Frequency Inverters

Beginner's Guide

FR-D700
FR-E700
FR-F700
FR-A700

Art. no.: 203603
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Version B

MITSUBISHI ELECTRIC INDUSTRIAL AUTOMATION

About This Manual

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-D700, FR-E700, FR-F700 and FR-A700 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 *www.mitsubishi-automation.com*..

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Beginner's Guide for Frequency Inverters of the
FR-D700, FR-E700, FR-F700 and FR-A700 series
Art. no.: 203603

Version			**Revisions / Additions / Corrections**	
A	02/2007	pdp-dk	First edition	
B	08/2008	pdp-gb	General:	Replacement of the inverters FR-S500 und FR-E500 by the models FR-D700 and FR-E700

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- D700, FR-E700, FR-F700 and FR-A700 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-D700, FR-E700, FR-F700 and FR-A700 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 regulations
  - VBG Nr.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 Installation Guideline, the safety instruction levels are classified into "WARNING" and "DANGER".

DANGER:
Failure to observe the safety warnings identified with this symbol can result in health and injury hazards for the user.

WARNING:
Failure to observe the safety warnings identified with this symbol can result in damage to the equipment or other property.

Note that even warnings 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

DANGER

- *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.*
- *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.*

Fire Prevention

WARNING

- ***Mount the inverter to incombustible material. 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.***
- ***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.***

Injury Prevention

WARNING

- ***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

WARNING

- ***When carrying products, use correct lifting gear to prevent injury.***
- ***Do not stack the inverter boxes higher than the number recommended.***
- ***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 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.***
- ***Prevent other conductive bodies such as screws and metal fragments or other flammable substance such as oil from entering the inverter.***
- ***Use the inverter under the environmental conditions mentioned in chapter 1. Otherwise, the inverter may be damaged.***

Wiring

WARNING

- ***Do not install assemblies or components (e. g. power factor correction capacitors) on the inverter output side, which are not approved from Mitsubishi.***
- **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.**

Test operation and adjustment

WARNING

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

Operation

WARNING

- ***When you have chosen the retry function, stay away from the equipment as it will restart suddenly after an alarm stop.***
- ***The STOP/RESET key is valid only when the appropriate function setting has been made. Prepare an emergency stop switch separately.***
- ***Make sure that the start signal is off before resetting the inverter alarm. A failure to do so may restart the motor suddenly.***
- ***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.***
- ***The connected load of a inverter should be a three-phase induction motor only. 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.***
- ***The electronic thermal relay function does not guarantee protection of the motor from overheating.***
- ***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.***
- ***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.***

Emergency stop

WARNING

- ***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

WARNING

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

Contents

1 Introduction

2 Introduction to the Inverters

3 Connections

4 Start-Up

5 Operation and Settings

6 Parameter

7 Protective and Diagnostics Functions

A Appendix

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.

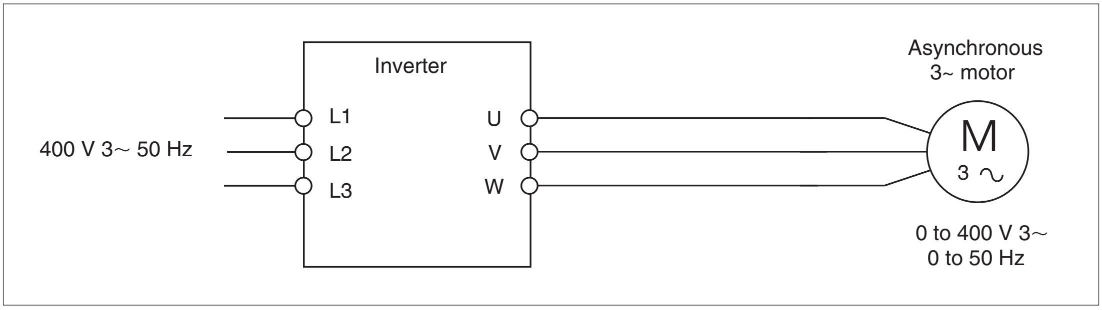
The speed of an asynchronous three-phase motor is determined by two factors:

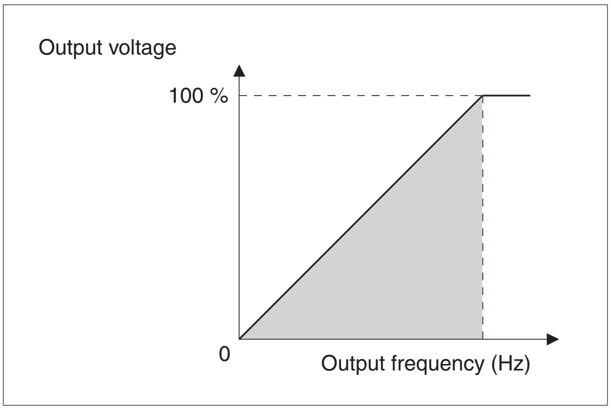
- The frequency of the three-phase current.
- The design of the motor winding (number of poles or pole pairs).

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-D700	FR-E700	FR-F700		FR-A700
				FR-F740	FR-F746	
Ambient temperature	for operation	–10°C to 50°C		–10°C to 50°C* –10°C to 40°C*	–10°C to 40°C* –10°C to 30°C*	–10°C to 50°C* –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		90% or less (non condensing)				
Vibration		5.9m/s^2 (0.6g) or less		5.9m/s^2 (0.6g) or less 2.9m/s^2 (0.3g) or less for inverter capacities 04320 or more		
Installation environment		Indoors (free from corrosive or flammable gas, oil mist, dust and dirt)				
Installation altitude		Maximum 1000m above sea level with no limitations. For altitudes above 1000m derate the inverter capacity by 3% for every additional 500m. Maximum installation altitude: 2500m (with 91% of the inverter rated capacity)				

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

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

- **Anticlockwise / Reverse**

PU Mode

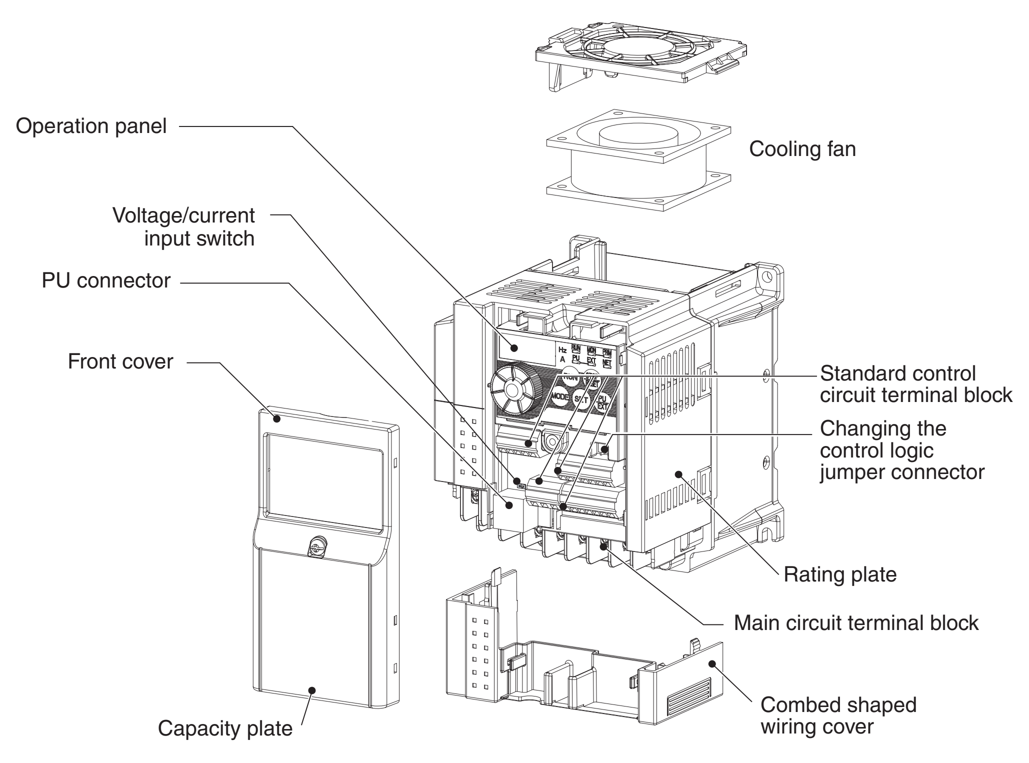
In PU (parameter unit) mode the inverter can be controlled with the integrated control unit or an optional external control unit (inverter control units often referred to as “parameter units”). The PU indicator LED lights up with the inverter is in PU mode.

PU Interface

An external control unit (parameter unit) can be connected to the inverter’s PU interface. Since this interface is actually an RS-485 port some inverters can also use it to communicate with other external devices.

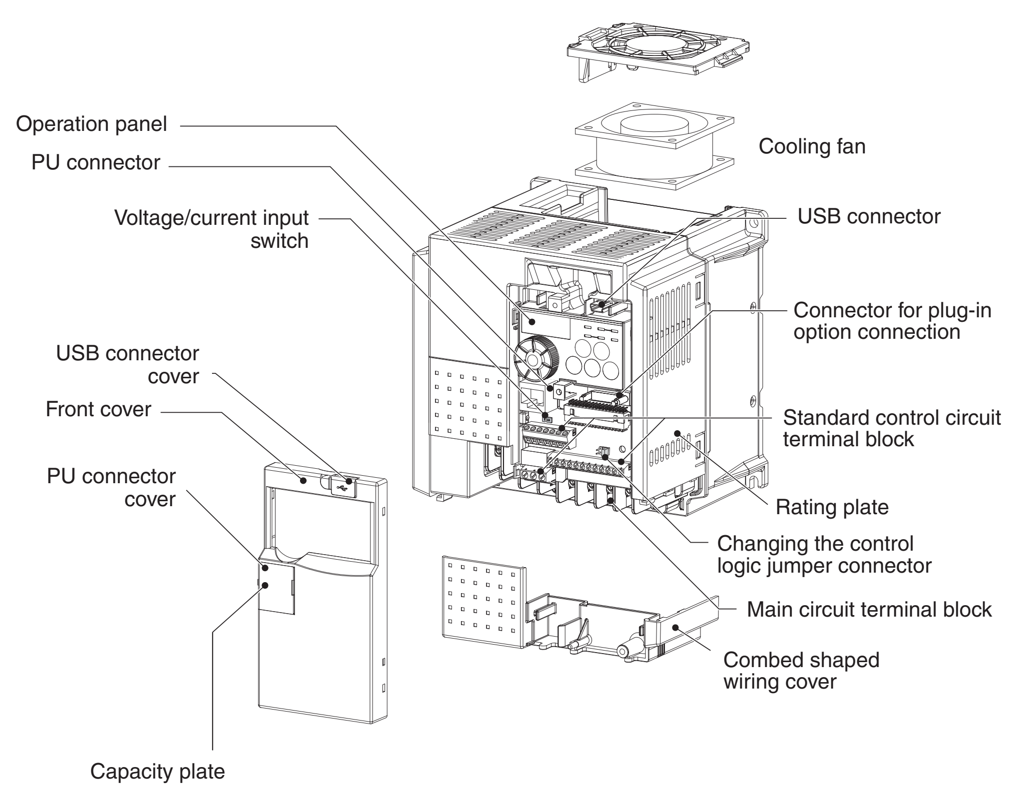
2 Introduction to the Inverters

2.1 FR-D700



NOTE Location of the capacity plate and the rating plate differs according to the inverter capacity.

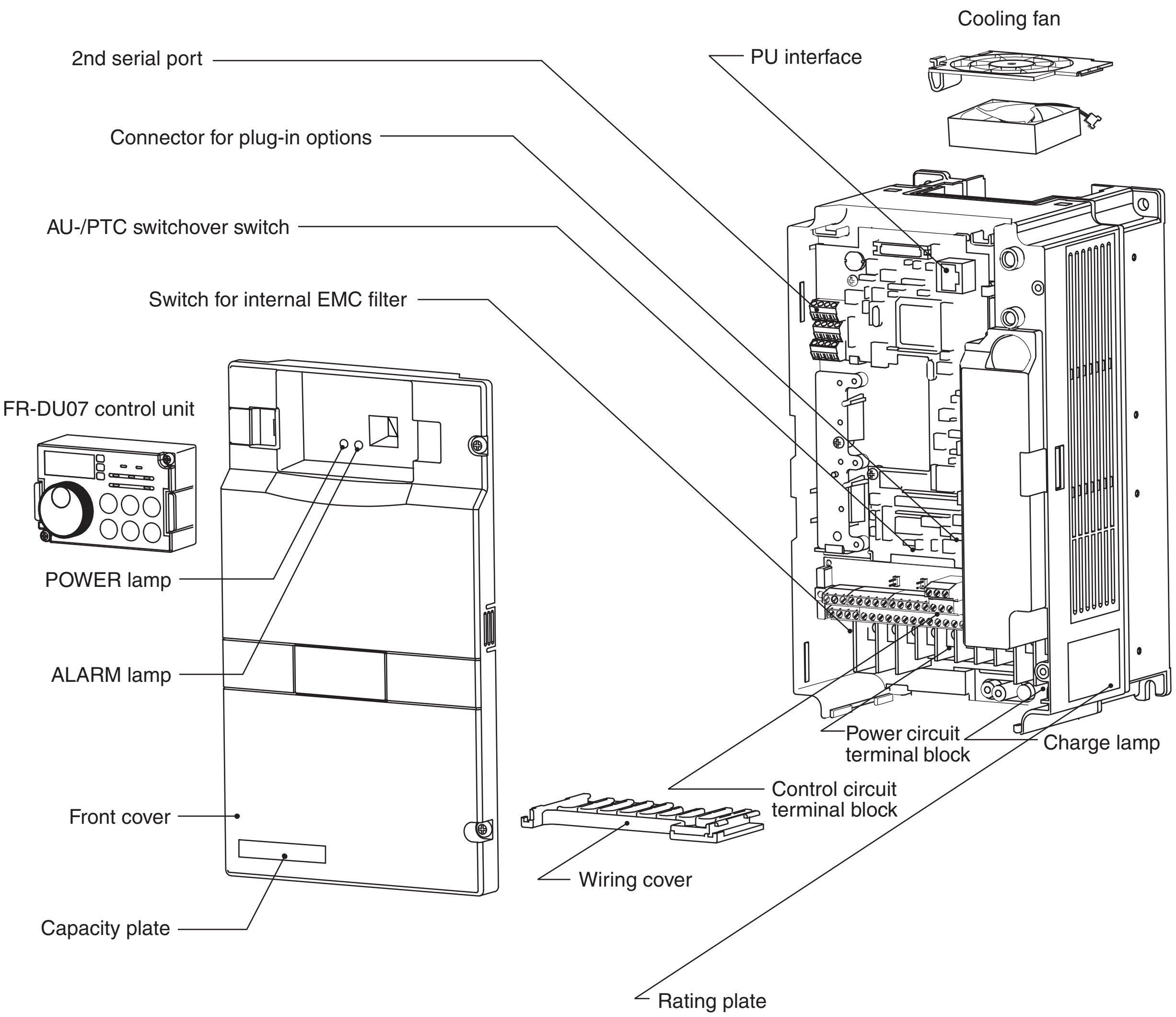
2.2 FR-E700



NOTE

Location of the capacity plate and the rating plate differs according to the inverter capacity.

2.3 FR-F700 and FR-A700



2.4 Removing and Replacing 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 replacing the cover varies.

However, the safety warnings below must always be observed for all inverter models.

DANGER:

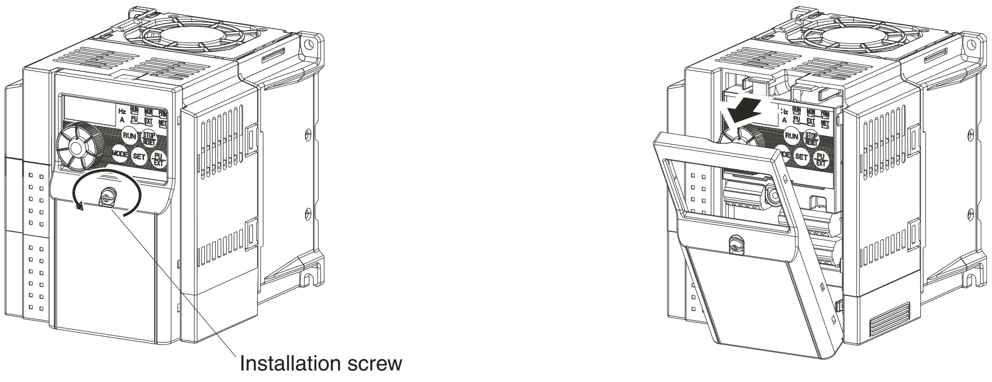
- ***Always SWITCH OFF the mains power supply before removing the front cover or performing any work on the inverter.***
- ***After switching off the power WAIT AT LEAST 10 MINUTES before removing the front cover to allow the charge in the inverter's power capacitors to fall to a safe level.***

2.4.1 FR-D700 Series Inverters

Removing and replacing on models from FR-D720S-008 through FR-D720S-100 and from FR-D740-012 through FR-D740-080

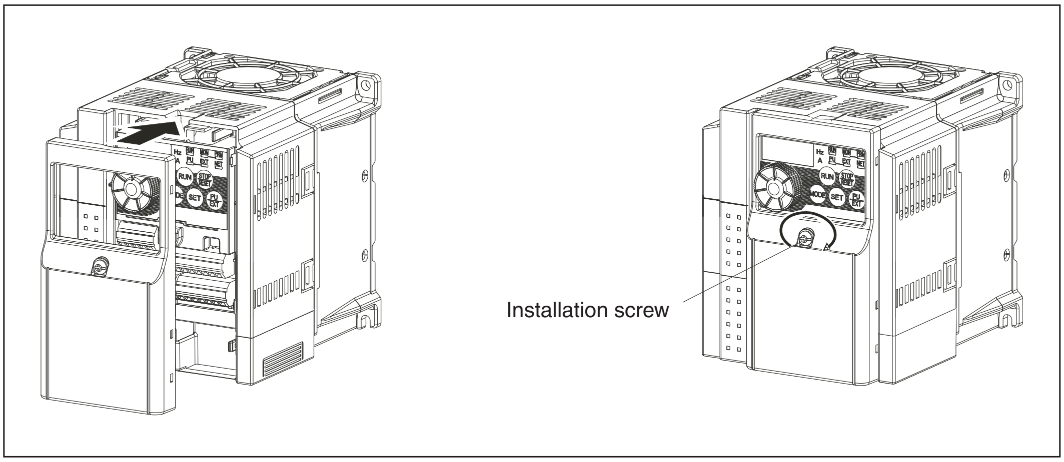
- **Removing the front cover**

  Loosen the installation screws of the front cover. (The screws cannot be removed.) Remove the front cover by pulling it like the direction of arrow.



- **Replacing the front cover**

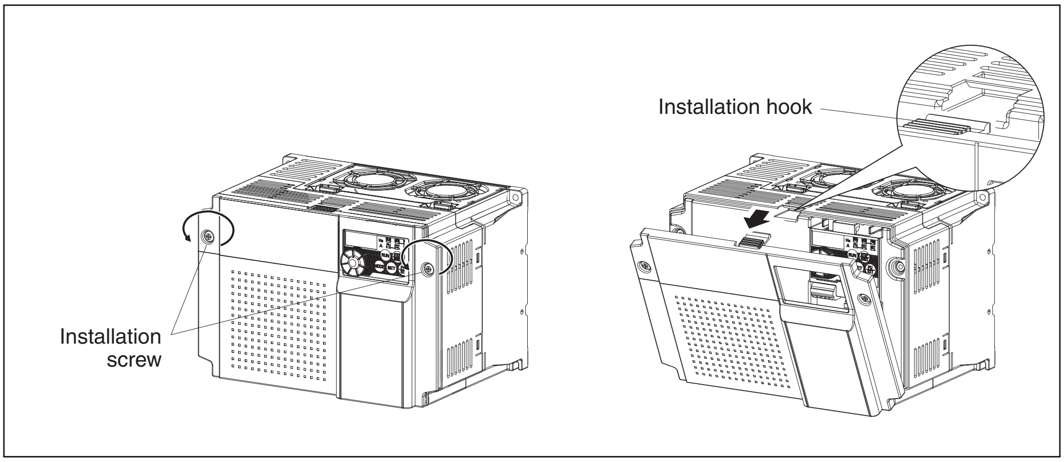
  Place the front cover in front of the inverter, and install it straight. Tighten the installation screws on the front cover.



Removing and replacing on models FR-D740-120 and FR-D740-160

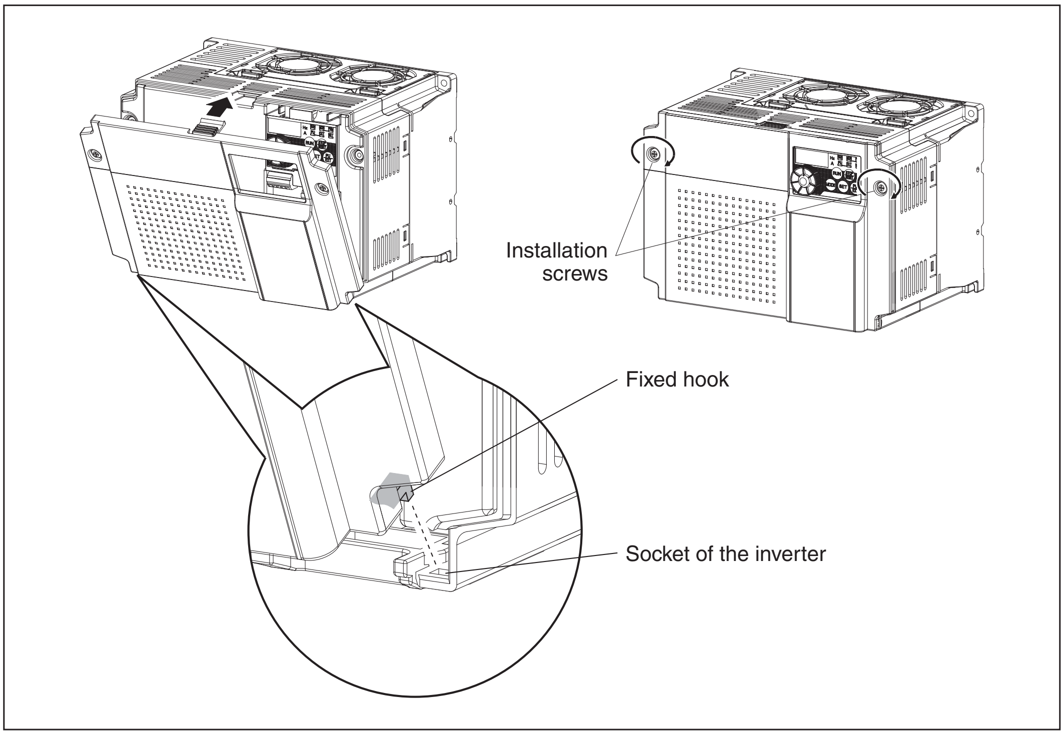
- **Removing the front cover**

  Loosen the installation screws of the front cover. (The screws cannot be removed.) Remove the front cover by pulling it like the direction of arrow with holding an installation hook on the front cover.



- **Replacing the front cover**

  Insert the two fixed hooks on the lower side of the front cover into the sockets of the inverter. Tighten the installation screws on the front cover.

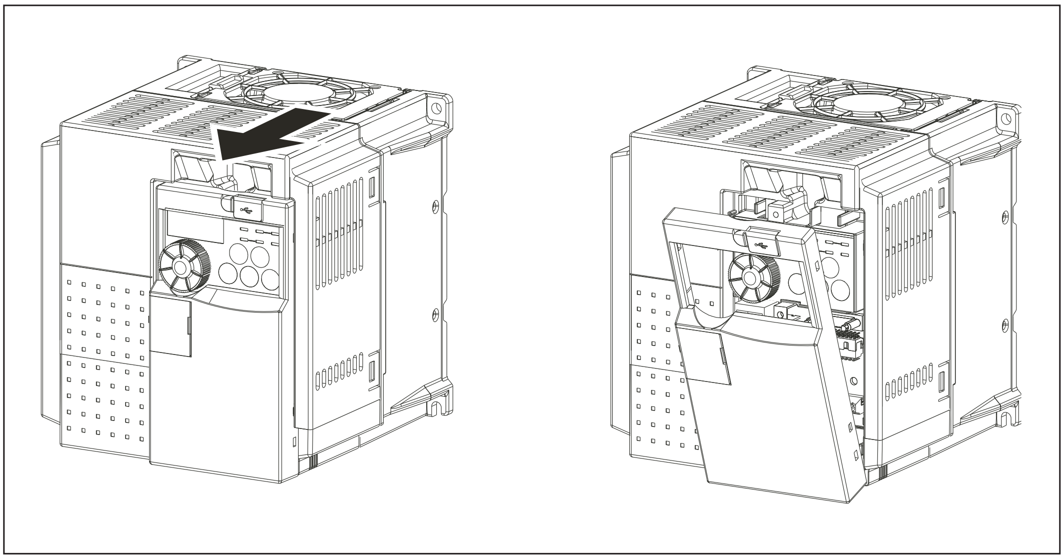


2.4.2 FR-E700 Series Inverters

Removing and replacing on models from FR-E740-012 through FR-E740-095

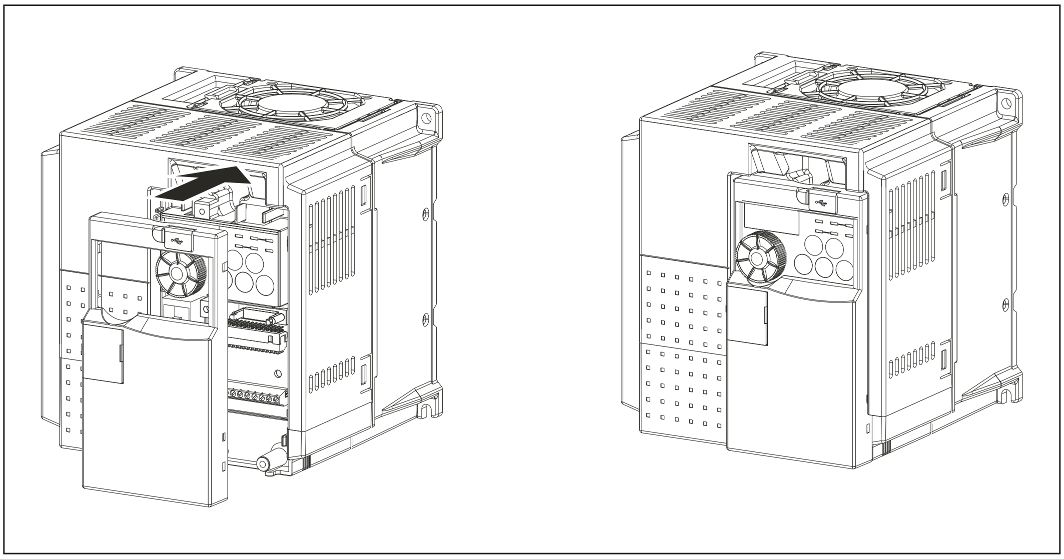
- **Removing the front cover**

  Remove the front cover by pulling it toward you in the direction of arrow (refer to the figure below).



