MITSUBISHI ELECTRIC

Frequency Inverter

Beginner's Guide

FR-A800

Art. no.: 280305
23 10 2014
Version A

MITSUBISHI ELECTRIC INDUSTRIAL AUTOMATION

Version check

About this manual

This manual is intended for use by properly trained and qualified electrical technicians, who want to get a first introduction and rough overview about the basic functions of a Mitsubishi frequency inverter. For detailed information refer to the related manuals for the products in this guide (refer to section 1.4).

The texts, illustration, diagrams and examples in this manual are provided for information purposes only. They are intended as aids to help explain the installation and operation of the inverter of the FR-A800 series.

If you have any questions about the installation and operation of any of the products described in this manual please contact your local sales office or distributor (see back cover). You can find the latest information and answers to frequently asked questions on our website at https://eu3a.mitsubishielectric.com.

MITSUBISHI ELECTRIC EUROPE BV reserves the right to make changes to this manual or the technical specifications of its products at any time without notice.

Beginner's Guide for Frequency Inverters FR-A800 Series Art. no.: 280305	
Version	**Revisions / Additions / Corrections**
A 10/2014 akl	First edition

Safety guidelines

For use by qualified staff only

This manual is only intended for use by properly trained and qualified electrical technicians who are fully acquainted with the relevant automation technology safety standards. All work with the hardware described, including system design, installation, configuration, maintenance, service and testing of the equipment, may only be performed by trained electrical technicians with approved qualifications who are fully acquainted with all the applicable automation technology safety standards and regulations. Any operations or modifications to the hardware and/or software of our products not specifically described in this manual may only be performed by authorised Mitsubishi Electric staff.

Proper use of the products

The inverters of the FR-A800 series are only intended for the specific applications explicitly described in this manual. All parameters and settings specified in this manual must be observed. The products described have all been designed, manufactured, tested and documented in strict compliance with the relevant safety standards. Unqualified modification of the hardware or software or failure to observe the warnings on the products and in this manual may result in serious personal injury and/or damage to property. Only peripherals and expansion equipment specifically recommended and approved by Mitsubishi Electric may be used with the inverters of the FR-A800 series.

All and any other uses or application of the products shall be deemed to be improper.

Relevant safety regulations

All safety and accident prevention regulations relevant to your specific application must be observed in the system design, installation, configuration, maintenance, servicing and testing of these products. The regulations listed below are particularly important in this regard. This list does not claim to be complete, however; you are responsible for being familiar with and conforming to the regulations applicable to you in your location.

- VDE Standards
  - VDE 0100
    Regulations for the erection of power installations with rated voltages below 1000 V
  - VDE 0105
    Operation of power installations
  - VDE 0113
    Electrical installations with electronic equipment
  - EN 50178
    Electronic equipment for use in power installations
- Fire safety regulations
- Accident prevention regulation
  - VBG No. 4
    Electrical systems and equipment

Safety warnings in this manual

Do not use the inverter until you have a full knowledge of the equipment, safety information and instructions. In this manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

WARNING:

Assumes that incorrect handling may cause hazardous conditions, resulting in death or severe injury.

CAUTION:

Assumes that incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause physical damage only.

Note that even the CAUTION level may lead to a serious consequence according to conditions. Please follow strictly the instructions of both levels because they are important to personnel safety.

Electric shock prevention

WARNING:

- ***While power is on or when the inverter is running, do not open the front cover. Otherwise you may get an electric shock.***
- ***Do not run the inverter with the front cover removed. Otherwise, you may access the exposed high-voltage terminals or the charging part of the circuitry and get an electric shock.***
- ***Even if power is off, do not remove the front cover except for wiring or periodic inspection.You may access the charged inverter circuits and get an electric shock.***
- ***Before starting wiring or inspection, check to make sure that the operation panel indicator is off, wait for at least 10 minutes after the power supply has been switched off, and check that there are no residual voltage using a tester or the like. The capacitor is charged with high voltage for some time after power off and it is dangerous.***
- ***This inverter must be earthed. Earthing must conform to the requirements of national and local safety regulations and electrical codes. (JIS, NEC section 250, IEC 536 class 1 and other applicable standards).***
- ***Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.***
- ***Always install the inverter before wiring. Otherwise, you may get an electric shock or be injured.***
- ***If your application requires by installation standards an RCD (residual current device) as up stream protection please select according to DIN VDE 0100-530 as following:***
  Single phase inverter type A or B
  Three phase inverter only type B.
- ***Perform setting dial and key operations with dry hands to prevent an electric shock. Otherwise you may get an electric shock.***
- ***Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise you may get an electric shock.***
- ***Do not replace the cooling fan while power is on. It is dangerous to replace the cooling fan while power is on.***
- ***Do not touch the printed circuit board with wet hands. You may get an electric shock.***
- ***Standard models and IP55 compatible models only: When measuring the main circuit capacitor capacity, the DC voltage is applied to the motor for 1s at powering OFF. Never touch the motor terminal, etc. right after powering OFF to prevent an electric shock.***
- ***A PM motor is a synchronous motor with high-performance magnets embedded in the rotor. Motor terminals holds high-voltage while the motor is running even after the inverter power is turned OFF. Before wiring or inspection, the motor must be confirmed to be stopped. In an application, such as fan and blower, where the motor is driven by the load, a low-voltage manual motor starter must be connected at the inverter's output side, and wiring and inspection must be performed while the motor starter is open. Otherwise you may get an electric shock.***

Fire prevention

CAUTION:

- ***Mount the inverter to incombustible material. Install the inverter on a nonflammable wall without holes (so that nobody can touch the inverter heatsink on the rear side, etc.). Mounting it to or near combustible material can cause a fire.***
- ***If the inverter has become faulty, switch off the inverter power. A continuous flow of large current could cause a fire.***
- ***When using a brake resistor, a sequence that will turn OFF power when a fault signal is output must be configured. Otherwise the brake resistor may excessively overheat due to damage of the brake transistor and such, causing a fire.***
- ***Do not connect a resistor directly to the DC terminals P/+ and N/–. This could cause a fire and destroy the inverter. The surface temperature of braking resistors can far exceed 100°C for brief periods. Make sure that there is adequate protection against accidental contact and a safe distance is maintained to other units and system parts.***
- ***Resistors cannot be used for FR-A842 (separated converter type) and FR-A846 (IP55 compatible models).***
- ***Be sure to perform daily and periodic inspections as specified in the Instruction Manual. If a product is used without any inspection, a burst, breakage, or a fire may occur.***

Injury prevention

CAUTION:

- ***Apply only the voltage specified in the instruction manual to each terminal. Otherwise, burst, damage, etc. may occur.***
- ***Ensure that the cables are connected to the correct terminals. Otherwise, burst, damage,etc.may occur.***
- ***Always make sure that polarity is correct to prevent damage, etc. Otherwise, burst, damage, etc. may occur.***
- ***While power is on or for some time after power-off, do not touch the inverter as it is hot and you may get burnt.***

Additional instructions

Also note the following points to prevent an accidental failure, injury, electric shock, etc.

Transportation and installation

CAUTION:

- ***Any person who is opening a package using a sharp object, such as a knife and cutter, must wear gloves to prevent injuries caused by the edge of the sharp object.***
- ***When carrying products, use correct lifting gear to prevent injury.***
- ***Do not stack the inverter boxes higher than the number recommended.***
- ***During installation, caution must be taken not to drop the inverter as doing so may cause injuries.***
- ***Ensure that installation position and material can withstand the weight of the inverter. Install according to the information in the instruction manual.***
- ***Do not install the product on a hot surface.***
- ***The inverter must be installed on a strong surface securely with screws so that it will not drop.***
- ***Do not install or operate the inverter if it is damaged or has parts missing. This can result in breakdowns.***
- ***When carrying the inverter, do not hold it by the front cover or setting dial; it may fall off or fail.***
- ***Do not stand or rest heavy objects on the product.Check the inverter mounting orientation is correct***
- ***Prevent other conductive bodies such as screws and metal fragments or other flammable substance such as oil from entering the inverter.***
- ***As the inverter is a precision instrument, do not drop or subject it to impact.***
- ***Use the inverter under the environmental conditions mentioned in chapter 1. Otherwise, the inverter may be damaged.***
- ***If halogen-based materials (fluorine, chlorine, bromine, iodine, etc.) infiltrate into a Mitsubishi product, the product will be damaged. Halogen-based materials are often included in fumigant, which is used to sterilize or disinfect wooden packages. When packaging, prevent residual fumigant components from being infiltrated into Mitsubishi products, or use an alternative sterilization or disinfection method (heat disinfection, etc.) for packaging. Sterilization of disinfection of wooden package should also be performed before packaging the product.***
- ***To prevent a failure, do not use the inverter with a part or material containing halogen flame retardant including bromine.***

Wiring

CAUTION:

- ***Do not install assemblies or components (e. g. power factor correction capacitors) on the inverter output side, which are not approved from Mitsubishi. These devices on the inverter output side may be overheated or burn out.***
- ***The direction of rotation of the motor corresponds to the direction of rotation commands (STF/STR) only if the phase sequence (U, V, W) is maintained.***
- ***PM motor terminals (U, V, W) hold high-voltage while the PM motor is running even after the power is turned OFF. Before wiring, the PM motor must be confirmed to be stopped. Otherwise you may get an electric shock.***
- ***Never connect an PM motor to the commercial power supply.***
  Applying the commercial power supply to input terminals (U,V, W) of a PM motor will burn the PM motor. The PM motor must be connected with the output terminals (U, V, W) of the inverter.

Test operation and adjustment

CAUTION:

- ***Before starting operation, confirm and adjust the parameters. A failure to do so may cause some machines to make unexpected motions.***

WARNING:

- ***When you have chosen the retry function, stay away from the equipment as it will restart suddenly after an alarm stop.***
- ***Since pressing the STOP RESET key may not stop output depending on the function setting status, provide a circuit and switch separately to make an emergency stop (power off, mechanical brake operation for emergency stop, etc).***
- ***Make sure that the start signal is off before resetting the inverter alarm. A failure to do so may restart the motor suddenly.***
- ***Do not use a PM motor for an application where the PM motor is driven by its load and runs at a speed higher than the maximum motor speed.***
- ***Performing pre-excitation (LX signal and X13 signal) under torque control (Real sensorless vector control) may start the motor running at a low speed even when the start command (STF or STR) is not input The motor may run also at a low speed when the speed limit value = 0 with a start command input. It must be confirmed that the motor running will not cause any safety problem before performing pre-excitation.***
- ***The inverter can be started and stopped via the serial port communications link or the field bus. However, please note that depending on the settings of the communications parameters it may not be possible to stop the system via these connections if there is an error in the communications system or the data line. In configurations like this it is thus essential to install additional safety hardware that makes it possible to stop the system in an emergency (e.g. controller inhibit via control signal, external motor contactor etc). Clear and unambiguous warnings about this must be posted on site for the operating and service staff.***
- ***Use this inverter only with three-phase induction motors or with a PM motor. Connection of any other electrical equipment to the inverter output may damage the inverter as well as the equipment.***
- ***Do not modify the equipment.***
- ***Do not perform parts removal which is not instructed in this manual. Doing so may lead to fault or damage of the inverter.***

CAUTION:

- ***The electronic thermal relay function does not guarantee protection of the motor from overheating. It is recommended to install both an external thermal and PTC thermistor for overheat protection.***
- ***Do not use a magnetic contactor on the inverter input for frequent starting/stopping of the inverter.***
- ***Use a noise filter to reduce the effect of electromagnetic interference and follow the accepted EMC procedures for proper installation of frequency inverters. Otherwise nearby electronic equipment may be affected.***
- ***Take appropriate measures regarding harmonics. Otherwise this can endanger compensation systems or overload generators.***
- ***When driving a 400V class motor by the inverter, the motor must be an insulation-enhanced motor or measures must be taken to suppress surge voltage. Surge voltage attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor.***
- ***Use a motor designed for inverter operation. (The stress for motor windings is bigger than in line power supply).***
- ***When parameter clear or all clear is performed, set again the required parameters before starting operations. Each parameter returns to the initial value.***
- ***The inverter can be easily set for high-speed operation. Before changing its setting, fully examine the performances of the motor and machine.***
- ***The DC braking function of the frequency inverter is not designed to continuously hold a load. Use an electro-mechanical holding brake on the motor for this purpose.***
- ***Before running an inverter which had been stored for a long period, always perform inspection and test operation.***
- ***For prevention of damage due to static electricity, touch nearby metal before touching this product to eliminate static electricity from your body.***
- ***Only one PM motor can be connected to an inverter.***
- ***A PM motor must be used under PM sensorless vector control. Do not use a synchronous motor, induction motor, or synchronous induction motor.***
- ***Do not connect a PM motor in the induction motor control settings (initial settings). Do not use an induction motor in the PM sensorless vector control settings. It will cause a failure.***
- ***In the system with a PM motor, the inverter power must be turned ON before closing the contacts of the contactor at the output side.***

Emergency stop

CAUTION:

- ***Provide a safety backup such as an emergency brake which will prevent the machine and equipment from hazardous conditions if the inverter fails.***
- ***When the breaker on the inverter primary side trips, check for the wiring fault (short circuit), damage to internal parts of the inverter, etc. Identify the cause of the trip, then remove the cause and power on the breaker.***
- ***When the protective function is activated (i. e. the frequency inverter switches off with an error message), take the corresponding corrective action as described in the inverter manual, then reset the inverter, and resume operation.***

Maintenance, inspection and parts replacement

CAUTION:

- ***Do not carry out a megger (insulation resistance) test on the control circuit of the inverter. It will cause a failure.***

Disposing of the inverter

CAUTION:

- ***Treat as industrial waste.***

IP55 compatible models: Waterproof and dustproof performances

CAUTION:

- ***The inverter is rated with an IPX5① waterproof rating and an IP5X② dustproof rating when the parameter unit (FR-DU08-01), the front cover, the wiring cover, and the cable glands are securely fixed with screws.***
- ***The items enclosed with the inverter such as the Instruction Manual or CD are not rated with the IPX5 waterproof or IP5X dustproof ratings.***
- ***Although the inverter is rated with the IPX5 waterproof and IP5X dustproof ratings, it is not intended for use in water. Also, the ratings do not guarantee protection of the inverter from needless submersion in water or being washed under strong running water such as a shower.***
- ***Do not pour or apply the following liquids over the inverter: water containing soap, detergent, or bath additives; sea water; swimming pool water; warm water; boiling water; etc.***
- ***The inverter is intended for indoor③ installation and not for outdoor installation. Avoid places where the inverter is subjected to direct sunlight, rain, sleet, snow, or freezing temperatures.***
- ***If the parameter unit (FR-DU08-01) is not installed, if the screws of the parameter unit are not tightened, or if the parameter unit is damaged or deformed, the IPX5 waterproof performance and the IP5X dustproof performance are impaired. If any abnormalities are found on the parameter unit, ask for an inspection and repair.***
- ***If the screws of the front cover or the wiring cover are not tightened, if any foreign matter (hair, sand grain, fiber, etc.) is stuck between the inverter and the gasket, if the gasket is damaged, or if the front cover or the wiring cover is damaged or deformed, the IPX5 waterproof performance and the IP5X dustproof performance are impaired. If any abnormalities are found on the front cover, wiring cover, or the gasket of the inverter, ask for an inspection and repair.***
- ***Cable glands are important components to maintain the waterproof and dustproof performances. Be sure to use cable glands of the recommended size and shape or equivalent. The standard protective bushes cannot sufficiently maintain the IPX5 waterproof performance and the IP5X dustproof performance.***
- ***If a cable gland is damaged or deformed, the IPX5 waterproof performance and the IP5X dustproof performance are impaired. If any abnormalities are found on the cable glands, ask the manufacturer of the cable glands for an inspection and repair.***
- ***To maintain the waterproof and dustproof performances of the inverter, daily and periodic inspections are recommended regardless of the presence or absence of abnormalities.***

① ***IPX5 refers to protection of the inverter functions against water jets from any direction when about 12.5-liter water (water here refers to fresh water at room temperature (5 to 35°C)) is injected from a nozzle with an inside diameter of 6.3 mm from the distance of about 3 m for at least 3 minutes.***

② ***IP5X refers to protection of the inverter functions and maintenance of safety when the inverter is put into a stirring device containing dust of 75 mm or smaller in diameter, stirred for 8 hours, and then removed from the device.***

③ ***Indoor here refers to the environments that are not affected by climate conditions.***

General instructions

Many of the diagrams and drawings in instruction manuals show the inverter without a cover, or partially open. Never run the inverter in this status. Always replace the cover and follow instruction manuals when operating the inverter. For more details on the PM motor, refer to the Instruction Manual of the PM motor.

Symbols used in the manual

Use of instructions

Instructions concerning important information are marked separately and are displayed as follows:

NOTE | Text of instruction

Use of examples

Examples are marked separately and are displayed as follows:

Example ▽ Example text △

Use of numbering in the figures

Numbering within the figures is displayed by white numbers within black circles and is explained in a table following it using the same number, e.g.:

❶ ❷ ❸ ❹

Use of handling instructions

Handling instructions are steps that must be carried out in their exact sequence during start-up, operation, maintenance and similar operations.

They are numbered consecutively (black numbers in white circles):

① Text.

② Text.

③ Text.

Use of footnotes in tables

Instructions in tables are explained in footnotes underneath the tables (in superscript). There is a footnote character at the appropriate position in the table (in superscript).

If there are several footnotes for one table then these are numbered consecutively underneath the table (black numbers in white circle, in superscript):

① Text
② Text
③ Text

Contents

1 Introduction

1.1 What is a frequency inverter?

Asynchronous three-phase electric motors are simple, reliable and inexpensive, which makes them a particularly popular choice for industrial applications.

The speed of an asynchronous three-phase motor is determined by two factors:

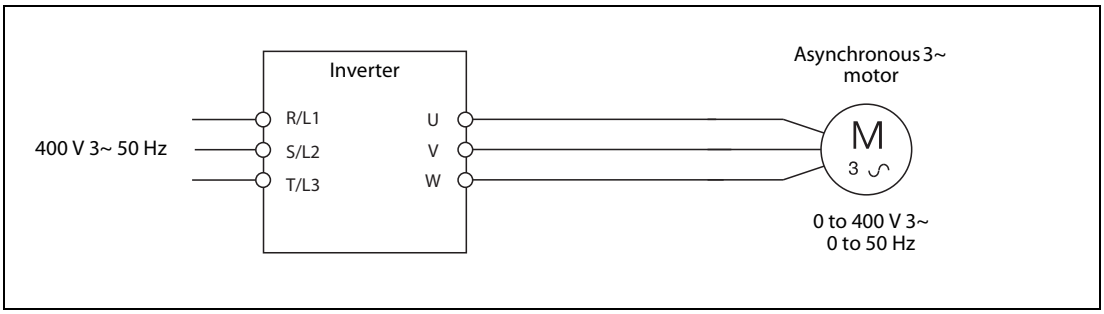
– The frequency of the three-phase current.

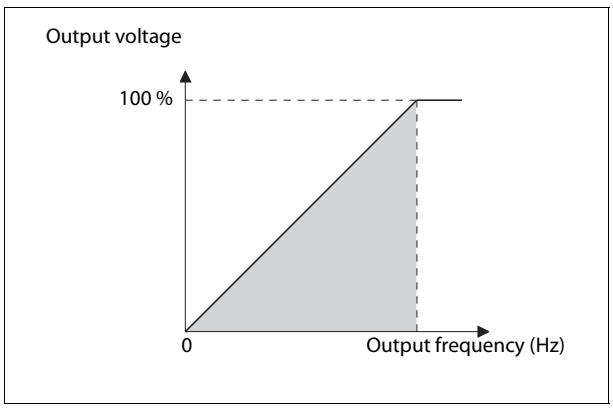
– The design of the motor winding (number of poles or pole pairs).

Since the frequency of the power supply is generally a constant 50Hz this means that the speed of the motor is inherently fixed – you can only change it for different applications by changing the construction of the winding. Once that has been chosen the motor will always run at a fixed speed, for example approximately 3,000 rpm or 1,500 rpm.

Providing more than one speed is only possible with "pole-changing" motors that have two sets of windings (2 windings enable up to 4 different speeds). That is the end of the line, however. Neither more speeds nor continuously-variable speeds are possible with pole-changing motors.

The solution to this problem is to use a frequency inverter, or inverter for short, which is a device that converts the fixed voltage and frequency of the mains power supply into a variable voltage with a variable frequency. It is installed between the mains supply and the motor and makes continuously- variable speed adjustment possible, turning a standard motor with a single winding into a flexible variable-speed drive system.





The speed of the connected motor can be adjusted continuously by changing the output voltage and frequency of the inverter.

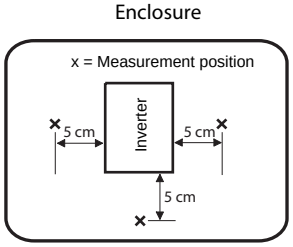
Inverters also have other benefits, including adjustable acceleration and braking times, torque boosting, integrated electronic overcurrent protection and even integrated PID controllers, another advanced feature that has already been realised.

1.2 Ambient conditions

Please observe the ambient conditions limits listed in the table below when operating the frequency inverters described in this guide.

Specification		FR-A800	
		FR-A820/A840/A842	FR-A846
Surrounding air temperature ①	for operation	–10 °C to 50 °C –10 °C to 40 ②	–10 °C to 40 °C
		Non freezing	
	for storage	–20 °C to 65 °C These temperatures are allowed for a short period only e.g. during shipping.	
Ambient humidity for operation and storage		With circuit board coating, IP55 compatible models: 95% RH or less (non-condensing), Without circuit board coating: 90% or less (non condensing)	
Vibration		5.9 m/s² (0.6 g) or less ③	
Installation environment		Indoors (free from corrosive or flammable gas, oil mist, dust and dirt)	
Installation altitude		Maximum 1000 m above sea level with no limitations. For altitudes above 1000 m derate the inverter capacity by 3% for every additional 500 m. Maximum installation altitude: 2500 m (with 91% of the inverter rated capacity)	

① Surrounding air temperature is a temperature measured at a measurement position in an enclosure. Ambient temperature is a temperature outside an enclosure.



② The specific acceptable ambient temperature depends on the overload capacity of the individual inverter.

③ 2.9 m/s² or less for the FR-A840-04320(160K) or higher

1.3 Terminology

The terms and concepts below are important for frequency inverters and are used frequently in this guide.

Direction of rotation of electric motors

The direction (or sense) of rotation of electric motors is defined looking at the end of the motor shaft. If the motor has two shaft ends the direction is defined looking at the main drive shaft end, which is defined as the shaft end away from the end where the cooling fan or the brake are installed.

The direction of rotation is described as:

- **Clockwise / Forward**

or

- **Counterclockwise / Reverse**

PU

The standard operation panel (FR-DU08/FR-DU08-01) and the optional external parameter unit (FR-PU07) are briefly referred to as "PU" ("**P**arameter **U**nit").

PU operation mode

In PU ("**P**arameter **U**nit") operation mode the inverter can be controlled with the standard parameter unit or an optional external parameter unit (The PU indicator LED lights up when the inverter is in PU operation mode.

Model designation

The following common designations are used for the different types of inverter models:

FR-A8□0: Standard model
FR-A8□2: Separated converter type (must be operated with a separate converter unit)
FR-A8□6: IP55 compatible model

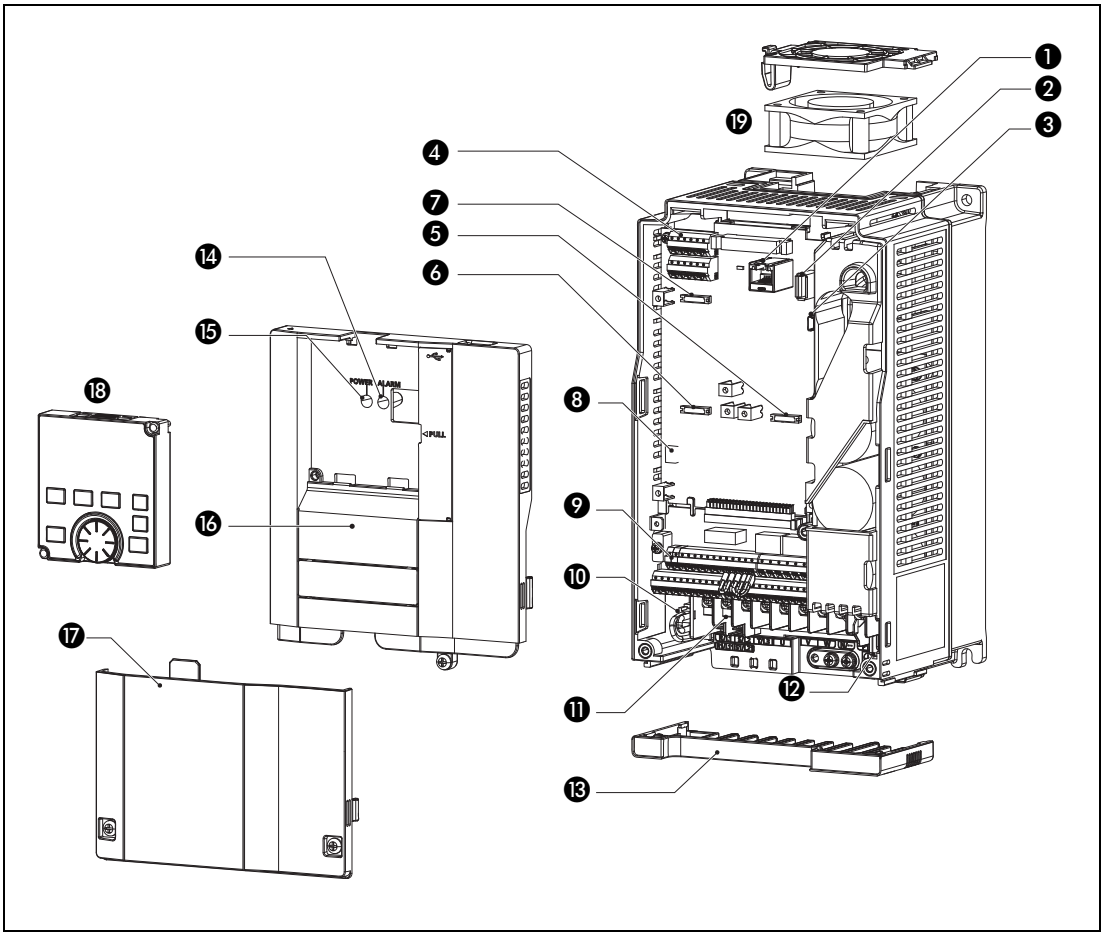
1.4 Related manuals

For further details concerning the products introduced in this guide refer to the following related manuals, which you can find in the download section of https://eu3a.mitsubishielectric.com:

FR-A800 Installation Guideline
FR-A800 Instruction Manual
FR-A802 (Separated Converter Type) Instruction Manual (Hardware)
FR-CC2 (Converter unit) Instruction Manual
FR-A806 (IP55/UL Type12 specification) Instruction Manual (Hardware)
FR Configurator2 Instruction Manual
FR-A800 PLC function programming manual
FR-A800 Safety stop function instruction manual (Document. no. BCN-A23228-001)

2 Introduction to the inverters

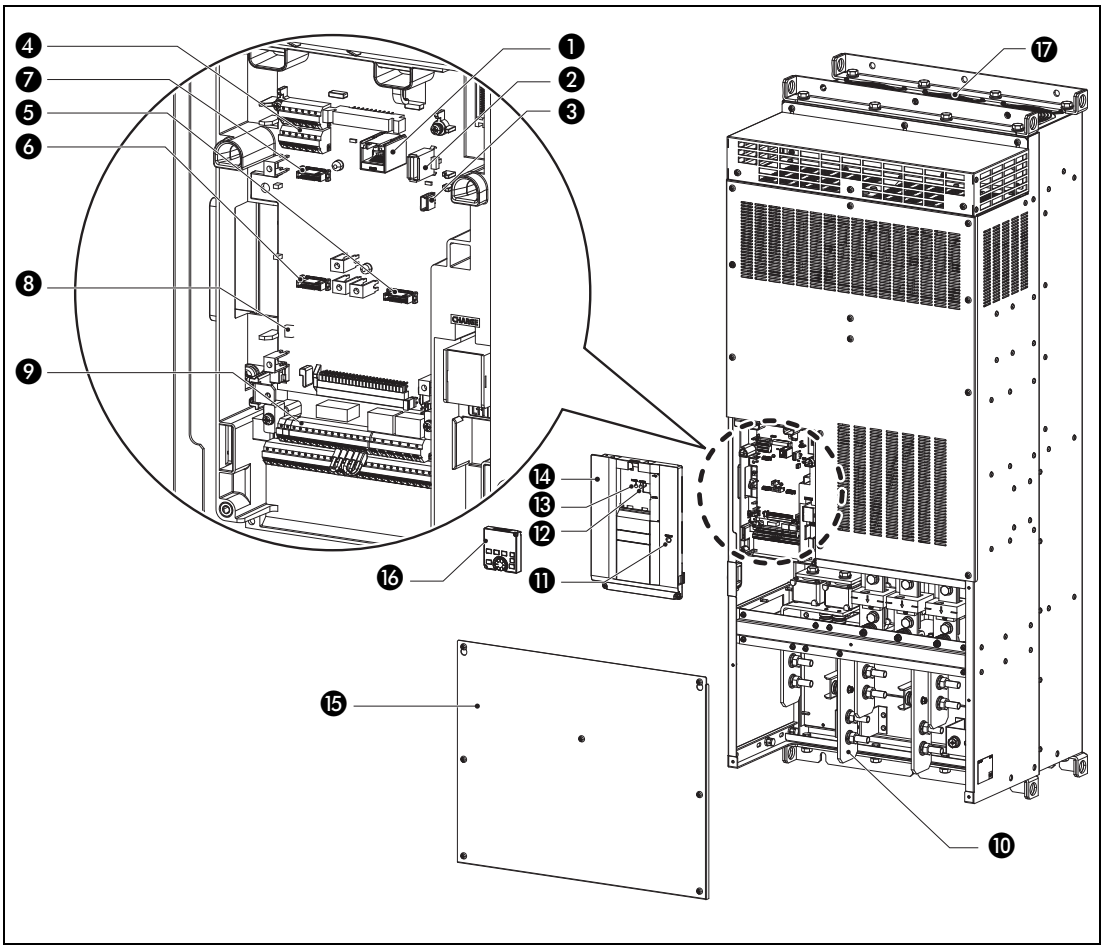
2.1 FR-A820/A840



Symbol	Name
❶	PU connector
❷	USB A connector
❸	USB mini B connector
❹	RS-485 terminals
❺	Plug-in option connector 1
❻	Plug-in option connector 2
❼	Plug-in option connector 3
❽	Voltage/current input switch
❾	Control circuit terminal block
❿	EMC filter ON/OFF connector

