

TRANSISTORIZED INVERTER

FR-E500

INSTRUCTION MANUAL

HIGH PERFORMANCE & HIGH FUNCTION

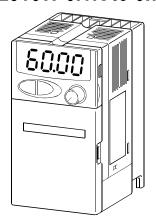
FR-E520-0.1K to 7.5K(C) FR-E540-0.4K to 7.5K(C) FR-E520S-0.1K to 0.75K FR-E510W-0.1K to 0.75K

OUTLINE Chapter 1

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Chapter 3



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Chapter 4

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Thank you for choosing the Mitsubishi Transistorized inverter.

This instruction manual gives handling information and precautions for use of this equipment.

Incorrect handling might cause an unexpected fault. Before using the inverter, please read this manual carefully to use the equipment to its optimum.

Please forward this manual to the end user.

This section is specifically about safety matters

Do not attempt to install, operate, maintain or inspect the inverter until you have read through this instruction manual and appended documents carefully and can use the equipment correctly.

Do not use the inverter until you have a full knowledge of the equipment, safety information and instructions.

In this manual, the safety instruction levels are classified into "WARNING" and "CAUTION".



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



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

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

SAFETY INSTRUCTIONS

1. Electric Shock Prevention

AWARNING

- While power is on or when the inverter is running, do not open the front cover.
 You may get an electric shock.
- Do not run the inverter with the front cover or wiring cover removed. Otherwise, you may access the exposed high-voltage terminals or the charging part of the circuitry and get an electric shock.
- 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 inverter power indicator lamp 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 (grounded). Earthing (grounding) 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.
- Operate the switches and potentiometers with dry hands to prevent 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 change the cooling fan while power is on. It is dangerous to change the cooling fan while power is on.

2. Fire Prevention

! CAUTION

- Mount the inverter and brake resistor on an incombustible surface. Installing the inverter directly on or near a combustible surface could lead to a fire.
- If the inverter has become faulty, switch off the inverter power. A continuous flow of large current could cause a fire.
- When a brake resistor is used, use an alarm signal to switch power off.
 Otherwise, the brake resistor may excessively overheat due to damage of the brake transistor and such, causing a fire.
- Do not connect a resistor directly to the DC terminals P(+), N(-). This could cause a fire.

3. Injury Prevention

ACAUTION

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

4. Additional Instructions

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

(1) Transportation and installation

⚠ CAUTION

- 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 operate if the inverter is damaged or has parts missing.
- Do not hold the inverter by the front cover or operation panel; it may fall off.
- Do not stand or rest heavy objects on the inverter.
- Check the inverter mounting orientation is correct.
- Prevent screws, wire fragments or other conductive bodies or oil or other flammable substance from entering the inverter.
- Do not drop the inverter, or subject it to impact.
- Use the inverter under the following environmental conditions:

	Ambient temperature	-10°C to +50°C(non-freezing) (-10°C to +40°C for totally enclosed structure feature)			
_	Ambient humidity	90%RH or less (non-condensing)			
nvironment	Storage temperature	-20°C to +65°C *			
Enviro	Ambience	Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt)			
	Altitude, vibration	Maximum 1000m above sea level for standard operation. After that derate by 3% for every extra 500m up to 2500m (91%). 5.9m/s² or less (conforming to JIS C 0040)			

^{*}Temperatures applicable for a short time, e.g. in transit.

(2) Wiring

ACAUTION

- Do not fit capacitive equipment such as power factor correction capacitor, radio noise filter or surge suppressor to the output of the inverter.
- The connection orientation of the output cables U, V, W to the motor will affect the direction of rotation of the motor.

(3) Trial run

! CAUTION

 Check all parameters, and ensure that the machine will not be damaged by a sudden start-up.

(4) 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] 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 load used should be a three-phase induction motor only. Connection of any other electrical equipment to the inverter output may damage 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.

A CAUTION

- The electronic thermal reray 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. Otherwise nearby electronic equipment may be affected.
- Take measures to suppress harmonics. Otherwise power supply harmonics from the inverter may heat/damage the power capacitor and generator.
- When a 400V class motor is inverter-driven, it should be insulation-enhanced or surge voltages suppressed. Surge voltages attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor.
- When parameter clear or all clear is performed, each parameter returns to the factory setting. Re-set the required parameters before starting operation.
- The inverter can be easily set for high-speed operation. Before changing its setting, fully examine the performances of the motor and machine.
- In addition to the inverter's holding function, install a holding device to ensure safety.
- Before running an inverter which had been stored for a long period, always perform inspection and test operation.

(5) Emergency stop

! CAUTION

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

(6) Maintenance, inspection and parts replacement

A CAUTION

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

(7) Disposing of the inverter

ACAUTION

Treat as industrial waste.

(8) General instructions

Many of the diagrams and drawings in this instruction manual show the inverter without a cover, or partially open. Never operate the inverter in this manner. Always replace the cover and follow this instruction manual when operating the inverter.

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CHAPTER 1 OUTLINE

This chapter gives information on the basic "outline" of this product.

Always read the instructions before using the equipment.

1.1	Pre-Operation Information	
1.2	Basic Configuration	•
1.3	Structure	į

<Abbreviations>

• PU

Operation panel and parameter unit (FR-PU04)

- Inverter
 Mitsubishi transistorized inverter
 FR-F500 series
- Pr. Parameter number

Chapter 1

Chapter 2

Chapter 3

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Pre-Operation Information 1.1

Precautions for operation 1.1.1

This manual is written for the FR-E500 series transistorized inverters.

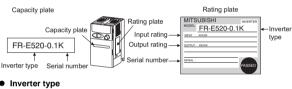
Incorrect handling may cause the inverter to operate incorrectly, causing its life to be reduced considerably, or at the worst, the inverter to be damaged. Handle the inverter properly in accordance with the information in each section as well as the precautions and instructions of this manual to use it correctly.

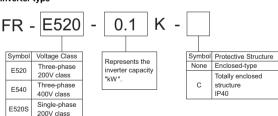
For handling information on the parameter unit (FR-PU04), stand-alone options, etc., refer to the corresponding manuals.

(1) Unpacking and product check

Unpack the inverter and check the capacity plate on the front cover and the rating plate on the inverter side face to ensure that the product agrees with your order and the inverter is intact

Inverter type





2) Accessory Instruction manual

E510W

Single-phase

100V class

If you have found any discrepancy, damage, etc., please contact your sales representative.

(2) Preparation of instruments and parts required for operation

Instruments and parts to be prepared depend on how the inverter is operated. Prepare equipment and parts as necessary. (Refer to page 58.)

(3) Installation

To operate the inverter with high performance for a long time, install the inverter in a proper place, in the correct direction, with proper clearances. (Refer to page 14.)

(4) Wiring

Connect the power supply, motor and operation signals (control signals) to the terminal block. Note that incorrect connection may damage the inverter and peripheral devices. (See page 16.)

1.2 Basic Configuration

1.2.1 Basic configuration

The following devices are required to operate the inverter. Proper peripheral devices must be selected and correct connections made to ensure proper operation. Incorrect system configuration and connections can cause the inverter to operate improperly, its life to be reduced considerably, and in the worst case, the inverter to be damaged. Please handle the inverter properly in accordance with the information in each section as well as the precautions and instructions of this manual. (For connections of the peripheral devices, refer to the corresponding manuals.)

	Name	Description
₩	Power supply	Use the power supply within the permissible power supply specifications of the inverter. (Refer to page 214.)
(NFB) or (ELB)	Earth (ground) leakage circuit breaker or no- fuse breaker	The breaker should be selected with care since a large inrush current flows in the inverter at power on. (Refer to page 48.)
(MC)	Magnetic contactor	Install for your safety. (Refer to page 53.) Do not use this magnetic contactor to start or stop the inverter. It might reduce the inverter life. (Refer to page 48.)
AC reactor (FR-BAL)	Reactors	The reactors must be used when the power factor is to be improved or the inverter is installed near a large power supply system (500KVA or more and wiring distance within 10m). Make selection carefully.
DC reactor (FR-BEL)	Inverter	The life of the inverter is influenced by ambient temperature. The ambient temperature should be as low as possible within the permissible range. This must be noted especially when the inverter is installed in an enclosure. (Refer to page 14.) Wrong wiring might lead to damage of the inverter. The control signal lines should be kept away from the main circuit to protect them from noise. (Refer to page 16.)
Earth (ground)	Devices connected to the output	Do not connect a power capacitor, surge suppressor or radio noise filter on the output side. When installing a no-fuse breaker on the output side of the inverter, contact each manufacturer for selection of the no-fuse breaker.
Earth (ground)	Earth (Ground)	To prevent an electric shock, always earth (ground) the motor and inverter. For reduction of induction noise from the power line of the inverter, it is recommended to wire the earth (ground) cable by returning it to the earth (ground) terminal of the inverter. (Refer to page 45.)

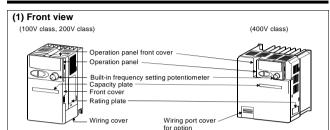
Harmonic Suppression Guideline

The "harmonic suppression guideline for household appliances and general-purpose products" was issued by Ministry of Economy, Trade and Industry (formerly Ministry of International Trade and Industry) in September, 1994. This guideline applies to the 3.7K" and less models of three-phase 200V classes. By installing the power factor improving reactor (FR-BEL or FR-BAL), inverters comply with the "harmonic suppression techniques for transistorized inverters (input current 20A or less)" established by the Japan Electrical Manufacturers' Association.

^{*} For the single-phase 200V class, the guideline applies to 2.2kW and less models. For the single-phase 100V class, the guideline applies to 0.75kW and less models.

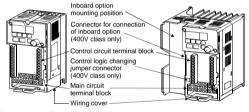
1.3 Structure

1.3.1 Appearance and structure

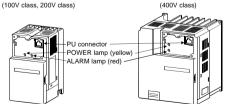


(2) Without front cover and operation panel front cover

(100V class, 200V class) (400V class)



(3) Without operation panel



Lamp indication -

Power lamp......Lit when power is spolled to the main circuit (R (L1),S (L2),T (L3)).

Alarm lamp......Lit when the inverter is in the alarm status (major faults).

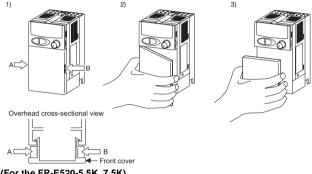
1.3.2 Removal and reinstallation of the front cover

●Removal

(For the FR-E520-0.1K to 3.7K, FR-E520S-0.1K to 0.75K, FR-E510W-0.1K to 0.75K)

The front cover is secured by hooks in positions A and B as shown below.

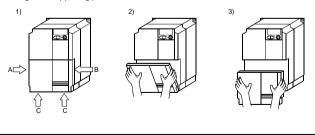
Push either A or B in the direction of arrows, and using the other end as a support. pull the front cover toward you to remove.



(For the FR-E520-5.5K, 7.5K)

The front cover is fixed with hooks in positions A, B and C.

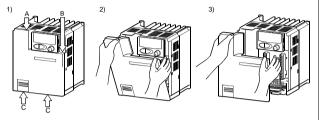
Push A and B in the directions of arrows at the same time and remove the cover using C as supporting points.



(For the FR-E540-0.4K to 7.5K)

The front cover is fixed with hooks in positions A, B and C.

Push A and B in the directions of arrows at the same time and remove the cover using C as supporting points.



Reinstallation

When reinstalling the front cover after wiring, fix the hooks securely. With the front cover removed, do not switch power on.

Note: 1. Make sure that the front cover has been reinstalled securely.

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

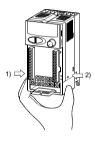
1.3.3 Removal and reinstallation of the wiring cover

●Removal

(For the FR-E520-0.1K to 7.5K, FR-E520S-0.1K to 0.75K, FR-E510W-0.1K to 0.75K)

The wiring cover is fixed by hooks in positions 1) and 2).

Push either 1) or 2) in the direction of arrows and pull the wiring cover downward to remove.

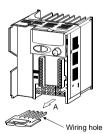




(For the FR-E540-0.4K to 7.5K)

Remove the wiring cover by pulling it in the direction of arrow A.





Reinstallation

Pass the cables through the wiring hole and reinstall the cover in the original position.

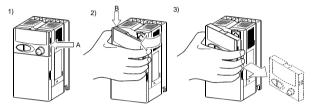
1.3.4 Removal and reinstallation of the operation panel

To ensure safety, remove and reinstall the operation panel after switching power off.

The charging area and control printed board are exposed on the rear surface of the operation panel. When removing the operation panel, always fit the rear cover option FR-E5P. Never touch the control printed board because touching it can cause the inverter to fail

●Removal

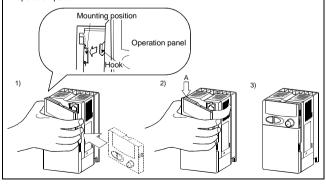
Hold down the portion A indicated by the arrow and lift the right hand side using the portion B indicated by the arrow as a support, and pull out the operation panel to the right.



(If the above procedure is not used for removal, the internal connector may be damaged by the force applied.)

Reinstallation

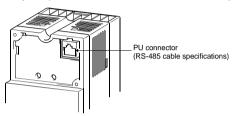
Insert the mounting hook (left hand side) of the operation panel into the mounting position of the inverter and push in the right hand side mounting hook to install the operation panel.



OUTLINE

Using the connection cable for operation

- 1) Remove the operation panel.
- 2) Fit the rear cover option FR-E5P to the back surface of the operation panel.
- 3) Securely plug one end of the connection cable into the PU connector of the inverter and the other end into the adaptor of the FR-E5P option to connect it to the operation panel. (For the connection cable of the FR-E5P, refer to page 29.)



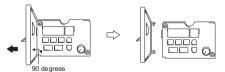
•Mounting the operation panel on an enclosure

When you open the operation panel front cover, the screw mounting guides for fixing the operation panel to an enclosure appear on the top left and bottom right. Remove the operation panel, fit the rear cover of the FR-E5P option, drill holes in the operation panel mounting guides, and securely mount the operation panel on the enclosure with screws.

1.3.5 Removal of the operation panel front cover

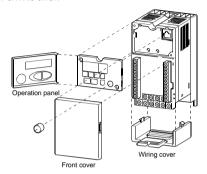
1)Open the operation panel front cover to 90 degrees.

2)Pull out the operation panel front cover to the left to remove it.

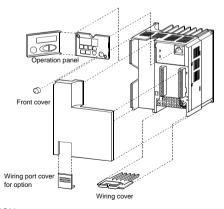


1.3.6 Exploded view

- FR-E520-0.1K to 7.5K
- FR-E520S-0.1K to 0.75K
- FR-E510W-0.1K to 0.75K



FR-E540-0.4K to 7.5K



- CAUTION -

Do not remove any parts other than the operation panel, front cover, and wiring cover from the inverter. Doing so will damage the inverter.

MEMO

CHAPTER 2 INSTALLATION AND WIRING

This chapter gives information on the basic "installation and wiring" for use of this product.

Always read the instructions in this chapter before using the equipment.

2.1	Installation	14
2.2	Wiring	16
2.3	Other Wiring	38

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

2.1 Installation

2.1.1 Instructions for installation

The FR-E520(S)-0.1K to 0.75K and FR-E510W-0.1K to 0.4K have top mounting holes in the back of the operation panel front cover. Tighten the screws after opening the cover.



1) Handle the unit carefully.

The inverter uses plastic parts. Handle it gently to protect it from damage. Also, hold the unit with even strength and do not apply too much strength to the front cover alone.

Install the inverter in a place where it is not affected by vibration easily (5.9m/s² maximum).

Note the vibration of a cart, press, etc.

3) Note on the ambient temperature.

The inverter life is under great influence of the ambient temperature. In the place of installation, the ambient temperature must be within the permissible range -10°C to +50°C (-10°C to +40°C when using the totally enclosed structure). Check that the ambient temperature is within that range in the positions shown in figure 3).

4) Install the inverter on a non-combustible surface.

The inverter will be very hot (maximum about 150°C). Install it on a non-combustible surface (e.g. metal). Also leave sufficient clearances around the inverter.

5) Avoid high temperature and high humidity.

Avoid direct sunlight and places of high temperature and high humidity.

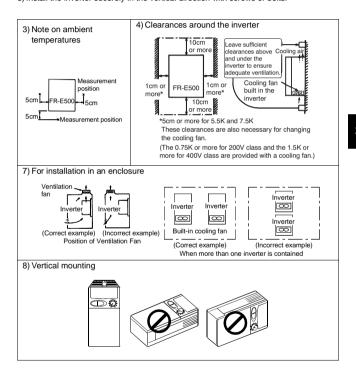
6) Avoid places where the inverter is exposed to oil mist, flammable gases, fluff, dust, dirt etc.

Install the inverter in a clean place or inside a "totally enclosed" panel which does not accept any suspended matter.

7) Note the cooling method when the inverter is installed in an enclosure.

When two or more inverters are installed or a ventilation fan is mounted in an enclosure, the inverters and ventilation fan must be installed in proper positions with extreme care taken to keep the ambient temperatures of the inverters with the permissible values. If they are installed in improper positions, the ambient temperatures of the inverters will rise and ventilation effect will be reduced.

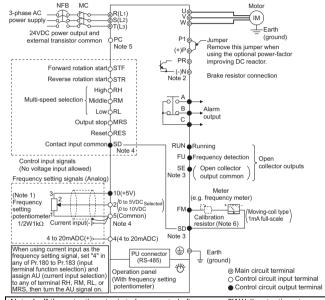
8) Install the inverter securely in the vertical direction with screws or bolts.



2.2 Wiring

2.2.1 Terminal connection diagram

- 3-phase 200V power input
- 3-phase 400V power input



- Note: 1. If the potentiometer is to be operated often, use a $2W1k\Omega$ potentiometer.
 - 0.1K and 0.2K do not contain a transistor.
 - 3. Terminals SD and SE are isolated.
 - Terminals SD and 5 are common terminals. Do not earth (ground) them to the ground. Terminals SD and 5 are not isolated. (Those of the 400V class are isolated.)
 - When terminals PC-SD are used as a 24VDC power supply, be careful not to short these terminals. If they are shorted, the inverter will be damaged.
 - 6. Not needed when the operation panel or parameter unit (FR-PU04) is used for calibration. Used when calibration must be made near the frequency meter for such a reason as a remote frequency meter. However, the frequency meter needle may not deflect to full-scale if the calibration resistor is connected. In this case, use this resistor and the operation panel or parameter unit tooether.

- Single-phase 200V power input
- Single-phase 100V power input



Note:1. To ensure safety, connect the power input to the inverter via a magnetic contactor and earth (ground) leakage circuit breaker or no-fuse breaker, and use the magnetic contactor to switch power on-off.

2. The output is three-phase 200V.

(1) Description of the main circuit terminals

Symbol	Terminal Name	Description
R, S, T (L1, L2, L3) (Note)	AC power input	Connect to the commercial power supply. Keep these terminals open when using the high power factor converter (FR-HC) or power regeneration common converter (FR-CV).
U, V, W	Inverter output	Connect a three-phase squirrel-cage motor.
P (+), PR	Brake resistor connection	Connect the optional brake resistor across terminals P-PR (+ - PR) (not for 0.1K and 0.2K).
P (+), N (-)	Brake unit connection	Connect the optional brake unit, high power factor converter (FR-HC), and power regeneration common converter (FR-CV).
P (+), P1	Power factor improving DC reactor connection	Disconnect the jumper from terminals P-P1 (+ - P1) and connect the optional power factor improving DC reactor. (can not be connected to the single phase 100V power input specification inverter)
(4)	Earth (Ground)	For earthing (grounding) the inverter chassis. Must be earthed (grounded).

Note: R, S (L₁, L₂) terminals for single-phase power input.

(2) Description of the control circuit terminals

Ту	ре	Symbol	Terminal Name	Description										
		STF Forward rotation star		Turn on the STF signal to start forward rotation and turn it off to stop. When the STF and STR signal and STR signal										
		STR	Reverse rotation start	Turn on the STR signal to start reverse rotation and turn it off to stop.	are turned on simultaneously, the stop command is given.									
	put	RH, RM, RL	Multi-speed selection	Combine the RH, RM and RL signals as appropriate to select multiple speeds.	Input terminal function selection									
S	Contact input	MRS	Output stop	Turn on the MRS signal (20ms or longer) to stop the inverter output. Used to shut off the inverter output to bring the motor to a stop by the electromagnetic brake.	(Pr. 180 to Pr. 183) changes terminal functions.									
Input signals		RES	Reset	Used to reset the protective circuit activate RES signal for more than 0.1s then turn it Factory setting is for reset always. By settican be set to enabled only at an inverter al (Refer to page 121.) Recover about 1s afte cancelled.	off. ng Pr.75, reset arm occurrence.									
	SD Contact input common (sink*)		common .	Common to the contact input terminals and terminal FM. Common output terminal for 24VDC 0.1A power output (PC terminal).										
	Power output and external transistor common Contact input common (source*)		and external transistor common Contact input common	When transistor output (open collector outprogrammable controller (PLC), is connect external power supply common for transist terminal to prevent a fault caused by under This terminal can be used as a 24VDC, 0.1	ed, connect the or output to this sirable current.									
		10	Frequency setting power supply	5VDC, permissible load current 10mA										
Analog	ency setting	ency setting	ency setting	ency setting	ency setting	ency setting	ency setting	Frequency setting	ency setting			By entering 0 to 5VDC (0 to 10VDC), the maximum output frequency is reached at 5V (or 10V) and I/O are proportional. Use Pr. 73 to switch between input 0 to 5VDC (factory setting) and 0 to 10VDC. Input resistance 10kΩ. Maximum permissible voltage 20V.		
Ana	Frequ	4	Frequency setting (current)	By entering 4 to 20mADC, the maximum ou reached at 20mA and I/O are proportional. is valid only when the AU signal (Note) is or invalid). Input resistance approximately 250 permissible current 30mA.	This input signal (voltage input is									
	5 Frequency setting common			Common to the frequency setting signals (terminal 2, 1 or 4). Do not connect to the earth (ground).										

Note: Assign the AU signal to any of the terminals using the input terminal function selection (Pr. 180 to Pr. 183).

Used as a contact input signal common terminal by switching between sink logic and source logic. (Refer to page 26.)

Ту	ре	Symbol	Terminal Name	Description			
	Contact	A, B, C	Alarm output	Change-over contact output ir the output has been stopped protective function activated. 2 30VDC 0.3A. Alarm: discontin C (continuity across A-C), nor continuity across B-C (discont A-C).	Output terminal		
als	Open collector	RUN	Inverter running	Switched low when the inverted frequency is equal to or highe starting frequency (factory set variable). Switched high durin injection brake operation (*1). Permissible load 24VDC 0.1A	r than the to 0.5Hz, g stop or DC	function selection (Pr. 190 to Pr. 192) changes terminal	
Output signals	Open c	FU	Frequency detection	Switched low when the output has reached or exceeded the frequency set as appropriate. high when the output frequency the detection frequency (*1). Permissible load 24VDC 0.1A	functions.		
	SE Open collector output common			Common to the RUN and FU terminals			
	FM For meter		For meter	One selected from output frequency, motor current and output voltage is output (*2). The output signal is proportional to the magnitude of each monitoring item. Factory setting of output item: Frequency permissible load current 1mA 1440 pulses/s at 60Hz		rmissible mA	
Communication				With the operation panel conn be made using the RS-485 pm • Conforming Standard : El/ • Transmission format : Mc • Communication speed : Ma • Overall length : 500	otocol. A Standard RS ulti-drop link sy aximum 19200l	-485 stem	

^{*1:} Low indicates that the open collector output transistor is on (conducts). High indicates that the transistor is off (does not conduct).

^{*2:} Not output during inverter resetting.

2.2.2 Wiring of the Main Circuit

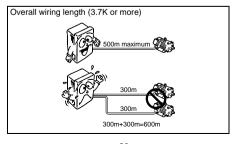
(1) Wiring instructions

- It is recommended to use insulation-sleeved crimping terminals for power supply and motor cables.
- 2) Application of power to the output terminals (U, V, W) of the inverter will damage the inverter. Never perform such wiring.
- 3) After wiring, wire off-cuts must not be left in the inverter.
 - Wire off-cuts can cause an alarm, failure or malfunction. Always keep the inverter clean. When drilling mounting holes in a control box etc., be careful so that chips and others do not enter the inverter.
- 4) Use thick cables to make the voltage drop 2% or less.
 - If the wiring distance is long between the inverter and motor, a main circuit cable voltage drop will cause the motor torque to decrease, especially at the output of a low frequency. (A selection example for the wiring length of 20m is shown on page 23.)
- 5) For long distance wiring, the overcurrent protection may be activated improperly or the devices connected to the output side may misoperate or become faulty under the influence of a charging current due to the stray capacitance of the wiring.

Therefore, the maximum overall wiring length should be as indicated in the following table. If the wiring length exceeds the value, it is recommended to set "1" in Pr. 156 to make the high-response current limit function invalid. (When two or more motors are connected to the inverter, the total wiring length should be within the indicated value.)

Inverter Capacity		0.1K	0.2K	0.4K	0.75K	1.5K	2.2K	3.7K or more
Non-low acoustic noise	100V, 200V class	200	200	300	500	500	500	500
mode	400V class	-	-	200	200	300	500	500
Low acoustic noise	100V, 200V class	30	100	200	300	500	500	500
mode	400V class		_	30	100	200	300	500

(Unit: m)



6) Connect only the recommended optional brake resistor between the terminals P-PR (+ - PR). Keep terminals P-PR (+ - PR) of 0.1K or 0.2K open.

These terminals must not be shorted.

- 0.1K and 0.2K do not accept the brake resistor. Keep terminals P-PR (+ PR) open. Also, never short these terminals.
- 7) Electromagnetic wave interference
 - The input/output (main circuit) of the inverter includes harmonic components, which may interfere with the communication devices (such as AM radios) used near the inverter. In this case, install the FR-BIF optional radio noise filter (for use in the input side only) or FR-BSF01 or FR-BLF line noise filter to minimize interference.
- 8) Do not install a power capacitor, surge suppressor or radio noise filter (FR-BIF option) on the output side of the inverter.
 - This will cause the inverter to trip or the capacitor and surge suppressor to be damaged. If any of the above devices are installed, immediately remove them. (When using the FR-BIF radio noise filter with a single-phase power supply, connect it to the input side of the inverter after isolating the T phase securely.)
- 9) When rewiring after operation, make sure that the POWER lamp has gone off, and when more than 10 minutes has elapsed after power-off, check with a meter etc. that the voltage is zero. After that, start rewiring work. For some time after power-off, there is a dangerous voltage in the capacitor.

Notes on Earthing (Grounding)

- Leakage currents flow in the inverter. To prevent an electric shock, the inverter and
 motor must be earthed (grounded). Earthing (grounding) 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)
- Use the dedicated earth (ground) terminal to earth (ground) the inverter. (Do not use the screw in the case, chassis, etc.) For the earth (ground) connection, avoid direct contact between aluminium and copper. Tin-plated cable lugs can be used if the plating does not contain zinc. When tightening the screws, take care not to damage the thread in the aluminium frame.
- Use the thickest possible earth (ground) cable. Use the cable whose size is equal
 to or greater than that indicated below, and minimize the cable length. The earthing
 (grounding) point should be as near as possible to the inverter.

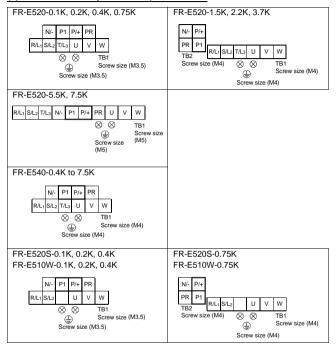
(Unit: mm²)

Motor Capacity	Earth (ground) Cable Gauge						
Wiotor Capacity	100V class	200V class	400V class				
2.2kW or less	2 (2.5)	2 (2.5)	2 (2.5)				
3.7kW	_	3.5 (4)	2 (4)				
5.5kW, 7.5kW	_	5.5 (6)	3.5 (4)				

For use as a product compliant with the Low Voltage Directive, use PVC cable whose size is indicated within parentheses.

• Earth (ground) the motor on the inverter side using one wire of the 4-core cable.

(2) Terminal block layout of the power circuit



(3) Cables, crimping terminals, etc.

The following table lists the cables and crimping terminals used with the inputs (R (L₁), S (L₂), T (L₃)) and outputs (U, V, W) of the inverter and the torques for tightening the screws:

1) FR-E520-0.1K to 7.5K

A P I. I	Tight-		Crimping			HIV C	PVC insulated Cables			
Applicable Inverter Type	Screw	ening Torque	Terminals		mm ²		AWG		mm ²	
туре	Size	N·m	R, S, T (L ₁ , L ₂ , L ₃)	U, V, W	R, S, T (L1, L2, L3)	U, V, W	R, S, T (L ₁ , L ₂ , L ₃)	U, V, W	R, S, T (L1, L2, L3)	U, V, W
FR-E520-0.1K to 0.75K	M3.5	1.2	2-3.5	2-3.5	2	2	14	14	2.5	2.5
FR-E520-1.5K, 2.2K	M4	1.5	2-4	2-4	2	2	14	14	2.5	2.5
FR-E520-3.7K	M4	1.5	5.5-4	5.5-4	3.5	3.5	12	12	4	2.5
FR-E520-5.5K	M5	2.5	5.5-5	5.5-5	5.5	5.5	10	10	6	4
FR-E520-7.5K	M5	2.5	14-5	8-5	14	8	6	8	16	6

2) FR-E540-0.4K to 7.5K

Applicable Inverter	Terminal '	Tight-	Crimping Terminals			HIV C	PVC insulated Cables			
Type	Screw	Torque			mm ²		AWG		mm ²	
туре	Size	N·m	R, S, T	U, V, W	W R, S, T	R, S, T	U, V, W	R, S, T	U, V, W	
	l N	N·m (L·	(L1, L2, L3)	U, V, VV	(L1, L2, L3)	U, V, W	(L1, L2, L3)	O, V, W	(L1, L2, L3)	O, V, W
FR-E540-0.4K	M4	1.5	2-4	2-4	2	2	14	14	2.5	2.5
FR-E540-0.75K	M4	1.5	2-4	2-4	2	2	14	14	2.5	2.5
FR-E540-1.5K	M4	1.5	2-4	2-4	2	2	14	14	2.5	2.5
FR-E540-2.2K	M4	1.5	2-4	2-4	2	2	14	14	2.5	2.5
FR-E540-3.7K	M4	1.5	2-4	2-4	2	2	14	14	2.5	2.5
FR-E540-5.5K	M4	1.5	5.5-4	2-4	3.5	2	12	14	4	2.5
FR-E540-7.5K	M4	1.5	5.5-4	5.5-4	3.5	3.5	12	12	4	4

3) FR-E520S-0.1K to 0.75K

Applicable Inverter	Terminal	Tight-	Crimping Terminals			HIV C	PVC insulated Cables			
Type	Screw	Torque					mm ²		AWG	
Size	N·m	R, S (L ₁ , L ₂)	U, V, W	R, S (L ₁ , L ₂)	U, V, W	R, S (L ₁ , L ₂)	U, V, W	R, S (L ₁ , L ₂)	U, V, W	
FR-E520S-0.1Kto 0.4K	M3.5	1.2	2-3.5	2-3.5	2	2	14	14	2.5	2.5
FR-E520S-0.75K	M4	1.5	2-4	2-4	2	2	14	14	2.5	2.5

4) FR-E510W-0.1K to 0.75K

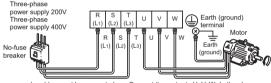
Te	Terminal Tight-		Crimping			HIV C	PVC insulated Cables				
Applicable Inverter Type	Screw	ening Torque	Terminals			mm ²		AWG		mm ²	
Турс	Size	N·m	R, S (L ₁ , L ₂)	U, V, W	R, S (L ₁ , L ₂)	U, V, W	R, S (L ₁ , L ₂)	U, V, W	R, S (L ₁ , L ₂)	U, V, W	
FR-E510W-0.1K to 0.4K	M3.5	1.2	2-3.5	2-3.5	2	2	14	14	2.5	2.5	
FR-E510W-0.75K	M4	1.5	5.5-4	2-4	3.5	2	12	14	4	2.5	

Note: 1. The cables used should be 75°C copper cables.

Tighten the terminal screws to the specified torques. Undertightening can cause a short or misoperation. Overtightening can cause the screws and unit to be damaged, resulting in a short or misoperation.

(4) Connection of the power supply and motor

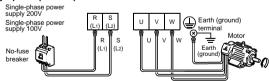
Three-phase power input



The power supply cables must be connected to R, S, T (L₁, L₂, L₃). If they are connected to U, V, W, the inverter will be damaged. (Phase sequence need not be matched.)

Connect the motor to U, V, W. In the above connection, turning on the forward rotation switch (signal) rotates the motor in the counterclockwise (arrow) direction when viewed from the load shaft.

Single-phase power input



Note: 1.To ensure safety, connect the power input to the inverter via a magnetic contactor and earth (ground) leakage circuit breaker or no-fuse breaker, and use the magnetic contactor to switch power on-off.

The output is three-phase 200V.

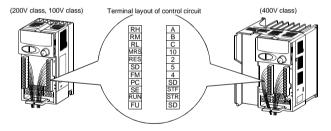
2.2.3 Wiring of the control circuit

(1) Wiring instructions

- 1) Terminals SD, SE and 5 are common to the I/O signals. These common terminals must not be earthed (grounded) to the ground.
 - Terminals SD and 5 are not isolated. Do not connect terminals SE-5. (Those of the 400V class are isolated. Avoid connecting the terminal SD and 5 and the terminal SE and 5.)
- 2) Use shielded or twisted cables for connection to the control circuit terminals and run them away from the main and power circuits (including the 200V relay sequence circuit).
- 3) The frequency input signals to the control circuit are micro currents. When contacts are required, use two or more parallel micro signal contacts or a twin contact to prevent a contact fault.
- 4) It is recommended to use the cables of 0.3mm² to 0.75mm² gauge for connection to the control circuit terminals

(2) Terminal block layout

In the control circuit of the inverter, the terminals are arranged as shown below: Terminal screw size: M2.5



(3) Wiring method

1) For wiring the control circuit, use cables after stripping their sheaths.

Refer to the gauge printed on the inverter and strip the sheaths to the following dimensions. If the sheath is stripped too much, its cable may be shorted with the adjoining cable. If the sheath is stripped too little, the cable may come off.



- 2) When using bar terminals and solid wires for wiring, their diameters should be 0.9mm maximum. If they are larger, the threads may be damaged during tightening.
- 3) Loosen the terminal screw and insert the cable into the terminal.
- 4) Tighten the screw to the specified torque.

Undertightening can cause cable disconnection or misoperation. Overtightening can cause damage to the screw or unit, leading to short circuit or misoperation.

Tightening torque: 0.25N·m to 0.49N·m

*Use a size 0 screwdriver to tighten.

Note: When routing the stripped cables, twist them so that they do not become loose. In addition, do not solder it.

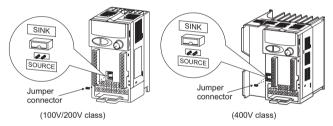
(4) Control logic changing

The input signal logic is factory-set to the sink logic.

To change the control logic, the position of the jumper connector must be changed.

 Use tweezers etc. to remove the jumper connector in the sink logic position and fit it in the source logic position.

Do this position changing before switching power on.