- **Replacing the front cover**

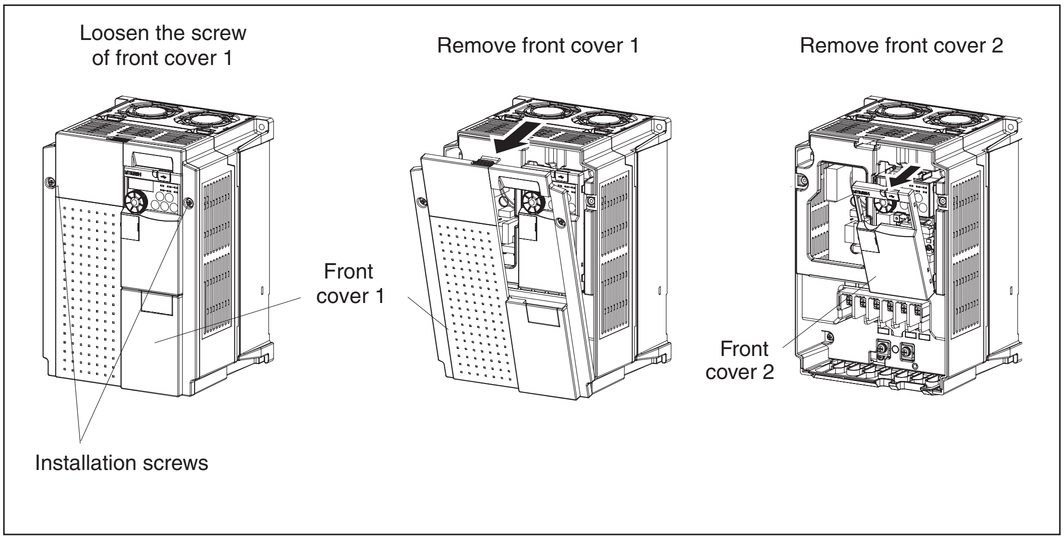
  To reinstall, match the cover to the inverter front and install it straight.



Removing and replacing on models FR-E740-230 and FR-E740-300

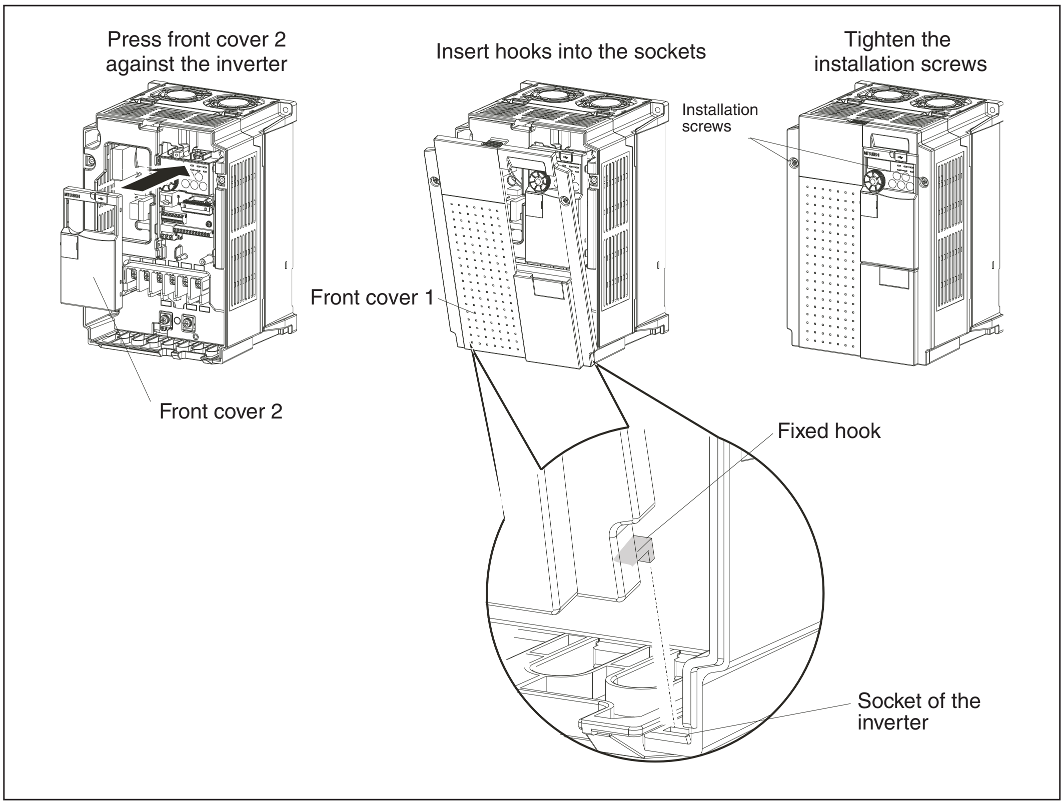
- **Removing the front cover**

Loosen the installation screws of the front cover 1. Remove the front cover 1 by pulling it toward you in the direction of arrow.
Remove the front cover 2 by pulling it toward you in the direction of arrow (refer to the figure below).



- **Replacing the front cover**

Match the front cover 2 to the inverter front and install it straight.
Insert the two fixed hooks on the lower side of the front cover 1 into the sockets of the inverter.
Tighten the screws of the front cover 1.

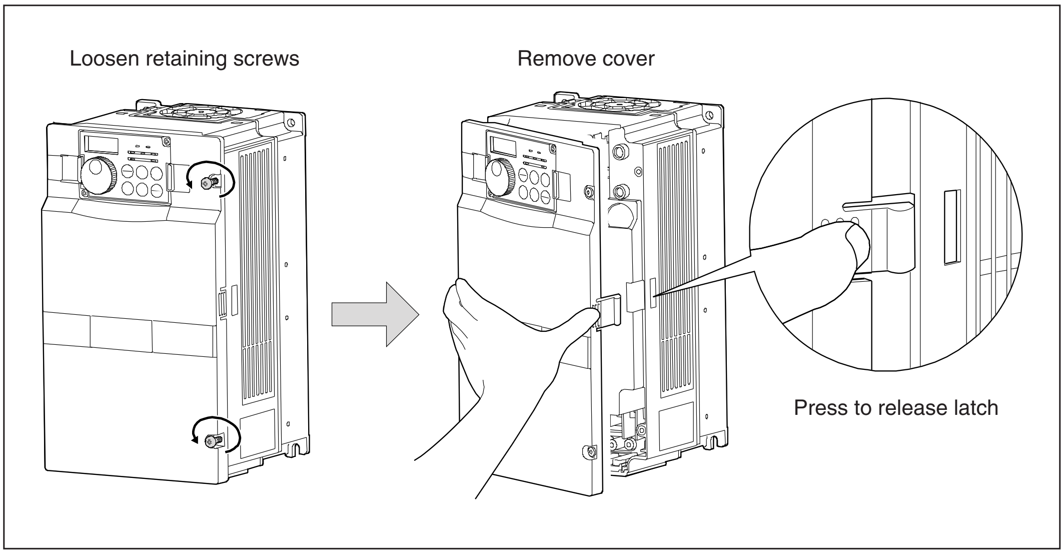


2.4.3 FR-F700 and FR-A700 Series Inverters

Removing and replacing on models up to FR-F740-00620/FR-A740-00620

- **Removing the front cover**

Loosen the cover's two retaining screws. Press on the latch on the right side of the cover to release it, then open the cover slightly and lift it away from the inverter.

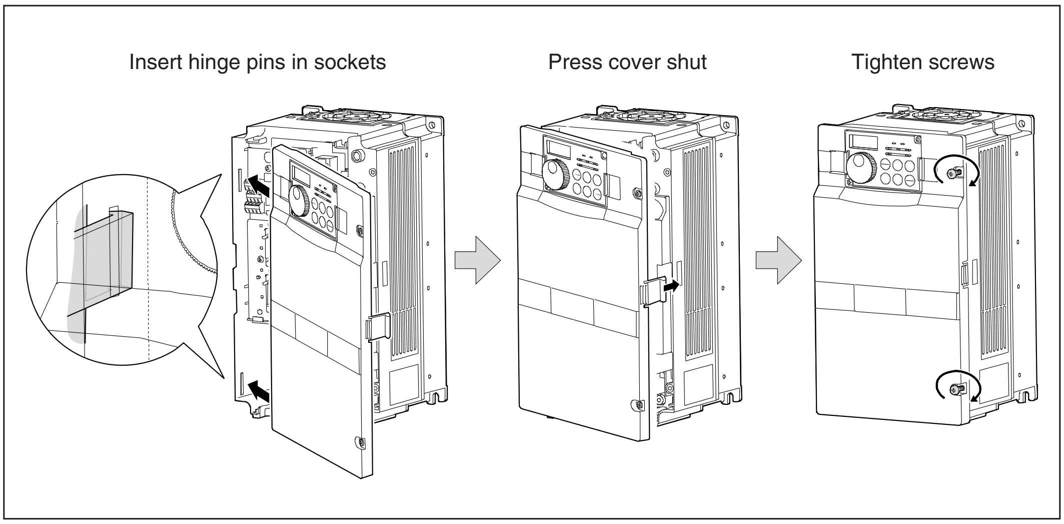


- **Replacing the front cover**

Insert the hinge pins on the left side of the cover in the matching sockets on the left side of the inverter casing.

Once the hinge pins are in the sockets press the cover shut until the latch snaps firmly into place. When replacing a front cover with the control unit installed take care to ensure that the control unit's connector plugs into the inverter correctly.

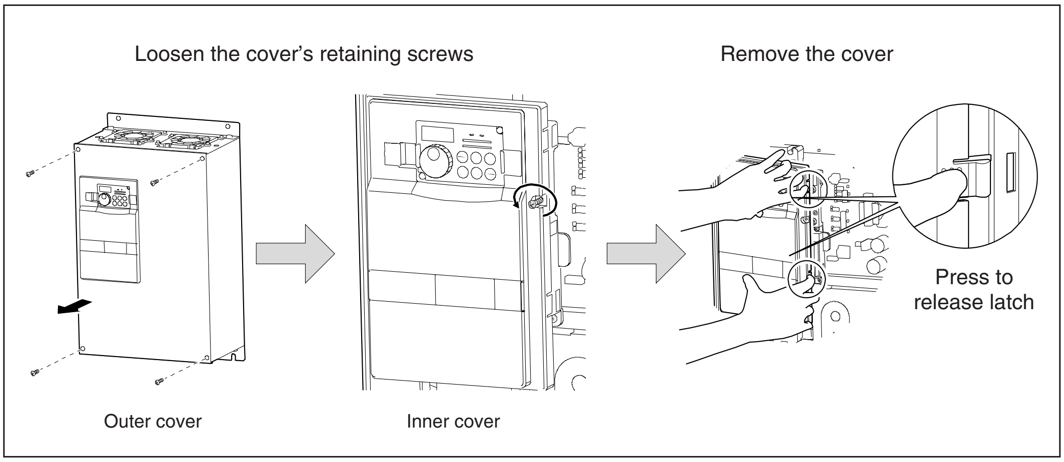
Finally, re-tighten the retaining screws to fasten the cover into place.



Removing and replacing on models from FR-F740-00770/FR-A740-00770

- **Removing the front cover**

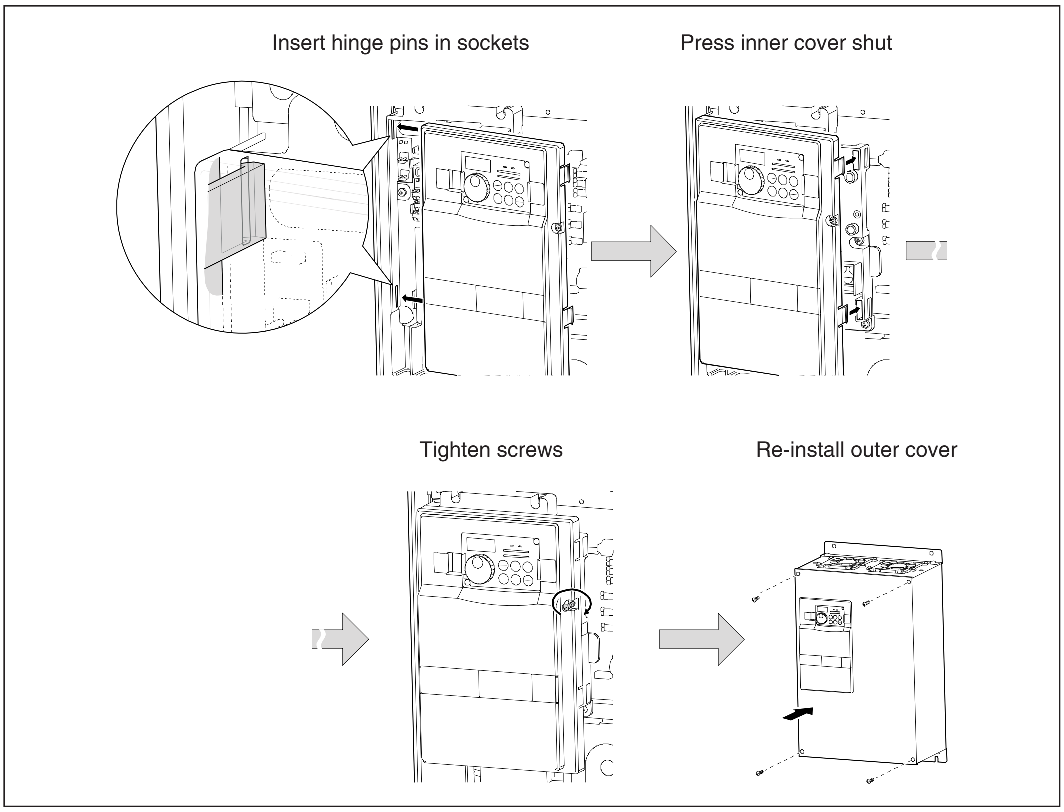
  Loosen the retaining screws of the outer cover and remove the outer cover. Then loosen the screws of the inner cover and press on the retaining latch on the side of the inverter to release it and open the cover slightly. After this you can remove the inner cover by lifting it forwards.



- **Replacing the front cover**

  Insert the hinge pins on the left side of the inner cover in the matching sockets on the left side of the inverter casing.

  Once the hinge pins are in the sockets press the cover shut until the retaining latch snaps firmly into place. When replacing the front cover with the control unit installed take care to ensure that the control unit's connector plugs into the inverter correctly. Fasten the retaining screws of the inner cover. Then re-install the outer cover and fasten it with its retaining screws.

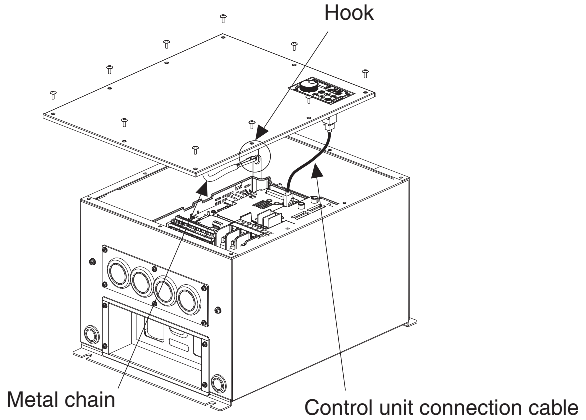


Removing and replacing on models from FR-F746-00023 through FR-F746-01160

- **Removing the front cover**

  Unscrew the retaining screws of the front cover. Then carefully lift up the front cover very slightly – the cover is connected to the main inverter chassis with a metal chain.

  Unplug the control unit cable and unhook the metal chain from the inverter. Now you can remove the front cover completely.



- **Replacing the front cover**

  First hook the end of the chain back into its original place in the inverter and reconnect the control unit cable with the inverter.

  You can then replace the front cover and fasten it with the screws. Take care that no cables or the metal chain get caught between the cover and the inverter casing.

3 Connections

DANGER:
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.

3.1 Power Supply, Motor and Earth Connections

Some inverters of the FR-D700 series can be connected to a single-phase AC power supply (230V). Other models of these series and all the models of the FR-E700, FR-F700 and FR-A700 must be connected directly to a 3-phase AC power supply.

FR-S 500 mains power supply specifications

Power supply	**FR-D700**	
	FR-D720S EC	**FR-D740 EC**
Voltage	1 phase, 200–240V AC	3 phase, 380–480V AC, −15% / +10%
Permissible input voltage range	170–264V AC	323–528V AC
Frequency	50 / 60Hz ± 5%	50 / 60Hz ± 5%

FR-E700, FR-F700 and FR-A700 mains power supply specifications

Power supply	**FR-E700, FR-F700, FR-A700**
Voltage	3 phase, 380–480V AC, −15% / +10%
Permissible input voltage range	323–528V AC
Frequency	50 / 60Hz ± 5%

NOTE

You must also connect 3-phase AC motors to the outputs of the inverters that are powered by a single-phase 200-240V mains power supply. These inverters also output 3-phase AC power with a range from 0V to the input voltage.

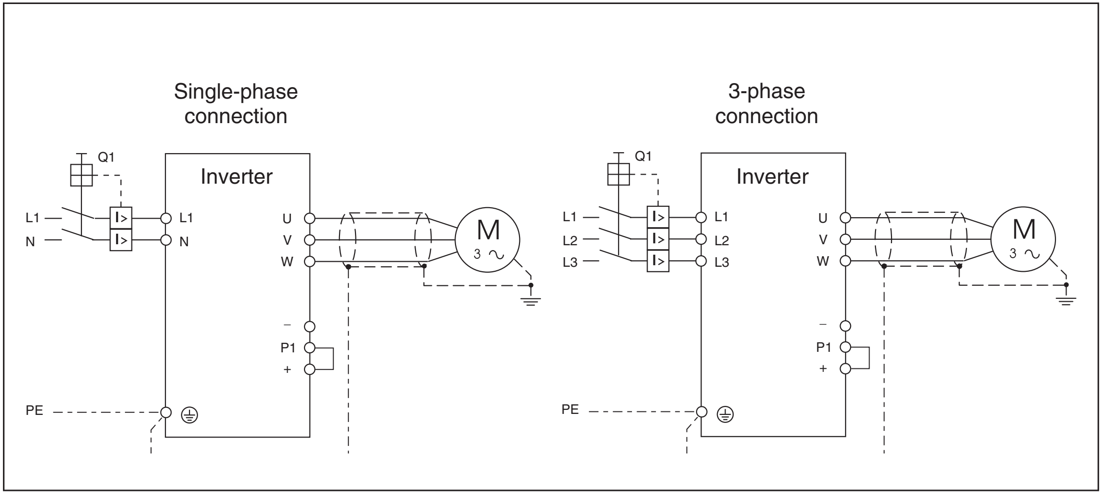
The single-phase AC mains power supply is connected to terminals L1 and N. The three-phase AC mains power supply is connected to terminals L1, L2 and L3.

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.



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

Terminals	Function	Description
L1, N	Mains power supply (single-phase)	Mains power supply input for the frequency inverter
L1, L2, L3	Mains power supply (3-phase)	
U, V, W	Motor output	This is the inverter's power output (3-phase, 0V to input voltage, 0.2 or 0.5 to 400 Hz)
L11, L21	Control circuit power	FR-F700 and FR-A700 only
P/+, PR	Brake resistor connection	Except FR-A700
+, –	External brake unit	An optional external brake unit can be connected to these terminals.
P/+, N/–		
+, P1	DC reactor	A DC reactor can be connected to these terminals. You must remove the jumper before connecting the reactor.
P/+, P1		
PR, PX	Only fitted on FR-F700 and FR-A700 inverters. Do not use these terminals and do not remove the jumper.	
⏚	PE	Earth (ground) connection

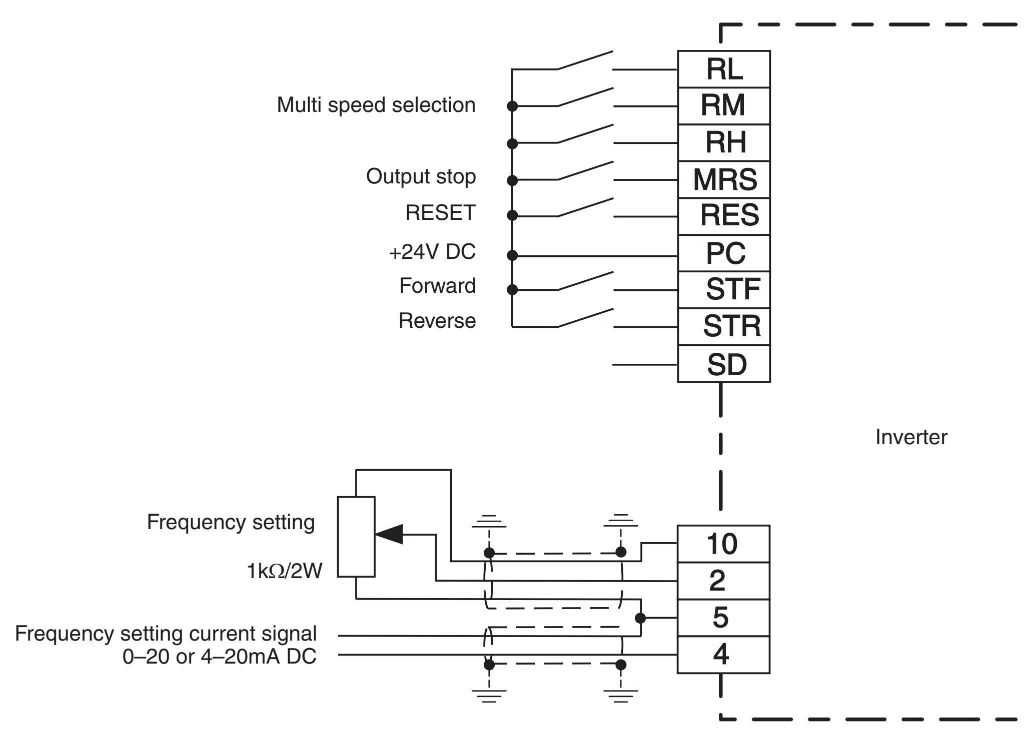
3.2 Control Terminals

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 – there are more.

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 (anticlockwise).	
		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)	
		MRS	Output stop	Applying a signal to this input for more than 20ms switches off the inverter output without delay.	
		RES	RESET input	Used to reset the inverter and clear the alarm state after a protective function has been triggered (see 7.3). A signal must be applied to RES for at least 0.1s to execute a reset.	
	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, 2W linear, (multi-potentiometer)	
		2	Input for frequency setting voltage signal (0 to 5V or 0 to 10V DC)	A setpoint signal of 0–5V or 0–10V is applied to this terminal. The range is preset to 0–5V. The input resistance is10 kΩ; the maximum permissible voltage is 20V.	
		5	Common terminal for frequency setting signal	Terminal 5 is the common terminal for the analog setting signals connected to terminals 2 and 4. Terminal 5 is isolated and to prevent interference it should not be earthed.	
		4	Input for frequency setting current signal (4 to 20mA DC)	If a current signal (0 to 20mA or 4 to 20mA DC) is used as the frequency setting signal it is connected to this terminal. The input resistance is 250 Ω, the maximum permissible current is 30mA. The factory default setting is 0Hz at 4mA and 50Hz at 20mA. Note that a signal must be applied to control input AU at the same time to activate this terminal.	

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

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



The manuals of the individual frequency inverters also include diagrams showing the connections for controlling the inverter inputs with PLC outputs and with sink 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 switchgear cabinet made of metal.
- Install an EMC filter (mains RFI suppression filter).
- Ensure that everything is properly earthed.
- Use shielded cables.
- Install sensitive equipment as far away as possible from interference sources or install the interference sources in a separate switchgear cabinet.
- 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 switchgear cabinet installation

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

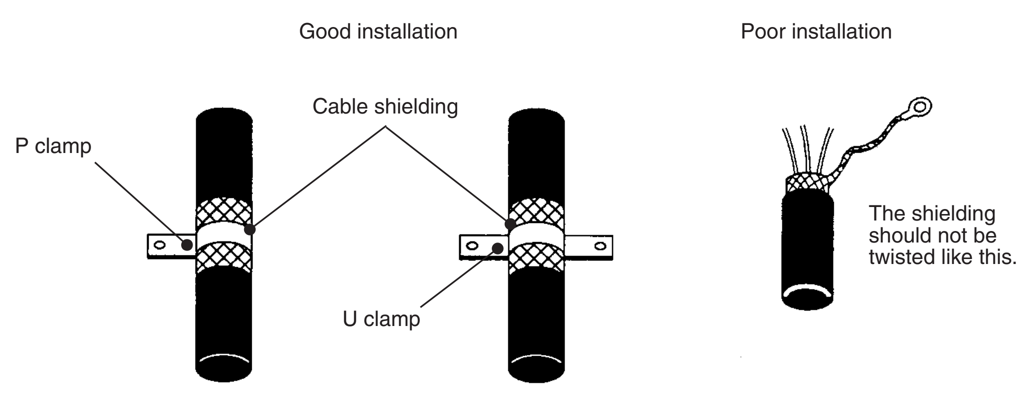
- Use an earthed cabinet made of metal.
- Use conductive seals between the cabinet door and chassis and connect the door and the chassis with a thick, braided earth cable.
- If an EMC filter is installed make sure that it has a good electrically conductive connection to the installation panel (remove 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.

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 0-5V 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.

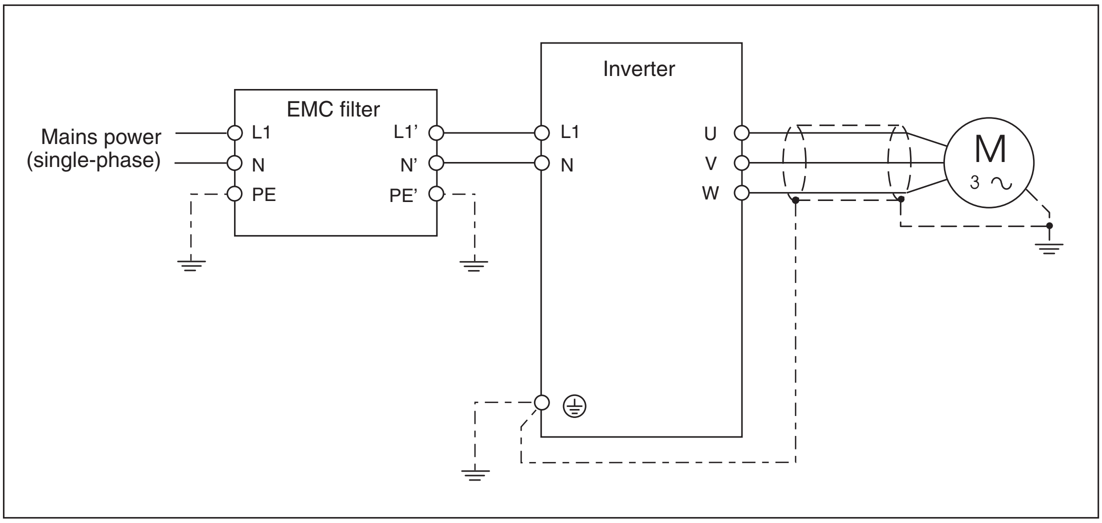
Motor connection cables should always be as short as possible. Long cables can sometimes trigger earth fault protection mechanisms. Avoid unnecessarily long cables and always use the shortest possible route for the cables.