Symbol	Name
⓫	Main circuit terminal block
⓬	CHARGE lamp
⓭	Combed shaped wiring cover
⓮	ALARM lamp
⓯	POWER lamp
⓰	Front cover
⓱	Terminal block cover
⓲	Parameter unit (FR-DU08)
⓳	Cooling fan

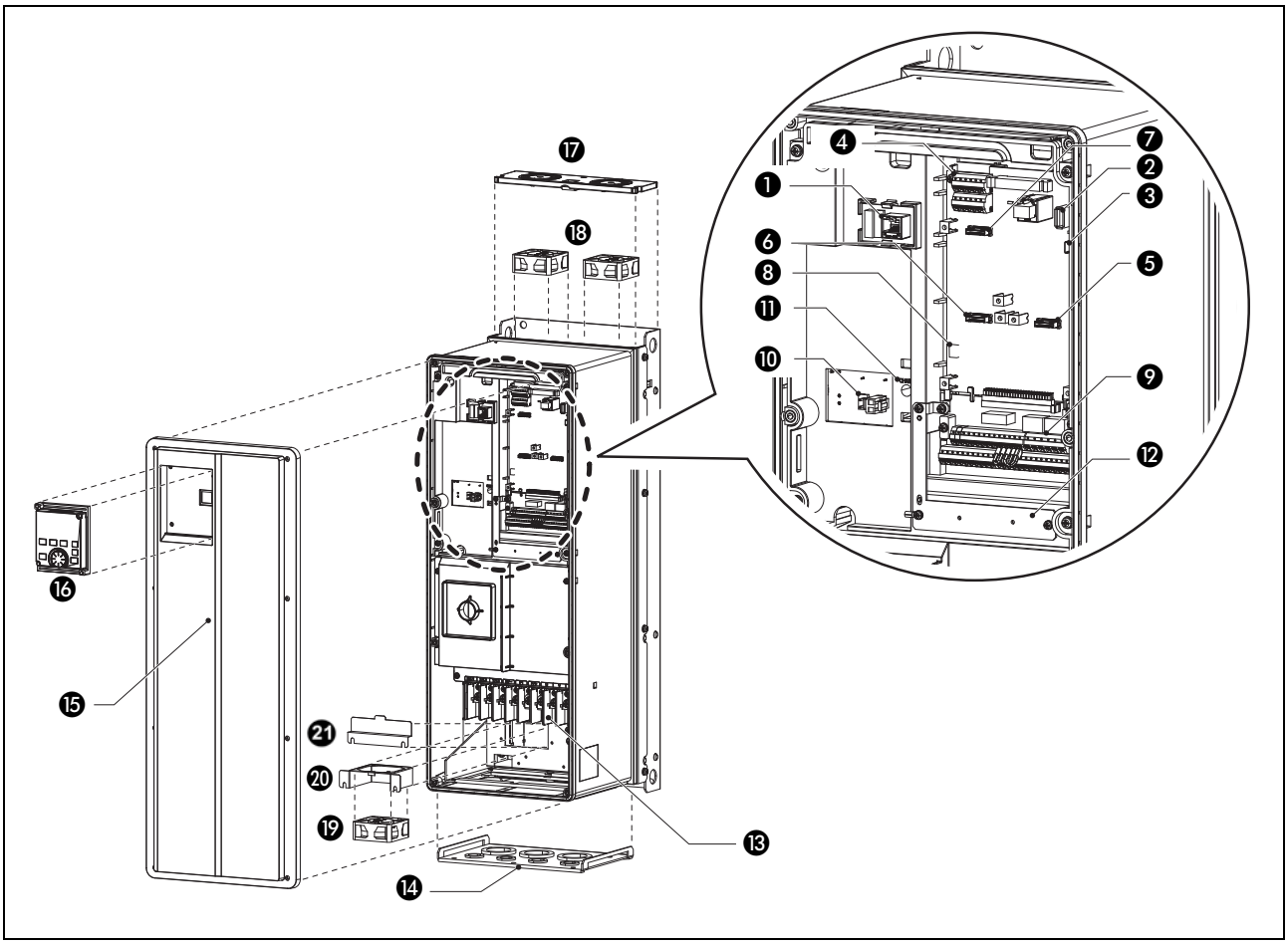
2.2 FR-A842



Symbol	Name
❶	PU connector
❷	USB A connector
❸	USB mini B connector
❹	RS-485 terminals
❺	Plug-in option connector 1
❻	Plug-in option connector 2
❼	Plug-in option connector 3
❽	Voltage/current input switch
❾	Control circuit terminal block

Symbol	Name
⓾	Main circuit terminal block
⓫	CHARGE lamp
⓬	ALARM lamp
⓭	POWER lamp
⓮	Front cover
⓯	Terminal block cover
⓰	Parameter unit (FR-DU08)
⓱	Cooling fan

2.3 FR-A846



Symbol	Name
❶	PU connector
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❻	Plug-in option connector 2
❼	Plug-in option connector 3
❽	Voltage/current input switch
❾	Control circuit terminal block
❿	EMC filter ON/OFF connector
⓫	CHARGE lamp

Symbol	Name
⓬	Metal fitting for earthing
⓭	Main circuit terminal block
⓮	Wiring cover
⓯	Front cover
⓰	Parameter unit (FR-DU08)
⓱	Fan cover
⓲	Cooling fan
⓳	Internal fan
⓴	Bracket
㉑	Protective cover

2.4 Removal and reinstallation of the front cover

Before connecting the inverter you must remove the front cover so that you can access the terminal blocks. The different series have different cover types and the procedure for removing and reinstalling the cover varies. However, the safety warnings below must always be observed for all inverter models.

WARNING:

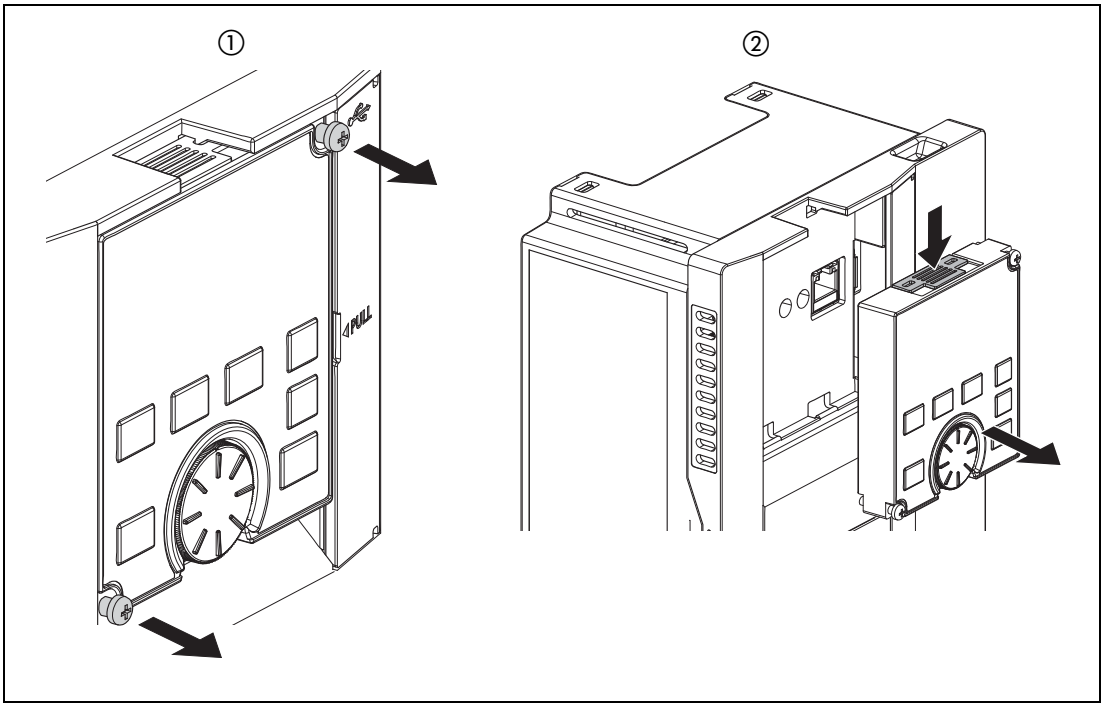
- ***Always SWITCH OFF the mains power supply before removing the front cover or performing any work on the inverter.***
- ***After switching off the power WAIT AT LEAST 10 MINUTES before removing the front cover to allow the charge in the inverter's power capacitors to fall to a safe level and check for residual voltage between terminal P/+ and N/- with a meter etc., to avoid a hazard of electrical shock.***

2.4.1 FR-A800 series inverters

Removal and reinstallation of the parameter unit (FR-A820/A840/A842 models)

① Loosen the two screws on the parameter unit. (These screws cannot be removed.)

② Press the upper edge of the parameter unit while pulling out the parameter unit.



To reinstall the parameter unit, align its connector on the back with the PU connector of the inverter, and insert the parameter unit. After confirming that the parameter unit is fit securely, tighten the screws. (Tightening torque: 0.40 to 0.45 Nm)

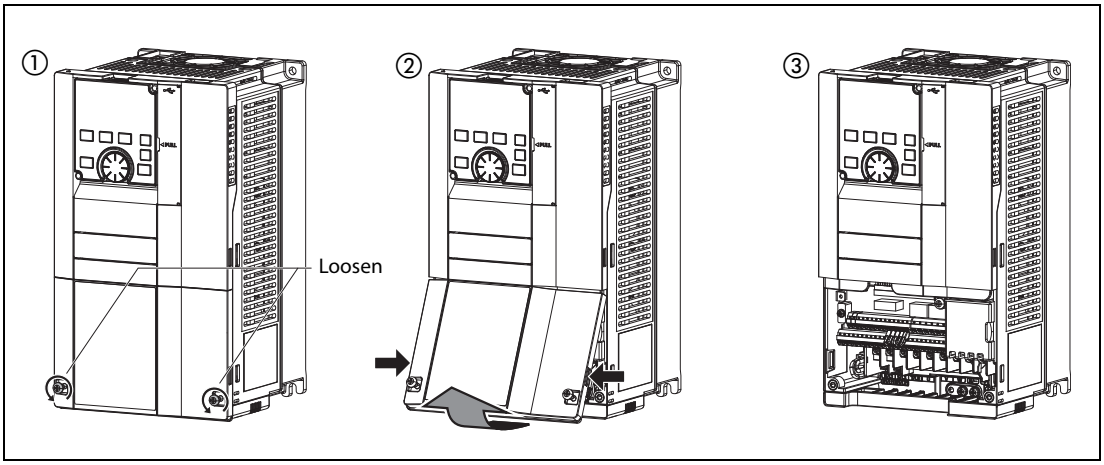
Removal and reinstallation (FR-A820-01540(30K) or lower, FR-A840-00770(30K) or lower)

- **Removal of the terminal block cover**

① Loosen the screws on the terminal block cover. (These screws cannot be removed.)

② Holding the areas around the installation hooks on the sides of the terminal block cover, pull out the terminal block cover using its upper side as a support.

③ With the terminal block cover removed, wiring of the main circuit terminals and control circuit terminals can be performed.

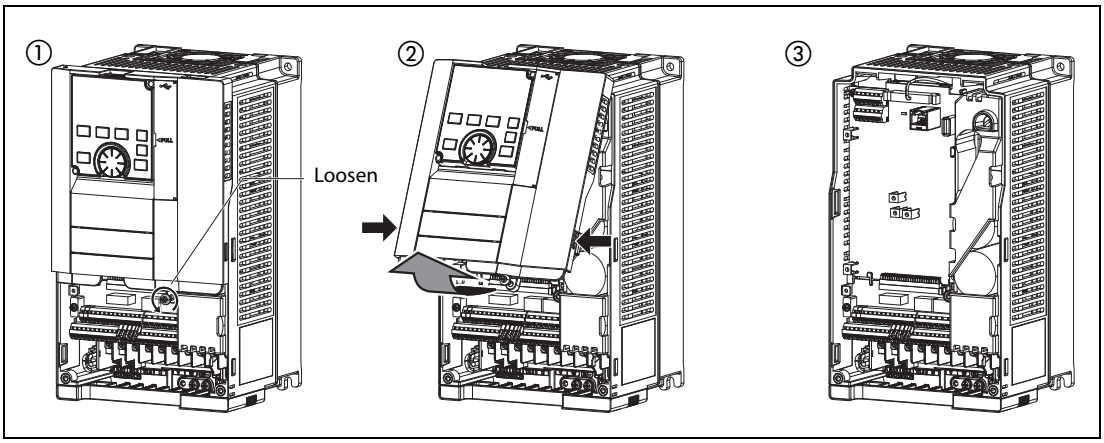


- **Removal of the front cover**

① With the terminal block cover removed, loosen the mounting screw(s) on the front cover.(The screw(s) cannot be removed.) (The number of the mounting screws differs by the capacity.)

② Holding the areas around the installation hooks on the sides of the front cover, pull out the cover using its upper side as a support.

③ With the front cover removed, wiring of the RS-485 terminals and installation of the plug-in option can be performed.



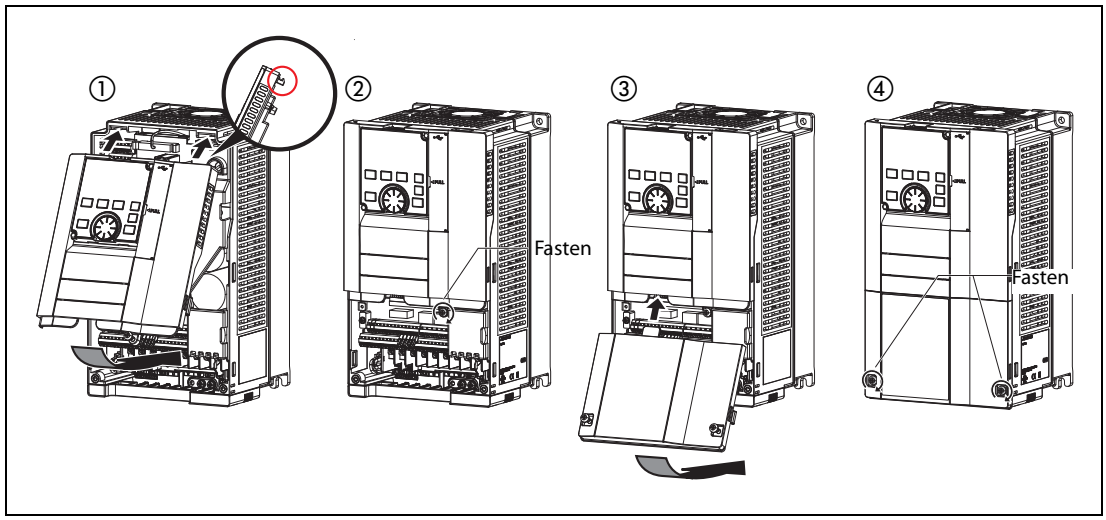
● **Reinstallation of the front cover and the terminal block cover**

① Insert the upper hooks of the front cover into the sockets of the inverter.
Securely install the front cover to the inverter by fixing the hooks on the sides of the cover into place.

② Tighten the mounting screw(s) at the lower part of the front cover.
(FR-A820-00340(5.5K) to FR-A820-01540(30K) and FR-A840-00170(5.5K) to FR-A840-00770(30K) have two mounting screws.)

③ Install the terminal block cover by inserting the upper hook into the socket of the front cover.

④ Tighten the mounting screws at the lower part of the terminal block cover.



NOTE

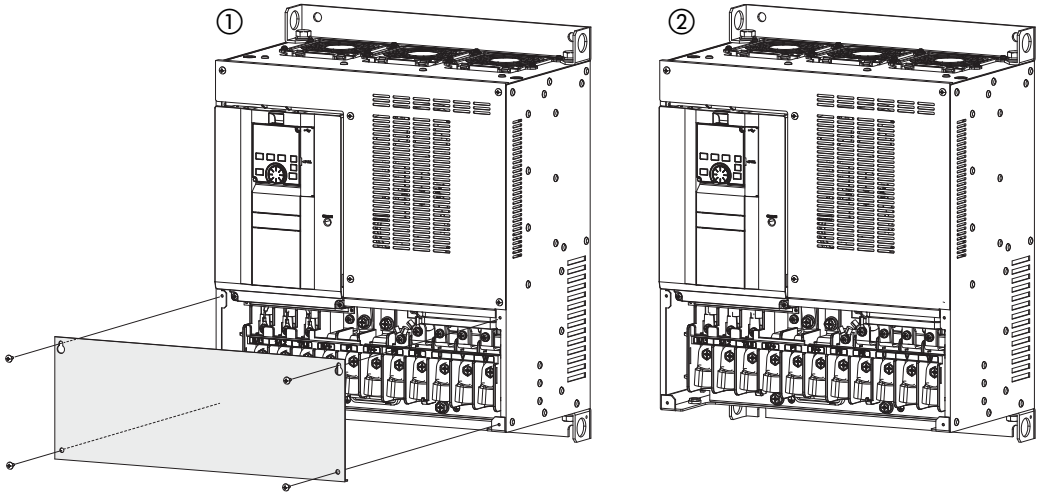
When installing the front cover, fit the connector of the parameter unit securely along the guides of the PU connector.

Removal and reinstallation
(FR-A820-01870(37K) or higher, FR-A840-00930(37K) or higher, FR-A842 models)

- **Removal of the terminal block cover**

① Remove the mounting screws to remove the terminal block cover. (The number of the mounting screws differs by the capacity.)

② With the terminal block cover removed, wiring of the main circuit terminals can be performed.



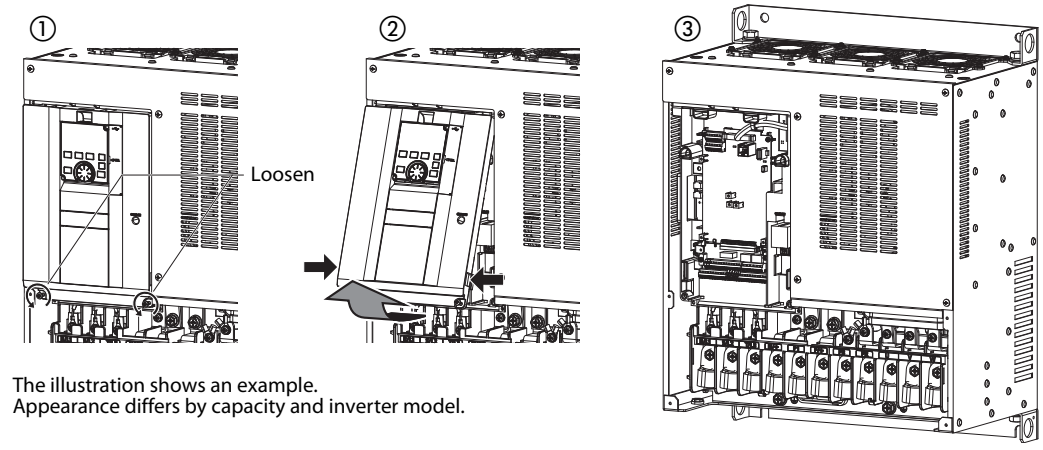
The illustration shows an example. Appearance differs by capacity and inverter model.

- **Removal of the front cover**

① With the terminal block cover removed, loosen the mounting screws on the front cover. (These screws cannot be removed.)

② Holding the areas around the installation hooks on the sides of the front cover, pull out the cover using its upper side as a support.

③ With the front cover removed, wiring of the control circuit and the RS-485 terminals, and installation of the plug-in option can be performed.



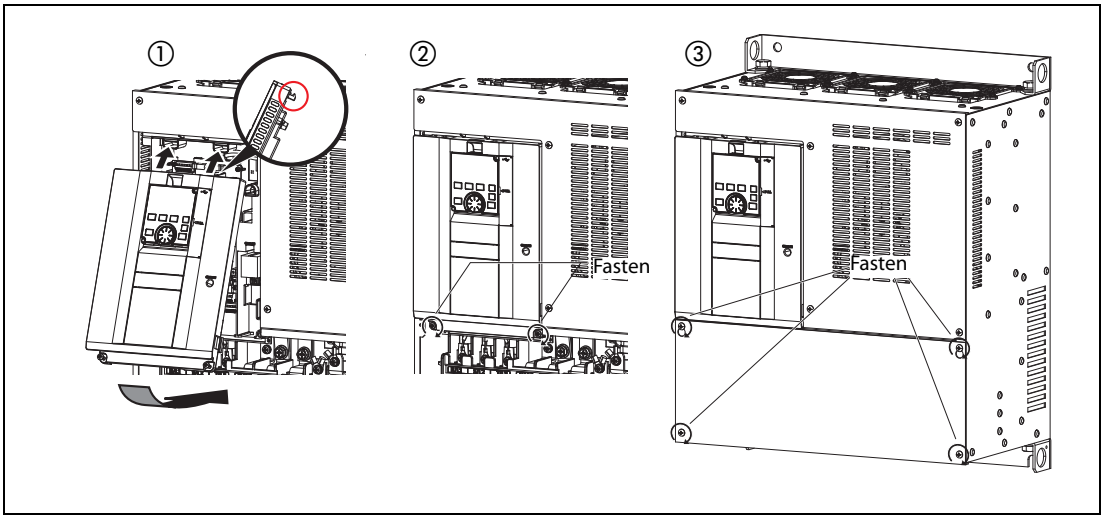
The illustration shows an example.
Appearance differs by capacity and inverter model.

● **Reinstallation of the front cover and the terminal block cover**

① Insert the upper hooks of the front cover into the sockets of the inverter.
Securely install the front cover to the inverter by fixing the hooks on the sides of the cover into place.

② Tighten the mounting screw(s) at the lower part of the front cover.

③ Fasten the terminal block cover with the mounting screws (The number of the mounting screws differs by the capacity.).



NOTES

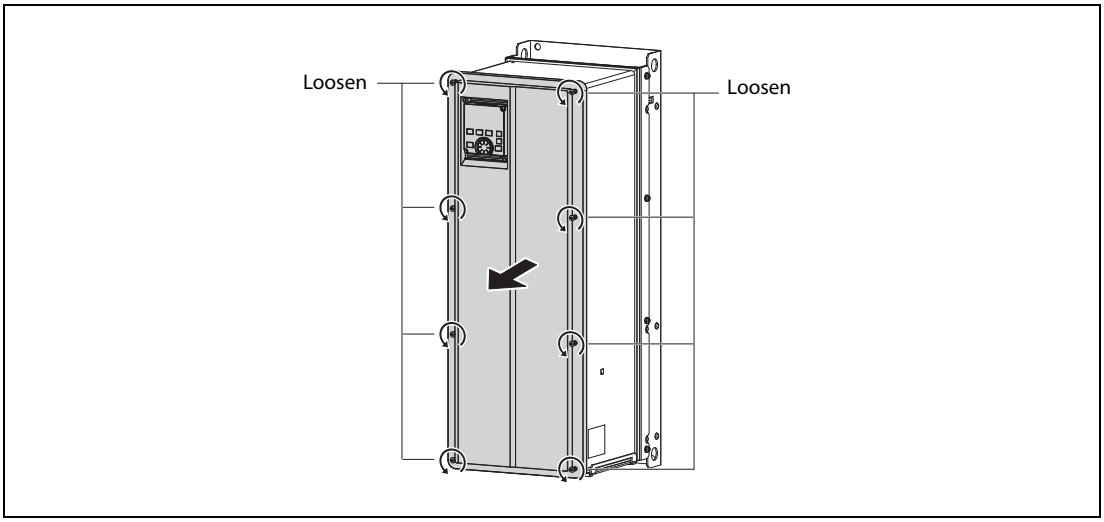
Fully make sure that the front cover, and the terminal block cover are installed securely. Always tighten the mounting screws of the front cover, and the terminal block cover.

The same serial number is printed on the capacity plate of the front cover and the rating plate of the inverter. Before reinstalling each cover, check the serial numbers to ensure that the cover removed is reinstalled to the inverter from where it was removed.

Removal and reinstallation (FR-A846 models)

● **Removal of the front cover**

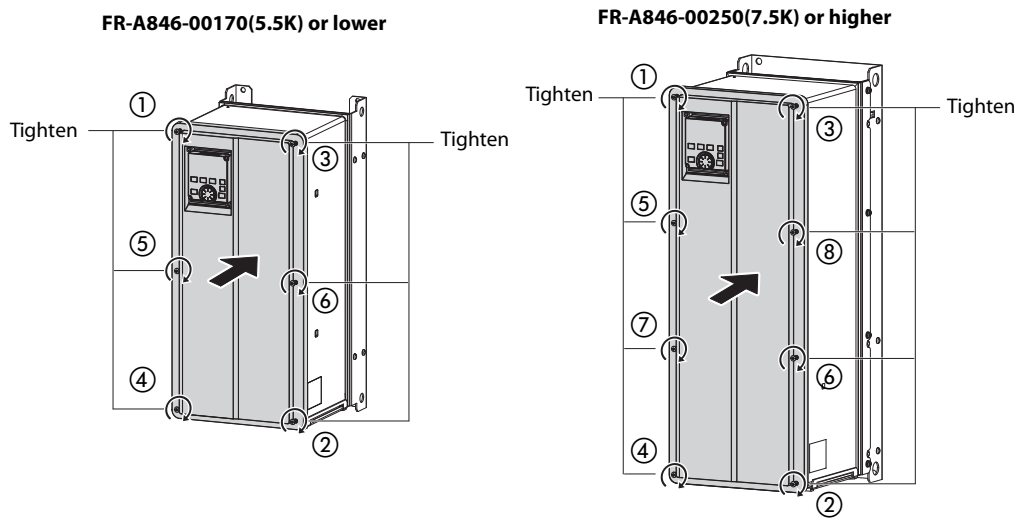
Remove the front cover installation screws (hexalobular screws, screw size: M4, screwdriver size: T20) to remove the front cover.



● **Reinstallation of the front cover**

Fix the front cover with the front cover installation screws. (Tightening torque: 1.4 to 1.9 Nm).

Tighten the front cover installation screws in the numerical order in the figure shown below.



NOTES

When installing the front cover, fit the connector of the parameter unit securely along the guides of the PU connector.

Before installing the front cover, check the waterproof gasket to make sure that it is not damaged. If it is damaged, contact the nearest Mitsubishi FA center.

Securely install the front cover to fit the waterproof gasket closely. Do not let the waterproof gasket get stuck between the front cover edge and the inverter. Otherwise, water may get into the inverter. Also, do not let any foreign matter get stuck between the waterproof gasket and the front cover.

Keep the waterproof gasket of the inverter clean. Otherwise, water may get into the inverter. If there is any dirt on the gasket, make sure to remove it.

Fully make sure that the front cover is installed securely. Always tighten the mounting screws of the front cover.

3 Connections

WARNING:

- ***Always disconnect the power before performing any wiring work on frequency inverters. Frequency inverters contain high voltages that are potentially lethal.***
- ***After switching off the power supply always wait for at least 10 minutes before proceeding to allow the charge in the inverter's capacitors to drop to safe levels and check for residual voltage between terminal P/+ and N/- with a meter etc., to avoid a hazard of electrical shock.***

3.1 Power supply, motor and earth connections

The models of the FR-A820/A840/A846 series must be connected directly to a 3-phase AC power supply. The FR-A842 models must be operated with a converter unit (FR-CC2), which has to be operated separately. For more details about the installation of the converter unit please refer to the corresponding FR-CC2 Instruction Manual.