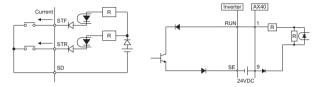
- Note: 1. Make sure that the front cover has been installed securely.
 - The front cover has a capacity plate and the inverter a rating plate on it. Since these plates have the same serial numbers, always reinstall the removed cover to the inverter from where it was removed.
 - Always install the sink-source logic changing jumper connector in either of the positions. If two connectors are installed in these positions at the same time, the inverter may be damaged.

2

INSTALLATION AND WIRING

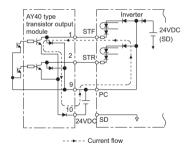
- 2) Sink logic type
- In this logic, a signal switches on when a current flows out of the corresponding signal input terminal.

Terminal SD is common to the contact input signals. Terminal SE is common to the open collector output signals.



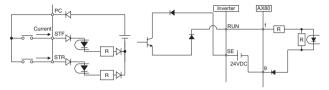
 Use terminal PC as a common terminal to prevent a malfunction caused by undesirable current.

(Do not connect terminal SD of the inverter with terminal 0V of the external power supply. When using terminals PC-SD as a 24VDC power supply, do not install the power supply in parallel outside the inverter. Doing so may cause misoperation due to undesirable current.)

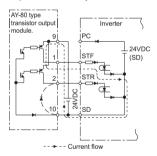


- 3) Source logic type
- In this logic, a signal switches on when a current flows into the corresponding signal input terminal.

Terminal PC is common to the contact input signals. Terminal SE is common to the open collector output signals.



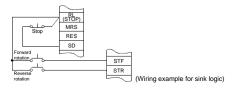
 When using an external power supply for transistor output, use terminal SD as a common to prevent misoperation caused by undesirable current.



(5) How to use the STOP signal

The following connection example shows how to self-hold the start signals (forward rotation, reverse rotation).

Use Pr. 180 to Pr. 183 (input terminal function selection) to assign the STOP signal.



2.2.4 Connection to the PU connector

(1) When connecting the operation panel or parameter unit using a cable
Use the option FR-CB2□□ or the following connector and commercially available cable:

<Connection cable>

Connector: RJ45 connector

Example: 5-554720-3, Tyco Electronics Corporation

• Cable: :Cable conforming to EIA568 (e.g. 10BASE-T cable)

Example: SGLPEV-T 0.5mm×4P (Twisted pair cable, 4 pairs),

MITSUBISHI CABLE INDUSTRIES, LTD.

Note: The rear cover and junction adaptor are required since the circuit board is exposed in the back of the operation panel. Use the FR-E5P option (cover and adaptor available as a set).

<Maximum wiring length>

- Operation panel: 20m
- Parameter unit (FR-PU04): 20m

(2) For RS-485 communication

With the operation panel disconnected, the PU connector can be used for communication operation from a personal computer etc.

When the PU connector is connected with a personal, FA or other computer by a communication cable, a user program can run and monitor the inverter or read and write to the parameters.

<PU connector pin-outs>

Viewed from the inverter (receptacle side) front



1) SG 5) SDA 2) P5S 6) RDB

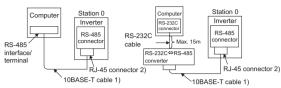
3) RDA 7) SG

4) SDB 8) P5S

- Note: 1. Do not connect the PU connector to a computer's LAN board, FAX modem socket or telephone modular connector. Otherwise, the product may be damaged due to electrical specification differences.
 - 2. Pins 2) and 8) (P5S) provide power to the operation panel or parameter unit
 - Do not use these pins for RS-485 communication.
 - 3. Refer to page 135 for the communication parameters.

<System configuration example>

(1) Connection of a computer to the inverter (1:1 connection)



Computer-inverter connection cable

For a connection cable between the computer having RS-232C and the inverter (RS-232C \Leftrightarrow RS-485 converter), refer to the table below.

Example of product available on the market (as of Oct., 2003)

Model Maker					
FA-T-RS40□*	Mitsubishi Electric Engineering Co., Ltd.				

* The converter cable cannot connect two or more inverters (the computer and inverter are connected on a 1:1 basis). Since the product is packed with the RS-232C cable and RS-485 cable (10BASE-T + RJ-45 connector), the cable and connector need not be prepared separately. Contact a maker for details of the product.

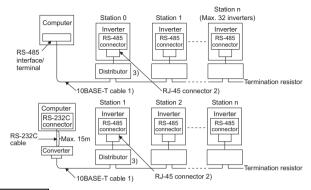
REMARKS

Refer to the following when fabricating the cable on the user side.

Example of product available on the market (as of Oct., 2003)

	Product	Model	Maker
1)	10BASE-T cable	* Do not use No. 2 and No. 8 pin (P5S).	Mitsubishi Cable Industries, Ltd.
2)	RJ-45 connector	5-554720-3	Tyco Electronics Corporation

(2) Connection of a computer to multiple inverters (1:n connection)



REMARKS

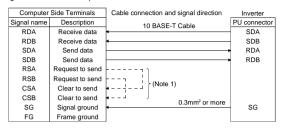
Refer to the following when fabricating the cable on the user side. Example of product available on the market (as of Oct., 2003)

	Product Model		Maker			
1)	10BASE-T cable	SGLPEV-T 0.5mm × 4P*	Mitsubishi Cable Industries, Ltd.			
2)	RJ-45 connector	5-554720-3	Tyco Electronics Corporation			

^{*} Do not use No. 2 and No. 8 pin (P5S) of the 10 BASE-T cable.

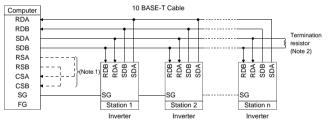
<Wiring methods>

1) Wiring of one RS-485 computer and one inverter



2) Wiring of one RS-485 computer and "n" inverters (several inverters)





- Note: 1. Make connections in accordance with the instruction manual of the computer used.
 - Fully check the terminal numbers of the computer as they differ between models.
 - 2. There may be the influence of reflection depending on the transmission speed and/or transmission distance. If this reflection hinders communication, provide a termination resistor. If the PU connector is used to make a connection, use the distributor as a termination resistor cannot be fitted.

Connect the termination resistor to only the inverter remotest from the computer. (Termination resistor: 100Ω)

2.2.5 Connection of stand-alone option units

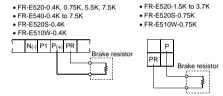
The inverter accepts a variety of stand-alone option units as required.

Incorrect connection will cause inverter damage or an accident. Connect and operate the option unit carefully in accordance with the corresponding option unit manual.

(1) Connection of the dedicated external brake resistor (option) (Cannot be connected to 0.1K and 0.2K)

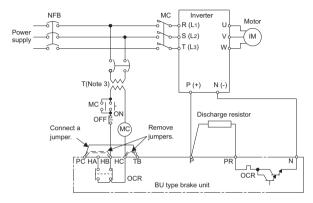
Connect a brake resistor across terminals P (+) and PR. Connect a dedicated brake resistor only.

(For the locations of terminals P (+) and PR, refer to the terminal block layout (page 22).)



(2) Connection of the brake unit (BU)

Connect the BU brake unit correctly as shown below. Incorrect connection will damage the inverter. Remove the jumper across terminals HB-PC and terminals TB-HC of the brake unit and fit it to across terminals PC-TB.

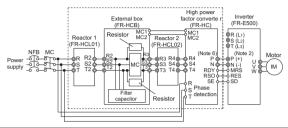


- Note: 1. The wiring distance between the inverter, brake unit and discharge resistor should be within 2m. If twisted wires are used, the distance should be within 5m.
 - If the transistors in the brake unit should fail, the resistor will be extremely hot, causing a fire. Therefore, install a magnetic contactor on the inverter's power supply side to shut off current in case of failure.
 - 3. When the power supply is 400V class, install a step-down transformer.

(3) Connection of the high power factor converter (FR-HC)

(In the case of single-phase power input, the FR-HC cannot be connected.)

When connecting the high power factor converter (FR-HC) to suppress power supply harmonics, perform wiring securely as shown below. Wrong connection will damage the high power factor converter and inverter.



- Note: 1. Use sink logic (factory setting) when the FR-HC is connected. The FR-HC cannot be connected when source logic is selected.
 - 2. The power input terminals R, S, T (L1, L2, L3) must be open. Incorrect connection will damage the inverter. Reverse polarity of terminals N (-), P (+) will damage the inverter.
 - 3. The voltage phases of terminals R, S, T (L1, L2, L3) and terminals R4, S4, T4 must be matched before connection. 4. The MRS terminal functions can be changed using Pr.183 "MRS terminal
 - function selection". When connecting the high power factor converter (FR-HC), use the inverter with "6" (factory-set) in Pr.183. (Refer to page 161.)
 - 5. If the load capacity is less than half of the high power factor converter capacity, satisfactory harmonic suppression effects cannot be produced.
 - Do not install the NFB between terminals P-N (P (+) -P. N (-) -N).

(4) Connection of the power factor improving DC reactor (FR-BEL)

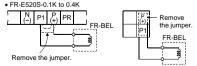
Connect the FR-BEL power factor improving DC reactor between terminals P1-P (+). In this case, the jumper connected across terminals P1-P (+) must be removed. Otherwise, the reactor will not function.

<Connection method>

 FR-E520-0.1K to 0.75K, 5.5K, 7.5K FR-E520-1.5K to 3.7K

FR-F540-0 4K to 7 5K

FR-F520S-0.75K

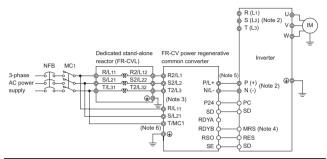


Note: 1. The wiring distance should be within 5m.

2. The size of the cables used should be equal to or larger than that of the power supply cables (R (L1), S (L2), T (L3)).

(5) Connection of the power regeneration common converter (FR-CV)

When connecting the type power regeneration common converter (FR-CV), connect the inverter terminals (P(+), N(-)) and power regeneration common converter (FR-CV) terminals as shown below so that their signals match with each other. For details, refer to the instruction manual of the power regeneration common converter (FR-CV).

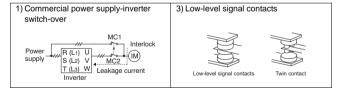


Note: 1. When the FR-CV is connected, use sink logic (factory setting). For source logic, the FR-CV cannot be connected.

- The DC power supply input from the terminals P (+) and N (-) is used as the control power supply. The power input terminals R (L1), S (L2), T (L3) must be open. Accidental connection will damage the inverter. Opposite polarity of terminals N (-), P (+) will damage the inverter.
- The voltage phases of terminals R/L11, S/L21, T/MC1 and terminals R2/L1, S2/L2, T2/L3 must be matched before connection.
- The MRS terminal functions can be changed using Pr.183 "MRS terminal function selection". When connecting the power regeneration common converter (FR-CV), use the inverter with "6" (factory-set) in Pr.183. (Refer to page 161.)
- 5. Do not insert NFB between terminals P-N(P (+) P/L+, N (-) N/L-)
- Make sure terminals R/L11, S/L21, T/MC1 are connected to the power supply. Running the inverter without connecting the terminals will damage the power regeneration common converter.

2.2.6 Design information

- When performing commercial power supply-inverter switch-over operation, securely provide electrical and mechanical interlocks for the MC1 and MC2 used for commercial power supply-inverter switch-over.
 - When there is a commercial power supply-inverter switch-over circuit as shown below, the inverter will be damaged by leakage current from the power supply due to arcs generated at the time of switch-over or chattering caused by a sequence error.
- 2) If the machine must not be restarted when power is restored after a power failure, provide a magnetic contactor in the inverter's primary circuit and also make up a sequence which will not switch on the start signal.
 - If the start signal (start switch) remains on after a power failure, the inverter will automatically restart as soon as the power is restored.
- 3) Since the input signals to the control circuit are on a low level, use two or more parallel micro signal contacts or a twin contact for contact inputs to prevent a contact fault
- 4) Do not apply a large voltage to the contact input terminals (e.g. STF) of the control circuit.
- Always apply a voltage to the alarm output terminals (A, B, C) via a relay coil, lamp etc.
- 6) Make sure that the specifications and rating match the system requirements.



2.3 Other Wiring

2.3.1 Power supply harmonics

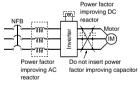
Power supply harmonics may be generated from the converter section of the inverter, affecting the power supply equipment, power capacitor, etc. Power supply harmonics are different in generation source, frequency band and transmission path from radio frequency (RF) noise and leakage currents. Take the following counter measures.

The differences between harmonics and RF noises are indicated below:

Item	Harmonics	RF Noise
Frequency	Normally 40th to 50th degrees or less (up to 3kHz or less)	High frequency (several 10kHz to 1GHz order)
Environment	To wire paths, power impedance	Across spaces, distance, laying paths
Quantitative understanding	Logical computation is possible	Occurs randomly, quantitative understanding is difficult.
Generated amount	Approximately proportional to load capacity	According to current fluctuation rate (larger with faster switching)
Immunity of affected device	Specified in standards for each device.	Differs according to maker's device specifications.
Examples of safeguard	Install a reactor.	Increase the distance.

Countermeasures

The harmonic current generated from the inverter to the power supply differs according to various conditions such as the wiring impedance, whether a power factor improving reactor is used or not, and output frequency and output current on load side. For the output frequency and output current, the adequate method is to obtain them under rated load at the maximum operating frequency.



Note: A power factor improving capacitor and surge suppressor on the inverter's output side may overheat or be damaged due to the harmonics of the inverter output. Also, when an overcurrent flows in the inverter, the overcurrent protection is activated. Hence, when the motor is driven by the inverter, do not install a capacitor or surge suppressor on the inverter's output side. To improve the power factor, insert a power factor improving reactor in the inverter's input or DC circuit. For details, refer to the FR-A500/E500 series technical information.

2.3.2 Harmonic suppression guideline

Harmonic currents flow from the inverter to a power receiving point via a power transformer. The harmonic suppression guideline was established to protect other consumers from these outgoing harmonic currents.

1) "Harmonic suppression guideline for household appliances and general-purpose products"

This guideline was issued by the Japanese Ministry of Economy, Trade and Industry (formerly Ministry of International Trade and Industry) in September, 1994 and applies to 200V class inverters of 3.7kW or less*. By installing the FR-BEL or FR-BAL power factor improving reactor, inverters comply with the "haramonic suppression techniques for transistorized inverters (input current 20A or less)" established by the Japan Electrical Manufacturers' Association. Therefore install the optional reactor for the 200V class. 3.7kW or less inverter.

- * For the single-phase 200V class, the guideline applies to 2.2kW and less models. For the single-phase 100V class, the guideline applies to 0.75kW and less models.
- 2) "Harmonic suppression guideline for specific consumers"

This guideline sets forth the maximum values of harmonic currents outgoing from a high-voltage or specially high-voltage consumer who will install, add or renew harmonic generating equipment. If any of the maximum values is exceeded, this guideline requires that consumer to take certain suppression measures.

Table 1 Maximum Values of Outgoing Harmonic Currents per 1kW Contract Power

Received Power Voltage	5th	7th	11th	13th	17th	19th	23rd	Over 23rd
6.6kV	3.5	2.5	1.6	1.3	1.0	0.9	0.76	0.70
22kV	1.8	1.3	0.82	0.69	0.53	0.47	0.39	0.36
33kV	1.2	0.86	0.55	0.46	0.35	0.32	0.26	0.24

(1) Application of the harmonic suppression guideline for specific consumers

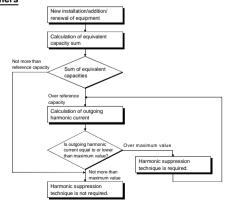


Table 2 Conversion Factors for FR-F500 Series

Class	Circ	uit Type	Conversion Factor (Ki)
3		Without reactor	K31 = 3.4
	3-phase bridge (Capacitor-smoothed)	With reactor (AC side)	K32 = 1.8
3		With reactor (DC side)	K33 = 1.8
		With reactors (AC, DC sides)	K34 = 1.4
5	Self-exciting 3-phase bridge	When high power factor converter is used	K5 = 0

Table 3 Equivalent Capacity Limits

Received Power Voltage	Reference Capacity				
6.6kV	50 kVA				
22/33 kV	300 kVA				
66kV or more	2000 kVA				

Table 4 Harmonic Contents (Values at the fundamental current of 100%)

Reactor	5th	7th	11th	13th	17th	19th	23rd	25th
Not used	65	41	8.5	7.7	4.3	3.1	2.6	1.8
Used (AC side)	38	14.5	7.4	3.4	3.2	1.9	1.7	1.3
Used (DC side)	30	13	8.4	5.0	4.7	3.2	3.0	2.2
Used (AC, DC sides)	28	9.1	7.2	4.1	3.2	2.4	1.6	1.4

1) Calculation of equivalent capacity (P0) of harmonic generating equipment The "equivalent capacity" is the capacity of a 6-pulse converter converted from the capacity of consumer's harmonic generating equipment and is calculated with the following equation. If the sum of equivalent capacities is higher than the limit in Table 3. harmonics must be calculated with the following procedure:

$P0=\Sigma$ (Ki× Pi) [kVA]

Ki : Conversion factor (refer to Table 2) Pi: Rated capacity of harmonic

- generating equipment* [kVA] i : Number indicating the conversion
- circuit type
- * Rated capacity: Determined by the capacity of the applied motor and found in Table 5. It should be noted that the rated capacity used here is used to calculate a generated harmonic amount and is different from the power supply capacity required for actual inverter drive.
- 2) Calculation of outgoing harmonic current

Outgoing harmonic current = fundamental wave current (value converterd from received power voltage) × operation ratio × harmonic content

- Operation ratio: Operation ratio = actual load factor × operation time ratio during 30 minutes
- . Harmonic content: Found in Table 4.

Table 5 Rated Capacities and Outgoing Harmonic Currents for Inverter Drive

Applied Motor (kW)	Rated Current [A]		6.6kV Equivalent of	Rated	Fundamental Wave Current Converted from 6.6kV (No reactor, 100% operation ratio)							
	200V	400V	Fundamental Wave Current (mA)	(kVA)	5th	7th	11th	13th	17th	19th	23rd	25th
0.4	1.61 (Note)	0.81	49	0.57	31.85	20.09	4.165	3.773	2.107	1.519	1.274	0.882
0.75	2.74 (Note)	1.37	83	0.97	53.95	34.03	7.055	6.391	3.569	2.573	2.158	1.494
1.5	5.50 (Note)	2.75	167	1.95	108.6	68.47	14.20	12.86	7.181	5.177	4.342	3.006
2.2	7.93 (Note)	3.96	240	2.81	156.0	98.40	20.40	18.48	10.32	7.440	6.240	4.320
3.7	13.0 (Note)	6.50	394	4.61	257.1	161.5	33.49	30.34	16.94	12.21	10.24	7.092
5.5	19.1	9.55	579	6.77	376.1	237.4	49.22	44.58	24.90	17.95	15.05	10.42
7.5	25.6	12.8	776	9.07	504.4	318.2	65.96	59.75	33.37	24.06	20.18	13.97

Note: When a motor of 3.7kW or less capacity is driven by a transistorized inverter of more than 3.7kW. For example, when a 3.7kW or less motor is driven by a 5.5kW transistorized inverter, the transistorized inverter is not the target of the household appliances/general-purpose products guideline, but because they must be included in the calculation of the harmonic current of the guideline, the fundamental wave input currents are indicated.

3) Harmonic suppression technique requirement

If the outgoing harmonic current is higher than; maximum value per 1kW (contract power) × contract power, a harmonic suppression technique is required.

4) Harmonic suppression techniques

No.	Item	Description
1	Reactor installation (ACL, DCL)	Install a reactor (ACL) on the AC side of the inverter or a reactor (DCL) on its DC side or both to suppress outgoing harmonic currents.
2	High power factor converter (FR-HC)	The converter circuit is switched on-off to convert an input current waveform into a sine wave, suppressing harmonic currents substantially. The high power factor converter (FR-HC) is used with the standard accessory.
3	Installation of power factor improving capacitor	When used with a series reactor, the power factor improving capacitor has an effect of absorbing harmonic currents.
4	Transformer multi- phase operation	Use two transformers with a phase angle difference of 30° as in λ - Δ , Δ - Δ combination to provide an effect corresponding to 12 pulses, reducing low-degree harmonic currents.
5	AC filter	A capacitor and a reactor are used together to reduce impedances at specific frequencies, producing a great effect of absorbing harmonic currents.
6	Passive filter (Active filter)	This filter detects the current of a circuit generating a harmonic current and generates a harmonic current equivalent to a difference between that current and a fundamental wave current to suppress a harmonic current at a detection point, providing a great effect of absorbing harmonic currents.

2.3.3 Inverter-generated noise and reduction techniques

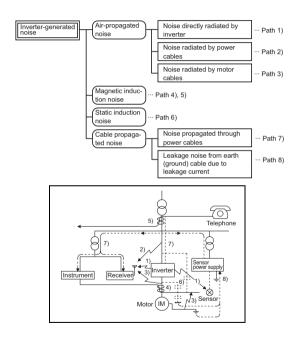
Some noises enter the inverter causing it to incorrectly operate, and others are radiated by the inverter causing misoperation of peripheral devices. Though the inverter is designed to be insusceptible to noise, it handles low-level signals, so it requires the following basic measures to be taken. Also, since the inverter chops the output at high carrier frequencies, it could generate noise. If these noises cause peripheral devices to misoperate, measures should be taken to suppress noise. The measures differ slightly depending on noise propagation paths.

1) Basic measures

- Do not run the power cables (I/O cables) and signal cables of the inverter in parallel with each other and do not bundle them.
- Use twisted shield cables for the detector connecting and control signal cables and connect the sheathes of the shield cables to terminal SD.
- Earth (ground) the inverter, motor, etc. at one point.
- 2) Measures against noise which enters and causes misoperation of the inverter When devices which generate noise (devices which use magnetic contactors, magnetic brakes, many relays, for example) are installed near the inverter, the inverter may misoperate due to noise. The following measures must be taken:
 - Provide surge suppressors for devices that generate noise to suppress noise.
 - Fit data line filters (refer to page 45) to signal cables.
 - Earth (ground) the shields of the detector connection and control signal cables with cable clamp metal.

Measures against noises which are radiated by the inverter causing misoperation of peripheral devices.

Inverter-generated noises are largely classified into those radiated by the cables connected to the inverter and inverter main circuit (I/O), those electromagnetically and electrostatically inducted to the signal cables of the peripheral devices close to the main circuit power supply, and those transmitted through the power supply cables.



Noise Path	Measures						
1), 2), 3)	When devices which handle low-level signals and are susceptible to misoperation due to noise (such as instruments, receivers and sensors) are installed near the inverter and their signal cables are contained in the same panel as the inverter or are run near the inverter, the devices may be misoperated by air-propagated noise and the following measures must be taken: (1) Install easily affected devices as far away as possible from the inverter. (2) Run easily affected signal cables as far away as possible from the inverter. (3) Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them. (4) Insert line noise filters onto I/O and radio noise filters into inputs to suppress cable-radiated noises. (5) Use shielded cables for signal cables and power cables and run them in individual metal conduits to further reduce effects.						
4), 5), 6)	When the signal cables are run in parallel with or bundled with the power cables, magnetic and static induction noises may be propagated to the signal cables causing misoperation of the devices and the following measures must be taken: (1) Install easily affected devices as far away as possible from the inverter. (2) Run easily affected signal cables as far away as possible from the inverter. (3) Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them. (4) Use shielded cables for signal cables and power cables and run them in individual metal conduits to further reduce effects.						
7)	When the power supplies of the peripheral devices are connected to the power supply of the inverter within the same line, inverter-generated noise may flow back through the power supply cables causing misoperation of the devices and the following measures must be taken: (1) Install the radio noise filter (FR-BIF) to the power cables (input cables) of the inverter. (2) Install the line noise filter (FR-BLF, FR-BSF01) to the power cables (I/O cables) of the inverter.						
8)	When a closed loop circuit is formed by connecting the peripheral device wiring to the inverter, leakage current may flow through the earth (ground) cable of the inverter causing misoperation of the device. In such a case, disconnection of the earth (ground) cable of the device may cause the device to operate properly.						

Data line filter

Noise entry can be prevented by providing a data line filter for the detector or other cable.

Data examples

By decreasing the carrier frequency, the noise terminal voltage* can be reduced. Use Pr. 72 to set the carrier frequency to a low value (1kHz).

Though motor noise increases at a low carrier frequency, selection of Soft-PWM will make it unoffending.

By using shielded cables as signal cables, induction noise can be reduced greatly (1/10 to 1/100). Induction noise can also be reduced by moving the signal cables away from the inverter output cables.

(Separation of 30cm reduces noise to 1/2 to 1/3.)

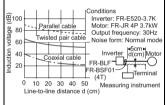
By fitting the FR-BSF01 or BLF on the inverter output side, induction noise to the signal cables can be reduced.

Differences between noise terminal voltages at different carrier frequencies

Conditions
Average terminal voltage

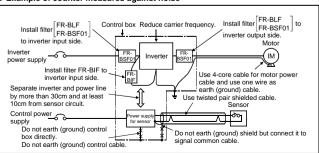
OdB=1µV
200B=1V
2

Noise induced to signal cables by inverter output cables



* Noise terminal voltage:Represents the magnitude of noise propagated from the inverter to the power supply.

Example of counter measures against noise



2.3.4 Leakage currents and countermeasures

Due to the static capacitance existing in the inverter I/O wiring and motor, leakage currents flow through them. Since their values depend on the static capacitance, carrier frequency, etc., take the following measures.

(1) To-earth (ground) leakage currents

Leakage currents may flow not only into the inverter's own line but also into the other lines through the earth (ground) cable, etc. These leakage currents may operate earth (ground) leakage circuit breakers and earth (ground) leakage relays unnecessarily.

Countermeasures

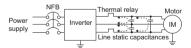
- If the carrier frequency setting is high, decrease the carrier frequency (Pr. 72) of the inverter.
 - Note that motor noise increases. Selection of Soft-PWM (Pr. 240) will make it unoffending.
- By using earth (ground) leakage circuit breakers designed for harmonic and surge suppression in the inverter's own line and other line, operation can be performed with the carrier frequency kept high (with low noise).

To-earth (ground) leakage current

- Note that a long wiring length will increase leakage currents. Decrease the carrier frequency of the inverter to reduce leakage currents.
- Higher motor capacity leads to larger leakage currents. The leakage currents of the 400V class are higher than those of the 200V class.

(2) Line-to-line leakage currents

Harmonics of leakage currents flowing in static capacities between the inverter output cables may operate the external thermal relay unnecessarily.



Line-to-line leakage current path

Countermeasures

- Use the electronic thermal relay function of the inverter.
- Decrease the carrier frequency. Note that motor noise increases. Selection of Soft-PWM will make it unoffending.

To ensure that the motor is protected not to be influenced by line-to-line leakage currents, we recommend the protection method which uses a temperature sensor to directly detect motor temperature.

2.3.5 Inverter-driven 400V class motor

In the PWM type inverter, a surge voltage attributable to wiring constants is generated at the motor terminals.

Especially for a 400V class motor, the surge voltage may deteriorate the insulation. When the 400V class motor is driven by the inverter, consider the following measures:

Measures

It is recommended to take either of the following measures:

(1) Rectifying the motor insulation

For the 400V class motor, use an insulation-enhanced motor, Specifically,

- 1) Specify the "400V class inverter-driven, insulation-enhanced motor".
- For the dedicated motor such as the constant-torque motor and low-vibration motor, use the "inverter-driven, dedicated motor".

Note: If the wiring length between the motor and inverter is 40m or longer, set Pr. 240 to long wiring mode in addition to the above countermeasures to operate the inverter. (Refer to page 118 for Pr. 240 "Soft-PWM selection".)

(2) Suppressing the surge voltage on the inverter side

On the secondary side of the inverter, connect the optional surge voltage suppression filter (FR-ASF-H).

2.3.6 Peripheral devices

(1) Selection of peripheral devices

Check the capacity of the motor to be used with the inverter you purchased. Appropriate peripheral devices must be selected according to the capacity. Refer to the following list and prepare appropriate peripheral devices:

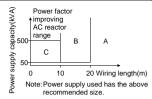
		Motor	Power	(Ground) Lea	r (NFB) or Earth akage Circuit V) (Note 6)	Magnetic Contactor (MC)				
	Inverter Type	Output (kW)	Supply Capacity (kVA)	Standard	With power factor improving reactor	А	В	С		
	FR-E520-0.1K	0.1	0.4	30AF 5A	30AF 5A	S-N11	S-N18	S-N20		
_	FR-E520-0.2K	0.2	0.8	30AF 5A	30AF 5A	S-N18	S-N20	S-N20		
00	FR-E520-0.4K	0.4	1.5	30AF 5A	30AF 5A	S-N18	S-N21	S-N21		
9e 2	FR-E520-0.75K	0.75	2.5	30AF 10A	30AF 10A	S-N18	S-N21	S-N21		
has	FR-E520-1.5K	1.5	4.5	30AF 15A	30AF 15A	S-N21	S-N25	S-N50		
Three-phase 200V	FR-E520-2.2K	2.2	5.5	30AF 20A	30AF 15A		S-N10			
Pre	FR-E520-3.7K	3.7	9	30AF 30A	30AF 30A	S-	N20, S-N	121		
_	FR-E520-5.5K	5.5	12	50AF 50A	50AF 40A	S-N25				
	FR-E520-7.5K	7.5	17	100AF 60A	50AF 50A	S-N35				
_	FR-E540-0.4K	0.4	1.5	30AF 5A	30AF 5A	S-N10				
9	FR-E540-0.75K	0.75	2.5	30AF 5A	30AF 5A	S-N10				
Three-phase 400V	FR-E540-1.5K	1.5	4.5	30AF 10A	30AF 10A	S-N10				
has	FR-E540-2.2K	2.2	5.5	30AF 15A	30AF 10A	S-N10				
9-	FR-E540-3.7K	3.7	9	30AF 20A	30AF 15A	S-N20, S-N21				
Pre-	FR-E540-5.5K	5.5	12	30AF 30A	30AF 20A	S-	N20, S-N	121		
_	FR-E540-7.5K	7.5	17	30AF 30A	30AF 30A	S-	N20, S-N	121		
700	FR-E520S-0.1K	0.1	0.4	30AF 5A	30AF 5A	S-N18	S-N20	S-N20		
Single-phase 200V	FR-E520S-0.2K	0.2	0.8	30AF 10A	30AF 10A	S-N18	S-N21	S-N21		
le-ph	FR-E520S-0.4K	0.4	1.5	30AF 10A	30AF 10A	S-N21	S-N25	S-N50		
_	FR-E520S-0.75K	0.75	2.5	30AF 15A	30AF 15A	S-N21	S-N25	S-N50		
Single-phase 100V	FR-E510W-0.1K	0.1	0.5	30AF 10A	30AF 10A	S-N18	S-N21	S-N21		
jase ,	FR-E510W-0.2K	0.2	0.9	30AF 15A	30AF 15A	S-N21	S-N25	S-N25		
gle-pt	FR-E510W-0.4K	0.4	1.5	30AF 20A	30AF 20A	S-N21	S-N25	S-N50		
Sing	FR-E510W-0.75K	0.75	2.5	30AF 30A	30AF 30A	S-N21	S-N25	S-N50		

Note:1. • Select the NFB according to the inverter power supply capacity.

. Install one NFB per inverter.



The power supply cable size of the motor indicated assumes that its length is 20m.



- 3. The inverter input side magnetic contactor to be chosen differs between the applicable ranges A, B and C shown on the right, depending on the power supply capacity and wiring length. For the FR-E520-0.4K to 1.5K, FR-E520S-0.4K to 0.75K and FR-E510W-0.4K to 0.75K, choose the S-N10 when the power factor improving reactor (FR-BEL or FR-BAL) is used.
- 4. When the inverter capacity is greater than the motor capacity, choose the breaker and magnetic contactor in accordance with the inverter type and choose the cables and power factor improving reactor in accordance with the motor output.
- 5. 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.
- For installations in the United States or Canada, the circuit breaker must be inverse time or instantaneous trip type.

Installation and selection of no-fuse breaker

Install a no-fuse breaker (NFB) in the power supply side for protection of the inverter's primary wiring. Refer to the previous table and choose the NFB according to the inverter's power supply side power factor (which changes with the power supply voltage, output frequency and load). Especially for a completely electromagnetic type NFB, the one with a larger capacity must be selected since its operational characteristics change with harmonic currents. (Check the data of the corresponding breaker for confirmation.) Also the earth (ground) leakage circuit breaker used should be our product durable against harmonics/surges.

Power factor improving reactor

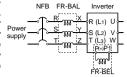
	Inverter Model	Power Factor Improving AC Reactor	Power Factor Improving DC Reactor
e 200V	FR-E520-0.1K	FR-BAL-0.4K (Note 1)	FR-BEL-0.4K (Note 1)
	FR-E520-0.2K	FR-BAL-0.4K (Note 1)	FR-BEL-0.4K (Note 1)
	FR-E520-0.4K	FR-BAL-0.4K	FR-BEL-0.4K
	FR-E520-0.75K	FR-BAL-0.75K	FR-BEL-0.75K
has	FR-E520-1.5K	FR-BAL-1.5K	FR-BEL-1.5K
d-ə	FR-E520-2.2K	FR-BAL-2.2K	FR-BEL-2.2K
Three-phase	FR-E520-3.7K	FR-BAL-3.7K	FR-BEL-3.7K
_	FR-E520-5.5K	FR-BAL-5.5K	FR-BEL-5.5K
	FR-E520-7.5K	FR-BAL-7.5K	FR-BEL-7.5K
	FR-E540-0.4K	FR-BAL-H0.4K	FR-BEL-H0.4K
Three-phase 400V	FR-E540-0.75K	FR-BAL-H0.75K	FR-BEL-H0.75K
e 4	FR-E540-1.5K	FR-BAL-H1.5K	FR-BEL-H1.5K
has	FR-E540-2.2K	FR-BAL-H2.2K	FR-BEL-H2.2K
e-b	FR-E540-3.7K	FR-BAL-H3.7K	FR-BEL-H3.7K
hre	FR-E540-5.5K	FR-BAL-H5.5K	FR-BEL-H5.5K
_	FR-E540-7.5K	FR-BAL-H7.5K	FR-BEL-H7.5K
٧	FR-E520S-0.1K	FR-BAL-0.4K (Note 1)	FR-BEL-0.4K (Note 1)
le- 200	FR-E520S-0.2K	FR-BAL-0.4K (Note 1)	FR-BEL-0.4K (Note 1)
Single- phase 200V	FR-E520S-0.4K	FR-BAL-0.75K (Note 1)	FR-BEL-0.75K (Note 1)
	FR-E520S-0.75K	FR-BAL-1.5K (Note 1)	FR-BEL-1.5K (Note 1)
Single- phase 100V	FR-E510W-0.1K	FR-BAL-0.75K (Note 1)	— (Note 2)
	FR-E510W-0.2K	FR-BAL-1.5K (Note 1)	— (Note 2)
se	FR-E510W-0.4K	FR-BAL-2.2K (Note 1)	— (Note 2)
s pha	FR-E510W-0.75K	FR-BAL-3.7K (Note 1)	— (Note 2)

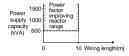
Note: 1. The power factor may be slightly lower.

The single-phase 100V power input models does not allow the power factor improving DC reactor to be fitted.

When the inverter is connected near a large-capacity power supply transformer (500kVA or more, wiring length 10m maximum) or there is power capacitor switch-over, excessive peak currents may flow into the power input circuit and damage the converter circuit. In such a case, the power supply improving reactor (FR-BEL or FR-BAL) must be installed.