It should go without saying that the motor itself should also be properly earthed

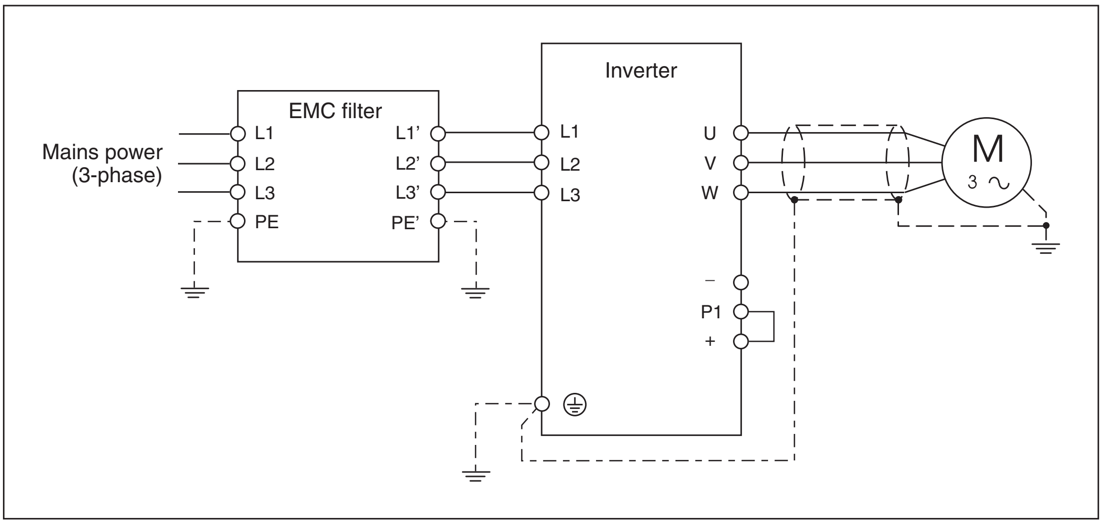
3.3.3 EMC Filters

EMC filters (mains RFI suppression filters) significantly reduce interference. They are installed between the mains power supply and the frequency inverter.

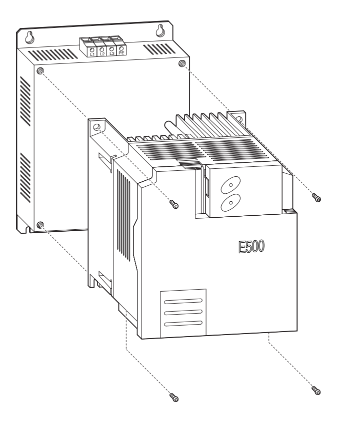
Installation of a EMC filter for a single-phase power supply



Installation of a EMC filter for a 3-phase power supply



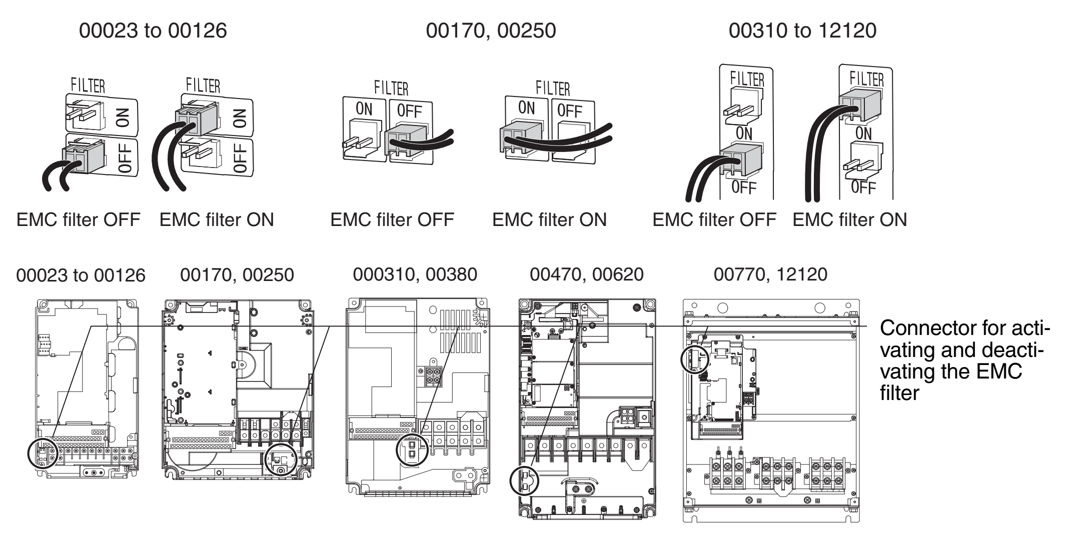
WARNING:
These filters are NOT designed for use in IT networks. When in operation these EMC filters discharge leakage currents to earth by design. This can trigger upstream protective devices, in particular in combination with asymmetrical mains voltages, mains phase failures and switching operations upstream from the filter. For more information please refer to the Mitsubishi frequency inverters EMC manual, which contains detailed instructions for EM-compatible installation.



The EMC filters of the FR-D700 and FR-E700 series are installed beside or behind the inverter, depending on their design. Installing the filter behind the inverter has the advantage that the filter does not take up any additional space in the switchgear cabinet.

The illustration on the left shows the installation of an EMC filter for a series FR-D700 inverter.

The inverters of the FR-F700 and FR-A700 series have an integrated EMC filter, which is activated by default at the factory. The filter can be disabled by moving the EMC on/off connector to the FILTER OFF position. The filter must be deactivated when the inverter is used in isolated neutral networks (IT networks).



Connector for activating and deactivating the EMC filter

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

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

Optional external EMC filters are also available for the inverters of the FR-F700 and FR-A700 series.

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: Single-phase to L1 and N, 3-phase to L1, L2 and 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 either the inverter’s own integrated control unit or with a connected external control 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 5.5 for examples of parameter settings.

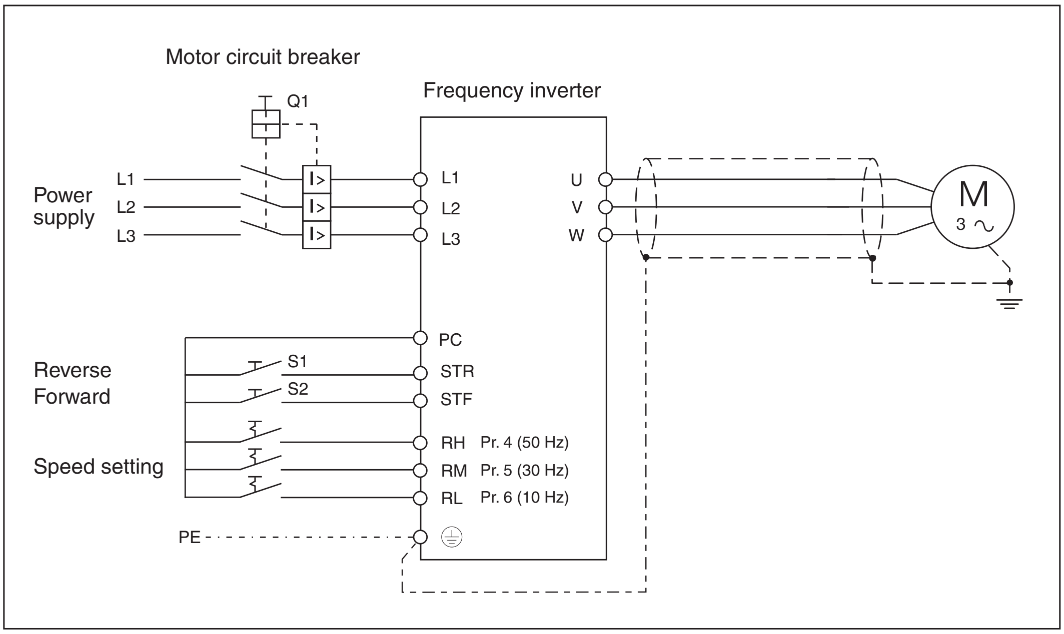
WARNING:
Incorrect parameter settings can damage or (in extreme cases) even destroy the connected motor. Take great care when you are setting the parameters and double-check the electrical and mechanical specifications of the motor, your entire drive system and the connected machine before proceeding.

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 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.

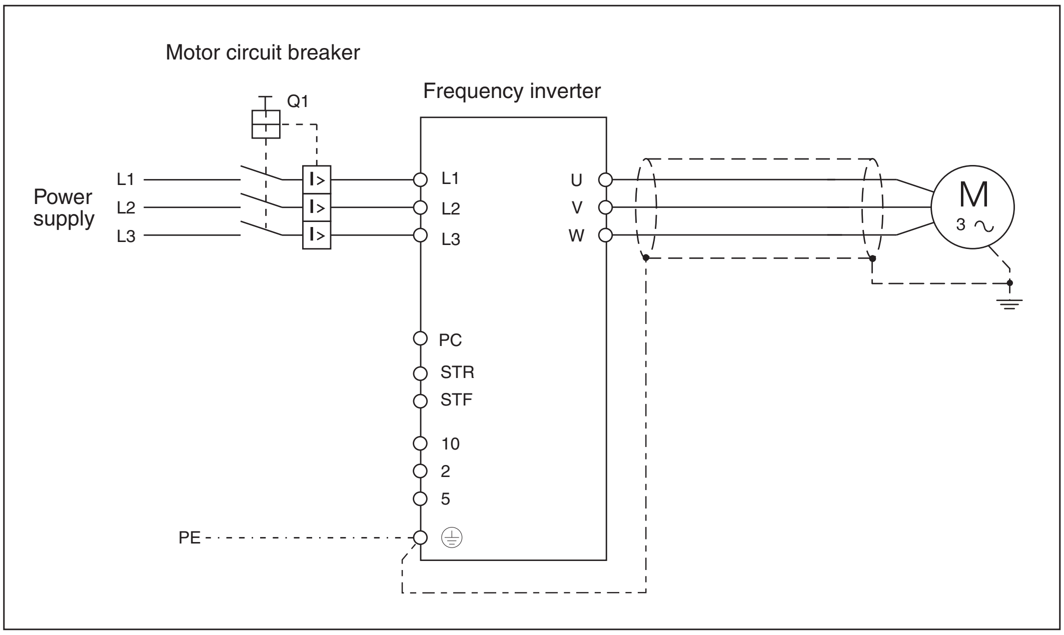


Some external components like pushbuttons and switches are required for this method but it has advantages over performing the test with the integrated or external control unit:

- When the inverter is switched on for the first time control with external signals is activated by default – you don't need the control 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 with the integrated or external control unit.

  The inverters of the FR-D700, FR-E700, FR-F700 and FR-A700 series have an integrated control unit with which you can operate the inverter and the connected motor. 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 to select the PU operation mode (see 5.3).

NOTE

Do not switch the motor on and off by turning the frequency inverter's power supply on and off. 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 control unit.

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.

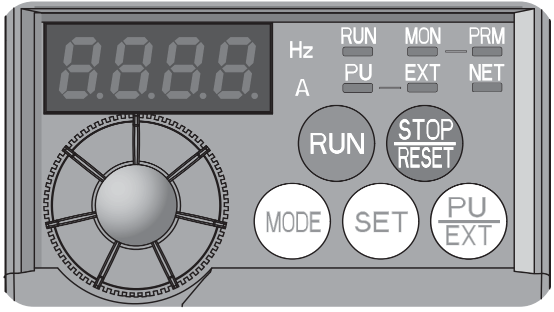
5 Operation and Settings

The frequency inverters of the FR-D700, FR-E700, FR-F700 and FR-A700 series have integrated control units.

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

5.1 Operating FR-D700 and FR-E700 Inverters



LED-Display

4-digit 7-segment display for operational values, parameter numbers, etc.

Unit indication

LED to indicate the current unit

- Hz: Frequency
- A: Current
- Off: Voltage
- Flicker: Set frequency

Rotation direction indication

Lit or flicker during inverter operation

- RUN is lit: Forward rotation
- RUN flickering slowly: Reverse rotation
- RUN flickering fast: Start command is given but the frequency command is missing

Monitor indication

Lit to indicate the monitoring mode.

Parameter setting mode

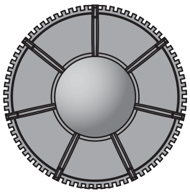
Lit to indicate the parameter setting mode.

Operation mode indication

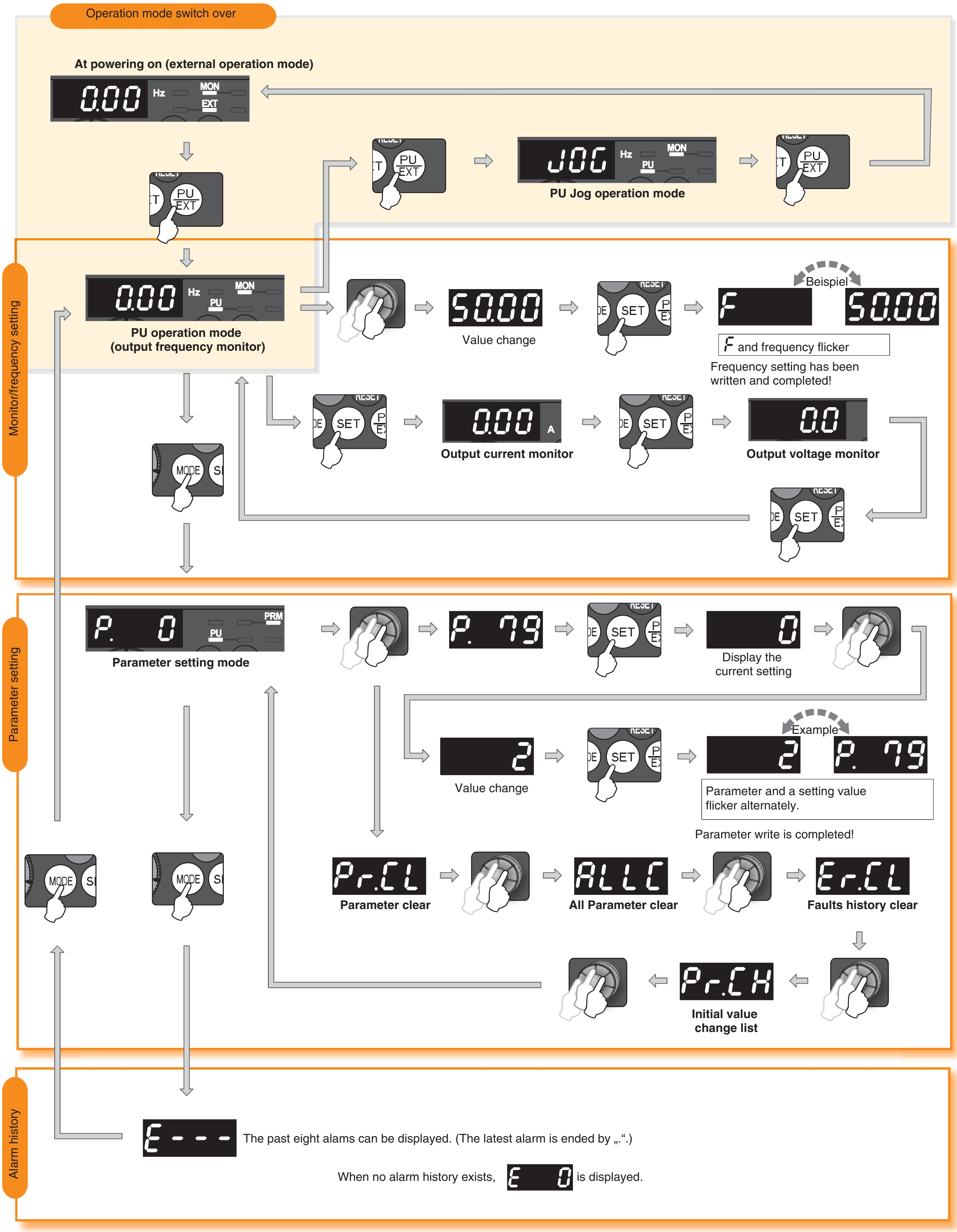
LED to indicate the operation mode

- PU operation mode (PU)
- External operation mode (EXT)
- Network operation mode (NET)
- Combined operation mode (PU and EXT)

Keys of the operation panel:

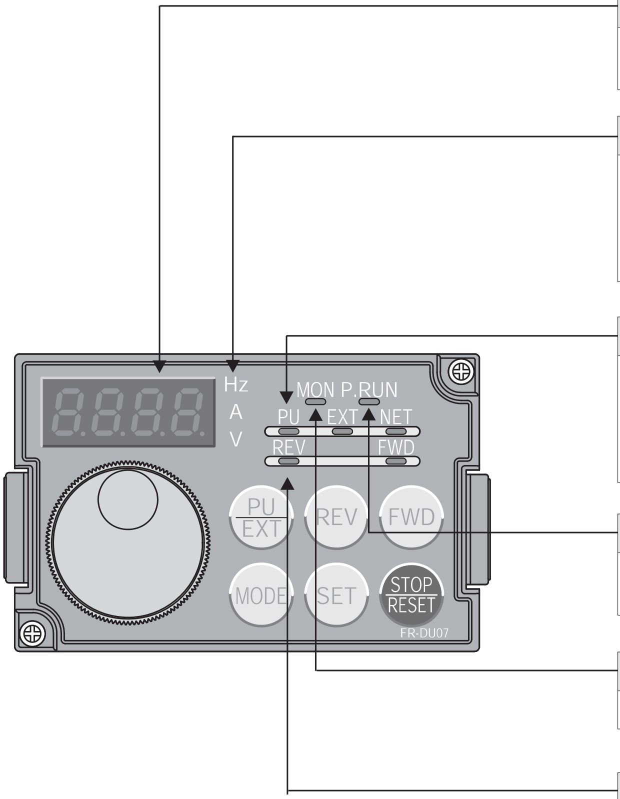
Key	**Function**	**Description**
	Digital dial	Used to change the frequency setting and parameter values. Press to display the following. ● Displays the set frequency in the monitor mode ● Currently set value is displayed during calibration ● Displays the order in the faults history mode
RUN	Rotation direction	RUN command for forward/reverse rotation. The rotation direction can be selected by setting Pr. 40.
STOP/RESET	Stop operation/ Fault reset	● Used to stop RUN command. ● Fault can be reset when protective function is activated (fault) (refer to section 7.3).
MODE	Mode switch over	Used to change each setting mode. ● Pressing PU/EXT simultaneously changes the operation mode. ● Pressing for a whilte (2s) can lock operation.
SET	Write settings	If pressed during operation, monitor changes as below: Running frequency → Output current → Output voltage → Running frequency
PU/EXT	Operation mode switch over	Used to switch between the PU and external operation mode. When using the external operation mode (operation using a separately connected frequency setting potentiometer and start signal), press this key to light up the EXT indication. (Press MODE simultanesouly (0.5s) or change Pr. 79 setting to change to combined mode.) PU: PU operation mode EXT: External operation mode (Cancels PU stop also.)

Overview of the basic functions of the operation panel (factory setting)



5.2 Operating FR-F700 and FR-A700 Inverters

The frequency inverters of the FR-F700 and FR-A700 series come with an integrated FR-DU07 control unit.



LED display

4-digit 7-segment display for status data, parameter numbers etc.

Units

LED indicators for units:

- Hz: Frequency
- A: Current
- V: Voltage

Mode

LED indicators for operating mode

- Control unit operation mode (PU)
- External operation mode (EXT)
- Network operation mode (NET)

PLC function

LED indicator for PLC function (only FR-A700)

Monitor mode

LED indicator for monitor mode

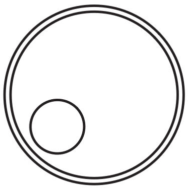
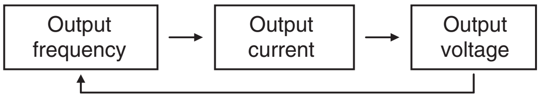
Motor direction

LED motor forward/reverse indicator

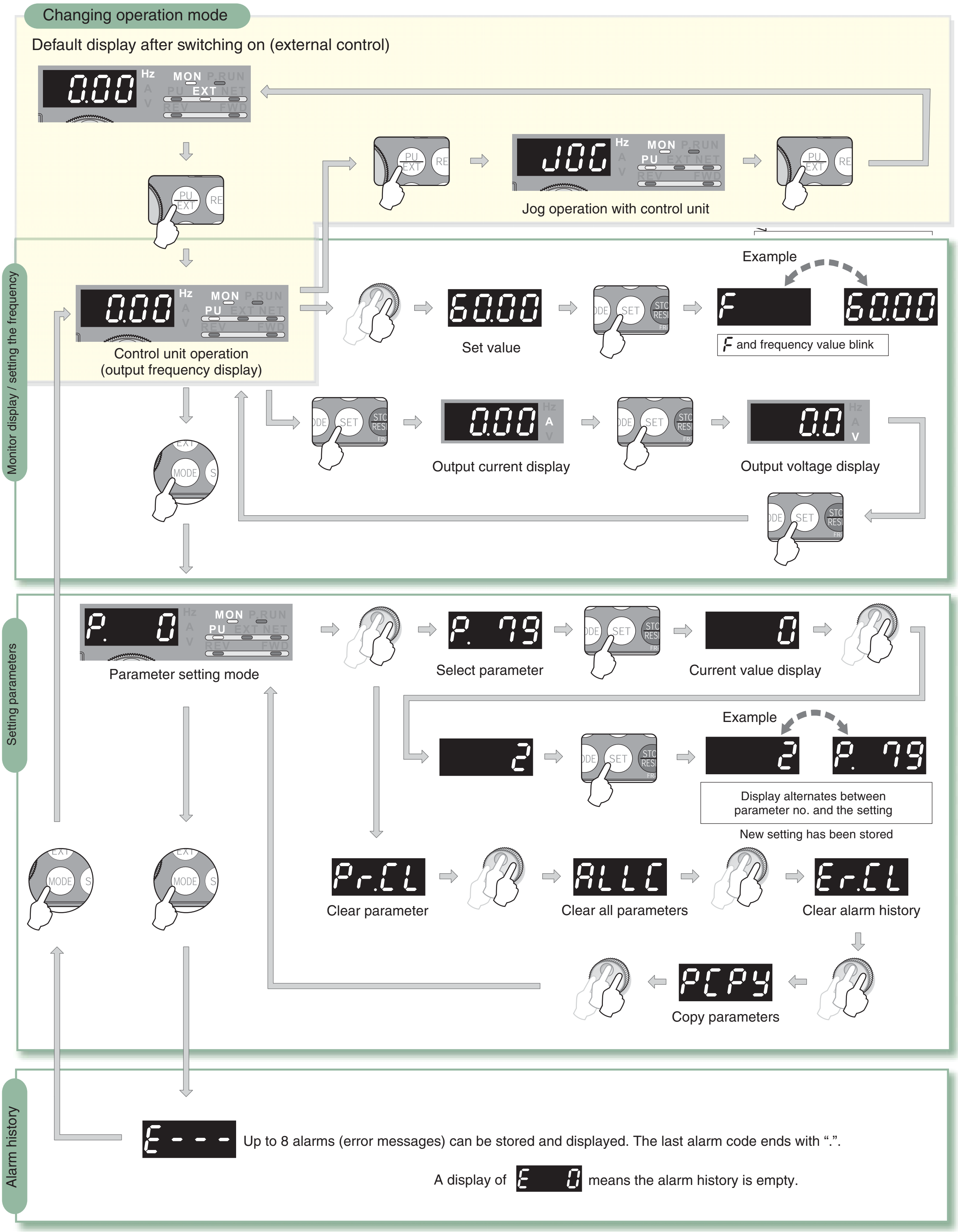
- FWD: Forward
- REV: Reverse

The FWD/REV LED lights up continuously when the motor is running and blinks when a Start command is registered without a frequency setting value.

Functions of the FR-DU07 control unit:

Control / Key	Function	Description
	Digital Dial	The Digital Dial is a little like a setting potentiometer. It can be turned in both directions to set frequencies, parameters and other values. It also has a pushbutton function. Pressing the Digital Dial stores the current frequency setting value.
FWD	Forward	Starts the motor forward
REV	Reverse	Starts the motor in reverse
MODE	Mode	Switches the setting mode
SET	Parameter Settings	Changes the status values displayed while the drive is running: 
PU EXT	Operation Mode	PU: Control unit operation mode EXT: External signals operation mode This key switches between control via external signals and operation with the control unit. To switch to external mode (setting signals via external potentiometer and external start signal) press and hold the key until the EXT indicator LED lights up. This combined mode is enabled with parameter 79.
STOP RESET	Stop Motor / Reset Inverter	When you are operating the inverter with the control unit you can stop the motor by pressing this key. It is also used to reset the inverter after an error message (see 7.3).

FR-DU07 control unit functions



Up to 8 alarms (error messages) can be stored and displayed. The last alarm code ends with “.”.

A display of E 0 means the alarm history is empty.

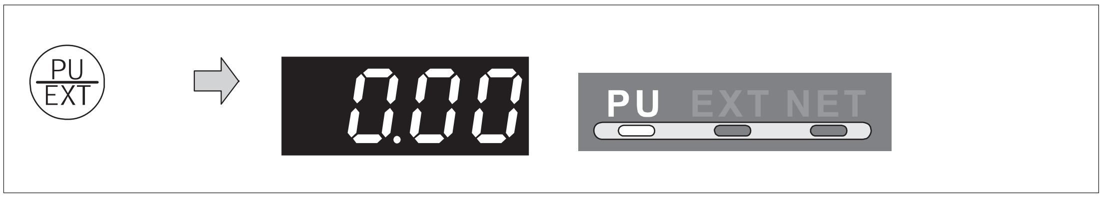
5.3 Operating Mode Selection

Frequency inverters can be operated either with external signals (switches, PLC outputs, external setpoint value sources etc.) or directly via the control unit. The mode is controlled with parameter 79 (see 6.2.7).

NOTE

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

You can switch between external and parameter unit (PU) modes by pressing the PU/EXT key on the parameter unit. The PU indicator lights up when the inverter is in parameter unit mode.



