ^{*1} | *3 | |
| bA124 | ○ | Overload restriction 1 action time, 1st-motor | 0.10 to 3600.00 (s) | 1.00 | |
| bA126 | - | Overload restriction 2 mode selection, 1st-motor | 00 (Disabled)/ 01 (Accelerate at constant speed)/ 02 (Only constant speed)/ 03 (Accelerate at constant speed/Increase speed at regeneration) | 01 | |
| bA127 | ○ | Overload restriction 2 active level, 1st-motor | (0.2 to 2.0) × Inverter rated current (A) ^{*1} | *3 | |
| bA128 | ○ | Overload restriction 2 Action time, 1st-motor | 0.10 to 3600.00 (s) | 1.00 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|--|--|------|
| bA-30 | - | Deceleration-stop at power failure | 00 (Disabled)/ 01 (Enabled: deceleration stop)/ 02 (Enabled: no recovery)/ 03 (Enabled: with recovery) | 00 | |
| bA-31 | ○ | Decel-stop at power failure starting voltage | (200 V class) 0.0 to 410.0 (V) (400 V class) 0.0 to 820.0 (V) | (200 V class) 220.0 (400 V class) 440.0 | |
| bA-32 | ○ | Decel-stop at power failure control target level | (200 V class) 0.0 to 410.0 (V) (400 V class) 0.0 to 820.0 (V) | (200 V class) 360.0 (400 V class) 720.0 | |
| bA-34 | ○ | Decel-stop at power failure deceleration time | 0.01 to 3600.00 (s) | 1.00 | |
| bA-36 | ○ | Decel-stop at power failure freq. width at deceleration start | 0.00 to 10.00 (Hz) | 0.00 | |
| bA-37 | ○ | Decel-stop at power failure DC-bus voltage constant control P-gain | 0.00 to 5.00 | 0.20 | |
| bA-38 | ○ | Decel-stop at power failure DC-bus voltage constant control I-gain | 0.00 to 150.00 (s) | 1.00 | |
| bA140 | ○ | Over-voltage suppression enable, 1st-motor | 00 (Disabled)/ 01 (DC voltage constant deceleration) 02 (Acceleration only at deceleration)/ 03 (Acceleration at constant speed/deceleration) | 00 | |
| bA141 | ○ | Over-voltage suppression active level, 1st-motor | (200 V class) 330.0 to 400.0 (V) (400 V class) 660.0 to 800.0 (V) | (200 V class) 380.0 (400 V class) 760.0 | |
| bA142 | ○ | Over-voltage suppression action time, 1st-motor | 0.00 to 3600.00 (s) | 1.00 | |
| bA144 | ○ | DC bus constant control proportional gain, 1st-motor | 0.00 to 5.00 | 0.20 | |
| bA145 | ○ | DC bus constant control integral gain, 1st-motor | 0.00 to 150.00 (s) | 1.00 | |
| bA146 | ○ | Over magnetization deceleration function selection, 1st_motor | 00 (Disabled)/01 (Regular operation)/ 02 (Operation only at deceleration)/ 03 (Level mode)/ 04 (Level mode only at deceleration) | 02 | |
| bA147 | ○ | Over magnetization output filter time constant, 1st_motor | 0.00 to 1.00(s) | 0.30 | |
| bA148 | ○ | Over magnetization voltage gain, 1st_motor | 50 to 400 (%) | 100 | |
| bA149 | ○ | Over magnetization level setting, 1st_motor | (200 V class) 330.0 to 400.0 (V) (400 V class) 660.0 to 800.0 (V) | (200 V class) 360.0 (400 V class) 720.0 | |
| bA-60 | ○ | Dynamic brake usage rate | 0.0 to 10.0 × ([bA-63]/minimum resistance) ² (%) *4 | 10.0 | |
| bA-61 | - | Dynamic brake selection | 00 (Disabled)/ 01 (Enabled: disabled at stop)/ 02 (Enabled: enabled at stop) | 00 | |
| bA-62 | - | Dynamic brake active level | (200 V class) 330.0 to 400.0 (V) (400 V class) 660.0 to 800.0 (V) | (200 V class) 360.0 (400 V class) 720.0 | |
| bA-63 | - | Dynamic brake resistor value | Minimum resistance to 600 (Ω)*4 | Minimum resistance *4 | |
| bA-70 | ○ | Cooling FAN control method selection | 00 (Always ON)/ 01 (ON during operation)/ 02 (Temperature dependent) | 00 | |
| bA-71 | - | Cooling FAN accumulation running time clear selection | 00 (Disabled)/01 (Clear) | 00 | |



Appendices C Table of Parameters

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---|--|------|
| bA201 | - | Frequency limit selection, 2nd motor | 00 (Disabling)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS485)/09 (Option 1)/ 10 (Option 2)/11 (Option 3)/ 12 (Pulse string input (main body))/ 13 (Pulse string input Option) | 00 | |
| bA202 | o | Upper frequency limit, 2nd motor | 0.00 to 590.00 (Hz) | 0.00 | |
| bA203 | o | Lower frequency limit, 2nd motor | 0.00 to 590.00 (Hz) | 0.00 | |
| bA210 | - | Torque limit selection, 2nd-motor | 00 (Disable)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3) | 07 | |
| bA211 | - | Torque limit parameter mode selection, 2nd-motor | 00 (Four quadrant specific)/ 01 ([TRQ] terminal switch) | 00 | |
| bA212 | o | Torque limit 1 (Forward driving), 2nd-motor | 0.0 to 500.0 (%) (Limited at at torque equivalent to 200% of inverter ND rating) | 150.0 (%) | |
| bA213 | o | Torque limit 2 (Reverse regenerative), 2nd-motor | 0.0 to 500.0 (%) (Limited at at torque equivalent to 200% of inverter ND rating) | 150.0 (%) | |
| bA214 | o | Torque limit 3 (Reverse driving), 2nd-motor | 0.0 to 500.0 (%) (Limited at at torque equivalent to 200% of inverter ND rating) | 150.0 (%) | |
| bA215 | o | Torque limit 4 (Forward regenerative), 2nd motor | 0.0 to 500.0 (%) (Limited at at torque equivalent to 200% of inverter ND rating) | 150.0 (%) | |
| bA216 | - | Torque limit LADSTOP selection, 2nd-motor | 00 (Disabled)/01 (Enabled) | 00 | |
| bA220 | - | Over current suppress enable, 2nd-motor | 00 (Disabled)/01 (Enabled) | 01 | |
| bA221 | - | Over current suppress Level, 2nd-motor | (0.0 to 2.0) × Inverter rated current (A) ^{*1} | *2 | |
| bA222 | - | Overload restriction 1 mode selection, 2nd-motor | 00 (Disabled)/ 01 (Accelerate at constant speed)/ 02 (Only constant speed)/ 03 (Accelerate at constant speed/Increase speed at regeneration) | 01 | |
| bA223 | o | Overload restriction 1 active level, 2nd-motor | (0.2 to 2.0) × Inverter rated current (A) ^{*1} | *3 | |
| bA224 | o | Overload restriction 1 action time, 2nd-motor | 0.10 to 3600.00 (s) | 1.00 | |
| bA226 | - | Overload restriction 2 mode selection, 2nd-motor | 00 (Disabled)/ 01 (Accelerate at constant speed)/ 02 (Only constant speed)/ 03 (Accelerate at constant speed/Increase speed at regeneration) | 01 | |
| bA227 | o | Overload restriction 2 active level, 2nd-motor | (0.2 to 2.0) × Inverter rated current (A) ^{*1} | *3 | |
| bA228 | o | Second overload limit 2 operation time | 0.10 to 3600.00 (s) | 1.00 | |
| bA240 | o | Over-voltage suppression enable, 2nd-motor | 00 (Disabled)/ 01 (DC voltage constant deceleration)/ 02 (Acceleration only at deceleration)/ 03 (Acceleration at constant speed/deceleration) | 00 | |
| bA241 | o | Over-voltage suppression active level, 2nd-motor | (200 V class) 330.0 to 400.0 (V) (400 V class) 660.0 to 800.0 (V) | (200 V class) 380.0 (400 V class) 760.0 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---|--|------|
| bA242 | ○ | Over-voltage suppression action time, 2nd-motor | 0.00 to 3600.00 (s) | 1.00 | |
| bA244 | ○ | DC bus constant control proportional gain, 2nd-motor | 0.00 to 5.00 | 0.20 | |
| bA245 | ○ | DC bus constant control integral gain, 2nd-motor | 0.00 to 150.00 (s) | 1.00 | |
| bA246 | ○ | Over magnetization function selection, 2nd-motor | 00 (Disabled)/01 (Regular operation)/ 02 (Operation only at deceleration)/ 03 (Level mode)/ 04 (Level mode only at deceleration) | 02 | |
| bA247 | ○ | Over magnetization output filter time constant, 2nd-motor | 0.00 to 1.00 (s) | 0.30 | |
| bA248 | ○ | Over magnetization voltage gain, 2nd-motor | 50 to 400 (%) | 100 | |
| bA249 | ○ | Over magnetization level setting, 2nd-motor | (200 V class) 330.0 to 400.0 (V) (400 V class) 660.0 to 800.0 (V) | (200 V class) 360.0 (400 V class) 720.0 | |

- *1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.
- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
 - 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
 - 3) Drive programming: 0.01% (Rated ratio)
- *2. $1.8 \times$ Inverter rated current (A)
- *3. $1.5 \times$ Inverter rated current (A)
- *4. Minimum resistance values vary in inverter model.

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---|---------------|------|
| bb101 | ○ | Carrier speed setting, 1st-motor | [Ub-03]=02: Normal duty 0.5 to 16.0 (kHz) [Ub-03]=01: Low duty 0.5 to 12.0 (kHz) [Ub-03]=00: Very low duty 0.5 to 10.0 (kHz) *1 | 2.0 | |
| bb102 | - | Sprinkle carrier pattern selection, 1st-motor | 00 (Disabled)/01 (Pattern 1 enabled)/ 02 (Pattern 2 enabled)/03 (Pattern 3 enabled)/ | 00 | |
| bb103 | ○ | Automatic-carrier reduction selection, 1st-motor | 00 (Disabled)/01 (Enabled: current)/ 02 (Enabled: temperature) | 00 | |
| bb-10 | - | Automatic error reset selection | 00 (Disabled)/ 01 (Enabled with operation command OFF)/ 02 (Enable after the setting time) | 00 | |
| bb-11 | - | Alarm signal selection at Automatic error reset is active | 00 (Output)/01 (Not output) | 00 | |
| bb-12 | - | Automatic error reset wait time | 0 to 600 (s) | 2 | |
| bb-13 | - | Automatic error reset number | 0 to 10 | 3 | |
| bb-20 | - | The number of retries after instantaneous power failure | 0 to 16/255 | 0 | |
| bb-21 | - | The number of retries after under voltage | 0 to 16/255 | 0 | |
| bb-22 | - | The number of retries after over current | 0 to 5 | 0 | |
| bb-23 | - | The number of retries after over voltage | 0 to 5 | 0 | |