When the FR-E510W-0.4K is connected to a singlephase 100V class output power transformer (in excess of 50kVA capacity), install the power factor improving reactor (FR-BAL-2.2K) to improve reliability

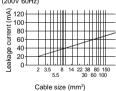




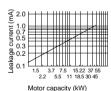
(2) Selecting the rated sensitivity current for the earth (ground) leakage circuit breaker

When using the earth (ground) leakage circuit breaker with the inverter circuit, select its rated sensitivity current as follows, independently of the PWM carrier frequency:

Example of leakage current per 1km in cable path during commercial power supply operation when the CV cable is routed in metal conduit (200V 60Hz)



Leakage current example of 3-phase induction motor during commercial power supply operation (200V 60Hz)



- Breaker for harmonic and surge Rated sensitivity current: I∆n ≥ 10×(Ig1+Ign+Ig2+Igm)
- · Standard breaker

Rated sensitivity current: $I\Delta n \ge 10 \times \{lg1 + lgn + 3 \times (lg2 + lgm)\}$

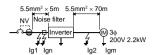
lg1, lg2: Leakage currents of cable path during commercial power supply operation

lgn* : Leakage current of noise filter on inverter input side

Igm : Leakage current of motor during commercial power supply operation

 Note the leakage current value of the noise filter installed on the inverter input side.

<Example>



Note: 1. The earth (ground) leakage circuit breaker should be installed to the primary (power supply) side of the inverter.

- Earth (ground) fault on the secondary side of the inverter can be detected at the running frequency of 120Hz or lower.
- 3. In the \(\triangle \) connection neutral point earthed (grounded) system, the sensitivity current becomes worse for earth (ground) faults on the inverter secondary side. Earthing (grounding) 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)
- 4. When the breaker is installed on the secondary side of the inverter, it may be unnecessarily operated by harmonics if the effective value is less than the rating. In this case, do not install the breaker since the eddy current, hysteresis loss, and the temperature all increase.

General products indicate the following models.

BV-C1, BC-V, NVB, NV-L, NV-G2N, NV-G3NA, NV-2F, earth (ground) leakage relay (except NV-ZHA), NV with AA neutral wire open-phase protection The other models are designed for harmonic and surge suppression NV-C/NV-S/MN series, NV30-FA, NV50-FA, BV-C2, earth (ground) leakage alarm breaker (NF-Z), NV-ZHA, NV-H

	Breaker for Harmonic and Surge	Standard Breaker
Leakage current (Ig1) (mA)	33 × = 0.17	
Leakage current (Ign) (mA)	0 (without noise filter)	
Leakage current (Ig2)	33 ×	
(mA)	33 ×	0m = 2.31
Motor leakage current (Igm) (mA)	0.18	
Total leakage current (mA)	2.66	7.64
Rated sensitivity current (mA) (\geq Ig \times 10)	30	100

2.3.7 Power off and magnetic contactor (MC)

(1) Inverter primary side magnetic contactor (MC)

On the inverter primary side, it is recommended to provide an MC for the following purposes. (Refer to page 48 for selection.)

- 1) To release the inverter from the power supply when the inverter protective function is activated or the drive becomes faulty (e.g. emergency stop operation) When cycle operation or heavy-duty operation is performed with an optional brake resistor connected, overheat and burnout of the electrical-discharge resistor can be prevented if a regenerative brake transistor is damaged due to insufficient heat capacity of the electrical-discharge resistor and excess regenerative brake duty.
- To prevent any accident due to an automatic restart at restoration of power after an inverter stop made by a power failure
- 3) To rest the inverter for an extended period of time The control power supply for inverter is always running and consumes a little power. When stopping the inverter for a long time, switching inverter power off saves power slightly.
- To separate the inverter from the power supply to ensure safe maintenance and inspection work
 - As the inverter's primary MC is used for the above purposes, select the one of class JEM1038-AC3 for the inverter input side current when making an emergency stop during normal operation.

REMARKS

The MC may be switched on/off to start/stop the inverter. However, since repeated inrush currents at power-on will shorten the life of the converter circuit (switching life is about 100,000 times), frequent starts and stops must be avoided.

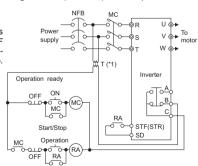
Turn on/off the inverter start controlling terminals (STF, STR) to run/stop the inverter.

Inverter Start/Stop Circuit Example

As shown on the right, always use the start signal (ON or OFF across terminals STF or STR-SD) to make a start or stop. (Refer to page 18.)

REMARKS

*1 When the power supply is 400V class, install a stepdown transformer.



(2) Handling of secondary side magnetic contactor

Note that if it is switched off then on again during operation when the magnetic contactor is installed between the inverter and motor, a large inrush current may flow, affecting the motor.

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(Standard to comply with: UL 508C, CSA C22.2 No. 14)

(1) Installation

The above types of inverter have been approved as products for use in enclosure and approval tests were conducted under the following



conditions. For enclosure design, refer to these conditions so that the ambient temperature of the inverter is 50°C or less.

200V class, 100V class

Inverter Type	Cabinet (enclosure) Size (Unit: mm)	Vent Hole Area	Cooling Fan
FR-E520 -3.7K	W H D 255×192×218	Cabinet Width of each slit: 3.2mm	Installed at the enclosure top to suck air from inside the enclosure to the outside. (Fan air flow: $2\times0.59m^3/min$ or more)

400V class

Design the enclosure so that the ambient temperature, humidity and ambience of the inverter will satisfy the above specifications. (Refer to page 219.)

Branch circuit protection

For installation in the United States, branch circuit protection must be provided, in accordance with the National Electrical Code and any applicable local codes.

For installation in Canada, branch circuit protection must be provided in accordance with the Canada Electrical Code and any applicable provincial codes.

(2) Wiring of the power supply and motor

Screw the cables wired to the input (R. S. T) < L1, L2, L3> and output (U, V, W) terminals and control circuit of the inverter to the specified tightening torque using UL-recognized. 75°C or higher rated copper wires and round crimping terminals. Crimp the crimping terminals with the crimping tool recommended by the terminal maker.

(3) Short circuit ratings

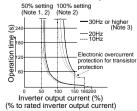
Suitable For Use In A Circuit Capable of Delivering Not More Than 5kA rms Symmetrical Amperes.

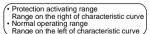
(4) Motor overload protection

When using the electronic thermal relay function as motor overload protection, set the rated motor current in Pr. 9 "electronic thermal O/L relav".

When connecting two or more motors to the inverter, install external thermal relays for individual motors

Reference: Motor overload protection characteristics





(Note 1) When you set the 50% value (current

value) of the rated inverter output current. Electronic overcurrent (Note 2) The % value denotes the percentage of the current value to the rated inverter output current, not to the rated motor current.

(Note 3) This characteristic curve will be described even under operation of 6Hz or higher when you set the electronic overcurrent protection dedicated to the Mitsubishi constant-torque motor.

2.3.9 Instructions for compliance with the European Directive

(The products conforming to the Low Voltage Directive carry the CE mark.)

(1) EMC Directive

1)Our view of transistorized inverters for the EMC Directive

A transistorized inverter is a component designed for installation in a control box and for use with the other equipment to control the equipment/device.

Therefore, we understand that the EMC Directive does not apply directly to transistorized inverters. For this reason, we do not place the CE mark on the transistorized inverters. (The CE mark is placed on inverters in accordance with the Low Voltage Directive.) The European power drive manufacturers' organization (CEMEP) also holds this point of view.

2)Compliance

We understand that the transistorized inverters are not covered directly by the EMC Directive. However, the EMC Directive applies to machines/equipment into which transistorized inverters have been incorporated, and these machines and equipment must carry the CE marks. Hence, we prepared the technical information "EMC Installation Guidelines" (information number BCN-A21041-202) so that machines and equipment incorporating transistorized inverters may conform to the EMC Directive more easily.

3)Outline of installation method

Install an inverter using the following methods:

- * Use the inverter with an European Standard-compliant noise filter.
- * For wiring between the inverter and motor, use shielded cables or run them in a metal piping and earth (ground) the cables on the inverter and motor sides with the shortest possible distance.
- * Insert a line noise filter and ferrite core into the power and control lines as required.
 - Full information including the European Standard-compliant noise filter specifications are written in the technical information "EMC Installation Guidelines" (BCN-A21041-202). Please contact your sales representative.

(2) Low Voltage Directive

1)Our view of transistorized inverters for the Low Voltage Directive

Transistorized inverters are covered by the Low Voltage Directive (Standard to comply with: DIN VDE0160 (200V class), EN50178 (400V class, 100V class)). 2)Compliance

We have self-confirmed our inverters as products compliant to the Low Voltage Directive and place the CE mark on the inverters.

- 3) Outline of instructions
- * In the 400V class inverters, the rated input voltage range is three-phase, 380V to 415V, 50Hz/60Hz.
- * Connect the equipment to the earth (ground) securely. Do not use an earth (ground) leakage circuit breaker as an electric shock protector without connecting the equipment to the earth (ground).
- * Wire the earth (ground) terminal independently. (Do not connect two or more cables to one terminal.)
- * The wire size on pages 21 and 23 are shown for following conditions
 - Ambient Temp: 40°C maximum
 - · Wire installation: On wall without ducts or conduits
 - If conditions are different from above, select appropriate wire according to EN60204 ANNEX C TABLE 5.
- Use the no-fuse breaker and magnetic contactor which conform to the EN or IEC Standard.

Design notice: Where residual-current-operated protective device (RCD) is used for protection in case of direct or indirect contact, only RCD of Type B is allowed on the supply side of this Electronic Equipment (EE). Otherwise another protective measure shall be applied such as separation of the EE from the environment by double or reinforced insulation or isolation of EE and supply system by a transformer. (Extract from EN\$1078)

- * Use the inverter under the conditions of overvoltage category II and contamination level 2 or higher specified in IEC664.
 - (a) To use the inverter under the conditions of overvoltage category II, put an insulated transformer or surge absorber which conform to the EN or IEC standard on the inverter input side.
 - (b) To meet the contamination level 2, install the inverter in a control box protected against ingress of water, oil, carbon, dust, etc. (IP54 or higher).
- Ton the input and output of the inverter, use cables of the type and size set forth in EN60204 Appendix C.
- * The operating capacity of the relay outputs (terminal symbols A, B, C) should be 30VDC, 0.3A.
- * The terminals indicated as the input and output terminals for control circuit on page 16 are isolated safely from the main circuit. Environment

	During operation	In storage	During transportation
Ambient Temperature	-10°C to +50°C	-20°C to +65°C	-20°C to +65°C
Ambient Humidity	90% RH or less	90% RH or less	90% RH or less
Maximum Altitude	1.000 m	1.000 m	10.000 m

Details are given in the technical information "Low Voltage Directive Conformance Guide" (BCN-A21041-203), Please contact your sales representative.

CHAPTER 3 OPERATION/CONTROL

This chapter provides the basic "operation/control" for use of this product.

Always read this chapter before using the equipment.

3.1	Pre-Operation Information	58
3.2	About the Operation Panel	61
3.3	Operation	68

Chapter

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

3.1 Pre-Operation Information

3.1.1 Types of operation modes

The inverter can be operated in any of "PU operation mode", "external operation mode", "combined operation mode" and "communication operation mode". Prepare required instruments and parts according to the operation mode. For the way of changing the operation mode, refer to page 64.

(1) PU operation mode

(factory setting, Pr. 79 "operation mode selection" = 1)

The inverter is operated from the operation panel or parameter unit.

Use Pr. 146 "frequency setting command selection" to choose the way to make frequency setting from the operation panel. For the Pr. 146 setting method, refer to page 65.

Pr. 146 = 0: Frequency setting using the built-in frequency setting potentiometer (factory setting)

Pr. 146 = 1: Digital frequency setting using ▲/▼ key

Preparation

- Operation unit......Operation panel (equipped as standard) or parameter unit (FR-PU04)
- Connection cable......To be prepared for use of the operation panel away from the inverter or for use of the parameter unit (FR-PU04).

 FR-CB2DD (option)
- FR-E5P (option)To be prepared for use of the operation panel away from
 the inverter. It is available as a set of operation panel cover
 and connection cable junction adaptor.

(2) External operation mode (Pr. 79 "operation mode selection" = 2)

The inverter is operated using an external start signal and an external frequency setting signal.



- Start signalSwitch, relay, etc.
- Frequency setting signal..0 to 5V, 0 to 10V or 4 to 20mA DC signals or multiple speeds from a potentiometer or outside the inverter.

Note: Operation cannot be started by the start signal alone. Both the start signal and frequency setting signal are required to run the inverter.



3

(3) Combined operation mode 1 (Pr. 79 "operation mode selection" = 3)

The start signal is an external signal.

The frequency setting signal is set using the operation panel or parameter unit.

Use Pr. 146 "frequency setting command selection" to choose the way to make frequency setting from the operation panel. For the Pr. 146 setting method, refer to page 66.

Pr. 146 = 0: Frequency setting using the built-in frequency setting potentiometer (factory setting)

Pr. 146 = 1: Digital frequency setting using ▲/▼ key



Preparation

- Start signalSwitch, relay, etc.
- Operation unitOperation panel (equipped as standard) or parameter unit (FR-PU04)

(4) Combined operation mode 2 (Pr. 79 "operation mode selection" = 4)

The start signal is entered from the operation command key of the operation panel.

The frequency setting signal is set using the external frequency setting signal.

Preparation

- Frequency setting signal .. 0 to 5V, 0 to 10V or 4 to 20mA
 - DC signals from an external potentiometer or from outside the inverter
- Operation unitOperation panel (equipped as standard) or parameter unit (FR-PU04)
- Connection cableRefer to (1) PU operation mode.
- FR-E5P (option)Refer to (1) PU operation mode.

(5) Communication operation mode

(Pr. 79 "operation mode selection" = 0 or 1)

Communication operation can be performed by connecting a personal computer and the PU connector with the RS-485 communication cable. The inverter setup software (FR-SWID-SETUP-WE (or -WJ for Japanese Version)) is available as an FR-E500 inverter start-up support software package.

Preparation

Cable: Cable conforming to EIA568

(e.g. 10BASE-T cable)

Personal computerRefer to the instruction manual of the inverter setup software for hardware requirements of the inverter

setup software.

 RS-485, RS-232C converterTo be prepared when the communication port of the personal computer has RS-232C specifications.



3.1.2 Power on

Before switching power on, check the following.

Installation check

Make sure that the inverter is installed correctly in a proper location. (Refer to page 14.)

Wiring check

Make sure that the main and control circuits are wired correctly.

Make sure that the options and peripheral devices are selected and connected correctly. (Refer to page 16.)

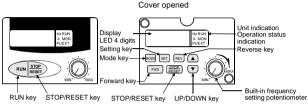
Switch power on.

Power-on is complete if the operation panel LED shows correct data or the POWER lamp (lit only when the operation panel is removed) is lit and the ALARM lamp is off.

3.2 About the Operation Panel

With the operation panel, you can run the inverter, set the frequency, monitor the operation command display, set parameters, and display an error.

3.2.1 Names and functions of the operation panel



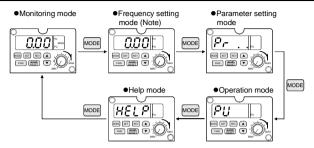
Key indication

Key	Description
RUN key	Used to give a start rotation command.
Built-in frequency setting potentiometer	You can set a frequency on an analog basis.
MODE key	You can select the operation mode or setting mode.
set key	You can determine the frequency and parameter setting.
▲/▼ key	Used to increase or decrease the running frequency consecutively. Hold down this key to change the frequency. Press this key in the setting mode to change the parameter setting consecutively.
FWD key	Used to give a forward rotation command.
REV key	Used to give a reverse rotation command.
STOP key	Used to stop operation. Used to reset the inverter when its output is stopped by the activated protective function.

Unit indications, operating status indications

Indication	Description
Hz	Lit to indicate frequency. (Flickers or lit when Pr.52 "operation panel/PU main display data selection" = "100". Refer to page 105.)
Α	Lit to indicate the current.
RUN	Lit while the inverter is operating. Lit to indicate forward rotation, and flickers to indicate reverse rotation.
MON	Lit in the monitor display mode.
PU	Lit in the PU operation mode.
EXT	Lit in the external operation mode.

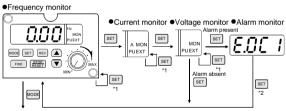
3.2.2 Monitor display is changed by pressing the key



(Note) The frequency setting mode is displayed only in the PU operation mode.

3.2.3 Monitoring

- Operation command indications given while a monitor display is being provided EXT is lit to indicate external operation.
 - PU is lit to indicate PU operation.
 - Both EXT and PU are lit to indicate combined operation.
- The monitor display can also be changed during operation.



To 3.2.4 Frequency setting mode (Note3)

Note: 1. Hold down the set key marked *1 for more than 1.5 s to change the current monitor to the power-on monitor.

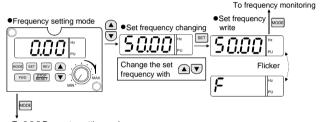
- Hold down the set key marked *2 for more than 1.5 s to display the last four errors including the most recent one.
- 3. In the external operation mode, it shifts to the parameter setting mode.

3.2.4 Frequency setting

When the built-in frequency setting potentiometer is invalid (Pr. 146 = 1) in the PU operation mode, set the frequency value used for operation performed under the operation command given by the key (Fivo or FeV key).

This mode is displayed only in PU operation.

When the ▲/▼ key is used to make the frequency setting
 Set "1" (built-in frequency setting potentiometer invalid) in Pr. 146 "frequency setting
 command selection". (For the setting method, refer to page 65.)
 Change the set frequency with the ▲/▼ key.



To 3.2.5 Parameter setting mode

3.2.5 Parameter setting method

With the exception of some parameters, parameter setting can be made when the PU operation mode is selected by the Pr. 79 setting.

(Also, as other to set method independently of the operation mode, you can set "2" in Pr. 77. Refer to page 123.)

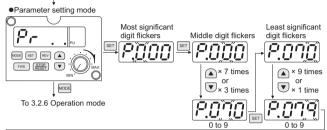
- A parameter value may either be set by updating its parameter number or setting the value digit-by-digit using the ▲/▼ key.
- To write the setting, change it and press the set key for about 1.5 s.

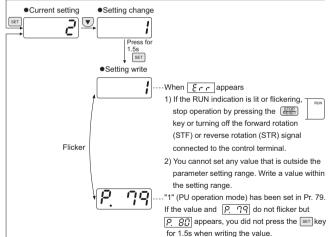
Note: If parameter write cannot be performed, refer to page 198.

(1) Example:To change the Pr. 79 "operation mode selection" setting from "2" (external operation mode) to "1" (PU operation mode)

(For details of Pr. 79, refer to page 124.)

Press the key, to choose the parameter setting mode.



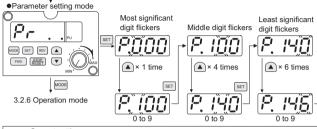


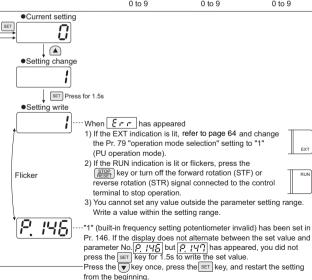
Press the key once, press the key, and restart the setting from the beginning.

(2) When changing the Pr. 146 "frequency setting command selection" setting from "0" (built-in frequency setting potentiometer valid) to "1" (built-in frequency setting potentiometer invalid)

(For details of Pr. 146, refer to page 156.)

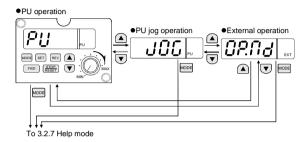
Press the key, to choose the parameter setting mode.





3.2.6 Operation mode

The operation mode change method which is shown below is only allowed when Pr. 79 "operation mode selection" is "0".



Note: If the operation mode cannot be changed, refer to page 198.

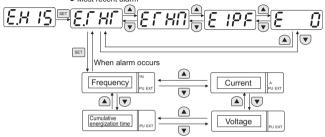
3.2.7 Help mode



To 3.2.3 Monitoring mode

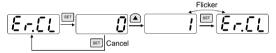
(1) Alarm history

Most recent alarm



(2) Alarm history clear

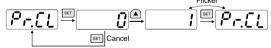
Clears all alarm history.



(3) Parameter clear

Initializes the parameter values to the factory settings. The calibration values are not initialized.

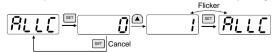
(Parameter values are not cleared by setting "1" in Pr. 77 "parameter write disable selection")



Note: The Pr. 75, Pr. 146, Pr. 180 to Pr. 183, Pr. 190 to Pr. 192, Pr. 900 to Pr. 905, Pr. 922 and Pr. 923 values are not initialized.

(4) All clear

Initializes the parameter values and calibration values to the factory settings.



Note: The Pr. 75 and Pr. 146 values are not initialized.

3.3 Operation

3.3.1 Pre-operation checks

Before starting operation, check the following:

Safety

Perform test operation after making sure that safety is ensured if the machine should become out of control

Machine

Make sure that the machine is free of damage.

Parameters

Set the parameter values to match the operating machine (system) environment.

Test operation

Perform test operation and make sure that the machine operates safely under light load at a low frequency. After that, start operation.

Since the Pr. 240 "Soft-PWM setting" value is factory-set to select Soft-PWM control, the tone is different from that in the conventional non-low acoustic noise mode, this is not a fault

3.3.2 PU operation mode (Operation using the operation panel)

(1) Using the built-in frequency setting potentiometer for operation at 60Hz (Factory setting)

Operation command: key or key key Frequency setting: built-in frequency setting potentiometer

Related parameters:Pr. 79 "operation mode selection", Pr. 146 "frequency setting command selection"

Step	Description	Image
1	Power on → Operation mode check In the factory setting, switching power on chooses the PU operation mode and lights up the [PU] indication. If the [PU] indication is not lit, refer to page 64 and set "1" in Pr. 79.	ON PU
2	Frequency setting potentiometer selection Refer to page 65 and set "0" (built-in frequency setting potentiometer) in Pr. 146 "frequency setting command selection". (Refer to page 156)	Flicker
3	Start Press the we key (or wo or key key) of the operation panel. The [RUN] indication is lit to indicate forward rotation, or flickers to indicate reverse rotation.	FWD / REV Hz RUN MON PU
4	Acceleration → Constant speed Slowly turn the potentiometer fully clockwise. The frequency shown on the display increases gradually to 60.00Hz.	5000
5	Deceleration Slowly turn the potentiometer fully counterclockwise. The frequency shown on the display decreases gradually to 0.00Hz. The motor stops running.	0.00
6	Stop Press the (SIDP) key. The [RUN] indication goes off.	MON PU EXT

<Reference> The running frequency available by turning the potentiometer fully counterclockwise or fully clockwise can be changed using Pr. 922 "built-in frequency setting potentiometer bias" or Pr. 923 "built-in frequency setting potentiometer gain". (Refer to page 172.)

(2) Using the digital frequency setting for operation at 60Hz

By repeating step 2 below during motor run, speed can be varied.

Operation command: (RUN key or FWD / REV key

Frequency setting: ♠/▼ key

Related parameters: Pr. 79 "operation mode selection", Pr. 146 "frequency setting command selection"

Step	Description	Image
1	Power on → Operation mode check In the factory setting, switching power on chooses the PU operation mode and shows [PU]. If the [PU] indication is not lit, refer to page 64 and set "1" in Pr. 79.	ON PU
2	Running frequency setting Set the running frequency to 60Hz. 1) Refer to page 65 and set "1" (built-in frequency setting potentiometer invalid) in Pr. 146 "frequency setting command selection". 2) Refer to page 69 and choose the frequency setting mode using the local key. 3) Refer to page 63, change the setting using the A/ key, and press the set key to write the setting.	(or) \$\overline{5000}\$
3	Start Press the key (or key key). The monitoring mode is automatically selected and the output frequency is displayed. The [RUN] indication is lit to indicate forward rotation, or flickers to indicate reverse rotation.	RUN PWO / REV
4	Stop Press the key. The motor is decelerated to a stop. The [RUN] indication goes off.	O.O.O. Pic. MONIN

(3) PU jog operation

Hold down the w (or rev) (or rev) key to perform operation, and release it to stop. 1) Set Pr. 15 "jog frequency" and Pr. 16 "jog acceleration/deceleration time". 2) Select the PU jog operation mode. (Refer to page 66.)

- 3) Hold down the ((or () key to perform operation.

 (If the motor remains stopped, check Pr. 13 "starting frequency". The motor will not start if its setting is lower than the starting frequency.

3.3.3 External operation mode (Operation using the external frequency setting potentiometer and external start signal)

(1) Operation at 60Hz

Operation command: Externally connected start signal

Frequency setting : Externally connected frequency setting potentiometer <Connection diagram>

Frequency setting by voltage input Frequency setting by current input



Refer to page 18 for details of each terminal.

Step	Description	Image
1	Power on → Operation mode check Switch power on, refer to page 64, and set "2" in Pr. 79 "operation mode selection". The [EXT] indication is lit.	ON EXT
2	Start Set the start switch (STF or STR) to ON. The [RUN] indication is lit to indicate forward rotation, or flickers to indicate reverse rotation. Note: The motor does not start if both the forward and reverse rotation switches are turned on. If both switches are turned on during operation, the motor decelerates to a stop.	Forward rotation Reverse rotation Hz RUN MON EXT
3	Acceleration → Constant speed Slowly turn the potentiometer connected across terminals 2-5 (4-5) (frequency setting potentiometer) fully clockwise. The frequency shown on the display increases gradually to 60.00Hz.	External potentiometer 6.0.00
4	Deceleration Slowly turn the potentiometer connected across terminals 2-5 (4-5) (frequency setting potentiometer) fully counterclockwise. The frequency shown on the display decreases gradually to 0.00Hz. The motor stops running.	External potentiometer
5	Stop Turn off the start switch (STF or STR).	Forward rotation Reverse rotation Stop OFF

<Reference> If other frequency is required at fully clockwise position, change Pr. 38 "frequency at 5V (10V)", Pr.39 "frequency at 20mA input" setting. (Refer to page 103.)

3.3.4 Combined operation mode 1 (Operation using both external start signal and operation panel)

When the start signal is provided externally (switch, relay, etc.) and the running frequency is set from the operation panel (Pr. 79 = 3).

The external frequency setting signal and PU's forward rotation, reverse rotation and stop keys are not accepted. (Note)

Operation command: externally connected start signal

Frequency setting: Built-in frequency setting potentiometer or (1/2) key, or multi-speed command (multi-speed command has priority) (Refer to page 88)

Related parameter: Pr. 146 "frequency setting command selection"

Power on Switch power on. Operation mode selection Refer to page 64 and set "3" in Pr. 79 "operation mode selection". The [PU] and [EXT] indications are lit.	Flicker
Refer to page 64 and set "3" in Pr. 79 "operation mode selection".	Flicker
Note: The motor does not start if both the forward and	rotation Reverse Otation Hz RUN MON PUEXT
Running frequency setting Slowly turn the built-in frequency setting potentiometer fully clockwise or set the running frequency to 60.00Hz with the (a) (v) key. Note: Use the built-in frequency setting potentiometer or (a) (v) key to make frequency setting. Select the operation using Pr. 146 "frequency setting command selection". Pr. 146 = "0" (Built-in frequency setting potentiometer valid) Pr. 146 = "1" (Built-in frequency setting potentiometer invalid) (Refer to page 65)	▼ «Step setting»
Stop Turn off the start switch (STF or STR). The motor stops. The [RUN] indication goes off.	Hz MON PUEXT

Note: The STOP key is made valid if any of "14" to "17" is set in Pr. 75 "PU stop selection".

3.3.5 Combined operation mode 2

When the running frequency is set from a potentiometer connected across terminals 2-5 (frequency setting potentiometer) and the start signal is provided by the key or key of the operation panel. (Pr.79 = 4)

Operation command: Run key (or FWD / REV key) of the operation panel

Frequency setting:Externally connected frequency setting potentiometer or multi-speed command (multi-speed command has priority) Refer to page 88.

Step	Description	Image
1	Power on Switch power on.	°N €
2	Operation mode Refer to page 64 and set "4" in Pr. 79 "operation mode selection". The [PU] and [EXT] indications are lit.	Flicker \$
3	Start Press the key (or key / key) of the operation panel. The [RUN] indication is lit to indicate forward rotation, or flickers to indicate reverse rotation.	FWD / REV Hz RUN MON PUEXT
4	Acceleration Constant speed Slowly turn the potentiometer connected across terminals 2-5 (frequency setting potentiometer) fully clockwise. The frequency shown on the display increases gradually to 60.00Hz.	External potentiometer 5000
5	Deceleration Slowly turn the potentiometer connected across terminals 2-5 (frequency setting potentiometer) fully counterclockwise. The frequency shown on the display decreases gradually to 0.00Hz. The motor stops running.	External potentiometer
6	Stop Press the Region key. The operation command indication RUN goes off.	OLO O PRIENT

<Reference> If other frequency is required at fully clockwise position, change Pr. 38 "frequency at 5V (10V)" setting. (Refer to page 103.)

MEMO

CHAPTER4 PARAMETERS

This chapter explains the "parameters" of this product.

With the factory settings, the inverter is designed to perform simple variable-speed operation. Set necessary parameter values according to the load and operating specifications.

Always read the instructions before using the equipment.

Note: By making parameter setting, you can change the functions of contact input terminals RL, RM, RH, MRS, open collector output terminals RUN, FU, and contact output terminals A, B, C. Therefore, signal names corresponding to the functions are used in the description of this chapter (except in the wiring examples). Note that they are not terminal names.

REMARKS

Do not use the copy/verify function between this inverter and another type (CC-Link type FR-E520-KN, DeviceNet type FR-E520-KND) inverter.

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

4.1 Parameter List

4.1.1 Parameter list

Func- tion	Param- eter Number	Name	Setting Range	Minimum Setting Increments	Factory Setting	Refer To:	Custo- mer Setting
	0	Torque boost (Note 1)	0 to 30%	0.1%	6%/4% (Note 10)	85	
	1	Maximum frequency	0 to 120Hz	0.01Hz (Note 3)	120Hz	86	
	2	Minimum frequency	0 to 120Hz	0.01Hz (Note 3)	0Hz	86	
s	3	Base frequency (Note 1)	0 to 400Hz	0.01Hz (Note 3)	60Hz	87	
ction	4	Multi-speed setting (high speed)	0 to 400Hz	0.01Hz (Note 3)	60Hz	88	
Basic functions	5	Multi-speed setting (middle speed)	0 to 400Hz	0.01Hz (Note 3)	30Hz	88	
Basi	6	Multi-speed setting (low speed)	0 to 400Hz	0.01Hz (Note 3)	10Hz	88	
	7	Acceleration time	0 to 3600 s/ 0 to 360 s	0.1 s/0.01 s	5 s/10s (Note 4)	89	
	8	Deceleration time	0 to 3600 s/ 0 to 360 s	0.1 s/0.01 s	5 s/10s (Note 4)	89	
	9	Electronic thermal O/L relay	0 to 500A	0.01A	Rated output current (Note 5)	91	
	10	DC injection brake operation frequency	0 to 120Hz	0.01Hz (Note 3)	3Hz	92	
	11	DC injection brake operation time	0 to 10 s	0.1 s	0.5 s	92	
	12	DC injection brake voltage	0 to 30%	0.1%	6%	92	
	13	Starting frequency	0 to 60Hz	0.01Hz	0.5Hz	93	
suc	14	Load pattern selection (Note 1)	0 to 3	1	0	94	
ınctic	15	Jog frequency	0 to 400Hz	0.01Hz (Note 3)	5Hz	95	
ion fi	16	Jog acceleration/ deceleration time	0 to 3600 s/ 0 to 360 s	0.1 s/ 0.01 s	0.5 s	95	
perat	18	High-speed maximum frequency	120 to 400Hz	0.1Hz (Note 3)	120Hz	86	
Standard operation functions	19	Base frequency voltage (Note 1)	0 to 1000V, 8888, 9999	0.1V	9999	87	
tand	20	Acceleration/deceleration reference frequency	1 to 400Hz	0.01Hz (Note 3)	60Hz	89	
S	21	Acceleration/deceleration time increments	0, 1	1	0	89	
	22	Stall prevention operation level	0 to 200%	0.1%	150%	96	
	23	Stall prevention operation level compensation factor at double speed (Note 6)	0 to 200%, 9999	0.1%	9999	96	

Func- tion	Param- eter Number	Name	Setting Range	Minimum Setting Increments	Factory Setting	Refer To:	Custo- mer Setting
	24	Multi-speed setting (speed 4)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
	25	Multi-speed setting (speed 5)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
	26	Multi-speed setting (speed 6)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
	27	Multi-speed setting (speed 7)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
su	29	Acceleration/deceleration pattern	0, 1, 2	1	0	99	
nctio	30	Regenerative function selection	0, 1	1	0	100	
on fu	31	Frequency jump 1A	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	101	
erati	32	Frequency jump 1B	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	101	
Standard operation functions	33	Frequency jump 2A	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	101	
tanda	34	Frequency jump 2B	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	101	
Ö	35	Frequency jump 3A	0 to 400Hz, 9999	999 (Note 3) 9999		101	
	36	Frequency jump 3B	0 to 400Hz, 9999	9999 (Note 3) 9999		101	
	37	Speed display	0, 0.01 to 9998	0.001 r/min	0	102	
	38	Frequency at 5V (10V) input	1 to 400Hz	0.01Hz (Note 3)	60Hz (Note 2)	103	
	39	Frequency at 20mA input	1 to 400Hz	0.01Hz (Note 3)	60Hz (Note 2)	103	
_ "	41	Up-to-frequency sensitivity	0 to 100%	0.1%	10%	104	
Output terminal unctions	42	Output frequency detection	0 to 400Hz	0.01Hz (Note 3)	6Hz	104	
호 후 들	43	Output frequency detection for reverse rotation	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	104	
_	44	Second acceleration/ deceleration time	0 to 3600 s /0 to 360 s	0.1 s/0.01 s	5s/10s (Note 11)	89	
Second functions	45	Second deceleration time	0 to 3600 s /0 to 360 s, 9999	0.1 s/0.01 s	9999	89	
nd fu	46	Second torque boost (Note 1)	0 to 30%, 9999	0.1%	9999	85	
Seco	47	Second V/F (base frequency) (Note 1)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	87	
	48	Second electronic thermal O/L relay	0 to 500A, 9999	0.01A	9999	91	
suc	52	Operation panel/PU main display data selection	0, 23, 100	1	0	105	
ınctio	54	FM terminal function selection	0, 1, 2	1	0	105	
Display functions	55	Frequency monitoring reference	0 to 400Hz	0.01Hz (Note 3)	60Hz	107	
Disp	56	Current monitoring reference	0 to 500A	0.01A	Rated output current	107	