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

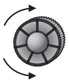
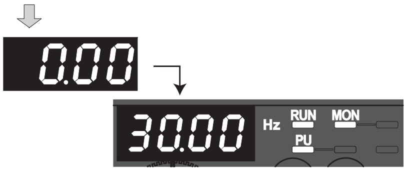
5.4 Setting the Frequency and Starting the Motor

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

FR-D700
FR-E700

Procedure on FR-D700 and FR-E700 inverters

Performing operation at 30Hz

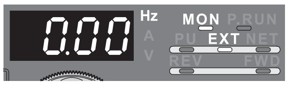
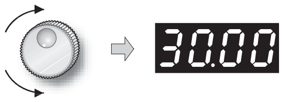
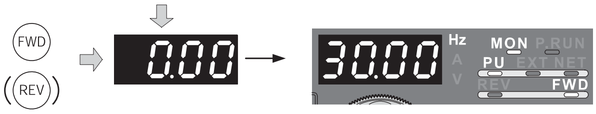
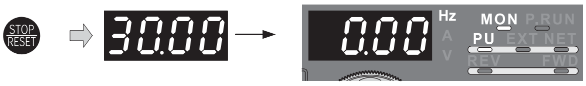
Operation		**Display**
Screen at powering on The monitor display appears.		
Press the PU/EXT key to choose the PU operation mode.	PU/EXT	 PU indication is lit.
Turn the digital dial to show the frequency you want to set. The frequency flickers for about 5s.		 Flickers for about 5s.
While the value is flickering press the SET key to set the frequency. (If you do not press the SET key, the value flickers for about 5s and the display returns to 0.00 (display) Hz. At this time, set the frequency again as described above.)	SET	 Flicker ... Frequency setting complete!
After the value flickered for about 3s, the display returns to 0.00 (monitor display). Press the RUN key to start operation.	RUN	3s later 
Press the STOP/RESET key to stop.	STOP/RESET	

Press the digital dial to show the set frequency.

FR-F700
FR-A700

Procedure on FR-F700 and FR-A700 inverters

Example of drive operation at a 30Hz output frequency.

Procedure	Inverter display
When you switch on the inverter the standard startup display appears.	
Press the PU/EXT key to select PU (control unit) mode.	
Turn the digital dial to set the output frequency to 30Hz. The value in the display will blink for around 5 seconds.	
Press the SET key while the frequency display is still blinking. (If you don't press SET within 5s the display will reset to 0.00. If this happens just set the output frequency again as described above.	
After 3 seconds the display then switches to 0.00 (Monitor mode). Now press FWD or REV to start the motor.	
To stop the motor press STOP/RESET.	

While the motor is running you can display the current setting frequency by pressing the Digital Dial.

NOTES

Troubleshooting tips

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

- Is the inverter in control unit 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 control and control unit mode with the PU/EXT key on the control 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 blinking) the output frequency setting value will not be stored.

5.5 Editing Parameter Settings

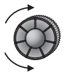
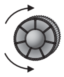
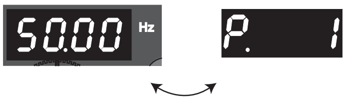
All the settings for the operation of frequency inverters are stored in editable parameters. You can find a detailed reference to the most important parameters in Chapter 6. All the parameters are preset to default values when the inverter leaves the factory. You can edit parameters on the integrated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

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

FR-D700
FR-E700

Procedure on the FR-D700 and FR-E700

Change the Pr. 1 “Maximum frequency” setting from 120Hz to 50Hz (refer to section 6.2.2 for details on Parameter 1).

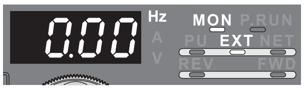
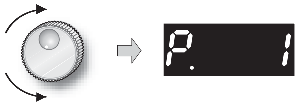
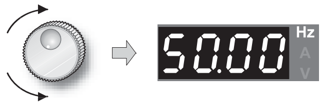
Operation		Display
Screen at powering on The monitor display appears..		
Press the PU/EXT key to choose the PU operation mode.	PU EXT	PU indication is lit. 
Press the MODE key to choose the parameter setting mode.	MODE	PRM indication is lit.  The parameter number read previously appears.
Turn the digital dial until P.1 (Pr. 1) appears.		
Press the SET key to show the currently set value. The initial value “120.0” appears.	SET	
Turn the digital dial counter clockwise to change it to the setting value of “50.00”.		
Press the SET key to set.	SET	 Flicker ... Parameter setting complete!

FR-F700

FR-A700

Procedure on FR-F700 and FR-A700 inverters

The following example shows how to change the maximum output frequency (refer to section 6.2.2 for details on Parameter 1) from 120Hz to 50Hz.

Procedure	**Inverter display**
When you switch on the inverter the standard startup display appears.	
Press the PU/EXT key to select PU (control unit) mode.	
Press MODE to activate the parameter setting mode.	
Turn the Digital Dial to select parameter no. 1.	
Press SET to display the current setting. The factory default setting is “120”.	
Turn the Digital Dial to change the value to “50”.	
Press SET to save the new setting.	

You can then turn the Digital Dial to select other parameters.

You can check the setting by pressing the SET key again once to display the current value.

Pressing the SET key twice selects the next parameter.

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, basic parameters and advanced parameters. The basic parameters should always be checked and configured before using the inverter but many of the more advanced parameters are only needed for special or complex applications.

WARNING:
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 Basic Parameters

The basic parameters of the FR-D700 and FR-E700 inverters

Parameter	Name	FR-D700		FR-E700	
		Setting Range	Initial Value	Setting Range	Initial Value
0	Torque boost	0–30%	3%/4%/6% ①	0–30%	2%/3%/4%/6% ①
1	Maximum frequency	0–120Hz	120Hz	0–120Hz	120Hz
2	Minimum frequency	0–120Hz	0Hz	0–120Hz	0Hz
3	Base frequency	0–400Hz	50Hz	0–400Hz	50Hz
4	Multi-speed setting (high speed) - RH	0–400Hz	50Hz	0–400Hz	50Hz
5	Multi-speed setting (medium speed) - RM	0–400Hz	30Hz	0–400Hz	30Hz
6	Multi-speed setting (low speed) - RL	0–400Hz	10Hz	0–400Hz	10Hz
7	Acceleration time	0–3600s	5s/10s ①	0–3600s	5s/10s/15s ①
8	Deceleration time	0–3600s	5s/10s ①	0–360s 0–3600s	5s/10s/15s ①
9	Electronic thermal O/L relay	0–500A	Rated output current	0–500A	Rated output current
19	Base frequency voltage	0–1000V 8888 ② 9999 ③	8888	0–1000V 8888 ② 9999 ③	8888
20	Acceleration/ deceleration reference frequency	1–400 Hz	50Hz	1–400Hz	50Hz
79	Operation mode selection	0–4/6/7	0	0–4/6/7	0

① The setting depends on the inverter capacity.

② With the setting "8888" the maximum output voltage is 95 % of the input voltage.

③ With the setting "9999" the maximum output voltage equals the input voltage.

Basic parameters of the FR-F700 and FR-A700 inverters

Parameter	Name	FR-F700		FR-A700	
		Setting Range	Initial Value	Setting Range	Initial Value
0	Torque boost	0–30%	1%/1.5%/2%/ 3%/4%/6% ①	0–30%	1%/2%/3%/ 4%/6% ①
1	Maximum frequency	0–120Hz	60Hz / 120Hz ①	0–120Hz	60Hz/120Hz ①
2	Minimum frequency	0–120Hz	0Hz	0–120Hz	0Hz
3	Base frequency	0–400Hz	50Hz	0–400Hz	50Hz
4	Multi-speed setting (high speed) - RH	0–400Hz	50Hz	0–400Hz	60Hz
5	Multi-speed setting (medium speed) - RM	0–400Hz	30Hz	0–400Hz	30Hz
6	Multi-speed setting (low speed) - RL	0–400Hz	10Hz	0–400Hz	10Hz
7	Acceleration time	0–3600s	5s or 15s ①	0–360s 0–3600s	5s or 15s ①
8	Deceleration time	0–3600s	10s or 30s①	0–360s 0–3600s	5s or 15s ①
9	Electronic thermal O/L relay	0–500A 0–3600A	Rated output current	0–500A 0–3600A	Rated output current
19	Base frequency voltage	0–1000V 8888 ② 9999 ③	8888	0–1000V 8888 ② 9999 ③	8888
20	Acceleration/ deceleration reference frequency	1–400Hz	50Hz	1–400Hz	50Hz
79	Operation mode selection	0–4/6/7	0	0–4/6/7	0

① The setting depends on the inverter capacity.

② With the setting "8888" the maximum output voltage is 95 % of the input voltage.

③ With the setting "9999" the maximum output voltage equals the input voltage.

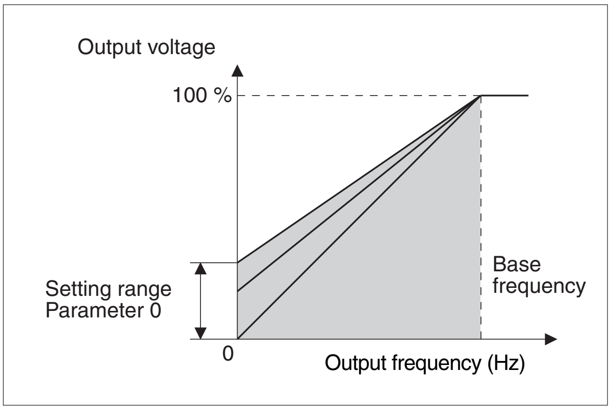
NOTE

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

6.2 The Basic Parameters in Detail

6.2.1 Torque Boost (parameter 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.

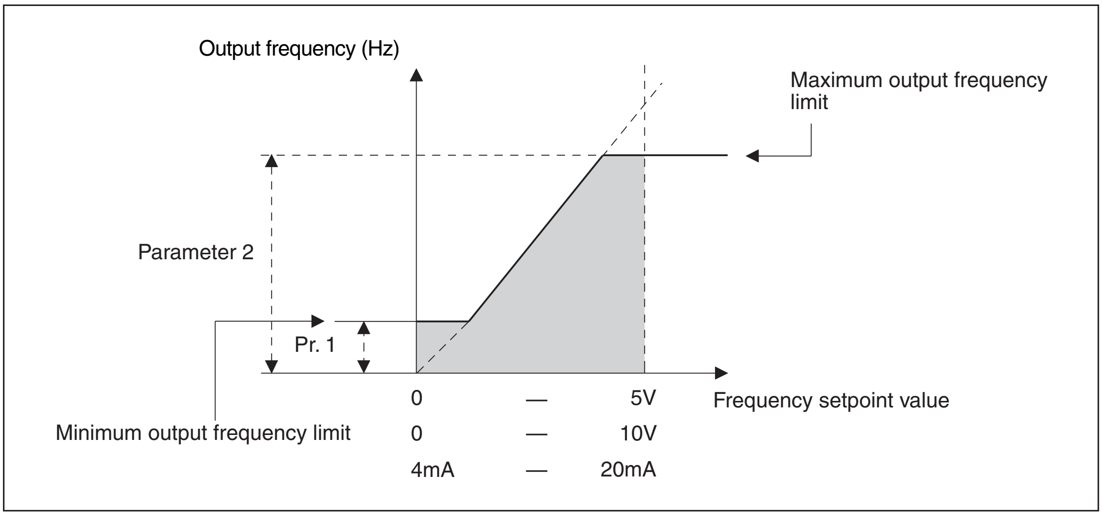


You can use parameter 0 to achieve better performance for starting the motor under load. The base frequency is set in parameter 3.

6.2.2 Minimum/Maximum Output Frequency (parameters 1 and 2)

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

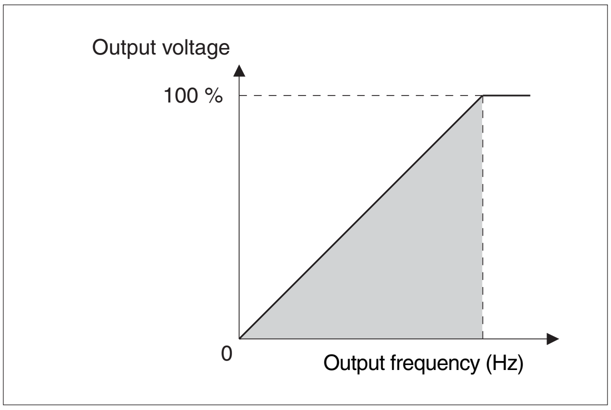
You can use these two parameters to adjust the frequency setting range to match the mechanical specifications of the connected system. For example, in many applications it is not desirable or possible to allow the drive to stop completely at the minimum setpoint value (output frequency = 0Hz). At the 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 (Parameter 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.



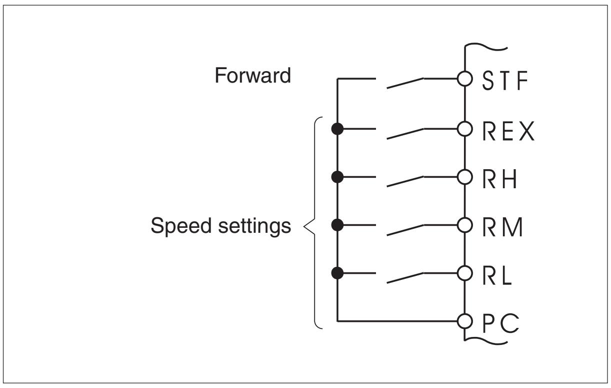
Parameter 3 defines the ratio between the output voltage and the output frequency (V/f pattern).

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 (parameters 4 – 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.

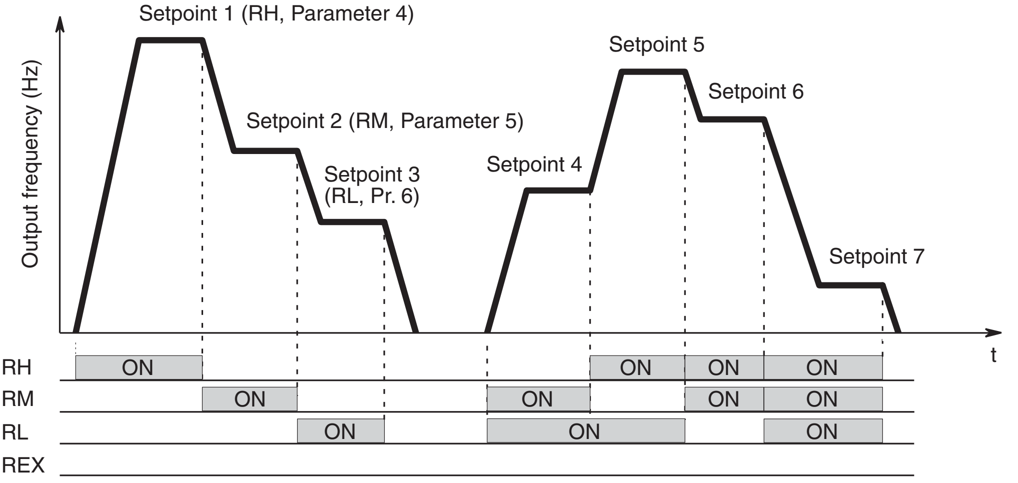


Example for connection of the inverter's RH, RM, RL and REX terminals.

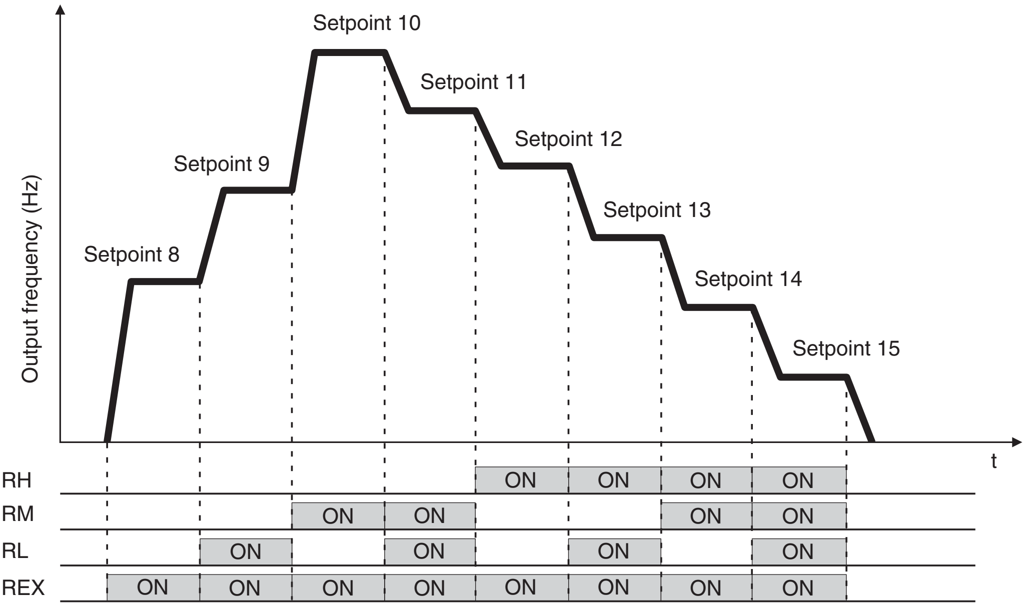
The frequency (speed) settings can be selected with relay output signals from a programmable logic controller (PLC).

The first three frequency settings are entered in parameters 4 through 6. Further fixed speed settings (4 – 16) 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:



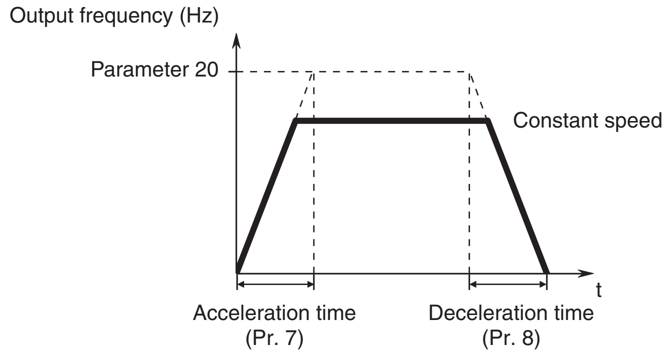
Important information for using preset frequency settings (speeds):

- 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 (parameters 7 and 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 (parameter 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 (parameter 79)

Parameter 79 sets the operation mode of the frequency inverter. You can set it for operation via external signals, an integrated or external control 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 internal or external control unit or via the PU interface.
- Select network mode (NET) for operation via RS-485 communication or an optional communication module (except FR-D700).

Parameter 79	**Description**		
0	At power on, the inverter is places in the external operation mode. Use the key on the control unit to switch between external control and control from the control unit. (Details of this modes are described in this table for the settings "1" and "2".)		
	Operation Mode	**Setting of the output frequency**	**Start signal**
1	Control unit mode	With control unit	RUN (FWD, REV) key of the control unit
2	External control mode	External signal input (e.g. terminals 2 (4)-5, multi-speed setting)	External signal input (terminal STF or STR)
3	Combined mode 1	With control unit or external signal input (e.g. terminals 2 (4)-5, multi-speed setting)	External signal input (terminal STF or STR)
4	Combined mode 2	External signal input (e.g. terminals 2 (4)-5, multi-speed setting)	RUN (FWD, REV) key of the control unit
6	Switch-over mode Switch among parameter unit, external control and control via a network while keeping the same operation status.		
7	External control (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 control) X12 signal OFF: Operation mode can not be switched to the parameter unit mode		

HINWEIS 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.

Mode 0 (external operation, switchable to control unit)
Mode 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 control unit 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 control unit mode (PU mode) by pressing PU/EXT on the internal or external control 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 mode.

When the inverter is in external 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.

Operation mode 1 (PU – control unit mode)

When parameter 79 is set to “1” the inverter switches to control unit mode when it is powered up and it can be operated with the keys on the integrated control unit or the external control unit.

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

Operation mode 3 (combined mode 1)

Select this combined mode when you want to set the speed frequency with the control unit (Digital Dial) and use the external terminals for the motor start signals.

You cannot switch the operating 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 control unit.

Mode 4 (combined mode 2)

Select this combined mode when you want to activate the start signals with the control 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.

7 Protective and Diagnostics Functions

The Mitsubishi Electric inverters of the FR-D700, FR-E700, FR-F700 and FR-A700 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 control 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 contactor 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 control unit.

- Resetting after activation of protective functions

  When a critical 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 critical error.

- Minor errors

  Minor errors do **not** disable the inverter output.

- Critical errors

  Critical errors 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 L1 and N (or L1, L3 and 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/+ resp. P1 and + 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. 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 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/+ resp. +	Check that the jumper across P1 and P/+ resp. P1 and + is connected.
Parameter write cannot be performed	Start signal lis ON	Make sure that operation is not being performed (signal STF or STR is not ON).
	SET key (WRITE key)	Press the SET key (parameter unit FR-DU07) respectively the WRITE key (parameter unit FR-PU04/FR-PU07) to save the parameter settings.
	Parameter setting	Check that the parameter settings are inside 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	Operation Panel Indication					Meaning
	FR-D700	FR-E700	FR-F700	FR-A700	Plaintext	
Error messages	E---	E---	E---	E---	E---	Faults history
	HOLd	HOLd	HOLd	HOLd	HOLD	Operation panel lock
	Er1 Er2 Er3 Er4	Er1 Er2 Er3 Er4	Er1 Er2 Er3 Er4	Er1 Er2 Er3 Er4	ER1 ER2 ER3 ER4	Parameter write error
	—	—	rE1 rE2 rE3 rE4	rE1 rE2 rE3 rE4	rE1 rE2 rE3 rE2	Copy operation error
	Err.	Err.	Err.	Err.	Err.	Error (e. g. incorrect parameter)
Warnings	OL	OL	OL	OL	OL	Stall prevention (overcurrent)
	oL	oL	oL	oL	oL	Stall prevention (overvoltage)
	rb	rb	rb	rb	RB	Regenerative brake prealarm
	TH	TH	TH	TH	TH	Electronic thermal relay function prealarm
	PS	PS	PS	PS	PS	Inverter has been stopped from PU
	MT	MT	MT	MT	MT	Maintenance signal output
	—	—	CP	CP	CP	Parameter copy
	—	—	—	SL	SL	Speed limit indication (Output during speed limit)
Minor error	Fn	Fn	Fn	Fn	FN	Fan fault

Classification	Operation Panel Indication					Meaning
	FR-D700	FR-E700	FR-F700	FR-A700	Plaintext	
Critical error	E.OC 1	E.OC 1	E.OC 1	E.OC 1	E.OC1	Overcurrent shut-off during acceleration
	E.OC2	E.OC2	E.OC2	E.OC2	E.OC2	Overcurrent shut-off during constant speed
	E.OC3	E.OC3	E.OC3	E.OC3	E.OC3	Overcurrent shut-off during deceleration or stop
	E.Ov 1	E.Ov 1	E.Ov 1	E.Ov 1	E.OV1	Regenerative overvoltage shut-off during acceleration
	E.Ov2	E.Ov2	E.Ov2	E.Ov2	E.OV2	Regenerative overvoltage shut-off during constant speed
	E.Ov3	E.Ov3	E.Ov3	E.Ov3	E.OV3	Regenerative overvoltage shut-off during deceleration or stop
	E.THT	E.THT	E.THT	E.THT	E.THT	Inverter overload shut-off (electronic thermal relay function)
	E.THM	E.THM	E.THM	E.THM	E.THM	Motor overload shut-off (electronic thermal relay function)
	E.FIn	E.FIn	E.FIn	E.FIn	E.FIN	Fin overheat
	—	—	E.IPF	E.IPF	E.IPF	Instantaneous power failure
	E.ILF	E.ILF	E.ILF	E.ILF	E.ILF	Input phase failure
	E.OLT	E.OLT	E.OLT	E.OLT	E.OLT	Stall prevention
	E. bE	E. bE	E. bE	E. bE	E.BE	Brake transistor alarm detection
	Uv	Uv	E.UvT	E.UvT	E.UVT	Undervoltage
	E. GF	E. GF	E. GF	E. GF	E.GF	Output side earth (ground) fault overcurrent
	E. LF	E. LF	E. LF	E. LF	E.LF	Output phase failure
	E.OHT	E.OHT	E.OHT	E.OHT	E.OHT	External thermal relay operation
	E.PTC	—	E.PTC	E.PTC	E.PTC	PTC thermistor operation
	—	—	E.OPT	E.OPT	E.OPT	Option alarm
	—	E.OP 1	E.OP 1	—	E.OP1	Communication option alarm
	—	—	—	E.OP3	E.OP3	
	—	E. 1	E. 1 E. 2 E. 3	E. 1 E. 2 E. 3	E.1 E.2 E.3	Option alarm (e. g. connection error)
	E.CPU	E. 6 E. 7 E.CPU	E. 6 E. 7 E.CPU	E. 6 E. 7 E.CPU	E.6 E.7 E.CPU	CPU error
	—	—	—	E. 11	E.11	Opposite rotation deceleration error
	—	E. 13	E. 13	E. 13	E.13	Internal circuit error
	E. PE	E. PE	E. PE	E. PE	E.PE	Parameter storage device alarm

Classification	**Operation Panel Indication**					**Meaning**
	FR-D700	**FR-E700**	**FR-F700**	**FR-A700**	**Plaintext**	
Critical error	—	E.PE2	E.PE2	E.PE2	E.PE2	Parameter storage device alarm
	E.PUE	E.PUE	E.PUE	E.PUE	E.PUE	PU disconnection
	—	—	E.CTE	E.CTE	E.CTE	● Operation panel power supply short circuit ● RS-485 terminal power supply short circuit
	E.rET	E.rET	E.rET	E.rET	E.RET	Retry count excess
	—	—	E.P24	E.P24	E.P24	24 V DC power output short circuit
	E.CdO	—	E.CdO	E.CdO	E.CDO	Output current detection value exceeded
	E.IOH	E.IOH	E.IOH	E.IOH	E.IOH	Inrush current limit circuit alarm
	—	—	E.SEr	E.SEr	E.SER	Communication error (inverter)
	E.AIE	E.AIE	E.AIE	E.AIE	E.AIE	Analog input error
	—	—	—	E. OS	E.OS	Overspeed occurence
	—	—	—	E.OSd	E.OSD	Speed deviation excess detection
	—	—	—	E.ECT	E.ECT	Signal loss detection
	—	—	—	E. Od	E.OD	Excessive position error
	—	E.Mb4 to E.Mb7	—	E.Mb1 to E.Mb7	E.MB1/4 to E.MB7	Brake sequence error
	—	—	—	E.EP	E.EP	Encoder phase error
	—	E.USb	—	E.USb	E.USB	USB communication error

7.3 Resetting the Inverter

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.

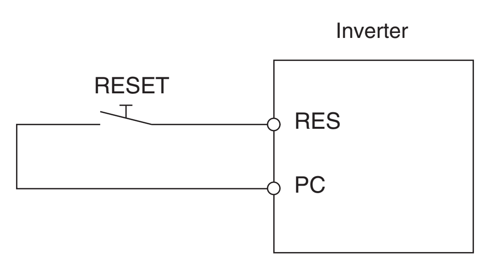
Up to three different ways to reset the inverter are available:

- Reset by pressing a key on the integrated or external control unit.

  After a serious error or triggering of a protective function 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 (negative switching logic) or RES and PC (positive 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.