Appendices C Table of Parameters

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---|--|------|
| bb-24 | - | Selection of restart mode @Instantaneous power failure/ under-voltage trip | 00 (0Hz)/01 (Frequency matching)/ 02 (Frequency entrainment)/ 03 (Detection speed)/ 04 (Trip after frequency matching deceleration stop) | 01 | |
| bb-25 | - | Allowable under-voltage power failure time | 0.3 to 25.0 (s) | 1.0 | |
| bb-26 | - | Retry wait time before motor restart | 0.3 to 100.0 (s) | 0.3 | |
| bb-27 | - | Instantaneous power failure/under-voltage trip alarm enable | 00 (Disabled)/01 (Enabled at stop)/ 02 (Disabled at stop and deceleration stop) | 00 | |
| bb-28 | - | Selection of restart mode @over-current | 00 (0Hz)/01 (Frequency matching)/ 02 (Frequency entrainment)/ 03 (Detection speed)/ 04 (Trip after frequency matching deceleration stop) | 01 | |
| bb-29 | - | Wait time of restart @over-current | 0.3 to 100.0 (s) | 0.3 | |
| bb-30 | - | Selection of restart mode @over-voltage | 00 (0Hz)/01 (Frequency matching)/ 02 (Frequency entrainment)/ 03 (Detection speed)/ 04 (Trip after frequency matching deceleration stop) | 01 | |
| bb-31 | - | Wait time of restart @over-voltage | 0.3 to 100.0 (s) | 0.3 | |
| bb-40 | ○ | Restart mode after FRS release | 00 (0Hz)/01 (Frequency matching)/ 02 (Frequency entrainment)/ 03 (Detection speed)* ² | 00 | |
| bb-41 | ○ | Restart mode after RS release | 00 (0Hz)/01 (Frequency matching)/ 02 (Frequency entrainment)/ 03 (Detection speed)* ² | 00 | |
| bb-42 | ○ | Restart frequency threshold | 0.00 to 590.00 (Hz) | 0.00 | |
| bb-43 | ○ | Restart level of Active frequency matching | (0.0 to 2.0) × Inverter rated current (A)* ³ | 1.0 × Inverter rated current | |
| bb-44 | ○ | Restart constant(speed) of Active frequency matching | 0.10 to 30.00 (s) | 0.50 | |
| bb-45 | ○ | Restart constant(Voltage) of Active frequency matching | 0.10 to 30.00 (s) | 0.50 | |
| bb-46 | ○ | OC-suppress level of Active frequency matching | (0.2 to 2.0) × Inverter rated current (A)* ³ | 1.0 × Inverter rated current | |
| bb-47 | ○ | Restart speed selection of Active frequency matching | 00 (Cutoff frequency)/ 01 (Maximum frequency)/02 (Setting frequency) | 00 | |
| bb160 | - | Over current detection level, 1st-motor | (0.2 to 2.2) × Inverter ND rated current (A)* ³ | 2.2 × Inverter ND rated current | |
| bb-61 | ○ | Power supply over voltage selection | 00 (Warning)/01 (Error) | 00 | |
| bb-62 | ○ | Power supply over voltage level setting | (200 V class) 300.0 to 410.0 (V) (400 V class) 600.0 to 820.0 (V) | (200 V class) 390.0 (400 V class) 780.0 | |
| bb-64 | - | Ground fault selection | 00 (Disabled)/01 (Enabled) | 01 | |
| bb-65 | ○ | Input phase loss enable | 00 (Disabled)/01 (Enabled) | 00 | |
| bb-66 | ○ | Output phase loss enable | 00 (Disabled)/01 (Enabled) | 00 | |
| bb-67 | ○ | Output phase loss detection sensitivity | 1 to 100 (%) | 10 | |
| bb-70 | ○ | Thermistor error level | 0 to 10000 (Ω) | 3000 | |
| bb-80 | ○ | Over-speed detection level | 0.0 to 150.0 (%) | 135.0 | |
| bb-81 | ○ | Over-speed detection time | 0.0 to 5.0 (s) | 0.5 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---|---------------------------------|------|
| bb-82 | - | Speed deviation error mode selection | 00 (Warning)/01 (Error) | 00 | |
| bb-83 | - | Speed deviation error detection level | 0.0 to 100.0 (%) | 15.0 | |
| bb-84 | - | Speed deviation error detection time | 0.0 to 5.0 (s) | 0.5 | |
| bb-85 | - | Position deviation error mode selection | 00 (Warning)/01 (Error) | 00 | |
| bb-86 | - | Position deviation error detection level | 0.0 to 65535 (×100pls) | 4096 | |
| bb-87 | - | Position deviation error detection time | 0.0 to 5.0 (s) | 0.5 | |
| bb201 | ○ | Carrier speed setting, 2nd-motor | [Ub-03]=02: Normal duty 0.5 to 16.0 (kHz) [Ub-03]=01: Low duty 0.5 to 12.0 (kHz) [Ub-03]=00: Very low duty 0.5 to 10.0 (kHz) *1 | 2.0 | |
| bb202 | - | Sprinkle carrier pattern selection, 2nd-motor | 00 (Disabled)/01 (Pattern 1 enabled)/ 02 (Pattern 2 enabled)/03 (Pattern 3 enabled)/ | 00 | |
| bb203 | ○ | Automatic-carrier reduction selection, 2nd-motor | 00 (Disabled)/01 (Enabled: current)/ 02 (Enabled: temperature) | 00 | |
| bb260 | - | Over current detection level, 2nd-motor | (0.2 to 2.2) x Inverter ND rated current (A) ^{*3} | 2.2 x Inverter rated current | |

*1. 3G3RX2-B4750 to 3G3RX2-B413K shall be as follows.

- [Ub-03]=02: 0.5 to 10.0 (kHz)
- [Ub-03]=00 or 01: 0.5 to 8.0 (kHz)

*2. Feedback input to the followings is required:

- Input Terminal A and B
- Optional cassette RX2-PG

*3. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
- 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- 3) Drive programming: 0.01% (Rated ratio)



| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|--|---------------------------------|------|
| bC110 | ○ | Electronic thermal level setting, 1st-motor | (0.0 to 3.0) × Inverter rated current ^{*1} | 1.0 × Inverter rated current | |
| bC111 | ○ | Electronic thermal characteristic selection, 1st-motor | 00 (Reduction characteristics)/ 01 (Constant torque characteristics)/ 02 (Arbitrary setting) | 00 ^{*2} | |
| bC112 | ○ | Electronic thermal Subtraction function enable, 1st-motor | 00 (Disabled)/01 (Enabled) | 01 | |
| bC113 | ○ | Electronic thermal Subtraction time, 1st-motor | 1 to 1000 (s) | 600 | |
| bC-14 | ○ | Electronic thermal counter memory selection at Power-off | 00 (Disabled)/01 (Enabled) | 01 | |
| bC120 | ○ | Free electronic thermal frequency-1, 1st-motor | 0.00 to [bC122] (Hz) | 0.00 | |
| bC121 | ○ | Free electronic thermal current-1, 1st-motor | (0.0 to 3.0) × Inverter rated current ^{*1} | 0.0 | |
| bC122 | ○ | Free electronic thermal frequency-2, 1st-motor | [bC120] to [bC124] (Hz) | 0.00 | |
| bC123 | ○ | Free electronic thermal current-2, 1st-motor | (0.0 to 3.0) × Inverter rated current ^{*1} | 0.0 | |
| bC124 | ○ | Free electronic thermal frequency-3, 1st-motor | [bC122] to 590.00 (Hz) | 0.00 | |
| bC125 | ○ | Free electronic thermal current-3, 1st-motor | (0.0 to 3.0) × Inverter rated current ^{*1} | 0.0 | |
| bC210 | ○ | Electronic thermal level setting, 2nd-motor | (0.0 to 3.0) × Inverter rated current ^{*1} | 1.0 × Inverter rated current | |
| bC211 | ○ | Electronic thermal characteristic selection, 2nd-motor | 00 (Reduction characteristics)/ 01 (Constant torque characteristics)/ 02 (Arbitrary setting) | 01 ^{*2} | |
| bC212 | ○ | Electronic thermal Subtraction function enable, 2nd-motor | 00 (Disabled)/01 (Enabled) | 01 | |
| bC213 | ○ | Electronic thermal Subtraction time, 2nd-motor | 1 to 1000 (s) | 600 | |
| bC220 | ○ | Free electronic thermal frequency-1, 2nd-motor | 0.00 to [bC222] (Hz) | 0.00 | |
| bC221 | ○ | Free electronic thermal current-1, 2nd-motor | (0.0 to 3.0) × Inverter rated current ^{*1} | 0.0 | |
| bC222 | ○ | Free electronic thermal frequency-2, 2nd-motor | [bC220] to [bC224] (Hz) | 0.00 | |
| bC223 | ○ | Free electronic thermal current-2, 2nd-motor | (0.0 to 3.0) × Inverter rated current ^{*1} | 0.0 | |
| bC224 | ○ | Free electronic thermal frequency-3, 2nd-motor | [bC222] to 590.00 (Hz) | 0.00 | |
| bC225 | ○ | Free electronic thermal current-3, 2nd-motor | (0.0 to 3.0) × Inverter rated current ^{*1} | 0.0 | |

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

- 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
- 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
- 3) Drive programming: 0.01% (Rated ratio)

*2. It is a default value when Default Value Selection (Ub-02) is set to 01.

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|--|---------------|------|
| bd-01 | - | STO input display selection | 00 (With indication)/01 (Without indication)/02 (Trip) | 00 | |
| bd-02 | - | STO input change time | 0.00 to 60.00 (s) | 1.00 | |
| bd-03 | - | Display selection at STO input change time | 00 (With indication)/01 (Without indication) | 00 | |
| bd-04 | - | Action selection after STO input change time | 00 (Retain only the condition)/01 (Disabled)/02 (Trip) | 00 | |



Parameter Mode (Code C)

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---|---------------|------|
| CA-01 | ○ | Input terminal [1] function | See <List of input terminal functions> on page C-44 | 028 | |
| CA-02 | ○ | Input terminal [2] function | | 015 | |
| CA-03 | ○ | Input terminal [3] function | | 029 | |
| CA-04 | ○ | Input terminal [4] function | | 032 | |
| CA-05 | ○ | Input terminal [5] function | | 031 | |
| CA-06 | ○ | Input terminal [6] function | | 003 | |
| CA-07 | ○ | Input terminal [7] function | | 004 | |
| CA-08 | ○ | Input terminal [8] function | | 002 | |
| CA-09 | ○ | Input terminal [9] function | | 001 | |
| CA-10 | ○ | Input terminal [A] function | | 033 | |
| CA-11 | ○ | Input terminal [B] function | | 034 | |
| CA-21 | ○ | Selection of Input terminal [1] active state | 00 (Normally open)/ 01 (Normally closed) | 00 | |
| CA-22 | ○ | Selection of Input terminal [2] active state | | 00 | |
| CA-23 | ○ | Selection of Input terminal [3] active state | | 00 | |
| CA-24 | ○ | Selection of Input terminal [4] active state | | 00 | |
| CA-25 | ○ | Selection of Input terminal [5] active state | | 00 | |
| CA-26 | ○ | Selection of Input terminal [6] active state | | 00 | |
| CA-27 | ○ | Selection of Input terminal [7] active state | | 00 | |
| CA-28 | ○ | Selection of Input terminal [8] active state | | 00 | |
| CA-29 | ○ | Selection of Input terminal [9] active state | | 00 | |
| CA-30 | ○ | Selection of Input terminal [A] active state | | 00 | |
| CA-31 | ○ | Selection of Input terminal [B] active state | | 00 | |
| CA-41 | ○ | Input terminal [1] response time | 0 to 400 (ms) | 2 | |
| CA-42 | ○ | Input terminal [2] response time | | 2 | |
| CA-43 | ○ | Input terminal [3] response time | | 2 | |
| CA-44 | ○ | Input terminal [4] response time | | 2 | |
| CA-45 | ○ | Input terminal [5] response time | | 2 | |
| CA-46 | ○ | Input terminal [6] response time | | 2 | |
| CA-47 | ○ | Input terminal [7] response time | | 2 | |
| CA-48 | ○ | Input terminal [8] response time | | 2 | |
| CA-49 | ○ | Input terminal [9] response time | | 2 | |
| CA-50 | ○ | Input terminal [A] response time | | 2 | |
| CA-51 | ○ | Input terminal [B] response time | | 2 | |
| CA-55 | ○ | Multistage input determination time | 0 to 2000 (ms) | 0 | |
| CA-60 | ○ | FUP/FDN overwrite target selection | 00 (Frequency command)/01 (PID1) | 00 | |
| CA-61 | ○ | FUP/FDN data save enable | 00 (Not save)/01 (Save) | 00 | |
| CA-62 | ○ | FUP/FDN UDC selection | 00 (0Hz)/01 (saved data) | 00 | |
| CA-64 | ○ | Acceleration time setting for FUP/FDN functions | 0.00 to 3600.00 (s) | 30.00 | |
| CA-66 | ○ | Deceleration time setting for FUP/FDN functions | 0.00 to 3600.00 (s) | 30.00 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|--|---------------|------|
| CA-70 | ○ | Speed reference source selection at [F-OP] is active | 01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/ 05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS 485)/09 (Option 1)/ 10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)/14 (Program function)/ 15 (PID calculation)/16 (Reserved) | 01 | |
| CA-71 | ○ | RUN command source selection at [F-OP] is active | 00 ([FW]/[RV] terminal)/01 (3 wire)/ 02 (RUN key on operator keypad)/ 03 (RS485)/04 (Option 1)/05 (Option 2)/06 (Option 3)/ | 00 | |
| CA-72 | - | Reset mode selection | 00 (On to Release Trip)/01 (Off to Release Trip)/ 02 (On to Release at Trip)/03 (Off to Release at Trip) | 00 | |
| CA-81 | - | Encoder constant setting | 32 to 65535 (pls) | 1024 | |
| CA-82 | - | Encoder position selection | 00 (Phase-A is leading)/ 01 (Phase-B is leading) | 00 | |
| CA-83 | - | Motor gear ratio Numerator | 1 to 10000 | 1 | |
| CA-84 | - | Motor gear ratio Denominator | 1 to 10000 | 1 | |
| CA-90 | - | Pulse train detection object selection | 00 (Disabled)/01 (Frequency command)/ 02 (Speed feedback)/03 (Pulse count) | 00 | |
| CA-91 | - | Mode selection of pulse train input | 00 (90° phase difference)/ 01 (forward/reverse rotation command and rotation direction)/ 02 (forward/reverse rotation pulse string) | 00 | |
| CA-92 | ○ | Pulse train frequency Scale | 0.05 to 32.00 (kHz) | 25.00 | |
| CA-93 | ○ | Pulse train frequency Filter time constant | 0.01 to 2.00 (s) | 0.10 | |
| CA-94 | ○ | Pulse train frequency Bias value | -100.0 to 100.0 (%) | 0.0 | |
| CA-95 | ○ | Pulse train frequency High Limit | 0.0 to 100.0 (%) | 100.0 | |
| CA-96 | ○ | Pulse train frequency detection low level | 0.0 to 100.0 (%) | 0.0 | |
| CA-97 | ○ | Comparing match output ON-level for Pulse count | 0 to 65535 | 0 | |
| CA-98 | ○ | Comparing match output OFF-level for Pulse count | 0 to 65535 | 0 | |
| CA-99 | ○ | Comparing match output Maximum value for Pulse count | 0 to 65535 | 65535 | |