Func- tion	Param- eter Number	Name	Setting Range	Minimum Setting Increments	Factory Setting	Refer To:	Custo- mer Setting	
Automatic restart functions	57	Restart coasting time	0 to 5 s, 9999	0.1s	9999	108		
Auto res funci	58	Restart cushion time	0 to 60 s	0.1s	1.0 s	108		
Additional function	59	Remote setting function selection	0, 1, 2	1	0	110		
	60	Shortest acceleration/ deceleration mode	0, 1, 2, 11, 12	1	0	113		
	61	Reference current	0 to 500A, 9999	0.01A	9999	113		
	62	Reference current for acceleration	0 to 200%, 9999	1%	9999	113		
	63	Reference current for deceleration	0 to 200%, 9999	1%	9999	113		
	65	Retry selection	0, 1, 2, 3	1	0	115		
6	66	Stall prevention operation level reduction starting frequency (Note 6)	0 to 400Hz	0.01Hz (Note 3)	60Hz	96		
ction	67	Number of retries at alarm occurrence	0 to 10, 101 to 110	1	0	115		
Š	68	Retry waiting time	0.1 to 360 s	0.1s	1 s	115		
Ē	69	Retry count display erasure	0	1	0	115		
ectio	70	Special regenerative brake duty	0 to 30%	0.1%	0%	100		
Operation selection functions	71	71 Applied motor (Note 6)	0, 1, 3, 5, 6, 13, 15, 16, 23, 100, 101, 103, 105, 106, 113, 115, 116, 123,	1	0	117		
ō	72	PWM frequency selection	0 to 15	1	1	118		
	73	0-5V/0-10V selection	0, 1	1	0	120		
	74	Filter time constant	0 to 8	1	1	120		
	75	Reset selection/ disconnected PU detection/ PU stop selection	0 to 3, 14 to 17	1	14	121		
	77	Parameter write disable selection	0, 1, 2	1	0	123		
	78	Reverse rotation prevention selection	0, 1, 2	1	0	124		
	79	Operation mode selection (Note 6)	0 to 4, 6 to 8	1	1	124		
ətic	80	Motor capacity (Note 6)	0.1 to 7.5kW, 9999 (Note 8)	0.01kW	9999	128		
nagne	82	Motor excitation current	0 to 500A, 9999	0.01A	9999	129		
ose n	83	Rated motor voltage (Note 6)	0 to 1000V	0.1V	200V/ 400V	129		
General-purpose magnetic flux vector control	84	Rated motor frequency (Note 6)	50 to 120Hz	0.01Hz (Note 3)	60Hz	129		
neral	90	Motor constant (R1)	0 to 50Ω, 9999	0.001Ω	9999	129		
Ge	96	Auto-tuning setting/status (Note 6)	0, 1	1	0	129		

Purpose Purp								
117		eter	Name		Setting			Custo- mer Setting
119 Stop bit length (data length 8) 1 1 135 135 120 Parity check presence/absence 0, 1, 2 1 2 135 135 121 122 135 122 125 122 125 125 122 125 125 122 125		117		0 to 31	1	0	135	
123 Waiting time setting 9999 1 9999 135		118	Communication speed	48, 96, 192	1	192	135	
123 Waiting time setting 9999 1 9999 135	functions	119		(data length 8) 10, 11	1	1	135	
123 Waiting time setting 3999 1 9999 135	tion f	120		0, 1, 2	1	2	135	
123 Waiting time setting 9999 1 9999 135	nnica	121		0 to 10, 9999	1	1	135	
123 Waiting time setting 9999 1 9999 135	шис	122			0.1s	0	135	
128 Selection 1,1,2 1 1 1,53 1,14 1,15 1	ŭ	123			1	9999	135	
129 PID proportional band 0.1 to 1000%, 9999 0.1% 100% 148 130 PID integral time 0.1 to 3600 s, 9999 0.1 s 1 s 148 131 Upper limit 0 to 1000%, 9999 0.1% 9999 148 132 Lower limit 0 to 1000%, 9999 0.1% 9999 148 132 Lower limit 0 to 1000%, 9999 0.1% 9999 148 133 PID action set point for PU 0 to 100% 0.01% 0 0% 148 134 PID differential time 10.00 s, 9999 0.01 s 9999 148 145 Parameter for option (FR-PU04). 146 Frequency setting command selection 0, 1, 9999 1 0 156 157 150 151 0 152 2 150 152 2 2 2 2 2 2 2 2 2			selection					
130 PID integral time 0.1 to 3600 s, 9999 0.1% 100% 148 131 Upper limit 0 to 100%, 9999 0.1% 9999 148 132 Lower limit 0 to 100%, 9999 0.1% 9999 148 133 PID action set point for PU 0 to 100% 0.01% 0 to 100%		128	PID action selection		1	0	148	
130 PiD integral time 9999 0.1 s 1 s 148 148 131 Upper limit 0 to 100%, 9999 0.1% 9999 148 132 Lower limit 0 to 100%, 9999 0.1% 9999 148 133 PiD action set point for PU 0 to 100% 0.01% 0 % 148 134 PiD differential time 10.00 s, 9999 0.01 s 9999 148 145 Parameter for option (FR-PU04). 146 Frequency setting 0.01 to 100% 0.01 s 0.01		129	PID proportional band	9999	0.1%	100%	148	
133 PID action set point for PU 0 to 100% 0.01% 0.0% 148 134 PID differential time 0.01 to 10.00 s, 9999 0.01 s 9999 148 145 Parameter for option (FR-PU04). 146 Frequency setting command selection 0, 1, 9999 1 0 156 150 Output current detection 0 to 200% 0.1% 150% 157 151 Output current detection 0 to 10 s 0.1 s 0 157 152 Zero current detection 0 to 200.0% 0.1% 5.0% 158 153 Zero current detection 0.05 to 1 s 0.01 s 0.5 s 158 154 Tender of the period 156 Stall prevention operation 0 to 31,100 1 0 96 168 169 Parameters set by manufacturer. Do not set.	<u> </u>	130	PID integral time	9999	0.1 s	1 s	148	
133 PID action set point for PU 0 to 100% 0.01% 0.0% 148 134 PID differential time 0.01 to 10.00 s, 9999 0.01 s 9999 148 145 Parameter for option (FR-PU04). 146 Frequency setting command selection 0, 1, 9999 1 0 156 150 Output current detection 0 to 200% 0.1% 150% 157 151 Output current detection 0 to 10 s 0.1 s 0 157 152 Zero current detection 0 to 200.0% 0.1% 5.0% 158 153 Zero current detection 0.05 to 1 s 0.01 s 0.5 s 158 154 Tender of the period 156 Stall prevention operation 0 to 31,100 1 0 96 168 169 Parameters set by manufacturer. Do not set.	cont	131	Upper limit	9999	0.1%	9999	148	
133 Operation 0.10 100% 0.01% 0.98 148	吕	132			0.1%	9999	148	
To To To To To To To To		133	PID action set point for PU operation		0.01%	0%	148	
146 Frequency setting command selection 0, 1, 9999 1 0 156				10.00 s, 9999	0.01 s	9999	148	
156 Stall prevention operation 0 to 31,100 1 0 96	ᅙ	145	Parameter for option (FR-PUC	14).				
156 Stall prevention operation 0 to 31,100 1 0 96	Addition	146	Frequency setting command selection	0, 1, 9999	1	0	156	
156 Stall prevention operation 0 to 31,100 1 0 96	tion	150		0 to 200%	0.1%	150%	157	
156 Stall prevention operation 0 to 31,100 1 0 96	dete		period					
156 Stall prevention operation 0 to 31,100 1 0 96	ent	152	Zero current detection level	0 to 200.0%	0.1%	5.0%	158	
160 User group read selection 0, 1, 10, 11 1 0 159	Curr	153		0.05 to 1 s	0.01 s	0.5 s	158	
Parameters set by manufacturer. Do not set.	Sub		Stall prevention operation selection	0 to 31,100		0		
	nal	160	User group read selection	0, 1, 10, 11	1	0	159	
	dition		Parameters set by manufactur	rer. Do not set.				
	Ad	169						
1 = 1 1 1 1 1 1 1 1 1	Initial monitor	171		0		0	161	

Func- tion	Param- eter Number	Name	Setting Range	Minimum Setting Increments	Factory Setting	Refer To:	Custo- mer Setting
SL	173	User group 1 registration	0 to 999	1	0	159	_
Jser functions	174	User group 1 deletion	0 to 999, 9999	1	0	159	
Į.	175	User group 2 registration	0 to 999	1	0	159	
User	176	User group 2 deletion	0 to 999, 9999	1	0	159	
	180	RL terminal function selection (Note 6)	0 to 8, 16, 18	1	0	161	
ous	181	RM terminal function selection (Note 6)	0 to 8, 16, 18	1	1	161	
uncti	182	RH terminal function selection (Note 6)	0 to 8, 16, 18	1	2	161	
Terminal ment fun	183	MRS terminal function selection (Note 6)	0 to 8, 16, 18	1	6	161	
Terminal assignment functions	190	RUN terminal function selection (Note 6)	0 to 99	1	0	163	
as	191	FU terminal function selection (Note 6)	0 to 99	1	4	163	
	192	A, B, C terminal function selection (Note 6)	0 to 99	1	99	163	
	232	Multi-speed setting (speed 8)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
_	233	Multi-speed setting (speed 9)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
ratio	234	Multi-speed setting (speed 10)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
odo p	235	Multi-speed setting (speed 11)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
Multi-speed operation	236	Multi-speed setting (speed 12)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
Multi	237	Multi-speed setting (speed 13)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
	238	Multi-speed setting (speed 14)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
	239	Multi-speed setting (speed 15)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	88	
	240	Soft-PWM setting	0, 1, 10, 11 (Note 12)	1	1	118	
su	244	Cooling fan operation selection	0, 1	1	0	164	
Sub functions	245	Rated motor slip	0 to 50%, 9999	0.01%	9999	165	
ub fu	246	Slip compensation response time	0.01 to 10 s	0.01 s	0.5 s	165	
Š	247	Constant-output region slip compensation selection	0, 9999	1	9999	165	
	249	Earth (ground) fault detection at start (Note 9)	0, 1	1	0	166	
Stop selection function	250	Stop selection	0 to 100 s, 1000 to 1100 s, 8888, 9999	1	9999	167	

Func- tion	Param- eter Number	Name		ting nge	Minimum Setting Increments		tory	Refer To:	Custo- mer Setting
ional	251	Output phase failure protection selection	0,	, 1	1		1	168	
Additional function	342	E ² PROM write selection	0,	, 1	1	()	135	
Capacitor life	503	Capacitor life timer (Note 9)	-	-	1 (100h)	()	169	
Capaci life	504	Capacitor life alarm output set time (Note 9)	0 to 9998, (9999)		1 (100h)	500 (50000h)		169	
	900	FM terminal calibration	_	_				170	
	902	Frequency setting voltage bias	0 to 10V	0 to 60Hz	0.01Hz	0V	0Hz	172	
ons	903	Frequency setting voltage gain	0 to 10V	1 to 400Hz	0.01Hz	5V	60 Hz	172	
uncti	904	Frequency setting current bias	0 to 20mA	0 to 60Hz	0.01Hz	4 mA	0Hz	172	
tion f	905	Frequency setting current gain	0 to 20mA	1 to 400Hz	0.01Hz	20 mA	60 Hz	172	
Calibration functions	922	Built-in frequency setting potentiometer bias	0 to 5V	0 to 60Hz	0.01Hz	0V	0Hz	172	
ű	923	Built-in frequency setting potentiometer gain	0 to 5V	1 to 400Hz	0.01Hz	5V	60 Hz	172	
	990	Parameter for options (FR-PU	Parameter for options (EP.PLIO4)						
	991	raiameter for options (FR-F004).							

- Note:1. Indicates the parameter of which setting is ignored when the generalpurpose magnetic flux vector control mode is selected.
 - Since calibration is made before shipment from the factory, the settings differ slightly between inverters. The inverter is preset to provide a frequency slightly higher than 60Hz.
 - When the operation panel is used and the setting is 100Hz or more, the setting increments are 0.1Hz. The setting increments are 0.01Hz when operating in the communication mode.
 - The setting varies according to the inverter capacity: (0.1K to 3.7K)/(5.5K to 7.5K)
 - The 0.1K to 0.75K are set to 85% of the rated inverter current.
 - If "2" is set in Pr. 77 (parameter write disable selection), the setting cannot be changed during operation.
 - 7. The shaded parameters allow their settings to be changed during operation if "0" (factory setting) has been set in Pr. 77 (parameter write disable selection). (However, the Pr. 72 and Pr. 240 values may be changed during PU operation only.)
 - The Pr. 80 setting range changes with the inverter class: 0.2kW to 7.5kW, 9999 for the 400V class.
 - Pr. 249, Pr. 503, Pr. 504 can be set for the 200V/100V class only.
 - 10.The factory setting of Pr. 0 changes with the inverter capacity. 4% for the FR-E540-5.5K, 7.5K.
 - 11. For the FR-E540-5.5K and 7.5K, the factory setting is 10s.
 - 12. The setting values "10, 11" can be set for the 400V class only.

4.1.2 List of parameters classified by purpose of use

Set the parameters according to the operating conditions. The following list indicates purpose of use and corresponding parameters.

Purpose of Use		Parameter Numbers
	Purpose of Use	Parameter numbers which must be set
	Operation mode selection	Pr. 79, Pr. 146
	Acceleration/deceleration time/pattern adjustment	Pr. 7, Pr. 8, Pr. 20, Pr. 21, Pr. 29
	Selection of output characteristics	Pr. 3. Pr. 14. Pr. 19
	optimum for load characteristics	-, , -
	Output frequency restriction (limit)	Pr. 1, Pr. 2, Pr. 18
	Operation over 60Hz	Pr. 1, Pr. 18, Pr. 38, Pr. 39, Pr. 903, Pr. 905, Pr. 923
	Adjustment of frequency setting	Pr. 38, Pr. 39, Pr. 73, Pr. 902 to Pr. 905, Pr.
=	signals and outputs	922, Pr. 923
뜵	Motor output torque adjustment	Pr. 0, Pr. 80
e is	Brake operation adjustment	Pr. 10, Pr. 11, Pr. 12
Related to operation	Multi-speed operation	Pr. 1, Pr. 2, Pr. 4, Pr. 5, Pr. 6, Pr. 15, Pr. 24, Pr. 25, Pr. 26, Pr. 27, Pr. 232, Pr. 233, Pr. 234, Pr. 235, Pr. 236, Pr. 237, Pr. 238, Pr. 239
<u>a</u>	Jog operation	Pr. 15, Pr. 16
ž	Frequency jump operation	Pr. 31, Pr. 32, Pr. 33, Pr. 34, Pr. 35, Pr. 36
	Automatic restart operation after instantaneous power failure	Pr. 57, Pr. 58
	Optimum acceleration/deceleration within continuous rated range	Pr. 60
	Slip compensation setting	Pr. 245 to Pr. 247
	Output stop method selection	Pr. 250
	Setting of output characteristics matching the motor	Pr. 3, Pr. 19, Pr. 71
	Stall prevention of motor, lift operation	Pr. 156
ation	General-purpose magnetic flux vector control operation	Pr. 80
ers	Electromagnetic brake operation timing	Pr. 42, Pr. 190 to Pr. 192
9	Offline auto tuning setting	Pr. 82 to Pr. 84, Pr. 90, Pr. 96
ation	Sub-motor operation	Pr. 0, Pr. 3, Pr. 7, Pr. 8, Pr. 9, Pr. 44, Pr. 45, Pr. 46, Pr. 47, Pr. 48
븚	Regenerative function selection	Pr. 30, Pr. 70
to ap	Operation in communication with personal computer	Pr. 117 to Pr. 124, Pr. 342
Related to application operation	Operation under PID control	Pr. 73, Pr. 79, Pr. 128 to Pr. 134, Pr. 180 to Pr. 183, Pr. 190 to Pr. 192
ž	Noise reduction	Pr. 72, Pr. 240

PARAMETERS

Burness of Use		Parameter Numbers
	Purpose of Use	Parameter numbers which must be set
	Frequency meter calibration	Pr. 54, Pr. 55, Pr. 56, Pr. 900
ed to oring	Display of monitor on operation panel or parameter unit (FR-PU04) Display of speed, etc. Clearing of inverter's actual operation	Pr. 54, Pr. 55, Pr. 56, Pr. 900
alat on it	Display of speed, etc.	Pr. 37, Pr. 52
	Clearing of inverter's actual operation time	Pr. 171
ect	Function write prevention	Pr. 77
to incorrect in prevention	Reverse rotation prevention	Pr. 78
to in	Parameter grouping	Pr. 160, Pr. 173 to Pr. 176
ted	Current detection	Pr. 150 to Pr. 153, Pr. 190 to Pr. 192
Related operation	Current detection Motor stall prevention	Pr. 22, Pr. 23, Pr. 66, Pr. 156
	Input terminal function assignment	Pr. 180 to Pr. 183
	Output terminal function assignment	Pr. 190 to Pr. 192
	Increased cooling fan life	Pr. 244
	Motor protection from overheat	Pr. 9, Pr. 71
Others	Automatic restart operation at alarm stop	Pr. 65, Pr. 67, Pr. 68, Pr. 69
ş	Earth (ground) fault overcurrent setting	Pr. 249
	Inverter reset selection	Pr. 75
	Output phase failure protection selection	Pr. 251
	To determine the replacement time of capacitor	Pr. 503, Pr. 504

4.1.3 Parameters recommended to be set by the user

We recommend the following parameters to be set by the user. Set them according to the operation specifications, load, etc.

Parameter Number	Name	Application
1	Maximum frequency	Used to set the maximum and minimum output
2	Minimum frequency	frequencies.
7	Acceleration time	Used to set the acceleration and deceleration
8	Deceleration time	times.
9	Electronic thermal O/L relay	Used to set the current of the electronic overcurrent protection to protect the motor from overheat.
14	Load pattern selection	Used to select the optimum output characteristics which match the application and load characteristics.
71	Applied motor	Used to set the thermal characteristics of the electronic overcurrent protection according to the motor used.
73	0-5V/0-10V selection	Used to select the specifications of the frequency setting signal entered across terminal 2-5 to perform operation with the voltage input signal.
146	Frequency setting command selection	Select whether the output frequency setting is the setting using the built-in frequency setting potentiometer or the digital setting using the \(\bigcirc \) \(\bigcirc \) key.
156	Stall prevention operation selection	In vertical lift applications, make setting so that the high-response current limit is not activated. When high response current restriction is activated, torque may not be produced, causing a gravity drop.
900	FM terminal calibration	Used to calibrate the meter connected across terminals FM-SD.
902	Frequency setting voltage bias	
903	Frequency setting voltage gain	Used to set the magnitude (slope) of the output frequency relative to the frequency setting
904	Frequency setting current bias	signal (0 to 5V, 0 to 10V or 4 to 20mA DC) as desired.
905	Frequency setting current gain	
922	Built-in frequency setting potentiometer bias	You can set the magnitude (slope) of the output frequency relative to the built-in frequency
923	Built-in frequency setting potentiometer gain	setting potentiometer of the operation panel as desired.

4.2 Parameter Function Details

4.2.1 Torque boost (Pr. 0, Pr. 46)

Pr. 0 "torque boost"

Pr. 46 "second torque boost"

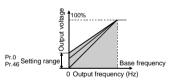
Increase the setting when the inverter-tomotor distance is long or motor torque in the low-speed range is insufficient, for example:

- Motor torque in the low-frequency range
 can be adjusted to the load to increase the starting motor torque.
- You can select either of the two starting torque boosts by RT terminal switching.

- Related parameters

- Pr. 3 "base frequency"
- Pr. 19 "base frequency voltage"
- Pr. 71 "applied motor"
- Pr. 80 "motor capacity"
- Pr. 180 to Pr. 183 (input terminal function selection)

Parameter Number	Factory Setting	Setting Range	Remarks
0	6%/4% (Note)	0 to 30%	(Note) FR-E510W-0.1K to 0.75K: 6% FR-E520 (S)-0.1K to 7.5K: 6% FR-E540-0.4K to 3.7K: 6% FR-E540-5.5K, 7.5K: 4%
46	9999	0 to 30%, 9999	9999: Function invalid



<Settina>

- Assuming that the base frequency voltage is 100%, set the 0Hz voltage in %.
- Pr. 46 "second torque boost" is valid when the RT signal is on. (Note 3)
- When using the inverter-dedicated motor (constant-torque motor), change the setting as indicated below:

use of the constant-torque motor, the Pr. 0 setting changes to the above value.

- Note:1. This parameter setting is ignored when the general-purpose magnetic flux vector control mode has been selected.
 - vector control mode has been selected.
 2. A large setting may result in an overheated motor or overcurrent trip. The quideline for the largest value for this parameter is about 10%.
 - The RT signal serves as the second function selection signal and makes the other second functions valid. Refer to page 161 for Pr. 180 to Pr. 183 (input terminal function selection).

4.2.2 Output frequency range (Pr. 1, Pr. 2, Pr. 18)

Pr. 1 "maximum frequency"

Pr. 2 "minimum frequency"

Pr. 18 "high-speed maximum frequency"

Used to clamp the upper and lower limits of the output frequency. Used for high-speed operation at or over 120Hz.

Related parameters

Pr. 13 "starting frequency"
Pr. 38 "frequency at 5V (10V)

input"

Pr. 39 "frequency at 20mA input"

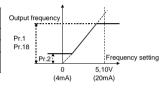
Pr. 79 "operation mode selection" Pr. 146 "frequency setting

command selection

• Can be used to set the upper and lower limits of motor speed.

Parameter Number	Factory Setting	Setting Range
1	120Hz	0 to 120Hz
2	0Hz	0 to 120Hz
18	120Hz	120 to 400Hz

Pr. 1 and Pr. 18.



<Setting>

- Use Pr. 1 to set the upper limit of the output frequency. If the frequency of the frequency command entered is higher than the setting, the output frequency is clamped at the maximum frequency.
- To perform operation over 120Hz, set the upper limit of the output frequency in Pr. 18. (When the Pr. 18 value is set, Pr. 1 automatically changes to the frequency in Pr. 18. Also, when the Pr. 1 value is set, Pr. 18 automatically changes to the frequency in Pr. 1.)
- Use Pr. 2 to set the lower limit of the output frequency.

Note: When the potentiometer (frequency setting potentiometer) connected across terminals 2-5 is used for operation beyond 60Hz, change the value of Pr. 38 (or Pr. 39 for use of the potentiometer connected across terminals 4-5). Alternatively, when the built-in frequency setting potentiometer (Pr.146 = 0) is used for operation beyond 60Hz, change the Pr. 923 value.

Operation over 60Hz cannot be performed by merely changing the settings of

A CAUTION

⚠ If the Pr. 2 setting is higher than the Pr. 13 "starting frequency" value, note that the motor will run at the set frequency according to the acceleration time setting by merely switching the start signal on, without entry of the command frequency.

4.2.3 Base frequency, base frequency voltage (Pr. 3, Pr. 19, Pr. 47)

Pr. 3 "base frequency"

Pr. 19 "base frequency voltage"

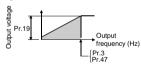
Pr. 47 "second V/F(base frequency)

Used to adjust the inverter outputs (voltage. frequency) to the motor rating.

- When running a standard motor, generally set the rated motor frequency. When running the motor using the commercial power supply-inverter switch-over, set
- Related parameters
- "load pattern selection" Pr 14
- Pr 71 "applied motor"
- Pr 80 "motor capacity"
- Pr. 83 "rated motor voltage"
- Pr. 180 to Pr. 183 (input terminal
 - function selection)
- the base frequency to the same value as the power supply frequency. If the frequency given on the motor rating plate is "50Hz" only, always set to "50Hz". Leaving it as "60Hz" may make the voltage too low and the torque less, resulting in overload tripping. Care must be taken especially when Pr. 14 "load pattern selection = 1.

Parameter Number	Factory Setting	Setting Range	Remarks
3	60Hz	0 to 400Hz	
19	9999	0 to 1000V, 8888, 9999	8888: 95% of power supply voltage *1 9999: Same as power supply voltage *2
47	9999	0 to 400Hz, 9999	9999: Function invalid

- *1: The base frequency voltage of the FR-E510W-0.1K to 0.75K is 1.9 times larger than the power supply voltage.
- *2: The base frequency voltage of the FR-E510W-0.1K to 0.75K is 2 times larger than the power supply voltage.



<Setting>

- Use Pr. 3 and Pr. 47 to set the base frequency (rated motor frequency). Two base frequencies can be set and the required frequency can be selected from them.
- Pr. 47 "second V/F (base frequency)" is valid when the RT signal is on. (Note 3)
- Use Pr. 19 to set the base voltage (e.g. rated motor voltage).
 - Note: 1. Set 60Hz in Pr. 3 "base frequency" when using a Mitsubishi constant-torque
 - 2. When the general-purpose magnetic flux vector control mode has been selected, Pr. 3, Pr. 19 and Pr. 47 are made invalid and Pr. 83 and Pr. 84 are made valid.
 - However, Pr. 3 or Pr. 47 is made valid for the S-shaped inflection pattern point of Pr. 29.
 - 3. The RT signal serves as the second function selection signal and makes the other second functions valid. Refer to page 161 for Pr. 180 to Pr. 183 (input terminal function selection).

4.2.4 Multi-speed operation (Pr. 4 to Pr. 6, Pr. 24 to Pr. 27, Pr. 232 to Pr. 239)

Pr. 4 "multi-speed setting (high speed)"

Pr. 5 "multi-speed setting (middle speed)

Pr. 6 "multi-speed setting (low speed)"

Pr. 24 to Pr. 27 "multi-speed setting (speeds 4 to 7)"

Pr. 232 to Pr. 239 "multi-speed setting

(speeds 8 to 15)"

Related parameters

Pr. 1 "maximum frequency"

Pr. 2 "minimum frequency

Pr. 29 "acceleration/

deceleration pattern"

Pr. 79 "operation mode selection"

Pr. 146 "frequency setting

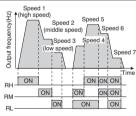
command selection"

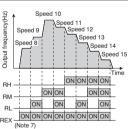
Pr. 180 to Pr. 183 (input terminal function selection)

Used to switch between the predetermined running speeds.

- Any speed can be selected by merely switching on/off the corresponding contact signals (RH, RM, RL, REX signals).
- By using these functions with Pr. 1 "maximum frequency" and Pr. 2 "minimum. frequency", up to 17 speeds can be set.
- Valid in the external operation mode or combined mode (Pr. 79 = 3 or 4).

Parameter Number	Factory Setting	Setting Range	Remarks
4	60Hz	0 to 400Hz	
5	30Hz	0 to 400Hz	
6	10Hz	0 to 400Hz	
24 to 27	9999	0 to 400Hz, 9999	9999: Not selected
232 to 239	9999	0 to 400Hz, 9999	9999: Not selected





<Setting>

- Set the running frequencies in the corresponding parameters.
- Each speed (frequency) can be set as desired between 0 and 400Hz during inverter operation.

After the required multi-speed setting parameter has been read, the setting can be changed by pressing the (A) (∇) key. In this case, when you release the (A) (∇) key. press the set key (were key when using the parameter unit (FR-PU04)) to store the set frequency.

Use any of Pr. 180 to Pr. 183 to assign the terminal used to input the REX signal.

- Note: 1. The priorities of external terminal of the frequency command are in order of jog, multi-speed, terminal 4 and terminal 2.
 - 2. The multi-speeds can also be set in the PU or external operation mode.
 - For 3-speed setting, if two or three speeds are simultaneously selected, priority is given to the frequency setting of the lower signal.
 - 4. Pr. 24 to Pr. 27 and Pr. 232 to Pr. 239 settings have no priority between them.
 - 5. The parameter values can be changed during operation.
 - When input terminal assignment is changed using Pr. 180 to Pr. 183, other functions may be affected. Check the functions of the corresponding terminals before making setting.
 - When only the REX signal is on with "9999" set in Pr.232, the set frequency is changed to 0Hz.

4.2.5 Acceleration/deceleration time (Pr. 7, Pr. 8, Pr. 20, Pr. 21, Pr. 44, Pr. 45)

Pr. 7 "acceleration time"

Pr. 8 "deceleration time"

Pr. 20 "acceleration/deceleration reference frequency"

Related parameters

Pr. 3 "base frequency"

Pr. 29 "acceleration/deceleration pattern"

Pr. 21 "acceleration/deceleration time increments"

Pr. 44 "second acceleration/deceleration time"

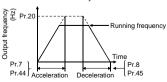
Pr. 45 "second deceleration time"

Used to set motor acceleration/deceleration time.

Set a larger value for a slower speed increase/decrease or a smaller value for a faster speed increase/decrease.

Parameter Number	Factory Setting		Setting Range	Remarks
7	0.1K to 3.7K	5s	0 to 3600s/0 to 360s	
,	5.5K, 7.5K	10s	0 10 30005/0 10 3005	
8	0.1K to 3.7K	5s	0 to 3600s/0 to 360s	
٥	5.5K, 7.5K	10s	0 10 30005/0 10 3005	
20	60Hz		1 to 400Hz	
21	0		0, 1	0: 0 to 3600s 1: 0 to 360s
44	5s (Note)		0 to 3600s/0 to 360s	
45	9999		0 to 3600s/ 0 to 360s, 9999	9999: acceleration time = deceleration time

Note: The FR-E540-5.5K and 7.5K are factory-set to 10s.



<Setting>

- Use Pr. 21 to set the acceleration/deceleration time and minimum setting increments:
- When you have changed the Pr. 21 setting, set the deceleration time again. (Note 5)
- Use Pr. 7 and Pr. 44 to set the acceleration time required to reach the frequency set in Pr. 20 from 0Hz
- Use Pr. 8 and Pr. 45 to set the deceleration time required to reach 0Hz from the frequency set in Pr. 20.
- Pr. 44 and Pr. 45 are valid when the RT signal is on. When the RT signal is on, the other second functions such as second torque boost are also selected.
- Set "9999" in Pr. 45 to make the deceleration time equal to the acceleration time (Pr. 44).
- Note:1. In S-shaped acceleration/deceleration pattern A (refer to page 99), the set time is the period required to reach the base frequency set in Pr. 3.
 - •Acceleration/deceleration time formula when the set frequency is the base frequency or higher

$$t = \frac{4}{9} \times \frac{T}{(Pr. 3)^2} \times f^2 + \frac{5}{9}T$$

- T: Acceleration/deceleration time setting (s)
- f : Set frequency (Hz)
- •Guideline for acceleration/deceleration time at the base frequency of 60Hz (0Hz to set frequency)

Frequency setting (Hz) Acceleration/ deceleration time (s)	60	120	200	400
5	5	12	27	102
15	15	35	82	305

- If the Pr. 20 setting is changed, the settings of calibration functions Pr. 903 and Pr. 905 (frequency setting signal gains) remain unchanged.
 To adjust the gains, adjust calibration functions Pr. 903 and Pr. 905.
- When the setting of Pr. 7, Pr. 8, Pr. 44 or Pr. 45 is "0", the acceleration/ deceleration time is 0.04s. At this time, set 120Hz or less in Pr. 20.
- 4. If the shortest acceleration/deceleration time is set, the actual motor acceleration/deceleration time cannot be made shorter than the shortest acceleration/deceleration time determined by the mechanical system's J (inertia moment) and motor torque.
- Changing the Pr. 21 setting changes the acceleration/deceleration setting (Pr. 7, Pr. 8, Pr. 16, Pr. 44, Pr. 45).
 - <Example>
 When Pr. 21 = "0" and the setting of Pr. 7 = "5.0"s, and if the setting of Pr. 21 is changed to "1", the setting value of Pr. 7 will change to "0.5"s.

4.2.6 Electronic thermal relay function (Pr. 9, Pr. 48)

Pr. 9 "electronic thermal O/L relay

Pr. 48 "second electronic thermal O/L relay "

Related parameter -

Pr. 71 "applied motor"
Pr. 180 to Pr. 183
(input terminal function selection)

Set the current of the electronic thermal relay function to protect the motor from overheat. This feature provides the optimum protective characteristics, including reduced motor cooling capability, at low speed.

Parameter Number	Factory Setting	Setting Range	Remarks
9	Rated output current*	0 to 500A	
48	9999	0 to 500A, 9999	9999: Function invalid

^{*0.1}K to 0.75K are set to 85% of the rated inverter current.

<Setting>

- Set the rated current [A] of the motor.
 (Normally set the rated current at 50Hz if the motor has both 50Hz and 60Hz rated current.)
- Setting "0" makes the electronic thermal relay function (motor protective function) invalid. (The inverter's protective function is valid.)
- Set "1" in Pr.71 when using the Mitsubishi constant torque motor. (This provides a 100% continuous torque characteristic in the low-speed region.) Then, set the rated motor current in Pr. 9.
- Pr. 48 "second electronic thermal O/L relay" is made valid when the RT signal is on. (Note 4)
- Note:1. When two or more motors are connected to the inverter, they cannot be protected by the electronic overcurrent protection. Install an external thermal relay to each motor.
 - When the difference between the inverter and motor capacities is large and the setting is small, the protective characteristics of the electronic thermal relay function will be deteriorated. In this case, use an external thermal relay.
 - A special motor cannot be protected by the electronic thermal relay function. Use an external thermal relay.
 - The RT signal serves as the second function selection signal and makes the other second functions valid. Refer to page 161 for Pr. 180 to Pr. 183 (input terminal function selection).

4.2.7 DC injection brake (Pr. 10 to Pr. 12)

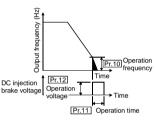
Pr. 10 "DC injection brake operation frequency"

Pr. 11 "DC injection brake operation time"

Pr. 12 "DC injection brake voltage"

By setting the DC injection brake voltage (torque), operation time and operation starting frequency, the stopping accuracy of positioning operation, etc. or the timing of operating the DC injection brake to stop the motor can be adjusted according to the load.

Parameter Number	Factory Setting	Setting Range
10	3Hz	0 to 120Hz
11	0.5s	0 to 10 s
12	6%	0 to 30%



<Setting>

- Use Pr. 10 to set the frequency at which the DC injection brake operation is started.
- · Use Pr. 11 to set the period during when the brake is operated.
- · Use Pr. 12 to set the percentage of the power supply voltage.
- Change the Pr. 12 setting when using the inverter-dedicated motor (constant-torque motor).

Note: When the Pr. 12 value is as factory-set, changing the Pr. 71 value to the setting for use of a constant-torque motor changes the Pr. 12 value to 4% automatically.

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riangle Install a mechanical brake. No holding torque is provided.

4.2.8 Starting frequency (Pr. 13)

Pr. 13 "starting frequency"

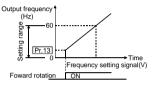
Related parameters

Pr. 2 "minimum frequency"

You can set the starting frequency between 0 and 60Hz.

· Set the starting frequency at which the start signal is switched on.

Parameter	Factory	Setting
Number	Setting	Range
13	0.5Hz	0 to 60Hz



Note: The inverter will not start if the frequency setting signal is less than the value set in Pr. 13 "starting frequency".

For example, when 5Hz is set in Pr. 13, the motor will not start running until the frequency setting signal reaches 5Hz.

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When the Pr. 13 setting is equal to or less than the Pr. 2 "minimum frequency" value, note that merely switching on the start signal will start the motor at the preset frequency even if the command frequency is not input.

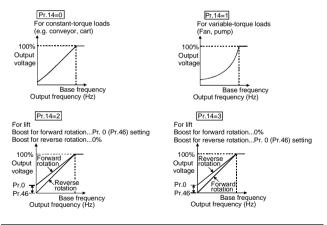
4.2.9 Load pattern selection (Pr. 14)

Pr. 14 "load pattern selection"

Pr. 0 "torque boost" Pr. 80 "second torque boost" Pr. 80 "motor capacity" Pr. 180 to Pr. 183 (input terminal function selection)

You can select the optimum output characteristic (V/F characteristic) for the application and load characteristics

Parameter	Factory	Setting
Number	Setting	Range
14	0	0 to 3



- Note: 1. This parameter setting is ignored when the general-purpose magnetic flux vector control mode has been selected.
 - Pr. 46 "second torque boost" is made valid when the RT signal turns on.
 The RT signal acts as the second function selection signal and makes the
 other second functions valid.