A.1.1 FR-D700

Parameter	Name	Setting Range	Initial Value
0	Torque boost	0–30%	6/4/3% ①
1	Maximum frequency	0–120Hz	120Hz
2	Minimum frequency	0–120Hz	0Hz
3	Base frequency	0–400Hz	50Hz
4	Multi-speed setting (high speed) - RH	0–400Hz	50Hz
5	Multi-speed setting (middle speed) - RM	0–400Hz	30Hz
6	Multi-speed setting (low speed) - RL	0–400Hz	10Hz
7	Acceleration time	0–3600s	5s/10s ①
8	Deceleration time	0–3600s	5s/10s ①
9	Electronic thermal O/L relay	0–500A	Rated inverter current
10	DC injection brake operation frequency	0–120Hz	3Hz
11	DC injection brake operation time	0–10s	0.5s
12	DC injection brake operation voltage	0–30%	6/4% ①
13	Starting frequency	0–60Hz	0.5Hz
14	Load pattern selection	0/1/2/3	1
15	Jog frequency	0–400Hz	5Hz
16	Jog acceleration/deceleration time	0–3600s	0.5s
17	MRS input selection	0/2/4	0
18	High speed maximum frequency	120–400Hz	120Hz
19	Base frequency voltage	0–1000V/ 8888 ②/9999 ③	8888
20	Acceleration/deceleration reference frequency	1–400Hz	50Hz
22	Stall prevention operation level	0–200%	150%
23	Stall prevention operation level compensation factor at double speed	0–200%/9999	9999
24-27	Multi-speed setting (speed 4 to speed 7)	0–400Hz/9999	9999
29	Acceleration/deceleration pattern selection	0/1/2	0
30	Regenerative function selection	0/1/2	0
31	Frequency jump 1A	0–400Hz/9999	9999
32	Frequency jump 1B	0–400Hz/9999	9999
33	Frequency jump 2A	0–400Hz/9999	9999
34	Frequency jump 2B	0–400Hz/9999	9999
35	Frequency jump 3A	0–400Hz/9999	9999
36	Frequency jump 3B	0–400Hz/9999	9999
37	Speed display	0/0.01–9998	0
40	RUN key rotation direction selection	0/1	0
41	Up-to-frequency sensitivity	0–100%	10%
42	Output frequency detection	0–400Hz	6Hz
43	Output frequency detection for reverse rotation	0–400Hz/9999	9999
44	Second acceleration/ deceleration time	0–3600s	5s/10s ①
45	Second deceleration time	0–3600s/9999	9999
46	Second torque boost	0–30%/9999	9999
47	Second V/F (base frequency)	0–400Hz/9999	9999
48	Second stall prevention operation current	0–120%	110%
51	Second electronic thermal O/L relay	0–500A, 9999	9999
52	DU/PU main display data selection	0/5/8–12/14/20/ 23–25/52–55/61/ 62/64/100	0
55	Frequency monitoring reference	0–400Hz	50Hz
56	Current monitoring reference	0–500A	Rated inverter current

Parameter	Name	Setting Range	Initial Value
57	Restart coasting time	0, 0.1–5s/9999 ①	9999
58	Restart cushion time	0–60s	1s
59	Remote function selection	0/1/2/3	0
60	Energy saving control selection	0/9	0
65	Retry selection	0–5	0
66	Stall prevention operation reduction starting frequency	0–400Hz	50Hz
67	Number of retries at fault occurrence	0–10/101–110	0
68	Retry waiting time	0.1–600s	1s
69	Retry count display erase	0	0
70	Special regenerative brake duty	0–30%	0%
71	Applied motor	0/1/3/13/23/ 40/43/50/53	0
72	PWM frequency selection	0–15	1
73	Analog input selection	0/1/10/11	1
74	Input filter time constant	0–8	1
75	Reset selection/disconnected PU detection/PU stop selection	0–3/14–17	14
77	Parameter write selection	0/1/2	0
78	Reverse rotation prevention selection	0/1/2	0
79	Operation mode selection	0/1/2/3/4/6/7	0
80	Motor capacity	0.1–7.5kW/9999	9999
82	Motor excitation current	0–500A/9999	9999
83	Motor rated voltage	0–1000V	200V/ 400V ④
84	Rated motor frequency	10–120Hz	50Hz
90	Motor constant (R1)	0–50Ω/9999	9999
96	Auto tuning setting/status	0/11/21	0
117	PU communication station number	0–31 (0–247)	0
118	PU communication speed	48/96/192/384	192
119	PU communication stop bit length	0/1/10/11	1
120	PU communication parity check	0/1/2	2
121	Number of PU communication retries	0–10/9999	1
122	PU communication check time interval	0/0.1–999.8s/ 9999	9999
123	PU communication waiting time setting	0–150ms/9999	9999
124	PU communication CR/LF selection	0/1/2	1
125	Terminal 2 frequency setting gain frequency	0–400Hz	50Hz

Parameter	Name	Setting Range	Initial Value
126	Terminal 4 frequency setting gain frequency	0–400Hz	50Hz
127	PID control automatic switchover frequency	0–400Hz/9999	9999
128	PID action selection	0/20/21/40–43	0
129	PID proportional band	0.1–1000%/9999	100%
130	PID integral time	0.1–3600s/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
134	PID differential time	0.01–10.00s/9999	9999
145	PU display language selection	0–7	1
146	Parameter for manufacturer setting. Do not set.		
150	Output current detection level	0–200%	150%
151	Output current detection signal delay time	0–10s	0s
152	Zero current detection level	0–200%	5%
153	Zero current detection time	0–1s	0.5s
156	Stall prevention operation selection	0–31/100/101	0
157	OL signal output timer	0–25s/ 9999	0s
158	AM terminal function selection	1–3/5/8–12/14/21/ 24/52/53/61/62	1
160	Extended function display selection	0/9999	9999
161	Frequency setting/key lock operation selection	0/1/10/11	0
162	Automatic restart after instantaneous power failure selection	0/1/10/11	1
165	Stall prevention operation level for restart	0–200%	150%
166	Output current detection signal retention time	0–10s/9999	0.1s
167	Output current detection operation selection	0/1	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
178	STF terminal function selection	0–5/7/8/10/12/14/ 16/18/24/25/37/ 60/62/65–67/9999	60
179	STR terminal function selection	0–5/7/8/10/12/14/ 16/18/24/25/37/ 61/62/65–67/9999	61

Parameter	Name	Setting Range	Initial Value
180	RL terminal function selection	0–5/7/8/10/12/14/ 16/18/24/25/37/ 62/65–67/9999	0
181	RM terminal function selection		1
182	RH terminal function selection		2
190	RUN terminal function selection	0/1/3/4/7/8/11–16/ 25/26/46/47/64/ 70/90/91/93/95/ 96/98/99/100/101/ 103/104/107/108/ 111–116/125/126/ 146/147/164//170/ 190/191/193/195/ 196/198/199/9999	0
192	ABC terminal function selection	0/1/3/4/7/8/11–16/ 25/26/46/47/64/ 70/90/91/95/96/ 98/99/100/101/ 103/104/107/108/ 111–116/125/126/ 146/147/164/170/ 190/191/195/196/ 198/199/9999	2
232–239	Multi-speed setting (speed 8 to speed 15)	0–400Hz/9999	9999
240	Soft-PWM operation selection	0/1	1
241	Analog input display unit switchover	0/1	0
244	Cooling fan operation selection	0/1	1
245	Rated slip	0–50%/9999	9999
246	Slip compensation time constant	0.01–10s	0.5s
247	Constant-power range slip compensation selection	0/9999	9999
249	Earth (ground) fault detection at start	0/1	0
250	Stop selection	0–100s/ 1000–1100s/ 8888/9999	9999
251	Output phase loss protection selection	0/1	1
255	Life alarm status display	(0–15)	0
256	Inrush current limit circuit life display	(0–100%)	100%
257	Control circuit capacitor life display	(0–100%)	100%
258	Main circuit capacitor life display	(0–100%)	100%
259	Main circuit capacitor life measuring	0/1	0
260	PWM frequency automatic switchover	0/1	0
261	Power failure stop selection	0/1/2	0
267	Terminal 4 input selection	0/1/2	0

Parameter	Name	Setting Range	Initial Value
268	Monitor decimal digits selection	0/1/9999	9999
269	Parameter for manufacturer setting. Do not set.		
295	Magnitude of frequency change setting	0/0.01/0.10/ 1.00/10.00	0
296	Password lock level	1–6/101–106/ 9999	9999
297	Password lock/unlock	1000–9998/ (0–5)/(9999)	9999
298	Frequency search gain	0–32767/9999	9999
299	Rotation direction detection selection at restarting	0/1/9999	9999
338	Communication operation command source	0/1	0
339	Communication speed command source	0/1/2	0
340	Communication startup mode selection	0/1/10	0
342	Communication EEPROM write selection	0/1	0
343	Communication error count	—	0
450	Second applied motor	0/1/9999	9999
495	Remote output selection	0/1/10/11	0
496	Remote output data 1	0–4095	0
502	Stop mode selection at communication error	0/1/2	0
503	Maintenance timer	0 (1–9998)	0
504	Maintenance timer alarm output set time	0–9998/9999	9999
549	Protocol selection	0/1	0
551	PU mode operation command source selection	2/4/9999	9999
555	Current average time	0.1–1.0s	1s
556	Data output mask time	0–20s	0s
557	Current average value monitor signal output reference current	0–500A	Rated inverter current
561	PTC thermistor protection level	0.5–30kΩ/9999	9999
563	Energization time carrying-over times	(0–65535)	0
564	Operating time carrying-over times	(0–65535)	0
571	Holding time at a start	0.0–10.0s/9999	9999
575	Output interruption detection time	0–3600s/ 9999	1s
576	Output interruption detection level	0–400Hz	0Hz
577	Output interruption cancel level	900–1100%	1000%
592	Traverse function selection	0/1/2	0

Parameter	Name	Setting Range	Initial Value
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	0.1–3600s	5s
597	Amplitude deceleration time	0.1–3600s	5s
611	Acceleration time at a restart	0–3600s/9999	9999
653	Speed smoothing control	0–200%	0
665	Regeneration avoidance frequency gain	0–200%	100%
872	Input phase loss protection selection ⑤	0/1	0
882	Regeneration avoidance operation selection	0/1/2	0
883	Regeneration avoidance operation level	300–800V	400V DC/ 780V DC ④
885	Regeneration avoidance compensation frequency limit value	0–10Hz/9999	6Hz
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

Parameter	Name	Setting Range	Initial Value
C1 (901)	AM terminal calibration	—	—
C2 (902)	Terminal 2 frequency setting bias frequency	0–400Hz	0Hz
C3 (902)	Terminal 2 frequency setting bias	0–300%	0%
125 (903)	Terminal 2 frequency setting gain frequency	0–400Hz	50Hz
C4 (903)	Terminal 2 frequency setting gain	0–300%	100%
C5 (904)	Terminal 4 frequency setting bias frequency	0–400Hz	0Hz
C6 (904)	Terminal 4 frequency setting bias	0–300%	20%
126 (905)	Terminal 4 frequency setting gain frequency	0–400Hz	50Hz
C7 (905)	Terminal 4 frequency setting gain	0–300%	100%
C22 (922) – C25 (923)	Parameter for manufacturer setting. Do not set.		
990	PU buzzer control	0/1	1
991	PU contrast adjustment	0–63	58
Pr.CL	Parameter clear	0/1	0
ALLC	All parameter clear	0/1	0
Er.CL	Faults history clear	0/1	0
PR.CH	Initial value change list	0	0

Remarks:

① Differ according to capacities.

③ When the value “8888” is set, the maximum output voltage is 95% of the input voltage.

③ When the value “9999” is set, the maximum output voltage equals the input voltage.

④ The initial value differs according to the voltage class.

⑤ Available only for the three-phase power input specification model.

A.1.2 FR-E700

Para-meter	Name	Setting Range	Initial Value
0	Torque boost	0–30%	6/4/3/2% ①
1	Maximum frequency	0–120Hz	120Hz
2	Minimum frequency	0–120Hz	0Hz
3	Base frequency	0–400Hz	50Hz
4	Multi-speed setting (high speed) - RH	0–400Hz	50Hz
5	Multi-speed setting (middle speed) - RM	0–400Hz	30Hz
6	Multi-speed setting (low speed) - RL	0–400Hz	10Hz
7	Acceleration time	0–3600s/360s	5/10/15s ①
8	Deceleration time	0–3600s/360s	5/10/15s ①
9	Electronic thermal O/L relay	0–500A	Rated inverter current ④
10	DC injection brake operation frequency	0–120Hz	3Hz
11	DC injection brake operation time	0–10s	0.5s
12	DC injection brake operation voltage	0–30%	4/2% ①
13	Starting frequency	0–60Hz	0.5Hz
14	Load pattern selection	0/1/2/3	1
15	Jog frequency	0–400Hz	5Hz
16	Jog acceleration/ deceleration time	0–3600s/360s	0.5s
17	MRS input selection	0/2/4	0
18	High speed maximum frequency	120–400Hz	120Hz
19	Base frequency voltage	0–1000V/ 8888 ②/9999 ③	8888
20	Acceleration/deceleration reference frequency	1–400Hz	50Hz
21	Acceleration/deceleration time increments	0/1	0
22	Stall prevention operation level	0–200%	150%
23	Stall prevention operation level compensation factor at double speed	0–200%/9999	9999
24-27	Multi-speed setting (speed 4 to speed 7)	0–400Hz/9999	9999
29	Acceleration/deceleration pattern selection	0/1/2	0
30	Regenerative function selection	0/1/2	0
31	Frequency jump 1A	0–400Hz/9999	9999
32	Frequency jump 1B	0–400Hz/9999	9999
33	Frequency jump 2A	0–400Hz/9999	9999
34	Frequency jump 2B	0–400Hz/9999	9999

Para-meter	Name	Setting Range	Initial Value
35	Frequency jump 3A	0–400Hz/9999	9999
36	Frequency jump 3B	0–400Hz/9999	9999
37	Speed display	0/0.01–9998	0
40	RUN key rotation direction selection	0/1	0
41	Up-to-frequency sensitivity	0–100%	10%
42	Output frequency detection	0–400Hz	6Hz
43	Output frequency detection for reverse rotation	0–400Hz/9999	9999
44	Second acceleration/ deceleration time	0–3600s/360s	5/10/15s ①
45	Second deceleration time	0–3600s/360s/ 9999	9999
46	Second torque boost	0–30%/9999	9999
47	Second V/F (base frequency)	0–400Hz/9999	9999
48	Second stall prevention operation current	0–120%	110%
51	Second electronic thermal O/L relay	0–500A/9999	9999
52	DU/PU main display data selection	0/5/7–12/14/20/ 23–25/52–57/61/ 62/100	0
55	Frequency monitoring reference	0–400Hz	50Hz
56	Current monitoring reference	0–500A	Rated inverter current
57	Restart coasting time	0/0.1–5s/9999 ①	9999
58	Restart cushion time	0–60s	1s
59	Remote function selection	0/1/2/3	0
60	Energy saving control selection	0/9	0
61	Reference current	0–500A/9999	9999
62	Reference value at acceleration	0–200%/9999	9999
63	Reference value at deceleration	0–200%/9999	9999
65	Retry selection	0–5	0
66	Stall prevention operation reduction starting frequency	0–400Hz	50Hz
67	Number of retries at alarm occurrence	0–10/101–110	0
68	Retry waiting time	0.1–360s	1s
69	Retry count display erase	0	0
70	Special regenerative brake duty	0–30%	0%
71	Applied motor	0/1–3–6/13–16/ 23/24/40/43/44/ 50/53/54	0

Parameter	Name	Setting Range	Initial Value
72	PWM frequency selection	0–15	1
73	Analog input selection	0/1/10/11	1
74	Input filter time constant	0–8	1
75	Reset selection/disconnected PU detection/PU stop selection	0–3/14–17	14
77	Parameter write selection	0/1/2	0
78	Reverse rotation prevention selection	0/1/2	0
79	Operation mode selection	0/1/2/3/4/6/7	0
80	Motor capacity	0.1–15kW/9999	9999
81	Number of motor poles	2/4/6/8/10/12/ 14/16/18/20/9999	9999
82	Motor excitation current	0–500A/9999 ⑤	9999
83	Motor rated voltage	0–1000V	400V
84	Rated motor frequency	10–120Hz	50Hz
89	Speed control gain (advanced magnetic flux vector)	0–200%/9999	9999
90	Motor constant (R1)	0–50Ω/9999 ⑤	9999
91	Motor constant (R2)	0–50Ω/9999 ⑤	9999
92	Motor constant (L1)	0–1000mH/ 9999 ⑤	9999
93	Motor constant (L2)	0–1000mH/ 9999 ⑤	9999
94	Motor constant (X)	0–1000%/9999 ⑤	9999
96	Auto tuning setting/status	0/1/11/21	0
117	PU communication station number	0–31 (0–247)	0
118	PU communication speed	48/96/192/384	192
119	PU communication stop bit length	0/1/10/11	1
120	PU communication parity check	0/1/2	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	0–150ms/9999	9999
124	PU communication CR/LF selection	0/1/2	1
125	Terminal 2 frequency setting gain frequency	0–400Hz	50Hz
126	Terminal 4 frequency setting gain frequency	0–400Hz	50Hz
127	PID control automatic switchover frequency	0–400Hz/9999	9999
128	PID action selection	0/20/21/40–43/ 50/51/60/61	0
129	PID proportional band	0.1–1000%/9999	100%
130	PID integral time	0.1–3600s/9999	1s

Parameter	Name	Setting Range	Initial Value
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
134	PID differential time	0.01–10.00s/9999	9999
145	PU display language selection	0–7	1
146	Parameter for manufacturer setting. Do not make setting.		
147	Acceleration/deceleration switching frequency	0–400Hz/9999	9999
150	Output current detection level	0–200%	150%
151	Output current detection signal delay time	0–10s	0s
152	Zero current detection level	0–200%	5%
153	Zero current detection time	0–1s	0.5s
156	Stall prevention operation selection	0–31/100/101	0
157	OL signal output timer	0–25s/ 9999	0s
158	AM terminal function selection	1–3/5/7–12/14/21/ 24/52/53/61/62	1
160	User group read selection	0/1/9999	9999
161	Frequency setting/key lock operation selection	0/1/10/11	0
162	Automatic restart after instantaneous power failure selection	0/1/10/11	1
165	Stall prevention operation level for restart	0–200%	150%
168	Parameter for manufacturer setting. Do not make setting.		
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	(0–16)/9999	9999
173	User group registration	0–999/9999	9999
174	User group clear	0–999/9999	9999
178	STF terminal function selection	0–5/7/8/10/12/ 14–16/18/24/25/ 60/62/65–67/9999	60
179	STR terminal function selection	0–5/7/8/10/12/ 14–16/18/24/25/ 61/62/65–67/9999	61
180	RL terminal function selection	0–5/7/8/10/12/ 14–16/18/24/25/ 62/65–67/9999	0
181	RM terminal function selection		1
182	RH terminal function selection		2
183	MRS terminal function selection		
184	RES terminal function selection		

Parameter	Name	Setting Range	Initial Value
190	RUN terminal function selection	0/1/3/4/7/8/11–16/20/25/26/46/47/64/90/91/93/95/96/98/99/100/101/103/104/107/108/111–116/120/125/126/146/147/164/190/191/193/195/196/198/199/9999	0
191	FU terminal function selection		1
192	ABC terminal function selection	0/1/3/4/7/8/11–16/20/25/26/46/47/64/90/91/95/96/98/99/100/101/103/104/107/108/111–116/120/125/126/146/147/164/190/191/195/196/198/199/9999	2
232–239	Multi-speed setting (speed 8 to speed 15)	0–400Hz/9999	9999
240	Soft-PWM operation selection	0/1	1
241	Analog input display unit switch over	0/1	0
244	Cooling fan operation selection	0/1	1
245	Rated slip	0–50%/9999	9999
246	Slip compensation time constant	0.01–10s	0.5s
247	Constant-output region slip compensation selection	0/9999	9999
249	Earth (ground) fault detection at start	0/1	0
250	Stop selection	0–100s/1000–1100s/8888/9999	9999
251	Output phase loss failure protection selection	0/1	1
255	Life alarm status display	(0–15)	0
256	Inrush current limit circuit life display	(0–100%)	100%
257	Control circuit capacitor life display	(0–100%)	100%
258	Main circuit capacitor life display	(0–100%)	100%
259	Main circuit capacitor life measuring	0/1	0
261	Power failure stop selection	0/1/2	0
267	Terminal 4 input selection	0/1/2	0
268	Monitor decimal digits selection	0/1/9999	9999
269	Parameter for manufacturer setting. Do not make setting.		
270	Stop-on contact control selection	0/1	0
275	Stop-on contact excitation current low-speed multiplying factor	0–300%/9999	9999
276	PWM carrier frequency at stop-on contact	0–9/9999	9999
277	Stall prevention operation current switchover	0/1	0
278	Brake opening frequency	0–30Hz	3Hz
279	Brake opening current	0–200%	130%
280	Brake opening current detection time	0–2s	0.3s
281	Brake operation time at start	0–5s	0.3s
282	Brake operation frequency	0–30Hz	6Hz
283	Brake operation time at stop	0–5s	0.3s
286	Droop gain	0–100%	0%
287	Droop filter time constant	0–1s	0.3s
292	Automatic acceleration/deceleration	0/1/7/8/11	0
293	Acceleration/deceleration separate selection	0/1/2	0
295	Magnitude of frequency change setting	0/0.01/0.10/1.00/10.00	0
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-A7AX E kit (16 bit digital input)	
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-A7AY E kit (Analog/digital output)	
307	Setting for zero analog output		
308	Setting for maximum analog output		
309	Analog output signal voltage/current switch over		
310	Analog meter voltage output selection		
311	Setting for zero analog meter voltage output		
312	Setting for maximum analog meter voltage output		
313	Y0 terminal function selection		
314	Y1 terminal function selection		
315	Y2 terminal function selection		
316	Y3 terminal function selection		
317	Y4 terminal function selection		
318	Y5 terminal function selection		
319	Y6 terminal function selection		
320	RA1 terminal function selection	Parameter for option FR-A7AR E kit (Relay output)	
321	RA2 terminal function selection		
322	RA3 terminal function selection		
323	AM0 0V adjustment	Parameter for option FR-A7AY E kit (Analog/digital output)	
324	AM1 0mA adjustment		
329	Digital input unit selection	Parameter for option FR-A7AX E kit (16 bit digital input)	
338	Communication operation command source	0/1	0
339	Communication speed command source	0/1/2	0
340	Communication start-up mode selection	0/1/10	0
342	Communication E²PROM write selection	0/1	0
343	Communication error count	—	0
345	DeviceNet address	Parameter for option FR-A7ND E kit/FR-A7NCA kit (DeviceNet communication option)	
346	DeviceNet baud rate		

Parameter	Name	Setting Range	Initial Value
349	Communication reset selection	Parameter for options FR-A7NC E kit/FR-A7ND E kit/FR-A7NL E kit/FR-A7NP E kit (CC-Link and PROFIBUS/DP communication option)	
387	Initial communication delay time	Parameter for option FR-A7NL E kit (LONWORKS communication option)	
388	Send time interval at heart beat		
389	Minimum sending time at heart beat		
390	% setting reference frequency		
391	Receive time interval at heart beat		
392	Event driven detection width		
450	Second applied motor	0/1/9999	9999
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
500	Communication error execution waiting time	Parameter for options FR-A7NC E kit/FR-A7ND E kit/FR-A7NL E kit/FR-A7NP E kit	
501	Communication error occurrence count display		
502	Stop mode selection at communication error	0/1/2/3	0
503	Maintenance timer	0 (1–9998)	0
504	Maintenance timer alarm output set time	0–9998/9999	9999
541	Frequency command sign selection	Parameter for option FR-A7NC E kit (CC-Link communication)	
542	Communication station number		
543	Baud rate		
544	CC-Link extended setting		
547	USB communication station number	0–31	0
548	USB communication check time interval	0/0.1–999.8s/9999	9999
549	Protocol selection	0/1	0
550	NET mode operation command source selection	0/2/9999	9999
551	PU mode operation command source selection	2/3/4/9999	9999
555	Current average time	0.1–1.0s	1s
556	Data output mask time	0–20s	0s
557	Current average value monitor signal output reference current	0–500A	Rated inverter current
563	Energizing time carrying-over times	(0–65535)	0

Parameter	Name	Setting Range	Initial Value
564	Operating time carrying-over times	(0–65535)	0
571	Holding time at a start	0.0–10.0s/9999	9999
611	Acceleration time at a restart	0–3600s/9999	9999
645	AM 0V adjustment	970–1200	1000
653	Speed smoothing control	0–200%	0
665	Regeneration avoidance frequency gain	0–200%	100%
800	Control method selection	20/30	20
859	Torque current	0–500A/9999 ⑤	9999
872	Input phase loss protection selection	0/1	0
882	Regeneration avoidance operation selection	0/1/2	0
883	Regeneration avoidance operation level	300–800V	780V DC
885	Regeneration avoidance compensation frequency limit value	0–10Hz/9999	6Hz
886	Regeneration avoidance voltage gain	0–200%	100%
888	Free parameter 1	0–9999	9999
889	Free parameter 2	0–9999	9999
C1 (901)	AM terminal calibration	—	—
C2 (902)	Terminal 2 frequency setting bias frequency	0–400Hz	0Hz

Parameter	Name	Setting Range	Initial Value
C3 (902)	Terminal 2 frequency setting bias	0–300%	0%
125 (903)	Terminal 2 frequency setting gain frequency	0–400Hz	50Hz
C4 (903)	Terminal 2 frequency setting gain	0–300%	100%
C5 (904)	Terminal 4 frequency setting bias frequency	0–400Hz	0Hz
C6 (904)	Terminal 4 frequency setting bias	0–300%	20%
126 (905)	Terminal 4 frequency setting gain frequency	0–400Hz	50Hz
C7 (905)	Terminal 4 frequency setting gain	0–300%	100%
C22 (922) – C25 (923)	Parameter for manufacturer setting. Do not make setting.		
990	PU buzzer control	0/1	1
991	PU contrast adjustment	0–63	58
Pr.CL	Parameter clear	0/1	0
ALLC	All parameter clear	0/1	0
Er.CL	Faults history clear	0/1	0
PR.CH	Initial value change list	0	0

Remarks:

① Differ according to capacities.

③ When the value “8888” is set, the maximum output voltage is 95% of the input voltage.

② When the value “9999” is set, the maximum output voltage equals the input voltage.

④ The initial value of the FR-E740-026 or less is set to 85% of the rated inverter current.

⑤ The range differs according to the Pr. 71 setting.