<List of input terminal functions>

| Function No. | Abbreviation | Function name |
|--------------|--------------|--|
| 000 | no | Without allocation |
| 001 | FW | Normal rotation |
| 002 | RV | Reverse rotation |
| 003 | CF1 | Multistage speed 1 |
| 004 | CF2 | Multistage speed 2 |
| 005 | CF3 | Multistage speed 3 |
| 006 | CF4 | Multistage speed 4 |
| 007 | SF1 | Multistage speed bit 1 |
| 008 | SF2 | Multistage speed bit 2 |
| 009 | SF3 | Multistage speed bit 3 |
| 010 | SF4 | Multistage speed bit 4 |
| 011 | SF5 | Multistage speed bit 5 |
| 012 | SF6 | Multistage speed bit 6 |
| 013 | SF7 | Multistage speed bit 7 |
| 014 | ADD | Addition of frequency |
| 015 | SCHG | Switching of command |
| 016 | STA | 3-wire starting up |
| 017 | STP | 3-wire stopping |
| 018 | F/R | 3-wire normal and reverse |
| 019 | AHD | Retention of analog command |
| 020 | FUP | Acceleration through remote operation |
| 021 | FDN | Deceleration through remote operation |
| 022 | UDC | Clearing of remote operation data |
| 023 | F-OP | Forced switching of command |
| 024 | SET | Second control |
| 028 | RS | Reset |
| 029 | JG | Jogging |
| 030 | DB | Braking with external direct current |
| 031 | 2CH | 2-step acceleration/deceleration |
| 032 | FRS | Free-run stop |
| 033 | EXT | External abnormality |
| 034 | USP | Prevention of power restoration restarting |
| 035 | CS | Commercial switch |
| 036 | SFT | Soft-lock |
| 037 | BOK | Brake check |
| 038 | OLR | Switching of overload limit |
| 039 | KHC | Clearing of integrated input power |
| 040 | OKHC | Clearing of integrated output power |
| 041 | PID | PID1 disabled |
| 042 | PIDC | Resetting of PID1 integration |
| 043 | PID2 | PID2 disabled |
| 044 | PIDC2 | Resetting of PID2 integration |
| 045 | PID3 | PID3 disabled |
| 046 | PIDC3 | Resetting of PID3 integration |
| 047 | PID4 | PID4 disabled |
| 048 | PIDC4 | Resetting of PID4 integration |
| 051 | SVC1 | PID1 multistage target value 1 |
| 052 | SVC2 | PID1 multistage target value 2 |
| 053 | SVC3 | PID1 multistage target value 3 |
| 054 | SVC4 | PID1 multistage target value 4 |
| 055 | PRO | Switching of PID gain |
| 056 | PIO1 | Switching of PID output |

| Function No. | Abbreviation | Function name |
|--------------|--------------|--|
| 057 | PIO2 | Switching of PID output 2 |
| 058 | SLEP | Satisfaction of SLEEP condition |
| 059 | WAKE | Satisfaction of WAKE condition |
| 060 | TL | Validation of torque limit |
| 061 | TRQ1 | Torque limit switchover 1 |
| 062 | TRQ2 | Torque limit switchover 2 |
| 063 | PPI | PPI control switch |
| 064 | CAS | Control gain switch |
| 065 | SON | Servo ON |
| 066 | FOC | Auxiliary excitation |
| 067 | ATR | Validation of torque control |
| 068 | TBS | Validation of torque bias |
| 069 | ORT | Orientation |
| 071 | LAC | Cancellation of LAD |
| 072 | PCLR | Clearing of positional deviation |
| 073 | STAT | Permission to inputting of Pulse string position command |
| 074 | PUP | Addition of positional bias |
| 075 | PDN | Subtraction of positional bias |
| 076 | CP1 | Positional command selection 1 |
| 077 | CP2 | Positional command selection 2 |
| 078 | CP3 | Positional command selection 3 |
| 079 | CP4 | Positional command selection 4 |
| 080 | ORL | Origin limit signal |
| 081 | ORG | Return-to-origin start up signal |
| 082 | FOT | Stopping of normal rotation driving |
| 083 | ROT | Stopping of reverse rotation driving |
| 084 | SPD | Switching of speed position |
| 085 | PSET | Presetting of positional data |
| 086 | MI1 | General purpose input 1 |
| 087 | MI2 | General purpose input 2 |
| 088 | MI3 | General purpose input 3 |
| 089 | MI4 | General purpose input 4 |
| 090 | MI5 | General purpose input 5 |
| 091 | MI6 | General purpose input 6 |
| 092 | MI7 | General purpose input 7 |
| 093 | MI8 | General purpose input 8 |
| 094 | MI9 | General purpose input 9 |
| 095 | MI10 | General purpose input 10 |
| 096 | MI11 | General purpose input 11 |
| 097 | PCC | Clearing of pulse counter |
| 098 | ECOM | Starting up of EzCOM |
| 099 | PRG | Starting of EzSQ program |
| 100 | HLD | Stopping of acceleration/deceleration |
| 101 | REN | Operation permission signal |
| 102 | DISP | Fixation of display |
| 103 | PLA | Pulse string input A |
| 104 | PLB | Pulse string input B |
| 105 | EMF | Emergency forced operation |
| 107 | COK | Contact check signal |
| 109 | PLZ | Pulse string input Z |
| 110 | TCH | Teaching signal |



| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|----------------|--|--|--|---------------|------|
| Cb-01 | ○ | Filter time constant of Terminal [Ai1] | 1 to 500 (ms) | 16 | |
| Cb-03 | ○ | Start value of Terminal [Ai1] | 0.00 to 100.00 (%) | 0.00 | |
| Cb-04 | ○ | End value of Terminal [Ai1] | 0.00 to 100.00 (%) | 100.00 | |
| Cb-05 | ○ | Start rate of Terminal [Ai1] | 0.0 to [Cb-06] (%) | 0.0 | |
| Cb-06 | ○ | End rate of Terminal [Ai1] | [Cb-05] to 100.0 (%) | 100.0 | |
| Cb-07 | ○ | Start point selection of Terminal [Ai1] | 00 (Start amount)/01 (0%) | 01 | |
| Cb-11 | ○ | Filter time constant of Terminal [Ai2] | 1 to 500 (ms) | 16 | |
| Cb-13 | ○ | Start value of Terminal [Ai2] | 0.00 to 100.00 (%) | 0.00 | |
| Cb-14 | ○ | End value of Terminal [Ai2] | 0.00 to 100.00 (%) | 100.00 | |
| Cb-15 | ○ | Start rate of Terminal [Ai2] | 0.0 to [Cb-16] (%) | 20.0 | |
| Cb-16 | ○ | End rate of Terminal [Ai2] | [Cb-15] to 100.0 (%) | 100.0 | |
| Cb-17 | ○ | Start point selection of Terminal [Ai2] | 00 (Start amount)/01 (0%) | 01 | |
| Cb-21 | ○ | Filter time constant of Terminal [Ai3] | 1 to 500 (ms) | 16 | |
| Cb-22 | - | Terminal [Ai3] selection | 00 (Single)/ 01 (Added to Ai1/Ai2: with reversibility)/ 02 (Added to Ai1/Ai2: without reversibility) | 00 | |
| Cb-23 | ○ | Start value of Terminal [Ai3] | -100.00 to 100.00 (%) | -100.00 | |
| Cb-24 | ○ | End value of Terminal [Ai3] | -100.00 to 100.00 (%) | 100.00 | |
| Cb-25 | ○ | Start rate of Terminal [Ai3] | -100.0 to [Cb-26] | -100.0 | |
| Cb-26 | ○ | End rate of Terminal [Ai3] | [Cb-25] to 100.0 | 100.0 | |
| Cb-30 | - | [Ai1] Voltage/Current zero-gain adjustment | -100.00 to 100.00 | 0.00 | |
| Cb-31 | - | [Ai1] Voltage/Current gain adjustment | 0 to 200.00 | 100.00 | |
| Cb-32 | - | [Ai2] Voltage/Current zero-gain adjustment | -100.00 to 100.00 | 0.00 | |
| Cb-33 | - | [Ai2] Voltage/Current gain adjustment | 0 to 200.00 | 100.00 | |
| Cb-34 | - | [Ai3] Voltage/Current zero-gain adjustment | -100.00 to 100.00 | 0.00 | |
| Cb-35 | - | [Ai3] Voltage gain adjustment | 0 to 200.00 | 100.00 | |
| Cb-40 | ○ | Thermistor selection | 00 (Disabled)/ 01 (PTC resistance value enabled)/ 02 (NTC resistance value enabled) | 00 | |
| Cb-41 | - | Thermistor gain adjustment | 0.0 to 1000.0 | 100.0 | |
| Cb-51 to Cb-57 | - | Reserved | - | | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|--|---------------|------|
| CC-01 | ○ | Output terminal [11] function | See <List of output terminal functions> on page C-49 | 001 | |
| CC-02 | ○ | Output terminal [12] function | | 002 | |
| CC-03 | ○ | Output terminal [13] function | | 003 | |
| CC-04 | ○ | Output terminal [14] function | | 007 | |
| CC-05 | ○ | Output terminal [15] function | | 035 | |
| CC-06 | ○ | Output terminal [16] function | | 000 | |
| CC-07 | ○ | Output terminal [AL] function | | 017 | |
| CC-11 | ○ | Output terminal [11] function | 00 (Normally open)/ 01 (Normally closed) | 00 | |
| CC-12 | ○ | Output terminal [12] function | | 00 | |
| CC-13 | ○ | Output terminal [13] function | | 00 | |
| CC-14 | ○ | Output terminal [14] function | | 00 | |
| CC-15 | ○ | Output terminal [15] function | | 00 | |
| CC-16 | ○ | Output terminal [16] function | | 00 | |
| CC-17 | ○ | Output terminal [AL] function | | 01 | |
| CC-20 | ○ | Output terminal [11] on-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-21 | ○ | Output terminal [11] off-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-22 | ○ | Output terminal [12] on-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-23 | ○ | Output terminal [12] off-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-24 | ○ | Output terminal [13] on-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-25 | ○ | Output terminal [13] off-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-26 | ○ | Output terminal [14] on-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-27 | ○ | Output terminal [14] off-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-28 | ○ | Output terminal [15] on-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-29 | ○ | Output terminal [15] off-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-30 | ○ | Output terminal [16] on-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-31 | ○ | Output terminal [16] off-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-32 | ○ | Output terminal [AL] on-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-33 | ○ | Output terminal [AL] off-delay time | 0.00 to 100.00 (s) | 0.00 | |
| CC-40 | ○ | Logical calculation target 1 selection of LOG1 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-41 | ○ | Logical calculation target 2 selection of LOG1 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-42 | ○ | Logical calculation symbol selection of LOG1 | 00 (AND)/01 (OR)/02 (XOR) | 00 | |
| CC-43 | ○ | Logical calculation target 1 selection of LOG2 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-44 | ○ | Logical calculation target 2 selection of LOG2 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-45 | ○ | Logical calculation symbol selection of LOG2 | 00 (AND)/01 (OR)/02 (XOR) | 00 | |
| CC-46 | ○ | Logical calculation target 1 selection of LOG3 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-47 | ○ | Logical calculation target 2 selection of LOG3 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-48 | ○ | Logical calculation symbol selection of LOG3 | 00 (AND)/01 (OR)/02 (XOR) | 00 | |
| CC-49 | ○ | Logical calculation target 1 selection of LOG4 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-50 | ○ | Logical calculation target 2 selection of LOG4 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-51 | ○ | Logical calculation symbol selection of LOG4 | 00 (AND)/01 (OR)/02 (XOR) | 00 | |
| CC-52 | ○ | Logical calculation target 1 selection of LOG5 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-53 | ○ | Logical calculation target 2 selection of LOG5 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |



| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|--|---------------|------|
| CC-54 | ○ | Logical calculation symbol selection of LOG5 | 00 (AND)/01 (OR)/02 (XOR) | 00 | |
| CC-55 | ○ | Logical calculation target 1 selection of LOG6 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-56 | ○ | Logical calculation target 2 selection of LOG6 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-57 | ○ | Logical calculation symbol selection of LOG6 | 00 (AND)/01 (OR)/02 (XOR) | 00 | |
| CC-58 | ○ | Logical calculation target 1 selection of LOG7 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-59 | ○ | Logical calculation target 2 selection of LOG7 | See <List of output terminal functions> on page C-49 062: LOG1 to 068: LOG7 cannot be selected. | 000 | |
| CC-60 | ○ | Logical calculation symbol selection of LOG7 | 00 (AND)/01 (OR)/02 (XOR) | 00 | |