Refer to page 161 for Pr. 180 to Pr. 183 (input terminal function selection).

4.2.10 Jog operation (Pr. 15, Pr. 16)

Pr. 15 "jog frequency"

Pr. 16 "jog acceleration/ deceleration time"

Related parameters -

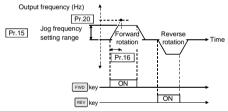
Pr. 20 "acceleration/deceleration reference frequency"

Pr. 21 "acceleration/deceleration time increments"

Jog operation can be started and stopped by selecting the jog mode from the operation panel and pressing and releasing the <a> key (<a> key).

• Set the frequency and acceleration/deceleration time for jog operation.

Parameter Number	Factory Setting	Setting Range	Remarks
15	5Hz	0 to 400Hz	
16	0.5s	0 to 3600 s	When Pr. 21 = 0
16		0 to 360 s	When Pr. 21 = 1



- Note: 1. In S-shaped acceleration/deceleration pattern A, the acceleration/ deceleration time is the period of time required to reach Pr. 3 "base frequency", not Pr. 20.
 - The acceleration time and deceleration time cannot be set separately for jog operation.
 - The value set in Pr. 15 "jog frequency" should be equal to or greater than the Pr. 13 "starting frequency" setting.

Pr. 18 → Refer to Pr. 1, Pr. 2.

Pr. 19 → Refer to Pr. 3.

Pr. 20, Pr. 21 → Refer to Pr. 7, Pr. 8.

4.2.11 Stall prevention and current restriction (Pr. 22, Pr. 23, Pr. 66, Pr. 156)

Pr. 22 "stall prevention operation level"

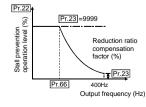
Pr. 23 "stall prevention operation level compensation factor at double speed"

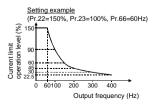
Pr. 66 "stall prevention operation level reduction starting frequency"

Pr. 156 "stall prevention operation selection"

- Stall prevention...........If the current exceeds the stall prevention operation level, the output frequency of the inverter is automatically varied to reduce the current.
- High-response current limit If the current exceeds the limit value, the output of the inverter is shut off to prevent an overcurrent.
- Set the output current level (% to the inverter rated current) at which the output frequency will be adjusted to prevent the inverter from stopping due to overcurrent etc.
- For high-speed operation at or over the motor base frequency, acceleration may not be made because the motor current does not increase.
 To improve the operation characteristics of the motor in such a case, the stall prevention level in the high-frequency range can be reduced. This is effective for operation of a centrifugal separator up to the high-speed range. Normally, set 60Hz in Pr. 66 and 100% in Pr. 23.
- For operation in the high-frequency range, the current in the locked motor state is smaller than the rated output current of the inverter and the inverter does not result in an alarm (protective function is not activated) if the motor is at a stop. To improve this and activate the alarm, the stall prevention level can be reduced.
- You can make setting to prevent stall caused by overcurrent and/or to prevent the inverter from resulting in an overcurrent trip (to disable high-response current restriction that limits the current) when an excessive current flows due to sudden load fluctuation or ON-OFF on the output side of a running inverter.

Parameter Number	Factory Setting	Setting Range	Remarks
22	150%	0 to 200%	
23	9999	0 to 200%, 9999	9999: Constant according to Pr. 22
66	60Hz	0 to 400Hz	
156	0	0 to 31, 100	





<Setting of stall prevention operation level>

- In Pr. 22, set the stall prevention operation level. Normally set it to 150% (factory setting). Set "0" in Pr. 22 to disable the stall prevention operation.
- To reduce the stall prevention operation level in the high-frequency range, set the reduction starting frequency in Pr. 66 and the reduction ratio compensation factor in Pr. 23.

Formula for stall prevention operation level

Stall prevention operation level (%) = A + B ×
$$\left[\frac{Pr. 22-A}{Pr. 22-B}\right]$$
 × $\left[\frac{Pr. 23-100}{100}\right]$

$$\text{where, A} = \frac{\text{Pr. 66 (Hz)} \times \text{Pr. 22 (\%)}}{\text{output frequency (Hz)}} \text{ , B} = \frac{\text{Pr. 66 (Hz)} \times \text{Pr. 22 (\%)}}{400\text{Hz}}$$

 By setting "9999" (factory setting) in Pr. 23, the stall prevention operation level is constant at the Pr. 22 setting up to 400Hz.

<Setting of stall prevention operation selection>

Refer to the following table and set the parameter.

Pr. 156 Setting	High- Response Current Limit O: Activated •: Not activated	Oper Select O: A	Constant Con	Deceleration party	OL Signal Output O: O: Operation continued •: Operation not continued (Note 1)
0	0	0	0	00000	0
1	•	Ô	Ó	0	0
2	0	•	0	0	0
3	•	•	0	0	0
4	0	0	•	0	0
5	•	0	•	0	0
6 7	0	•	•	00.	00
		•	•	0	0
8	0	0	0		0
9	•	0	0	•	0
10	0	•	0	•	0
11	•	•	0	•	0
12	0	0		•	0
13	•	0	•	•	0
14	0	•	•	•	0
15	•	•	•	•	0

١	High- Response Current O: Activated •: Not activa				d /ated	O: Operation	
	Setting	Limit O: Activated •: Not activated	Acceleration	Constant speed	Deceleration	continued : Operation not continued (Note 1)	
	16)	0	0	0	0	•
1	17		•	0	0	0	•
	18	3	0		0	0	•
	19)	•	•	0	0	•
	20 21 22 23)	0	0	•	0	•
	21		•		•	0	•
	22	2	0	•	•	0	•
1	23	3		•	•	0	•
1	24		0	0	0	•	•
1	25	5	•	0	0	•	•
1	26)	0	•	0	•	•
1	27			•	0	•	•
1	28		0	0	•	•	•
1	29			0	•	•	•
1	30)	0	•	•	•	•
	31		•	•	•	•	•
		Driving	0	0	0	0	0
	100	Regenerative	•	•	•	•	0

Stall Prevention Operation Selection

OL Signal Output

- Note:1. When "Operation not continued for OL signal output" is selected using Pr.156, the "E.OLT" alarm code (stopped by stall prevention) is displayed and operation stopped. (Alarm stop display "E.OLT")
 - If the load is heavy, the lift is predetermined, or the acceleration/deceleration time is short, the stall prevention may be activated and the motor not stopped in the preset acceleration/deceleration time. Therefore, set optimum values to the Pr. 156 and Pr. 22 (Pr. 23).
 - When the high-response current limit has been set in Pr. 156 (factory setting has the current limit activated), do not set the Pr. 22 value to 170% or more. Torque will not be developed by doing so.
 - In vertical lift applications, make setting so that the high-response current limit is not activated. Torque may not be produced, causing a gravity drop.

ACAUTION

- △ Do not set a small value as the stall prevention operation current. Otherwise, torque generated will reduce.
- ⚠ Test operation must be performed.

Stall prevention operation during acceleration may increase the acceleration time.

Stall prevention operation during constant speed may change the speed suddenly.

Stall prevention operation during deceleration may increase the deceleration time, increasing the deceleration distance.

Pr. 24 to Pr. 27 →Refer to Pr. 4 to Pr. 6.

4.2.12 Acceleration/deceleration pattern (Pr. 29)

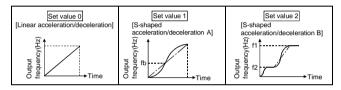
Pr. 29 "acceleration/deceleration pattern"

Set the acceleration/deceleration pattern.

Parameter	Factory	Setting
Number	Setting	Range
29	0	0, 1, 2

-Related parameters

- Pr. 3 "base frequency"
- Pr. 7 "acceleration time"
- Pr 8 "deceleration time"
- Pr. 20 "acceleration/deceleration reference frequency"
- Pr. 44 "second
- acceleration/deceleration time"
- Pr. 45 "second deceleration time"



<Setting>

Pr. 29 Setting	Function	Description
0	Linear acceleration/ deceleration	Linear acceleration/deceleration is made up/down to the preset frequency (factory setting).
1	S-shaped acceleration/ deceleration A (Note)	For machine tool spindles This setting is used when it is necessary to make acceleration/deceleration in a short time up to the base frequency or higher speed range. In this acceleration/deceleration pattern, fb (base frequency) is always the inflection point of an S shape, and you can set the acceleration/deceleration time according to the reduction in motor torque in the base frequency or higher constant-output operation range.
2	S-shaped acceleration/ deceleration B	For prevention of cargo collapse on conveyor, etc. This setting provides S-shaped acceleration/deceleration from f2 (current frequency) to f1 (target frequency), easing an acceleration/deceleration shock. This pattern has an effect on the prevention of cargo collapse, etc.

Note: For the acceleration/deceleration time, set the time required to reach the "base frequency" in Pr. 3, not the "acceleration/deceleration reference frequency" in Pr. 20.

4.2.13 Regenerative brake duty (Pr. 30, Pr. 70)

Pr. 30 "regenerative function selection"

Pr. 70 "special regenerative brake duty"

 When making frequent starts/stops, use the optional "brake resistor" to increase the regenerative brake duty. (0.4K or more)

Parameter Number	Factory Setting	Setting Range
30	0	0,1
70	0%	0 to 30%

<Setting>

(1) When using the brake resistor (MRS), BU type brake unit, high power factor converter (FR-HC), power regeneration common converter (FR-CV)

- Set "0" in Pr. 30.
- The Pr. 70 setting is made invalid.

(2) When using the brake resistors (2 MYSs in parallel) (3.7K is only allowed)

- Set "1" in Pr. 30.
- Set "6%" in Pr. 70.

(3) When using the high-duty brake resistor (FR-ABR)

- Set "1" in Pr. 30.
- Set "10%" in Pr. 70.
 - Note:1. Pr. 70 "regenerative brake duty" indicates the %ED of the built-in brake transistor operation. The setting should not be higher than the permissible value of the brake resistor used. Otherwise, the resistor can overheat.
 - When Pr. 30 = "0", Pr. 70 is not displayed but the brake duty is fixed at 3%. (Fixed at 2% for 5.5K, 7.5K)
 - 3. The brake resistor cannot be connected to 0.1K and 0.2K inverters.

AWARNING

The value set in Pr. 70 should not exceed the value set to the brake resistor used.

Otherwise, the resistor can overheat.

4.2.14 Frequency jump (Pr. 31 to Pr. 36)

Pr. 31 "frequency jump 1A"

Pr. 32 "frequency jump 1B"

Pr. 33 "frequency jump 2A"

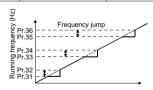
Pr. 34 "frequency jump 2B"

Pr. 35 "frequency jump 3A"

Pr. 36 "frequency jump 3B"

- When it is desired to avoid resonance attributable to the natural frequency of a
 mechanical system, these parameters allow resonant frequencies to be jumped. Up
 to three areas may be set, with the jump frequencies set to either the top or bottom
 point of each area.
- The value set to 1A, 2A or 3A is a jump point and operation is performed at this frequency.

Parameter Number	Factory Setting	Setting Range	Remarks
31	9999	0 to 400Hz, 9999	9999: Function invalid
32	9999	0 to 400Hz, 9999	9999: Function invalid
33	9999	0 to 400Hz, 9999	9999: Function invalid
34	9999	0 to 400Hz, 9999	9999: Function invalid
35	9999	0 to 400Hz, 9999	9999: Function invalid
36	9999	0 to 400Hz, 9999	9999: Function invalid



<Setting>

- To fix the frequency at 30Hz between Pr. 33 and Pr. 34 (30Hz and 35Hz), set 35Hz in Pr. 34 and 30Hz in Pr. 33.
- To jump to 35Hz between 30 and 35Hz, set 35Hz in Pr. 33 and 30Hz in Pr. 34.

Pr.34:35Hz Pr.33:30Hz

Pr.33:35Hz Pr.34:30Hz

Note: During acceleration/deceleration, the running frequency within the set area is valid.

4.2.15 Speed display (Pr. 37)

Pr. 37 "speed display"

Related parameter –

Pr. 52 "operation panel/PU main display data selection"

The unit of the output frequency display of the operation panel and PU (FR-PU04) can be changed from the frequency to the motor speed or machine speed.

Parameter	Factory	Setting	Remarks
Number	Setting	Range	
37	0	0, 0.01 to 9998	0: Output frequency

<Setting>

• To display the machine speed, set in Pr. 37 the machine speed for 60Hz operation.

Note:1. The motor speed is converted into the output frequency and does not match the actual speed.

- 2. To change the operation panel monitor (PU main display), refer to Pr. 52.
- As the operation panel display is 4 digits, "----" is displayed when the monitored value exceeds "9999".
- 4. Only the PU monitor display uses the unit set in this parameter. Set the other speed-related parameters (e.g. Pr. 1) in the frequency unit.
- Due to the restrictions of the resolution of the set frequency, the displayed value may be different from the setting for the second decimal place.

⚠ CAUTION

Make sure that the running speed setting is correct.
Otherwise, the motor might run at extremely high speed, damaging the machine.

4.2.16 Frequency at 5V (10V) input (Pr. 38)

Pr. 38 "frequency at 5V (10V) input"

Related parameters

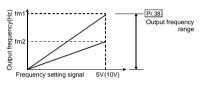
Pr 73 "0-5V/0-10V selection"

Pr. 79 "operation mode selection"

Pr. 902 "frequency setting voltage bias"

Pr. 903 "frequency setting voltage gain'

· You can set the frequency provided when the frequency setting signal from the potentiometer connected across terminals 2-5 (frequency setting potentiometer) is 5VDC (or 10VDC).



Parameter Number	Factory Setting	Setting Range
38	60Hz	1 to 400Hz

Note: For the frequency setting of the built-in frequency setting potentiometer, refer to Pr. 922 and Pr. 923. (Page 172)

Frequency at 20mA input (Pr. 39) 4.2.17

Pr. 39 "frequency at 20mA input"

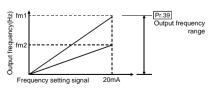
Related parameters

Pr. 79 "operation mode selection"

Pr. 904 "frequency setting current bias"

Pr. 905 "frequency setting current gain'

· You can set the frequency provided when the frequency setting signal input across terminals 4-5 is 20mA.



Parameter Number	Factory Setting	Setting Range	
39	60Hz	1 to 400Hz	

4.2.18 Up-to-frequency sensitivity (Pr. 41)

Pr. 41 "up-to-frequency sensitivity"

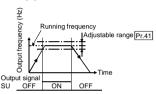
- Related parameters

Pr. 190 to Pr. 192 (output terminal function selection)

The ON range of the up-to-frequency signal (SU) output when the output frequency reaches the running frequency can be adjusted between 0 and $\pm 100\%$ of the running frequency.

This parameter can be used to ensure that the running frequency has been reached or used as the operation start signal etc. for related equipment.

Parameter Number		
41	10%	0 to 100%



Use any of Pr. 190 to Pr. 192 to allocate the terminal used for SU signal output.
 Refer to page 163 for Pr. 190 to Pr. 192 (output terminal function selection).

Note: When terminal assignment is changed using Pr. 190 to Pr. 192, the other functions may be affected. Check the functions of the corresponding terminals before making settings.

4.2.19 Output frequency detection (Pr. 42, Pr. 43)

Pr. 42 "output frequency detection"

Related parameters

Pr. 43 "output frequency detection for reverse rotation"

Pr. 190 to Pr. 192 (output terminal function selection)

The output frequency detection signal (FU) is output when the output frequency reaches or exceeds the setting. This function can be used for electromagnetic brake operation, open signal etc.

You can also set the detection of the frequency used exclusively for reverse rotation.
 This function is effective for switching the timing of electromagnetic brake operation between forward rotation (rise) and reverse rotation (fall) during vertical lift operation etc.

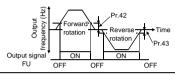
Parameter Number	Factory Setting	Setting Range	Remarks
42	6Hz	0 to 400Hz	
43	9999	0 to 400Hz, 9999	9999: Same as Pr. 42 setting

<Setting>

Refer to the figure below and set the corresponding parameters:

- When Pr. 43 ≠ 9999, the Pr. 42 setting applies to forward rotation and the Pr. 43 setting applies to reverse rotation.
- Assign the terminal used for FU signal output with any of Pr. 190 to Pr. 192 (output terminal function selection).

Refer to page 163 for Pr. 190 to Pr. 192 (output terminal function selection).



Note: Changing the terminal assignment using Pr. 190 to Pr. 192 may affect the other functions. Make setting after confirming the function of each terminal.

Pr. 44, Pr. 45 → Refer to Pr. 7.

Pr. 46 →Refer to Pr. 0.

Pr. 47 →Refer to Pr. 3.

Pr. 48 →Refer to Pr. 9.

4.2.20 Monitor display (Pr. 52, Pr. 54)

Pr. 52 "operation panel/PU main display data selection"

Pr. 54 "FM terminal function selection"

- Related parameters

Pr. 37 "speed display"

Pr. 55 "frequency monitoring reference"

Pr. 56 "current monitoring reference"

Pr. 171 "actual operation hour

meter clear"
Pr. 900 "FM terminal calibration"

You can select the signals shown on the operation panel/parameter unit (FR-PU04) main display screen and the signal output to the FM terminal.

•There is a pulse train output terminal FM. Select the signal using Pr. 54.

Parameter Number	Factory Setting	Setting Range	
52	0	0, 23, 100	
54	0	0, 1, 2	

<Setting>

Set Pr. 52 and Pr. 54 in accordance with the following table:

		Parameter Setting			
Signal Type	Unit	Pr.	52	Pr. 54	Full-Scale Value of
Oigilal Type	igilal Type Offic		PU main monitor	FM terminal	FM Level Meter
Output frequency	Hz	0/100	0/100	0	Pr. 55
Output current	А	0/100	0/100	1	Pr. 56
Output voltage		0/100	0/100	2	400V or 800V
Alarm display		0/100	0/100	×	
Actual operation time	10h	23	23	×	

When 100 is set in Pr. 52, the monitored values during stop and during operation differ as indicated below: (LED of Hz flickers during stop and is lit during operation.)

	Pr. 52			
	0	100		
	During operation/ during stop	During stop	During operation	
Output frequency	Output frequency Set frequency Output freq			
Output current	Output current			
Output voltage	Output voltage			
Alarm display	Alarm display			

- Note: 1. During an error, the output frequency at error occurrence is displayed.
 - During MRS, the values are the same as during a stop.
 During offline auto tuning, the tuning status monitor has priority.
 - Note: 1. The monitoring of items marked × cannot be selected.
 - 2. By setting "0" in Pr. 52, the monitoring of "output frequency to alarm display" can be selected in sequence by the set key.
 - Running speed on the PU main monitor is selected by "other monitor selection" of the parameter unit (FR-PU04).
 - The actual operation time displayed by setting "23" in Pr. 52 is calculated using the inverter operation time. (Inverter stop time is not included.) Set "0" in Pr. 171 to clear it.
 - The actual operation time is calculated from 0 to 99990 hours, then cleared, and recalculated from 0. If the operation time is less than 10 hours there is no display.
 - The actual operation time is not calculated if the inverter has not operated for more than 1 hour continuously.
 - 7. When the operation panel is used, the display unit is Hz or A only.

4.2.21 Monitoring reference (Pr. 55, Pr. 56)

Pr. 55 "frequency monitoring reference"

Pr. 56 "current monitoring reference"

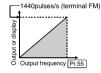
Related parameters -

Pr. 54 "FM terminal function selection"

Pr. 900 "FM terminal calibration"

Set the frequency or current which is referenced when the output frequency or output current is selected for the FM terminal.

Parameter Number	Factory Setting	Setting Range
55	60Hz	0 to 400Hz
56	Rated output current	0 to 500A





<Setting>

Refer to the above diagrams and set the frequency monitoring reference value in Pr. 55 and the current monitoring reference value in Pr. 56.

Pr. 55 is set when Pr. 54 = 0 and Pr. 56 is set when Pr. 54 = 1.

Set the Pr. 55 and Pr. 56 values so that the output pulse train output of terminal FM is 1440pulses/s.

Note: The maximum pulse train output of terminal FM is 2400pulses/s. If Pr. 55 is not adjusted, the output of terminal FM will be filled to capacity. Therefore, adjust Pr. 55.

4.2.22 Automatic restart after instantaneous power failure (Pr. 57, Pr. 58)

Pr. 57 "restart coasting time"

Pr. 58 "restart cushion time"

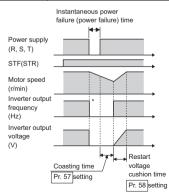
 You can restart the inverter without stopping the motor (with the motor coasting) when power is restored after an instantaneous power failure.

Parameter Number	Factory Setting	Setting Range	Remarks
57	9999	0 to 5 s, 9999	9999: No restart
58	1.0 s	0 to 60 s	

<Setting>

Refer to the following table and set the parameters:

Parameter Number			Description	
	0	0.1K to 1.5K	0.5 s coasting time	Generally use this setting.
	0	2.2K to 7.5K	1.0 s coasting time	Generally use this setting.
57 0.1 to 5 s		1 to 5 s	Waiting time for inverter-triggered restart after power is restored from an instantaneous power failure. (Set this time between 0.1s and 5s according to the inertia moment (J) and torque of the load.)	
	9999		No restart	
58	0	to 60 s	Normally the inverter may be run with the factory settings. These values are adjustable to the load (inertia moment, torque).	



^{*}The output shut off timing differs according to the load condition.

- Note:1. Automatic restart after instantaneous power failure uses a reduced-voltage starting system in which the output voltage is raised gradually with the preset frequency unchanged, independently of the coasting speed of the motor.
 - As in the FR-A024/044, a motor coasting speed detection system (speed search system) is not used but the output frequency before an instantaneous power failure is output. Therefore, if the instantaneous power failure time is longer than 0.2s, the frequency before the instantaneous power failure cannot be stored and the inverter will start at 0Hz.
 - The SU and FU signals are not output during restart but are output after the restart cushion time has elapsed.

ACAUTION

When automatic restart after instantaneous power failure has been selected, the motor and machine will start suddenly (after the reset time has elapsed) after occurrence of an instantaneous power failure. Stay away from the motor and machine.

When you have selected automatic restart after instantaneous power failure, apply the supplied CAUTION seals in easily visible places.

⚠ When the start signal is turned off or the key is pressed during the cushion time for automatic restart after instantaneous power failure, deceleration starts after the automatic restart cushion time set in Pr. 58 "cushion time for automatic restart after instantaneous power failure" has elapsed.

Related parameters

Pr. 1 "maximum frequency"

Pr. 18 "high-speed maximum frequency"

Pr. 44 "second acceleration/

deceleration time"

Pr. 45 "second deceleration time

Pr. 7 "acceleration time" Pr. 8 "deceleration time"

4.2.23 Remote setting function selection (Pr. 59)

Pr. 59 "remote setting function selection"

If the operator panel is located away from the control box, you can use contact signals to perform continuous variable-speed operation, without using analog signals.

- By merely setting this parameter, you can use the acceleration, deceleration and setting clear functions of the motorized speed setter (FR-FK).
- When the remote function is used, the output frequency of the inverter can be compensated for as follows:

External operation mode

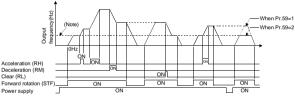
Frequency set by RH/RM operation plus built-in frequency setting potentiometer or external analog frequency command

frequency command
Frequency set by RH/RM operation plus PU's digitally-set frequency or built-in frequency setting potentiometer

PU operation mode

59

er	Factory Setting	Setting Range	1
	0	0, 1, 2	
		•	-



Note: External operation frequency or PU operation frequency other than multi-speed

D. 50	Operation		
Pr. 59 Setting	Remote setting function	Frequency setting storage function (E ² PROM)	
0	No	_	
1	Yes	Yes	
2	Yes	No	

- Use Pr. 59 to select whether the remote setting function is used or not and whether
 the frequency setting storage function* in the remote setting mode is used or not.
 When "remote setting function yes" is selected, the functions of signals RH, RM and
 RL are changed to acceleration (RH), deceleration (RM) and clear (RL). Use Pr. 180
 to Pr. 183 (input terminal function selection) to set signals RH, RM and RL.
- * Frequency setting storage function

The remote setting frequency (frequency set by RH, RM operation) is stored into memory. When power is switched off once, then on again, operation is resumed at this setting of the output frequency. (Pr. 59=1)

<Frequency setting storage condition>

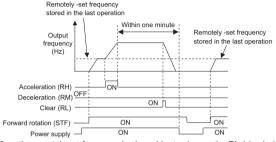
- Frequency at the time when the start signal (STF or STR) has switched off
- The remotely-set frequency is stored every one minute after one minute has elapsed since turn off (on) of both the RH (acceleration) and RM (deceleration) signals. (The frequency is written if the present frequency setting compared with the past frequency setting every one minute is different.) (The state of the RL signal dose not affect writing.)
- Note: 1. The frequency can be varied by RH (acceleration) and RM (deceleration) between 0 and the maximum frequency (Pr. 1 or Pr. 18 setting).
 - 2. When the acceleration or deceleration signal switches on, the set frequency varies according to the slope set in Pr. 44 or Pr. 45. The output frequency acceleration/deceleration times are as set in Pr. 7 and Pr. 8, respectively. Therefore, the longer preset times are used to vary the actual output frequency.
 - If the start signal (STF or STR) is off, turning on the acceleration (RH) or deceleration (RM) signal varies the set frequency.
 - When switching the start signal from ON to OFF, or changing frequency by the RH or RM signal frequently, set the frequency setting value storage function (E²PROM) invalid (Pr.59="2").
 - If set invalid (Pr.59="1"), frequency is written to E²PROM frequently, this will shorten the life of the E²PROM.

REMARKS

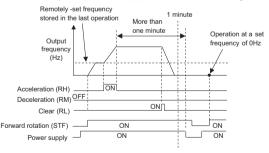
This function is invalid during jog operation and PID control operation.

Setting frequency is "0"

 Even when the remotely-set frequency is cleared by turning on the RL (clear) signal after turn off (on) of both the RH and RM signals, the inverter operates at the remotely-set frequency stored in the last operation if power is reapplied before one minute has elapsed since turn off (on) of both the RH and RM signals



 When the remotely-set frequency is cleared by turning on the RL (clear) signal after turn off (on) of both the RH and RM signals, the inverter operates at the frequency in the remotely-set frequency cleared state if power is reapplied after one minute has elapsed since turn off (on) of both the RH and RM signals.



! CAUTION

riangle When selecting this function, re-set the maximum frequency according to the machine.

4.2.24 Shortest acceleration/deceleration mode (Pr. 60 to Pr. 63)

Pr. 60 "shortest acceleration/deceleration mode"

Pr. 61 "reference current"

Pr. 62 "reference current for acceleration"

Pr. 63 "reference current for deceleration"

Related parameters

Pr. 7 "acceleration time"
Pr. 8 "deceleration time"

The inverter automatically sets the shortest time for acceleration/deceleration for operation.

If you do not set the acceleration and deceleration times and V/F pattern, you can run
the inverter as if appropriate values had been set in the corresponding parameters.
 This operation mode is useful when you want to operate without fine parameter
setting.

Pr. 61 to Pr. 63 are valid only when Pr. 60 = "1, 2, 11,12".

When the shortest acceleration/deceleration mode is selected, the setting values of Pr. 7 "acceleration time", Pr. 8 "deceleration time", Pr. 22 "stall prevention operation level" are made invalid.

Parameter Number	Factory Setting	Setting Range	Remarks
60	0	0, 1, 2, 11, 12	
61	9999	0 to 500A, 9999	9999: Referenced from rated inverter current.
62	9999	0 to 200%, 9999	
63	9999	0 to 200%, 9999	

<Setting>

Pr. 60 Setting	Operation Mode	Description		Invalid parameter
0	Ordinary operation mode			
1	Shortest acceleration/	Set to accelerate/decelerate the motor in the shortest time.	Stall prevention operation level	
11	deceleration mode I	The inverter makes acceleration/ deceleration in the shortest time	150%	Pr. 7, Pr. 8,
2	Shortest acceleration/	celeration/ Set "11" or "12" when using	Stall prevention operation level	Pr. 22
12	deceleration mode II	brake resistance and the brake unit.	180%	

Note: When the shortest acceleration/deceleration mode is selected, regenerative over voltage (E.OV3) may occur if the regenerative brake does not have enough capability at deceleration..

 Set the parameters when it is desired to improve the performance in the shortest acceleration/deceleration mode.

(1) Pr. 61 "reference current"

Set the current value (A) that is referenced for stall prevention operation level. Set this value when you want to use the motor rated current as reference such as when capacities of the motor and inverter differ.

Setting	Reference Current	
9999 (factory setting)	Referenced from rated inverter current	
0 to 500A	Referenced from setting (rated motor current)	

(2) Pr. 62 "reference current for acceleration"

Set the stall prevention operation level (%) at acceleration.

Set when you want to restrict torque at acceleration, etc.

The value set in Pr.61 "reference current" becomes the reference value (100%).

Setting	Reference Current	
9999 (factory setting)	150% (180%) is the limit value.	
0 to 200%	The setting of 0 to 200% is the limit value.	

(3) Pr. 63 "reference current for deceleration"

Set the stall prevention operation level (%) at deceleration.

Set when you want to restrict torque at deceleration, etc.

The value set in Pr.61 "reference current" becomes the reference value (100%).

Setting	Reference Current
9999 (factory setting)	150% (180%) is the limit value.
0 to 200%	The setting of 0 to 200% is the limit value.

4.2.25 Retry function (Pr. 65, Pr. 67 to Pr. 69)

Pr. 65 "retry selection"

Pr. 67 "number of retries at alarm occurrence"

Pr. 68 "retry waiting time"

Pr. 69 "retry count display erasure"

When any protective function (major fault) is activated and the inverter stops its output, the inverter itself resets automatically and performs retries. You can select whether retry is made or not, alarms reset for retry, number of retries made, and waiting time.

Parameter Number	Factory Setting	Setting Range
65	0	0 to 3
67	0	0 to 10, 101 to 110
68	1 s	0.1 to 360 s
69	0	0

<Setting>

Use Pr. 65 to select the protective functions (major faults) which execute retry.

Errors Reset for Retry	Setting			
Display	0	1	2	3
E.OC1	•	•		•
E.OC2	•	•		•
E.OC3	•	•		•
E.OV1	•		•	•
E.OV2	•		•	•
E.OV3	•		•	•
E.THM	•			
E.THT	•			
E.FIN				
E. BE	•			
E. GF	•			
E. LF				
E.OHT	•			
E.OLT	•			
E.OPT	•			
E. PE	•			
E.PUE				
E.RET				
E.CPU				
E.P24				
E. 3				
E. 6				
E. 7				

Note: ● indicates the retry items selected.

Use Pr. 67 to set the number of retries at alarm occurrence.

Pr. 67 Setting	Number of Retries	Alarm Signal Output
0	Retry is not made.	
1 to 10	1 to 10 times	Not output.
101 to 110	1 to 10 times	Output.

- Use Pr. 68 to set the waiting time from when an inverter alarm occurs until a restart in the range 0.1 to 360s.
- Reading the Pr. 69 value provides the cumulative number of successful restart times made by retry. The setting of "0" erases the cumulative number of times.
 - Note: 1. The cumulative number in Pr. 69 is incremented by "1" when retry operation is regarded as successful, i.e. when normal operation is continued without the protective function (major fault) activated during a period five times longer than the time set in Pr. 68.
 - 2. If the protective function (major fault) is activated consecutively within a period five times longer than the above waiting time, the operation panel may show data different from the most recent data or the parameter unit (FR-PU04) may show data different from the first retry data. The data stored as the error reset for retry is only that of the protective function (major fault) which was activated the first time.
 - When an inverter alarm is reset by the retry function at the retry time, the stored data of the electronic thermal relay function, etc. are not cleared. (Different from the power-on reset.)

ACAUTION

⚠ When you have selected the retry function, stay away from the motor and machine unless required. They will start suddenly (after the reset time has elapsed) after occurrence of an alarm.

When you have selected the retry function, apply the supplied CAUTION stickers easily visible places.

Pr. 66 → Refer to Pr. 22.

Pr. 70 →Refer to Pr. 30.

4.2.26 Applied motor (Pr. 71)

Pr. 71 "applied motor"

Set the motor used

· When using the Mitsubishi constanttorque motor, set "1" in Pr. 71 for either V/F control or general-purpose magnetic flux vector control.

The electronic thermal relay function is

Related parameters

Pr. 0 "torque boost"

Pr. 12 "DC injection brake voltage"

Pr. 19 "base frequency voltage" Pr. 80 "motor capacity"

Pr. 96 "auto-tuning setting/status"

set to the thermal characteristic of the constant-torque motor. When you selected the Mitsubishi constant-torque motor, the values of the following parameters are automatically changed. (only for the factory setting value) Pr. 0 "torque boost", Pr. 12 "DC injection brake voltage"

Parameter Number	Factory Setting	Setting Range
71	0	0, 1, 3, 5, 6, 13, 15, 16, 23, 100, 101, 103, 105, 106, 113, 115, 116, 123

<Setting>

Refer to the following list and set this parameter according to the motor used.

Pr. 71	Thermal Characteristics of Electronic		Applied motor		
Setting		mal Relay Function		Standard	Constant- Torque
0, 100	Thermal characteristics	of a standard n	notor	0	
1, 101	Thermal characteristics of a Mitsubishi constant-torque motor			0	
3, 103	Standard motor	Select "offline auto tuning setting".		0	
13, 113	Constant-torque motor				0
23, 123	Mitsubishi general- purpose motor SF-JR4P (1.5kW or less)			0	
5, 105	Standard motor	Star	Motor	0	
15, 115	Constant-torque motor	connection constants can Delta be entered		0	
6, 106	Standard motor		0		
16, 116	Constant-torque motor	connection directly.			0

By setting any of "100 to 123", thermal characteristic of electronic thermal relay function (applied motor) can be changed as indicated below according to the ON/OFF status of the RT signal:

RT Signal	Thermal Characteristic of Electronic Thermal Relay Function (Applied Motor)
OFF	As indicated in the above table
ON	Constant-torque motor

! CAUTION

riangle Set this parameter correctly according to the motor used. Incorrect setting may cause the motor to overheat and burn.

4.2.27 PWM carrier frequency and long wiring mode (Pr. 72, Pr. 240)

Pr. 72 "PWM frequency selection"

Pr. 240 "Soft-PWM setting"

You can change the motor tone.

The long wiring mode can be set for the 400V class.

- By parameter setting, you can select Soft-PWM control which changes the motor tone.
- Soft-PWM control changes motor noise from a metallic tone into an unoffending complex tone.
- Surge voltage is suppressed regardless of wiring length in the long wiring mode. (When operating a 400V motor with wiring length of 40m or longer, select long wiring mode.)

Parameter Number	Factory Setting	Setting Range	Remarks
72	1	0 to 15	0: 0.7kHz, 15: 14.5kHz
240	1	0, 1, 10, 11 (*)	_

^{*}The setting values "10, 11" can be set for the 400V class only.

<Setting>

· Refer to the following list and set the parameters:

Pr. 72 Setting	Setting	Description	
72	0 to 15	PWM carrier frequency can be changed. The setting displayed is in [kHz]. Note that 0 indicates 0.7kHz and 15 indicates 14.5kHz.	