FR-A800 mains power supply specifications

Power supply	FR-A800			
	FR-A820	FR-A840/A846	FR-A842	
			DC power supply	Auxiliary control power supply
Voltage	3-phase, 200–240 V AC, −15 % / +10 %	3-phase, 380–500 V AC, −15 % / +10 %	430–780 V DC	1-phase, 380–500 V AC, ± 10 %
Permissible input voltage range	170–264 V AC	323–550 V AC	—	342–550 V AC
Frequency	50 / 60 Hz ± 5 %		—	50 / 60 Hz ± 5 %

The three-phase AC mains power supply is connected to terminals R/L1, S/L2 and T/L3 of the inverter (resp. the converter unit for FR-A842 inverters).

The motor is connected to terminals U, V and W.

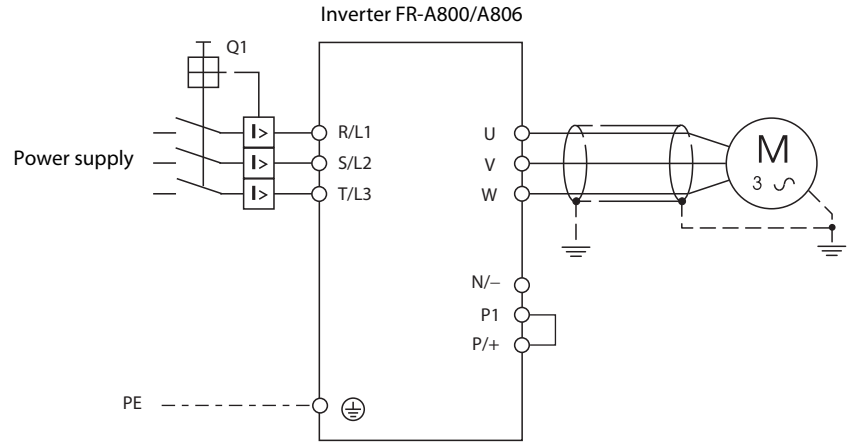
The inverter must also be grounded with a cable connected to the protective earth terminal.

WARNING:

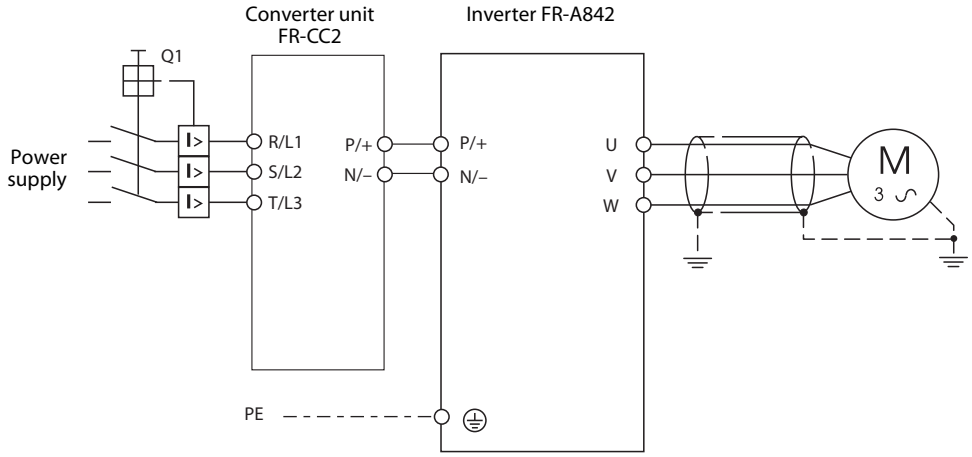
Never connect mains power to the output terminals U, V or W! This would cause permanent damage to the inverter and would also create a serious shock hazard for the operator!

The schematic illustration below shows the basic input and output connections of a frequency inverter.

3-phase connection



3-phase connection of converter unit (FR-CC2) with inverter (FR-A842)



The following table lists the power connection terminals found on the various inverter models.

Terminals	Function	Description
R/L1, S/L2, T/L3	Mains power supply (3-phase)	Mains power supply input for the frequency inverter
U, V, W	Inverter output	This is the inverter's power output Connect these terminals to a three-phase squirrel cage motor or a PM motor.
R1/L11, S1/L21	Control circuit power	FR-A820/A840: Connected to AC power supply terminals R/L1 and S/L2 FR-A842: Connected to terminals P/+, N/– FR-A846: Not applicable
P/+, PR P3, PR	Brake resistor connection	Standard models only Connecting a brake resistor increases the regenerative braking capability.Terminals depending on inverter capacities.
P/+, N/– P3, N/–	External brake unit/	An optional external brake unit can be connected to these terminals. Terminals depending on inverter capacities.
P/+, N/–	Converter unit connection.	For separated converter type (FR-A842)
P/+, P1	DC reactor	A DC reactor can be connected to these terminals (standard models only). You must remove the jumper before connecting the reactor. Depending on inverter and motor capacities, a DC reactor has to be connected (available as an option) FR-A842: Not applicable FR-A846: Jumper should not be removed.
PR, PX	Built-in brake circuit connection	Standard models only. When the jumper is connected across terminals PX and PR (initial status), the built-in brake circuit is valid (depending on inverter capacity).
⏚	PE	Earth (ground) connection

3.2 Control terminals

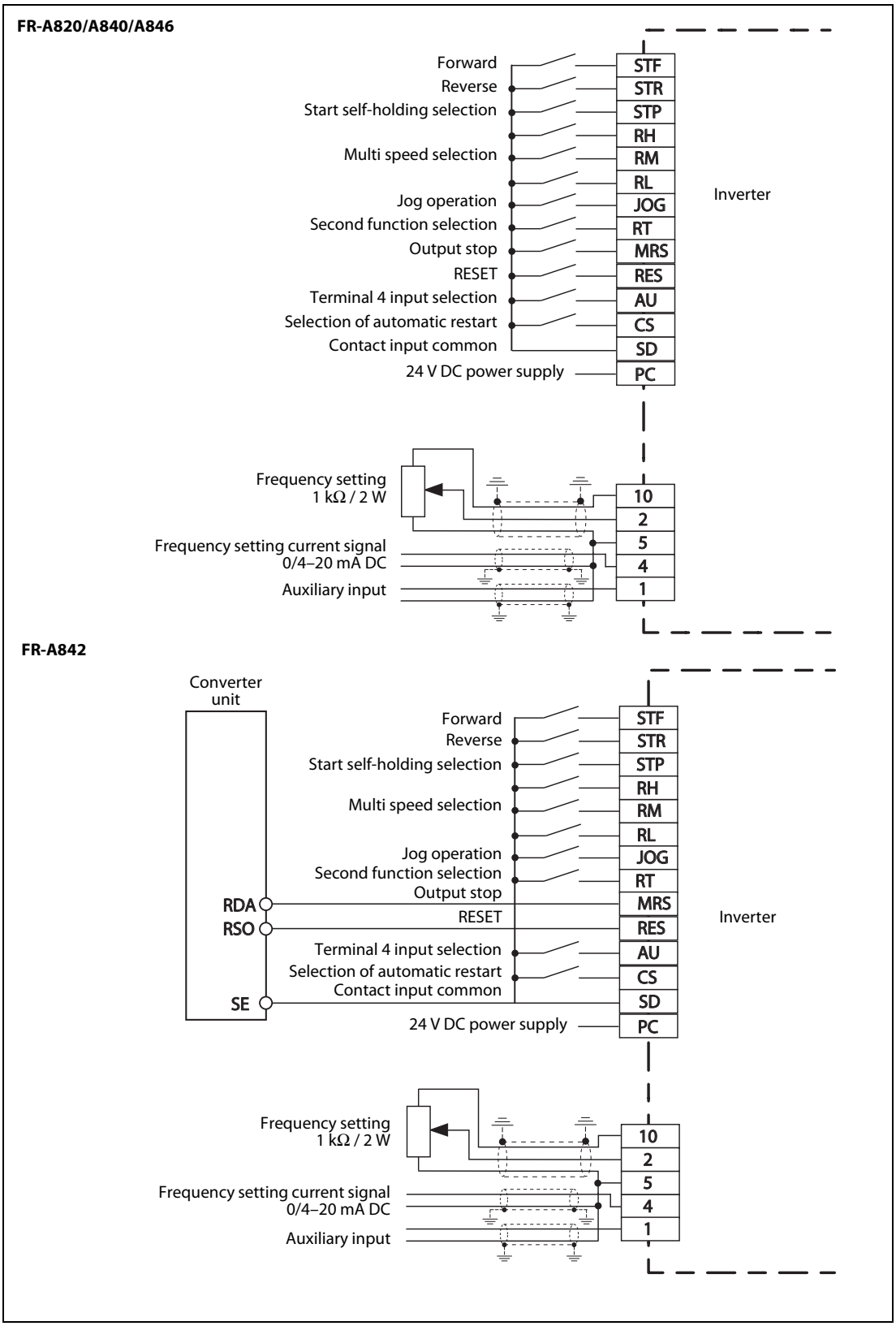
In addition to the power terminals for the mains power supply and the motor there are also a large number of additional terminals that are used for controlling the frequency inverter. The table below only lists the most important control terminals – for complete details refer to the Instruction Manual of your inverter.

Type		Terminal	Function	Description	
Contact inputs	Control terminals	STF	Start forward	Applying a signal to terminal STF starts the motor with forward rotation (clockwise).	Applying signals to STF and STR simultaneously stops the motor.
		STR	Start reverse	Applying a signal to terminal STR starts the motor with reverse rotation (counterclockwise).	
		STP (STOP)	Start self-holding selection	Turn ON the STOP signal to self-hold the start signal.	
		RH, RM, RL	Speed selection	Up to 15 different speeds (output frequencies) can be selected by combining these signals (see also section 6.2.4)	
		JOG	Jog mode selection / Pulse train input	Turn ON the JOG signal to enable JOG operation (initial setting) and turn ON the start signal (STF or STR) to start JOG operation. Terminal JOG is also used as a pulse train input terminal.	
		RT	Second function selection	Turn ON the RT signal to enable the second function.	
		MRS	Output stop	Applying a signal to this input for more than 20 ms switches off the inverter output without delay. For separated converter types connect this terminal to terminal RDA of the converter unit FR-CC2. When RDA signal turns off, inverter output shuts off.	
		RES	RESET input	Used to reset the inverter and clear the alarm state after a protective function has been triggered (see section 7.3). A signal must be applied to RES for at least 0.1 s to execute a reset.	
		AU	Terminal 4 input selection	The terminal 4 function is available only when the AU signal is turned ON. Turning the AU signal ON makes terminal 2 invalid.	
		CS	Automatic restart after instantaneous power failure	When the CS signal is left ON, the inverter restarts automatically at power restoration. Note that restart setting is necessary for this operation. In the initial setting, a restart is disabled.	
	Reference points	SD ①	Common terminal for control inputs using sink logic		
		PC ①	24V DC output and common terminal for control inputs using source logic		
Analog	Frequency setting signals	10	Power supply for frequency setting potentiometer	Output 5V DC, max current 10 mA. Recommended potentiometer: 1 kΩ, 2 W linear, (multi-potentiometer)	
		2	Input for frequency setting voltage signal (0 to 5 V or 0 to 10 V DC)	A setpoint signal of 0–5 V or 0–10 V is applied to this terminal. The range is preset to 0–5 V. The input resistance is 10 kΩ; the maximum permissible voltage is 20 V.	
		5	Common terminal for frequency setting signal	Terminal 5 is the common terminal for the analog setting signals connected to terminals 2, 1 and 4. Terminal 5 is isolated and to prevent interference it should not be earthed.	
		4	Input for frequency setting current signal (4 to 20 mA DC)	Input for frequency setting current signal (4 to 20 mA DC). If a current signal (0 to 20 mA or 4 to 20 mA DC) is used as the frequency setting signal it is connected to this terminal. The input resistance is 245 Ω, the maximum permissible current is 30mA. The factory default setting is 0 Hz at 4 mA and 50 Hz at 20 mA. Note that a signal must be applied to control input AU at the same time to activate this terminal.	
		1	Frequency setting auxiliary	Inputting 0 to ±5 V DC or 0 to ±10 V DC adds this signal to terminal 2 or 4 frequency setting signal. Use Pr. 73 to switch between input 0 to ±5 V DC and 0 to ±10 V DC (initial setting). The input resistance is 10 kΩ, the maximum permissible voltage is 20 V DC.	

Type		Terminal	Function	Description
Safety stop function (FR-A800/A806 only)	Safety stop signal	S1	Safety stop input (Channel 1)	Used for the safety stop input signal for the safety relay module. Input resistance 4.7 kΩ Input current 4–6 mA DC
		S2	Safety stop input (Channel 2)	
		SIC	Safety stop input terminal common	Common terminal for terminals S1 and S2.
		SO	Safety monitor output (open collector output)	Indicates the safety stop input signal status.
		SOC	Safety monitor output terminal common	Common terminal for terminal SO.

① Never connect terminals PC and SD to one another! These terminals are the common terminals for the control inputs when you use source logic (PC, factory default for CA types) or sink logic (SD, factory default for FM types).

The following illustration shows the connection of the control terminals when sink logic (factory default for FM types) is used. The inputs are connected to 24 V DC.



The manuals of the individual frequency inverters also include diagrams showing the connections for controlling the inverter inputs with PLC outputs and with source logic.

3.3 EM-compatible installation

Fast switching of electrical currents and voltages, which naturally also occurs when frequency inverters are used, generates radio frequency interference (RF noise) that can be propagated both along cables and through the air. The power and signal cables of the inverter can act as noise transmission antennas. Because of this the cabling work needs to be performed with the utmost care. The cables connecting the inverter and the motor are a particularly powerful source of potential interference.

In the European Union several EMC (electromagnetic compatibility) directives have been passed with regulations for the limitation of interference generated by variable-speed drive systems. To conform to these regulations you must observe some basic guidelines when you are planning, installing and wiring your systems:

- To reduce noise radiation install the equipment in a closed and properly earthed enclosure made of metal.
- The inverter is equipped with a built-in EMC filter. Set the EMC filter valid. (For details, refer to the Instruction Manual of your inverter).
- Ensure that everything is properly earthed.
- Install a motor and a control cable according to the EMC Installation Guidelines (BCN-A21041-204).
- Install sensitive equipment as far away as possible from interference sources or install the interference sources in a separate enclosure.
- Keep signal and power cables separate. Avoid routing interference-suppressed cables (e.g. power supply cables) and interference-prone cables (e.g. shielded motor cables) together for more than short distances.

3.3.1 EM-compatible enclosure installation

The design of the enclosure is critical for compliance with the EMC directives. Please follow the following guidelines:

- Use an earthed enclosure made of metal.
- Use conductive seals between the cabinet door and chassis and connect the door and the chassis with a thick, braided earth cable.
- If an EMC filter is installed make sure that it has a good electrically conductive connection to the installation panel (remove paint etc). Ensure that the base on which the equipment is installed is also properly connected to the switchgear cabinet earth.
- All cabinet plates should be welded or screwed together not more than 10cm apart to limit transparency to RF noise. The diameters of any openings and cable glands in the cabinet should not exceed 10cm and there should not be any unearthed components anywhere in the cabinet. If larger openings are required they must be covered with wire mesh. Always remove paint etc. between all metal-on-metal contacts to ensure good conductivity – for example between the wire mesh covers and the cabinet.
- If inverters and controllers must be installed in the same cabinet they should be kept as far away from one another as possible. It is better to use separate cabinets if possible. If you must install everything in a single cabinet you can separate the inverters and controllers with a metal panel.
- Earth the installed equipment with short, thick earth conductors or suitable earthing strips. Earthing strips with a large surface area are better for earthing RFI signals than equipotential bonding conductors with large cross-sections.

FR-A846 inverters (IP55 compatible model)

These types of inverter have been approved as products for a UL type12 enclosure that is suitable for Installation in a Compartment Handling Conditioned Air (Plenum).

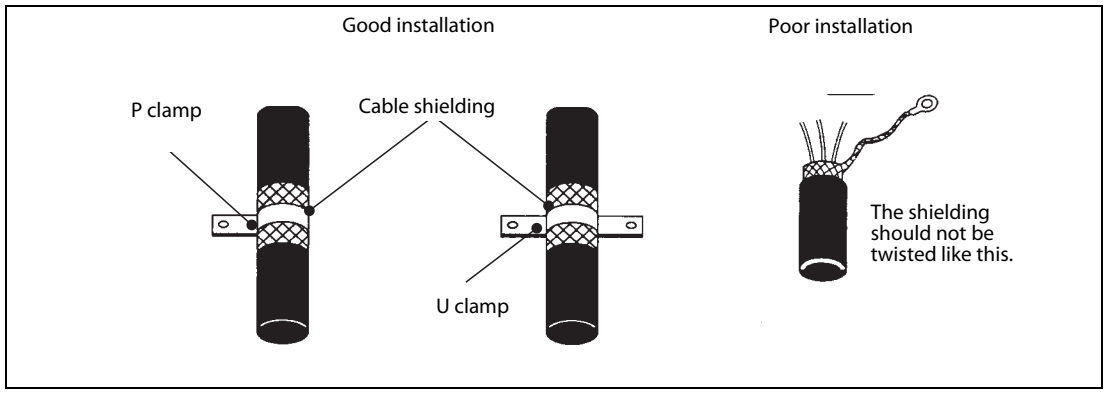
- Install the inverter so that the inverter surrounding air temperature, humidity and atmosphere satisfy the specifications (refer to section 1.2).
- The drive must be installed in clean air according to enclosure classification.
- Cooling air must be clean, free from corrosive materials and electrically conductive dust regarding the UL Type 12 enclosure.
- This enclosure provides protection from airborne dust and light sprays or splashing water from all directions.

3.3.2 Wiring

All analog and digital signal cables should be shielded or routed in metal cable conduits.

At the entrance point to the chassis run the cable through a metal cable gland or fasten it with a P or U type cable clamp, connecting the shielding to the earth either with the gland or the clamp (see illustration below). If you use a cable clamp install it as near as possible to the cable entry point to keep the distance to the earthing point as short as possible. To keep the unshielded portion of the cable (RFI transmission antenna!) as short as possible ensure that the end of the motor cable shielding is as close as possible to the connection terminal without causing a risk of earth faults or short circuits.

When using a P or U clamp make sure that the clamp is installed cleanly and that it does not pinch the cable more than necessary.



Route control signal cables at least 30cm away from all power cables. Do not route the power supply cables or the cables connecting the frequency inverter and the motor in parallel to control signal cables, telephone cables or data cables.

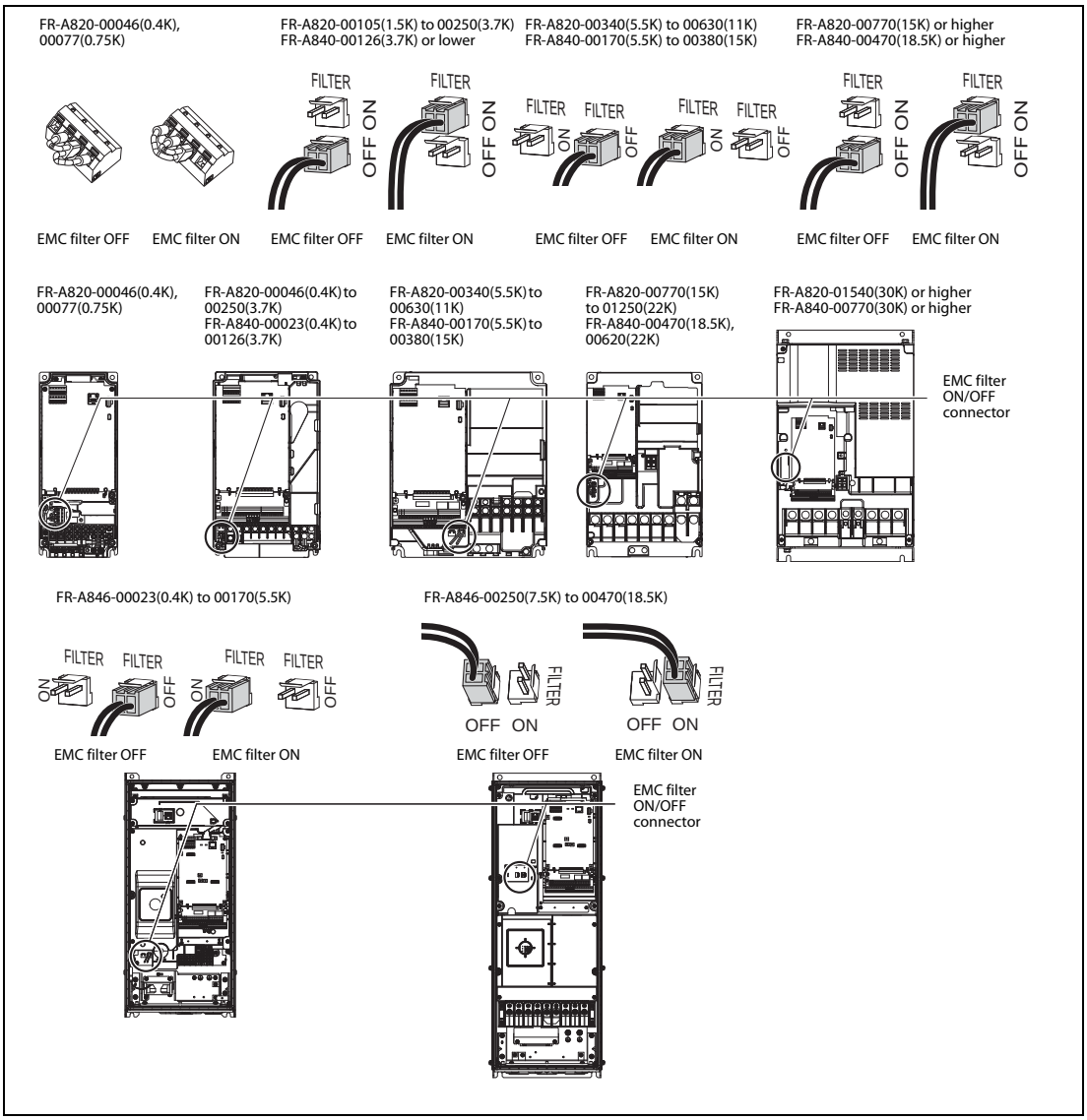
If possible, all control signal cables to and from the inverter should only be routed inside the earthed switchgear cabinet. If routing control signal cables outside the cabinet is not possible always use shielded cables, as signal cables can also function as antennas. The shielding of the cables must always be earthed. To prevent corruption of sensitive analog signals (e.g. the 0-5 V analog frequency setting signal) by currents circulating in the earthing system it may be necessary to earth only one end of the cable shielding. In such cases always earth the shielding at the inverter end of the cable.

Installation of standard ferrite cores on the signal cables can further improve RFI suppression. The cable should be wound around the core several times and the core should be installed as close to the inverter as possible.

Motor connection cables should always be as short as possible. Long cables can sometimes trigger earth fault protection mechanisms. Avoid unnecessarily long cables and always use the shortest possible route for the cables. It should go without saying that the motor itself should also be properly earthed.

3.3.3 EMC filters

EMC filters (mains RFI suppression filters) significantly reduce interference. They are installed between the mains power supply and the frequency inverter.
The standard models and the IP55 compatible models of the FR-A800 inverter series are equipped with a built-in EMC filter. For the FR-A842 types of inverters (separate converter types) the converter unit is equipped with a built-in EMC filter. Those filters are effective in reducing conducted noise on the input side of the inverter. To enable the EMC filter, fit the EMC filter ON/OFF connector to the ON position.



The connector must always be installed, either in the ON position or in the OFF position.

WARNING:

To avoid serious shock hazard always turn off the inverter power supply before removing the front cover to activate or deactivate the EMC filter.

NOTE

Under some conditions, it is necessary, to install an additional AC-reactor or noise filter on the input side of the inverter/converter unit. Please refer to the instruction manual of your inverter.

4 Start-up

4.1 Preparations

4.1.1 Before switching on the inverter for the first time

Check all the following points carefully before switching on a frequency inverter for the first time:

- Has all the wiring been performed correctly? Check the power supply connections particularly carefully: 3-phase to R/ L1, S/L2 and T/L3.
- Double-check for damaged cables and insufficiently insulated terminals to eliminate any possibility of short circuits.
- Is the inverter properly earthed? Double-check for possible earth faults and short circuits in the output circuit.
- Check that all screws, connection terminals and other cable connections are connected correctly and firmly.

4.1.2 Important settings before switching on the motor for the first time

All settings necessary for the operation of the inverter, like acceleration and deceleration times or the trigger threshold for the electronic motor protection relay, are programmed and changed with the parameter unit.

The following settings must be checked before switching on the motor for the first time:

- Maximum output frequency (parameter 1)
- V/f pattern (parameter 3)
- Acceleration and deceleration times (parameters 7 and 8)

See chapter 6 for detailed descriptions of these parameters and what they are for. See section 5.4 for examples of parameter settings.

CAUTION:

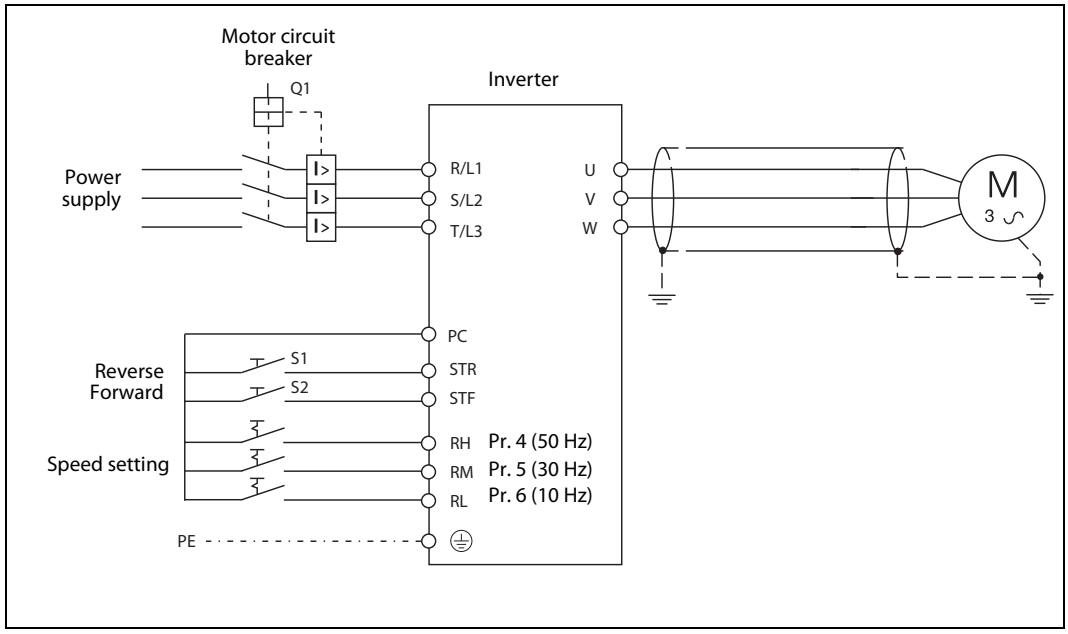
Incorrect parameter settings can damage or (in extreme cases) even destroy the connected motor. Take great care when you are setting the parameters and double-check the electrical and mechanical specifications of the motor, your entire drive system and the connected machine before proceeding.

4.2 Functional test

For a functional test the inverter is operated with minimum external wiring. The motor should be allowed to run free without any connected load. You need to check whether the connected motor runs properly and that you can adjust its speed with the inverter. There are two ways to perform this test:

- Controlling the inverter with external signals

  The commands for starting the motor in forward or reverse mode are activated with external pushbuttons. Motor speed is adjusted with the help of the frequencies stored in parameters 4 through 6 (see section 6.2.4). To do this you can either connect switches to terminals RH, RM and RL of the inverter or connect the appropriate terminals to the PC terminal with a wire jumper.