<List of output terminal functions>

| Function No. | Abbreviation | Function name |
|--------------|--------------|---------------------------------------|
| 000 | no | Without allocation |
| 001 | RUN | During operation |
| 002 | FA1 | When the constant speed is attained |
| 003 | FA2 | Equal to or above the set frequency |
| 004 | FA3 | Set frequency only |
| 005 | FA4 | Equal to or above the set frequency 2 |
| 006 | FA5 | Set frequency only 2 |
| 007 | IRDY | Operation ready completion |
| 008 | FWR | During normal rotation operation |
| 009 | RVR | During reverse rotation operation |
| 010 | FREF | Frequency command panel |
| 011 | REF | Operation command panel |
| 012 | SETM | Second control under selection |
| 016 | OPO | Optional output |
| 017 | AL | Alarm signal |
| 018 | MJA | Severe failure signal |
| 019 | OTQ | Excessive torque |
| 020 | IP | During instantaneous power failure |
| 021 | UV | Under insufficient voltage |
| 022 | TRQ | During torque limitation |
| 023 | IPS | During power failure deceleration |
| 024 | RNT | RUN time elapsed |
| 025 | ONT | Power ON time elapsed |
| 026 | THM | Electronic thermal warning |
| 027 | THC | Electronic thermal warning |
| 029 | WAC | Capacitor life advance notice |
| 030 | WAF | Fan life advance notice |
| 031 | FR | Operation command signal |
| 032 | OHF | Cooling fin heating advance notice |
| 033 | LOC | Low current signal |
| 034 | LOC2 | Low current signal 2 |
| 035 | OL | Overload advance notice |
| 036 | OL2 | Overload advance notice 2 |
| 037 | BRK | Brake release |
| 038 | BER | Brake abnormality |
| 039 | CON | Contacting control |
| 040 | ZS | 0 Hz detection signal |
| 041 | DSE | Excessive speed deviation |
| 042 | PDD | Excessive positional deviation |
| 043 | POK | Positioning completed |
| 044 | PCMP | Pulse count compare-match output |
| 045 | OD | PID excessive deviation |
| 046 | FBV | PID feedback comparison |
| 047 | OD2 | PID2 excessive deviation |
| 048 | FBV2 | PID2 feedback comparison |
| 049 | NDc | Communication disconnection |
| 050 | Ai1Dc | Analog disconnection Ai1 |
| 051 | Ai2Dc | Analog disconnection Ai2 |
| 052 | Ai3Dc | Analog disconnection Ai3 |
| 056 | WCAi1 | Window comparator Ai1 |
| 057 | WCAi2 | Window comparator Ai2 |
| 058 | WCAi3 | Window comparator Ai3 |



| Function No. | Abbreviation | Function name |
|--------------|--------------|--------------------------------------|
| 062 | LOG1 | Result of logical operation 1 |
| 063 | LOG2 | Result of logical operation 2 |
| 064 | LOG3 | Result of logical operation 3 |
| 065 | LOG4 | Result of logical operation 4 |
| 066 | LOG5 | Result of logical operation 5 |
| 067 | LOG6 | Result of logical operation 6 |
| 068 | LOG7 | Result of logical operation 7 |
| 069 | MO1 | General purpose output 1 |
| 070 | MO2 | General purpose output 2 |
| 071 | MO3 | General purpose output 3 |
| 072 | MO4 | General purpose output 4 |
| 073 | MO5 | General purpose output 5 |
| 074 | MO6 | General purpose output 6 |
| 075 | MO7 | General purpose output 7 |
| 076 | EMFC | Forced operation in process signal |
| 077 | EMBP | During-bypass-mode signal |
| 080 | LBK | Operation panel battery insufficient |
| 081 | OVS | Excessive voltage of accepted power |
| 084 | AC0 | Alarm code bit 0 |
| 085 | AC1 | Alarm code bit 1 |
| 086 | AC2 | Alarm code bit 2 |
| 087 | AC3 | Alarm code bit 3 |
| 089 | OD3 | PID3 excessive deviation |
| 090 | FBV3 | PID3 feedback comparison |
| 091 | OD4 | PID4 excessive deviation |
| 092 | FBV4 | PID4 feedback comparison |
| 093 | SSE | PID soft start abnormality |
| 053 to 055 | | Reserved |
| 059 to 061 | | Reserved |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---|---------------|------|
| Cd-01 | - | [FM] monitor output wave form selection | 00 (PWM)/01 (frequency) | 00 | |
| Cd-02 | - | [FM] monitor output base frequency (at PWM output) | 0 to 3600 (Hz) | 2880 | |
| Cd-03 | o | [FM] monitor output selection | See the <List of output monitor functions> on page C-52 | [dA-01] | |
| Cd-04 | o | [Ao1] monitor output selection | See the <List of output monitor functions> on page C-52 | [dA-01] | |
| Cd-05 | o | [Ao2] monitor output selection | See the <List of output monitor functions> on page C-52 | [dA-01] | |
| Cd-10 | - | Analog monitor adjustment mode enable | 00 (Disabled)/01 (Enabled) | 00 | |
| Cd-11 | - | Filter time constant of [FM]monitor | 1 to 500 (ms) | 100 | |
| Cd-12 | - | [FM] Data type selection | 00 (absolute value)/01 (with sign) | 00 | |
| Cd-13 | o | [FM] monitor bias adjustment | -100.0 to 100.0 (%) | 0.0 | |
| Cd-14 | o | [FM] monitor gain adjustment | -1000.0 to 1000.0 (%) | 100.0 | |
| Cd-15 | o | Output level setting at [FM] monitor adjust mode | -100.0 to 100.0 (%) | 100.0 | |
| Cd-21 | - | Filter time constant of [Ao1] monitor | 1 to 500 (ms) | 100 | |
| Cd-22 | - | [Ao1] Data type selection | 00 (absolute value)/01 (with sign) | 00 | |
| Cd-23 | o | [Ao1] monitor bias adjustment | -100.0 to 100.0 (%) | 0.0 | |
| Cd-24 | o | [Ao1] monitor gain adjustment | -1000.0 to 1000.0 (%) | 100.0 | |
| Cd-25 | o | Output level setting at [Ao1] monitor adjust mode | -100.0 to 100.0 (%) | 100.0 | |
| Cd-31 | - | Filter time constant of [Ao2] monitor | 1 to 500 (ms) | 100 | |
| Cd-32 | - | [Ao2] data type selection | 00 (absolute value)/01 (with sign) | 00 | |
| Cd-33 | o | [Ao2] monitor bias adjustment | -100.0 to 100.0 (%) | 20.0 | |
| Cd-34 | o | [Ao2] monitor gain adjustment | -1000.0 to 1000.0 (%) | 80.0 | |
| Cd-35 | o | Output level setting at [Ao2] monitor adjust mode | -100.0 to 100.0 (%) | 100.0 | |



<List of output monitor functions>

| Monitor No. | Function | Modbus No. | Register No. |
|-------------|---|------------|---|
| | | | 0 to 65535 (Register No. of d, F code) |
| dA-01 | Output frequency monitor | 2711h | 10001 |
| dA-02 | Output current monitor | 2712h | 10002 |
| dA-04 | Frequency command after calculation | 2714h | 10004 |
| dA-08 | Speed detection value monitor | 2718h | 10008 |
| dA-12 | Output frequency monitor (with sign) | 271Ch | 10012 |
| dA-14 | Frequency upper limit monitor | 271Eh | 10014 |
| dA-15 | Torque command monitor after calculation | 271Fh | 10016 |
| dA-16 | Torque limit monitor | 2720h | 10017 |
| dA-17 | Output torque monitor | 2721h | 10018 |
| dA-18 | Output voltage monitor | 2722h | 10020 |
| dA-30 | Input power monitor | 272Eh | 10030 |
| dA-34 | Output power monitor | 2732h | 10034 |
| dA-38 | Motor temperature monitor | 2736h | 10038 |
| dA-40 | DC voltage monitor | 2738h | 10040 |
| dA-41 | BRD load factor monitor | 2739h | 10041 |
| dA-42 | Electronic thermal duty ratio monitor MTR | 273Ah | 10042 |
| dA-43 | Electronic thermal duty ratio monitor CTL | 273Bh | 10043 |
| dA-61 | Analog input [Ai1] monitor | 274Dh | 10061 |
| dA-62 | Analog input [Ai2] monitor | 274Eh | 10062 |
| dA-63 | Analog input [Ai3] monitor | 274Fh | 10063 |
| dA-70 | Pulse string input monitor main body | 2756h | 10070 |
| dA-71 | Pulse string input monitor option | 2757h | 10071 |
| db-18 | Analog output monitor YA0 | 2786h | 10118 |
| db-19 | Analog output monitor YA1 | 2787h | 10119 |
| db-20 | Analog output monitor YA2 | 2788h | 10120 |
| db-30 | PID1 feedback data 1 monitor | 2792h | 10130 |
| db-32 | PID1 feedback data 2 monitor | 2794h | 10132 |
| db-34 | PID1 feedback data 3 monitor | 2796h | 10134 |
| db-36 | PID2 feedback data monitor | 2798h | 10136 |
| db-38 | PID3 feedback data monitor | 279Ah | 10138 |
| db-40 | PID4 feedback data monitor | 279Ch | 10140 |
| db-42 | PID1 target value monitor after calculation | 279Eh | 10142 |
| db-44 | PID1 feedback data | 27A0h | 10144 |
| db-50 | PID1 output monitor | 27A6h | 10150 |
| db-51 | PID1 deviation monitor | 27A7h | 10151 |
| db-52 | PID1 deviation 1 monitor | 27A8h | 10152 |
| db-53 | PID1 deviation 2 monitor | 27A9h | 10153 |
| db-54 | PID1 deviation 3 monitor | 27AAh | 10154 |
| db-55 | PID2 output monitor | 27ABh | 10155 |
| db-56 | PID2 deviation monitor | 27ACh | 10156 |
| db-57 | PID3 output monitor | 27ADh | 10157 |
| db-58 | PID3 deviation monitor | 27AEh | 10158 |
| db-59 | PID4 output monitor | 27AFh | 10159 |
| db-60 | PID4 deviation monitor | 27B0h | 10160 |
| db-64 | PID feed-forward monitor | 27B4h | 10164 |
| dC-15 | Cooling fin temperature monitor | 27E7h | 10215 |
| FA-01 | Main Speed reference monitor | 2AF9h | 11001 |
| FA-02 | Sub Speed reference monitor | 2AFAh | 11002 |
| FA-15 | Torque reference monitor | 2B07h | 11015 |
| FA-16 | Torque bias monitor | 2B08h | 11016 |

| Monitor No. | Function | Modbus No. | Register No. |
|-------------|--------------------------|------------|---|
| | | | 0 to 65535 (Register No. of d, F code) |
| FA-30 | PID1 Set Value 1 monitor | 2B16h | 11030 |
| FA-32 | PID1 Set Value 2 monitor | 2B18h | 11032 |
| FA-34 | PID1 Set Value 3 monitor | 2B1Ah | 11034 |
| FA-36 | PID2 Set Value monitor | 2B1Ch | 11036 |
| FA-38 | PID3 Set Value monitor | 2B1Eh | 11038 |
| FA-40 | PID4 Set Value monitor | 2B20h | 11040 |



| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|--|---------------------------------|------|
| CE101 | ○ | Low current signal output mode selection, 1st motor | 00 (During acceleration/deceleration, at constant speed)/ 01 (Only at constant speed) | 01 | |
| CE102 | ○ | Low current detection level 1, 1st motor | (0.0 to 2.0) × Inverter rated current ^{*1} | 1.0 × Inverter rated current | |
| CE103 | ○ | Low current detection level 2, 1st motor | (0.0 to 2.0) × Inverter rated current ^{*1} | 1.0 × Inverter rated current | |
| CE105 | ○ | Over current signal output mode selection, 1st motor | 00 (During acceleration/deceleration, at constant speed)/ 01 (Only at constant speed) | 01 | |
| CE106 | ○ | Over current detection level 1, 1st motor | (0.0 to 2.0) × Inverter rated current ^{*1} | 1.0 × Inverter rated current | |
| CE107 | ○ | Over current detection level 2, 1st motor | (0.0 to 2.0) × Inverter rated current ^{*1} | 1.0 × Inverter rated current | |
| CE-10 | ○ | Arrival frequency setting during acceleration 1 | 0.00 to 590.00 (Hz) | 0.00 | |
| CE-11 | ○ | Arrival frequency setting during deceleration 1 | 0.00 to 590.00 (Hz) | 0.00 | |
| CE-12 | ○ | Arrival frequency setting during acceleration 2 | 0.00 to 590.00 (Hz) | 0.00 | |
| CE-13 | ○ | Arrival frequency setting during deceleration 2 | 0.00 to 590.00 (Hz) | 0.00 | |
| CE120 | ○ | Over torque level (Forward driving), 1st motor | 0.0 to 500.0 (%) | 100.0 | |
| CE121 | ○ | Over torque level (Reverse regenerative), 1st motor | 0.0 to 500.0 (%) | 100.0 | |
| CE122 | ○ | Over torque level (Reverse driving), 1st motor | 0.0 to 500.0 (%) | 100.0 | |
| CE123 | ○ | Over torque level (Forward regenerative), 1st motor | 0.0 to 500.0 (%) | 100.0 | |
| CE-30 | ○ | Electronic thermal warning level (MTR) | 0.00 to 100.00 (%) | 80.00 | |
| CE-31 | ○ | Electronic thermal warning level (CTL) | 0.00 to 100.00 (%) | 80.00 | |
| CE-33 | ○ | Zero speed detection level | 0.00 to 100.00 (%) | 0.50 | |
| CE-34 | ○ | Cooling FAN over-heat warning level | 0 to 200 (°C) | 120 | |
| CE-36 | ○ | Accum.RUN(RNT)/Accum.Pow er-on (ONT) time setting | 0 to 100000 (hr) | 0 | |
| CE-40 | ○ | Window comparator for [Ai1] higher level | 0 to 100 (%) | 100 | |
| CE-41 | ○ | Window comparator for [Ai1] lower level | 0 to 100 (%) | 0 | |
| CE-42 | ○ | Window comparator for [Ai1] hysteresis width | 0 to 10 (%) | 0 | |
| CE-43 | ○ | Window comparator for [Ai2] higher level | 0 to 100 (%) | 100 | |
| CE-44 | ○ | Window comparator for [Ai2] lower level | 0 to 100 (%) | 0 | |
| CE-45 | ○ | Window comparator for [Ai2] hysteresis width | 0 to 10 (%) | 0 | |
| CE-46 | ○ | Window comparator for [Ai3] higher level | -100 to 100 (%) | 100 | |
| CE-47 | ○ | Window comparator for [Ai3] lower level | -100 to 100 (%) | -100 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|--|---------------------------------|------|
| CE-48 | ○ | Window comparator for [Ai3] hysteresis width | 0 to 10 (%) | 0 | |
| CE-50 | ○ | Operation level at [Ai1] disconnection | 0 to 100 (%) | 0 | |
| CE-51 | ○ | Operation level selection at [Ai1] disconnection | 00 (Disabled)/01 (Enabled: out of range) 02 (Enabled: within the range) | 00 | |
| CE-52 | ○ | Operation level at [Ai2] disconnection | 0 to 100(%) | 0 | |
| CE-53 | ○ | Operation level selection at [Ai2] disconnection | 00 (Disabled)/01 (Enabled: out of range)/ 02 (Enabled: within the range) | 00 | |
| CE-54 | ○ | Operation level at [Ai3] disconnection | -100 to 100(%) | 0 | |
| CE-55 | ○ | Operation level selection at [Ai3] disconnection | 00 (Disabled)/01 (Enabled: out of range)/ 02 (Enabled: within the range) | 00 | |
| CE201 | ○ | Low current signal output mode selection, 2nd-motor | 00 (During acceleration/deceleration, at constant speed)/ 01 (Only at constant speed) | 01 | |
| CE202 | ○ | Low current detection level 1, 2nd-motor | (0.0 to 2.0) × Inverter rated current*1 | 1.0 × Inverter rated current | |
| CE203 | ○ | Low current detection level 2, 2nd-motor | (0.0 to 2.0) × Inverter rated current*1 | 1.0 × Inverter rated current | |
| CE205 | ○ | Over current signal output mode selection, 2nd-motor | 00 (During acceleration/deceleration, at constant speed)/ 01 (Only at constant speed) | 01 | |
| CE206 | ○ | Over current detection level 1, 2nd-motor | (0.0 to 2.0) × Inverter rated current*1 | 1.0 × Inverter rated current | |
| CE207 | ○ | Over current detection level 2, 2nd-motor | (0.0 to 2.0) × Inverter rated current*1 | 1.0 × Inverter rated current | |
| CE220 | ○ | Over torque level (Forward driving), 2nd-motor | 0.0 to 500.0 (%) | 100.0 | |
| CE221 | ○ | Over torque level (Reverse regenerative), 2nd-motor | 0.0 to 500.0 (%) | 100.0 | |
| CE222 | ○ | Over torque level (Reverse driving), 2nd-motor | 0.0 to 500.0 (%) | 100.0 | |
| CE223 | ○ | Over torque level (Forward regenerative), 2nd motor | 0.0 to 500.0 (%) | 100.0 | |

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.
 1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
 2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
 When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
 When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
 3) Drive programming: 0.01% (Rated ratio)



Appendices C Table of Parameters

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---|---------------|------|
| CF-01 | - | RS485 communication baud rate selection | 03 (2400bps)/04 (4800bps)/05 (9600bps)/06 (19.2kbps)/07 (38.4kbps)/08 (57.6kbps)/09 (76.8kbps)/10 (115.2kbps) | 05 | |
| CF-02 | ○ | RS485 communication Node allocation | 1 to 247 | 1 | |
| CF-03 | ○ | RS485 communication parity selection | 00 (Without parity)/01 (Even number parity)/02 (Odd number parity) | 00 | |
| CF-04 | ○ | RS485 communication stop-bit selection | 01 (1bit)/02 (2bit) | 01 | |
| CF-05 | ○ | RS485 communication error selection | 00 (Error)/01 (Trip after deceleration stop)/02 (Ignore)/03 (Free run)/04 (Deceleration stop) | 02 | |
| CF-06 | ○ | RS485 communication timeout setting | 0.00 to 100.00 (s) | 0.00 | |
| CF-07 | ○ | RS485 communication wait time setting | 0 to 1000 (ms) | 2 | |
| CF-08 | ○ | RS485 communication mode selection | 01 (Modbus-RTU)/02 (EzCOM)/03 (EzCOM management) | 01 | |
| CF-11 | - | Resister data selection | 00 (A,V)/01 (%) | 00 | |
| CF-20 | - | EzCOM start node No. | 01 to 08 | 1 | |
| CF-21 | - | EzCOM End node No. | 01 to 08 | 1 | |
| CF-22 | - | EzCOM start method selection | 00 (ECOM terminal)/01 (Modbus spec) | 00 | |
| CF-23 | ○ | EzCOM data size | 01 to 05 | 5 | |
| CF-24 | ○ | EzCOM destination address 1 | 1 to 247 | 1 | |
| CF-25 | ○ | EzCOM destination register 1 | 0000 to FFFF | 0000 | |
| CF-26 | ○ | EzCOM source register 1 | 0000 to FFFF | 0000 | |
| CF-27 | ○ | EzCOM destination address 2 | 1 to 247 | 2 | |
| CF-28 | ○ | EzCOM destination register 2 | 0000 to FFFF | 0000 | |
| CF-29 | ○ | EzCOM source register 2 | 0000 to FFFF | 0000 | |
| CF-30 | ○ | EzCOM destination address 3 | 1 to 247 | 3 | |
| CF-31 | ○ | EzCOM destination register 3 | 0000 to FFFF | 0000 | |
| CF-32 | ○ | EzCOM source register 3 | 0000 to FFFF | 0000 | |
| CF-33 | ○ | EzCOM destination address 4 | 1 to 247 | 4 | |
| CF-34 | ○ | EzCOM destination register 4 | 0000 to FFFF | 0000 | |
| CF-35 | ○ | EzCOM source register 4 | 0000 to FFFF | 0000 | |
| CF-36 | ○ | EzCOM destination address 5 | 1 to 247 | 5 | |
| CF-37 | ○ | EzCOM destination register 5 | 0000 to FFFF | 0000 | |
| CF-38 | ○ | EzCOM source register 5 | 0000 to FFFF | 0000 | |
| CF-50 | ○ | USB communication Node allocation | 1 to 247 | 1 | |

Parameter Mode (Code H)

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---|---------------|------|
| HA-01 | - | Auto-tuning selection | 00 (Disabled)/01 (Non-rotation)/02 (Rotation)/03 (IVMS) | 00 | |
| HA-02 | - | RUN command selection at Auto-tuning | 00 (RUN key on the LCD operator)/01 ([AA111]/[AA211]) | 00 | |
| HA-03 | - | Online auto-tuning selection | 00 (Disabled)/01 (Enabled) | 00 | |
| HA110 | o | Stabilization constant, 1st-motor | 0 to 1000 (%) | 100 | |
| HA115 | o | Speed response for Async.M, 1st-motor | 0 to 1000 (%) | 100 | |
| HA120 | o | ASR gain switching mode selection, 1st-motor | 00 ([CAS] terminal)/01 (setting switch) | 00 | |
| HA121 | o | ASR gain switching time setting, 1st-motor | 0 to 10000 (ms) | 100 | |
| HA122 | o | ASR gain mapping intermediate speed 1, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| HA123 | o | ASR gain mapping intermediate speed 2, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| HA124 | o | ASR gain mapping Maximum speed, 1st-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| HA125 | o | ASR gain mapping P-gain 1, 1st-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA126 | o | ASR gain mapping I-gain 1, 1st-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA127 | o | ASR gain mapping P-gain 1 at P-control, 1st-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA128 | o | ASR gain mapping P-gain 2, 1st-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA129 | o | ASR gain mapping I-gain 2, 1st-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA130 | o | ASR gain mapping P-gain 2 at P-control, 1st-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA131 | o | ASR gain mapping P-gain 3, 1st-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA132 | o | ASR gain mapping I-gain 3, 1st-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA133 | o | ASR gain mapping P-gain 4, 1st-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA134 | o | ASR gain mapping I-gain 4, 1st-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA210 | o | Stabilization constant, 2nd-motor | 0 to 1000 (%) | 100 | |
| HA215 | o | Speed response for Async.M, 2nd-motor | 0 to 1000 (%) | 100 | |
| HA220 | o | ASR gain switching mode selection, 2nd-motor | 00 ([CAS] terminal)/01 (setting switch) | 00 | |
| HA221 | o | ASR gain switching time setting, 2nd-motor | 0 to 10000 (ms) | 100 | |
| HA222 | o | ASR gain mapping intermediate speed 1, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| HA223 | o | ASR gain mapping intermediate speed 2, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| HA224 | o | ASR gain mapping Maximum speed, 2nd-motor | 0.00 to 590.00 (Hz) | 0.00 | |
| HA225 | o | ASR gain mapping P-gain 1, 2nd-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA226 | o | ASR gain mapping I-gain 1, 2nd-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA227 | o | ASR gain mapping P-gain 1 at P-control, 2nd-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA228 | o | ASR gain mapping P-gain 2, 2nd-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA229 | o | ASR gain mapping I-gain 2, 2nd-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA230 | o | ASR gain mapping P-gain 2 at P-control, 2nd-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA231 | o | ASR gain mapping P-gain 3, 2nd-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA232 | o | ASR gain mapping I-gain 3, 2nd-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA233 | o | ASR gain mapping P-gain 4, 2nd-motor | 0.0 to 1000.0 (%) | 100.0 | |
| HA234 | o | ASR gain mapping I-gain 4, 2nd-motor | 0.0 to 1000.0 (%) | 100.0 | |



| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---|--|------|
| Hb102 | - | Async.Motor capacity setting, 1st-motor | 0.01 to 160.00 (kW) | *1 | |
| Hb105 | - | Async.Motor Maximum frequency setting, 1st-motor | 10.00 to 590.00 (Hz) | 50.00*2 | |
| Hb106 | - | Async.Motor rated voltage, 1st-motor | 1 to 1000 (V) | 200 V class: 230 400 V class: 400*2 460 (*FUF) | |
| Hb108 | - | Async.Motor rated current, 1st-motor | 0.01 to 10000.00 (A) | *1 | |
| Hb110 | - | Async.Motor constant R1, 1st-motor | 0.000001 to 1000.000000 (Ω) | *1 | |
| Hb112 | - | Async.Motor constant R2, 1st-motor | 0.000001 to 1000.000000 (Ω) | *1 | |
| Hb114 | - | Async.Motor constant L, 1st-motor | 0.000001 to 1000.000000 (mH) | *1 | |
| Hb116 | - | Async.Motor constant I _o , 1st-motor | 0.01 to 10000.00 (A) | *1 | |
| Hb118 | - | Async.Motor constant J, 1st-motor | 0.00001 to 10000.00000 (kgm ²) | *1 | |
| Hb130 | - | Minimum frequency adjustment, 1st-motor | 0.10 to 10.00 (Hz) | 0.50 | |
| Hb131 | ○ | Reduced voltage start time setting, 1st-motor | 0 to 2000 (ms) | 36 | |
| Hb140 | - | Manual torque boost operational mode selection, 1st-motor | 00 (Disabled)/ 01 (Always enabled)/ 02 (Enabled only for forward revolution)/ 03 (Enabled only for reverse revolution) | 01 | |
| Hb141 | ○ | Manual torque boost value, 1st-motor | 0.0 to 20.0 (%) | 0.0 | |
| Hb142 | ○ | Manual torque boost Peak speed, 1st-motor | 0.0 to 50.0 (%) | 0.0 | |
| Hb145 | - | Eco drive enable, 1st-motor | 00 (Disabled)/01 (Enabled) | 00 | |
| Hb146 | ○ | Eco drive response adjustment, 1st-motor | 0.0 to 100.0(%) | 50.0 | |
| Hb150 | - | Free-V/f frequency 1 setting, 1st-motor | 0.00 to [Hb152] (Hz) | 0.00 | |
| Hb151 | - | Free-V/f Voltage 1 setting, 1st-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb152 | - | Free-V/f frequency 2 setting, 1st-motor | [Hb150] to [Hb154] (Hz) | 0.00 | |
| Hb153 | - | Free-V/f Voltage 2 setting, 1st-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb154 | - | Free-V/f frequency 3 setting, 1st-motor | [Hb152] to [Hb156] (Hz) | 0.00 | |
| Hb155 | - | Free-V/f Voltage 3 setting, 1st-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb156 | - | Free-V/f frequency 4 setting, 1st-motor | [Hb154] to [Hb158] (Hz) | 0.00 | |
| Hb157 | - | Free-V/f Voltage 4 setting, 1st-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb158 | - | Free-V/f frequency 5 setting, 1st-motor | [Hb156] to [Hb160] (Hz) | 0.00 | |
| Hb159 | - | Free-V/f Voltage 5 setting, 1st-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb160 | - | Free-V/f frequency 6 setting, 1st-motor | [Hb158] to [Hb162] (Hz) | 0.00 | |
| Hb161 | - | Free-V/f Voltage 6 setting, 1st-motor | 0.0 to 1000.0 (V) | 0.0 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---|--|------|
| Hb162 | - | Free-V/f frequency 7 setting, 1st-motor | [Hb160] to [Hb104] (Hz) | 0.00 | |
| Hb163 | - | Free-V/f Voltage 7 setting, 1st-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb170 | ○ | Slip Compensation P-gain with encoder, 1st-motor | 0 to 1000 (%) | 100 | |
| Hb171 | ○ | Slip Compensation I-gain with encoder, 1st-motor | 0 to 1000 (%) | 100 | |
| Hb180 | ○ | Output voltage gain, 1st-motor | 0 to 255 (%) | 100 | |
| Hb202 | - | Async.Motor capacity setting, 2nd-motor | 0.01 to 160.00 (kW) | *1 | |
| Hb203 | - | Async.Motor poles setting, 2nd-motor | 2 to 48 (poles) | 4 | |
| Hb204 | - | Async.Motor Base frequency setting, 2nd-motor | 10.00 to 590.00 (Hz) | 50.00 ^{*2} | |
| Hb205 | - | Async.Motor Maximum frequency setting, 2nd-motor | 10.00 to 590.00 (Hz) | 50.00 ^{*2} | |
| Hb206 | - | Async.Motor rated voltage, 2nd-motor | 1 to 1000 (V) | 200 V class: 230 400 V class: 400 ^{*2} | |
| Hb208 | - | Async.Motor rated current, 2nd-motor | 0.01 to 10000.00 (A) | *1 | |
| Hb210 | - | Async.Motor constant R1, 2nd-motor | 0.000001 to 1000.000000 (Ω) | *1 | |
| Hb212 | - | Async.Motor constant R2, 2nd-motor | 0.000001 to 1000.000000 (Ω) | *1 | |
| Hb214 | - | Async.Motor constant L, 2nd-motor | 0.000001 to 1000.000000 (mH) | *1 | |
| Hb216 | - | Async.Motor constant I _o , 2nd-motor | 0.01 to 10000.00 (A) | *1 | |
| Hb218 | - | Async.Motor constant J, 2nd-motor | 0.00001 to 10000.00000 (kgm ²) | *1 | |
| Hb230 | - | Minimum frequency adjustment, 2nd-motor | 0.10 to 10.00 (Hz) | 0.50 | |
| Hb231 | ○ | Reduced voltage start time setting, 2nd-motor | 0 to 2000 (ms) | 36 | |
| Hb240 | - | Manual torque boost operational mode selection, 2nd-motor | 00 (Disabled)/ 01 (Always enabled)/ 02 (Enabled only for forward revolution)/ 03 (Enabled only for reverse revolution) | 01 | |
| Hb241 | ○ | Manual torque boost value, 2nd-motor | 0.0 to 20.0 (%) | 0.0 | |
| Hb242 | ○ | Manual torque boost Peak speed, 2nd-motor | 0.0 to 50.0 (%) | 0.0 | |
| Hb245 | - | Eco drive enable, 2nd-motor | 00 (Disabled)/01 (Enabled) | 00 | |
| Hb246 | ○ | Eco drive response adjustment, 2nd-motor | 0.0 to 100.0 (%) | 50.0 | |
| Hb250 | - | First free V/f frequency 2 | 0.00 to [Hb252] (Hz) | 0 | |
| Hb251 | - | Free-V/f Voltage 1 setting, 2nd-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb252 | - | Free-V/f frequency 2 setting, 2nd-motor | [Hb250] to [Hb254] (Hz) | 0.00 | |
| Hb253 | - | Free-V/f Voltage 2 setting, 2nd-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb254 | - | Free-V/f frequency 3 setting, 2nd-motor | [Hb252] to [Hb256] (Hz) | 0.00 | |
| Hb255 | - | Free-V/f Voltage 3 setting, 2nd-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb256 | - | Free-V/f frequency 4 setting, 2nd-motor | [Hb254] to [Hb258] (Hz) | 0.00 | |



| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|-------------------------|---------------|------|
| Hb257 | - | Free-V/f Voltage 4 setting, 2nd-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb258 | - | Free-V/f frequency 5 setting, 2nd-motor | [Hb256] to [Hb260] (Hz) | 0.00 | |
| Hb259 | - | Free-V/f Voltage 5 setting, 2nd-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb260 | - | Free-V/f frequency 6 setting, 2nd-motor | [Hb258] to [Hb262] (Hz) | 0.00 | |
| Hb261 | - | Free-V/f Voltage 6 setting, 2nd-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb262 | - | Free-V/f frequency 7 setting, 2nd-motor | [Hb260] to [Hb204] (Hz) | 0.00 | |
| Hb263 | - | Free-V/f Voltage 7 setting, 2nd-motor | 0.0 to 1000.0 (V) | 0.0 | |
| Hb270 | ○ | Slip Compensation P-gain with encoder, 2nd-motor | 0 to 1000 (%) | 100 | |
| Hb271 | ○ | Slip Compensation I-gain with encoder, 2nd-motor | 0 to 1000 (%) | 100 | |
| Hb280 | ○ | Output voltage gain, 2nd-motor(V/f) | 0 to 255 (%) | 100 | |

*1. Varies depending on inverter models and settings of duty rating.

*2. It is a default value when Default Value Selection (Ub-02) is set to 01.

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|----------------------------|---------------|------|
| HC101 | ○ | Automatic torque boost voltage compensation gain, 1st-motor | 0 to 255 (%) | 100 | |
| HC102 | ○ | Automatic torque boost slip compensation gain, 1st-motor | 0 to 255 (%) | 100 | |
| HC110 | ○ | Zero speed area limit for Async.M-0SLV, 1st-motor | 0 to 100 (%) | 80 | |
| HC111 | ○ | Boost value at start for Async.M-SLV/IM-CLV, 1st-motor | 0 to 50 (%) | 0 | |
| HC112 | ○ | Boost value at start for Async.M-0SLV, 1st-motor | 0 to 50 (%) | 10 | |
| HC113 | - | Secondary resistance correction, 1st-motor | 00 (Disabled)/01 (Enabled) | 00 | |
| HC114 | ○ | Counter direction run protection selection, 1st-motor | 00 (Disabled)/01 (Enabled) | 00 | |
| HC120 | ○ | Torque current reference filter time constant, 1st-motor | 0 to 100 (ms) | 2 | |
| HC121 | ○ | Speed feedforward compensation gain, 1st-motor | 0 to 1000 | 0 | |
| HC201 | ○ | Automatic torque boost voltage compensation gain, 2nd-motor | 0 to 255 (%) | 100 | |
| HC202 | ○ | Automatic torque boost slip compensation gain, 2nd-motor | 0 to 255 (%) | 100 | |
| HC210 | ○ | Zero speed area limit for Async.M-0SLV, 2nd-motor | 0 to 100 (%) | 80 | |
| HC211 | ○ | Boost value at start for Async.M-SLV/IM-CLV, 2nd-motor | 0 to 50 (%) | 0 | |
| HC212 | ○ | Boost value at start for Async.M-0SLV, 2nd-motor | 0 to 50 (%) | 10 | |
| HC213 | - | Secondary resistance correction, 2nd-motor | 00 (Disabled)/01 (Enabled) | 00 | |
| HC214 | ○ | Counter direction run protection selection, 2nd-motor | 00 (Disabled)/01 (Enabled) | 00 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---------------|---------------|------|
| HC220 | ○ | Torque current reference filter time constant, 2nd-motor | 0 to 100 (ms) | 2 | |
| HC221 | ○ | Speed feedforward compensation gain, 2nd-motor | 0 to 1000 | 0 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|--|---------------|------|
| Hd102 | - | Sync.Motor capacity setting, 1st-motor | 0.01 to 160.00 (kW) | *1 | |
| Hd103 | - | Sync.Motor poles setting, 1st-motor | 2 to 48 (poles) | *1 | |
| Hd104 | - | Sync.Base frequency setting, 1st-motor | 10.00 to 590.00 (Hz) | *1 | |
| Hd105 | - | Sync.Maximum frequency setting, 1st-motor | 10.00 to 590.00 (Hz) | *1 | |
| Hd106 | - | Sync.Motor rated voltage, 1st-motor | 1 to 1000 (V) | *1 | |
| Hd108 | - | Sync.Motor rated current, 1st-motor | 0.01 to 10000.00 (A) | *1 | |
| Hd110 | - | Sync.Motor constant R, 1st-motor | 0.000001 to 1000.000000 (Ω) | *1 | |
| Hd112 | - | Sync.Motor constant Ld, 1st-motor | 0.000001 to 1000.000000 (mH) | *1 | |
| Hd114 | - | Sync.Motor constant Lq, 1st-motor | 0.000001 to 1000.000000 (mH) | *1 | |
| Hd116 | - | Sync.Motor constant Ke, 1st-motor | 0.1 to 100000.0 (mVs/rad) | *1 | |
| Hd118 | - | Sync.Motor constant J, 1st-motor | 0.00001 to 10000.00000 (kgm ²) | *1 | |
| Hd130 | ○ | Minimum Frequency for Sync.M-SLV, 1st-motor | 0 to 50 (%) | 8 | |
| Hd131 | ○ | No-Load current for Sync.M-SLV, 1st-motor | 0 to 100 (%) | 10 | |
| Hd132 | - | Starting Method for Sync.M, 1st-motor | 00 (Position estimation disabled)/ 01 (Position estimation enabled) | 00 | |
| Hd133 | - | IMPE 0V wait number for Sync.M, 1st-motor | 0 to 255 | 10 | |
| Hd134 | - | IMPE detect wait number for Sync.M, 1st-motor | 0 to 255 | 10 | |
| Hd135 | - | IMPE detect number for Sync.M, 1st-motor | 0 to 255 | 30 | |
| Hd136 | - | IMPE voltage gain for Sync.M, 1st-motor | 0 to 200 (%) | 100 | |
| Hd137 | - | IMPE Mg-pole position offset, 1st-motor | 0 to 359 (deg) | 0 | |
| Hd-41 | ○ | Carrier frequency at IVMS | 0.5 to 16.0 (kHz) | 2.0 | |
| Hd-42 | ○ | Filter gain of current detection at IVMS | 0 to 1000 | 100 | |
| Hd-43 | - | Open phase voltage detection gain | 00 (Gain 0)/01 (Gain 1)/02 (Gain 2)/03 (Gain 3) | 00 | |
| Hd-44 | ○ | Open phase switching threshold compensation | 00 (Disabled)/01 (Enabled) | 01 | |
| Hd-45 | ○ | P-Gain for speed control, SM(PMM)-IVMS | 0 to 1000 | 100 | |
| Hd-46 | ○ | I-Gain for speed control, SM(PMM)-IVMS | 0 to 10000 | 100 | |
| Hd-47 | ○ | Wait time for open phase switching, SM(PMM)-IVMS | 0 to 1000 | 15 | |
| Hd-48 | ○ | Limitation of decision about the drive direction, SM(PMM)-IVMS | 00 (Disabled)/01 (Enabled) | 01 | |
| Hd-49 | ○ | Open phase voltage detection timing adjustment, SM(PMM)-IVMS | 0 to 1000 | 10 | |
| Hd-50 | ○ | Minimum pulse width adjustment, SM(PMM)-IVMS | 0 to 1000 | 100 | |
| Hd-51 | ○ | IVMS Current Limit for threshold | 0 to 255 | 100 | |
| Hd-52 | ○ | IVMS threshold gain | 0 to 255 | 100 | |
| Hd-58 | ○ | IVMS carrier-frequency start/end point | 0 to 50 (%) | 5 | |
| Hd202 | - | Sync.Motor capacity setting, 2nd-motor | 0.01 to 160.00 (kW) | *1 | |



| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|--|---------------|------|
| Hd203 | - | Sync.Motor poles setting, 2nd-motor | 2 to 48 (poles) | *1 | |
| Hd204 | - | Sync.Base frequency setting, 2nd-motor | 10.00 to 590.00 (Hz) | *1 | |
| Hd205 | - | Sync.Maximum frequency setting, 2nd-motor | 10.00 to 590.00 (Hz) | *1 | |
| Hd206 | - | Sync.Motor rated voltage, 2nd-motor | 1 to 1000 (V) | *1 | |
| Hd208 | - | Sync.Motor rated current, 2nd-motor | 0.01 to 10000.00 (A) | *1 | |
| Hd210 | - | Sync.Motor constant R, 2nd-motor | 0.000001 to 1000.000000 (Ω) | *1 | |
| Hd212 | - | Sync.Motor constant Ld, 2nd-motor | 0.000001 to 1000.000000 (mH) | *1 | |
| Hd214 | - | Sync.Motor constant Lq, 2nd-motor | 0.000001 to 1000.000000 (mH) | *1 | |
| Hd216 | - | Sync.Motor constant Ke, 2nd-motor | 0.1 to 100000.0 (mVs/rad) | *1 | |
| Hd218 | - | Sync.Motor constant J, 2nd-motor | 0.00001 to 10000.00000 (kgm^2) | *1 | |
| Hd230 | o | Minimum Frequency for Sync.M-SLV, 2nd-motor | 0 to 50 (%) | 8 | |
| Hd231 | o | No-Load current for Sync.M-SLV, 2nd-motor | 0 to 100 (%) | 10 | |
| Hd232 | - | Starting Method for Sync.M, 2nd-motor | 00 (Position estimation disabled)/ 01 (Position estimation enabled) | 00 | |
| Hd233 | - | IMPE 0V wait number for Sync.M, 2nd-motor | 0 to 255 | 10 | |
| Hd234 | - | IMPE detect wait number for Sync.M, 2nd-motor | 0 to 255 | 10 | |
| Hd235 | - | IMPE detect number for Sync.M, 2nd-motor | 0 to 255 | 30 | |
| Hd236 | - | IMPE voltage gain for Sync.M, 2nd-motor | 0 to 200 (%) | 100 | |
| Hd237 | - | IMPE Mg-pole position offset, 2nd-motor | 0 to 359 (deg) | 0 | |

*1. Varies depending on inverter models and settings of duty rating.

Parameter Mode (Code o)

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---|---------------|------|
| oA-10 | ○ | Operation mode on option card error (SLOT-1) | 00 (Error)/01 (Continue operation) | 00 | |
| oA-11 | ○ | Communication Watch Dog Timer | 0.00 to 100.00 (s) | 1.00 | |
| oA-12 | - | Action selection at communication error | 00 (Error)/ 01 (Trip after deceleration stop)/02 (Ignore)/ 03 (Free run)/04 (Deceleration stop) | 01 | |
| oA-13 | - | Run command enable option during the option card (SLOT-1) start-up | 00 (Operation command disabled)/ 01 (Operation command enabled) | 00 | |
| oA-20 | ○ | Operation mode on option card error (SLOT-2) | 00 (Error)/01 (Continue operation) | 00 | |
| oA-21 | ○ | Communication Watch Dog Timer | 0.00 to 100.00 (s) | 1.00 | |
| oA-22 | - | Action selection at communication error | 00 (Error)/ 01 (Trip after deceleration stop)/02 (Ignore)/ 03 (Free run)/04 (Deceleration stop) | 01 | |
| oA-23 | - | Run command enable option during the option card (SLOT-2) start-up | 00 (Operation command disabled)/ 01 (Operation command enabled) | 00 | |
| oA-30 | ○ | Operation mode on option card error (SLOT-3) | 00 (Error)/01 (Continue operation) | 00 | |
| oA-31 | ○ | Communication Watch Dog Timer | 0.00 to 100.00 (s) | 1.00 | |
| oA-32 | - | Action selection at communication error | 00 (Error)/ 01 (Trip after deceleration stop)/02 (Ignore)/ 03 (Free run)/04 (Deceleration stop) | 01 | |
| oA-33 | - | Run command enable option during the option card (SLOT-3) start-up | 00 (Operation command disabled)/ 01 (Operation command enabled) | 00 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|---|---------------|------|
| ob-01 | - | Encoder constant setting | 32 to 65535 (pls) | 1024 | |
| ob-02 | - | Encoder position selection | 00 (Phase-A is leading)/ 01 (Phase-B is leading) | 00 | |
| ob-03 | - | Motor gear ratio numerator | 1 to 10000 | 1 | |
| ob-04 | - | Motor gear ratio denominator | 1 to 10000 | 1 | |
| ob-10 | - | Pulse train detection object selection | 00 (Command)/ 01 (Pulse string position command) | 00 | |
| ob-11 | - | Mode selection of pulse train input | 00 (90° phase difference)/ 01 (forward/reverse rotation command and rotation direction)/ 02 (forward/reverse rotation pulse string) | 01 | |
| ob-12 | ○ | Pulse train frequency Scale | 0.05 to 200.0 (kHz) | 25.00 | |
| ob-13 | ○ | Pulse train frequency Filter time constant | 0.01 to 2.00 (s) | 0.10 | |
| ob-14 | ○ | Pulse train frequency Bias value | -100.0 to 100.0 (%) | 0.0 | |
| ob-15 | ○ | Pulse train frequency High Limit | 0.0 to 100.0 (%) | 100.0 | |
| ob-16 | ○ | Pulse train frequency detection low level | 0.0 to 100.0 (%) | 0.0 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|----------------|--|----------|------------|---------------|------|
| oC-01 to oC-28 | - | Reserved | - | | |
| oE-01 to oE-70 | - | Reserved | - | | |
| oH-01 to oH-34 | - | Reserved | - | | |
| oJ-01 to oJ-60 | - | Reserved | - | | |
| oL-01 to oL-76 | - | Reserved | - | | |

Parameter Mode (Code P)

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---|---|--|------|
| PA-01 | - | Mode selection for Emergency-force drive | 00 (Disabled)/01 (Enabled) | 00 | |
| PA-02 | - | Frequency reference setting at Emergency-force drive | 0.00 to 590.00 (Hz) | 0.00 | |
| PA-03 | - | Direction command at Emergency-force drive | 00 (Normal rotation)/01 (Reverse rotation) | 00 | |
| PA-04 | - | Commercial power supply bypass function selection | 00 (Disabled)/01 (Enabled) | 00 | |
| PA-05 | - | Delay time of Bypass function | 0.0 to 1000.0 (s) | 5.0 | |
| PA-20 | - | Simulation mode selection | 00 (Disabled)/01 (Enabled) | 00 | |
| PA-21 | - | Error code selection for Alarm test | 000 to 255 | 000 | |
| PA-22 | ○ | Output current monitor optional output enable | 00 (Disabled)/01 (Enabled: parameter setting [PA-23]) 02 (Enabled: set from [Ai1])/03 (Enabled: set from [Ai2])/ 04 (Enabled: set from [Ai3])/05 (Reserved)/ 06 (Reserved)/07 (Reserved) | 01 | |
| PA-23 | ○ | Output current monitor optional output value setting | 0.0 to 3.0 × Inverter rated current (A) | 0.0 | |
| PA-24 | ○ | DC-bus voltage monitor optional output enable | 00 (Disabled)/01 (Enabled: parameter setting [PA-25]) 02 (Enabled: set from [Ai1])/03 (Enabled: set from [Ai2])/ 04 (Enabled: set from [Ai3])/05 (Reserved)/ 06 (Reserved)/07 (Reserved) | 01 | |
| PA-25 | ○ | DC-bus voltage monitor optional value output | 200 V class: 0.0 to 450.0 (Vdc) 400 V class: 0.0 to 900.0 (Vdc) | 200 V class: 270.0 400 V class: 540.0 | |
| PA-26 | ○ | Output voltage monitor optional output enable | 00 (Disabled)/01 (Enabled: parameter setting [PA-27]) 02 (Enabled: set from [Ai1])/03 (Enabled: set from [Ai2])/ 04 (Enabled: set from [Ai3])/05 (Reserved)/ 06 (Reserved)/07 (Reserved) | 01 | |
| PA-27 | ○ | Output voltage monitor optional output value setting | 200 V class: 0.0 to 300.0 (V) 400 V class: 0.0 to 600.0 (V) | 0.0 | |
| PA-28 | ○ | Output torque monitor optional output enable | 00 (Disabled)/01 (Enabled: parameter setting [PA-29]) 02 (Enabled: set from [Ai1])/03 (Enabled: set from [Ai2])/ 04 (Enabled: set from [Ai3])/05 (Reserved)/ 06 (Reserved)/07 (Reserved) | 01 | |
| PA-29 | ○ | Output torque monitor optional output value setting | -500.0 to +500.0 (%) | 0.0 | |
| PA-30 | ○ | Start with frequency matching optional Setting enable | 00 (Disabled)/01 (Enabled: parameter setting [PA-31]) 02 (Enabled: set from [Ai1])/03 (Enabled: set from [Ai2])/ 04 (Enabled: set from [Ai3])/05 (Reserved)/ 06 (Reserved)/07 (Reserved) | 01 | |
| PA-31 | ○ | Start with frequency matching optional value setting | 0.0 to 590.00 (Hz) | 0.00 | |



Parameter Mode (Code U)

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|--|--|---------------|------|
| UA-01 | - | Password input for display selection | - | 0000 | |
| UA-02 | - | Soft-lock password input | - | 0000 | |
| UA-10 | - | Display restriction selection | 00 (Full display)/01 (By function)/02 (User setting)/03 (Conveyor display)/04 (Only monitor display) | 00 | |
| UA-12 | o | Accumulation input power monitor clear | 00 (Disabled)/01 (Clear) | 00 | |
| UA-13 | o | Display gain for Accumulation input power monitor | 1 to 1000 | 1 | |
| UA-14 | o | Accumulation output power monitor clear | 00 (Disabled)/01 (Clear) | 00 | |
| UA-15 | o | Display gain for Accumulation output power monitor | 1 to 1000 | 1 | |
| UA-16 | o | Soft-lock selection | 00 ([SFT] terminal)/01 (Always enabled) | 00 | |
| UA-17 | o | Soft-lock target selection | 00 (All data cannot be changed)/01 (Data other than set frequency cannot be changed) | 00 | |
| UA-18 | - | Data R/W selection | 00 (R/W enabled)/01 (R/W disabled) | 00 | |
| UA-19 | - | Low battery warning enable | 00 (Disabled)/01 (Warning)/02 (Error) | 00 | |
| UA-20 | - | Action selection at Keypad disconnection | 00 (Error)/01 (Error after deceleration stop)/02 (Ignore)/03 (Free run)/04 (Deceleration stop) | 02 | |
| UA-21 | - | 2nd-motor parameter display selection | 00 (Not display)/01 (Display) | 01 | |
| UA-22 | - | Option parameter display selection | 00 (Not display)/01 (Display) | 01 | |
| UA-30 | - | User parameter auto setting function enable | 00 (Disabled)/01 (Enabled) | 00 | |
| UA-31 | o | User parameter 1 selection | no/***** (select a parameter) | no | |
| UA-32 | o | User parameter 2 selection | no/***** (select a parameter) | no | |
| UA-33 | o | User parameter 3 selection | no/***** (select a parameter) | no | |
| UA-34 | o | User parameter 4 selection | no/***** (select a parameter) | no | |
| UA-35 | o | User parameter 5 selection | no/***** (select a parameter) | no | |
| UA-36 | o | User parameter 6 selection | no/***** (select a parameter) | no | |
| UA-37 | o | User parameter 7 selection | no/***** (select a parameter) | no | |
| UA-38 | o | User parameter 8 selection | no/***** (select a parameter) | no | |
| UA-39 | o | User parameter 9 selection | no/***** (select a parameter) | no | |
| UA-40 | o | User parameter 10 selection | no/***** (select a parameter) | no | |
| UA-41 | o | User parameter 11 selection | no/***** (select a parameter) | no | |
| UA-42 | o | User parameter 12 selection | no/***** (select a parameter) | no | |
| UA-43 | o | User parameter 13 selection | no/***** (select a parameter) | no | |
| UA-44 | o | User parameter 14 selection | no/***** (select a parameter) | no | |
| UA-45 | o | User parameter 15 selection | no/***** (select a parameter) | no | |
| UA-46 | o | User parameter 16 selection | no/***** (select a parameter) | no | |
| UA-47 | o | User parameter 17 selection | no/***** (select a parameter) | no | |
| UA-48 | o | User parameter 18 selection | no/***** (select a parameter) | no | |
| UA-49 | o | User parameter 19 selection | no/***** (select a parameter) | no | |
| UA-50 | o | User parameter 20 selection | no/***** (select a parameter) | no | |
| UA-51 | o | User parameter 21 selection | no/***** (select a parameter) | no | |
| UA-52 | o | User parameter 22 selection | no/***** (select a parameter) | no | |
| UA-53 | o | User parameter 23 selection | no/***** (select a parameter) | no | |
| UA-54 | o | User parameter 24 selection | no/***** (select a parameter) | no | |
| UA-55 | o | User parameter 25 selection | no/***** (select a parameter) | no | |
| UA-56 | o | User parameter 26 selection | no/***** (select a parameter) | no | |
| UA-57 | o | User parameter 27 selection | no/***** (select a parameter) | no | |



| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|----------------|--|-----------------------------|-------------------------------|---------------|------|
| UA-58 | ○ | User parameter 28 selection | no/***** (select a parameter) | no | |
| UA-59 | ○ | User parameter 29 selection | no/***** (select a parameter) | no | |
| UA-60 | ○ | User parameter 30 selection | no/***** (select a parameter) | no | |
| UA-61 | ○ | User parameter 31 selection | no/***** (select a parameter) | no | |
| UA-62 | ○ | User parameter 32 selection | no/***** (select a parameter) | no | |
| UA-90 to UA-94 | - | Reserved | - | | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|---------------------------|--|---------------|------|
| Ub-01 | - | Initialize Mode selection | 00 (Disabled)/01 (Trip history)/02 (Parameter initialization)/03 (Trip history + parameters)/04 (Trip history + parameters + DriveProgramming)/05 (Other than terminal function)/06 (Other than communication function)/07 (Other than terminal&communication functions)/08 (DriveProgramming) | 00 | |
| Ub-02 | - | Initialize Data selection | 00 (Mode 0)/01 (Mode 1)/02 (Mode 2)/03 (Mode 3) | 01 | |
| Ub-03 | - | Load type selection | 00 (VLD)/01 (LD)/02 (ND) | 02 | |
| Ub-05 | - | Initialize Enable | 00 (Disabled)/01 (Start initialization) | 00 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|-------------------|-----------------|---------------|------|
| UC-01 | ○ | Debug mode enable | (do not change) | 00 | - |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|----------------|--|----------|------------|---------------|------|
| Ud-01 to Ud-60 | - | Reserved | - | | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|----------------------------|---|---------------|------|
| UE-01 | - | EzSQ operation cycle | 00 (1 ms)/01 (2 ms) | 00 | |
| UE-02 | ○ | EzSQ function enable | 00 (Disabled)/01 ([PRG] terminal)/02 (Always) | 00 | |
| UE-10 | ○ | EzSQ user parameter U (00) | 0 to 65535 | 0 | |
| UE-11 | ○ | EzSQ user parameter U (01) | 0 to 65535 | 0 | |
| UE-12 | ○ | EzSQ user parameter U (02) | 0 to 65535 | 0 | |
| UE-13 | ○ | EzSQ user parameter U (03) | 0 to 65535 | 0 | |
| UE-14 | ○ | EzSQ user parameter U (04) | 0 to 65535 | 0 | |
| UE-15 | ○ | EzSQ user parameter U (05) | 0 to 65535 | 0 | |
| UE-16 | ○ | EzSQ user parameter U (06) | 0 to 65535 | 0 | |
| UE-17 | ○ | EzSQ user parameter U (07) | 0 to 65535 | 0 | |
| UE-18 | ○ | EzSQ user parameter U (08) | 0 to 65535 | 0 | |
| UE-19 | ○ | EzSQ user parameter U (09) | 0 to 65535 | 0 | |
| UE-20 | ○ | EzSQ user parameter U (10) | 0 to 65535 | 0 | |
| UE-21 | ○ | EzSQ user parameter U (11) | 0 to 65535 | 0 | |

Appendices C Table of Parameters

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|----------------------------|------------|---------------|------|
| UE-22 | ○ | EzSQ user parameter U (12) | 0 to 65535 | 0 | |
| UE-23 | ○ | EzSQ user parameter U (13) | 0 to 65535 | 0 | |
| UE-24 | ○ | EzSQ user parameter U (14) | 0 to 65535 | 0 | |
| UE-25 | ○ | EzSQ user parameter U (15) | 0 to 65535 | 0 | |
| UE-26 | ○ | EzSQ user parameter U (16) | 0 to 65535 | 0 | |
| UE-27 | ○ | EzSQ user parameter U (17) | 0 to 65535 | 0 | |
| UE-28 | ○ | EzSQ user parameter U (18) | 0 to 65535 | 0 | |
| UE-29 | ○ | EzSQ user parameter U (19) | 0 to 65535 | 0 | |
| UE-30 | ○ | EzSQ user parameter U (20) | 0 to 65535 | 0 | |
| UE-31 | ○ | EzSQ user parameter U (21) | 0 to 65535 | 0 | |
| UE-32 | ○ | EzSQ user parameter U (22) | 0 to 65535 | 0 | |
| UE-33 | ○ | EzSQ user parameter U (23) | 0 to 65535 | 0 | |
| UE-34 | ○ | EzSQ user parameter U (24) | 0 to 65535 | 0 | |
| UE-35 | ○ | EzSQ user parameter U (25) | 0 to 65535 | 0 | |
| UE-36 | ○ | EzSQ user parameter U (26) | 0 to 65535 | 0 | |
| UE-37 | ○ | EzSQ user parameter U (27) | 0 to 65535 | 0 | |
| UE-38 | ○ | EzSQ user parameter U (28) | 0 to 65535 | 0 | |
| UE-39 | ○ | EzSQ user parameter U (29) | 0 to 65535 | 0 | |
| UE-40 | ○ | EzSQ user parameter U (30) | 0 to 65535 | 0 | |
| UE-41 | ○ | EzSQ user parameter U (31) | 0 to 65535 | 0 | |
| UE-42 | ○ | EzSQ user parameter U (32) | 0 to 65535 | 0 | |
| UE-43 | ○ | EzSQ user parameter U (33) | 0 to 65535 | 0 | |
| UE-44 | ○ | EzSQ user parameter U (34) | 0 to 65535 | 0 | |
| UE-45 | ○ | EzSQ user parameter U (35) | 0 to 65535 | 0 | |
| UE-46 | ○ | EzSQ user parameter U (36) | 0 to 65535 | 0 | |
| UE-47 | ○ | EzSQ user parameter U (37) | 0 to 65535 | 0 | |
| UE-48 | ○ | EzSQ user parameter U (38) | 0 to 65535 | 0 | |
| UE-49 | ○ | EzSQ user parameter U (39) | 0 to 65535 | 0 | |
| UE-50 | ○ | EzSQ user parameter U (40) | 0 to 65535 | 0 | |
| UE-51 | ○ | EzSQ user parameter U (41) | 0 to 65535 | 0 | |
| UE-52 | ○ | EzSQ user parameter U (42) | 0 to 65535 | 0 | |
| UE-53 | ○ | EzSQ user parameter U (43) | 0 to 65535 | 0 | |
| UE-54 | ○ | EzSQ user parameter U (44) | 0 to 65535 | 0 | |
| UE-55 | ○ | EzSQ user parameter U (45) | 0 to 65535 | 0 | |
| UE-56 | ○ | EzSQ user parameter U (46) | 0 to 65535 | 0 | |
| UE-57 | ○ | EzSQ user parameter U (47) | 0 to 65535 | 0 | |
| UE-58 | ○ | EzSQ user parameter U (48) | 0 to 65535 | 0 | |
| UE-59 | ○ | EzSQ user parameter U (49) | 0 to 65535 | 0 | |
| UE-60 | ○ | EzSQ user parameter U (50) | 0 to 65535 | 0 | |
| UE-61 | ○ | EzSQ user parameter U (51) | 0 to 65535 | 0 | |
| UE-62 | ○ | EzSQ user parameter U (52) | 0 to 65535 | 0 | |
| UE-63 | ○ | EzSQ user parameter U (53) | 0 to 65535 | 0 | |
| UE-64 | ○ | EzSQ user parameter U (54) | 0 to 65535 | 0 | |
| UE-65 | ○ | EzSQ user parameter U (55) | 0 to 65535 | 0 | |
| UE-66 | ○ | EzSQ user parameter U (56) | 0 to 65535 | 0 | |
| UE-67 | ○ | EzSQ user parameter U (57) | 0 to 65535 | 0 | |
| UE-68 | ○ | EzSQ user parameter U (58) | 0 to 65535 | 0 | |
| UE-69 | ○ | EzSQ user parameter U (59) | 0 to 65535 | 0 | |
| UE-70 | ○ | EzSQ user parameter U (60) | 0 to 65535 | 0 | |
| UE-71 | ○ | EzSQ user parameter U (61) | 0 to 65535 | 0 | |
| UE-72 | ○ | EzSQ user parameter U (62) | 0 to 65535 | 0 | |
| UE-73 | ○ | EzSQ user parameter U (63) | 0 to 65535 | 0 | |

| Code | Codes that can be changed during operation | Name | Data range | Initial value | Note |
|-------|--|-----------------------------|---------------------------|---------------|------|
| UF-02 | ○ | EzSQ user parameter UL (00) | -2147483647 to 2147483647 | 0 | |
| UF-04 | ○ | EzSQ user parameter UL (01) | -2147483647 to 2147483647 | 0 | |
| UF-06 | ○ | EzSQ user parameter UL (02) | -2147483647 to 2147483647 | 0 | |
| UF-08 | ○ | EzSQ user parameter UL (03) | -2147483647 to 2147483647 | 0 | |
| UF-10 | ○ | EzSQ user parameter UL (04) | -2147483647 to 2147483647 | 0 | |
| UF-12 | ○ | EzSQ user parameter UL (05) | -2147483647 to 2147483647 | 0 | |
| UF-14 | ○ | EzSQ user parameter UL (06) | -2147483647 to 2147483647 | 0 | |
| UF-16 | ○ | EzSQ user parameter UL (07) | -2147483647 to 2147483647 | 0 | |
| UF-18 | ○ | EzSQ user parameter UL (08) | -2147483647 to 2147483647 | 0 | |
| UF-20 | ○ | EzSQ user parameter UL (09) | -2147483647 to 2147483647 | 0 | |
| UF-22 | ○ | EzSQ user parameter UL (10) | -2147483647 to 2147483647 | 0 | |
| UF-24 | ○ | EzSQ user parameter UL (11) | -2147483647 to 2147483647 | 0 | |
| UF-26 | ○ | EzSQ user parameter UL (12) | -2147483647 to 2147483647 | 0 | |
| UF-28 | ○ | EzSQ user parameter UL (13) | -2147483647 to 2147483647 | 0 | |
| UF-30 | ○ | EzSQ user parameter UL (14) | -2147483647 to 2147483647 | 0 | |
| UF-32 | ○ | EzSQ user parameter UL (15) | -2147483647 to 2147483647 | 0 | |



<Unit options>

| No. | Unit |
|-----|-------------------|
| 00 | non |
| 01 | % |
| 02 | A |
| 03 | Hz |
| 04 | V |
| 05 | kW |
| 06 | W |
| 07 | hr |
| 08 | s |
| 09 | kHz |
| 10 | ohm |
| 11 | mA |
| 12 | ms |
| 13 | P |
| 14 | kgm ² |
| 15 | pls |
| 16 | mH |
| 17 | Vdc |
| 18 | °C |
| 19 | kWh |
| 20 | mF |
| 21 | mVs/rad |
| 22 | Nm |
| 23 | min ⁻¹ |
| 24 | m/s |
| 25 | m/min |
| 26 | m/h |
| 27 | ft/s |
| 28 | ft/min |
| 29 | ft/h |
| 30 | m |

| No. | Unit |
|-----|----------------------|
| 31 | cm |
| 32 | °F |
| 33 | l/s |
| 34 | l/min |
| 35 | l/h |
| 36 | m ³ /s |
| 37 | m ³ /min |
| 38 | m ³ /h |
| 39 | kg/s |
| 40 | kg/min |
| 41 | kg/h |
| 42 | t/min |
| 43 | t/h |
| 44 | gal/s |
| 45 | gal/min |
| 46 | gal/h |
| 47 | ft ³ /s |
| 48 | ft ³ /min |
| 49 | ft ³ /h |
| 50 | lb/s |
| 51 | lb/min |
| 52 | lb/h |
| 53 | mbar |
| 54 | bar |
| 55 | Pa |
| 56 | kPa |
| 57 | PSI |
| 58 | mm |

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