- Note: 1. Note that when the inverter is run at the ambient temperature above 40°C with a 2kHz or higher value set in Pr. 72, the rated output current of the inverter must be reduced. (Refer to page 214.)
 - An increased PWM frequency will decrease the motor sound but increase noise and leakage currents. Therefore, perform the reduction techniques (Refer to pages 42 to 46).

<Setting>

Pr. 240 Setting	Description			
	Soft-PWM	Long wiring mode	Remarks	
0	invalid	invalid	_	
1	valid (when Pr. 72="0 to 5")	invalid	_	
10 (Note)	invalid	valid	Setting can be made	
11 (Note)	valid	valid	only for the 400V class	

Note: Note the following when Pr. 240="10 or 11"

- When Pr. 72 "PWM frequency selection" = "2 or more", PWM carrier frequency is 1kHz.
- 2. Output voltage at the rated frequency decreases by 4V maximum.
- If you copied parameters to the previous version inverter (Pr. 240="10 or 11" is not available), set Pr. 240 again.
- For the 400V class, use an insulation-enhanced motor. (Using other motors may result in insulation deterioration of motors due to surge voltage independently of the Pr. 240 setting.)
- Values exceeding 120Hz can not be written to Pr. 1 (Pr. 18) when Pr. 240="10 or 11". Similarly, "10 or 11" can not be written to Pr. 240 when the value set in Pr. 1 (Pr. 18) exceeds 120Hz.

4.2.28 Voltage input (Pr. 73)

Pr. 73 "0-5V/0-10V selection"

Related parameters -

Pr. 38 "frequency at 5V (10V) input"

 You can change the input (terminal 2) specifications in response to the frequency setting voltage signal. When entering 0 to 10VDC, always make this setting.

Parameter	Factory	Setting	
Number	Setting	Range	
73	0	0, 1	

Setting Terminal 2 Input Voltage	
0	For 0 to 5VDC input (factory setting)
1	For 0 to 10VDC input

Note:1. To change the maximum output frequency at the input of the maximum frequency command voltage, use Pr. 38. Also, the acceleration/deceleration time, which is a slope up/down to the acceleration/deceleration reference frequency, is not affected by the change in Pr. 73 setting.

2. When connecting a frequency setting potentiometer across terminals 10-2-5 for operation, always set "0" in this parameter.

4.2.29 Input filter time constant (Pr. 74)

Pr. 74 "filter time constant"

You can set the input section's internal filter constant for an external voltage or current frequency setting signal.

- Effective for eliminating noise in the frequency setting circuit.
- Increase the filter time constant if steady operation cannot be performed due to noise.
 A larger setting results in slower response. (The time constant can be set between approximately 1ms to 1s with the setting of 0 to 8. A larger setting results in a larger filter time constant.)

Parameter	Factory	Setting
Number	Setting	Range
74	1	0 to 8

4.2.30 Reset selection/disconnected PU detection/PU stop selection (Pr. 75)

Pr. 75 "reset selection/disconnected PU detection/PU stop selection"

You can select the reset input acceptance, operation panel or PU (FR-PU04) connector disconnection detection function and PU stop function.

- Reset selection : You can select the reset function input timing.
- PU disconnection detection: When it is detected that the operation panel/PU (FR-PU04) is disconnected from the inverter for more than 1s, the inverter outputs an alarm code (E.PUE) and
 - comes to an alarm stop.
- PU stop selection : When an alarm occurs in any operation mode, you can stop the inverter from the PU by pressing the Rev.

Parameter Number	Factory Setting	Setting Range
75	14	0 to 3, 14 to 17

<Setting>

Pr. 7 Setti	-	Reset Selection	PU Disconnection Detection	PU Stop Selection
0		Reset input normally enabled.	If the PU is disconnected.	Pressing the
1		Reset input enabled only when the protective function is activated.	operation will be continued.	
2		Reset input normally enabled.	When the PU is	inverter to a stop
3		Reset input enabled only when the protective function is activated.	disconnected, an error is displayed on the PU and the inverter output is shut off.	only in the PU operation mode.
14	ļ	Reset input normally enabled.	If the PU is disconnected,	Pressing the STOP RESET key decelerates the inverter to a stop in any of the PU,
15	5	Reset input enabled only when the protective function is activated.	operation will be continued.	
16	5	Reset input normally enabled.		
17	,	Reset input enabled only when the protective function is activated.		

How to make a restart after a stop by the key on the PU

(1) Operation panel

- 1) After completion of deceleration to a stop, switch off the STF or STR signal.
- 2) Press the key two times* to display [[P, n]].

Note: When Pr. 79 = 3, press the local key three times, to display P U.

Then, press the ▼ key and proceed to step 3).

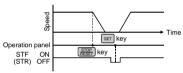
(For the monitor screen)Refer to page 62 for the monitor display provided by pressing the key.

- 3) Press the SET key.
- 4) Switch on the STF or STR signal.

(2) Parameter unit (FR-PU04)

1) After completion of deceleration to a stop, switch off the STF or STR signal.

- Press the SET kev.
- 3) Switch on the STF or STR signal.



Stop and restart example for external operation

The other way of making a restart other than the above method is to perform a powerreset or to make a reset with the inverter reset terminal.

- Note:1. By entering the reset signal (RES) during operation, the inverter shuts off output while it is reset, the data of the electronic thermal relay function and regenerative brake duty are reset, and the motor coasts.
 - The PU disconnection detection function judges that the PU is disconnected when it is removed from the inverter for more than 1s. If the PU had been disconnected before power-on, it is not judged as an alarm.
 - To resume operation, reset the inverter after confirming that the PU is connected securely.
 - The Pr. 75 value can be set any time. Also, if parameter (all) clear is executed, this setting will not return to the initial value.
 - When the inverter is stopped by the PU stop function, PS is displayed but an alarm is not output.

When the PU connector is used for RS-485 communication operation, the reset selection and PU stop selection functions are valid but the PU disconnection detection function is invalid.

! CAUTION

⚠ Do not reset the inverter with the start signal on. Otherwise, the motor will start instantly after resetting, leading to potentially hazardous conditions.

4.2.31 Parameter write disable selection (Pr. 77)

Pr. 77 "parameter write disable selection"

Related parameters -

Pr. 79 "operation mode selection"

You can select between write-enable and disable for parameters. This function is used to prevent parameter values from being rewritten by incorrect operation.

ſ	Parameter Number	Factory Setting	Setting Range
Γ	77	0	0, 1, 2

<Setting>

Pr. 77 Setting	Function	
Parameter values may only be written during a sto PU operation mode. (Note 1)		
1	Write disabled. (Note 2) Values of Pr. 22, Pr. 75, Pr. 77 and Pr. 79 "operation mode selection" can be written.	
2	Write enabled even during operation. (Note 3) Setting is enabled independently of the operation mode.	

- Note:1. The shaded parameters in the parameter list (page 76) can be set at any time.
 - 2. By setting "1" in Pr. 77, the following clear operations can be inhibited:
 - Parameter clear
 - · Parameter all clear
 - 3. If Pr. 77 = 2, the values of Pr. 23, Pr. 66, Pr. 71, Pr. 79, Pr. 80, Pr. 83, Pr. 84, Pr. 96, Pr. 180 to Pr.183 and Pr. 190 to Pr. 192 cannot be written during operation. Stop operation when changing their parameter settings.

4.2.32 Reverse rotation prevention selection (Pr. 78)

Pr. 78 "reverse rotation prevention selection"

Related parameters

Pr. 79 "operation mode selection"

This function can prevent any reverse rotation fault resulting from the incorrect input of the start signal.

Used for a machine which runs only in one direction, e.g. fan, pump.
 (The setting of this function is valid for the combined, PU, external and communication operations.)

Parameter	Factory	Setting
Number	Setting	Range
78	0	0, 1, 2

<Setting>

Pr. 78 Setting	Function	
0	Both forward and reverse rotations allowed	
Reverse rotation disallowed		
2	Forward rotation disallowed	

4.2.33 Operation mode selection (Pr. 79)

Pr. 79 "operation mode selection"

Used to select the operation mode of the inverter. The inverter can be run from the operation panel or parameter unit (PU operation), with external signals (external operation), or by combination of PU operation and external operation (external/PU combined operation).

When power is switched on (factory setting), the PU operation mode is selected.

Parameter	Factory	Setting		
Number	Setting	Range		
79	1	0 to 4, 6 to 8		

Related parameters

Pr. 4 to Pr. 6, Pr. 24 to Pr. 27,

Pr. 232 to Pr. 239 (multi-speed operation)

Pr. 75 "reset selection/disconnected PU detection/PU stop selection"

Pr. 146 "frequency setting command

selection" Pr. 180 to Pr. 183

(input terminal function selection

<Setting>

In the following table, operation using the operation panel or parameter unit is abbreviated to PU operation.

Pr. 79 Setting	Function			
0	When power is switched on, the external operation mode is selected. PU or external operation can be selected by pressing the keys of the operation pan parameter unit. (Refer to page 60) For these modes, refer to the setting 1 and 2 be			
	Operation mode	Running frequency	Start signal	
1	PU operation mode (*)	Digital setting using the built-in frequency setting potentiometer or by the key operation of the operation panel or parameter unit	(FWD), (REV) key of operation panel or FWD or REV key of parameter unit	
2	External operation mode	External signal input (across terminals 2 (4)-5, multi-speed selection)		
3	External/PU combined operation mode 1 (*)	Digital setting using the built-in frequency setting potentiometer or by the key operation of the operation panel or parameter unit, or external signal input (multi-speed setting only)	External signal input (terminal STF, STR)	
4	External/PU combined operation mode 2	External signal input (across terminals 2 (4)-5, multi-speed selection)	(FWD), REV) key of operation panel or FWD or REV key of parameter unit	
6	Switch-over mode Switch-over between PU and external operation modes can be done while re			
7 External operation mode (PU operation interlock) MRS signal ONAble to be switched to PU operation mode during external operation) MRS signal OFF Switching to PU operation mode inhibited			ode inhibited	
8	Switching to other than external operation mode (disallowed during operation) X16 signal ON Switched to external operation mode X16 signal OFF Switched to PU operation mode			

Use Pr. 146 "frequency setting command selection" to select whether operation is to be performed with the built-in frequency setting potentiometer or (▲)/√√ key.

Note: 1. Either "3" or "4" may be set to select the PU/external combined operation.

These settings differ in starting method.

The stop function (PU stop selection) activated by pressing estimates of the PU (operation panel/FR-PU04) is valid even in other than the PU operation mode when shipped from the factory. (Refer to page 121.)

(1) Switch-over mode

During operation, you can change the current operation mode to another operation mode.

Operation Mode Switching	Switching Control/Operating Status	
External operation to PU operation	Operate the operation panel keys to select the PU operation mode. Rotation direction is the same as that of external operation. Set frequency is the same as the external frequency setting signal value. (Note that the setting will disappear when power is switched off or the inverter is reset.)	
PU operation to external operation	Operate the operation panel keys to select the external operation mode. Rotation direction is determined by the external operation input signal. Set frequency is determined by the external frequency setting signal.	

Note: When the switch-over mode is selected, the operation panel's potentiometer setting is made invalid even if the Pr. 146 "built-in potentiometer switching" setting is 0 or 9999.

(2) PU operation interlock

PU operation interlock forces the operation mode to be changed to the external operation mode when the MRS signal switches off. This function prevents the inverter from being inoperative by the external command if the mode is accidentally left unswitched from the PU operation mode.

1)Preparation

- Set "7" in Pr. 79 (PU operation interlock).
- Set the terminal used for MRS signal input with any of Pr. 180 to Pr. 183 (input terminal function selection).

Refer to page 161 for Pr. 180 to Pr. 183 (input terminal function selection).

Note: When terminal assignment is changed using Pr. 180 to Pr. 183, the other functions may be affected.

Check the functions of the corresponding terminals before making settings.

2)Function

MRS Signal	Function/Operation
ON	Output stopped during external operation. Operation mode can be switched to PU operation mode. Pu operation allowed. PU operation allowed.
OFF	Forcibly switched to external operation mode. External operation allowed. Switching to PU operation mode inhibited.

<Function/operation changed by switching on-off the MRS signal>

Operating Condition		IVIING	Operation Mode	Operating Status	Parameter	Switching to PU
Operation mode	Status	Signal	(Note 4)	Operating Status	Write	Operation Mode
	During stop	ON → OFF (Note 3)		During stop	Enabled → disabled	Disabled
PU	During operation	ON → OFF (Note 3)	External	If external operation frequency setting and start signal are entered, operation is performed in that status.	Enabled → disabled	Disabled
	During	$OFF \to ON$		During stop	Disabled → disabled	Enabled
External	stop	$ON \rightarrow OFF$	External	During stop	Disabled → disabled	Disabled
LAGIIIdi	During	$OFF \to ON$	LAIGIIIdi	During operation → output stop	Disabled → disabled	Disabled
	operation	$ON \rightarrow OFF$		Output stop → operation	Disabled → disabled	Disabled

- Note: 1. If the MRS signal is on, the operation mode cannot be switched to the PU operation mode when the start signal (STF, STR) is on.
 - The operation mode switches to the external operation mode independently of whether the start signal (STF, STR) is on or off. Therefore, the motor is run in the external operation mode when the MRS signal is switched off with either of STF and STR on.
 - 3. When the protective function (major fault) is activated, the inverter can be reset by pressing the key of the operation panel.
 - Switching the MRS signal on and rewriting the Pr. 79 value to other than "7" in the PU operation mode causes the MRS signal to provide the ordinary MRS function (output stop). Also as soon as "7" is set in Pr. 79, the operation mode is switched to PU operation mode.

(3) Operation mode switching by external signal

Preparation

Set "8" (switching to other than external operation mode) in Pr. 79.

Use any of Pr. 180 to Pr. 183 (input terminal function selection) to set the terminal used for X16 signal input.

Refer to page 161 for Pr. 180 to Pr. 183 (input terminal function selection).

Note: When terminal assignment is changed using Pr. 180 to Pr. 183, the other functions may be affected.

Check the functions of the corresponding terminals before making settings.

2) Function

This switching is enabled during an inverter stop only and cannot be achieved during operation.

X16 Signal Operation Mode	
ON	External operation mode (cannot be changed to the PU operation mode)
OFF	PU operation mode (cannot be changed to the external operation mode)

4.2.34 General-purpose magnetic flux vector control selection (Pr. 80)

Pr. 80 "motor capacity"

Related parameters

Pr. 71 "applied motor"

Pr. 83 "rated motor voltage"

Pr. 84 "rated motor frequency"

Pr. 96 "auto-tuning setting/status

You can set the general-purpose magnetic flux vector control.

General-purpose magnetic flux vector control

Provides large starting torque and sufficient low-speed torque.

If the motor constants vary slightly, stable, large low-speed torque is provided without specific motor constant setting or tuning.

Parameter Factory Number Setting		Setting Range	Remarks
80	9999	0.1kW to 7.5kW, 9999 (Note)	9999: V/F control

Note: The setting range changes with the inverter: 0.2kW to 7.5kW, 9999 for the 400V class.

If any of the following conditions are not satisfied, faults such as torque shortage and speed fluctuation may occur. In this case, select V/F control.

<Operating conditions>

- The motor capacity is equal to or one rank lower than the inverter capacity.
- The number of motor poles is any of 2, 4, and 6. (4 poles only for the constant-torque motor)
- · Single-motor operation (one motor for one inverter) is performed.
- The wiring length between the inverter and motor is within 30m. (If the length is over 30m, perform offline auto tuning with the cables wired.)

<Setting>

(1) General-purpose magnetic flux vector control

 The general-purpose magnetic flux vector control can be selected by setting the capacity of the motor used in Pr. 80.

	Parameter Number	Setting	Description	
	80	9999	V/F control	
		0.1 to 7.5/ 0.2 to 7.5 (Note)	Set the motor capacity applied.	General-purpose magnetic flux vector control

Note: The setting range changes with the inverter: 0.2kW to 7.5kW, 9999 for the 400V class.

 When using Mitsubishi constant-torque motor (SF-JRCA), set "1" in Pr. 71. (When using the SF-HRCA, perform the offline auto tuning.)

4.2.35 Offline auto tuning function (Pr. 82 to Pr. 84, Pr. 90, Pr. 96)

Pr. 82 "motor excitation current"

Pr. 83 "rated motor voltage"

Pr. 84 "rated motor frequency"

Pr. 90 "motor constant (R1)"

Pr. 96 "auto-tuning setting/status"

Related parameters

Pr. 7 "acceleration time"

Pr. 9 "electronic thermal O/L relay

Pr. 71 "applied motor"

Pr. 79 "operation mode selection"

Pr. 80 "motor capacity"

What is auto tuning?

- (1) The general-purpose magnetic flux vector control system gets the best performance from the motor for operation.
- (2) Using the offline auto tuning function to improve the operational performance of the motor.

When you use the general-purpose magnetic flux vector control, you can perform the offline auto tuning operation to calculate the motor constants automatically.

- Offline auto tuning is made valid only when Pr. 80 is set to other than "9999" to select the general-purpose magnetic flux vector control.
- The Mitsubishi standard motor (SF-JR0.4kW or more) or Mitsubishi constant-torque motor (SF-JRCA 200V class and 4-pole motor of 0.4kW to 7.5kW) allows general-purpose magnetic flux vector control operation to be performed without using the offline auto tuning function. However, if any other motor (Motor made of the other manufacturers or SF-JRC, etc.) is used or the wiring distance is long, using the offline auto tuning function allows the motor to be operated with the optimum operational characteristics.
- Offline auto tuning

Automatically measures the motor constants used for general-purpose magnetic flux vector control.

- · Offline auto tuning can be performed with the load connected.
- The offline auto tuning status can be monitored with the operation panel or PU (FR-PU04).
- Offline auto tuning is available only when the motor is at a stop.
- Tuning data (motor constants) can be copied to another inverter with the PU (FR-PU04).
 - You can read, write and copy the motor constants tuned by the offline auto tuning.

Parameter Number	Factory Setting	Setting Range	Remarks
82	9999	0 to 500A, 9999	9999: Mitsubishi standard motor
83	200V/400V	0 to 1000V	Rated inverter voltage
84	60Hz	50 to 120Hz	
90	9999	0 to 50Ω, 9999	9999: Mitsubishi standard motor
96	0	0, 1	0: No tuning

<Operating conditions>

- · The motor is connected.
- The motor capacity is equal to or one rank lower than the inverter capacity.
- Special motors such as high-slip motors and high-speed motors cannot be tuned.
- The motor may move slightly. Therefore, fix the motor securely with a mechanical brake, or before tuning, make sure that there will be no problem in safety if the motor runs.
 - *This instruction must be followed especially for vertical lift applications.

If the motor runs slightly, tuning performance is unaffected.

 Offline auto tuning will not be performed properly if it is started when a reactor or surge voltage suppression filter (FR-ASF-H) is connected between the inverter and motor. Remove it before starting tuning.

<Setting>

(1) Parameter setting

- Set the motor capacity (kW) in Pr. 80 and select the general-purpose magnetic flux vector control.
- · Refer to the parameter details list and set the following parameters:
 - 1) Set "1" in Pr. 96.
 - 2) Set the rated motor current (A) in Pr. 9.
 - 3) Set the rated motor voltage (V) in Pr. 83.
 - 4) Set the rated motor frequency (Hz) in Pr. 84.
 - 5) Select the motor using Pr. 71.
 - Standard motorPr. 71 = "3" or "103"

 - Mitsubishi standard motor SF-JR 4 poles (1.5kW or less)...... Pr. 71 = "23" or "123"

Note: Pr. 83 and Pr. 84 are only displayed when the general-purpose magnetic flux vector control is selected.

In these parameters, set the values given on the motor plate. Set 200V/60Hz or 400V/60Hz if the standard or other motor has more than one rated value.

After tuning is over, set the Pr. 9 "electronic thermal O/L relay" value to the rated current at the operating voltage/frequency.

■ Parameter details

Parameter Number	Setting	Description			
9	0 to 500A	Set the rated motor current (A).			
	0, 100	Thermal characteristics suitable for standard motor			
	1, 101	Thermal characteristics sui torque motor	oishi's constant-		
	3, 103	Standard motor		Calaat Ila#iilaa	
	13, 113	Constant-torque motor		Select "offline auto tuning setting"	
71 (Note)	23, 123	Mitsubishi's SF-JR4P standard motor (1.5kW or less)			
	5, 105	Standard motor	Star		
	15, 115	Constant-torque motor	connection	Direct input of motor constants enabled	
	6, 106	Standard motor	Delta		
	16, 116	Constant-torque motor	connection		
83	0 to 1000V	Set the rated motor voltage (V).			
84	50 to 120Hz	Set the rated motor frequency (Hz).			
90	0 to 50Ω, 9999	Tuning data (Values measured by offline auto tuning are set automatically.)			
96	0	Offline auto tuning is not performed.			
90	1	Offline auto tuning is perfor	Offline auto tuning is performed.		

Note: The electronic thermal relay function characteristics are also selected simultaneously. By setting any of "100 to 123", the electronic thermal relay function changes to the thermal characteristic of the constant-torque motor when the RT signal switches on.

(2) Tuning execution

- For PU operation or combined operation 2, press the FWD or REV key.
- For external operation or combined operation 1, switch on the run command.

Note: 1. To force tuning to end

- Switch on the MRS or RES signal or press the REST key to end.
- Switch off the tuning start command to make a forced end.
- 2. During offline auto tuning, only the following I/O signals are valid:
 - Input signals
 - <Valid signals> MRS, RES, STF, STR
 - Output signals
 RUN, FM, A, B, C
- Special caution should be exercised when a sequence has been designed to open the mechanical brake with the RUN signal.

(3) Monitoring the offline tuning status

When the parameter unit (FR-PU04) is used, the Pr. 96 value is displayed during tuning on the main monitor as shown below. When the operation panel is used, the same value as on the PU is only displayed:

· Operation panel display

(For inverter trip)

	1. Setting	2. Tuning in progress	3. Completion	4. Error- activated end
Displayed value	1 —	2 —	→ 3	9

· Parameter unit (FR-PU04) main monitor

(For inverter trip)

	1. Setting	2. Tuning in progress	3. Completion	4. Error- activated end
Display	1 STOP PU	TUNE 2 STF FWD PU	TUNE 3 COMPLETION STF STOP PU	TUNE 9 ERROR STF STOP PU

· Reference: Offline auto tuning time (factory setting) is about 10s.

(4) Ending the offline auto tuning

1) Confirm the Pr. 96 value.

Normal end: "3" is displayed.

Abnormal end: "9". "91". "92" or "93" is displayed.

· Forced end: "8" is displayed.

2) When tuning ended normally

For PU operation or combined operation 2, press the key. For external operation or combined operation 1, switch off the start signal (STF or STR) once. This operation resets the offline auto tuning and the PU's monitor display returns to the ordinary indication. (Without this operation, next operation cannot be done.) Do not change the Pr.96 setting after completion of tuning (3). If the Pr.96 setting is changed, tuning data is made invalid. If the Pr.96 setting is changed, tuning must be performed again.

3) When tuning was ended due to an error

Offline auto tuning did not end normally. (The motor constants have not been set.)
Reset the inverter and start tuning all over again.

4) Error display definitions

Error Display	Error Cause	Remedy
9	Inverter trip	Make setting again.
91	Current limit (stall prevention) function was activated.	Increase acceleration/deceleration time. Set "1" in Pr. 156.
92	Converter output voltage reached 75% of rated value.	Check for fluctuation of power supply voltage.
93	Calculation error	Check the motor wiring and make setting again.

No connection with motor will result in a calculation (93) error.

5) When tuning was forced to end

An forced end occurs when you forced the tuning to end by pressing the key or switching off the start signal (STF or STR) during tuning.

In this case, the offline auto tuning has not ended normally.

(The motor constants are not set.)

Reset the inverter and restart the tuning.

- Note: 1. The R1 motor constant measured during the offline auto tuning is stored as a parameter and its data is held until the offline auto tuning is performed again.
 - An instantaneous power failure occurring during tuning will result in a tuning error.
 - After power is restored, the inverter goes into the ordinary operation mode. Therefore, when STF (STR) is on, the motor runs in forward (reverse) rotation.
 - Any alarm occurring during tuning is handled as in the ordinary mode. Note that if an error retry has been set, retry is ignored.
 - 4. The set frequency monitor displayed during the offline auto tuning is 0Hz.

! CAUTION

When the offline auto tuning is used for an elevating machine, e.g. a lifter, it may drop due to insufficient torque.

<Setting the motor constant as desired>

• To set the motor constant without using the offline auto tuning data

<Operating procedure>

1. Set any of the following values in Pr. 71:

		Star Connection Motor	Delta Connection Motor
Setting	Standard motor	5 or 105	6 or 106
	Constant-torque motor	15 or 115	16 or 116

By setting any of "105 to 116", the electronic thermal relay function changes to the thermal characteristics of the constant-torque motor when the RT signal switches on.

2. Set "801" in Pr. 77.

(Only when the Pr. 80 setting is other than "9999", the parameter values of the motor excitation current (Pr. 82) and motor constant (Pr. 90) can be displayed. Though the parameters other than Pr. 82 and Pr. 90 can also be displayed, they are parameters for manufacturer setting and their values should not be changed.)

3. In the parameter setting mode, read the following parameters and set desired values:

Parameter Number	Name	Setting Range	Setting Increments	Factory Setting
82	Motor excitation current	0 to 500A, 9999	0.01A	9999
90	Motor constant (R1)	0 to 50Ω, 9999	0.001Ω	9999

- 4. Return the Pr. 77 setting to the original value.
- 5. Refer to the following table and set Pr. 84:

Parameter Number	Name	Setting Range	Setting Increments	Factory Setting
84	Rated motor frequency	50 to 120Hz	0.01Hz	60Hz

- Note: 1. The Pr. 90 value may only be read when general-purpose magnetic flux vector control has been selected.
 - Set "9999" in Pr. 90 to use the standard motor constant (including that for the constant-torque motor).
 - If "star connection" is mistaken for "delta connection" or vice versa during setting of Pr. 71, general-purpose magnetic flux vector control cannot be exercised normally.

Related parameter

Pr. 146 "frequency setting

command selection"

4.2.36 Computer link operation (Pr. 117 to Pr. 124, Pr. 342)

Pr. 117 "communication station number"

Pr. 118 "communication speed"

Pr. 119 "stop bit length"

Pr. 120 "parity check presence/absence"

Pr. 121 "number of communication retries"

Pr. 122 "communication check time interval"

Pr. 123 "waiting time setting"

Pr. 124 "CR • LF presence/absence selection"

Pr. 342 "E²PROM write selection"

Used to perform required settings for RS-485 communication between the inverter and personal computer.

Using the inverter setup software (FR-SW□-SETUP-WE (or -WJ for Japanese version)), parameter setting, monitoring, etc. can be done efficiently.

■ The motor can be run from the PU connector of the inverter using RS-485

 The motor can be run from the PU connector of the inverter using RS-485 communication.

Communication specifications

Conforming standard			RS-485		
Num	ber of inv	erters connected	1:N (maximum 32 inverters)		
Com	municatio	n speed	Selectable between 19200, 9600 and 4800bps		
Cont	rol protoc	ol	Asynchronous		
Com	municatio	n method	Half-duplex		
uc s	Characte	r system	ASCII (7 bits/8 bits) selectable		
atio	Stop bit I	ength	Selectable between 1 bit and 2 bits.		
nici at	Terminat	or	CR/LF (presence/absence selectable)		
E ij	Check	Parity check	Selectable between presence (even/odd) and absence		
Communication specifications	Stop bit length Terminator Check Parity check Sum check		Present		
0 "	Waiting t	ime setting	Selectable between presence and absence		

For the instruction codes of the parameters, refer to Appendix 1 "Instruction Code List" (page 228).

REMARKS

For computer link operation, set 65520 (HFFF0) as the value "8888" and 65535 (HFFFF) as the value "9999".

Parameter Number	Factory Setting	Setting Range	
117	0	0 to	31
118	192	48, 96	6, 192
119	4	Data length 8	0, 1
119	ı	Data length 7	10, 11
120	2	0, 1, 2	
121	1	0 to 10), 9999
122*	0	0, 0.1 to 999.8 s, 9999	
123	9999	0 to 150, 9999	
124	1	0, 1, 2	
342 0 0, 1			1

^{*} When making communication, set any value other than 0 in Pr. 122 "communication check time interval".

<Setting>

To make communication between the personal computer and inverter, the communication specifications must be set to the inverter initially. If initial setting is not made or there is a setting fault, data transfer cannot be made.

Note: After making the initial setting of the parameters, always reset the inverter. After you have changed the communication-related parameters, communication cannot be made until the inverter is reset.

Parameter Number	Description	Setti	ing	Description
117	Communication station number	0 to	31	Station number specified for communication from the PU connector. Set the inverter station numbers when two or more inverters are connected to one personal computer.
	Communication	48	-	4800bps
118	speed	96		9600bps
	эреец	19	2	19200bps
		8 bits	0	Stop bit length 1 bit
119	Stop bit length	O Dito	1	Stop bit length 2 bits
113	Stop bit length	7 bits	10	Stop bit length 1 bit
		7 5113	11	Stop bit length 2 bits
	Parity check	0		Absent
120	presence/	1		Odd parity present
	absence	2		Even parity present
	Number of	0 to	10	Set the permissible number of retries at occurrence of a data receive error. If the number of consecutive errors exceeds the permissible value, the inverter will come to an alarm stop.
121	communication retries	9999 (65535)		If a communication error occurs, the inverter will not come to an alarm stop. At this time, the inverter can be coasted to a stop by MRS or RES input. During a communication error (H0 to H5), the minor fault signal (LF) is switched on. Allocate the used terminal with any of Pr. 190 to Pr. 192 (multi-function outputs).

PARAMETERS

Parameter Number	Description	Setting	Description		
		0	No communication		
122	Communication check time interval	0.1 to 999.8	Set the communication check time [seconds] interval. If a no-communication state persists for longer than the permissible time, the inverter will come to an alarm stop.		
		9999	Communication check suspension		
123	Waiting time setting	0 to 150	Set the waiting time between data transmission to the inverter and response.		
	seung	9999	Set with communication data.		
	CR • LF	0	Without CR/LF		
124	instruction presence/ absence	1	With CR, without LF		
124		2	With CR/LF		
342*	E ² PROM write selection	0	When parameter write is performed from the computer, parameters are written to E ² PROM.		
342		1	When parameter write is performed from the computer, parameters are written to RAM.		

When you have set write to RAM, powering off the inverter clears the parameter values that have been changed. Therefore the parameter values available when power is switched on again are those stored previously in E²PROM.

When the parameter values will be changed frequently, set "1" in Pr. 342 to choose write to RAM. Performing frequent parameter write with "E²PROM write" set will shorten the life of the F²PROM

The Pr. 342 " E²PROM write selection" setting is also valid when the communication option is fitted.

Set "1" or "9999" in Pr. 146 "frequency setting command selection" .

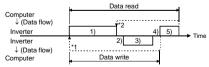
REMARKS

When parameter is set to without E²PROM write (Pr.342="1"), performing power reset or terminal reset returns the setting value to the original value (value stored in E²PROM).

<Computer programming>

(1) Communication protocol

Data communication between the computer and inverter is performed using the following procedure:



- *1. If a data error is detected and a retry must be made, execute retry operation with the user program. The inverter comes to an alarm stop if the number of consecutive retries exceeds the parameter setting.
- *2. On receipt of a data error occurrence, the inverter returns "reply data 3)" to the computer again. The inverter comes to an alarm stop if the number of consecutive data errors reaches or exceeds the parameter setting.

(2) Communication operation presence/absence and data format types

Communication operation presence/absence and data format types are as follows:

No.	Opera	ation	Run Command	Running Frequency	Parameter Write	Inverter Reset	Monitoring	Parameter Read
1)	Communication sent to the investment accordance will program in the	erter in th the user	A'	A (A") Note 1	A (A") Note 2	Α	В	В
2)	Inverter data p time	Present	Present	Present	Absent	Present	Present	
3)	Reply data from the inverter	No error* (Request accepted)	С	С	С	Absent	E,E' (E") Note 1	E (E") Note 2
3)	(Data 1) is checked for error.	With error (request rejected)	D	D	D	Absent	F	F
4)	Computer processing delay time		Absent	Absent	Absent	Absent	Absent	Absent
	Answer from computer in response to	No error* (No inverter processing)	Absent	Absent	Absent	Absent	G	G
5)		With error. (Inverter outputs 3) again)	Absent	Absent	Absent	Absent	Н	Н

^{*} In the communication request data from the computer to the inverter, 10ms or more is also required after "no data error (ACK)", (Refer to page 141.)

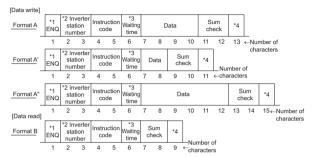
- Note: 1. Setting any of "0.01 to 9998" in Pr. 37 "speed display" and "1" in instruction code "HFF" changes the data format to A" or E" (400V class). Regardless of the instruction code "HFF" setting, the data format for 200V or 100V class is always A" or E". The output frequency is the value of the speed display and its unit is 0.001r/min. If the instruction code FF is not 1, the unit is 1r/min and the 4-digit data format can be used.
 - 2. The read/write data format of Pr. 37 "speed display" is always E"/A".

(3) Data format

Data used is hexadecimal.

Data is automatically transferred in ASCII between the computer and inverter.

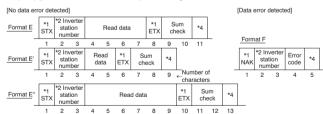
- Data format types
- 1) Communication request data from computer to inverter



2) Reply data from inverter to computer during data write



3) Reply data from inverter to computer during data read



4) Send data from computer to inverter during data read



- *1. Indicate a control code. (Refer to page 140.)
- *2. The inverter station numbers may be set between H00 and H1F (stations 0 and 31) in hexadecimal.
- *3. When the Pr. 123 "waiting time setting" setting is other than "9999", create the communication request data without "waiting time" in the data format. (The number of characters is decremented by 1.)
- *4. CR. LF code

When data is transmitted from the computer to the inverter, codes CR (carriage return) and LF (line feed) are automatically set at the end of a data group on some computers. In this case, setting must also be made on the inverter according to the computer. Also, the presence and absence of the CR and LF codes can be selected using Pr. 124.

(4) Data definitions

1)Control codes

Signal	ASCII Code	Description			
STX	H02	Start of Text (Start of data)			
ETX	H03	End of Text (End of data)			
ENQ	H05	Enquiry (Communication request)			
ACK	H06	Acknowledge (No data error detected)			
LF	H0A	Line Feed			
CR	H0D	Carriage Return			
NAK	H15	Negative Acknowledge (Data error detected)			

2)Inverter station number

Specify the station number of the inverter which communicates with the computer.

3)Instruction code

Specify the processing request, e.g. operation, monitoring, given by the computer to the inverter. Hence, the inverter can be run and monitored in various ways by specifying the instruction code as appropriate. (Refer to page 228.)

4)Data

Indicates the data such as frequency and parameters transferred to and from the inverter. The definitions and ranges of set data are determined in accordance with the instruction codes. (Refer to page 228.)

5)Waiting time

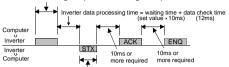
Specify the waiting time between the receipt of data at the inverter from the computer and the transmission of reply data. Set the waiting time in accordance with the response time of the computer between 0 and 150ms in 10ms increments (e.g. 1 = 10ms, 2 = 20ms).