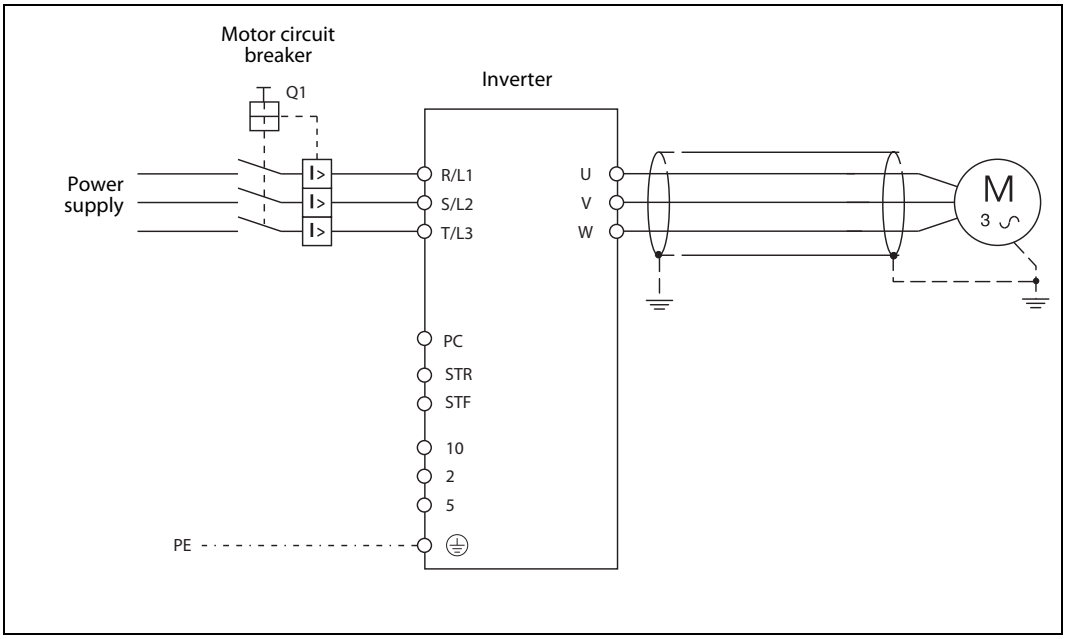
Some external components like pushbuttons and switches are required for this method but it has advantages over performing the test with the parameter unit:

– When the inverter is switched on for the first time control with external signals is activated by default – you don't need the parameter unit to switch to this mode.

– In normal operation inverters are also usually operated via external signals, either by activating stored parameter values or by sending external analog setpoint values to the inverter.For example, start commands can be sent by a PLC or executed manually with switches or pushbuttons.
  Testing the system with external signals enables you to simultaneously test the control inputs for proper functioning.

- Controlling the inverter using the PU

  The inverters of the FR-A800 series can be controlled directly using the standard parameter unit or an optional parameter unit. This makes it possible to perform the functional test without connecting anything to the control inputs.



Please note that when the inverter is switched on for the first time control via external signals is activated by default. Press the PU/EXT key of the parameter unit FR-DU08 (HAND/AUTO key for FR-DU08-01) to select the PU operation mode (see section 5.2).

NOTE

Don't install a permanent jumper between PC and e.g. STF terminal to switch the motor on and off by turning the frequency inverter's power on and off. Because this will reduce inverter life time. Repeated switching of the inverter's mains power supply at short intervals can damage the inrush current limiter. Switch the inverter's power supply on first and then control the motor with the forward/reverse commands via terminals STF and STR or with the PU.

Performing the test

During the test run pay particular attention to the following points:

- The motor should not generate any unusual noises or vibrations.
- Changing the frequency setting value should change the speed of the motor.
- If a protective function triggers during motor acceleration or deceleration check:
  - Motor load
  - Acceleration and deceleration times (you may need to increase these times with parameters 7 and 8)
  - The manual torque boost setting (parameter 0)

These parameters are described in chapter 6.

5 Operation and settings

The frequency inverters of the FR-A800/A802 series are equipped with the parameter unit FR-DU08 as standard. The FR-A846 models are equipped with the IP55 compatible parameter unit FR-DU08-01.

These parameter units allow you to monitor and display status data and alarms and to enter and display the inverter's setting parameters (see chapter 6).

In addition you can also use the parameter unit to operate the inverter and the connected motor. This option is particularly useful for setting up the system, troubleshooting and testing.

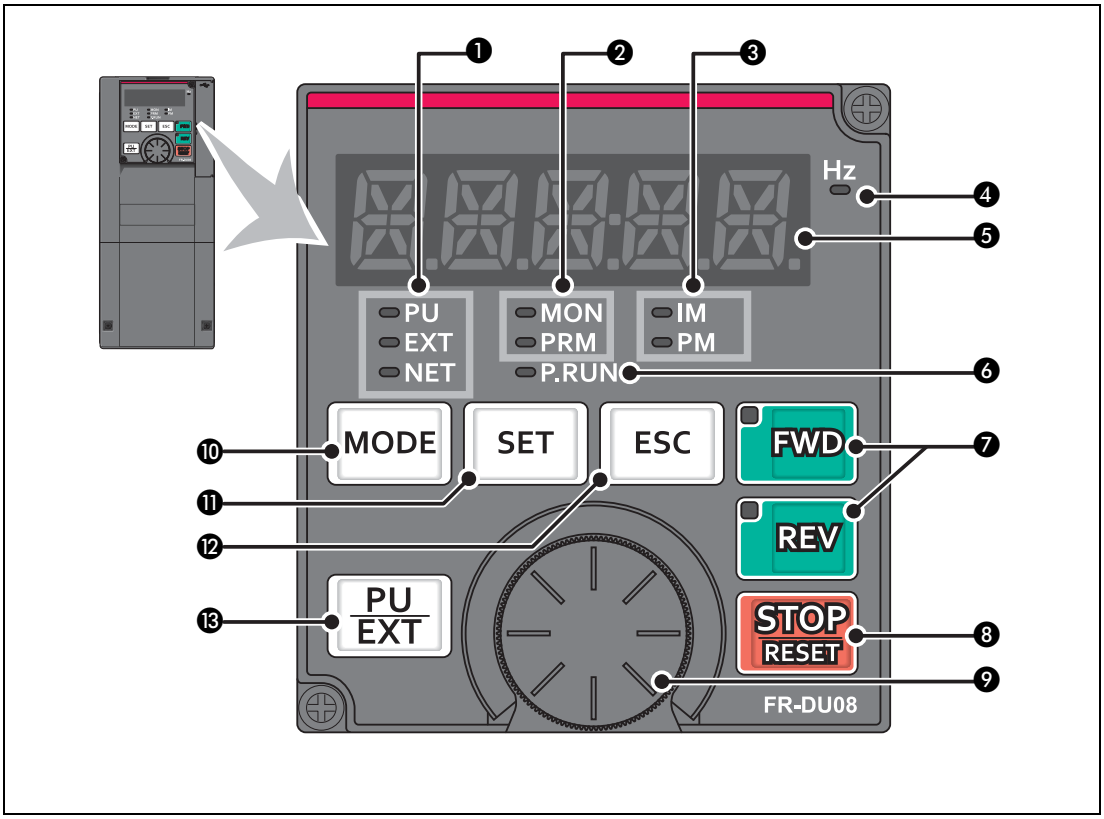
The parameter unit FR-DU08 is removable and can be mounted on the enclosure surface with a connection cable (installation on the enclosure is not possible for the IP55 compatible model FR-DU08-01). This is convenient for remote operation of inverter and motor, for monitoring, setting parameters, troubleshooting and testing.

Parameter units with enhanced display functions are available as an option and can be connected to the PU connector directly or with a connection cable.

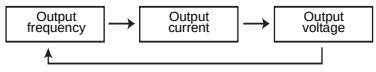
5.1 Operating FR-A800 inverters

5.1.1 Parameter unit FR-DU08 (FR-A800/A802)

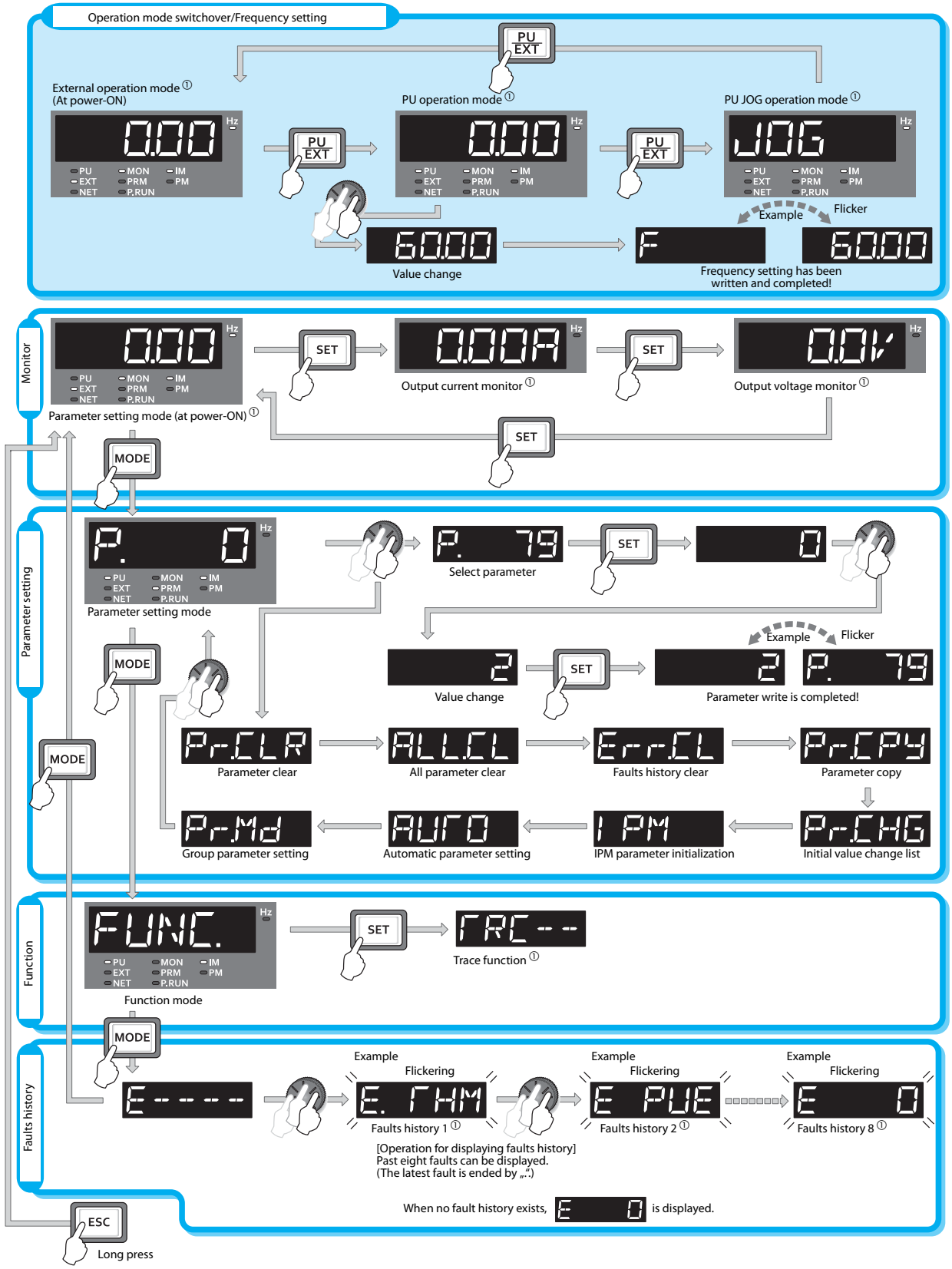
Components of the parameter unit are shown below.



Refer to the next page for a description of the components.

No.	Component	Name	Description
❶		Operation mode indicator	PU : Lit to indicate the PU operation mode. EXT: Lit to indicate the External operation mode. (Lit at power-ON in the initial setting.) NET: Lit to indicate the Network operation mode. PU and EXT: Lit to indicate the External/PU combined operation mode 1 or 2.
❷		Operation panel status indicator	MON: Lit to indicate the monitoring mode. Quickly flickers twice intermittently while the protective function is activated. Slowly flickers in the display-OFF mode. PRM: Lit to indicate the parameter setting mode.
❸		Control motor indicator	IM: Lit to indicate the induction motor control. PM: Lit to indicate the PM sensorless vector control. The indicator flickers when test operation is selected.
❹		Frequency unit indicator	Lit to indicate frequency. (Flickers when the set frequency is displayed in the monitor.)
❺		Monitor (5-digit LED)	Shows the frequency, parameter number, etc. (Using Pr. 52, Pr. 774 to Pr. 776, the monitored item can be changed.)
❻		PLC function indicator	Lit to indicate that the sequence program can be executed.
❼		FWD key, REV key	FWD key: Starts forward rotation. The LED is lit during forward operation. REV key: Starts reverse rotation. The LED is lit during reverse operation. The LED flickers under the following conditions. • When the frequency command is not given even if the forward/reverse command is given. • When the frequency command is the starting frequency or lower. • When the MRS signal is being input.
❽		STOP/RESET key	Stops the operation commands. Resets the inverter when the protection function is activated.
❾		Setting dial	The setting dial of the Mitsubishi inverters. The setting dial is used to change the frequency and parameter settings. Press the setting dial to perform the following operations: • To display a set frequency in the monitoring mode (the setting can be changed using Pr. 992.) • To display the present setting during calibration. • To display a fault history number in the faults history mode
❿		MODE key	Switches to different modes. Pressing the "MODE" and "PU/EXT" keys simultaneously switches to the easy setting mode. Holding this key for 2 seconds locks the operation. The key lock is invalid when Pr. 161 ="0 (initial setting)". (Refer to the FR-A800 Instruction Manual.)
⓫		SET key	Enters each setting. If pressed during operation, the monitored item changes. (Using Pr. 52 and Pr. 774–Pr. 776, the monitored item can be changed.) When the initial setting is set. 
⓬		ESC key	Goes back to the previous display. Holding this key for a longer time changes the mode back to the monitor mode.
⓭		PU/EXT key	Switches between the PU operation mode, the PU JOG operation mode and the External operation mode. Pressing the "MODE" and "PU/EXT" keys simultaneously switches to the easy setting mode. Cancels the PU stop also.

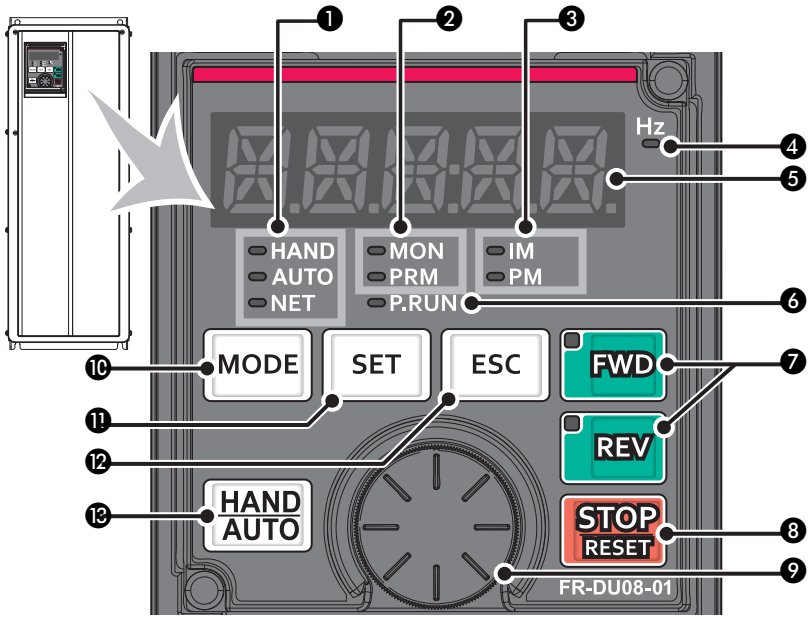
Basic functions (FR-DU08)



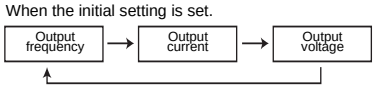
① For details of operation modes, monitored items, trace function and faults history refer to the Instruction Manual of your inverter.

5.1.2 Parameter unit FR-DU08-01 (FR-A806)

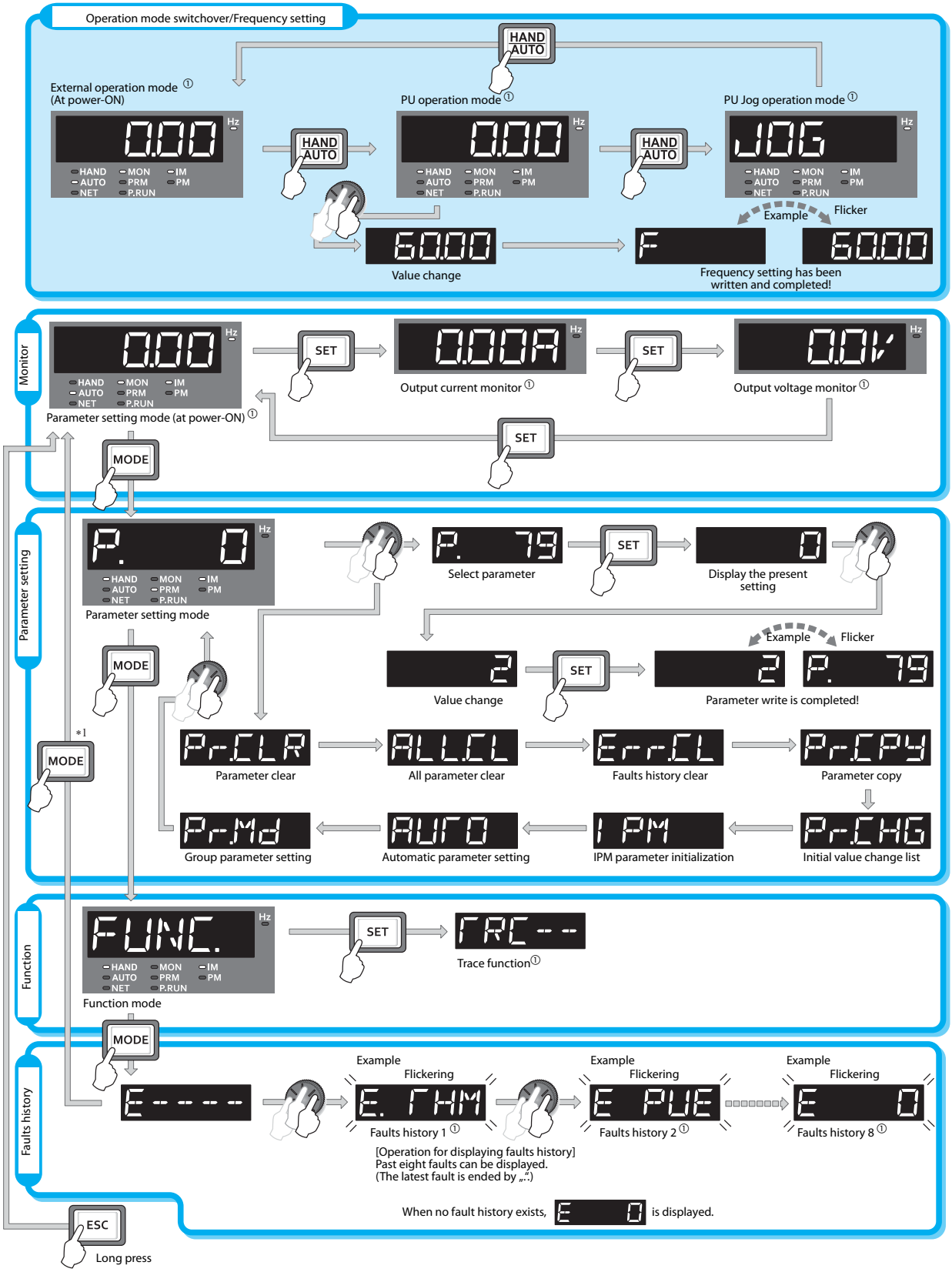
Components of the parameter unit are shown below. Compared with the FR-DU08 two components are different: the operation key (HAND/AUTO) and the operation mode indicator.



Refer to the next page for a description of the components.

No.	Component	Name	Description
❶		Operation mode indicator	HAND : Lit to indicate the PU operation mode. AUTO: Lit to indicate the External operation mode. (Lit at power-ON in the initial setting.) NET: Lit to indicate the Network operation mode. HAND and AUTO: Lit to indicate the External/PU combined operation mode 1 or 2.
❷		Operation panel status indicator	MON: Lit to indicate the monitoring mode. Quickly flickers twice intermittently while the protective function is activated. Slowly flickers in the display-OFF mode. PRM: Lit to indicate the parameter setting mode.
❸		Control motor indicator	IM: Lit to indicate the induction motor control. PM: Lit to indicate the PM sensorless vector control. The indicator flickers when test operation is selected.
❹		Frequency unit indicator	Lit to indicate frequency. (Flickers when the set frequency is displayed in the monitor.)
❺		Monitor (5-digit LED)	Shows the frequency, parameter number, etc. (Using Pr. 52, Pr. 774 to Pr. 776, the monitored item can be changed.)
❻		PLC function indicator	Lit to indicate that the sequence program can be executed.
❼		FWD key, REV key	FWD key: Starts forward rotation. The LED is lit during forward operation. REV key: Starts reverse rotation. The LED is lit during reverse operation. The LED flickers under the following conditions. • When the frequency command is not given even if the forward/reverse command is given. • When the frequency command is the starting frequency or lower. • When the MRS signal is being input.
❽		STOP/RESET key	Stops the operation commands. Resets the inverter when the protection function is activated.
❾		Setting dial	The setting dial of the Mitsubishi inverters. The setting dial is used to change the frequency and parameter settings. Press the setting dial to perform the following operations: • To display a set frequency in the monitoring mode (the setting can be changed using Pr. 992.) • To display the present setting during calibration. • To display a fault history number in the faults history mode
❿		MODE key	Switches to different modes. Pressing the "MODE" and "HAND/AUTO" keys simultaneously switches to the easy setting mode. Holding this key for 2 seconds locks the operation. The key lock is invalid when Pr. 161 ="0 (initial setting)". (Refer to the FR-A800 Instruction Manual.)
⓫		SET key	Enters each setting. If pressed during operation, the monitored item changes. (Using Pr. 52 and Pr. 774–Pr. 776, the monitored item can be changed.) When the initial setting is set. 
⓬		ESC key	Goes back to the previous display. Holding this key for a longer time changes the mode back to the monitor mode.
⓭		HAND/AUTO key	Switches between the PU operation mode, the PU JOG operation mode and the External operation mode. Pressing the "MODE" and "HAND/AUTO" keys simultaneously switches to the easy setting mode. Cancels the PU stop also.

Basic functions (FR-DU08-01)



① For details of operation modes, monitored items, trace function and faults history refer to the Instruction Manual of your inverter.

5.2 Operation mode selection

The operation mode specifies the source of the start command and the frequency command for the inverter. The mode is controlled with parameter 79 (see section 6.2.7).

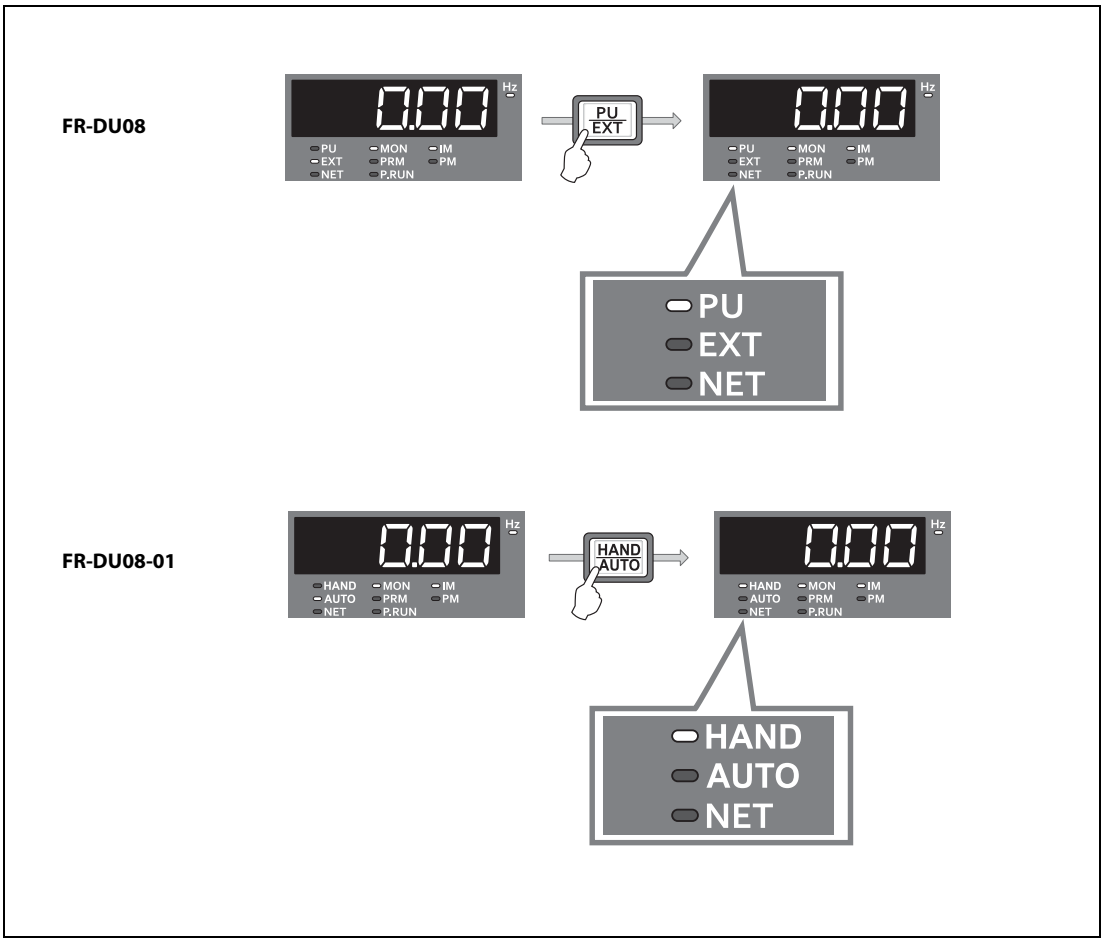
Basically, there are following operation modes:

- External operation mode (EXT): For inputting a start command and a frequency command with an external potentiometer and switches which are connected to the control circuit terminal.
- PU operation mode (PU): Operations using the standard parameter unit (FR-DU08/FR-DU08-01), the optional parameter unit (FR-PU07) or the RS-485 communication via PU connector.
- Network operation mode (NET): When RS-485 terminals or communication option is used.

NOTE

You can only switch the operation mode when the drive is stopped and no start command is active.

In the initial setting, the inverter is in the External operation mode (EXT) at power ON. You can switch to the parameter unit operation mode (PU) by pressing the PU/EXT key on the parameter unit FR-DU08 (resp. the HAND/AUTO key on the FR-DU08-01). The PU (HAND) indicator lights up.



Pressing PU/EXT when the inverter is in PU operation mode switches the system to external operation mode and the EXT indicator lights up.

5.3 Setting the frequency and starting the motor

When external control signals are not used you can only start, stop and change the speed of the external motor with the parameter unit.

Example ▽

Procedure on FR-A800 inverters (using FR-DU08):
Example of drive operation at a 30 Hz output frequency.

	Operation
①	Screen at power-ON The monitor display appears.
②	Changing the operation mode Press [PU EXT] to choose the PU operation mode. [PU] indicator is lit.
③	Setting the frequency Turn  until the target frequency, " 30.00 " (30.00 Hz), appears. The frequency flickers for about 5 s. While the value is flickering, press [SET] to enter the frequency. " F " and " 30.00 " flicker alternately. After about 3 s of flickering, the indication goes back to " 0.00 " (monitor display). (If [SET] is not pressed, the indication of the value goes back to " 0.00 " (0.00 Hz) after about 5 s of flickering. In that case, turn  again and set the frequency.)
④	Start ➔ acceleration ➔constant speed Press [FWD] or [REV] to start running. The frequency value on the indication increases in Pr. 7 "Acceleration time", and " 30.00 " (30.00 Hz) appears. (To change the set frequency, perform the operation in above step 3. The previously set frequency appears.)
⑤	Deceleration ➔stop Press [STOP RESET] to stop. The frequency value on the indication decreases in Pr. 8 "Deceleration time", and the motor stops rotating with " 0.00 " (0.00 Hz) displayed.

NOTE

Troubleshooting tips

If you cannot set the frequency or if you are unable to start the motor with the parameter unit please go through the following checklist:

- Is the inverter in PU operation mode? The PU indicator LED should be on.
  Check parameter 79 and make sure that it is set to „0“. This is the default factory setting, which allows the inverter to be switched between external operation mode and PU operation mode with the PU/EXT key on the parameter unit.
- Are all external start commands inactive?
- Did you press the SET key within 5 seconds of setting the frequency?
  If you don‘t press SET during this time (while the display is flickering) the output frequency setting value will not be stored.

△

5.4 Editing parameter settings

All the settings for the operation of frequency inverters are stored in editable parameters. You can find a detailed reference to the most important parameters in chapter 6. All the parameters are preset to default values when the inverter leaves the factory. You can edit parameters on the parameter unit to configure the inverter for the connected motor and your application.

Note that editing parameters is only possible when the inverter is in PU operation mode (PU) or combined mode and when no motor start (FWD or REV) command is active.

Example ▽

Procedure on FR-A800 inverters (using FR-DU08):
The following example shows how to change the maximum output frequency (refer to section 6.2.2 for details on Parameter 1) from 120 Hz to 60 Hz.

Operation
① Screen at power-ON The monitor display appears.
② Changing the operation mode Press [PU EXT] to choose the PU operation mode. [PU] indicator is lit.
③ Parameter setting mode Press [MODE] to choose the parameter setting mode. (The parameter number read previously appears.)
④ Selecting the parameter number Turn the dial until "P. 1" (Pr. 1) appears. Press [SET] to read the present set value. "120.00" (initial value) appears.
⑤ Changing the setting value Turn the dial to change the set value to "60.00". Press [SET] to enter the setting. "60.00" and "P. 1" flicker alternately. • Turn the dial to read another parameter. • Press [SET] to show the setting again. • Press [SET] twice to show the next parameter. • Press [MODE] three times to return to the monitor display of the frequency.