A.1.3 FR-F700

Parameter	Name	Setting Range	Initial Value
0	Torque boost	0–30%	6/4/3/ 2/1.5/1% ①
1	Maximum frequency	0–120Hz	120/60Hz ①
2	Minimum frequency	0–120Hz	0Hz
3	Base frequency	0–400Hz	50Hz
4	Multi-speed setting (high speed) - RH	0–400Hz	50Hz
5	Multi-speed setting (medium speed) - RM	0–400Hz	30Hz
6	Multi-speed setting (low speed) - RL	0–400Hz	10Hz
7	Acceleration time	0–3600/360s	5s/15s ①
8	Deceleration time	0–3600/360s	10s/30s ①
9	Electronic thermal O/L relay	0–500/ 0–3600A ①	Rated output current
10	DC injection brake operation frequency	0–120Hz/9999	3Hz
11	DC injection brake operation time	0–10s/8888	0.5s
12	DC injection brake operation voltage	0–30%	4/2/1% ①
13	Starting frequency	0–60Hz	0.5Hz
14	Load pattern selection	0/1	1
15	Jog frequency	0–400Hz	5Hz
16	Jog acceleration/deceleration time	0–3600/360s	0.5s
17	MRS input selection	0/2	0
18	High speed maximum frequency	120–400Hz	120/60Hz ①
19	Base frequency voltage	0–1000V/ 8888 ②/9999 ③	8888
20	Acceleration/deceleration reference frequency	1–400Hz	50Hz
21	Acceleration/deceleration time increments	0/1	0
22	Stall prevention operation level	0–120%/9999	110%
23	Stall prevention operation level compensation factor at double speed	0–150%/9999	9999
24-27	Multi-speed setting 4th speed to 7th speed	0–400Hz/9999	9999
28	Multi-speed input compensation selection	0/1	0
29	Acceleration/deceleration pattern selection	0–3	0
30	Regenerative function selection	0/2 0/1/2	0
31	Frequency jump 1A	0–400Hz/9999	9999
32	Frequency jump 1B	0–400Hz/9999	9999
33	Frequency jump 2A	0–400Hz/9999	9999
34	Frequency jump 2B	0–400Hz/9999	9999
35	Frequency jump 3A	0–400Hz/9999	9999
36	Frequency jump 3B	0–400Hz/9999	9999
37	Speed display	0/1–9998	0
41	Up-to-frequency sensitivity	0–100%	10%
42	Output frequency detection	0–400Hz	6Hz
43	Output frequency detection for reverse rotation	0–400Hz/9999	9999
44	Second acceleration/deceleration time	0–3600/360s	5s
45	Second deceleration time	0–3600/360s/ 9999	9999
46	Second torque boost	0–30%/9999	9999
47	Second V/F (base frequency)	0–400Hz/9999	9999
48	Second stall prevention operation current	0–120%	110%
49	Second stall prevention operation frequency	0–400Hz/9999	0Hz
50	Second output frequency detection	0–400Hz	30Hz
51	Second electronic thermal O/L relay	0–500A, 9999/ 0–3600A, 9999 ①	9999
52	DU/PU main display data selection	0/5/6/8–14/17/20/ 23–25/50–57/100	0
54	CA terminal function selection	1–3/5/6/8–14/17/ 21/24/50/52/53,	1
55	Frequency monitoring reference	0–400Hz	50Hz
56	Current monitoring reference	0–500A/ 0–3600A ①	Rated current
57	Restart coasting time	0, 0.1–5s, 9999/ 0, 0.1–30s, 9999 ①	9999
58	Restart cushion time	0–60s	1s
59	Remote function selection	0/1/2/3	0
60	Energy saving control selection	0/4/9	0
65	Retry selection	0–5	0
66	Stall prevention operation reduction starting frequency	0–400Hz	50Hz
67	Number of retries at alarm occurrence	0–10/101–110	0
68	Retry waiting time	0–10s	1s
69	Retry count display erase	0	0
70	Special regenerative brake duty	0–10%	0%
71	Applied motor	0/1/2/20	0
72	PWM frequency selection	0–15/0–6/25 ①	2

Para-meter	Name	Setting Range	Initial Value
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/ 100–103/114–117	14
76	Alarm code output selection	0/1/2	0
77	Parameter write selection	0/1/2	0
78	Reverse rotation prevention selection	0/1/2	0
79	Operation mode selection	0/1/2/3/4/6/7	0
80	Motor capacity (simple magnetic flux vector control)	0.4–55kW, 9999/ 0–3600kW, 9999 ①	9999
90	Motor constant (R1)	0–50Ω, 9999/ 0–400mΩ, 9999 ①	9999
100	V/f1 (frequency)	0–400Hz/9999	9999
101	V/f1 (voltage)	0–1000V	0V
102	V/f2 (frequency)	0–400Hz/9999	9999
103	V/f2 (voltage)	0–1000V	0V
104	V/f3 (frequency)	0–400Hz/9999	9999
105	V/f3 (voltage)	0–1000V	0V
106	V/f4 (frequency)	0–400Hz/9999	9999
107	V/f4 (voltage)	0–1000V	0V
108	V/f5 (frequency)	0–400Hz/9999	9999
109	V/f5 (voltage)	0–1000V	0V
117	PU communication station number	0–31	0
118	PU communication speed	48/96/192/384	192
119	PU communication stop bit length	0/1/10/11	1
120	PU communication parity check	0/1/2	2
121	Number of PU communication retries	0–10/9999	1
122	PU communication check time interval	0/0.1–999.8s/ 9999	9999
123	PU communication waiting time setting	0–150ms/9999	9999
124	PU communication CR/LF presence/absence selection	0/1/2	1
125	Terminal 2 frequency setting gain frequency	0–400Hz	50Hz
126	Terminal 4 frequency setting gain frequency	0–400Hz	50Hz
127	PID control automatic switchover frequency	0–400Hz/9999	9999
128	PID action selection	10/11/20/21/50/ 51/60/61	10
129	PID proportional band	0.1–1000%/9999	100%
130	PID integral time	0.1–3600s/9999	1s

Para-meter	Name	Setting Range	Initial Value
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
134	PID differential time	0.01–10.00s/9999	9999
135	Commercial power-supply switchover sequence output terminal selection	0/1	0
136	MC switchover interlock time	0–100s	1s
137	Start waiting time	0–100s	0.5s
138	Commercial power-supply operation switchover selection at an alarm	0/1	0
139	Automatic switchover frequency between inverter and commercial power-supply operation	0–60Hz/9999	9999
140	Backlash acceleration stopping frequency	0–400Hz	1Hz
141	Backlash acceleration stopping time	0–360s	0.5s
142	Backlash deceleration stopping frequency	0–400Hz	1Hz
143	Backlash deceleration stopping time	0–360s	0.5s
144	Speed setting switchover	0/2/4/6/8/10/102/ 104/106/108/110	4
145	PU display language selection	0–7	1
148	Stall prevention level at 0 V input	0–120%	110%
149	Stall prevention level at 10 V input	0–120%	120%
150	Output current detection level	0–120%	110%
151	Output current detection signal delay time	0–10s	0s
152	Zero current detection level	0–150%	5%
153	Zero current detection time	0–1s	0.5s
154	Voltage reduction selection during stall prevention operation	0/1	1
155	RT signal reflection time selection	0/10	0
156	Stall prevention operation selection	0–31/100/101	0
157	OL signal output timer	0–25s/ 9999	0s
158	AM terminal function selection	1–3/5/6/7/8–14/ 17/ 21/24/50/ 52/ 53	1
159	Automatic switchover ON range between commercial power-supply and inverter operation	0–10Hz/9999	9999
160	User group read selection	0/1/9999	0

Para-meter	Name	Setting Range	Initial Value
161	Frequency setting/key lock operation selection	0/1/10/11	0
162	Automatic restart after instantaneous power failure selection	0/1/2/10/11	0
163	First cushion time for restart	0–20s	0s
164	First cushion voltage for restart	0–100%	0%
165	Stall prevention operation level for restart	0–120%	110%
166	Output current detection signal retention time	0–10s/9999	0.1s
167	Output current detection operation selection	0/1	0
168	Parameter for manufacturer setting. Do not set.		
169			
170	Cumulative power 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	0–999/9999	9999
174	User group clear	0–999/9999	9999
178	STF terminal function selection	0–8/10–14/16/24/25/37/60/62/64–67/9999	60
179	STR terminal function selection	0–8/10–14/16/24/25/37/61/62/64–67/9999	61
180	RL terminal function selection	0–8/10–14/16/24/25/37/62/64–67/9999	0
181	RM terminal function selection		1
182	RH terminal function selection		2
183	RT terminal function selection		3
184	AU terminal function selection	0–8/10–14/16/24/25/37/62–67/9999	4
185	JOG terminal function selection	0–8/10–14/16/24/25/37/62/64–67/9999	5
186	CS terminal function selection		6
187	MRS terminal function selection		24
188	STOP terminal function selection		25
189	RES terminal function selection		62

Para-meter	Name	Setting Range	Initial Value
190	RUN terminal function selection	0–5/7/8/10–19/25/26/45–47/64/70–78/90–96/98/99/100–105/107/108/110–116/125/126/145–147/164/170/190–196/198/199/9999	0
191	SU terminal function selection		1
192	IPF terminal function selection		2
193	OL terminal function selection		3
194	FU terminal function selection		4
195	ABC1 terminal function selection	0–5/7/8/10–19/25/26/45–47/64/70–78/90/91/94–96/98/99/100–105/107/108/110–116/125/126/145–147/164/170/190/191/194–196/198/199/9999	99
196	ABC2 terminal function selection		9999
232–239	Multi-speed setting (speeds 8 to 15)	0–400Hz/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	1
245	Rated slip	0–50%/9999	9999
246	Slip compensation time constant	0.01–10s	0.5s
247	Constant-output region slip compensation selection	0/9999	9999
250	Stop selection	0–100s/1000–1100s/8888/9999	9999
251	Output phase failure protection selection	0/1	1
252	Override bias	0–200%	50%
253	Override gain	0–200%	150%
255	Life alarm status display	(0–15)	0
256	Inrush current suppression circuit life display	(0–100%)	100%
257	Control circuit capacitor life display	(0–100%)	100%
258	Main circuit capacitor life display	(0–100%)	100%

Parameter	Name	Setting Range	Initial Value
259	Main circuit capacitor life measuring	0/1	0
260	PWM frequency automatic switchover	0/1	1
261	Power failure stop selection	0/1/2	0
262	Subtracted frequency at deceleration start	0–20Hz	3Hz
263	Subtraction starting frequency	0–120Hz/9999	50Hz
264	Power-failure deceleration time 1	0–3600/360s	5s
265	Power-failure deceleration time 2	0–3600/360s/ 9999	9999
266	Power failure deceleration time switchover frequency	0–400Hz	50Hz
267	Terminal 4 input selection	0/1/2	0
268	Monitor decimal digits selection	0/1/9999	9999
269	Parameter for manufacturer setting. Do not set.		
299	Rotation direction detection selection at restarting	0/1/9999	9999
300	BCD input bias	Parameter for option FR-A7AX (16 bit digital input)	
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		
306	Analog output signal selection	Parameter for option FR-A7AY (Analog/digital output)	
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		
314	DO1 output selection		
315	DO2 output selection		
316	DO3 output selection		
317	DO4 output selection		
318	DO5 output selection		
319	DO6 output selection		

Parameter	Name	Setting Range	Initial Value
320	RA1 output selection	Parameter for option FR-A7AR (Relay outputs)	
321	RA2 output selection		
322	RA3 output selection		
323	AM0 0V adjustment	Parameter for option FR-A7AY (Analog/digital output)	
324	AM1 0mA adjustment		
329	Digital input unit selection	Parameter for option FR-A7AX (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	96
333	RS-485 communication stop bit length	0/1/10/11	1
334	RS-485 communication parity check selection	0/1/2	2
335	RS-485 communication number of retries	0–10/ 9999	1
336	RS-485 communication check time interval	0–999.8s/ 9999	0s
337	RS-485 communication waiting time setting	0–150ms/ 9999	9999
338	Communication operation command source	0/1	0
339	Communication speed command source	0/1/2	0
340	Communication startup mode selection	0/1/2/10/12	0
341	RS-485 communication CR/LF selection	0/1/2	1
342	Communication EEPROM write selection	0/1	0
343	Communication error count	—	0
345	DeviceNet address	Parameter for option FR-A7ND (DeviceNet communication)	
346	DeviceNet baud rate		
349	Communication reset selection	Parameter for communication options FR-A7NC/FR-A7NP (CC-Link/PROFIBUS/DP)	
387	Initial communication delay time	Parameter for option FR-A7NL (LONWORKS communication)	
388	Send time interval at hart beat		
389	Minimum sending time at hart beat		
390	% setting reference frequency		
391	Receive time interval at hart beat		
392	Event driven detection width		
495	Remote output selection	0/1	0
496	Remote output data 1	0–4095	0
497	Remote output data 2	0–4095	0

Para-meter	Name	Setting Range	Initial Value
500	Communication error execution waiting time	Parameter for networks options	
501	Communication error occurrence count display		
502	Stop mode selection at communication error		
503	Maintenance timer	0 (1–9998)	0
504	Maintenance timer alarm output set time	0–9998/9999	9999
542	Communication station number (CC-Link)	Parameter for option FR-A7NC (CC-Link communication)	
543	Baud rate (CC-Link)		
544	CC-Link extended setting		
549	Protocol selection	0/1	0
550	NET mode operation command source selection	0/1/9999	9999
551	PU mode operation command source selection	1/2	2
555	Current average time	0.1–1.0s	1s
556	Data output mask time	0.0–20.0s	0s
557	Current average value monitor signal output reference current	0–500A/ 0–3600A ②	Rated inverter output current
563	Energization time carrying-over times	(0–65535)	0
564	Operating time carrying-over times	(0–65535)	0
570	Multiple rating setting	0/1	0
571	Holding time at a start	0.0–10.0s/9999	9999
573	4 mA Input check selection	1/9999	9999
575	Output interruption detection time	0–3600s, 9999	1s
576	Output interruption detection level	0–400Hz	0Hz
577	Output interruption release level	900–1100%	1000%
578	Auxiliary motor operation selection	0–3	0
579	Motor swichover selection	0–3	0
580	MC switching interlock time	0–100s	1s
581	Start waiting time	0–100s	1s
582	Auxiliary motor connection-time deceleration time	0–3600s/9999	1s
583	Auxiliary motor disconnection-time acceleration time	0–3600s/9999	1s
584	Auxiliary motor 1 starting frequency	0–400Hz	50Hz
585	Auxiliary motor 2 starting frequency	0–400Hz	50Hz
586	Auxiliary motor 3 starting frequency	0–400Hz	50Hz
587	Auxiliary motor 1 stopping frequency	0–400Hz	0Hz

Para-meter	Name	Setting Range	Initial Value
588	Auxiliary motor 2 stopping frequency	0–400Hz	0Hz
589	Auxiliary motor 3 stopping frequency	0–400Hz	0Hz
590	Auxiliary motor start detection time	0–3600s	5s
591	Auxiliary motor stop detection time	0–3600s	5s
592	Traverse function selection	0/1/2	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	0.1–3600s	5s
597	Amplitude deceleration time	0.1–3600s	5s
611	Acceleration time at a restart	0–3600s/9999	5/15s ①
867	AM output filter	0–5s	0.01s
869	Current output filter	0–5s	0.02s
872	Input phase failure protection selection	0/1	0
882	Regeneration avoidance operation selection	0/1	0
883	Regeneration avoidance operation level	300–800V	760V DC
884	Regeneration avoidance at deceleration detection sensitivity	0–5	0
885	Regeneration avoidance compensation frequency limit value	0–10Hz/9999	6Hz
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)	0.1–55kW/ 0–3600kW ②	LD/SLD value of applied motor capacity
894	Control selection during commercial power-supply operation	0/1/2/3	0
895	Power saving rate reference value	0/1/9999	9999
896	Power unit cost	0–500/9999	9999

Parameter	Name	Setting Range	Initial Value
897	Power saving monitor average time	0/1–1000h/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)	FM terminal calibration	—	—
C1 (901)	AM terminal calibration	—	—
C2 (902)	Terminal 2 frequency setting bias frequency	0–400Hz	0Hz
C3 (902)	Terminal 2 frequency setting bias	0–300%	0%
125 (903)	Terminal 2 frequency setting gain frequency	0–400Hz	50Hz
C4 (903)	Terminal 2 frequency setting gain	0–300%	100%
C5 (904)	Terminal 4 frequency setting bias frequency	0–400Hz	0Hz
C6 (904)	Terminal 4 frequency setting bias	0–300%	20%

Parameter	Name	Setting Range	Initial Value
126 (905)	Terminal 4 frequency setting gain frequency	0–400Hz	50Hz
C7 (905)	Terminal 4 frequency setting gain	0–300%	100%
C8 (930)	Current output bias signal	0–100%	0%
C9 (930)	Current output bias current	0–100%	0%
C10 (931)	Current output gain signal	0–100%	100%
C11 (931)	Current output gain current	0–100%	100%
989	Parameter copy alarm release	10/100	10/100 ②
990	PU buzzer control	0/1	1
991	PU contrast adjustment	0–63	58
Pr.CL	Parameter clear	0/1	0
ALLC	All parameter clear	0/1	0
Er.CL	Alarm history clear	0/1	0
PCPY	Parameter copy	0/1/2/3	0

Remarks:

① The setting depends on the inverter capacity.

② When the value “8888” is set, the maximum output voltage is 95% of the input voltage.

③ When the value “9999” is set, the maximum output voltage equals the input voltage.

A.1.4 FR-A700

Parameter	Name	Setting Range	Initial Value
0	Torque boost	0 to 30%	6/4/3/ 2/1% ①
1	Maximum frequency	0–120Hz	120/60Hz ①
2	Minimum frequency	0–120Hz	0Hz
3	Base frequency	0–400Hz	50Hz
4	Multi-speed setting (high speed) - RH	0–400Hz	50Hz
5	Multi-speed setting (medium speed) - RM	0–400Hz	30Hz
6	Multi-speed setting (low speed) - RL	0–400Hz	10Hz
7	Acceleration time	0–3600/360s	5 s/15s ①
8	Deceleration time	0–3600/360s	5 s/15s ①
9	Electronic thermal O/L relay	0–500/ 0–3600A ②	Rated output current
10	DC injection brake operation frequency	0–120Hz/9999	3Hz
11	DC injection brake operation time	0–10s/8888	0.5s
12	DC injection brake operation voltage	0–30%	4/2/1% ①
13	Starting frequency	0–60Hz	0.5Hz
14	Load pattern selection	0–5	0
15	Jog frequency	0–400Hz	5Hz
16	Jog acceleration/deceleration time	0–3600/360s	0.5s
17	MRS input selection	0/2/4	0
18	High speed maximum frequency	120–400Hz	120/60Hz ①
19	Base frequency voltage	0–1000V/ 8888 ②/9999 ③	8888
20	Acceleration/deceleration reference frequency	1–400Hz	50Hz
21	Acceleration/deceleration time increments	0/1	0
22	Stall prevention operation level	0–400%	150%
23	Stall prevention operation level compensation factor at double speed	0–200%/9999	9999
24-27	Multi-speed setting 4th speed to 7th speed	0–400Hz/9999	9999
28	Multi-speed input compensation selection	0/1	0
29	Acceleration/deceleration pattern selection	0–5	0
30	Regenerative function selection	0/1/2/10/11/20/21	0
31	Frequency jump 1A	0–400Hz/9999	9999
32	Frequency jump 1B	0–400Hz/9999	9999
33	Frequency jump 2A	0–400Hz/9999	9999
34	Frequency jump 2B	0–400Hz/9999	9999
35	Frequency jump 3A	0–400Hz/9999	9999
36	Frequency jump 3B	0–400Hz/9999	9999
37	Speed display	0/1–9998	0
41	Up-to-frequency sensitivity	0–100%	10%
42	Output frequency detection	0–400Hz	6Hz
43	Output frequency detection for reverse rotation	0–400Hz/9999	9999
44	Second acceleration/deceleration time	0–3600/360s	5s
45	Second deceleration time	0–3600/360s/ 9999	9999
46	Second torque boost	0–30%/9999	9999
47	Second V/F (base frequency)	0–400Hz/9999	9999
48	Second stall prevention operation current	0–220%	150%
49	Second stall prevention operation frequency	0–400Hz/9999	0Hz
50	Second output frequency detection	0–400Hz	30Hz
51	Second electronic thermal O/L relay	0–500A, 9999/ 0–3600A, 9999 ①	9999
52	DU/PU main display data selection	0/5–14/17–20/22–25/32–35/50–57/100	0
54	CA terminal function selection	1–3/5–14/17/18/21/24/32–34/50/52/53/70	1
55	Frequency monitoring reference	0–400Hz	50Hz
56	Current monitoring reference	0–500A/ 0–3600A ①	Rated current
57	Restart coasting time	0/ 0.1–5s, 9999/ 0/ 0.1–30s/ 9999 ①	9999
58	Restart cushion time	0–60s	1s
59	Remote function selection	0/1/2/3	0
60	Energy saving control selection	0/4	0
61	Automatic acceleration/deceleration: Reference current	0–500A, 9999/ 0–3600A, 9999 ①	9999
62	Automatic acceleration/deceleration: Reference value at acceleration	0–220%/9999	9999
63	Automatic acceleration/deceleration: Reference value at deceleration	0–220%/9999	9999
64	Automatic acceleration/deceleration: Starting frequency for elevator mode	0–10Hz/9999	9999

Parameter	Name	Setting Range	Initial Value
65	Retry selection	0–5	0
66	Stall prevention operation reduction starting frequency	0–400Hz	50Hz
67	Number of retries at alarm occurrence	0–10/101–110	0
68	Retry waiting time	0–10s	1s
69	Retry count display erase	0	0
70	Special regenerative brake duty	0–30%/0–10% ①	0%
71	Applied motor	0–8/13–18/20/23/24/30/33/34/40/43/44/50/53/54	0
72	PWM frequency selection	0–15/0–6/25 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/ 100–103/114–117	14
76	Alarm code output selection	0/1/2	0
77	Parameter write selection	0/1/2	0
78	Reverse rotation prevention selection	0/1/2	0
79	Operation mode selection	0/1/2/3/4/6/7	0
80	Motor capacity (simple magnetic flux vector control)	0.4–55kW, 9999/ 0–3600kW, 9999 ①	9999
81	Number of motor poles (simple magnetic flux vector control)	2/4/6/8/10/12/14/16/18/20/9999	9999
82	Motor excitation current	0–500A, 9999/ 0–3600A, 9999 ①	9999
83	Motor rated voltage	0–1000V	400V
84	Rated motor frequency	10–120Hz	50Hz
89	Speed control gain (magnetic flux vector)	0–200%/9999	9999
90	Motor constant (R1)	0–50Ω, 9999/ 0–400mΩ, 9999 ①	9999
91	Motor constant (R2)	0–50Ω, 9999/ 0–400mΩ, 9999 ①	9999
92	Motor constant (L1)	0–50Ω, (0–1000mH), 9999/ 0–3600mΩ, (0–400mH), 9999 ①	9999
93	Motor constant (L2)	0–50Ω, (0–1000mH), 9999/ 0–3600mΩ, (0–400mH), 9999 ①	9999

Parameter	Name	Setting Range	Initial Value
94	Motor constant (X)	0–500Ω, (0–100%), 9999/ 0–100Ω, (0–100%), 9999 ①	9999
95	Online auto tuning selection	0–2	0
96	Auto tuning setting/status	0/1/101	0
100	V/f1 (frequency)	0–400Hz/9999	9999
101	V/f1 (voltage)	0–1000V	0V
102	V/f2 (frequency)	0–400Hz/9999	9999
103	V/f2 (voltage)	0–1000V	0V
104	V/f3 (frequency)	0–400Hz/9999	9999
105	V/f3 (voltage)	0–1000V	0V
106	V/f4 (frequency)	0–400Hz/9999	9999
107	V/f4 (voltage)	0–1000V	0V
108	V/f5 (frequency)	0–400Hz/9999	9999
109	V/f5 (voltage)	0–1000V	0V
110	Third acceleration/deceleration time	0–3600/360s/9999	9999
111	Third deceleration time	0–3600/360s/9999	9999
112	Third torque boost	0–30%/9999	9999
113	Third V/F (base frequency)	0–400Hz/9999	9999
114	Third stall prevention operation current	0–220%	150%
115	Third stall prevention operation frequency	0–400Hz	0
116	Third output frequency detection	0–400Hz	50Hz
117	PU communication station number	0–31	0
118	PU communication speed	48/96/192/384	192
119	PU communication stop bit length	0/1/10/11	1
120	PU communication parity check	0/1/2	2
121	Number of PU communication retries	0–10/9999	1
122	PU communication check time interval	0/0.1–999.8s/9999	9999
123	PU communication waiting time setting	0–150ms/9999	9999
124	PU communication CR/LF presence/absence selection	0/1/2	1
125	Terminal 2 frequency setting gain frequency	0–400Hz	50Hz
126	Terminal 4 frequency setting gain frequency	0–400 Hz	50 Hz
127	PID control automatic switchover frequency	0–400Hz/9999	9999

Para-meter	Name	Setting Range	Initial Value
128	PID action selection	10/11/20/21/50/51/60/61/70/71/80/81/90/91/100/101	10
129	PID proportional band	0.1–1000%/9999	100%
130	PID integral time	0.1–3600s/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
134	PID differential time	0.01–10.00s/9999	9999
135	Commercial power-supply switchover sequence output terminal selection	0/1	0
136	MC switchover interlock time	0–100s	1s
137	Start waiting time	0–100s	0.5s
138	Commercial power-supply operation switchover selection at an alarm	0/1	0
139	Automatic switchover frequency between inverter and commercial power-supply operation	0–60Hz/9999	9999
140	Backlash acceleration stopping frequency	0–400Hz	1Hz
141	Backlash acceleration stopping time	0–360s	0.5s
142	Backlash deceleration stopping frequency	0–400Hz	1Hz
143	Backlash deceleration stopping time	0–360s	0.5s
144	Speed setting switchover	0/2/4/6/8/10/102/104/106/108/110	4
145	PU display language selection	0–7	1
148	Stall prevention level at 0 V input	0–220%	150%
149	Stall prevention level at 10 V input	0–220%	200%
150	Output current detection level	0–220%	150%
151	Output current detection signal delay time	0–10s	0s
152	Zero current detection level	0–220%	5%
153	Zero current detection time	0–1s	0.5s
154	Voltage reduction selection during stall prevention operation	0/1	1
155	RT signal reflection time selection	0/10	0
156	Stall prevention operation selection	0–31/100/101	0
157	OL signal output timer	0–25s/9999	0s
158	AM terminal function selection	1–3/5–14/17/18/21/24/32–34/50/52/53	1

Para-meter	Name	Setting Range	Initial Value
159	Automatic switchover ON range between commercial power-supply and inverter operation	0–10Hz/9999	9999
160	User group read selection	0/1/9999	0
161	Frequency setting/key lock operation selection	0/1/10/11	0
162	Automatic restart after instantaneous power failure selection	0/1/2/10/11/12	0
163	First cushion time for restart	0–20s	0s
164	First cushion voltage for restart	0–100%	0%
165	Stall prevention operation level for restart	0–220%	150%
166	Output current detection signal retention time	0–10s/9999	0.1s
167	Output current detection operation selection	0/1	0
168	Parameter for manufacturer setting. Do not set.		
169			
170	Cumulative power 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	0–999/9999	9999
174	User group clear	0–999/9999	9999
178	STF terminal function selection	0–20/22–28/37/42–44/50/60/62/64–71/9999	60
179	STR terminal function selection	0–20/22–28/37/42–44/50/61/62/64–71/9999	61
180	RL terminal function selection	0–20/22–28/37/42–44/50/62/64–71/9999	0
181	RM terminal function selection		1
182	RH terminal function selection		2
183	RT terminal function selection		3
184	AU terminal function selection	0–20/22–28/37/42–44/50/62–71/9999	4
185	JOG terminal function selection	0–20/22–28/37/42–44/50/62/64–71/9999	5
186	CS terminal function selection		6
187	MRS terminal function selection		24
188	STOP terminal function selection		25
189	RES terminal function selection		62