Note: When the Pr. 123 "waiting time setting" setting is other than "9999", create the communication request data without "waiting time" in the data format. (The number of characters is decremented by 1.)

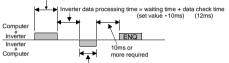
6)Response time

Data sending time (refer to the following formula)



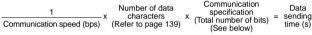
Data sending time (refer to the following formula)

Data sending time (refer to the following formula)



Data sending time (refer to the following formula)

[Formula for data sending time]



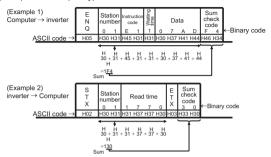
Communication specification

Name		Number of Bits
Stop bit length	1	1 bit 2 bits
Data length		7 bits 8 bits
Parity Yes		1 bit
check	No	0 bit

In addition to the bits in the above table, 1 bit is required for the start bit. Minimum total number of bits...... 9 bits Maximum total number of bits...... 12 bits

7)Sum check code

The sum check code is 2-digit ASCII (hexadecimal) representing the lower 1 byte (8 bits) of the sum (binary) derived from the checked ASCII data.



8)Error code

If any error is found in the data received by the inverter, its definition is sent back to the computer together with the NAK code. (Refer to page 146.)

- Note: 1. When the data from the computer has an error, the inverter will not accept that data.
 - Any data communication, e.g. run command, monitoring, is started when the computer gives a communication request. Without the computer's command, the inverter does not return any data. For monitoring, therefore, design the program to cause the computer to provide a data read request as required.
 - When the parameter setting is read or written, the data of the link parameter expansion setting changes depending on the parameter. For the data, refer to the parameter instruction code list on page 228.

ACAUTION

- When the inverter's permissible communication time interval is not set, interlocks are provided to disable operation to prevent hazardous conditions. Always set the communication check time interval before starting operation.
- ⚠ Data communication is not started automatically but is made only once
 when the computer provides a communication request. If communication
 is disabled during operation due to signal cable breakage etc, the inverter
 cannot be stopped. When the communication check time interval has
 elapsed, the inverter will come to an alarm stop (E.PUE).

 The inverter can be coasted to a stop by switching on its RES signal or by
 switching power off.
- ⚠ If communication is broken due to signal cable breakage, computer fault etc, the inverter does not detect such a fault. This should be fully noted.

<Setting items and set data>

After completion of parameter settings, set the instruction codes and data then start communication from the computer to allow various types of operation control and monitoring.

		ltem		Instruction Code	Description			Number of Data Digits (Instruction code FF=1)		
	Opera	ıtion	Read	H7B		H0001: External operation H0002: Communication operation				
	mode		Write	HFB	H0001:	External opera	tion		4 digits	
			vviile	ПГБ		H0002: Communication operation				
	frec	tput quen eed]		H6F	H0000 to	H0000 to HFFFF: Output frequency (hexadecimal) in 0.01Hz increments [Speed (hexadecimal) in r/min increments if Pr. 37 = 1 to 9998]				
		tput rent		H70		0.01A	incremen		4 digits	
		Output voltage H71		H71	H0000 to				4 digits	
2 Variotivo W	Alaı			H0000 to HFFFF:Two most recent alarm			4 digits			
					H60 H70	OLT BE	HF7	E. 7		

PARAMETERS

No.	Item	Instruction Code		D	escriptio	n		Number of Data Digits (Instruction code FF=1)
3	Run command	HFA	[Fo	0 0 0 or example 1 1] H02 For rota 2] H00 Stop	b2:] b3: vard b4: tion b5:	Forward rotati Reverse rotati		2 digits
4	Inverter status monitor	Н7А	[Example 1]					
	Set frequency read (RAM) Set frequency	H6D H6E		Reads the set frequency (RAM or E ² PROM). H0000 to H9C40: 0.01Hz increments				
5	read (E ² PROM) Set frequency write (RAM)	HED	H0000 to H	H0000 to H9C40: 0.01Hz increments (hexadecimal) (0 to 400.00Hz)				
	Set frequency write (E ² PROM)	HEE	write data (Instructio	To change the set frequency consecutively, write data to the inverter RAM. (Instruction code: HED)				
6	Inverter reset	HFD	H9696: Re As the inv communic cannot se	erter is re	set on sta	uter, the in		4 digits
7	Alarm definition batch clear	HF4	H9696: Ba	atch clear	of alarm	history		4 digits
			All parame Any of fou performed	ır differen	t all clear	operation		
			Pr. Data	Commu- nication Pr.	Calibra- tion	Other Pr.*	HEC HFF	
			H9696	0	×	0	0	
8	All parameter	HFC	H9966	0 ×	0 ×	0 0	0	4 digits
	clear		H5A5A H55AA	×	Ô	0	0	
			When all parameter clear is executed for H9696 or H9966, communication-related parameter settings also return to the factory settings. When resuming operation, set the parameters again. * Pr. 75 and Pr. 146 are not cleared.				imeter ngs.	

PARAMETERS

No.	Item		ltem		ltem		Instruction Code	Description	Number of Data Digits (Instruction code FF=1)
9	Parameter write		H80 to HFD	Refer to the "Instruction Code List" (page 228)	4 -11 -14 -				
10	Parameter	read	H00 to H7B	and write and/or read the values as required.	4 digits				
11	11 parameter		H7F	Parameter description is changed according to the H00 to H09 setting.	2 digits				
11			HFF	For details of the settings, refer to the parameter instruction code list (page 228).					
12	Second parameter changing	Read	H6C	When setting the bias/gain (instruction codes H5E to H61, HDE to HE1) parameters	2 digits				
12	(Instruction code HFF = 1)		HEC	H00: Offset/gain H01: Analog H02: Analog value of terminal	2 uigits				

REMARKS
For the instruction codes HFF, HEC, their set values are held once they are written, but changed to 0 when the inverter is reset or all clear is performed.

<Error Code List>

The corresponding error code in the following list is displayed if an error is detected in any communication request data from the computer:

Error Code	Item	Definition	Inverter Operation		
Н0	Computer NAK error				
H1	Parity error	The parity check result does not match the specified parity.			
H2	Sum check error	The sum check code in the computer does not match that of the data received by the inverter.	Brought to an alarm stop (E.PUE) if error occurs		
НЗ	Protocol error	Data received by the inverter is in wrong protocol, data receive is not completed within given time, or CR and LF are not as set in the parameter.	continuously more than the allowable number of retries.		
H4	Framing error	The stop bit length is not as specified by initialization.			
H5	Overrun error	New data has been sent by the computer before the inverter completes receiving the preceding data.			
H6	_	_	_		
H7	Character error	The character received is invalid (other than 0 to 9, A to F, control code).	Does not accept received data but is not brought to an alarm stop.		
H8	_	_			
H9	_	_	_		
НА	Mode error	Parameter write was attempted in other than the computer link operation mode or during inverter operation.	Does not accept		
НВ	Instruction code error	The specified command does not exist.	not brought to an alarm stop.		
НС	Data range error	Invalid data has been specified for parameter write, frequency setting, etc.	alaitii stop.		
HD	_	_	_		
HE	_	_	_		
HF	_	_	_		

(5) Communication specifications for RS-485 communication

		Operation Mode			
Operation Location	Item	Communication Operation from PU Connector	External Operation		
	Run command (start)	Enabled	Disabled		
Computer	Running frequency setting	Enabled	Enabled (Combined operation mode)		
user program	Monitoring	Enabled	Enabled		
via PU connector	Parameter write	Enabled (*2)	Disabled (*2)		
Connector	Parameter read	Enabled	Enabled		
	Inverter reset	Enabled	Enabled		
	Stop command (*1)	Enabled	Enabled		
0	Inverter reset	Enabled	Enabled		
Control circuit terminal	Run command	Disabled	Enabled		
	Running frequency setting	Disabled	Enabled		

^{*1.} As set in Pr. 75 "reset selection/disconnected PU detection/PU stop selection". *2. As set in Pr. 77 "parameter write disable selection".

Note: At occurrence of RS-485 communication fault, the inverter cannot be reset from the computer.

(6) Operation at alarm occurrence

			Operation Mode	
Fault Location	Status		Communication Operation (PU connector)	External Operation
Inverter fault	Inverter operation Communication PU connector		Stop	Stop
inverter fault			Continued	Continued
Communication error (Communication from			Stop/continued (*3)	Continued
PU connector)	Communication	PU connector	Stop	Stop

^{*3.} Can be selected using the corresponding parameter (factory-set to stop).

(7) Communication error

Fault Location	Error Message	Remarks
Communication error (Error in communication from PU connector)	Not displayed	Error code is E.PUE

4.2.37 PID control (Pr. 128 to Pr. 134)

Pr. 128 "PID action selection"

Pr. 129 "PID proportional band"

Pr. 130 "PID integral time"

Pr. 131 "upper limit"

Pr. 132 "lower limit"

Pr. 133 "PID action set point for PU operation"

-Related parameters-

Pr. 73 "0-5V/0-10V selection"

Pr. 79 "operation mode selection" Pr. 180 to Pr. 183 (input

terminal function selection)

Pr. 190 to Pr. 192 (output terminal function selection)

Pr. 902 to Pr. 905 (frequency setting voltage (current) biases and gains)

Pr. 134 "PID differential time"

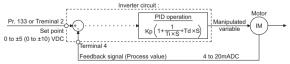
The inverter can be used to exercise process control, e.g. flow rate, air volume or pressure.

 The voltage input signal (0 to ±5V or 0 to ±10V) or Pr. 133 setting is used as a set point and the 4 to 20mA DC current input signal used as a feedback value to constitute a feedback system for PID control.

Parameter Number	Factory Setting	Setting Range	Remarks
128	0	0, 20, 21	
129	100%	0.1 to 1000%, 9999	9999: No proportional control
130	1s	0.1 to 3600s, 9999	9999: No integral control
131	9999	0 to 100%, 9999	9999: Function invalid
132	9999	0 to 100%, 9999	9999: Function invalid
133	0%	0 to 100%	
134	9999	0.01 to 10.00s, 9999	9999: No differential control

<Setting>

(1) Basic PID control configuration



Kp: Proportion constant Ti: Integral time S: Operator Td: Differential time

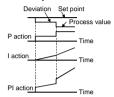
(2) PID action overview

1) PI action

A combination of proportional control action (P) and integral control action (I) for providing a manipulated variable in response to deviation and changes with time.

[Operation example for stepped changes of process value]

Note: Pl action is the sum of P and Lactions.



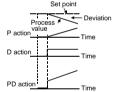
2) PD action

A combination of proportional control action

(P) and differential control action (D) for providing a manipulated variable in response to deviation speed to improve the transient characteristic.

[Operation example for proportional changes of process value]

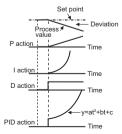
Note: PD action is the sum of P and D actions.



3) PID action

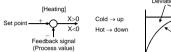
The PI action and PD action are combined to utilize the advantages of both actions for control.

Note: The PID action is the sum of the P, I and D actions.



4) Reverse action

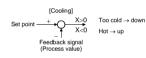
Increases the manipulated variable (output frequency) if deviation X = (set point - process value) is positive, and decreases the manipulated variable if deviation is negative.





5) Forward action

Increases the manipulated variable (output frequency) if deviation X = (set point - process value) is negative, and decreases the manipulated variable if deviation is positive.



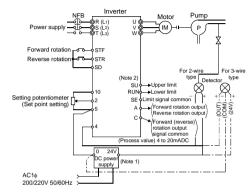


Relationships between deviation and manipulated variable (output frequency)

	Deviation	
	Positive	Negative
Reverse action	7	7
Forward action	7	7

(3) Wiring example

- Pr. 128 = 20
- Pr. 190 = 14
- Pr. 191 = 15
- Pr. 192 = 16



- Note:1. The power supply must be selected in accordance with the power specifications of the detector used.
 - 2. The output signal terminals used depends on the Pr. 190 to Pr. 192 settings.

(4) I/O signals

s	ignal	Terminal Used	Function	Description
=	2	2	Set point input	Enter the set point for PID control.
Input	4	4	Process value input	Enter the 4 to 20mA process value signal from the detector.
	FUP		Upper limit output	Output to indicate that the process value signal exceeded the upper limit value.
Ħ	FDN	Depending on	Lower limit output	Output to indicate that the process value signal exceeded the lower limit value.
Output	RL	Pr. 190 to Pr. 192	Forward (reverse) rotation direction output	"Hi" is output to indicate that the output indication of the parameter unit is forward rotation (FWD) or "Low" to indicate that it is reverse rotation (REV) or stop (STOP).

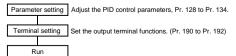
 Enter the set point across inverter terminals 2-5 or in Pr. 133 and enter the process value signal across inverter terminals 4-5. At this time, set "20" or "21" in Pr. 128.

Item	Entry	Description	
	Across terminals	Set 0V as 0% and 5V as 100%.	When "0" is set in Pr. 73 (5V selected for terminal 2).
Set point	2-5	Set 0V as 0% and 10V as 100%.	When "1" is set in Pr. 73 (10V selected for terminal 2).
	Pr. 133	Set the set point (%) in Pr. 133.	
Process value	Across terminals 4-5	4mA is equivalent to 0% and 20mA to 100%.	

(5) Parameter setting

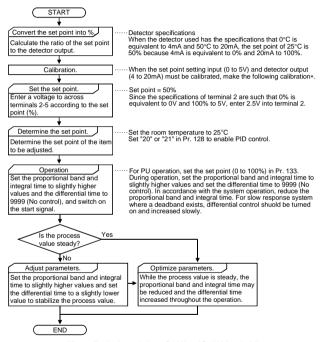
Parameter Number	Setting	Name	Description	on
	0		No PID action	
128	20	PID action selection	For heating, pressure control, etc.	PID reverse action
	21		For cooling, etc.	PID forward action
129	0.1 to 1000%	PID proportional band	If the proportional band is narrow (parameter setting is small), the manipulated variable varies greatly with a slight change of the process value. Hence, as the proportional band narrows, the response sensitivity (gain) improves but the stability deteriorates, e.g. hunting occurs. Gain K = 1/proportional band	
	9999		No proportional control	
130	0.1 to 3600 s	PID integral time	Time required for the integral the same manipulated variab proportional (P) action. As the decreases, the set point is re- hunting occurs more easily.	le as that for the integral time
	9999		No integral control.	
131	0 to 100%	Upper limit	Set the upper limit. If the feedb the setting, the FUP signal is or of 4mA is equivalent to 0% and	utput. (Process value
	9999		No function	
132	0 to 100%	Lower limit	Set the lower limit. (If the feedb the setting, the FDN signal is o of 4mA is equivalent to 0% and	utput. Process value
	9999		No function	
133	0 to 100%	PID action set point for PU operation	Only valid for the PU command or PU/external combined oper For external operation, the vothe set point. (Pr. 902 value is equivalent to value to 100%.)	ation mode. Itage across 2-5 is
134	0.01 to 10.00 s	PID differential time	Time required for the differential provide the same process valual proportional (P) action. As the increases, greater response is deviation change.	e as that for the differential time
	9999		No differential control.	

(6) Adjustment procedure



(7) Calibration example

(A detector of 4mA at 0°C and 20mA at 50°C is used to adjust the room temperature to 25°C under PID control. The set point is given to across inverter terminals 2-5 (0-5V).)



 When calibration is required, use Pr. 902 and Pr. 903 (terminal 2) or Pr. 904 and Pr. 905 (terminal 4) to calibrate the detector output and set point setting input in the PU mode during an inverter stop.

<Set point input calibration>

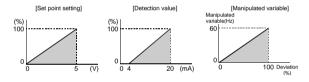
- 1. Apply the input voltage of 0% set point setting (e.g. 0V) to across terminals 2-5.
- Make calibration using Pr. 902. At this time, enter the frequency which should be output by the inverter at the deviation of 0% (e.g. 0Hz).
- 3. Apply the voltage of 100% set point setting (e.g. 5V) to across terminals 2-5.
- Make calibration using Pr. 903. At this time, enter the frequency which should be output by the inverter at the deviation of 100% (e.g. 60Hz).

<Detector output calibration>

- 1. Apply the output current of 0% detector setting (e.g. 4mA) across terminals 4-5.
- 2. Make calibration using Pr. 904.
- 3. Apply the output current of 100% detector setting (e.g. 20mA) across terminals 4-5.
- 4. Make calibration using Pr. 905.

Note: The frequencies set in Pr. 904 and Pr. 905 should be the same as set in Pr. 902 and Pr. 903.

The results of the above calibration are as shown below:



- Note: 1. Entering multi-speed (RH, RM, RL signal) or JOG operation will stop PID control and start multi-speed or JOG operation.
 - When the terminal functions are changed using Pr. 190 to Pr. 192, the other functions may be affected. Confirm the functions of the corresponding terminals before making settings.
 - When you have chosen the PID control, the minimum frequency is as set in Pr. 902 and the maximum frequency is as set in Pr. 903.
 The certifient of Pr. 1 "maximum frequency" and Pr. 2 "minimum frequency."

(The settings of Pr. 1 "maximum frequency" and Pr. 2 "minimum frequency" are also valid.)

4.2.38 Frequency setting command selection (Pr. 146)

Pr. 146 "frequency setting command selection"

Related parameters —

Pr. 79 "operation mode selection"

 Used to switch the frequency setting between the frequency setting using the built-in frequency setting potentiometer and the digital frequency setting using the A/v

Parameter	Factory	Setting
Number	Setting	Range
146	0	0, 1, 9999

<Setting>

Pr. 146 Setting	Frequency Setting Command
0	Built-in frequency setting potentiometer valid
U	Frequency setting using the built-in frequency setting potentiometer
	Built-in frequency setting potentiometer invalid
	Digital frequency setting using the ▲/▼ key
1	Using this method, the frequency is varied continuously by pressing
	the 🛕/🔻 key.
	The frequency is varied only while the (A) (V) key is pressed.
	Frequency setting using the built-in frequency setting potentiometer is made valid when the frequency setting using the
	. , , , ,
	▲/▼ key is "0Hz".
0000	(When you press the A/ key during operation performed by
9999	the frequency setting potentiometer, the digital frequency setting is
	selected and the frequency setting using the potentiometer is made
	invalid.)
	When power is switched on with "0" set in Pr. 79 "operation mode
	selection", the PU operation mode is selected.

4.2.39 Output current detection function (Pr. 150, Pr. 151)

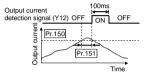
Pr. 150 "output current detection level"

Pr. 151 "output current detection period"

Related parameters —
 Pr. 190 to Pr. 192
 (output terminal function selection)

If the output current remains higher than the Pr. 150 setting during inverter operation
for longer than the time set in Pr. 151, the output current detection signal (Y12) is
output from the inverter's open collector output terminal.
 (Use any of Pr. 190 to Pr. 192 to assign the terminal used for Y12 signal output.)

Parameter Number	Factory Setting	Setting Range
150	150%	0 to 200.0%
151	0s	0 to 10 s



<Setting>

Refer to the following list and set the parameters:

Parameter Number	Description
150	Set the output current detection level. 100% is the rated inverter current.
151	Set the output current detection time. Set a period of time from when the output current rises to or above the Pr. 150 setting to when the output current detection signal (Y12) is output.

- Note: 1. Once turned ON, when the output current has risen above the preset detection level, the output current detection signal is held for at least 100ms (approximately).
 - 2. This function is also valid during execution of offline auto tuning.
 - When the terminal functions are changed using Pr. 190 to Pr. 192, the other functions may be affected. Confirm the functions of the corresponding terminals before making settings.

4.2.40 Zero current detection (Pr. 152, Pr. 153)

Pr. 152 "zero current detection level"

Pr. 153 "zero current detection period"

Pr. 190 to Pr. 192 (output terminal function selection)

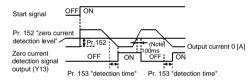
When the inverter's output current falls to "0", torque will not be generated. This may cause a gravity drop when the inverter is used in vertical lift application.

To prevent this, the output current "zero" signal can be output from the inverter to close the mechanical brake when the output current has fallen to "zero".

 If the output current remains lower than the Pr. 152 setting during inverter operation for longer than the time set in Pr. 153, the zero current detection (Y13) signal is output from the inverter's open collector output terminal.

(Use any of Pr. 190 to Pr. 192 to assign the terminal used for Y13 signal output.)

Parameter Number	Factory Setting	Setting Range
152	5.0%	0 to 200.0%
153	0.5 s	0.05 to 1 s



<Setting>

Refer to the following list and set the parameters:

Parameter Number	Description
152	Set the zero current detection level. Set this parameter to define the percentage of the rated current at which the zero current will be detected.
153	Set the zero current detection time. Set a period of time from when the output current falls to or below the Pr. 152 setting to when the zero current detection signal (Y13) is output.

- Note: 1. If the current rises above the preset detection level but the timing condition is not satisfied, the zero current detection signal is held on for about 100ms.
 - 2. This function is also valid during execution of offline auto tuning.
 - When the terminal functions are changed using Pr. 190 to Pr. 192, the other functions may be affected. Confirm the functions of the corresponding terminals before making settings.

ACAUTION

The zero current detection level setting should not be too high, and the zero current detection time setting should not be too long. Otherwise, the detection signal may not be output when torque is not generated at a low output current.

To prevent the machine and equipment from resulting in hazardous conditions by use of the zero current detection signal, install a safety backup such as an emergency brake.

Pr. 156 →Refer to Pr. 22.

4.2.41 User group selection (Pr. 160, Pr. 173 to Pr. 176)

Pr. 160 "user group read selection"

Pr. 173 "user group 1 registration"

Pr. 174 "user group 1 deletion"

Pr. 175 "user group 2 registration"

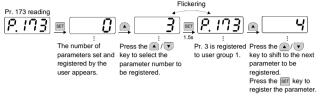
Pr. 176 "user group 2 deletion"

Among all parameters, a total of 32 parameters can be registered to two different user groups. The registered parameters may only be accessed. The other parameters cannot be read.

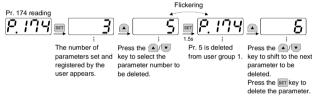
Parameter Number	Factory Setting	Setting Range	Remarks
160	0	0, 1, 10, 11	
173	0	0 to 999	
174	0	0 to 999, 9999	9999: Batch deletion
175	0	0 to 999	
176	0	0 to 999, 9999	9999: Batch deletion

<Examples of use>

(1) Registration of parameter to user group (when registering Pr. 3 to user group 1)



(2) Deletion of parameter from the user group (when Pr. 5 is deleted from user group 1)



(3) Set the required value in Pr. 160 to make the user group or groups valid or invalid.

Pr. 160 Setting	Description
0	Accessible to all parameters.
1	Accessible to only the parameters registered to user group 1.
10	Accessible to only the parameters registered to user group 2.
11	Accessible to only the parameters registered to user groups 1 and 2.

- Note: 1. The Pr. 77, Pr. 160 and Pr. 991 values may always be read independently of the user group setting.
 - The Pr. 173 or Pr. 174 value read indicates the number of parameters registered to group 1, and the Pr. 175 or Pr. 176 value read indicates the number of parameters registered to group 2.
 - If "0" is set in the second digit of two-digit Pr. 160, it is not displayed. However, "0" is displayed when it is set in the first digit only.
 - When "9999" is set in Pr. 174 or Pr. 176, the parameters registered to the corresponding user group are batch-deleted.

4.2.42 Actual operation hour meter clear (Pr. 171)

Pr. 171 "actual operation hour meter clear"

Related parameter -

Pr. 52 "operation panel/PU main display data selection"

You can clear the monitor (actual operation hour) value which is selected when Pr. 52 is "23"

Parameter	Factory	Setting	
Number	Setting	Range	
171	0	0	

<Setting>

Write "0" in the parameter to clear the actual operation hour.

Pr. 173 to Pr. 176 → Refer to Pr. 160.

4.2.43 Input terminal function selection (Pr. 180 to Pr. 183)

Pr. 180 "RL terminal function selection"

Pr. 181 "RM terminal function selection"

Pr. 182 "RH terminal function selection"

Pr. 183 "MRS terminal function selection"

Use these parameters to select/change the input terminal functions.

Parameter Number	Terminal Symbol	Factory Setting	Factory-Set Terminal Function	Setting Range
180	RL	0	Low-speed operation command (RL)	0 to 8, 16, 18
181	RM	1	Middle-speed operation command (RM)	0 to 8, 16, 18
182	RH	2	High-speed operation command (RH)	0 to 8, 16, 18
183	MRS	6	Output shut-off (MRS)	0 to 8, 16, 18

<Setting>

Refer to the following list and set the parameters.

Setting	Signal Name		Related Parameters	
0	RL	Pr. 59 = 0	Low-speed operation command	Pr. 4 to Pr. 6 Pr. 24 to Pr. 27 Pr. 232 to Pr. 239
		Pr. 59 = 1, 2 *	Remote setting (setting clear)	Pr. 59
1	RM	Pr. 59 = 0	Middle-speed operation command	Pr. 4 to Pr. 6, Pr. 24 to Pr. 27, Pr. 232 to Pr. 239
		Pr. 59 = 1, 2 *	Remote setting (deceleration)	Pr. 59
2	RH	Pr. 59 = 0	High-speed operation command	Pr. 4 to Pr. 6, Pr. 24 to Pr. 27, Pr. 232 to Pr. 239
		Pr. 59 = 1, 2 *	Remote setting (acceleration)	Pr. 59
3	RT	Second function	Pr. 44 to Pr. 48	
4	AU	Current input se		
5	STOP	Start self-holding		
6	MRS	Output shut-off t		
7	ОН	External thermal relay input ** The external thermal relay provided for overheat protection or the embedded temperature relay within the motor is activated to stop the inverter. Refer to page 189		
8	REX	15-speed selection (combination with three speeds of RL, RM, RH) Pr. 4 to Pr. 6, Pr. 24 to Pr. 27, Pr. 232 to Pr. 239		
16	X16	PU operation-ex	Pr. 79	
18	X18	General-purpos over (OFF: gen control, ON: V/F	Pr. 80	

^{*:} When Pr. 59 = "1" or "2", the functions of the RL, RM and RH signals change as listed above.

- Note:1. One function can be assigned to two or more terminals. In this case, the terminal inputs are OR' ed.
 - The speed command priorities are higher in order of multi-speed setting (RH. RM. RL. REX) and AU.
 - 3. When V/F control is selected using the V/F-general-purpose magnetic flux switch-over function, the secondary functions are also selected. During operation, you cannot switch between V/F and general-purpose magnetic flux. Should you switch between V/F and general-purpose magnetic flux, only the second functions are selected.
 - 4. Use common terminals to assign multi-speeds (7 speeds) and remote setting. They cannot be set individually. (Common terminals are used since these functions are designed for
 - multiple speed setting and need not be set at the same time.)
 5. Functions are invalid if values other than the above are set to Pr. 180 to Pr.
 183 (input terminal function selection).
 - 6. Turning the AU signal on makes voltage input invalid.

^{**:} Activated when the relay contact "opens".

4.2.44 Output terminal function selection (Pr. 190 to Pr. 192)

Pr. 190 "RUN terminal function selection"

Pr. 191 "FU terminal function selection"

Pr. 192 "A, B, C terminal function selection"

You can change the functions of the open collector and contact output terminals.

Parameter Number	Terminal Symbol	Factory Setting	Factory-Set Terminal Function	Setting Range
190	RUN	0	Inverter running	0 to 99
191	FU	4	Output frequency detection	0 to 99
192	ABC	99	Alarm output	0 to 99

<Setting>

Refer to the following table and set the parameters:

Setting	Signal Name	Function	Operation	Related Parameters
0	RUN	Inverter running	Output during operation when the inverter output frequency rises to or above the starting frequency.	
1	SU	Up to frequency	Refer to Pr. 41 "up-to-frequency sensitivity". (Note 1)	Pr. 41
3	OL	Overload alarm	Output while stall prevention function is activated.	Pr. 22, Pr. 23, Pr. 66
4	FU	Output frequency detection	Refer to Pr. 42, Pr. 43 (output frequency detection).	Pr. 42, Pr. 43
11	RY	Inverter operation ready	Output when the inverter is ready to be started by switching the start signal on.	
12	Y12	Output current detection	Refer to Pr. 150 and Pr. 151 (output current detection).	Pr. 150, Pr. 151
13	Y13	Zero current detection	Refer to Pr. 152 and Pr. 153 (zero current detection).	Pr. 152, Pr. 153
14	FDN	PID lower limit		
15	FUP	PID upper limit	Refer to Pr. 128 to Pr. 134 (PID	Pr. 128 to
16	RL	PID forward- reverse rotation output	control).	Pr. 134
95	Y95	Capacitor life alarm output	Refer to Pr.503 and Pr.504 (capacitor life alarm).	Pr. 503, Pr. 504
98	LF	Minor fault output	Output when a minor fault (fan failure or communication error warning) occurs.	Pr. 121, Pr. 244
99	ABC	Alarm output	Output when the inverter's protective function is activated to stop the output (major fault).	

Note: 1. The same function may be set to more than one terminal.

2. Pr. 190 to Pr. 192 do not function if the values set are other than the above.

Pr. 232 to Pr. 239 → Refer to Pr. 4.

Pr. 240 → Refer to Pr. 72.

4.2.45 Cooling fan operation selection (Pr. 244)

Pr. 244 "cooling fan operation selection"

You can control the operation of the cooling fan built in the inverter (whether there is a cooling fan or not depends on the models. Refer to the outline dimensional drawings (page 220)).

Parameter	Factory	Setting
Number	Setting	Range
244	0	0, 1

<Setting>

Setting	Description
0	Operated at power on (independent of whether the inverter is running or at a stop).
1	Cooling fan on-off control valid (The cooling fan is always on while the inverter is running. During a stop, the inverter status is monitored and the fan switches on-off according to temperature.)

<Reference>

In either of the following cases, fan operation is regarded as faulty, [FN] is shown on the operation panel, and the minor fault (LF) signal is output. Use any of Pr. 190 to Pr. 192 (output terminal function selection) to allocate the terminal used to output the LF signal.

- 1) Pr. 244 = "0"
 - When the fan comes to a stop with power on.
- 2) Pr. 244 = "1"

When the inverter is running and the fan stops during fan ON command.

Note: When the terminal assignment is changed using Pr. 190 to Pr. 192, the other functions may be affected. Confirm the functions of the corresponding terminals before making settings.

4.2.46 Slip compensation (Pr. 245 to Pr. 247)

Pr. 245 "rated motor slip"

Pr. 246 "slip compensation response time"

Pr. 247 "constant-output region slip compensation selection"

The inverter output current may be used to assume motor slip to keep the motor speed constant.

Parameter Number	Factory Setting	Setting Range	Remarks
245	9999	0 to 50%, 9999	9999: No slip compensation
246	0.5	0.01 to 10 s	
247	9999	0, 9999	9999: Slip compensation is made in the constant output region when Pr.245 ≠ "9999"and slip compensation is selected.

<Setting>

Parameter Number	Setting	Function
245	0 to 50%	Used to set the rated motor slip.
243	9999	Slip compensation is not made.
246	0.01 to 10 s	Used to set the slip compensation response time. (Note)
	0	Slip compensation is not made in the constant output range (frequency range above the frequency set in Pr. 3).
247	9999	Slip compensation is made in the constant output region when Pr.245 ≠ "9999"and slip compensation is selected. Slip compensation is not made when Pr.245 = "9999"

Note: When this value is made smaller, response will be faster.

However, as load inertia is greater, a regenerative overvoltage (OVT) error is more liable to occur.

4.2.47 Earth (ground) fault detection at start (Pr. 249) (400V class does not have this function)

Pr. 249 "earth (ground) fault detection at start"

You can select whether earth (ground) fault detection at start is made or not. Earth (ground) fault detection is made only immediately after the start signal is input to the inverter.

If an earth (ground) fault occurs during operation, the protective function is not activated.

Parameter	Factory	Setting	
Number	Setting	Range	
249	0	0, 1	

<Setting>

Setting	Description	
0	Earth (ground) fault detection not made	
1	Earth (ground) fault detection made	

Note:1. Since detection is made at a start, an about 20ms output delay occurs at every start.

- When an earth (ground) fault is detected with "1" set in Pr. 249, alarm output "E.GF" is detected and the output is shut off.
- If the motor capacity is less than 0.1kW, earth (ground) fault protection may not be provided.

4.2.48 Stop selection (Pr. 250)

Pr. 250 "stop selection"

Related parameters

Pr. 7 "acceleration time" Pr. 8 "deceleration time"

Pr. 44 "second acceleration/ deceleration time"

Pr. 45 "second deceleration time"

Used to select the stopping method (deceleration to a stop or coasting) when the start signal (STF/STR) switches off.

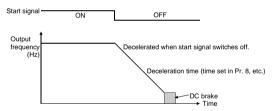
Parameter Number	Factory Setting	Setting Range
250		0 to 100 s, 1000 to 1100 s, 8888, 9999

was switched off. The motor coasts to a stop.

(1) Pr. 250 = "9999"

RUN signal

When the start signal switches off, the motor is decelerated to a stop.



(2) Pr. 250 = 0 to 100s (output is shut off after preset time)
The output is shut off when the time set in Pr. 250 has elapsed after the start signal

Other Start signal

Other Output is shut off when time set in Pr. 250 has elapsed after start signal was switched off.

Motor coasts to a stop.

OFF

When the Pr. 250 value is 8888, the functions of terminals STF and STR change as shown below:

STF = start signal, STR = rotation direction signal

STF	STR	Inverter Operating Status	
OFF	OFF	Stop	
OFF	ON	Stop	
ON	OFF	Forward rotation	
ON	ON	Reverse rotation	

When the Pr. 250 value is any of 1000 to 1100s, the functions of terminals STF and STR are the same as when the Pr. 250 value is 8888.

Also, for the stopping method used when the start signal switches off, the output is shut off (the motor coasts to a stop) after the period set in Pr. 250 (i.e. 1000s) have elapsed.

- Note: 1. The RUN signal switches off when the output stops.
 - When the start signal is switched on again during motor coasting, the motor starts at 0Hz.
 - 3. When the Pr. 250 value is 0, the output is shut off within the shortest time.

4.2.49 Output phase failure protection selection (Pr. 251)

Pr. 251 "Output phase failure protection selection"

You can make invalid the output phase failure protection (E.LF) function which stops the inverter output if one of the three phases (U, V, W) on the inverter's output side (load side) becomes open.

Choose "without output phase failure protection" when the motor capacity is smaller than the inverter capacity (when the output current is less than approximately 25% of the rated inverter current value as a guideline), since performing operation in such a case may activate output phase failure protection.

Parameter Number	Setting Range	Minimum Setting Increments	Factory Setting	Description
251	0, 1	1	1	Without output phase failure protection With output phase failure protection

Pr. 342 → Refer to Pr. 117

4.2.50 Capacitor life alarm (Pr. 503, Pr. 504) (No function for the 400V class)

Pr. 503 "capacitor life timer"

Pr. 504 "capacitor life alarm output set time"

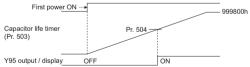
Pr. 190 to Pr. 192 (output terminal function selection)

Indicate the replacement time (note 1) of the inverter main circuit smoothing capacitor by outputting the capacitor life alarm output signal "Y95" when the cumulative energization time of the inverter reaches the time set in Pr.504 "capacitor life alarm output set time".