△

6 Parameter

For optimum operation you need to configure your frequency inverter for the specific requirements and specifications of the connected drive system and your application. All the necessary settings are stored in numbered parameters in the inverter's memory – you only have to set them once because this memory is not cleared when the power is switched off. All the parameters are preset to default values when the inverter leaves the factory so that the unit can be used at once.

There are two main classes of parameters, simple mode parameters and extended parameters. The simple mode parameters should always be checked and configured before using the inverter but many of the extended parameters are only needed for special or complex applications.

CAUTION:

Incorrect parameter settings can damage or (in extreme cases) even destroy the connected motor. Take great care when you are setting the parameters and double-check the electrical and mechanical specifications of the motor, your entire drive system and the connected machine before proceeding.

6.1 Simple mode parameters

Simple mode parameters of the FR-A800 inverters

Parameter	Name	FR-A800		
		Setting Range	Initial Value	
			FM-type	CA- type
0	Torque boost	0–30 %	1/2/3/4/6 % ①	
1	Maximum frequency	0–120 Hz	60 /120 Hz ①	
2	Minimum frequency	0–120 Hz	0 Hz	
3	Base frequency	0–590 Hz	60 Hz	50 Hz
4	Multi-speed setting (high speed) - RH	0–590 Hz	60 Hz	50 Hz
5	Multi-speed setting (medium speed) - RM	0–590 Hz	30 Hz	
6	Multi-speed setting (low speed) -RL	0–590 Hz	10 Hz	
7	Acceleration time	0–3600 s	5/15 s ①	
8	Deceleration time	0–3600 s	5/15 s ①	
9	Electronic thermal O/L relay	0–3600 A	Rated current	
79	Operation mode selection	0–4/6/7	0	
125	Terminal 2 frequency setting gain frequency	0 to 590 Hz	60 Hz	50 Hz
126	Terminal 4 frequency setting gain frequency	0 to 590 Hz	60 Hz	50 Hz
160	User group read selection	0, 1, 9999	0	
998	PM parameter initialization	0, 3003, 3103, 8009, 8109, 9009, 9109	0	
999	Automatic parameter setting	1, 2, 10, 11, 12, 13, 20, 21, 9999	9999	

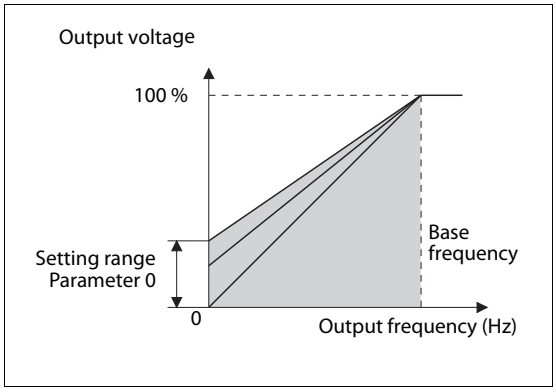
① The setting depends on the inverter capacity.

NOTE You can find a reference list of all inverter parameters in the Appendix (section A.1).

6.2 The simple mode parameters in detail

6.2.1 Torque Boost (Pr. 0)

Parameter 0 enables you to increase the output voltage at low output frequencies, which increases the motor's torque. This function is useful in applications when you need high start-up torque at low speeds.

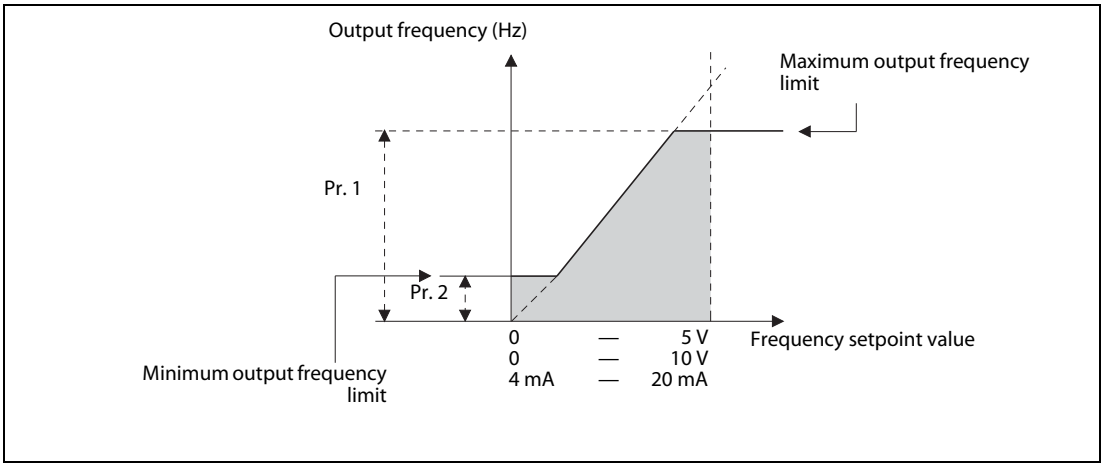


You can use parameter 0 to achieve better performance for starting the motor under load. The base frequency is set in parameter 3.

6.2.2 Minimum/maximum output frequency (Pr. 1, Pr. 2)

The minimum and maximum output frequencies define the range within which the motor speed can be adjusted with the frequency setting value.

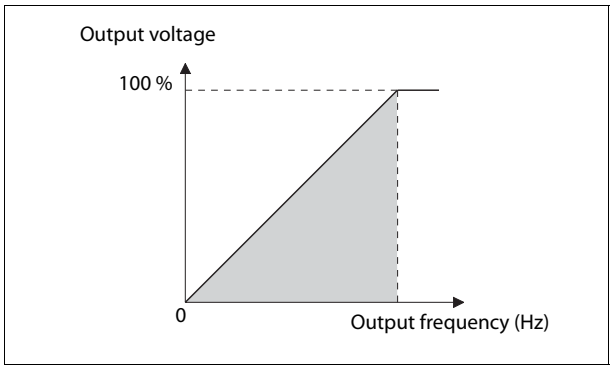
You can use these two parameters to adjust the frequency setting range to match the mechanical specifications of the connected system. For example, in many applications it is not desirable or possible to allow the drive to stop completely at the minimum setpoint value (output frequency = 0Hz). At the other end of the scale you will often want to limit the maximum output frequency, and thus the motor speed, so that you don't overstress the machine mechanically or exceed a maximum permitted speed.



6.2.3 Base frequency (Pr. 3)

The setting of parameter 3 is very important because it matches the frequency inverter's output to the requirements of the motor.

Parameter 3 specifies the output frequency at which the output voltage is set to its maximum value. This is normally set to the rated frequency of the motor, which can be found on the motor's rating plate. Be careful with this parameter – incorrect settings can cause overload states and lead to automatic shutdown of the inverter.



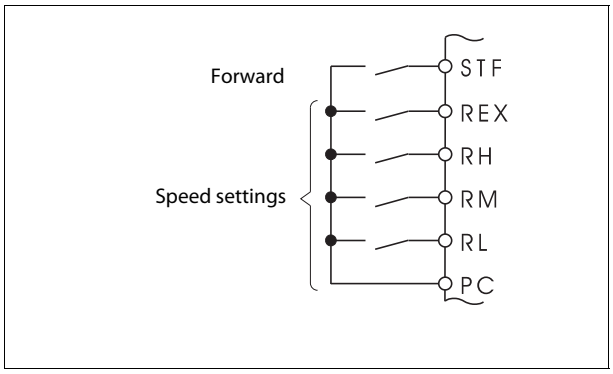
Parameter 3 defines the ratio between the output voltage and the output frequency (V/f pattern).

You can set the inverter's maximum output voltage with parameter 19, which should be set to the maximum output voltage allowed for the motor (this can be found on the motor's rating plate).

6.2.4 Multi-speed settings (Pr. 4 to Pr. 6)

A limited number of preset speeds is quite adequate for many applications. This can be achieved without the need for analog setpoint signals. Instead, you enter fixed setpoint values in these parameters and activate them with ON/OFF signals applied to the inverter's terminals.

All the inverters described in this guide allow selection of up to 15 frequency setpoint values (corresponding to 15 speeds) via terminals RH, RM, RL and REX. The inverter must be in external operation mode for this to be possible, of course.

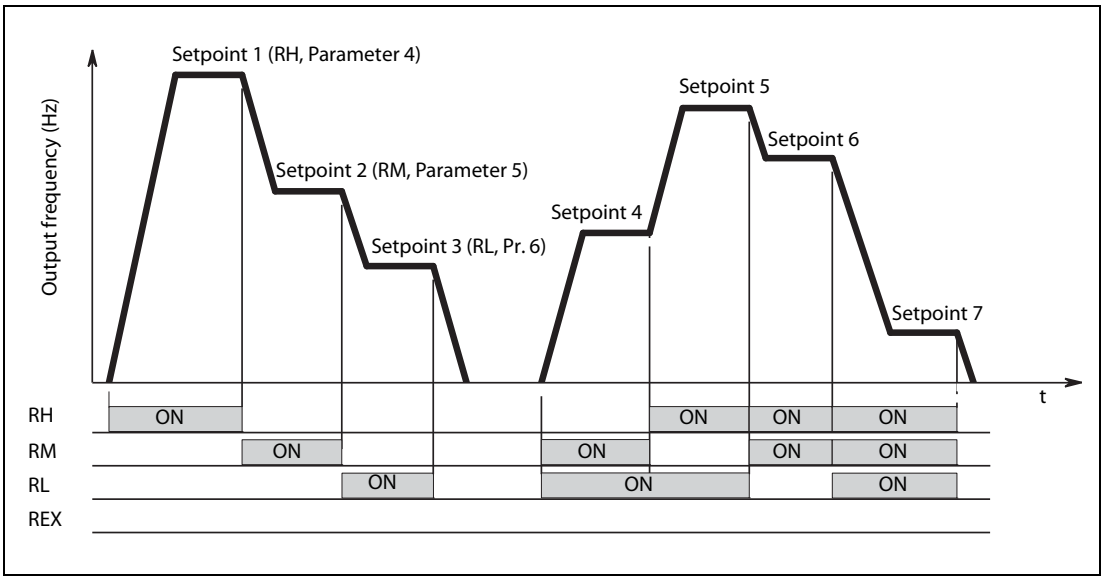


Example for connection of the inverter's RH, RM, RL and REX terminals (in source logic).

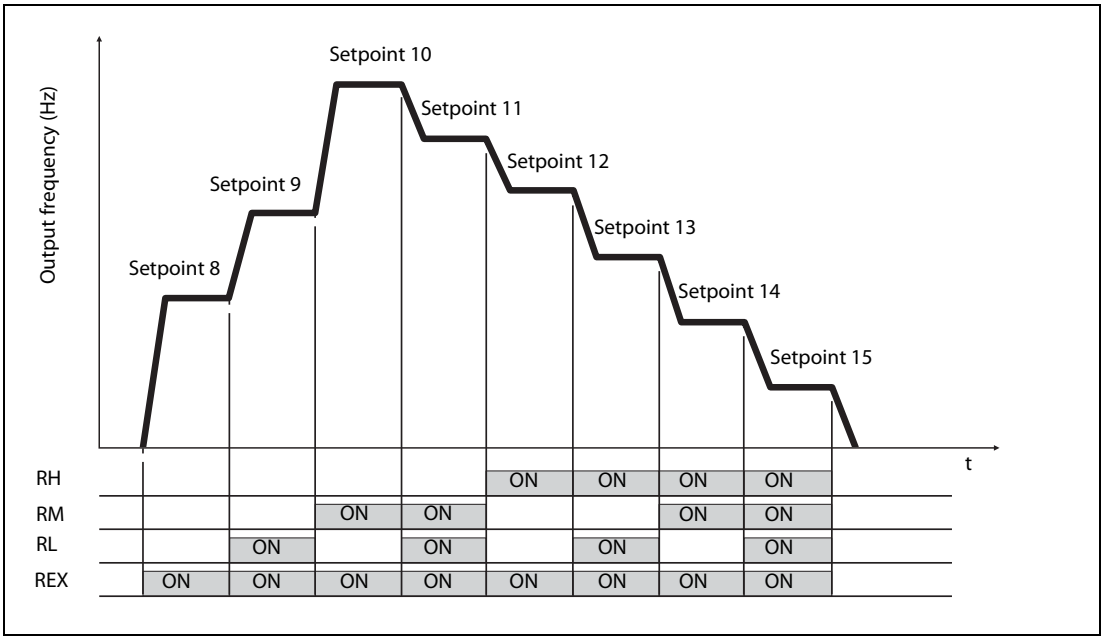
The frequency (speed) settings can be selected with relay output signals from a programmable logic controller (PLC).

The first three frequency settings are entered in parameters 4 through 6. Further fixed speed settings (4 to 15) can be stored in additional parameters. See your frequency inverter's documentation for further details.

As the graphic below shows, you can select up to seven frequency setpoint values by applying combinations of signals to terminals RH, RM and RL. The first three values are selected with single terminals, the remaining values with combinations.



Eight additional frequency settings (8 through 15) can be achieved by using the REX terminal as well:



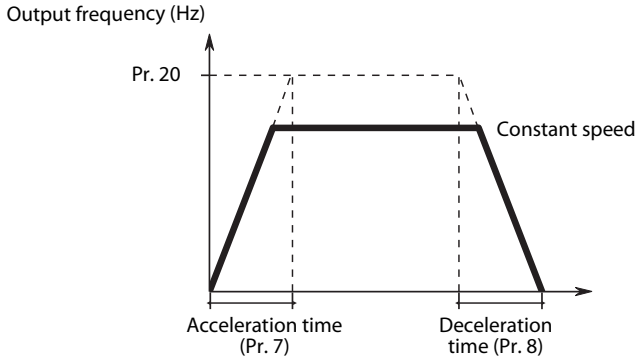
Important information for using preset frequency settings (speeds):

- If only parameters 4, 5 and 6 are used for speed settings the terminals have the following automatic priority if two speeds are accidentally selected at the same time: RL before RM and RM before RH.
- You can also change the parameter values while the inverter is operating.

6.2.5 Acceleration and deceleration times (Pr. 7, Pr. 8)

One of the big advantages of frequency inverters is that they can accelerate and slow down the connected motor gradually. Electric motors connected directly to the mains power accelerate up to their maximum speed very rapidly; this is often not desirable, particularly for machines with delicate mechanical parts.

Parameters 7 and 8 allow you to adjust the acceleration and deceleration times. The parameter value defines the acceleration or deceleration period. This means that the speed change per unit of time gets smaller as you increase the value.



Parameter 7 sets the acceleration time for the drive. The value defines the time in seconds in which the drive will be accelerated up from 0 Hz to the frequency preset in parameter 20.

Parameter 8 sets the deceleration time, which is the time in seconds in which the drive will be slowed down to 0 Hz from the frequency preset in parameter 20.

6.2.6 Electronic thermal overload relay (Pr. 9)

Mitsubishi's frequency inverters have an internal electronic thermal overload relay to protect the motor. The motor's frequency and current are monitored in relation to its rated current and if the values rise too high the protection function is activated. This function serves primarily to protect the motor against overheating during operation at low speeds and high torques. The reduced cooling function of the motor's fan at low speeds and other factors are also taken into account.

Enter the motor's rated current in parameter 9. You can find this value on the motor's rating plate.

You can deactivate the thermal overload relay by setting parameter 9 to „0" (for example if you are using an external motor protection device or if multiple motors are connected to the inverter). Deactivating the relay will not turn off the overload protection feature for the frequency inverter's own transistors.

6.2.7 Operation mode selection (Pr. 79)

Parameter 79 sets the operation mode of the frequency inverter.

You can set it for operation via external signals, via parameter unit (PU mode), a combination of external signals and PU mode or via a network connection.

- Select external operation mode if you want to control the inverter primarily with signals applied to the control terminals, for example with potentiometers and switches or with a PLC.
- Select PU mode if you want to start the motor and set the speed via the parameter unit or via the PU connector.
- Select network mode (NET) for operation via RS-485 communication or an optional communication module.

Parameter 79	Description		
0 (initial value)	At power on, the inverter is in the external operation mode. Use the PU/EXT key on the parameter unit to switch between the External and PU operation mode. (Details of these modes are described in this table for the settings "1" and "2".)		
	Operation Mode	**Setting of the output frequency**	**Start signal**
1	PU operation mode	With PU	FWD or REV key on PU
2	External operation mode	External signal input (e.g. terminals 2 and 4, JOG, multi-speed setting etc.)	External signal input (terminal STF or STR)
3	Combined operation mode 1	With PU or external signal input (e.g. terminal 4, multi-speed setting)	External signal input (terminal STF or STR)
4	Combined operation mode 2	External signal input (e.g. terminals 2 and 4, JOG, multi-speed setting, etc.)	RUN (FWD, REV) key of the PU
6	Switch-over mode Switching of PU, External, and NET operation modes can be performed during operation.		
7	External operation mode (Enable/Disable switch-over to the parameter unit mode) X12 signal ON: Operation mode can be switched to the parameter unit mode (output stop during external operation) X12 signal OFF: Operation mode can not be switched to the parameter unit mode		

NOTE

You must also set the appropriate parameters to assign signal X12 to an input terminal on the inverter. See the documentation of your inverter for details.

Pr. 79 = „0“ (external operation mode, switchable to PU, initial value)
Pr. 79 = „2“ (external operation, non-switchable)

When parameter 79 is set to „0“ or „2“, external operation mode is activated when the power supply is switched on. It is not generally possible to adjust parameters while the unit is in this mode.

If you do not often need to adjust parameters you can prevent switching to PU operation mode by setting parameter 79 to „2“.

However, if you often need to change parameter settings you should set parameter 79 to “0“ so that you can switch back to PU operation mode by pressing PU/EXT on the parameter unit. Parameters can be entered and edited in PU mode. When you have finished making your settings you can then press PU/EXT again to switch back to external operation mode.

When the inverter is in external operation mode start commands are executed with signals applied to terminals STF (forward) and STR (reverse). The frequency/speed can be set with an analog signal (current or voltage) or by selecting preset speed settings on terminals RH, RM and RL.

Pr. 79 = „1“ (PU operation mode)

When parameter 79 is set to „1“ the inverter switches to PU operation mode when it is powered up and it can be operated with the keys on the parameter unit.

When operation mode 1 is set it is not possible to switch the operation mode by pressing the PU/EXT key.

Pr. 79 = „3“ (PU/External combined operation mode 1)

Select this combined mode when you want to set the speed frequency with the setting dial of the parameter unit and use the external terminals for the motor start signals.

You cannot switch the operation mode with the PU/EXT key in this mode.

You can also use external signals to set the speed. If an external speed setting signal is used it has higher priority than the frequency setting on the parameter unit.

Pr. 79 = „4“ (PU/External combined operation mode 2)

Select this combined mode when you want to activate the start signals with the parameter unit and set the speed frequency with an external potentiometer or the speed setting parameters.

Here too, you cannot switch modes with the PU/EXT key.

6.2.8 Setting input gain maximum frequency (terminals 2, 4) (Pr. 125, Pr. 126)

The "gain" function serves to adjust the relationship between a setting input signal and the output frequency. A setting input signal is such as 0 to 5 V DC/0 to 10 V or 4 to 20 mA DC externally input to set the output frequency.

Set Pr. 125 „Terminal 2 frequency setting gain frequency“ to change the frequency for the maximum analog voltage input (at 5V, initial value). Set Pr. 126 „Terminal 4 frequency setting gain frequency“ respectively to change the frequency for the maximum analog current input (at 20 mA, initial value).

For more details refer to the Instruction Manual of your inverter.

6.2.9 User group read selection (Pr. 160)

This function restricts the parameters that are read by the parameter unit.

With the initial value (Pr. 160 = "0"), simple mode parameters and extended parameters can be displayed.

When Pr. 160 is set to "9999", only the simple mode parameters can be displayed on the parameter unit. For the simple mode parameters, refer to the parameter list on page 6-1.

For more details refer to the Instruction Manual of your inverter.

6.2.10 PM parameter initialization (Pr. 998)

Pr. 998 „PM parameter initialization“ sets parameters required for driving an IPM motor MM-CF. The offline auto tuning enables the operation with an IPM motor other than MM-CF and with SPM motors.

Pr. 998 setting	Description	
0 (initial value)	Parameter settings for an induction motor (frequency)	
3003	For IPM motor MM-CF.: Parameter setting (rotations per minute)	
3103	For IPM motor MM-CF: Parameter setting (frequency)	
8009	The parameters settings required to drive an IPM motor other than MM-CF are set (rotations per minute) (after tuning).	Set Pr. 71 "Applied motor" and perform offline auto tuning in advance
8109	The parameters settings required to drive an IPM motor other than MM-CF are set (frequency) (after tuning).	
9009	The parameters settings required to drive an SPM motor are set (rotations per minute) (after tuning).	
9109	The parameters settings required to drive an SPM motor are set (frequency) (after tuning).	

For more details refer to the Instruction Manual of your inverter.

6.2.11 Automatic parameter setting (Pr. 999)

Multiple parameter settings are changed automatically. Those include communication parameter settings for the Mitsubishi's human machine interface (GOT) connection and the parameter setting for the rated frequency settings of 50 Hz/60 Hz and acceleration/deceleration time.

Following table shows the setting values for Pr. 999. Select which parameters to automatically set and set them in Pr. 999.

Pr. 9999 setting	Description	
1	Sets the standard monitor indicator setting of PID control.	
2	Automatically sets the monitor indicator for PID control.	
10	Automatically sets the communication parameters for the GOT connection with a PU connector	"Controller Type" in GOT: FREQROL 500/700/800, SENSORLESS SERVO
11	Automatically sets the communication parameters for the GOT connection with RS-485 terminals	
12	Automatically sets the communication parameters for the GOT connection with a PU connector	"Controller Type" in GOT: FREQROL 800(Automatic Negotiation
13	Automatically sets the communication parameters for the GOT connection with RS-485 terminals	
20	50 Hz rated frequency	Sets the related parameters of the rated frequency according to the power supply frequency
21	60 Hz rated frequency	
9999	No action	

For more details refer to the Instruction Manual of your inverter.

7 Protective and diagnostics functions

The Mitsubishi Electric inverters of the FR-A800 series have many functions that protect both the inverter itself and the connected motor against damage when errors occur. If a serious error triggers a protective function the inverter output is turned off, the motor coasts to a stop and an error code is displayed on the parameter unit. It is then usually easy to localise the cause of the problem with the help of the error code and the troubleshooting information in the inverter documentation. Further assistance is always available from Mitsubishi Electric service if necessary.

Please note the following important points for dealing with error codes:

- Power is needed to store error codes

  Error codes can only be output after an error occurs if the inverter's power supply remains on.For example, if the power is switched on by a contact or that trips when a protective function activates the error codes cannot be stored and will be lost.

- Error code display

  When a protective function activates, the appropriate error code is automatically displayed on the parameter unit.

- Resetting after activation of protective functions

  When a protective function activates, the inverter's power output is disabled, cutting off the power to the connected motor, which then coasts to a halt. The inverter cannot be restarted until the protective functions have been reset with a RESET command.

  When an error occurs you should always first localise and correct the cause. Only reset the inverter and continue normal operation when you are sure that the problem has been resolved.

The error codes that can be displayed can be divided into four basic categories:

– Error messages

  Error messages are normally caused by operator or configuration errors. These codes do not disable the inverter's power output.

– Warnings

  Warnings also do not disable inverter's power output – here too, the motor continues to run. However, if you ignore a warning and fail to correct the cause it can lead to a fault.

– Alarms

  Alarms do **not** disable the inverter output.

– Faults

  Faults are errors that activate the inverter's protective functions, which include disabling the power output and switching off the connected motor.

7.1 Troubleshooting

When an error occurs or you experience some other problem with operation you can often diagnose the cause from the behaviour of the motor and/or the inverter.

Error	Possible cause	Check points / Remedy
Motor does not rotate as commanded.	Main circuit or motor are not connected properly.	Are the terminals R/L1, S/L2 and T/L3) connected properly? Is the proper power supply voltage applied?
		Are the terminals U, V and W wired properly?
		Check that the jumper across P1 and P/+ is connected.
	Missing or wrong input signals	Check that the start signal is input.
		Check that both the forward and reverse rotation start signals are not input simultaneously.
		Check that the frequency setting signal is not zero.
		Check that the AU signal is on when the frequency setting signal is 4 to 20mA.
		Check that the output stop signal (MRS) or reset signal (RES) is not on.
		Check that the sink or source jumper connector is fitted securely.
	Incorrect parameter settings	Check that the setting of Pr. 79 is correct.
		Check that frequency settings of each running frequency (such as multi-speed operation or Pr. 1) are not zero.
	Load	Check that the load is not too heavy.
		Check that the shaft is not locked.
	Other	Is a error message displayed (e. g. E.OC1)?
Motor rotates in opposite direction	Wrong phase sequence	Check that the phase sequence of output terminals U, V and W is correct.
	Start signal	Check that the start signals (forward rotation, reverse rotation) are connected properly.
	Incorrect rotation signal	
Speed greatly differs from the setting	Frequency setting signal	Check that the frequency setting signal is correct. (Measure the input signal level.)
	Incorrect parameter settings	Check the setting of the parameters 1, 2, and 19.
	External noise	Check that the input signal lines are not affected by external noise. (Use shielded cables)
	Load	Check that the load is not too heavy.
Acceleration/deceleration is not smooth	Incorrect settings for acceleration/deceleration time	Check that the acceleration and deceleration time settings are not too short (Pr. 7 and 8). Increase this values.
	Load	Check that the load is not too heavy.
	Torque boost	Check that the torque boost setting is not too large to activate the stall function.
Motor current is large	Load	Check that the load is not too heavy.
	Torque boost	Check that the Pr. 0 „Torque boost" setting is appropriate.
Speed does not increase	Maximum frequency	Check that the maximum frequency (Pr. 1) setting is correct.
	Load	Check that the load is not too heavy.
	Torque boost	Check that the torque boost setting is not too large to activate the stall function.

Error	Possible cause	Check points / Remedy
Speed varies during operation	Load	Check that the load is not varying.
	Input signals	Check that the frequency setting signal is not varying.
		Check that the frequency setting signal is not affected by noise.
		Check for a malfunction due to undesirable currents when the transistor output unit is connected.
	Other	Check that the wiring length is not too long.
Operation mode is not changed properly	Start signal is ON	Check that the STF or STR signal is OFF. When it is on, the operation mode cannot be changed.
	Parameter setting	Check the Pr. 79 setting. When the Pr. 79 setting is "0" (initial value), the inverter is placed in the external operation mode at input power-on. Use the PU/EXT key to switch to the control unit mode. For a description of the operation mode selection please refer to section 6.2.7.
Operation panel display is not operating	Connection between terminals PC and SD	The terminals PC and SD must not be connected.
	Jumper across P1 and P/+	Check that the jumper across P1 and P/+ is connected.
Parameter write cannot be performed	Start signal is ON	Make sure that operation is not being performed (signal STF or STR is not ON).
	SET key	Press the SET key (parameter unit FR-DU08) to save the parameter settings.
	Parameter setting	Check that the parameter settings are within the setting ranges.
		Make sure that you are not attempting to set the parameter in the external operation mode (Pr. 79, section 6.2.7).
Motor generates abnormal noise	Parameter setting	Check that the deceleration time is not too short (Pr. 8).