Parameter	Name	Setting Range	Initial Value
190	RUN terminal function selection	0–8/10–20/25–28/30–36/39/41–47/64/70/84/85/90–99/100–108/110–116/120/125–128/130–136/139/141–147/164/170/184/185/190–199/9999	0
191	SU terminal function selection		1
192	IPF terminal function selection		2
193	OL terminal function selection		3
194	FU terminal function selection		4
195	ABC1 terminal function selection	0–8/10–20/25–28/30–36/39/41–47/64/70/84/85/90/91/94–99/100–108/110–116/120/125–128/130–136/139/141–147/164/170/184/185/190/191/194–199/9999	99
196	ABC2 terminal function selection		9999
232–239	Multi-speed setting (speeds 8 to 15)	0–400Hz/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	1
245	Rated slip	0–50%/9999	9999
246	Slip compensation time constant	0.01–10s	0.5s
247	Constant-output region slip compensation selection	0/9999	9999
250	Stop selection	0–100s/1000–1100s/8888/9999	9999
251	Output phase failure protection selection	0/1	1
252	Override bias	0–200%	50%
253	Override gain	0–200%	150%
255	Life alarm status display	(0–15)	0
256	Inrush current suppression circuit life display	(0–100%)	100%
257	Control circuit capacitor life display	(0–100%)	100%
258	Main circuit capacitor life display	(0–100%)	100%
259	Main circuit capacitor life measuring	0/1	0
260	PWM frequency automatic switchover	0/1	1

Parameter	Name	Setting Range	Initial Value
261	Power failure stop selection	0/1/2/11/12	0
262	Subtracted frequency at deceleration start	0–20Hz	3Hz
263	Subtraction starting frequency	0–120Hz/9999	50Hz
264	Power-failure deceleration time 1	0–3600/360s	5s
265	Power-failure deceleration time 2	0–3600/360s/9999	9999
266	Power failure deceleration time switchover frequency	0–400Hz	50Hz
267	Terminal 4 input selection	0/1/2	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	0/1/2/3	0
271	High-speed setting maximum current	0–220%	50%
272	Medium-speed setting minimum current	0–220%	100%
273	Current averaging range	0–400Hz/9999	9999
274	Current averaging filter time constant	1–4000	16
275	Stop-on contact excitation current low-speed multiplying factor	0–1000%/9999	9999
276	PWM carrier frequency at stop-on contact	0–9, 9999/ 0–4, 9999 ①	9999
278	Brake opening frequency	0–30Hz	3Hz
279	Brake opening current	0–220%	130%
280	Brake opening current detection time	0–2s	0.3s
281	Brake operation time at start	0–5s	0.3s
282	Brake operation frequency	0–30Hz	6Hz
283	Brake operation time at stop	0–5s	0.3s
284	Deceleration detection function selection	0/1	0
285	Overspeed detection frequency (Excessive speed deviation detection frequency)	0–30Hz/9999	9999
286	Droop gain	0–100%	0%
287	Droop filter time constant	0–1s	0.3s
288	Droop function activation selection	0/1/2/10/11	0
291	Pulse train input selection	0/1/10/11/20/21/100	0
292	Automatic acceleration/deceleration	0/1/3/5–8/11	0

Parameter	Name	Setting Range	Initial Value
293	Acceleration/deceleration separate selection	0–2	0
294	UV avoidance voltage gain	0–200%	100%
299	Rotation direction detection selection at restarting	0/1/9999	9999
300	BCD input bias	Parameter for option FR-A7AX (16 bit digital input)	
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		
306	Analog output signal selection	Parameter for option FR-A7AY (Analog/digital output)	
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		
314	DO1 output selection		
315	DO2 output selection		
316	DO3 output selection		
317	DO4 output selection		
318	DO5 output selection		
319	DO6 output selection		
320	RA1 output selection	Parameter for option FR-A7AR (Relay outputs)	
321	RA2 output selection		
322	RA3 output selection		
323	AM0 0V adjustment	Parameter for option FR-A7AY (Analog/digital output)	
324	AM1 0mA adjustment		
329	Digital input unit selection	Parameter for option FR-A7AX (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	96
333	RS-485 communication stop bit length	0/1/10/11	1
334	RS-485 communication parity check selection	0/1/2	2
335	RS-485 communication number of retries	0–10/9999	1

Parameter	Name	Setting Range	Initial Value
336	RS-485 communication check time interval	0–999.8s/ 9999	0s
337	RS-485 communication waiting time setting	0–150ms/ 9999	9999
338	Communication operation command source	0/1	0
339	Communication speed command source	0/1/2	0
340	Communication startup mode selection	0/1/2/10/12	0
341	RS-485 communication CR/LF selection	0/1/2	1
342	Communication EEPROM write selection	0/1	0
343	Communication error count	—	0
345	DeviceNet address	Parameter for option FR-A7ND (DeviceNet communication)	
346	DeviceNet baud rate		
349	Communication reset selection	Parameter for communication options FR-A7N☐☐	
350 ④	Stop position command selection	0/1/9999	9999
351 ④	Orientation speed	0–30Hz	2Hz
352 ④	Creep speed	0–10Hz	0.5Hz
353 ④	Creep switchover position	0–16383	511
354 ④	Position loop switchover position	0–8191	96
355 ④	DC injection brake start position	0–255	5
356 ④	Internal stop position command	0–16383	0
357 ④	Orientation in-position zone	0–255	5
358 ④	Servo torque selection	0–13	1
359 ④	Encoder rotation direction	0/1	1
360 ④	16 bit data selection	0–127	0
361 ④	Position shift	0–16383	0
362 ④	Orientation position loop gain	0.1–100	1
363 ④	Completion signal output delay time	0–5s	0.5s
364 ④	Encoder stop check time	0–5s	0.5s
365 ④	Orientation limit	0–60s/9999	9999
366 ④	Recheck time	0–5s/9999	9999
367 ④	Speed feedback range	0–400Hz/9999	9999
368 ④	Feedback gain	0–100	1
369 ④	Number of encoder pulses	0–4096	1024
374	Overspeed detection level	0–400Hz	115Hz
376 ④	Encoder signal loss detection enable/disable selection	0/1	0
380	Acceleration S-pattern 1	0–50%	0

Parameter	Name	Setting Range	Initial Value
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 0 input pulse	0–400Hz	0
386	Frequency for maximum input pulse	0–400Hz	50Hz
387	Initial communication delay time	Parameter for option FR-A7NL (LONWORKS communication)	
388	Send time interval at hart beat		
389	Minimum sending time at hart beat		
390	% setting reference frequency		
391	Receive time interval at hart beat		
392	Event driven detection width		
393 ④	Orientation selection	0/1/2	0
396 ④	Orientation speed gain (P term)	0–1000	60
397 ④	Orientation speed integral time	0–20s	0.333s
398 ④	Orientation speed gain (D term)	0–100	1
399 ④	Orientation deceleration ratio	0–1000	20
414	PLC function operation selection	0/1	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
419 ④	Position command source selection	0/2	0
420 ④	Command pulse scaling factor numerator	0–32767	1
421 ④	Command pulse scaling factor denominator	0–32767	1
422 ④	Position loop gain	0–150 [1/s]	25 [1/s]
423 ④	Position feed forward gain	0–100%	0
424 ④	Position command acceleration/deceleration time constant	0–50s	0s
425 ④	Position feed forward command filter	0–5s	0s
426 ④	In-position width	0–32767 pulse	100
427 ④	Excessive level error	0–400k/9999	40k
428 ④	Command pulse selection	0–5	0
429 ④	Clear signal selection	0/1	1

Parameter	Name	Setting Range	Initial Value
430 ④	Pulse monitor selection	0–5/9999	9999
447	Digital torque command bias	Parameter for option FR-A7AX (16 bit digital input)	
448	Digital torque command gain		
450	Second applied motor	0–8/13–18/20/23/24/30/33/34/40/43/44/50/53/54/9999	9999
451	Second motor control method selection	10/11/12/20/9999	9999
453	Second motor capacity	0.4–55kW, 9999/ 0–3600kW, 9999 ④	9999
454	Number of second motor poles	2/4/6/8/10/9999	9999
455	Second motor excitation current	0–500A, 9999/ 0–3600A, 9999 ②	9999
456	Rated second motor voltage	0–1000V	400V
457	Rated second motor frequency	10–120Hz	50Hz
458	Second motor constant A	0–50Ω, 9999/ 0–400mΩ, 9999 ①	9999
459	Second motor constant B	0–50Ω, 9999/ 0–400mΩ, 9999 ①	9999
460	Second motor constant C	0–50Ω, (0–1000mH), 9999/ 0–3600mΩ, (0–400mH), 9999 ①	9999
461	Second motor constant D	0–50Ω, (0–1000mH), 9999/ 0–3600mΩ, (0–400mH), 9999 ①	9999
462	Second motor constant E	0–500Ω, (0–100%), 9999/ 0–100Ω, (0–100%), 9999 ①	9999
463	Second motor auto tuning setting/status	0/1/101	0
464 ④	Digital position control sudden stop deceleration time	0–360.0s	0
465 ④	1st position feed amount lower 4 digits	0–9999	0
466 ④	1st position feed amount upper 4 digits	0–9999	0
467 ④	2nd position feed amount lower 4 digits	0–9999	0
468 ④	2nd position feed amount upper 4 digits	0–9999	0
469 ④	3rd position feed amount lower 4 digits	0–9999	0

Parameter	Name	Setting Range	Initial Value
470 ④	3rd position feed amount upper 4 digits	0–9999	0
471 ④	4th position feed amount lower 4 digits	0–9999	0
472 ④	4th position feed amount upper 4 digits	0–9999	0
473 ④	5th position feed amount lower 4 digits	0–9999	0
474 ④	5th position feed amount upper 4 digits	0–9999	0
475 ④	6th position feed amount lower 4 digits	0–9999	0
476 ④	6th position feed amount upper 4 digits	0–9999	0
477 ④	7th position feed amount lower 4 digits	0–9999	0
478 ④	7th position feed amount upper 4 digits	0–9999	0
479 ④	8th position feed amount lower 4 digits	0–9999	0
480 ④	8th position feed amount upper 4 digits	0–9999	0
481 ④	9th position feed amount lower 4 digits	0–9999	0
482 ④	9th position feed amount upper 4 digits	0–9999	0
483 ④	10th position feed amount lower 4 digits	0–9999	0
484 ④	10th position feed amount upper 4 digits	0–9999	0
485 ④	11th position feed amount lower 4 digits	0–9999	0
486 ④	11h position feed amount upper 4 digits	0–9999	0
487 ④	12th position feed amount lower 4 digits	0–9999	0
488 ④	12th position feed amount upper 4 digits	0–9999	0
489 ④	13th position feed amount lower 4 digits	0–9999	0
490 ④	13th position feed amount upper 4 digits	0–9999	0
491 ④	14th position feed amount lower 4 digits	0–9999	0
492 ④	14th position feed amount upper 4 digits	0–9999	0
493 ④	15th position feed amount lower 4 digits	0–9999	0
494 ④	15th position feed amount upper 4 digits	0–9999	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 networks options	
501	Communication error occurrence count display		
502	Stop mode selection at communication error		
503	Maintenance timer	0 (1–9998)	0
504	Maintenance timer alarm output set time	0–9998/9999	9999
505	Speed setting reference	0–120Hz	50Hz
506	Parameter 1 for user	0–65535	0
507	Parameter 2 for user	0–65535	0
508	Parameter 3 for user	0–65535	0
509	Parameter 4 for user	0–65535	0
510	Parameter 5 for user	0–65535	0
511	Parameter 6 for user	0–65535	0
512	Parameter 7 for user	0–65535	0
513	Parameter 8 for user	0–65535	0
514	Parameter 9 for user	0–65535	0
515	Parameter 10 for user	0–65535	0
516	S-pattern time at a start of acceleration	0.1–2.5s	0.1s
517	S-pattern time at a completion of acceleration	0.1–2.5s	0.1s
518	S-pattern time at a start of deceleration	0.1–2.5s	0.1s
519	S-pattern time at a completion of deceleration	0.1–2.5s	0.1s
539	Modbus-RTU communication check time interval	0–999.8s/ 9999	9999
542	Communication station number (CC-Link)	Parameter for option FR-A7NC (CC-Link communication)	
543	Baud rate (CC-Link)		
544	CC-Link extended setting		
547	USB communication station number	0–31	0
548	USB communication check time interval	0–999.8s/ 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	1/2/3	2
555	Current average time	0.1–1.0s	1s
556	Data output mask time	0.0–2.0s	0s
557	Current average value monitor signal output reference current	0–500A/ 0–3600A ①	Rated inverter output current
563	Energization time carrying-over times	(0–65535)	0
564	Operating time carrying-over times	(0–65535)	0

Parameter	Name	Setting Range	Initial Value
569	Second motor speed control gain	0–200%/9999	9999
570	Multiple rating setting	0–3	2
571	Holding time at a start	0.0–10.0s/9999	9999
573	4 mA Input check selection	1/9999	9999
574	Second motor online auto tuning	0/1	0
575	Output interruption detection time	0–3600s/ 9999	1s
576	Output interruption detection level	0–400Hz	0Hz
577	Output interruption release level	900–1100%	1000%
592	Traverse function selection	0/1/2	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	0.1–3600s	5s
597	Amplitude deceleration time	0.1–3600s	5s
611	Acceleration time at a restart	0–3600s/9999	5/15s ①
665	Regeneration avoidance frequency gain	0–200%	100
684	Tuning data unit switchover	0/1	0
800	Control method selection	0–5/9–12/20	20
802 ④	Pre-excitation selection	0/1	0
803	Constant power range torque characteristic selection	0/1	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	0/1/2	0
808	Forward rotation speed limit	0–120Hz	50Hz
809	Reverse rotation speed limit	0–120Hz/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

Parameter	Name	Setting Range	Initial Value
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	0–20s	0.333s
822	Speed setting filter 1	0–5s/9999	9999
823 ④	Speed detection filter 1	0–0.1s	0.001s
824	Torque control P gain 1	0–200%	100%
825	Torque control integral time 1	0–500ms	5ms
826	Torque setting filter 1	0–5s/9999	9999
827	Torque detection filter 1	0–0.1s	0s
828	Model speed control gain	0–1000%	60%
830	Speed control P gain 2	0–1000%/9999	9999
831	Speed control integral time 2	0–20s/9999	9999
832	Speed setting filter2	0–5s/9999	9999
833 ④	Speed detection filter 2	0–0.1s/9999	9999
834	Torque control P gain 2	0–200%/9999	9999
835	Torque control integral time 2	0–500ms/9999	9999
836	Torque setting filter 2	0–5s/9999	9999
837	Torque detection filter 2	0–0.1s/9999	9999
840 ④	Torque bias selection	0–3/9999	9999
841 ④	Torque bias 1	600–1400%/9999	9999
842 ④	Torque bias 2	600–1400%/9999	9999
843 ④	Torque bias 3	600–1400%/9999	9999
844 ④	Torque bias filter	0–5s/9999	9999
845 ④	Torque bias operation time	0–5s/9999	9999
846 ④	Torque bias balance compensation	0–10V/ 9999	9999
847 ④	Fall-time torque bias terminal 1 bias	0–400%/ 9999	9999
848 ④	Fall-time torque bias terminal 1 gain	0–400%/ 9999	9999
849	Analog input off set adjustment	0–200%	100%
850	Control operation selection	0/1	0
853	Speed deviation time	0–100s	1s

Para-meter	Name	Setting Range	Initial Value
854	Excitation ratio	0–100%	100%
858	Terminal 4 function assignment	0/1/4/9999	0
859	Torque current	0–500A, 9999/ 0–3600A, 9999 ①	9999
860	Second motor torque current	0–500A, 9999/ 0–3600A, 9999 ①	9999
862	Notch filter time constant	0–60	0
863	Notch filter depth	0/1/2/3	0
864	Torque detection	0–400%	150%
865	Low speed detection	0–400Hz	1.5Hz
866	Torque monitoring reference	0–400%	150%
867	AM output filter	0–5s	0.01s
868	Terminal 1 function assignment	0–6/9999	0
869	Current output filter	0–5s	0.02s
872	Input phase failure protection selection	0/1	0
873	Speed limit	0–120Hz	20Hz
874	OLT level setting	0–200%	150%
875	Fault definition	0/1	0
877	Speed feed forward control/model adaptive speed control selection	0/1/2	0
878	Speed feed forward filter	0–1s	0s
879	Speed feed forward torque limit	0–400%	150%
880	Load inertia ratio	0–200	7
881	Speed feed forward gain	0–1000%	0%
882	Regeneration avoidance operation selection	0/1/2	0
883	Regeneration avoidance operation level	300–800V	760/785V DC ①
884	Regeneration avoidance at deceleration detection sensitivity	0–5	0
885	Regeneration avoidance compensation frequency limit value	0–10Hz/9999	6Hz
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)	0.1–55kW/ 0–3600kW ①	SLD/LD/ND/ HD value of applied motor capacity

Para-meter	Name	Setting Range	Initial Value
894	Control selection during commercial power-supply operation	0/1/2/3	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	0/1–1000h/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)	FM terminal calibration	—	—
C1 (901)	AM terminal calibration	—	—
C2 (902)	Terminal 2 frequency setting bias frequency	0–400Hz	0Hz
C3 (902)	Terminal 2 frequency setting bias	0–300%	0%
125 (903)	Terminal 2 frequency setting gain frequency	0–400Hz	50Hz
C4 (903)	Terminal 2 frequency setting gain	0–300%	100%
C5 (904)	Terminal 4 frequency setting bias frequency	0–400Hz	0Hz
C6 (904)	Terminal 4 frequency setting bias	0–300%	20%
126 (905)	Terminal 4 frequency setting gain frequency	0–400Hz	50Hz
C7 (905)	Terminal 4 frequency setting gain	0–300%	100%
C8 (930)	Current output bias signal	0–100%	0%
C9 (930)	Current output bias current	0–100%	0%
C10 (931)	Current output gain signal	0–100%	100%
C11 (931)	Current output gain current	0–100%	100%
C12 (917)	Terminal 1 bias frequency (speed)	0–400Hz	0Hz
C13 (917)	Terminal 1 bias (speed)	0–300%	0%
C14 (918)	Terminal 1 gain frequency (speed)	0–400Hz	50Hz
C15 (918)	Terminal 1 gain (speed)	0–300%	100%
C16 (919)	Terminal 1 bias command (torque/magnetic flux)	0–400%	0%

Para-meter	Name	Setting Range	Initial Value
C17 (919)	Terminal 1 bias (torque/magnetic flux)	0–300%	0%
C18 (920)	Terminal 1 gain command (torque/magnetic flux)	0–400%	150%
C19 (920)	Terminal 1 gain (torque/magnetic flux)	0–300%	100%
C38 (932)	Terminal 4 bias command (torque/magnetic flux)	0–400%	0%
C39 (932)	Terminal 4 bias (torque/magnetic flux)	0–300%	20%
C40 (933)	Terminal 4 gain command (torque/magnetic flux)	0–400%	150%

Para-meter	Name	Setting Range	Initial Value
C41 (933)	Terminal 4 gain (torque/magnetic flux)	0–300%	100%
989	Parameter copy alarm release	10/100	10/100 ②
990	PU buzzer control	0/1	1
991	PU contrast adjustment	0–63	58
Pr.CL	Parameter clear	0/1	0
ALLC	All parameter clear	0/1	0
Er.CL	Alarm history clear	0/1	0
PCPY	Parameter copy	0/1/ 2/3	0

Remarks:

① The setting depends on the inverter capacity.

② When the value “8888” is set, the maximum output voltage is 95% of the input voltage.

③ When the value “9999” is set, the maximum output voltage equals the input voltage.

④ Setting can be made only when the FR-A7AP is mounted.

A.2 Sample Applications

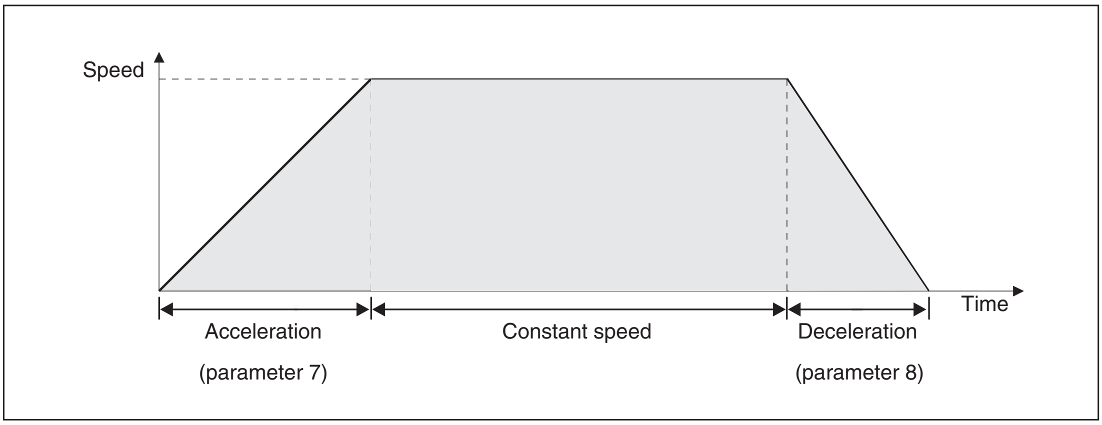
The applications in this section have been chosen to demonstrate some of the things that you can do with frequency inverters.

NOTE

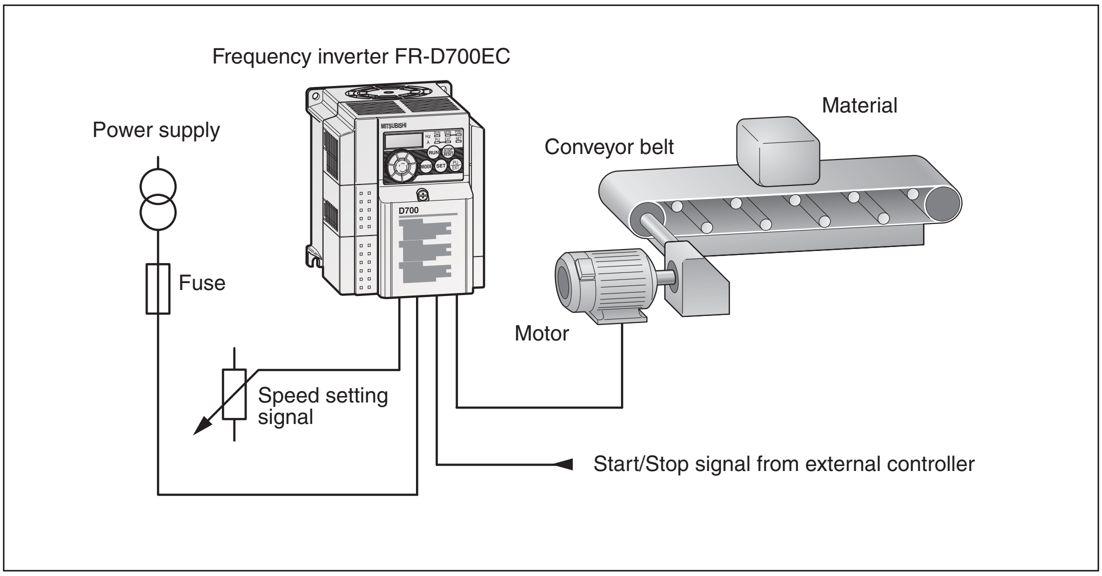
> The wiring diagrams and the parameter settings are only provided to illustrate these specific examples. They should not be copied directly – you will need to wire and configure your inverter for the specific requirements of your own application. When you are planning and installing your system please 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

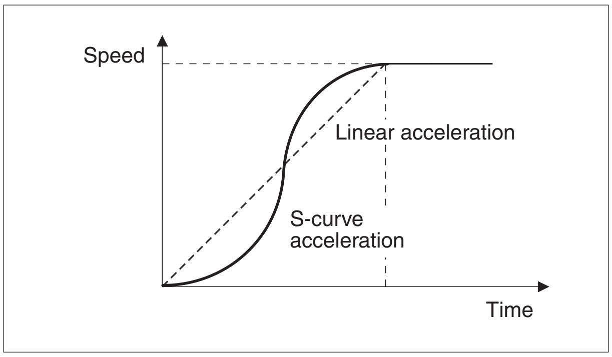
Frequency inverters are often used to control conveyor belts to feed parts and material to processing stations because they are able to accelerate and decelerate the drive gently.



In this example we are going to use an FR-D700 series inverter to power and control the belt using the speed/time pattern shown in the graph above. The configuration is as follows:



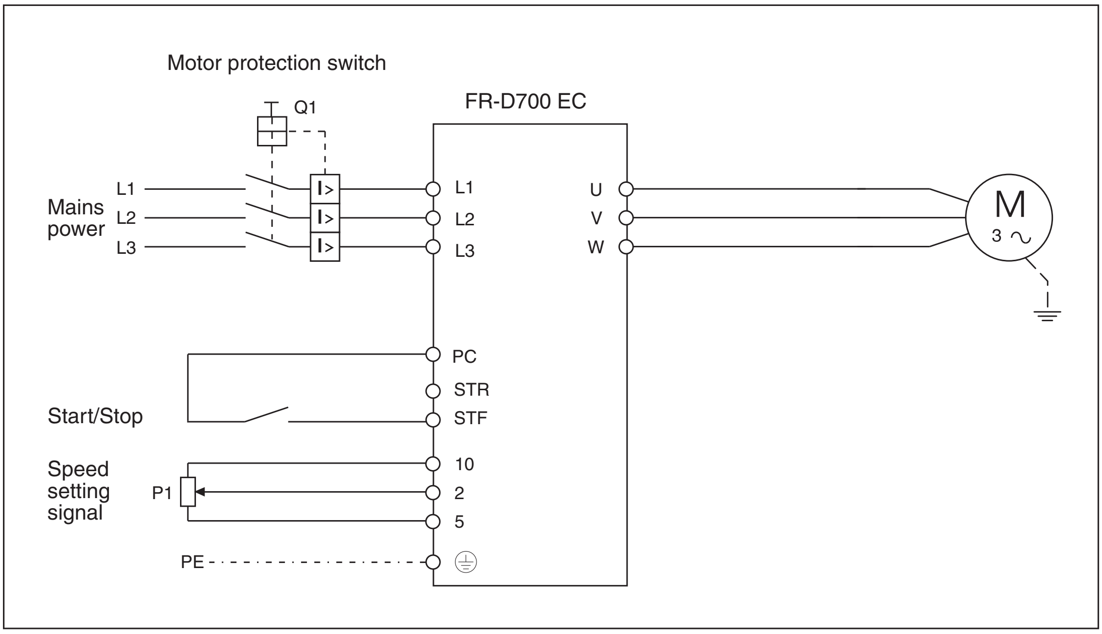
The belt is started and stopped by an external controller (for example a PLC). The speed of the motor and thus of the conveyor belt can be adjusted with a setpoint potentiometer.



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.