7.2 List of alarm displays

Classification	Inverter Display		Meaning
	FR-A800	Plaintext	
Error messages	E-----	E---	Faults history
	HOLd	HOLD	Operation panel lock
	LOCd	LOCD	Password locked
	Er 1 to Er4 Er8	Er1 to Er4, Er8	Parameter write error
	rE 1 to rE4 rE6 to rE8	rE1 to rE4, rE6 to rE8	Copy operation error
	Err.	Err.	Error (e. g. incorrect parameter)
Warnings	OL	OL	Stall prevention (overcurrent)
	oL	oL	Stall prevention (overvoltage)
	Rb	RB ①②	Regenerative brake prealarm
	TH	TH	Electronic thermal relay function prealarm
	PS	PS	PU stop
	MT 1 MT3	MT1 to MT3	Maintenance signal output
	CP	CP ②	Parameter copy
	SL	SL	Speed limit indication (Output during speed limit)
	SA	SA	Safety stop
	UF	UF	USB host error
	EV	EV	24 V external power supply operation
	HP 1	HP1	Home position return setting error
	HP3	HP2	Home position return uncompleted
	HP3	HP3	Home position return parameter setting error
Alarm	FN	FN	Fan fault
	FN2	FN2③	Internal fan alarm
Fault	E. OC 1	E.OC1	Overcurrent shut-off during acceleration
	E. OC2	E.OC2	Overcurrent shut-off during constant speed
	E. OC3	E.OC3	Overcurrent shut-off during deceleration or stop

Classification	Inverter Display		Meaning
	FR-A800	Plaintext	
Fault	E. OV 1	E.OV1	Regenerative overvoltage shut-off during acceleration
	E. OV2	E.OV2	Regenerative overvoltage shut-off during constant speed
	E. OV3	E.OV3	Regenerative overvoltage shut-off during deceleration or stop
	E. THT	E.THT	Inverter overload shut-off (electronic thermal relay function)
	E. THM	E.THM	Motor overload shut-off (electronic thermal relay function)
	E. FIN	E.FIN	Fin overheat
	E. IPF	E.IPF①	Instantaneous power failure
	E. UVT	E.UVT①	Undervoltage
	E. ILF	E.ILF①	Input phase failure
	E. OLT	E.OLT	Stall prevention
	E. SOT	E.SOT	Loss of synchronism detection
	E. bE	E.BE①	Brake transistor alarm detection
	E. GF	E.GF	Output side earth (ground) fault overcurrent
	E. LF	E.LF	Output phase failure
	E. OHT	E.OHT	External thermal relay operation
	E. PTC	E.PTC	PTC thermistor operation
	E. OPT	E.OPT	Option alarm
	E. OP 1	E.OP1	Communication option alarm
	E. 16 E. 17 E. 18 E. 19 E. 20	E.16 to E.20	User definition error by the PLC function
	E. PE	E.PE	Parameter storage device alarm
	E. PUE	E.PUE	PU disconnection
	E. RET	E.RET	Retry count excess
	E. PE2	E.PE2	Parameter storage device alarm
	E. 5 E. 6 E. 7 E. CPU	E.5 E.6 E.7 E.CPU	CPU error
	E. CTE	E.CTE	• Operation panel power supply short circuit • RS-485 terminal power supply short circuit
	E. P24	E.P24	24 V DC power output short circuit

Classification	Inverter Display		Meaning
	FR-A800	Plaintext	
Fault	E. CdO	E.CDO	Output current detection value exceeded
	E. IOH	E.IOH①	Inrush current limit circuit alarm
	E. SER	E.SER	Communication error (inverter)
	E. AIE	E.AIE	Analog input error
	E. USb	E.USB	USB communication error
	E. SAF	E.SAF	Safety circuit fault
	E. PbT	E.PBT	Internal circuit fault
	E. OS	E.OS	Overspeed occurrence
	E. OSd	E.OSD	Speed deviation excess detection
	E. ECT	E.ECT	Signal loss detection
	E. Od	E.OD	Excessive position error
	E. Mb1 E. Mb2 E. Mb3 E. Mb4 E. Mb5 E. Mb6 E. Mb7	E.MB1 to E.MB7	Brake sequence error
	E. EP	E.EP	Encoder phase error
	E. IAH	E.IAH①	Abnormal internal temperature
	E. LCI	E.LCI	4mA input fault
	E. PCH	E.PCH	Pre-charge fault
	E. PId	E.PID	PID signal fault
	E. 1 E. 20 E. 3	E.1 E.2 E.3	Option alarm (e. g. connection error)
	E. 11	E.11	Opposite rotation deceleration error
	E. 13	E.13	Internal circuit error

① Not available for FR-A842 (Separated converter type)
② Not available for FR-A846 (IP55 compatible models)
③ Available for FR-A846 (IP55 compatible models) only

7.3 Resetting the inverter (Reset)

After you have located and corrected the cause of a shutdown you need to reset the inverter so that normal operation can continue. In addition to clearing the error history, executing a RESET also clears the stored record of the number of restart attempts and the stored values registered for the electronic thermal overload relay.

Three different ways to reset the inverter are available:

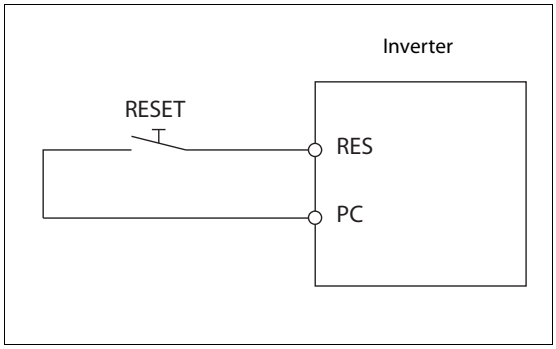
- Reset by pressing the STOP/RESET key on the parameter unit.

  After a fault occurred (a protective function is activated to trip the inverter) you can reset the inverter by pressing the STOP/RESET key.

- Reset by switching the power supply to the inverter off and on again.

- Reset with an external RESET signal

  You can reset by briefly (but at least 0.1s) connecting terminals RES and SD (sink logic) or RES and PC (source logic). Never make a permanent connection between the RES terminal and the SD or PC terminal!



This example shows how to wire the RES terminal for positive logic.

Instead of a pushbutton you can also use a contactor controlled by PLC (programmable logic controller).

A Appendix

A.1 Parameter list

This reference section lists all the parameters supported in each series of Mitsubishi Electric inverters. Please see the documentation of your inverter for more detailed descriptions of each parameter.

NOTE

Simple indicates simple mode parameters. Use Pr. 160 "User group read selection" to switch between the simple mode and extended mode display (initially set to extended mode).

A.1.1 FR-A800

Parameter	Name	Setting Range	Initial Value
0	Torque boost Simple	0–30%	6/4/3/2/1% ①
1	Maximum frequency Simple	0–120 Hz	120 Hz ① 60 Hz ①
2	Minimum frequency Simple	0–120 Hz	0 Hz
3	Base frequency Simple	0–590 Hz	60/50 Hz ⑤
4	Multi-speed setting (high speed) Simple	0–590 Hz	60/50 Hz ⑤
5	Multi-speed setting (middle speed) Simple	0–590 Hz	30 Hz
6	Multi-speed setting (low speed) Simple	0–590 Hz	10 Hz
7	Acceleration time Simple	0–3600 s	5 s ① 15 s ①
8	Deceleration time Simple	0–3600 s	5 s ① 15 s ①
9	Electronic thermal O/L relay Simple	0–500 ① 0–3600A ①	Rated inverter current
10	DC injection brake operation frequency	0–120 Hz, 9999	3 Hz
11	DC injection brake operation time	0–10s, 8888	0.5 s
12	DC injection brake operation voltage	0–30 %	4/2/1 % ①
13	Starting frequency	0–60 Hz	0.5 Hz
14	Load pattern selection	0–5	0
15	Jog frequency	0–590 Hz	5 Hz
16	Jog acceleration/ deceleration time	0–3600 s	0.5 s
17	MRS input selection	0, 2, 4	0
18	High speed maximum frequency	120–590 Hz	120 Hz ① 60 Hz ①
19	Base frequency voltage	0–1000V, 8888, 9999	9999/ 8888 ⑤
20	Acceleration/ deceleration reference frequency	1–590 Hz	60/50 Hz ⑤
21	Acceleration/ deceleration time increments	0, 1	0
22	Stall prevention operation level (Torque limit level)	0–400 %	150 %
23	Stall prevention operation level compensation factor at double speed	0–200%, 9999	9999
24–27	Multi-speed setting (4 speed to 7 speed)	0–590 Hz, 9999	9999
28	Multi-speed input compensation selection	0, 1	0
29	Acceleration/ deceleration pattern selection	0–6	0
30	Regenerative function selection	0–2, 10, 11, 20, 21,100–102,110, 111, 120, 121/2, 10, 11, 102, 110, 111/0, 2, 10, 20, 100, 102, 110, 120 ⑩	0/10/0 ⑩
31	Frequency jump 1A	0–590 Hz, 9999	9999
32	Frequency jump 1B	0–590 Hz, 9999	9999

Parameter	Name	Setting Range	Initial Value
33	Frequency jump 2A	0–590 Hz, 9999	9999
34	Frequency jump 2B	0–590 Hz, 9999	9999
35	Frequency jump 3A	0–590 Hz, 9999	9999
36	Frequency jump 3B	0–590 Hz, 9999	9999
37	Speed display	0, 1–9998	0
41	Up-to-frequency sensitivity	0–100 %	10 %
42	Output frequency detection	0–590 Hz	6 Hz
43	Output frequency detection for reverse rotation	0–590 Hz, 9999	9999
44	Second acceleration/ deceleration time	0–3600 s	5 s
45	Second deceleration time	0–3600 s, 9999	9999
46	Second torque boost	0–30 %, 9999	9999
47	Second V/F (base frequency)	0–590 Hz, 9999	9999
48	Second stall prevention operation level	0–400 %	150 %
49	Second stall prevention operation frequency	0–590 Hz, 9999	0 Hz
50	Second output frequency detection	0–590 Hz	30 Hz
51	Second electronic thermal O/L relay	0–500 A, 9999 ① 0–3600 A, 9999 ①	9999
52	Operation panel main monitor selection	0, 5–14, 17–20, 22–35, 38, 40–45, 50–57, 61, 62, 64, 67, 87–98, 100	0
54	FM/CA terminal function selection ⑤	1–3, 5–14, 17, 18, 21, 24, 32–34, 50, 52, 53, 61, 62, 67, 70, 87–90, 92, 93, 95, 97, 98	1
55	Frequency monitoring reference	0–590 Hz	60/50 Hz ⑤
56	Current monitoring reference	0–500 A ① 0–3600 A ①	Rated inverter current
57	Restart coasting time	0, 0.1–30 s, 9999	9999
58	Restart cushion time	0–60 s	1 s
59	Remote function selection	0–3, 11–13	0
60	Energy saving control selection	0, 4, 9	0
61	Reference current	0–500 A, 9999 ① 0–3600 A, 9999 ①	9999
62	Reference value at acceleration	0–400 %, 9999	9999
63	Reference value at deceleration	0–400 %, 9999	9999
64	Starting frequency for elevator mode	0–10 Hz, 9999	9999
65	Retry selection	0–5	0
66	Stall prevention operation reduction starting frequency	0–590 Hz	60/50 Hz ⑤
67	Number of retries at fault occurrence	0–10, 101–110	0
68	Retry waiting time	0.1–600 s	1 s
69	Retry count display erase	0	0
70 ⑪	Special regenerative brake duty	0–100 %	0 %
71	Applied motor	0–6, 13–16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094	0
72	PWM frequency selection	0–15 ① 0–6, 25 ①	2
73	Analog input selection	0–7, 10–17	1
74	Input filter time constant	0–8	1
75	Reset selection/ disconnected PU detection/PU stop selection	0–3, 14–17 ① 0–3, 14–17, 100–103, 114–117 ①	14
76	Fault code output selection	0–2	0
77	Parameter write selection	0–2	0
78	Reverse rotation prevention selection	0–2	0
79	Operation mode selection Simple	0–4, 6, 7	0
80	Motor capacity	0.4–55 kW, 9999 ① / 0–3600 kW, 9999 ①	9999

Parameter	Name	Setting Range	Initial Value
81	Number of motor poles	2, 4, 6, 8, 10, 12, 9999	9999
82	Motor excitation current	0–500 A, 9999 ① 0–3600 A, 9999 ①	9999
83	Rated motor voltage	0–1000 V	200/400 V ②
84	Rated motor frequency	10–400 Hz, 9999	9999
89	Speed control gain (Advanced magnetic flux vector)	0–200 %, 9999	9999
90	Motor constant (R1)	0–50 Ω, 9999 ① / 0–400 mΩ, 9999 ①	9999
91	Motor constant (R2)	–50 Ω, 9999 ① / 0–400 mΩ, 9999 ①	9999
92	Motor constant (L1)/d-shaft inductance (Ld)	0–6000 mH, 9999 ① / 0–400 mH, 9999 ①	9999
93	Motor constant (L2)/q-shaft inductance (Lq)	0–6000 mH, 9999 ① 0–400 mH, 9999 ①	9999
94	Motor constant (X)	0–100 %, 9999	9999
95	Online auto tuning selection	0–2	0
96	Auto tuning setting/ status	0, 1, 11, 101	0
100	V/F1 (first frequency)	0–590 Hz, 9999	9999
101	V/F1 (first frequency voltage)	0–1000 V	0 V
102	V/F2 (second frequency)	0–590 Hz, 9999	9999
103	V/F2 (second frequency voltage)	0–1000 V	0 V
104	V/F3 (third frequency)	0–590 Hz, 9999	9999
105	V/F3 (third frequency voltage)	0–1000 V	0 V
106	V/F4 (fourth frequency)	0–590 Hz, 9999	9999
107	V/F4 (fourth frequency voltage)	0–1000 V	0 V
108	V/F5 (fifth frequency)	0–590 Hz, 9999	9999
109	V/F5 (fifth frequency voltage)	0–1000 V	0 V
110	Third acceleration/ deceleration time	0–3600 s, 9999	9999
111	Third deceleration time	0–3600 s, 9999	9999
112	Third torque boost	0–30 %, 9999	9999
113	Third V/F (base frequency)	0–590 Hz, 9999	9999
114	Third stall prevention operation level	0–400 %	150 %
115	Third stall prevention operation frequency	0–590 Hz	0 Hz
116	Third output frequency detection	0–590 Hz	60/50 Hz ⑤
117	PU communication station number	0–31	0
118	PU communication speed	48, 96, 192, 384, 576, 768, 1152	192
119	PU communication stop bit length / data length	0, 1, 10, 11	1
120	PU communication parity check	0–2	2
121	Number of PU communication retries	0–10, 9999	1
122	PU communication check time interval	0, 0.1–999.8 s, 9999	9999
123	PU communication waiting time setting	0–150 ms, 9999	9999
124	PU communication CR/LF selection	0–2	1
125	Terminal 2 frequency setting gain frequency Simple	0–590 Hz	60/50 Hz ⑤
126	Terminal 4 frequency setting gain frequency Simple	0–590 Hz	60/50 Hz ⑤
127	PID control automatic switchover frequency	0–590 Hz, 9999	9999
128	PID action selection	0, 10, 11, 20, 21, 40–43, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010,1011, 2000, 2001, 2010,2011	0
129	PID proportional band	0.1–1000 %, 9999	100%
130	PID integral time	0.1–3600 s, 9999	1s
131	PID upper limit	0–100 %, 9999	9999
132	PID lower limit	0–100 %, 9999	9999
133	PID action set point	0–100 %, 9999	9999

Parameter	Name	Setting Range	Initial Value
134	PID differential time	0.01–10.00 s, 9999	9999
135	Electronic bypass sequence selection	0, 1	0
136	MC switchover interlock time	0–100 s	1 s
137	Start waiting time	0–100 s	0.5 s
138	Bypass selection at a fault	0, 1	0
139	Automatic switchover frequency between inverter and commercial power-supply operation	0–60 Hz, 9999	9999
140	Backlash acceleration stopping frequency	0–590 Hz	1 Hz
141	Backlash acceleration stopping time	0–360 s	0.5 s
142	Backlash deceleration stopping frequency	0–590 Hz	1 Hz
143	Backlash deceleration stopping time	0–360 s	0.5 s
144	Speed setting switchover	0, 2, 4, 6, 8, 10, 102, 104, 106, 108, 110, 112	4
145	PU display language selection	0–7	1
147	Acceleration/ deceleration time switching frequency	0–590 Hz,9999	9999
148	Stall prevention level at 0 V input	0–400 %	150 %
149	Stall prevention level at 10 V input	0–400 %	200 %
150	Output current detection level	0–400 %	150 %
151	Output current detection signal delay time	0–10 s	0 s
152	Zero current detection level	0–400 %	5 %
153	Zero current detection time	0–10 s	0.5 s
154	Voltage reduction selection during stall prevention operation	0, 1, 10, 11	1
155	RT signal function validity condition selection	0, 10	0
156	Stall prevention operation selection	0–31, 100, 101	0
157	OL signal output timer	0–25 s, 9999	0 s
158	AM terminal function selection	1–3, 5–14, 17, 18, 21, 24, 32–34, 50, 52–54, 61, 62, 67, 70, 87–90, 91–98	1

Parameter	Name	Setting Range	Initial Value
159	Automatic switch-over frequency range from bypass to inverter operation	0–10 Hz, 9999	9999
160	User group read selection *Simple*	0, 1, 9999	0
161	Frequency setting/key lock operation selection	0, 1, 10, 11	0
162	Automatic restart after instantaneous power failure selection	0–3, 10–13	0
163	First cushion time for restart	0–20 s	0 s
164	First cushion voltage for restart	0–100 %	0 %
165	Stall prevention operation level for restart	0–400 %	150 %
166	Output current detection signal retention time	0–10 s, 9999	0.1 s
167	Output current detection operation selection	0, 1, 10, 11	0
168	Parameter for manufacturer setting. Do not set.		
169			
170	Watt-hour meter clear	0, 10, 9999	9999
171	Operation hour meter clear	0, 9999	9999
172	User group registered display/batch clear	9999, (0–16)	0
173	User group registration	0–1999, 9999	9999
174	User group clear	0–1999, 9999	9999
178	STF terminal function selection	0–20, 22–28, 37, 42–47, 50, 51, 60–62, 64–74, 76–80, 87, 92, 93, 9999 ⑦	60
179	STR terminal function selection		61
180	RL terminal function selection		0
181	RM terminal function selection		1
182	RH terminal function selection		2
183	RT terminal function selection		3
184	AU terminal function selection		4
185	JOG terminal function selection		5
186	CS terminal function selection		6
187	MRS terminal function selection		24/10/24 ⑩
188	STOP terminal function selection		25
189	RES terminal function selection		62

Parameter	Name	Setting Range	Initial Value
190	RUN terminal function selection	0–8, 10–20, 22, 25–28, 30–36, 38–54, 56, 57, 60, 61, 63, 64, 68, 70, 79, 84, 85, 90 to99, 100–108, 110–116, 120, 122, 125–128, 130–136, 138–154, 156, 157, 160, 161, 163, 164, 168, 170, 179, 184, 185, 190–199, 200–208, 300–308, 9999 ⑧	0
191	SU terminal function selection		1
192	IPF terminal function selection		2/9999/2 ⑩
193	OL terminal function selection		3
194	FU terminal function selection		4
195	ABC1 terminal function selection		99
196	ABC2 terminal function selection		9999
232–239	Multi-speed setting (speeds 8 to 15)	0–590 Hz, 9999	9999
240	Soft-PWM operation selection	0, 1	1
241	Analog input display unit switchover	0, 1	0
242	Terminal 1 added compensation amount (terminal 2)	0–100 %	100 %
243	Terminal 1 added compensation amount (terminal 4)	0–100 %	75 %
244	Cooling fan operation selection	0, 1, 101–105	1
245	Rated slip	0–50 %, 9999	9999
246	Slip compensation time constant	0.01–10 s	0.5 s
247	Constant-power range slip compensation selection	0, 9999	9999
248	Self power management selection	0–2	0
249	Earth fault detection at start	0, 1	0

Parameter	Name	Setting Range	Initial Value
250	Stop selection	0–100 s, 1000–1100 s, 8888, 9999	9999
251	Output phase loss protection selection	0, 1	1
252	Override bias	0–200 %	50 %
253	Override gain	0–200 %	150 %
254	Main circuit power OFF waiting time	0–3600 s, 9999	600 s
255	Life alarm status display	(0–15)	0
256 ⑫	Inrush current limit circuit life display	(0–100 %)	100 %
257	Control circuit capacitor life display	(0–100 %)	100 %
258 ⑫	Main circuit capacitor life display	(0–100 %)	100 %
259 ⑫	Main circuit capacitor life measuring	0, 1	0
260	PWM frequency automatic switchover	0, 1	1
261 ⑫	Power failure stop selection	0–2, 21, 22	0
262 ⑫	Subtracted frequency at deceleration start	0–20 Hz	3 Hz
263 ⑫	Subtraction starting frequency	0–590 Hz, 9999	60/50 Hz ⑤
264 ⑫	Power-failure deceleration time 1	0–3600 s	5 s
265 ⑫	Power-failure deceleration time 2	0–3600 s, 9999	9999
266 ⑫	Power failure deceleration time switchover frequency	0–590 Hz	60/50 Hz ⑤
267	Terminal 4 input selection	0–2	0
268	Monitor decimal digits selection	0, 1, 9999	9999
269	Parameter for manufacturer setting. Do not set.		
270	Stop-on contact/load torque high-speed frequency control selection	0–3, 11, 13	0
271	High-speed setting maximum current	0–400 %	50 %
272	Middle-speed setting minimum current	0–400 %	100 %
273	Current averaging range	0–590 Hz, 9999	9999
274	Current averaging filter time constant	1–4000	16
275	Stop-on contact excitation current low-speed multiplying factor	50–300 %, 9999	9999
276	PWM carrier frequency at stop-on contact	0–9, 9999 ① / 0–4, 9999 ①	9999
278	Brake opening frequency	0–30 Hz	3 Hz

Parameter	Name	Setting Range	Initial Value
279	Brake opening current	0–400 %	130 %
280	Brake opening current detection time	0–2 s	0.3 s
281	Brake operation time at start	0–5 s	0.3 s
282	Brake operation frequency	0–30 Hz	6 Hz
283	Brake operation time at stop	0–5 s	0.3 s
284 ⑫	Deceleration detection function selection	0, 1	0
285	Overspeed detection frequency (Excessive speed deviation detection frequency)	0–30 Hz, 9999	9999
286	Droop gain	0–100 %	0 %
287	Droop filter time constant	0–1 s	0.3 s
288	Droop function activation selection	0–2, 10, 11	0
289	Inverter output terminal filter	5–50 ms, 9999	9999
290	Monitor negative output selection	0–7	0
291	Pulse train I/O selection	0, 1, 10, 11, 20, 21, 100 (FM type) 0,1 (CA type)	0
292	Automatic acceleration/ deceleration	0, 1, 3, 5–8, 11	0
293	Acceleration/ deceleration separate selection	0–2	0
294 ⑫	UV avoidance voltage gain	0–200 %	100 %
295	Frequency change increment amount setting	0, 0.01, 0.10, 1.00, 10.00	0
296	Password lock level	0–6, 99, 100–106, 199, 9999	9999
297	Password lock/unlock	(0–5), 1000–9998, 9999	9999
298	Frequency search gain	0–32767, 9999	9999
299	Rotation direction detection selection at restarting	0, 1, 9999	9999
300	BCD input bias	Parameter for option FR-A8AX	
301	BCD input gain		
302	BIN input bias		
303	BIN input gain		
304	Digital input and analog input compensation enable/disable selection		
305	Read timing operation selection		

Parameter	Name	Setting Range	Initial Value
306	Analog output signal selection	Parameter for option FR-A8AY	
307	Setting for zero analog output		
308	Setting for maximum analog output		
309	Analog output signal voltage/current switchover		
310	Analog meter voltage output selection		
311	Setting for zero analog meter voltage output		
312	Setting for maximum analog meter voltage output		
313	DO0 output selection	Parameter for options FR-A8AY, FR-A8NC	
314	DO1 output selection		
315	DO2 output selection		
316	DO3 output selection	Parameter for option FR-A8AY	
317	DO4 output selection		
318	DO5 output selection		
319	DO6 output selection		
320	RA1 output selection	Parameter for option FR-A8AR (Relay outputs)	
321	RA2 output selection		
322	RA3 output selection		
323	AM0 0V adjustment	Parameter for option FR-A8AY (Analog/digital output)	
324	AM1 0mA adjustment		
329	Digital input unit selection	Parameter for option FR-A8AX (16 bit digital input)	
331	RS-485 communication station	0–31 (0–247)	0
332	RS-485 communication speed	3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152	96
333	RS-485 communication stop bit length/data length	0, 1, 10, 11	1
334	RS-485 communication parity check selection	0–2	2
335	RS-485 communication retry count	0–10, 9999	1
336	RS-485 communication check time interval	0–999.8 s, 9999	0 s
337	RS-485 communication waiting time setting	0–150 ms, 9999	9999
338	Communication operation command source	0, 1	0
339	Communication speed command source	0–2	0
340	Communication startup mode selection	0–2, 10, 12	0
341	RS-485 communication CR/LF selection	0–2	1

Parameter	Name	Setting Range	Initial Value
342	Communication EEPROM write selection	0, 1	0
343	Communication error count	—	0
345	DeviceNet address	Parameter for option FR-A8ND (DeviceNet communication)	
346	DeviceNet baud rate		
349	Communication reset selection	Parameter for communication options FR-A8NC, FR-A8ND FR-A8NP	
350 ③	Stop position command selection	0, 1, 9999	9999
351 ③	Orientation speed	0–30 Hz	2 Hz
352 ③	Creep speed	0–10 Hz	0.5 Hz
353 ③	Creep switchover position	0–16383	511
354 ③	Position loop switchover position	0–8191	96
355 ③	DC injection brake start position	0–255	5
356 ③	Internal stop position command	0–16383	0
357 ③	Orientation in-position zone	0–255	5
358 ③	Servo torque selection	0–13	1
359 ③	Encoder rotation direction	0, 1, 100, 101	1
360 ③	16 bit data selection	0–127	0
361 ③	Position shift	0–16383	0
362 ③	Orientation position loop gain	0.1–100	1
363 ③	Completion signal output delay time	0–5 s	0.5 s
364 ③	Encoder stop check time	0–5 s	0.5 s
365 ③	Orientation limit	0–60 s, 9999	9999
366 ③	Recheck time	0–5 s, 9999	9999
367 ③	Speed feedback range	0–590 Hz, 9999	9999
368 ③	Feedback gain	0–100	1
369 ③	Number of encoder pulses	0–4096	1024
374	Overspeed detection level	0–590 Hz, 9999	9999
376 ③	Encoder signal loss detection enable/disable selection	0, 1	0
380	Acceleration S-pattern 1	0–50 %	0
381	Deceleration S-pattern 1	0–50 %	0
382	Acceleration S-pattern 2	0–50 %	0
383	Deceleration S-pattern 2	0–50 %	0
384	Input pulse division scaling factor	0–250	0
385	Frequency for zero input pulse	0–590 Hz	0
386	Frequency for maximum input pulse	0–590 Hz	60/50 Hz ⑤

Parameter	Name	Setting Range	Initial Value
393 ③	Orientation selection	0–2	0
396 ③	Orientation speed gain (P term)	0–1000	60
397 ③	Orientation speed integral time	0–20 s	0.333 s
398 ③	Orientation speed gain (D term)	0–100	1
399 ③	Orientation deceleration ratio	0–1000	20
414	PLC function operation selection	0–2	0
415	Inverter operation lock mode setting	0, 1	0
416	Pre-scale function selection	0–5	0
417	Pre-scale setting value	0–32767	1
418	Extension output terminal filter	Parameter for options FR-A8AY, FR-A8AR	
419	Position command source selection	0, 2	0
420	Command pulse scaling factor numerator (electronic gear numerator)	1–32767	1
421	Command pulse multiplication denominator (electronic gear denominator)	1–32767	1
422	Position control gain	0–150 s^{-1}	25 s^{-1}
423	Position feed forward gain	0–100 %	0 %
424	Position command acceleration/ deceleration time constant	0–50 s	0 s
425	Position feed forward command filter	0–5 s	0 s
426	In-position width	0–32767 pulse	100 pulse
427	Excessive level error	0–400K pulse, 9999	40K pulse
428	Command pulse selection	0–5	0
429	Clear signal selection	0, 1	1
430	Pulse monitor selection	0–5, 100–105, 1000 to1005, 1100–1105, 8888, 9999	9999
434	IP address 1	Parameter for option FR-A8NCE	
435	IP address 2		
446	Model position control gain	0–150 s^{-1}	25 s^{-1}
447	Digital torque command bias	Parameter for option FR-A8AX (16 bit digital input)	
448	Digital torque command gain		

Parameter	Name	Setting Range	Initial Value
450	Second applied motor	0, 1, 3–6, 13–16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094, 9999	9999
451	Second motor control method selection	10–14, 20, 110–114, 9999	9999
453	Second motor capacity	0.4–55kW, 9999 ①/ 0–3600kW, 9999 ①	9999
454	Number of second motor poles	2, 4, 6, 8, 10, 12, 9999	9999
455	Second motor excitation current	0–500A, 9999 ① 0–3600A, 9999 ①	9999
456	Rated second motor voltage	0–1000 V	200/400 V ②
457	Rated second motor frequency	10–400 Hz, 9999	9999
458	Second motor constant (R1)	0–50 Ω, 9999 ① 0–400 mΩ, 9999 ①	9999
459	Second motor constant (R2)	0–50 Ω, 9999 ①/ 0–400 mΩ, 9999 ①	9999
460	Second motor constant (L1)/ Second motor d-shaft inductance (Ld)	0–6000 mH, 9999 ①/ 0–400 mH, 9999 ①	9999
461	Second motor constant (L2)/Second motor q-shaft inductance (Lq)	0–6000 mH, 9999 ①/ 0–400mH, 9999 ①	9999
462	Second motor constant (X)	0–100 %, 9999	9999
463	Second motor auto tuning setting/status	0, 1, 11, 101	0
464	Digital position control sudden stop deceleration time	0–360 s	0
465	First target position lower 4 digits	0–9999	0
466	First target position upper 4 digits		0
467	Second target position lower 4 digits		0
468	Second target position upper 4 digits		0
469	Third target position lower 4 digits		0
470	Third target position upper 4 digits		0
471	Fourth target position lower 4 digits		0
472	Fourth target position upper 4 digits		0
473	Fifth target position lower 4 digits		0
474	Fifth target position upper 4 digits		0
475	Sixth target position lower 4 digits		0
476	Sixth target position upper 4 digits		0
477	Seventh target position lower 4 digits		0
478	Seventh target position upper 4 digits		0
479	Eighth target position lower 4 digits		0
480	Eighth target position upper 4 digits		0
481	Ninth target position lower 4 digits		0
482	Ninth target position upper 4 digits		0
483	Tenth target position lower 4 digits		0
484	Tenth target position upper 4 digits		0
485	Eleventh target position lower 4 digits		0
486	Eleventh target position upper 4 digits		0
487	Twelfth target position lower 4 digits		0
488	Twelfth target position upper 4 digits	0–9999	0
489	Thirteenth target position lower 4 digits		0
490	Thirteenth target position upper 4 digits		0
491	Fourteenth target position lower 4 digits		0
492	Fourteenth target position upper 4 digits		0
493	Fifteenth target position lower 4 digits		0
494	Fifteenth target position upper 4 digits		0
495	Remote output selection	0, 1, 10, 11	0
496	Remote output data 1	0–4095	0
497	Remote output data 2	0–4095	0
498	PLC function flash memory clear	0–9999	0

Parameter	Name	Setting Range	Initial Value
500	Communication error execution waiting time	Parameter for communication options FR-A8NC, FR-A8ND, FR-A8NP	
501	Communication error occurrence count display		
502	Stop mode selection at communication error	0–3	0
503	Maintenance timer 1	0 (1–9998)	0
504	Maintenance timer 1 alarm output set time	0–9998, 9999	9999
505	Speed setting reference	1–590 Hz	60/50 Hz ⑤
516	S-pattern time at a start of acceleration	0.1–2.5 s	0.1 s
517	S-pattern time at a completion of acceleration	0.1–2.5 s	0.1 s
518	S-pattern time at a start of deceleration	0.1–2.5 s	0.1 s
519	S-pattern time at a completion of deceleration	0.1–2.5 s	0.1 s
522	Output stop frequency	0–590 Hz, 9999	9999
539	Modbus-RTU communication check time interval	0–999.8 s,9999	9999
541	Frequency command sign selection	Parameter for communication options FR-A8NC, FR-A8NCE, FR-A8NP	
542	Communication station number (CC-Link)	Parameter for option FR-A8NC (CC-Link communication)	
543	Baud rate selection (CC-Link)		
544	CC-Link extended setting		
547	USB communication station number	0–31	0
548	USB communication check time interval	0–999.8 s, 9999	9999
549	Protocol selection	0, 1	0
550	NET mode operation command source selection	0, 1, 9999	9999
551	PU mode operation command source selection	1–3, 9999	9999
552	Frequency jump range	0–30 Hz, 9999	9999
553	PID deviation limit	0–100%, 9999	9999
554	PID signal operation selection	0–3, 10–13	0
555	Current average time	0.1–1.0 s	1 s
556	Data output mask time	0–20 s	0 s
557	Current average value monitor signal output reference current	0–500A ① / 0–3600A ①	Rated inverter current
560	Second frequency search gain	0–32767, 9999	9999
561	PTC thermistor protection level	0.5–30 kΩ, 9999	9999

Parameter	Name	Setting Range	Initial Value
563	Energization time carrying-over times	(0–65535)	0
564	Operating time carrying-over times	(0–65535)	0
569	Second motor speed control gain	0–200 %, 9999	9999
570	Multiple rating setting	0–3/0–3/ 1, 2 ⑩	2
571	Holding time at a start	0–10 s, 9999	9999
573	4mA input check selection	1–4, 9999	9999
574	Second motor online auto tuning	0, 1	0
575	Output interruption detection time	0–3600 s, 9999	1s
576	Output interruption detection level	0–590 Hz	0 Hz
577	Output interruption release level	900–1100 %	1000 %
592	Traverse function selection	0–2	0
593	Maximum amplitude amount	0–25 %	10 %
594	Amplitude compensation amount during deceleration	0–50 %	10 %
595	Amplitude compensation amount during acceleration	0–50 %	10 %
596	Amplitude acceleration time	0.1–3600 s	5 s
597	Amplitude deceleration time	0.1–3600 s	5 s
598 ⑨	Undervoltage level	350–430 V, 9999	9999
599	X10 terminal input selection	0, 1	0/1/0 ⑩
600	First free thermal reduction frequency 1	0–590 Hz, 9999	9999
601	First free thermal reduction ratio 1	1–100 %	100 %
602	First free thermal reduction frequency 2	0–590 Hz, 9999	9999
603	First free thermal reduction ratio 2	1–100 %	100 %
604	First free thermal reduction frequency 3	0–590 Hz, 9999	9999
607	Motor permissible load level	110–250 %	150 %
608	Second motor permissible load level	110–250 %, 9999	9999
609	PID set point/deviation input selection	1–5	2
610	PID measured value input selection	1–5	3

Parameter	Name	Setting Range	Initial Value
611	Acceleration time at a restart	0–3600 s, 9999	9999
639	Brake opening current selection	0, 1	0
640	Brake operation frequency selection	0, 1	0
641	Second brake sequence operation selection	0, 7, 8, 9999	0
642	Second brake opening frequency	0–30 Hz	3 Hz
643	Second brake opening current	0–400 %	130 %
644	Second brake opening current detection time	0–2 s	0.3 s
645	Second brake operation time at start	0–5 s	0.3 s
646	Second brake operation frequency	0–30 Hz	6 Hz
647	Second brake operation time at stop	0–5 s	0.3 s
648	Second deceleration detection function selection	0, 1	0
650	Second brake opening current selection	0, 1	0
651	Second brake operation frequency selection	0, 1	0
653	Speed smoothing control	0–200 %	0 %
654	Speed smoothing cutoff frequency	0–120 Hz	20 Hz
655	Analog remote output selection	0, 1, 10, 11	0
656	Analog remote output 1	800–1200 %	1000 %
657	Analog remote output 2	800–1200 %	1000 %
658	Analog remote output 3	800–1200 %	1000 %
659	Analog remote output 4	800–1200 %	1000 %
660	Increased magnetic excitation deceleration operation selection	0, 1	0
661	Magnetic excitation increase rate	0–40 %, 9999	9999
662	Increased magnetic excitation current level	0–300 %	100 %
663	Control circuit temperature signal output level	0–100 °C	0 °C
665	Regeneration avoidance frequency gain	0–200 %	100 %
668 ⑫	Power failure stop frequency gain	0–200 %	100 %
684	Tuning data unit switchover	0, 1	0
686	Maintenance timer 2	0 (1–9998)	0
687	Maintenance timer 2 warning output set time	0–9998, 9999	9999
688	Maintenance timer 3	0 (1–9998)	0
689	Maintenance timer 3 warning output set time	0–9998, 9999	9999

Parameter	Name	Setting Range	Initial Value
690	Deceleration check time	0–3600 s, 9999	1 s
692	Second free thermal reduction frequency 1	0–590 Hz, 9999	9999
693	Second free thermal reduction ratio 1	1–100 %	100 %
694	Second free thermal reduction frequency 2	0–590 Hz, 9999	9999
695	Second free thermal reduction ratio 2	1–100 %	100 %
696	Second free thermal reduction frequency 3	0–590 Hz, 9999	9999
699	Input terminal filter	5–50 ms, 9999	9999
702	Maximum motor frequency	0–400 Hz, 9999	9999
706	Induced voltage constant (phi f)	0–5000 mV/(rad/s), 9999	9999
707	Motor inertia (integer)	10–999, 9999	9999
711	Motor Ld decay ratio	0–100 %, 9999	9999
712	Motor Lq decay ratio	0–100 %, 9999	9999
717	Starting resistance tuning compensation	0–200 %, 9999	9999
721	Starting magnetic pole position detection pulse width	0–6000 µs, 10000–16000 µs, 9999	9999
724	Motor inertia (exponent)	0–7, 9999	9999
725	Motor protection current level	100–500 %, 9999	9999
738	Second motor induced voltage constant (phi f)	0–5000 mV/(rad/s), 9999	9999
739	Second motor Ld decay ratio	0–100 %, 9999	9999
740	Second motor Lq decay ratio	0–100 %, 9999	9999
741	Second starting resistance tuning compensation	0–200 %, 9999	9999
742	Second motor magnetic pole detection pulse width	0–6000 µs, 10000–16000 µs, 9999	9999
743	Second motor maximum frequency	0–400 Hz, 9999	9999
744	Second motor inertia (integer)	10–999, 9999	9999
745	Second motor inertia (exponent)	0–7, 9999	9999
746	Second motor protection current level	100–500 %, 9999	9999

Parameter	Name	Setting Range	Initial Value
747	Second motor low-speed range torque characteristic selection	0, 9999	9999
753	Second PID action selection	0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010, 1011, 2000, 2001, 2010, 2011	0
754	Second PID control automatic switch-over frequency	0–590 Hz,9999	9999
755	Second PID action set point	0–100 %,9999	9999
756	Second PID proportional band	0.1–1000 %,9999	100%
757	Second PID integral time	0.1–3600 s,9999	1 s
758	Second PID differential time	0.01–10.00 s, 9999	9999
759	PID unit selection	0–43, 9999	9999
760	Pre-charge fault selection	0, 1	0
761	Pre-charge ending level	0–100 %, 9999	9999
762	Pre-charge ending time	0–3600 s, 9999	9999
763	Pre-charge upper detection level	0–100 %, 9999	9999
764	Pre-charge time limit	0–3600 s, 9999	9999
765	Second pre-charge fault selection	0, 1	0%
766	Second pre-charge ending level	0–100 %,9999	9999
767	Second pre-charge ending time	0–3600 s, 9999	9999
768	Second pre-charge upper detection level	0–100 %,9999	9999
769	Second pre-charge time limit	0–3600 s,9999	9999
774	Operation panel monitor selection 1	1–3, 5–14, 17–20, 22–35, 38, 40–45, 50–57, 61, 62, 64, 67, 87–98, 100, 9999	9999
775	Operation panel monitor selection 2		9999
776	Operation panel monitor selection 3		9999

Parameter	Name	Setting Range	Initial Value
777	4mA input fault operation frequency	0–590 Hz, 9999	9999
778	4mA input check filter	0–10 s	0
779	Operation frequency during communication error	0–590 Hz,9999	9999
788	Low speed range torque characteristic selection	0, 9999	9999
791	Acceleration time in low-speed range	0–3600 s, 9999	9999
792	Deceleration time in low-speed range	0–3600 s, 9999	9999
799	Pulse increment setting for output power	0.1, 1, 10, 100, 1000kWh	1 kWh
800	Control method selection	0–6, 9–14, 20, 100–106, 109–114	20
802	Pre-excitation selection	0, 1	0
803	Constant output range torque characteristic selection	0, 1, 10, 11	0
804	Torque command source selection	0, 1, 3–6	0
805	Torque command value (RAM)	600–1400 %	1000 %
806	Torque command value (RAM, EEPROM)	600–1400 %	1000 %
807	Speed limit selection	0–2	0
808	Forward rotation speed limit/speed limit	0–400 Hz	60/50 Hz ⑤
809	Reverse rotation speed limit/reverse-side speed limit	0–400 Hz, 9999	9999
810	Torque limit input method selection	0, 1	0
811	Set resolution switchover	0, 1, 10, 11	0
812	Torque limit level (regeneration)	0–400 %, 9999	9999
813	Torque limit level (3rd quadrant)	0–400 %, 9999	9999
814	Torque limit level (4th quadrant)	0–400 %, 9999	9999
815	Torque limit level 2	0–400 %, 9999	9999
816	Torque limit level during acceleration	0–400 %, 9999	9999
817	Torque limit level during deceleration	0–400 %, 9999	9999
818	Easy gain tuning response level setting	1–15	2
819	Easy gain tuning selection	0–2	0
820	Speed control P gain 1	0–1000 %	60 %
821	Speed control integral time 1	0–20 s	0.333 s
822	Speed setting filter 1	0–5 s, 9999	9999
823 ③	Speed detection filter 1	0–0.1 s	0.001 s

Parameter	Name	Setting Range	Initial Value
824	Torque control P gain 1 (current loop proportional gain)	0–500 %	100 %
825	Torque control integral time 1 (current loop integral time)	0–500 ms	5 ms
826	Torque setting filter 1	0–5 s, 9999	9999
827	Torque detection filter 1	0–0.1 s	0 s
828	Model speed control gain	0–1000 %	60 %
830	Speed control P gain 2	0–1000 %,9999	9999
831	Speed control integral time 2	0–20 s, 9999	9999
832	Speed setting filter 2	0–5 s, 9999	9999
833 ③	Speed detection filter 2	0–0.1 s, 9999	9999
834	Torque control P gain 2	0–500 %, 9999	9999
835	Torque control integral time 2	0–500 ms, 9999	9999
836	Torque setting filter 2	0–5 s, 9999	9999
837	Torque detection filter 2	0–0.1 s, 9999	9999
840 ③	Torque bias selection	0–3, 24, 25, 9999	9999
841 ③	Torque bias 1	600–1400 %, 9999	9999
842 ③	Torque bias 2	600–1400 %, 9999	9999
843 ③	Torque bias 3	600–1400 %, 9999	9999
844 ③	Torque bias filter	0–5 s, 9999	9999
845 ③	Torque bias operation time	0–5 s, 9999	9999
846 ③	Torque bias balance compensation	0–10 V, 9999	9999
847 ③	Fall-time torque bias terminal 1 bias	0–400 %, 9999	9999
848 ③	Fall-time torque bias terminal 1 gain	0–400 %, 9999	9999
849	Analog input offset adjustment	0–200 %	100 %
850	Brake operation selection	0–2	0
853 ③	Speed deviation time	0–100 s	1 s
854	Excitation ratio	0–100 %	100 %
858	Terminal 4 function assignment	0, 1, 4, 9999	0
859	Torque current/Rated PM motor current	0–500 A, 9999 ① 0–3600 A, 9999 ①	9999
860	Second motor torque current/Rated PM motor current	0–500 A, 9999 ① 0–3600 A, 9999 ①	9999
864	Torque detection	0–400 %	150 %
865	Low speed detection	0–590 Hz	1.5 Hz
866	Torque monitoring reference	0–400 %	150 %
867	AM output filter	0–5 s	0.01 s
868	Terminal 1 function assignment	0–6, 9999	0
869 ⑥	Current output filter	0–5 s	0.02 s
870	Speed detection hysteresis	0–5 Hz	0 Hz
872 ⑫	Input phase loss protection selection	0, 1	0
873 ③	Speed limit	0–400 Hz	20 Hz
874	OLT level setting	0–400 %	150 %
875	Fault definition	0, 1	0
877	Speed feed forward control/model adaptive speed control selection	0–2	0
878	Speed feed forward filter	0–1 s	0 s
879	Speed feed forward torque limit	0–400 %	150 %
880	Load inertia ratio	0–200 times	7 times
881	Speed feed forward gain	0–1000 %	0 %
882	Regeneration avoidance operation selection	0–2	0
883	Regeneration avoidance operation level	300–800 V	380 V DC/ 760 V DC ②
884	Regeneration avoidance at deceleration detection sensitivity	0–5	0
885	Regeneration avoidance compensation frequency limit value	0–590 Hz, 9999	6 Hz
886	Regeneration avoidance voltage gain	0–200 %	100 %
888	Free parameter 1	0–9999	9999
889	Free parameter 2	0–9999	9999
891	Cumulative power monitor digit shifted times	0–4, 9999	9999
892	Load factor	30–150 %	100 %
893	Energy saving monitor reference (motor capacity)	0.1–55 kW ① / 0–3600 kW ①	Rated inverter capacity
894	Control selection during commercial power-supply operation	0–3	0
895	Power saving rate reference value	0, 1, 9999	9999
896	Power unit cost	0–500, 9999	9999
897	Power saving monitor average time	0, 1–1000 h, 9999	9999
898	Power saving cumulative monitor clear	0, 1, 10, 9999	9999
899	Operation time rate (estimated value)	0–100 %, 9999	9999
C0 (900) ④	FM/CA terminal calibration ⑤	—	—
C1 (901) ④	AM terminal calibration	—	—

Parameter	Name	Setting Range	Initial Value
C2 (902) ④	Terminal 2 frequency setting bias frequency	0–590 Hz	0 Hz
C3 (902) ④	Terminal 2 frequency setting bias	0–300 %	0 %
125 (903) ④	Terminal 2 frequency setting gain frequency	0–590 Hz	60/50 Hz ⑤
C4 (903) ④	Terminal 2 frequency setting gain	0–300 %	100 %
C5 (904) ④	Terminal 4 frequency setting bias frequency	0–590 Hz	0 Hz
C6 (904) ④	Terminal 4 frequency setting bias	0–300 %	20 %
126 (905) ④	Terminal 4 frequency setting gain frequency	0–590 Hz	60/50 Hz ⑤
C7 (905) ④	Terminal 4 frequency setting gain	0–300 %	100 %
C8 (930) ④,⑥	Current output bias signal	0–100 %	0 %
C9 (930) ④,⑥	Current output bias current	0–100 %	0 %
C10 (931) ④,⑥	Current output gain signal	0–100 %	100 %
C11 (931) ④,⑥	Current output gain current	0–100 %	100 %
C12 (917) ④	Terminal 1 bias frequency (speed)	0–590 Hz	0 Hz
C13 (917) ④	Terminal 1 bias (speed)	0–300 %	0 %
C14 (918) ④	Terminal 1 gain frequency (speed)	0–590 Hz	60/50 Hz ⑤
C15 (918) ④	Terminal 1 gain (speed)	0–300 %	100 %
C16 (919) ④	Terminal 1 bias command (torque/ magnetic flux)	0–400 %	0 %
C17 (919) ④	Terminal 1 bias (torque/ magnetic flux)	0–300 %	0 %
C18 (920)	Terminal 1 gain command (torque/ magnetic flux)	0–400 %	150 %
C19 (920) ④	Terminal 1 gain (torque/ magnetic flux)	0–300 %	100 %
C38 (932) ④	Terminal 4 bias command (torque/ magnetic flux)	0–400%	0%
C39 (932) ④	Terminal 4 bias (torque/ magnetic flux)	0–300 %	20 %
C40 (933) ④	Terminal 4 gain command (torque/ magnetic flux)	0–400 %	150 %
C41 (933) ④	Terminal 4 gain (torque/ magnetic flux)	0–300 %	100 %
C42 (934) ④	PID display bias coefficient	0–500.00, 9999	9999
C43 (934) ④	PID display bias analog value	0–300.0 %	20 %
C44 (935) ④	PID display gain coefficient	0–500.00, 9999	9999
C45 (935) ④	PID display gain analog value	0–300.0 %	100 %
977	Input voltage mode selection	0, 1	0
989	Parameter copy alarm release	10 ① 100 ①	10 ① 100 ①
990	PU buzzer control	0, 1	1
991	PU contrast adjustment	0–63	58
992	Operation panel setting dial push monitor selection	0–3, 5–14, 17–20, 22–35, 38, 40–45, 50–57, 61, 62, 64, 67, 87–97, 100	0
994	Droop break point gain	0.1–100 %, 9999	9999
995	Droop break point torque	0.1–100 %	100 %
997	Fault initiation	0–255, 9999	9999
998	PM parameter initialization Simple	0, 3003, 3103, 8009, 8109, 9009, 9109	0
999	Automatic parameter setting Simple	1, 2, 10–13, 20, 21, 9999	9999
1002	Lq tuning target current adjustment coefficient	50–150 %, 9999	9999
1003	Notch filter frequency	0, 8–1250 Hz	0
1004	Notch filter depth	0–3	0
1005	Notch filter width	0–3	0
1006	Clock (year)	2000–2099	2000
1007	Clock (month, day)	101–131, 201–229, 301–331, 401–430, 501–531, 601–630, 701–731, 801–831, 901–930, 1001–1031, 1101–1130, 1201–1231	101

Parameter	Name	Setting Range	Initial Value
1008	Clock (hour, minute)	0–59, 100–159, 200–259, 300–359, 400–459, 500–559, 600–659, 700–759, 800–859, 900–959, 1000–1059, 1100–1159, 1200–1259, 1300–1359, 1400–1459, 1500–1559, 1600–1659, 1700–1759, 1800–1859, 1900–1959, 2000–2059, 2100–2159, 2200–2259, 2300–2359	0
1019	Analog meter voltage negative output selection	Parameter for option FR-A8AY	
1020	Trace operation selection	0–4	0
1021	Trace mode selection	0–2	0
1022	Sampling cycle	0–9	2
1023	Number of analog channels	1–8	4
1024	Sampling auto start	0, 1	0
1025	Trigger mode selection	0–4	0
1026	Number of sampling before trigger	0–100 %	90 %

Parameter	Name	Setting Range	Initial Value
1027	Analog source selection (1ch)	1–3, 5–14, 17–20, 22–24, 32–35, 40–42, 52–54, 61, 62, 64, 67, 87–98, 201–213, 222–227, 230–238, 240–247, 251–254	201
1028	Analog source selection (2ch)		202
1029	Analog source selection (3ch)		203
1030	Analog source selection (4ch)		204
1031	Analog source selection (5ch)		205
1032	Analog source selection (6ch)		206
1033	Analog source selection (7ch)		207
1034	Analog source selection (8ch)		208
1035	Analog trigger channel	1–8	1
1036	Analog trigger operation selection	0, 1	0
1037	Analog trigger level	600–1400	1000
1038	Digital source selection (1ch)	1–255	1
1039	Digital source selection (2ch)		2
1040	Digital source selection (3ch)		3
1041	Digital source selection (4ch)		4
1042	Digital source selection (5ch)		5
1043	Digital source selection (6ch)		6
1044	Digital source selection (7ch)		7
1045	Digital source selection (8ch)		8
1046	Digital trigger channel	1–8	1
1047	Digital trigger operation selection	0, 1	0
1048	Display-off waiting time	0–60 min	0 min
1049	USB host reset	0, 1	0
1072	DC brake judgment time for swinging suppression control operation	0–10 s	3 s
1073	Swinging suppression control operation selection	0, 1	0

Parameter	Name	Setting Range	Initial Value
1074	Swinging suppression frequency	0.05–3 Hz, 9999	1 Hz
1075	Swinging suppression depth	0–3	0
1076	Swinging suppression width	0–3	0
1077	Rope length	0.1–50 m	1 m
1078	Trolley weight	1–50000 kg	1 kg
1079	Load weight	1–50000 kg	1 kg
1103	Deceleration time at emergency stop	0–3600 s	5 s
1106	Torque monitor filter	0–5 s, 9999	9999
1107	Running speed monitor filter	0–5 s, 9999	9999
1108	Excitation current monitor filter	0–5 s, 9999	9999
1109	PROFIBUS communication command source selection	Parameter for option FR-A8NP	
1110	PROFIBUS format selection		
1113	Speed limit method selection	0–2, 10, 9999	9999
1114	Torque command reverse selection	0, 1	1
1115	Speed control integral term clear time	0–9998 ms	0 s
1116	Constant output range speed control P gain compensation	0–100 %	0 %
1117	Speed control P gain1 (per-unit system)	0–300, 9999	9999
1118	Speed control P gain2 (per-unit system)	0–300, 9999	9999
1119	Model speed control gain (per-unit system)	0–300, 9999	9999
1121	Per-unit speed control reference frequency	0–400 Hz 60 Hz ①	120 Hz ①
1134	PID upper limit manipulated value	0–100 %	100 %
1135	PID lower limit manipulated value	0–100 %	100 %
1136	Second PID display bias coefficient	0–500, 9999	9999
1137	Second PID display bias analog value	0–300 %	20 %
1138	Second PID display gain coefficient	0–500, 9999	9999
1139	Second PID display gain analog value	0–300 %	100 %
1140	Second PID set point/ deviation input selection	1–5	2
1141	Second PID measured value input selection	1–5	3
1142	Second PID unit selection	0–43, 9999	9999
1143	Second PID upper limit	0–100 %, 9999	9999
1144	Second PID lower limit	0–100 %, 9999	9999

Parameter	Name	Setting Range	Initial Value
1145	Second PID deviation limit	0.0–100.0 %, 9999	9999
1146	Second PID signal operation selection	0–3, 10–13	0
1147	Second output interruption detection time	0–3600 s, 9999	1 s
1148	Second output interruption detection level	0–590 Hz	0 Hz
1149	Second output interruption cancel level	900–1100 %	1000 %
1150–1199	PLC function user parameters1 to 50	0–65535	0
1220	Target position/speed selection	0–2	0
1221	Start command edge detection selection	0, 1	0
1222	First positioning acceleration time	0.01–360 s	5 s
1223	First positioning deceleration time	0.01–360 s	5 s
1224	First positioning dwell time	0–20000 ms	0 ms
1225	First positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1226	Second positioning acceleration time	0.01–360 s	5 s
1227	Second positioning deceleration time	0.01–360 s	5 s
1228	Second positioning dwell time	0–20000 ms	0 ms
1229	Second positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1230	Third positioning acceleration time	0.01–360 s	5 s
1231	Third positioning deceleration time	0.01–360 s	5 s
1232	Third positioning dwell time	0–20000 ms	0 ms
1233	Third positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1234	Fourth positioning acceleration time	0.01–360 s	5 s
1235	Fourth positioning deceleration time	0.01–360 s	5 s
1236	Fourth positioning dwell time	0–20000 ms	0 ms
1237	Fourth positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1238	Fifth positioning acceleration time	0.01–360 s	5 s
1239	Fifth positioning deceleration time	0.01–360 s	5 s

Parameter	Name	Setting Range	Initial Value
1240	Fifth positioning dwell time	0–20000 ms	0 ms
1241	Fifth positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1242	Sixth positioning acceleration time	0.01–360 s	5 s
1243	Sixth positioning deceleration time	0.01–360 s	5 s
1244	Sixth positioning dwell time	0–20000 ms	0 ms
1245	Sixth positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1246	Seventh positioning acceleration time	0.01–360 s	5 s
1247	Seventh positioning deceleration time	0.01–360 s	5 s
1248	Seventh positioning dwell time	0–20000 ms	0 ms
1249	Seventh positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1250	Eighth positioning acceleration time	0.01–360 s	5 s
1251	Eighth positioning deceleration time	0.01–360 s	5 s
1252	Eighth positioning dwell time	0–20000 ms	0 ms
1253	Eighth positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1254	Ninth positioning acceleration time	0.01–360 s	5 s
1255	Ninth positioning deceleration time	0.01–360 s	5 s
1256	Ninth positioning dwell time	0–20000 ms	0 ms
1257	Ninth positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1258	Tenth positioning acceleration time	0.01–360 s	5 s
1259	Tenth positioning deceleration time	0.01–360 s	5 s
1260	Tenth positioning dwell time	0–20000 ms	0 ms
1261	Tenth positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1262	Eleventh positioning acceleration time	0.01–360 s	5 s
1263	Eleventh positioning deceleration time	0.01–360 s	5 s
1264	Eleventh positioning dwell time	0–20000 ms	0 ms
1265	Eleventh positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1266	Twelfth positioning acceleration time	0.01–360 s	5 s
1267	Twelfth positioning deceleration time	0.01–360 s	5 s
1268	Twelfth positioning dwell time	0–20000 ms	0 ms
1269	Twelfth positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1270	Thirteenth positioning acceleration time	0.01–360 s	5 s
1271	Thirteenth positioning deceleration time	0.01–360 s	5 s
1272	Thirteenth positioning dwell time	0–20000 ms	0 ms
1273	Thirteenth positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1274	Fourteenth positioning acceleration time	0.01–360 s	5 s
1275	Fourteenth positioning deceleration time	0.01–360 s	5 s
1276	Fourteenth positioning dwell time	0–20000 ms	0 ms
1277	Fourteenth positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1278	Fifteenth positioning acceleration time	0.01–360 s	5 s
1279	Fifteenth positioning deceleration time	0.01–360 s	5 s
1280	Fifteenth positioning dwell time	0–20000 ms	0 ms
1281	Fifteenth positioning sub-function	0, 1, 10, 11, 100, 101, 110, 111	10
1282	Home position return method selection	0–6	4
1283	Home position return speed	0–30 Hz	2 Hz
1284	Home position return creep speed	0–10 Hz	0.5 Hz
1285	Home position shift amount lower 4 digits	0–9999	0
1286	Home position shift amount upper 4 digits	0–9999	0
1287	Travel distance after proximity dog ON lower 4 digits	0–9999	2048
1288	Travel distance after proximity dog ON upper 4 digits	0–9999	0
1289	Home position return stopper torque	0–200 %	40 %

Param-eter	Name	Setting Range	Initial Value
1290	Home position return stopper waiting time	0–10 s	0.5 s
1292	Position control terminal input selection	0, 1	0
1293	Roll feeding mode selection	0, 1	0
1294	Position detection lower 4 digits	0–9999	0
1295	Position detection upper 4 digits	0–9999	0
1296	Position detection selection	0–2	0
1297	Position detection hysteresis width	0–32767	0
1300 – 1343	Communication option parameters		
1350– 1359			
Pr.CLR	Parameter clear	(0,) 1	0
ALL.CL	All parameter clear	(0,) 1	0
Err.CL	Fault history clear	(0,) 1	0
Pr.CPY	Parameter copy	(0,) 1–3	0
Pr.CHG	Initial value change list	—	—
IPM	IPM initialization	0, 3003	0
AUTO	Automatic parameter setting	—	—
Pr.Md	Group parameter setting	(0,) 1, 2	0

Remarks:

① Differs according to capacities.
② Differs according to the voltage class. (200V class/400V class)
③ The setting is available only when the FR-A8AP is mounted.
④ The parameter number in parentheses is the one for use with the parameter unit (FR-PU07).
⑤ Differs according to types. (FM type/CA type)
⑥ The setting is available only with the CA type.
⑦ The setting value "60" is only available for Pr. 178, and "61" is only for Pr. 179.
⑧ The setting values "92, 93, 192, 193" are only available for Pr. 190 to Pr. 194.
⑨ The setting is available only with the 400V class.
⑩ Differs according to model types (standard model, separated converter type, IP55 compatible model).
⑪ Setting available for standard models only.
⑫ Setting available for standard models and IP55 compatible models.