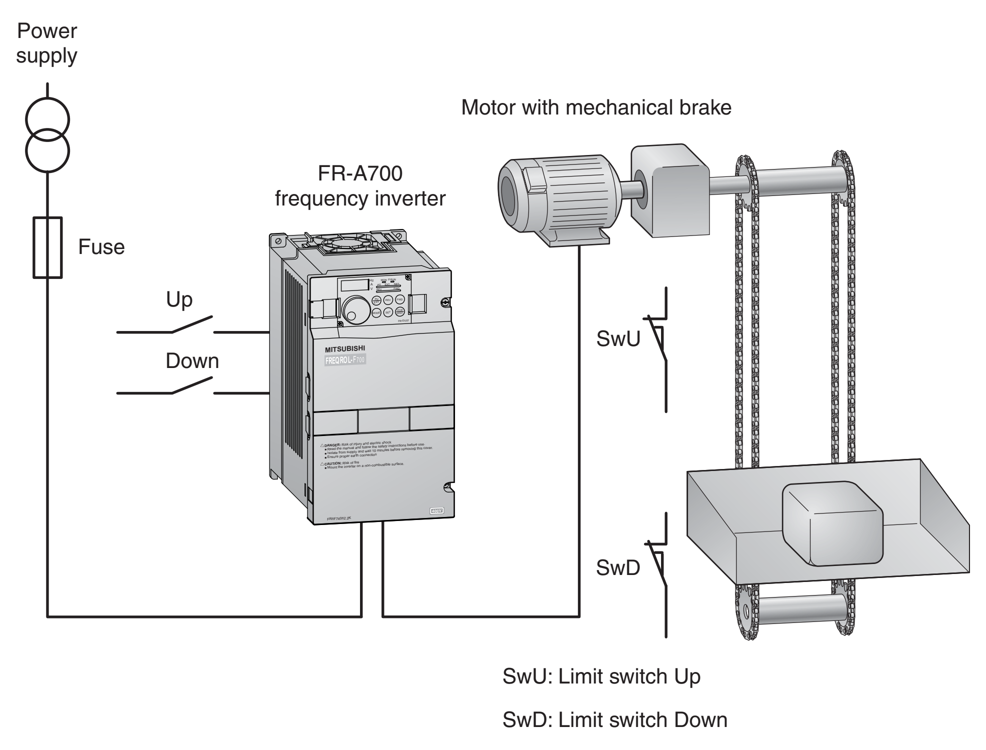
Wiring



A.2.2 Lifting Drive

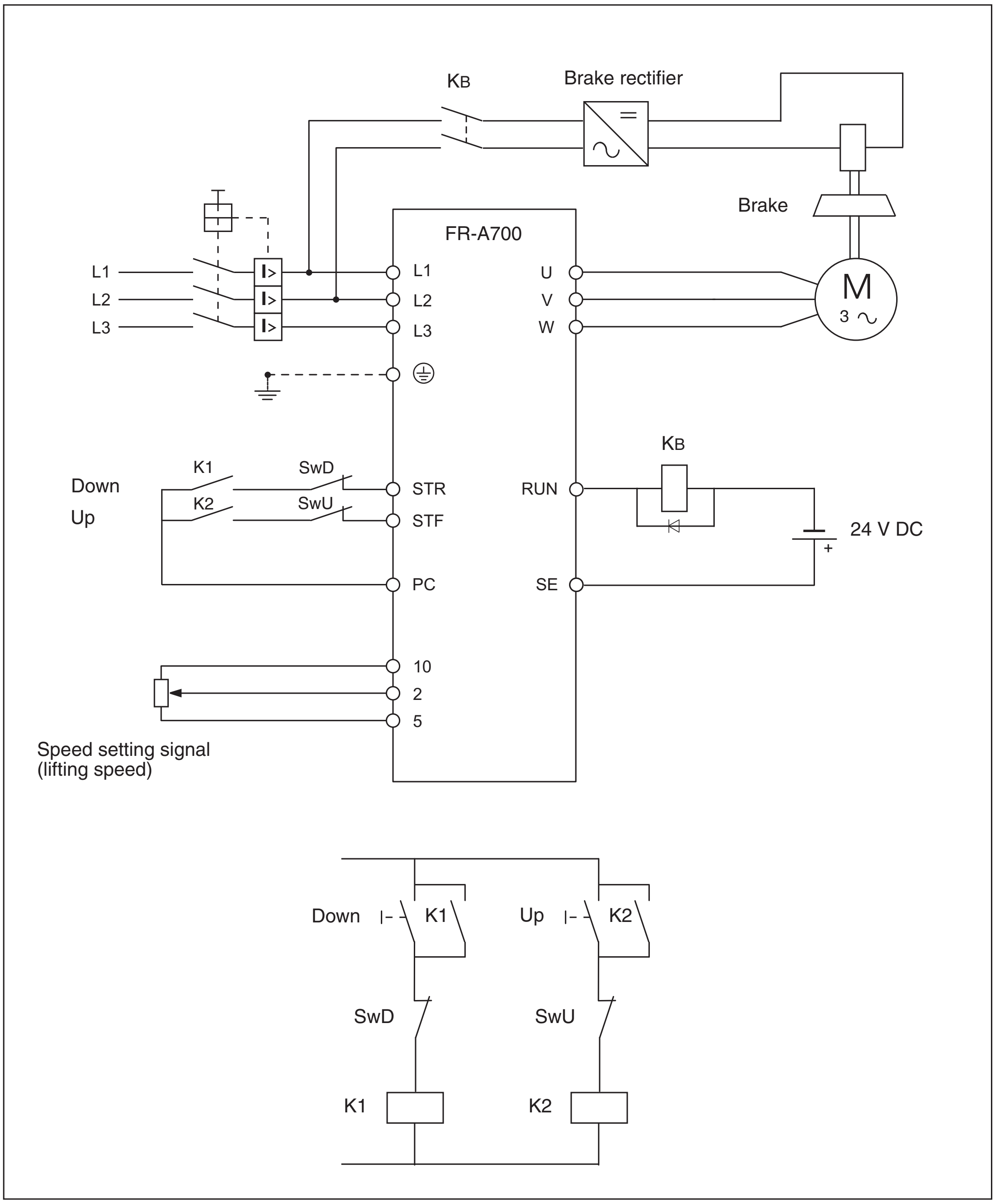
The illustration below shows the basic configuration of an inverter for powering a drive for lifting applications like hoists or roll-up gates. A motor with a mechanical brake is used to ensure that the load cannot not slip down when the motor is off.

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-A700
L1
L2
L3
L1
L2
L3
U
V
W
M
3 ∿
KB
K1
SwD
Down
K2
SwU
Up
STR
STF
RUN
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-D700, FR-E700, FR-F700 and FR-A700 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 and 5. The actual value is input as an analog current signal (4-20mA) via input terminals 4 and 5.

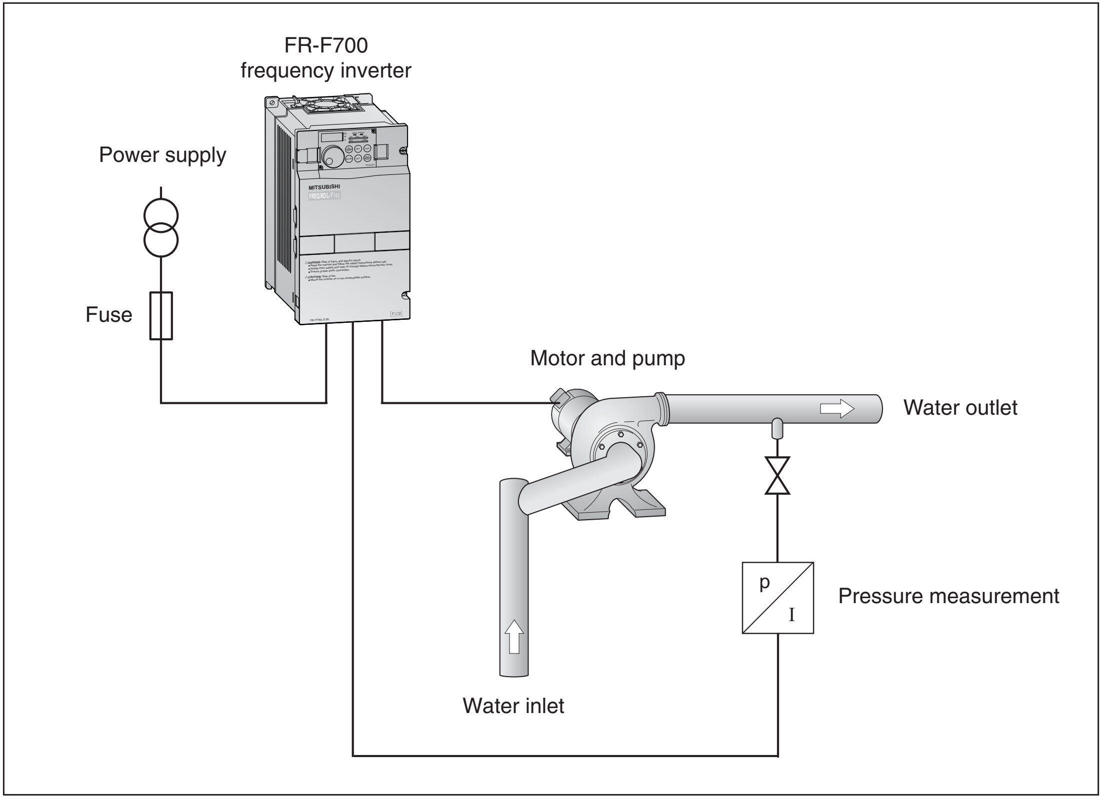
The inverter automatically adjusts its output frequency (the *control variable*) in response to the difference between the setpoint and actual values (the *control deviation*). This increases or decreases the speed of the motor to bring the actual value closer to the setpoint value.

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

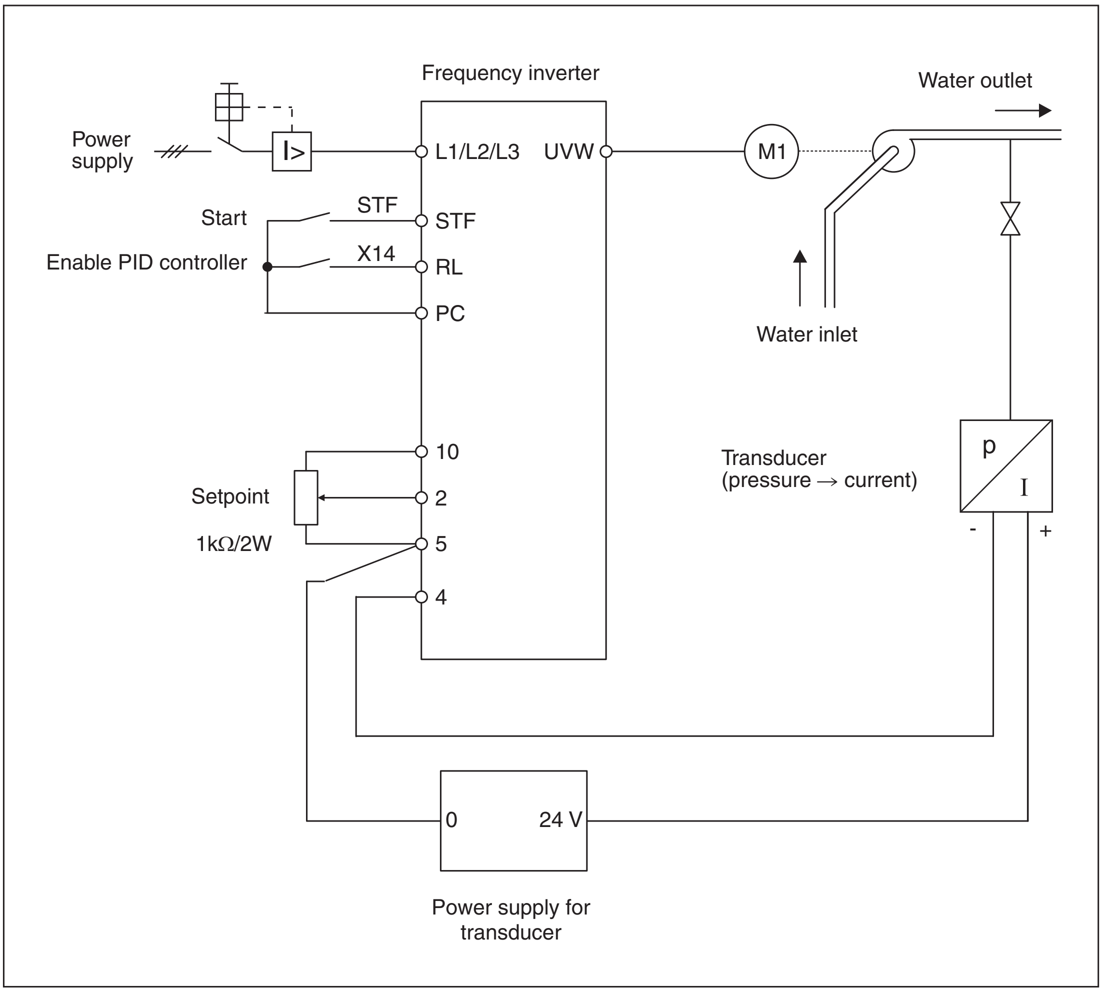
Control Direction	Controller Behaviour	Application (temperature control)
Forward	Actual > Setpoint: Increase control variable Actual < Setpoint: Decrease control variable	Cooling/refrigeration system
Reverse	Actual > Setpoint: Decrease control variable Actual < Setpoint: Increase control variable	Heating 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-F700 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



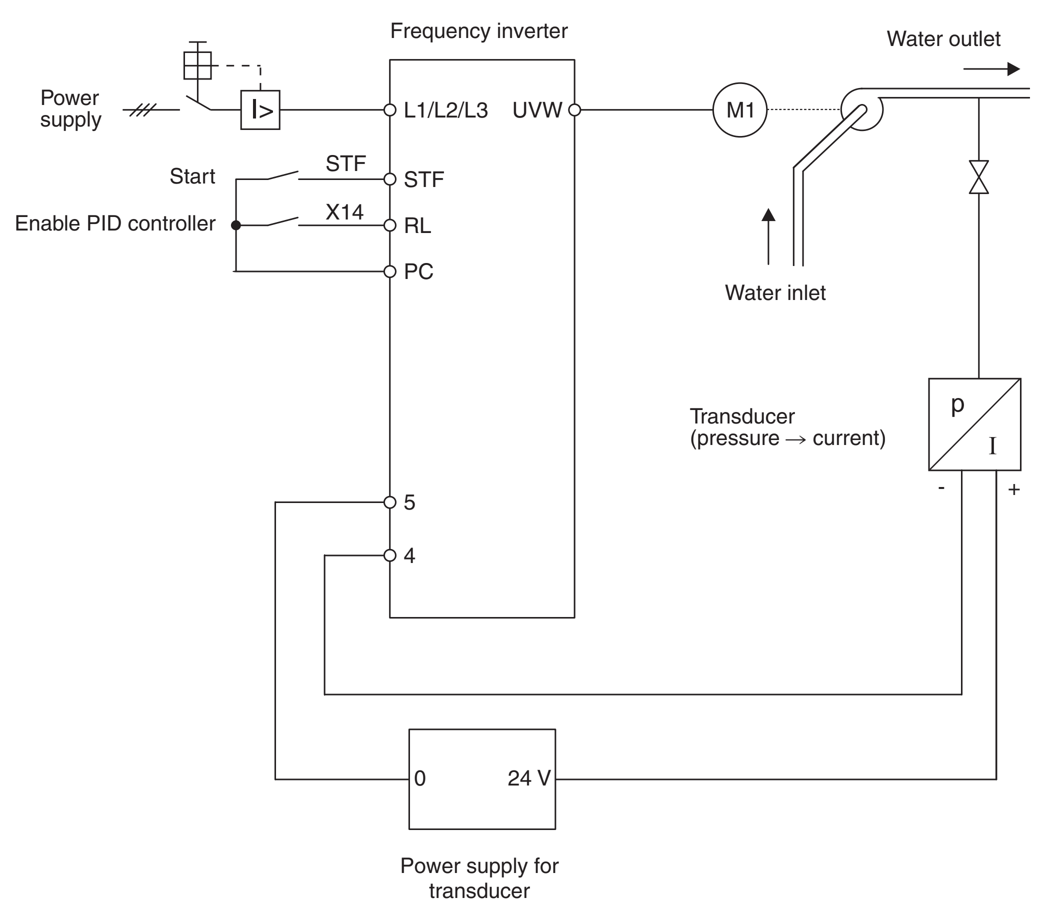
For the PID controller application using the configuration shown above you must also set the inverter parameters shown in the table below, in addition to the basic parameters.

Parameters	Function	Setting
180	RL terminal function assignment	“14” (enable PID control)
128	PID action direction	“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 control 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 assignment	“14” (enable PID control)
128	PID action direction	“20” (reverse action)
133	Setpoint	0 –100%

Index

MITSUBISHI ELECTRIC

HEADQUARTERS

MITSUBISHI ELECTRIC EUROPE B.V. **EUROPE**
German Branch
Gothaer Straße 8
D-40880 Ratingen
Phone: +49 (0)2102 / 486-0
Fax: +49 (0)2102 / 486-1120

MITSUBISHI ELECTRIC EUROPE B.V. **CZECH REPUBLIC**
Czech Branch
Radlicka 714/113 a
CZ-158 00 Praha 5
Phone: +420 251 551 470
Fax: +420-251-551-471

MITSUBISHI ELECTRIC EUROPE B.V. **FRANCE**
French Branch
25, Boulevard des Bouvets
F-92741 Nanterre Cedex
Phone:+33 (0)1 / 55 68 55 68
Fax: +33 (0)1 / 55 68 57 57

MITSUBISHI ELECTRIC EUROPE B.V. **IRELAND**
Irish Branch
Westgate Business Park, Ballymount
IRL-Dublin 24
Phone: +353 (0)1 4198800
Fax: +353 (0)1 4198890

MITSUBISHI ELECTRIC EUROPE B.V. **ITALY**
Italian Branch
Viale Colleoni 7
I-20041 Agrate Brianza (MI)
Phone: +39 039 / 60 53 1
Fax: +39 039 / 60 53 312

MITSUBISHI ELECTRIC EUROPE B.V. **SPAIN**
Spanish Branch
Carretera de Rubí 76-80
E-08190 Sant Cugat del Vallés (Barcelona)
Phone: 902 131121 // +34 935653131
Fax: +34 935891579

MITSUBISHI ELECTRIC EUROPE B.V. **UK**
UK Branch
Travellers Lane
UK-Hatfield, Herts. AL10 8XB
Phone: +44 (0)1707 / 27 61 00
Fax: +44 (0)1707 / 27 86 95

MITSUBISHI ELECTRIC CORPORATION **JAPAN**
Office Tower “Z” 14 F
8-12,1 chome, Harumi Chuo-Ku
Tokyo 104-6212
Phone: +81 3 622 160 60
Fax: +81 3 622 160 75

MITSUBISHI ELECTRIC AUTOMATION, Inc. **USA**
500 Corporate Woods Parkway
Vernon Hills, IL 60061
Phone: +1 847 478 21 00
Fax: +1 847 478 22 53

EUROPEAN REPRESENTATIVES

GEVA **AUSTRIA**
Wiener Straße 89
AT-2500 Baden
Phone: +43 (0)2252 / 85 55 20
Fax: +43 (0)2252 / 488 60

TEHNIKON **BELARUS**
Oktyabrskaya 16/5, Off. 703-711
BY-220030 Minsk
Phone: +375 (0)17 / 210 46 26
Fax: +375 (0)17 / 210 46 26

Koning & Hartman b.v. **BELGIUM**
Woluwelaan 31
BE-1800 Vilvoorde
Phone: +32 (0)2 / 257 02 40
Fax: +32 (0)2 / 257 02 49

AKHNATON **BULGARIA**
4 Andrej Ljapchev Blvd. Pb 21
BG-1756 Sofia
Phone: +359 (0)2 / 817 6004
Fax: +359 (0)2 / 97 44 06 1

INEA CR d.o.o. **CROATIA**
Losinjska 4 a
HR-10000 Zagreb
Phone: +385 (0)1 / 36 940 - 01/ -02/ -03
Fax: +385 (0)1 / 36 940 - 03

AutoCont C.S., s.r.o. **CZECH REPUBLIC**
Technologicka 374/6
CZ-708 00 Ostrava Pustkovec
Phone: +420 (0)59 / 5691 150
Fax: +420 (0)59 / 5691 199

B:TECH, a.s. **CZECH REPUBLIC**
U Borove 69
CZ-58001 Havlickuv Brod
Phone: +420 (0)569 777 777
Fax: +420 (0)569-777 778

Beijer Electronics A/S **DENMARK**
Lykkegardsvej 17, 1.
DK-4000 Roskilde
Phone: +45 (0)46/ 75 56 66
Fax: +45 (0)46 / 75 56 26

Beijer Electronics Eesti OÜ **ESTONIA**
Pärnu mnt.160i
EE-11317 Tallinn
Phone: +372 (0)6 / 51 81 40
Fax: +372 (0)6 / 51 81 49

Beijer Electronics OY **FINLAND**
Jaakonkatu 2
FIN-01620 Vantaa
Phone: +358 (0)207 / 463 500
Fax: +358 (0)207 / 463 501

UTECO A.B.E.E. **GREECE**
5, Mavrogenous Str.
GR-18542 Piraeus
Phone: +30 211 / 1206 900
Fax: +30 211 / 1206 999

MELTRADE Ltd. **HUNGARY**
Fertő utca 14.
HU-1107 Budapest
Phone: +36 (0)1 / 431-9726
Fax: +36 (0)1 / 431-9727

Beijer Electronics SIA **LATVIA**
Vestienas iela 2
LV-1035 Riga
Phone: +371 (0)784 / 2280
Fax: +371 (0)784 / 2281

Beijer Electronics UAB **LITHUANIA**
Savanoriu Pr. 187
LT-02300 Vilnius
Phone: +370 (0)5 / 232 3101
Fax: +370 (0)5 / 232 2980

EUROPEAN REPRESENTATIVES

INTEHSIS srl **MOLDOVA**
bld. Traian 23/1
MD-2060 Kishinev
Phone: +373 (0)22 / 66 4242
Fax: +373 (0)22 / 66 4280

Koning & Hartman b.v. **NETHERLANDS**
Haarlerbergweg 21-23
NL-1101 CH Amsterdam
Phone: +31 (0)20 / 587 76 00
Fax: +31 (0)20 / 587 76 05

Beijer Electronics AS **NORWAY**
Postboks 487
NO-3002 Drammen
Phone: +47 (0)32 / 24 30 00
Fax: +47 (0)32 / 84 85 77

MPL Technology Sp. z o.o. **POLAND**
Ul. Krakowska 50
PL-32-083 Balice
Phone: +48 (0)12 / 630 47 00
Fax: +48 (0)12 / 630 47 01

Sirius Trading & Services srl **ROMANIA**
Aleea Lacul Morii Nr. 3
RO-060841 Bucuresti, Sector 6
Phone: +40 (0)21 / 430 40 06
Fax: +40 (0)21 / 430 40 02

Craft Con. & Engineering d.o.o. **SERBIA**
Bulevar Svetog Cara Konstantina 80-86
SER-18106 Nis
Phone: +381 (0)18 / 292-24-4/5 , 523 962
Fax: +381 (0)18 / 292-24-4/5 , 523 962

INEA SR d.o.o. **SERBIA**
Karadjordjeva 12/260
SER-113000 Smederevo
Phone: +381 (0)26 / 617 163
Fax: +381 (0)26 / 617 163

AutoCont Control, s.r.o. **SLOVAKIA**
Radlinského 47
SK-02601 Dolny Kubin
Phone: +421 (0)43 / 5868210
Fax: +421 (0)43 / 5868210

CS MTrade Slovensko, s.r.o. **SLOVAKIA**
Vajanskeho 58
SK-92101 Piestany
Phone: +421 (0)33 / 7742 760
Fax: +421 (0)33 / 7735 144

INEA d.o.o. **SLOVENIA**
Stegne 11
SI-1000 Ljubljana
Phone: +386 (0)1 / 513 8100
Fax: +386 (0)1 / 513 8170

Beijer Electronics Automation AB **SWEDEN**
Box 426
SE-20124 Malmö
Phone: +46 (0)40 / 35 86 00
Fax: +46 (0)40 / 35 86 02

Econotec AG **SWITZERLAND**
Hinterdorfstr. 12
CH-8309 Nürensdorf
Phone: +41 (0)44 / 838 48 11
Fax: +41 (0)44 / 838 48 12

GTS **TURKEY**
Darulaceze Cad. No. 43 KAT. 2
TR-34384 Okmeydani-Istanbul
Phone: +90 (0)212 / 320 1640
Fax: +90 (0)212 / 320 1649

CSC Automation Ltd. **UKRAINE**
15, M. Raskova St., Fl. 10, Office 1010
UA-02002 Kiev
Phone: +380 (0)44 / 494 33 55
Fax: +380 (0)44 / 494-33-66

EURASIAN REPRESENTATIVES

Kazpromautomatics Ltd. **KAZAKHSTAN**
Mustafina Str. 7/2
KAZ-470046 Karaganda
Phone: +7 7212 / 50 11 50
Fax: +7 7212 / 50 11 50

CONSYS **RUSSIA**
Promyshlennaya st. 42
RU-198099 St. Petersburg
Phone: +7 812 / 325 36 53
Fax: +7 812 / 325 36 53

ELECTROTECHNICAL SYSTEMS **RUSSIA**
Derbenevskaya st. 11A, Office 69
RU-115114 Moscow
Phone: +7 495 / 744 55 54
Fax: +7 495 / 744 55 54

ELEKTROSTILY **RUSSIA**
Rubzowskaja nab. 4-3, No. 8
RU-105082 Moscow
Phone: +7 495 / 545 3419
Fax: +7 495 / 545 3419

RPS-AUTOMATIKA **RUSSIA**
Budennovsky 97, Office 311
RU-344007 Rostov on Don
Phone: +7 8632 / 22 63 72
Fax: +7 8632 / 219 45 51

STC Drive Technique **RUSSIA**
Poslannikov per. 9, str 1
RU-105005 Moscow
Phone: +7 495 / 790 72 10
Fax: +7 495 / 790 72 12

MIDDLE EAST REPRESENTATIVE

SHERF Motion Techn. Ltd. **ISRAEL**
Rehov Hamerkava 19
IL-58851 Holon
Phone: +972 (0)3 / 559 54 62
Fax: +972 (0)3 / 556 01 82

AFRICAN REPRESENTATIVE

CBI Ltd. **SOUTH AFRICA**
Private Bag 2016
ZA-1600 Isando
Phone: + 27 (0)11 / 928 2000
Fax: + 27 (0)11 / 392 2354

MITSUBISHI
ELECTRIC
FACTORY AUTOMATION

Mitsubishi Electric Europe B.V. /// FA - European Business Group /// Gothaer Straße 8 /// D-40880 Ratingen /// Germany
Tel.: +49(0)2102-4860 /// Fax: +49(0)2102-4861120 /// info@mitsubishi-automation.com /// www.mitsubishi-automation.com