A.2 Sample applications

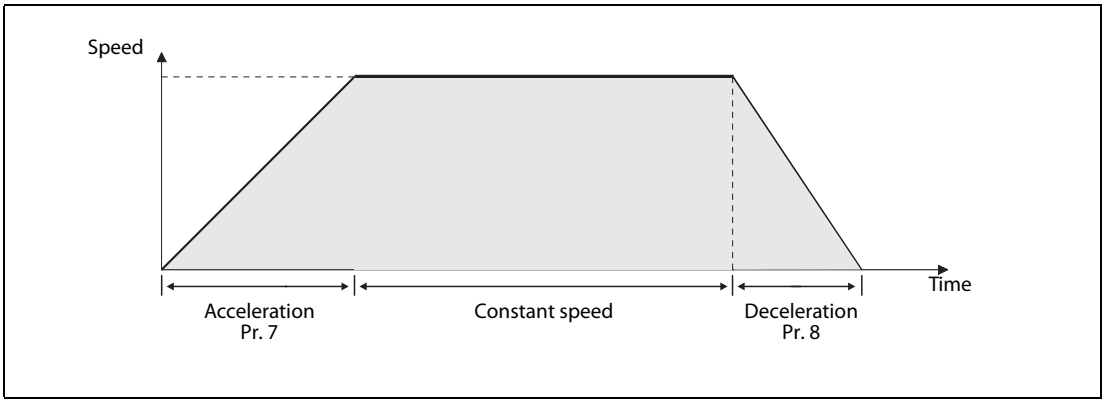
The applications in this section have been chosen to demonstrate some of the things that you can do with frequency inverters.

HINWEIS

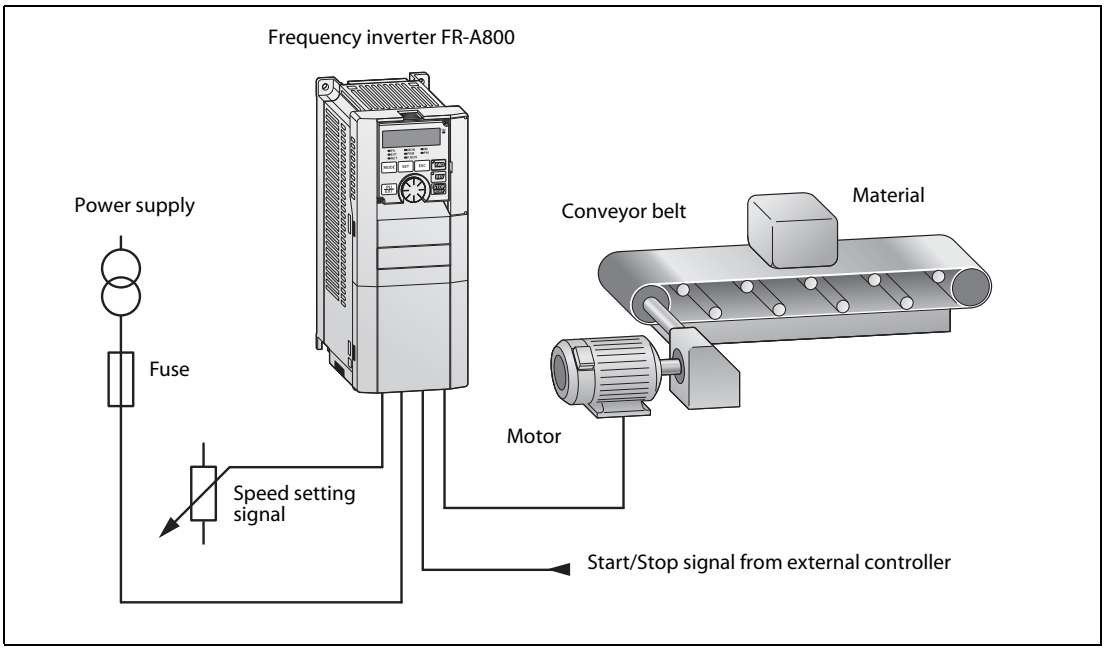
The wiring diagrams and the parameter settings are only provided to illustrate these specific examples. They should not be copied directly – you will need to wire and configure your inverter for the specific requirements of your own application.
When you are planning and installing your system please also be sure to observe all the relevant regulations and standards for electrical systems applicable in your location, particularly the safety regulations.

A.2.1 Conveyor belt

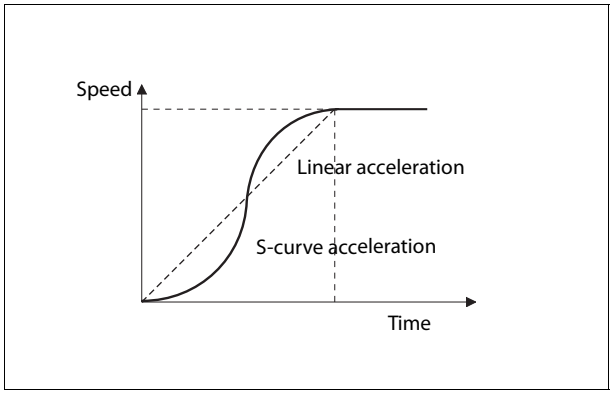
Frequency inverters are often used to control conveyor belts to feed parts and material to processing stations because they are able to accelerate and decelerate the drive gently.



In this example we are going to use an FR-A800 series inverter to power and control the belt using the speed/time pattern shown in the graph above.



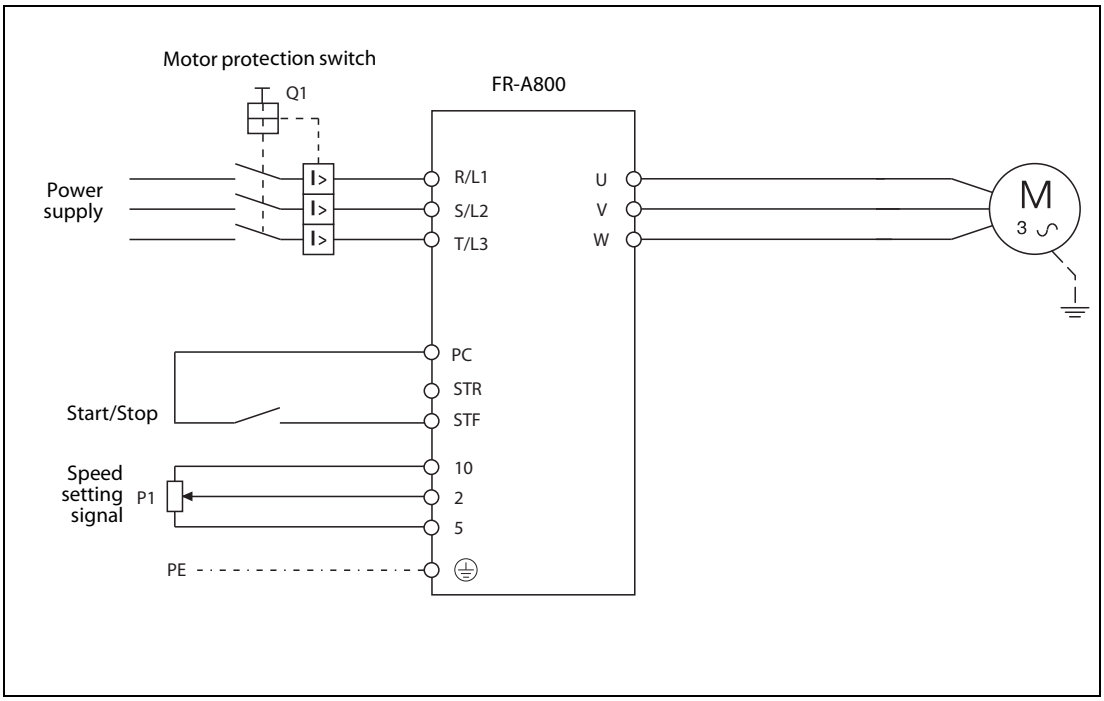
The configuration is as follows: The belt is started and stopped by an external controller (for example a PLC). The speed of the motor and thus of the conveyor belt can be adjusted with a setpoint potentiometer.



If the material on the belt still shifts when stopping and starting even with a gentle acceleration curve you can solve the problem by programming an S-curve for acceleration and deceleration, as shown in the graph on the left.

You can change the curve with parameter 29. A value of „0“ sets a linear acceleration/deceleration curve, a value of „1“ sets an S-curve.

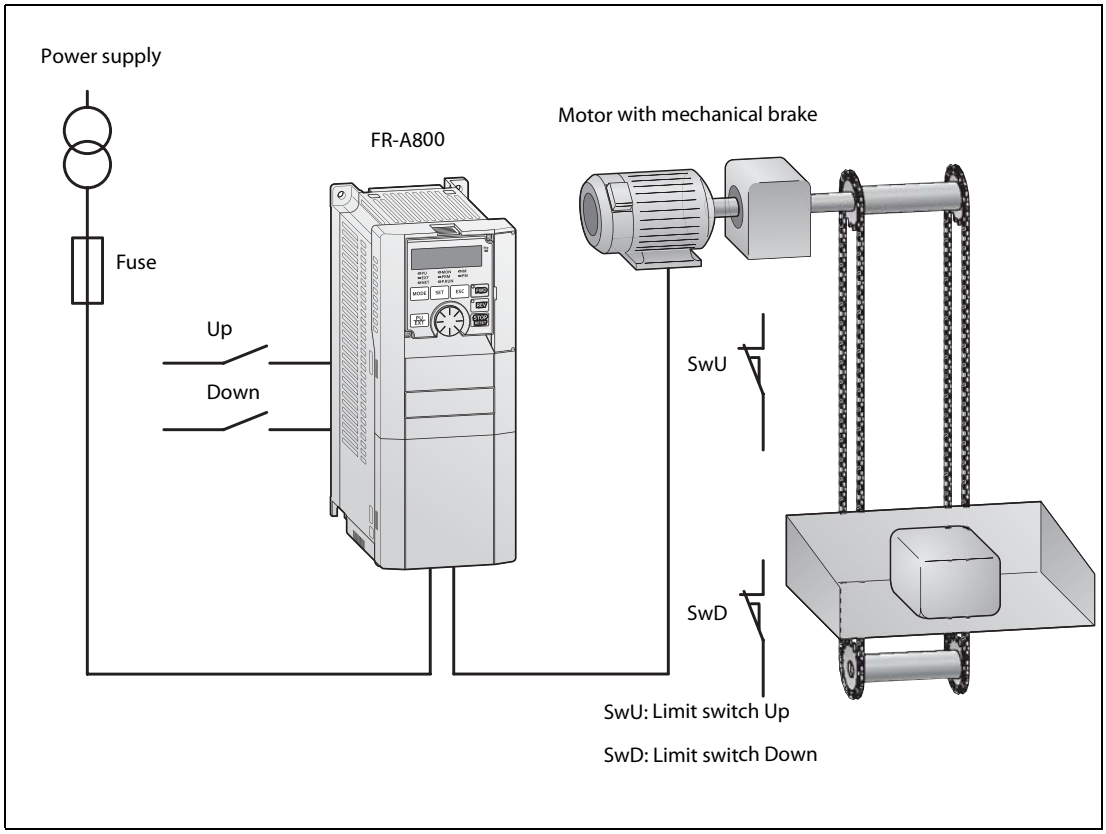
Wiring



A.2.2 Lifting drive

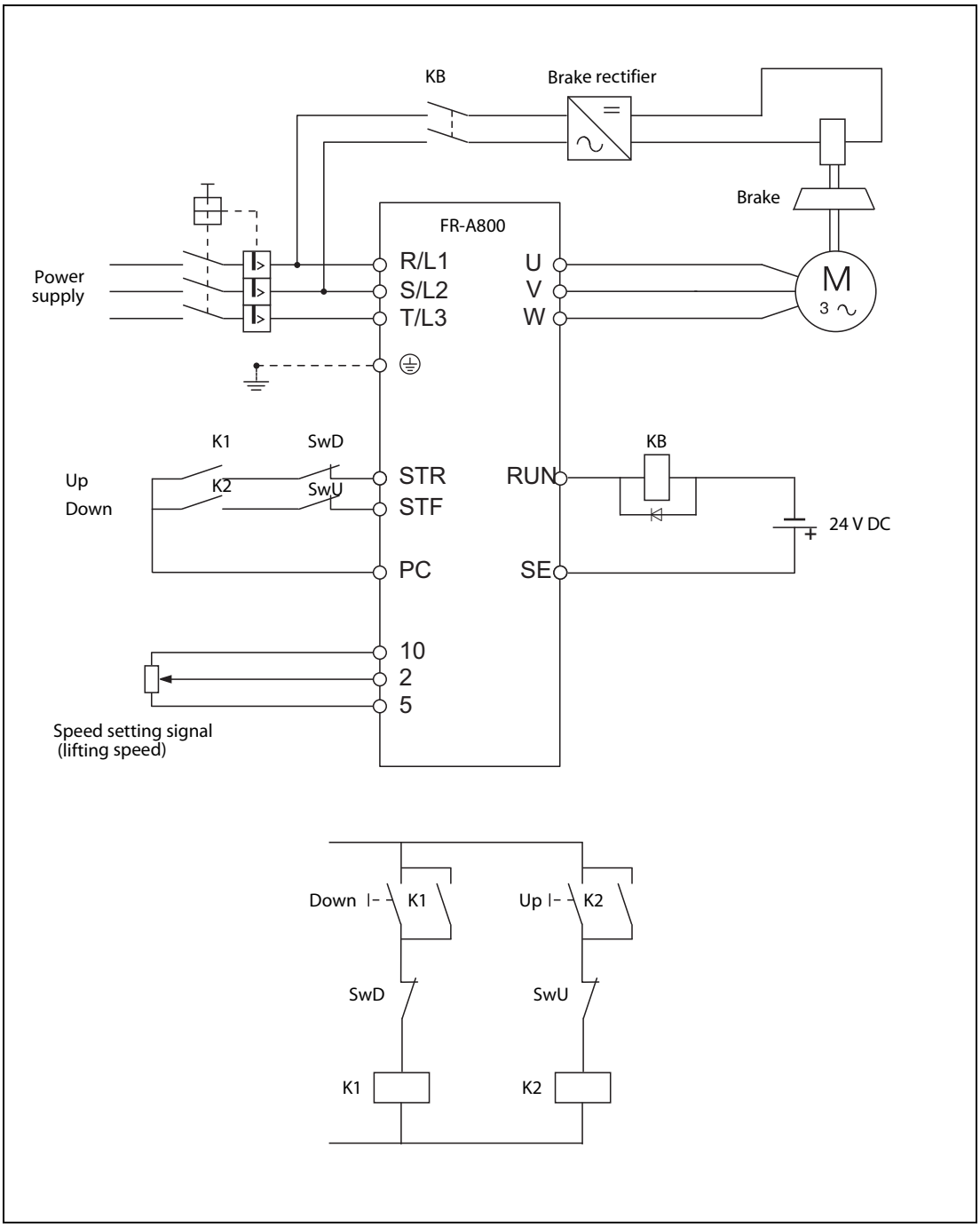
The illustration below shows the basic configuration of an inverter for powering a drive for lifting applications like hoists or roll-up gates. A motor with a mechanical brake is used to ensure that the load cannot slip down when the motor is off.

When the end position is reached the motor is turned off by a limit switch. After this it can only be activated in the other direction.



In the wiring diagram on the next page the mechanical brake is controlled via the RUN terminal. The frequency at which the brake is released can be set with parameter 13.

Wiring


KB
Brake rectifier
Brake
FR-A800
Power supply
R/L1
S/L2
T/L3
U
V
W
M
3 ~
K1
SwD
KB
Up
K2
SwU
STR
RUN
Down
STF
24 V DC
PC
SE
10
2
5
Speed setting signal (lifting speed)
Down
K1
Up
K2
SwD
SwU
K1
K2

A.2.3 PID controller

The FR-A800 series have integrated PID controllers, which makes it possible to use these inverters for applications in the process industry like flow and pressure regulation.

The setpoint value is stored internally in an inverter parameter or input as an external signal via input terminals 2. The actual value is input as an analog current signal (4-20mA) via input terminals 4.

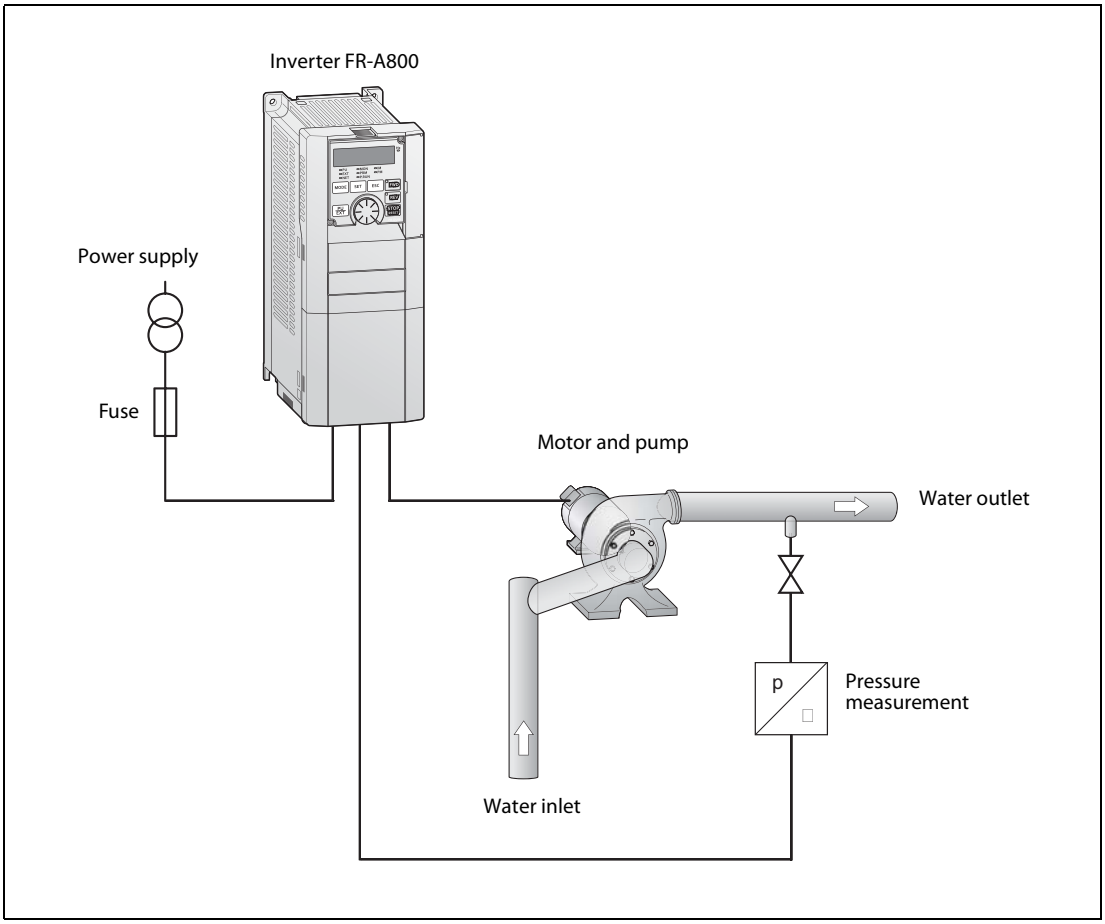
The inverter automatically adjusts its output frequency (the control variable) in response to the difference between the setpoint and actual values (the control deviation). This increases or decreases the speed of the motor to bring the actual value closer to the setpoint value.

The PID control action direction (forward/reverse) can be set with a parameter.

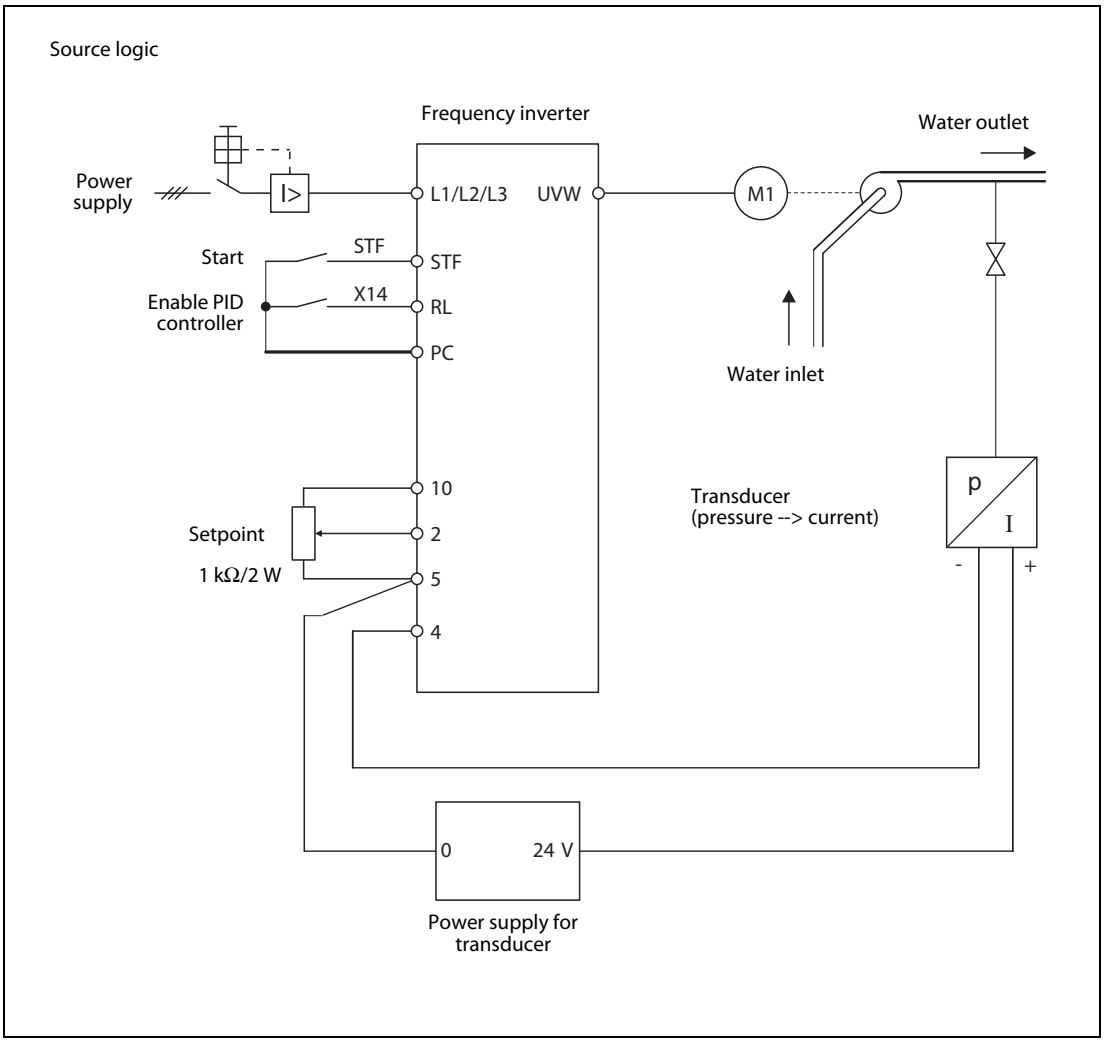
Control Direction	Controller Behaviour	Application (temperature control)
Forward	Actual > Setpoint: Increase control variable Actual < Setpoint: Decrease control variable	Cooling/refrigeration system
Reverse	Actual > Setpoint: Decrease control variable Actual < Setpoint: Increase control variable	Heating system

The illustration below shows a typical configuration for maintaining a constant pressure in the controlled system. The example shows the setup for this application for the FR-A800 inverter.

Schematic diagrams for two versions are included. In the first version an external setpoint signal is provided by a potentiometer connected to the input terminals, in the second the setpoint is set with the control unit and the value is stored in an inverter parameter.



External setpoint signal



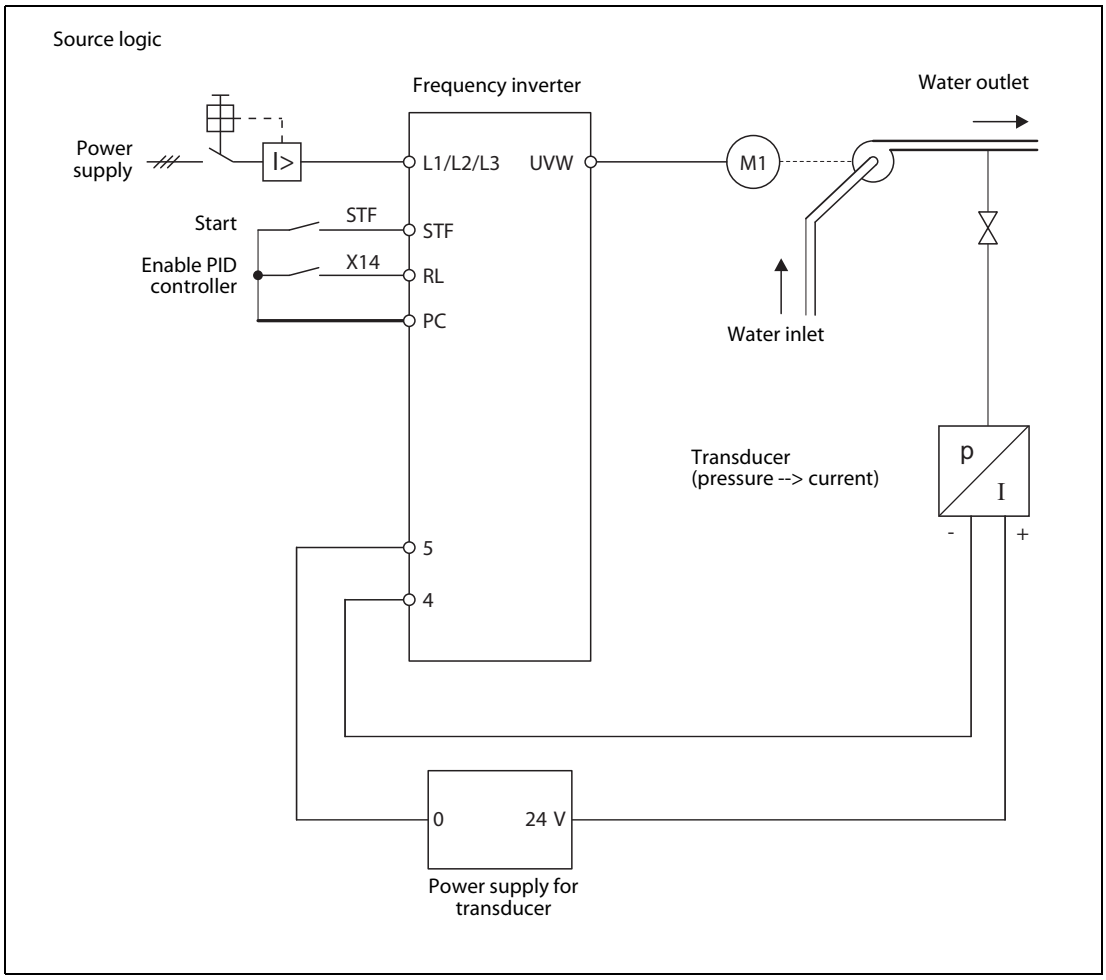
For the PID controller application using the configuration shown above you must also set the inverter parameters shown in the table below, in addition to the basic parameters.

Parameter	Function	Setting
180	RL terminal function selection	„14“ (enable PID control)
128	PID action selection	„20“ (reverse action)*

* In a pressure control application you increase pump speed when the actual value is smaller than the setpoint value.

Setpoint value set with parameters

In the configuration shown in the circuit diagram below the setpoint is entered via the parameter unit and stored in a parameter.



In addition to the basic parameters you must also set the following parameters for this configuration:

Parameter	Function	Setting
180	RL terminal function selection	„14“ (enable PID control)
128	PID action selection	„20“ (reverse action)
133	PID action setpoint	0 to 100 %

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