Parameter Number	Factory Setting	Setting Range	
503	_	_	
504	500 (50000h)	0 to 9998, (9999)	

<Settina>

Parameter Number Setting		Description	Remarks
503	_	Display the cumulative energization time of the inverter in 100h increments. (Cannot be written.) Clamped at 9998(999800h).	The capacitor life is counted every 1h and the figures above hundreds are displayed.
504	0 to 9998	Set the time until the maintenance timer alarm signal (Y95) is output.	By setting "95" in Pr.190 to Pr.192 "output terminal function selection", the capacitor life alarm signal "Y95" can be output. (Refer to page 163.)
304	9999	For maker setting. The set time is 50000h.	



The life of electrolytic capacitor is about eight years (50000h) if used for 20 hours a day and 300 days a year in the average yearly ambient temperature of 35°C. (Note 2)

The life of electrolytic capacitor decreases to half if the ambient temperature increases by 10°C and doubles if decreases by 10°C. Please note this as reference when setting the time

For example, when the average yearly ambient temperature is 45°C, set "250" (25000h) in Pr. 504.

Note: 1. For replacement of the capacitor, contact the nearest Mitsubishi FA center.

2. The estimated life time (50000h) of the capacitor differs according to the

The estimated life time (50000h) of the capacitor differs according to the environmental conditions (ambient temperature, conditions, etc.) of the inverter.

4.2.51 Meter (frequency meter) calibration (Pr. 900)

Pr. 900 "FM terminal calibration"

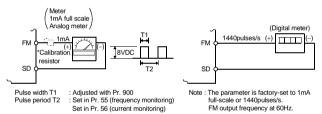
Related parameters

Pr. 54 "FM terminal function selection"

Pr. 55 "frequency monitoring reference"

Pr. 56 "current monitoring reference"

- By using the operation panel or parameter unit, you can calibrate a meter connected to terminal FM to full scale deflection.
- Terminal FM provides the pulse output. By setting Pr. 900, you can calibrate the meter connected to the inverter from the parameter unit without providing a calibration resistor.
- You can display a digital value on a digital counter using the pulse train signal from terminal FM. A 1440 pulses/s output is provided at the full scale value as explained in the section of Pr. 54. When the running frequency has been selected for monitoring, the ratio of this FM terminal output frequency can be set in Pr. 55.



- Not needed when the operation panel or parameter unit (FR-PU04) is used for calibration. Used when calibration must be made near the frequency meter for such a reason as a remote frequency meter. However, the frequency meter needle may not deflect to full-scale if the calibration resisitor is connected. In this case, use this resistor and the operation panel or parameter unit together.
- (1) Calibration of terminal FM
 - 1) Connect a meter (frequency meter) across inverter terminals FM-SD. (Note the polarity. FM is the positive terminal.)
 - 2) When a calibration resistor has already been connected, adjust the resistance to "0" or remove the resistor.
 - 3) Set any of "0 to 2" in Pr. 54.

When the running frequency or inverter output current has been selected as the output signal, preset in Pr. 55 or Pr. 56 the running frequency or current at which the output signal is 1440pulses/s.

At this 1440 pulses/s, the meter normally deflects to full scale.

<Operation procedure>

When using the operation panel

1) Select the PU operation mode.

2) Set the running frequency.

3) Press the SET key.

4) Read Pr. 900 "FM terminal calibration".

Press the wo key to run the inverter. (Motor need not be connected.)

6) Hold down the \(\bigsec{\text{\tinx}\text{\ti}\text{\texi{\text{\texi}\tint{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\tex{

7) Press the set key for about 1.5s.

8) Press the (RESET) key to stop the inverter.

REMARKS

Calibration can also be made for external operation. Set the frequency in the external operation mode and make calibration in the steps 4) to 8).

- Note:1. Pr. 900 is factory-set to 1mA full-scale and FM output frequency of 1440 pulses/s at 60Hz. The maximum pulse train output of terminal FM is 2400 pulses/s.
 - When a frequency meter is connected across terminals FM-SD to monitor the running frequency, the FM terminal output is filled to capacity at the factory setting if the maximum output frequency reaches or exceeds 100Hz. In this case, the Pr. 55 setting must be changed to the maximum frequency.
 - 3. It is possible to calibrate even during operation.

4.2.52 Biases and gains of the frequency setting voltage (current) and built-in frequency setting potentiometer (Pr. 902 to Pr. 905, Pr. 922, Pr. 923)

Pr. 902 "frequency setting voltage bias"

Pr. 903 "frequency setting voltage gain"

Pr. 904 "frequency setting current bias"

Pr. 905 "frequency setting current gain"

Related parameters

Pr. 38 "frequency at 5V (10V) input"
Pr. 39 "frequency at 20mA input"

Pr. 73 "0-5/0-10V selection"

Pr. 79 "operation mode selection"
Pr.146"frequency setting
command selection"

Pr. 922 "built-in frequency setting potentiometer bias"

Pr. 923 "built-in frequency setting potentiometer gain"

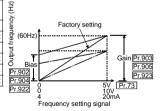
You can set the output frequency as desired in relation to the frequency setting potentiometer of the operation panel or the external frequency setting signal (0 to 5V,0 to 10V or 4 to 20mA DC).

The "bias" and "gain" functions are used to adjust the relationship between the input signal entered from outside the inverter (to set the output frequency), i.e. 0 to 5VDC,0 to 10VDC or 4 to 20mADC, and the output frequency.

- Use Pr. 902 to set the bias of the voltage signal and use Pr. 903 to set its gain
- Use Pr. 904 to set the bias of the current signal and use Pr. 905 to set its gain.
- Use Pr. 922 to set the bias of the operation panel's potentiometer and use Pr. 923 to set its gain.

Parameter Number	Factory Setting (*)		Setting Range		
902	0V	0Hz	0 to 10V	0 to 60Hz	
903	5V	60Hz	0 to 10V	1 to 400Hz	
904	4mA	0Hz	0 to 20mA	0 to 60Hz	
905	20mA	60Hz	0 to 20mA	1 to 400Hz	
922	0V	0Hz	0 to 5V	1 to 60Hz	
923	5V	60Hz	0 to 5V	1 to 400Hz	

Factory settings may differ because of calibration parameters.



<Setting>

- (1) The frequency setting voltage (current) biases and gains may be adjusted by any of the three following ways:
 - 1) Any point can be adjusted with a voltage applied across terminals 2-5 (with a current flowing across terminals 4-5).
 - Any point can be adjusted with no voltage applied across terminals 2-5 (with no current flowing across terminals 4-5).
 - Only the bias and gain frequencies are adjusted and the voltage (current) is not adjusted.

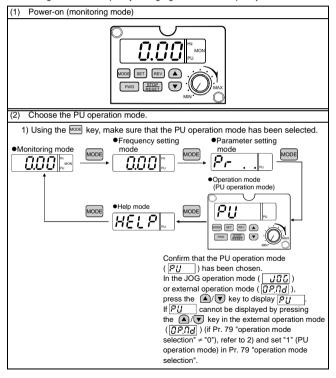
- (2) The bias and gain of the frequency setting potentiometer may also be adjusted by any of the three following ways:
 - 1) Any point can be adjusted with the potentiometer being turned.
 - 2) Any point can be adjusted without the potentiometer being turned.
 - 3) Only the bias and gain frequencies are adjusted.

Pr. 903 "frequency setting voltage gain"

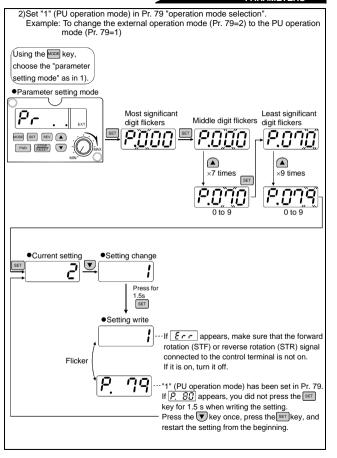
(Pr. 902, Pr. 904 and Pr. 905 can also be adjusted similarly.)

<Adjustment procedure>

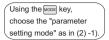
When using an external frequency setting signal to set the frequency.



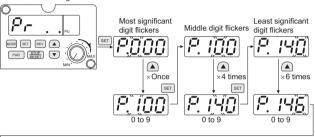
PARAMETERS

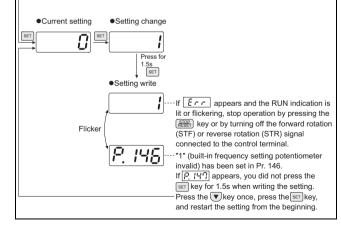


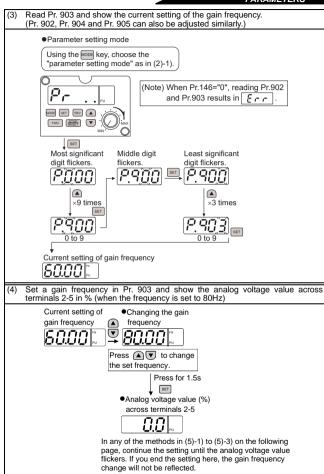
- 3)Set "1" (built-in frequency setting potentiometer invalid) in Pr. 146 "frequency setting command selection".
 - Change the setting of built-in frequency setting potentiometer valid (Pr. 146 = 0) to that of built-in frequency setting potentiometer invalid (Pr. 146 = 1).



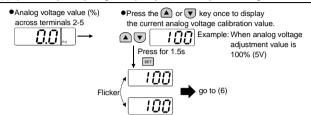
Parameter setting mode



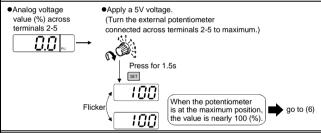




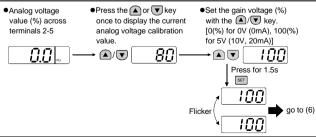
- When not adjusting the gain voltage → go to (5)-1)
- When adjusting any point by applying a voltage → go to (5)-2)
- When adjusting any point without applying a voltage → go to (5)-3)
- (5)-1) How to adjust only the gain frequency and not to adjust the voltage



(5)-2) How to adjust any point by applying a voltage across terminals 2-5 (e.g. from the external potentiometer) (current: across terminals 4-5) (when applying 5V))



(5)-3)How to adjust any point without applying a voltage across terminals 2-5 (without a current flowing across terminals 4-5) (when changing from 4V (80%) to 5V (100%)



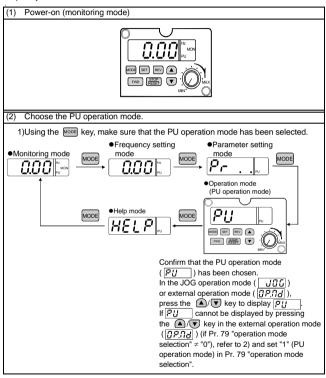
- (6) Press the set key to shift to the next parameter.
- (7) Re-set Pr. 79 "operation mode selection" according to the operation mode to be used.
- Note: 1. If the Pr. 903 or Pr. 905 (gain adjustment) value is changed, the Pr. 20 value does not change.
 - When the Pr. 903 or Pr. 905 value is set, the value of Pr. 38 "frequency at 5V (10V) input" or Pr. 39 "frequency at 20mA input" changes automatically.

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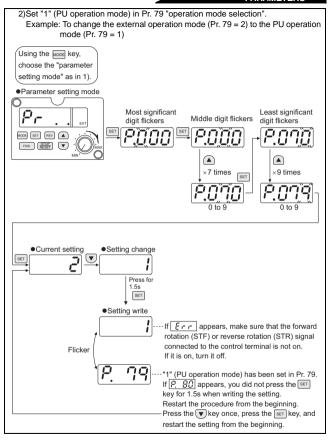
⚠ Be careful when setting the bias frequency at 0V to any value other than "0". Even without the speed command, the motor will start running at the set frequency by merely switching on the start signal.

Pr. 923 "built-in frequency setting potentiometer gain" (Pr. 922 can be adjusted in the same manner)

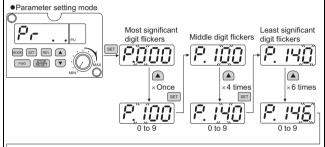
When the built-in frequency setting potentiometer is used to set the bias and gain of the built-in frequency setting potentiometer to set the magnitude (slope) of the output frequency as desired.

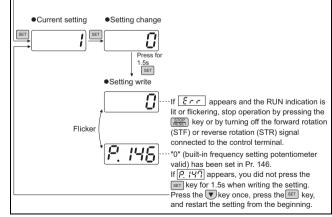


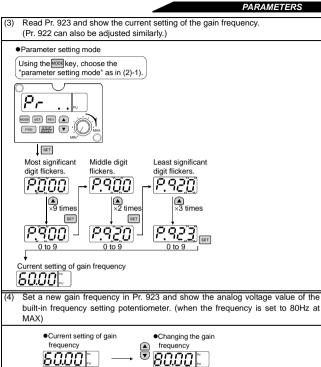
PARAMETERS

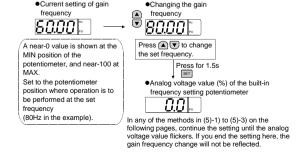


- 3)Set "0" (built-in frequency setting potentiometer valid) in Pr. 146 "frequency setting command selection". Change the setting of built-in frequency setting potentiometer invalid (Pr. 146 = 1) to that of built-in frequency setting potentiometer valid (Pr. 146 = 0). Using the MODE key,
- choose the "parameter setting mode" as in (2) -1)

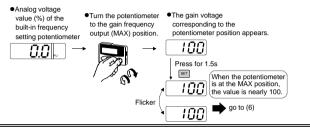




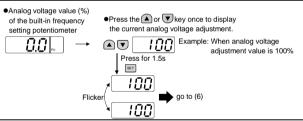




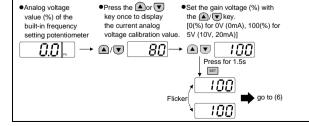
- When adjusting any point by turning the potentiometer → go to (5)-1)
- When not adjusting the gain voltage → go to (5)-2)
- When adjusting any point without turning the potentiometer → go to (5)-3)
- (5)-1)How to adjust any point by turning the built-in frequency setting potentiometer (when applying 5V)



(5)-2) How to adjust the gain frequency only without the voltage being adjusted



(5)-3) How to adjust any point without turning the potentiometer (When changing from 4V (80%) to 5V (100%))



- (6) Press the set key to shift to the next parameter.
- (7) Re-set Pr. 79 "operation mode selection" according to the operation mode to be used.

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⚠ You should be careful when setting any value other than "0" to the bias frequency at 0V, since the motor will start at the preset frequency by merely turning on the start signal if no speed command is given.

CHAPTER 5 PROTECTIVE FUNCTIONS

This chapter explains the "protective functions" of this product. Always read the instructions before using the equipment.

5.1	Errors (Alarms)	186
5.2	Troubleshooting	196

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

5.1 Errors (Alarms)

If any fault has occurred in the inverter, the corresponding protective function is activated to bring the inverter to an alarm stop and automatically give the corresponding error (alarm) indication on the PU display.

If your fault does not correspond to any of the following errors or if you have any other problem, please contact your sales representative.

- Retention of alarm output signal When the magnetic contactor (MC) provided on the power supply side of the inverter is opened at the activation of the protective function, the inverter's control power will be lost and the alarm output will not be held.

 Alarm indication When the protective function is activated, the operation panel display automatically switches to the above indication.

 Resetting method When the protective function is activated, the inverter output is kept stopped. Unless reset, therefore, the inverter cannot restart. Switch power off once, then on again; or apply RES signal for more than 0.1s. Kept on, "Err." appears (flickers) to indicate that the inverter is being reset.
- When the protective function is activated, take the appropriate corrective action, then
 reset the inverter, and resume operation.

5.1.1 Error (alarm) definitions

(1) Major faults

When the protective function is activated, the inverter output is shut off and the alarm is output.

Operation Panel Indication	E. OC1	<i>E.D.C.</i>	;	FR-PU04	OC During Acc	
Name	Overcurrent shut-off during acceleration					
Description	When the inverter output current reaches or exceeds approximately 200% of the rated current during acceleration, the protective circuit is activated to stop the inverter output					
Check point	Check for sudden acceleration. Check that the downward acceleration time is not long in vertical lift application. Check for output short-circuit/earth (ground) fault.					
Corrective action Increase the acceleration time. (Shorten the downward acceleration time in vertical lift application.)						

Operation Panel Indication	E. OC2	5.002	FR-PU04	Stedy Spd OC		
Name	Overcurrent shut-off during constant speed					
Description	When the inverter output current reaches or exceeds approximately 200% of the rated current during constant speed, the protective circuit is activated to stop the inverter output.					
Check point	Check for sudden load change. Check for output short-circuit/earth (ground) fault.					
Corrective action	Keep load stable.					

Operation Panel Indication	E. OC3	E.D.C.3	FR-PU04	OC During Dec		
Name	Overcurrent shut-off during deceleration					
Description	When the inverter output current reaches or exceeds approximately 200% of the rated current during deceleration (other than acceleration or constant speed), the protective circuit is activated to stop the inverter output.					
Check point	Check for sudden speed reduction. Check for output short-circuit/earth (ground) fault. Check for too fast operation of motor's mechanical brake.					
Corrective action	Increase the deceleration time. Adjust brake operation.					

Operation Panel Indication	E. OV1	E.O	;	FR-PU04	OV During Acc	
Name	Regenerative overvoltage shut-off during acceleration					
Description	voltage to re is activated t surge voltag	ach or exce to stop the in te generated	ed th vert in t	ne specified v er output. It r he power su	r's internal main circuit DC value, the protective circuit nay also be activated by a pply system.	
Check point	Check for too slow acceleration. (e.g. during descending acceleration with lifting load)					
Corrective action	Decrease the acceleration time.					

Operation Panel Indication	E. OV2	S.0 u 2	FR-PU04	Stedy Spd OV		
Name	Regenerative overvoltage shut-off during constant speed					
Description	If regenerative energy causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protective circuit is activated to stop the inverter output. It may also be activated by a surge voltage generated in the power supply system.					
Check point	Check for sudden load change.					
Corrective action	Keep load stable. Use the brake unit, high power factor converter (FR-HC) power regeneration common converter (FR-CV) as required.					

Operation Panel Indication	E. OV3	E.O 3	FR-PU04	OV During Dec	
Name	Regenerati	ve overvoltage	shut-off dur	ing deceleration or stop	
Description	If regenerative energy causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protective circuit is activated to stop the inverter output. It may also be activated by a surge voltage generated in the power supply system.				
Check point	Check for s	udden speed r	eduction.		
Corrective action	Increase the deceleration time. (Set the deceleration time which matches the moment of inertia of the load) Decrease the braking duty. Use the brake unit, high power factor converter (FR-HC) or power regeneration common converter (FR-CV) as required.				

Operation Panel Indication	E. THM	E.C.H.O.	FR-PU04	Motor Overload			
Name	Motor overload shut-off (electronic thermal relay function (Note 1)						
Description	The electronic overcurrent protection in the inverter detects motor overheat due to overload or reduced cooling capability during constant-speed operation to stop the inverter output. When a multi-pole motor or two or more motors are run, provide a thermal relay on the output side of the inverter.						
Check point	Check the r	motor for use u	nder overlo	ad.			
Reduce the load weight. For the constant-torque motor, change the Pr. 71 the constant-torque motor setting.							

Operation Panel Indication	E. THT	E.F.H.F.	FR-PU04	Inv. Overload			
Name	Inverter overload shut-off (electronic thermal relay function) (Note 1)						
Description	If a current of more than 150% of the rated output current flows and overcurrent shut-off does not occur (200% or less), inverse-time characteristics cause the electronic thermal relay function to be activated to stop the inverter output in order to protect the output transistors.						
Check point	Check the motor for use under overload.						
Corrective action	Reduce the load weight.						

Note:1. Resetting the inverter initializes the internal heat integrating data of the electronic thermal relay function.

Operation Panel Indication	E. FIN	8.F1 n	FR-PU04	H/Sink O/Temp		
Name	Fin overheat					
Description	If the heatsink overheats, the temperature sensor is actuated to stop the inverter output.					
Check point	Check for too high ambient temperature.					
Corrective action	Check for heatsink_clogging. Set the ambient temperature to within the specifications.					

Operation Panel Indication	E. BE	Ε.	68	•	FR-PU04	Br. Cct. Fault (Note)
Name	Brake transistor alarm detection					
Description	If a brake transistor fault occurs due to excessively large regenerative energy from the motor, for example, that fault is detected to stop the inverter output. In this case, the inverter power must be switched off immediately.					
Check point	Check for improper braking duty.					
Corrective action	Change the inverter. Please contact your sales representative.					

Operation Panel Indication	E. GF	€.	GF	FR-PU04	Ground Fault			
Name	Output side	earth	(ground	fault overc	urrent protection			
Description	This function stops the inverter output if an earth (ground) fault overcurrent flows due to an earth (ground) fault which occurred in the inverter's output (load) side. Use Pr. 249 "ground fault detection at start" to set whether the protective function is to be activated or not. (The 400V class always has the protective function.)							
Check point	Check for a cable.	n eart	h (groun	d) fault in th	e motor and connection			
Corrective action	Remedy the earth (ground) fault portion.							

Operation Panel Indication	E. OHT	E.0 H C	FR-PU04	OH Fault			
Name	External the	ermal relay ope	ration (Note	2)			
Description	If the external thermal relay provided for motor overheat protection or the internally mounted temperature relay in the motor switches on (contacts open), the inverter output is stopped. If the relay contacts are reset automatically, the inverter will not restart unless it is reset.						
Check point	Check for motor overheating. Check that the value of "7" (OH signal) is set correctly in any of Pr. 180 to Pr. 183 (input terminal function selection).						
Corrective action	Reduce the load and operating duty.						

Note: 2. This function is activated only when OH has been set to any of Pr. 180 to Pr. 183 (input terminal function selection).

Operation Panel Indication	E. OLT	E.DLT	FR-PU04	Stll Prev STP		
Name	Stall prevention					
Description	The running frequency has fallen to 0 by stall prevention activated. (OL while stall prevention is being activated.)					
Check point	Check the motor for use under overload.					
Corrective action	Reduce the load weight.					

Operation Panel Indication	E.OPT	E.0PF	FR-PU04	Option Fault				
Name	Option alar	m						
Description	communica the commu Stops the ir from the sy Stops the	tion error of the nication option. Inverter output it stem in the NE inverter outpu	the communi the inverte T mode. (No tif a setti	functional fault (e.g. ication option) occurs in r station is disconnected ote 3) ng error or connection in-board option.				
Check point	Check that the communication cable is not open.							
Corrective action	Please contact your sales representative.							

Note: 3. Only when the communication option is fitted to the three-phase 400V power input model.

Operation Panel Indication	E. PE	ε.	PE	FR-PU)4	Corrupt Memory
Name	Parameter storage device alarm					
Description	A fault occurred in parameters stored (example: E ² PROM fault).					
Check point	Check for too many number of parameter write times.					
Corrective action	Please contact your sales representative.					

Operation Panel Indication	E. PUE	<i>E.PUE</i>	FR-PU04	PU Leave Out				
Name	Parameter	unit disconnect	ion	•				
Description	between the disconnected This function successive of permissi	e inverter and ed, when "2", on stops the communication ble retries who	PU is sus "3", "16" or inverter ou n errors is g en the Pr.	utput if communication pended, e.g. the PU is "17" was set in Pr. 75. utput if the number of greater than the number 121 value is other than the PU connector.				
Check point	Check for loose fitting of the operation panel or FR-PU04. Check the Pr. 75 setting.							
Corrective action	Fit the operation panel and FR-PU04 securely.							

Operation Panel Indication	E. RET	8.585	FR-PU04	Retry No Over			
Name	Retry count	exceeded					
Description		If operation cannot be resumed properly within the number of retries set, this function stops the inverter output.					
Check point	Find the cause of alarm occurrence.						
Corrective action	Eliminate the cause of the error preceding this error indication.						

Operation Panel Indication	E. CPU	E.C P U	FR-PU04	CPU Fault		
Name	CPU error					
Description	If the arithmetic operation of the built-in CPU does not end within a predetermined period, the inverter self-determines it as an alarm and stops the output.					
Check point						
Corrective action	Please contact your sales representative.					

Operation Panel Indication	E. 3	Ε.	3	FR-PU04	Fault 3		
Name	Option fau	lt					
Description	Also stops the inverter output if the dedicated option used in the inverter results in setting error or connection (connector) fault. (Note 4)						
Check point	Check that the function setting and operation of the option are correct. Check that the communication option is plugged in the connector securely. Check for devices producing excess electrical noises around the inverter.						
Corrective action	the inverter. Connect the communication option securely. Take measures against noises if there are devices producing excess electrical noises around the inverter. Contact your sales representative.						

Note: 4. Only when the communication option is fitted to the three-phase 400V power input model.

Operation Panel Indication	E. 6	Ε.	8	FR-PU04	Fault 6		
Operation Failer indication	E. 7	Ε.	7		Fault 7		
Name	CPU error						
Description	This function stops the inverter output if a communication error occurs in the built-in CPU. (400V class only)						
Check point	Check for devices producing excess electrical noises around the inverter.						
Corrective action	Take measures against noises if there are devices producing excess electrical noises around the inverter. Please contact your sales representative.						

Operation Panel Indication	E. P24	<i>E.P.2</i> 4	FR-PU04	Pr.24 alarm			
Name	24VDC pov	24VDC power output short circuit					
Description	shorted, thi all external reset by en panel or sw	s function shut contact inputs tering the RES ritch power off,	s off the po switch off. signal. To re then on aga	om the PC terminal is wer output. At this time, The inverter cannot be eset it, use the operation iin. (for 400V class only)			
Check point	Check for a short circuit in the PC terminal output.						
Corrective action	Remedy the earth (ground) fault portion.						

Operation Panel Indication	E. LF	ε.	L	F	FR-PU04	E. LF
Name	Output pha	se fail	ure p	rote	ction	•
Description	This function stops the inverter output if one of the three phases (U, V, W) on the inverter's output side (load side) results in open phase.					
Check point	Check the wiring (Check the motor for a fault.) Check that the capacity of the used motor is not smaller than the inverter capacity.					
Corrective action	Wire the cables properly. Check the setting of Pr. 251 "output phase failure protection selection".					

(2) Minor fault

The output is not shut off when the protective function is activated. You can make parameter setting to output the minor fault signal. (Set "98" in any of Pr. 190 to Pr. 192 (output terminal function selection). Refer to page 163.)

Operation Panel Indication	FN	۶n	FR-PU04	Fan Failure			
Name	Fan fault						
Description	For the inverter which contains a cooling fan, FN appears on the operation panel when the cooling fan stops due to a fault or operates differently from the setting of Pr. 244 "cooling fan operation selection"						
Check point	Check the cooling fan for a fault.						
Corrective action	Replace the	Replace the fan. (Refer to page 205.)					

(3) Warnings

Operation Panel Indication	OL	0	L	FR-PU04	OL		
Name	Stall prevention (overcurrent)						
	During acceleration	on	If a current of more than 150% (Note 5) of the rated inverter current flows in the motor this function stops the increase in frequency until the overload current reduces to prevent the inverter from resulting in overcurrent shut-off. When the overload current has reduced below 150%, this function increases the frequency again.				
Description	During constant-s operation	speed	If a current of more than 150% (Note 5) of the rated inverter current flows in the motor, this function lowers the frequency until the overload current reduces to prevent overcurrent shut-off. When the overload current has reduced below 150%, this function increases the frequency up to the set value.				
	During deceleration		If a current of more than 150% (Note 5) o the rated inverter current flows in the motor this function stops the decrease in frequency until the overload current reduces to preven the inverter from resulting in overcurren shut-off. When the overload current has reduced below 150%, this functior decreases the frequency again.				
Check point	Check the motor for use under overload.						
Corrective action	The acceleration/deceleration time may change. Increase the stall prevention operation level with Pr. 22 "stall prevention operation level", or disable stall prevention with Pr. 156 "stall prevention operation selection".						

Note:5. The stall prevention operation current can be set as desired. It is factory-set to 150%.

Operation Panel Indication	oL	οL	FR-PU04	oL			
Name	Stall prevention (overvoltage)						
Description	During deceleration	energy of the motor to exceed the brake in stops the decrease in overvoltage shut-off. As we energy has reduced,					
Check point	Check for sudden speed reduction.						
Corrective action	The deceleration time may change. Increase the deceleration time using Pr. 8 "deceleration time".						

Operation Panel Indication	PS	25	FR-PU04	PS			
Name	PU stop						
Description	A stop made by pressing the REPU has been set in Pr. 75 "PU stop selection".						
Check point	Check for a stop made by pressing the key of the operation panel during external operation.						
Corrective action	Refer to page	ge 121.					

Operation Panel Indication	Err.	Err.
Description	You atter operation You atter operation You atter range. You atter (while sign You atter)	signal is on; mpted to set any parameter value in the external n mode; impted to change the operation mode during n; mpted to set any parameter value outside its setting mpted to set any parameter value during operation nnal STF or STR is ON). mpted to set any parameter value while parameter being inhibited in Pr. 77 "parameter write disable
Corrective action	Perform op	eration correctly.

5

5.1.2 To know the operating status at the occurrence of alarm

When any alarm has occurred, the display automatically switches to the indication of the corresponding protective function (error). By pressing the well be at this point without resetting the inverter, the display shows the output frequency. In this way, it is possible to know the running frequency at the occurrence of the alarm. This also applies to the current. After resetting, you can confirm the data in the alarm history (refer to page 67).

5.1.3 Correspondence between digital and actual characters

There are the following correspondences between the actual alphanumeric characters and the digital characters displayed on the operation panel:

Actual	Display
0	0
1	โด้
2	l jā
3	lä
4	l H
5	। डा
6	l
7	l ñ
8	Ø
9	l ğ

13	3 displayed on the ope						
	Actual	Display					
	A	A					
	В	Ы Ы					
	C	ñ					
	D	Ä					
	E	Ē					
	F) []					
	G	20					
	H						
		Ä					
	J						

i pariei.	
Actual	Display
M	n
N	A
0	Ø
0	9
P	0
S	9
T	
U	<u>U</u>
V	
Г	
-	

5.1.4 Resetting the inverter

The inverter can be reset by performing any of the following operations. Note that the electronic overcurrent protection's internal heat calculation value and the number of retries are cleared (erased) by resetting the inverter.

Recover about 1s after reset is cancelled.

Operation 1:Using the operation panel, press the set to reset the inverter.

(This may only be performed when the inverter protective function

(major fault) is activated.)

Operation 2:Switch power off once, then switch it on again.

Operation 3:Switch on the reset signal (RES).

5.2 Troubleshooting

POINT: Check the corresponding areas. If the cause is still unknown, it is recommended to initialize the parameters (return to factory settings), re-set the required parameter values, and check again.

5.2.1 Motor remains stopped

1) Check the main circuit Check that a proper power supply voltage is applied (operation panel display is provided). Check that the motor is connected properly. Check that the conductor across P1-P is connected. 2) Check the input signals Check that the start signal is input. Check that both the forward and reverse rotation start signals are not input. 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/source jumper connector is fitted securely. Check the parameter settings Check that the reverse rotation prevention (Pr. 78) is not selected. Check that the operation mode (Pr. 79) setting is correct. Check that the frequency setting command selection (Pr. 146) setting is correct. Check that the bias and gain (Pr. 902 to Pr. 905, Pr. 922, Pr. 923) settings are Check that the starting frequency (Pr. 13) setting is not greater than the running frequency. Check that various operational functions (such as three-speed operation). especially the maximum frequency (Pr. 1), are not zero. 4) Check the load Check that the load is not too heavy. Check that the shaft is not locked. 5) Others Check that the ALARM lamp is off. Check that the operation panel display does not show an error (e.g. E.OC1). Check that the Pr. 15 "jog frequency" setting is not lower than the Pr. 13

5.2.2 Motor rotates in opposite direction

"starting frequency" value.

Check that the phase sequence of output terminals U, V and W is correct.

Check that the start signals (forward rotation, reverse rotation) are connected properly.

5.2.3 Speed greatly differs from the setting

- Check that the frequency setting signal is correct. (Measure the input signal level.)
 Check that the following parameter settings are correct (Pr. 1, Pr. 2, Pr. 19, Pr. 38.
- Pr. 39, Pr. 245, Pr. 902 to Pr. 905).

 Check that the input signal lines are not affected by external noise. (Use shielded cables)
 - Check that the load is not too heavy.

5.2.4 Acceleration/deceleration is not smooth

- Check that the acceleration and deceleration time settings are not too short.
- Check that the load is not too heavy.
 - Check that the torque boost setting is not too large to activate the stall prevention function.

5.2.5 Motor current is large

- Check that the load is not too heavy.
 - Check that the torque boost setting is not too large.

5.2.6 Speed does not increase

- Check that the maximum frequency setting is correct.
- Check that the load is not too heavy. (In agitators, etc., load may become heavier in winter.)
- Check that the torque boost setting is not too large to activate the stall prevention
- Check that the brake resistor is not connected to terminals P-P1 or terminals P1-PR accidentally.

5.2.7 Speed varies during operation

When slip compensation is selected, the output frequency varies with load fluctuation between 0 and 2Hz. This is a normal operation and is not a fault.

Inspection of load

— Check that the load is not varying.

2) Inspection of input signal

- Check that the frequency setting signal is not varying.
- Check that the frequency setting signal is not affected by noise.
- Check that a malfunction does not occur due to an undesirable current when the transistor output unit is connected, for example. (Refer to page 26.)

3) Others

- Check that the setting of the applied motor capacity (Pr. 80) is correct for the inverter capacities in general-purpose magnetic flux vector control.
- Check that the wiring length is within 30m in general-purpose magnetic flux vector control.
- Check that the wiring length is correct in V/F control.

528 Operation mode is not changed properly

If the operation mode does not change correctly, check the following:

Check that the STF or STR signal is off. 1) External input signal When it is on, the operation mode cannot be changed.

Parameter setting Check the Pr. 79 setting.

When the setting of Pr. 79 "operation mode selection" is "0", switching input power on places the inverter in the external operation mode. By pressing the Model key twice and

pressing the (A) key, the external operation mode changes to the PU operation mode. For any other setting (1 to 8), the operation mode is limited according to the setting. (For details of Pr. 79, refer to page 124.)

5.2.9 Operation panel display is not operating

- Make sure that the operation panel is connected securely with the inverter.
- Check for a short circuit across terminals PC-SD.
- Check that the jumper across terminals P-P1 is fitted securely.

5.2.10 POWER lamp is not lit

(Check the power lamp after removing the operation panel.) Make sure that the wiring and installation are correct.

5.2.11 Parameter write cannot be performed

- Make sure that operation is not being performed (signal STF or STR is not ON).
- Make sure that you pressed the set key (write key) for longer than 1.5 s.
- Make sure that you are not attempting to set the parameter outside the setting
- Make sure that you are not attempting to set the parameter in the external operation mode.
 - (Set "2" in Pr. 77 when performing parameter setting in the external operation mode. (Refer to page 123))
- Check Pr. 77 "parameter write disable selection".

CHAPTER 6 MAINTENANCE/ INSPECTION

This chapter explains the "maintenance/inspection" of this product.

Always read the instructions before using the equipment.

 Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

6.1 Precautions for Maintenance and Inspection

The transistorized inverter is a static unit mainly consisting of semiconductor devices. Daily inspection must be performed to prevent any fault from occurring due to adverse influence by the operating environment, such as temperature, humidity, dust, dirt and vibration, changes in the parts with time, service life, and other factors.

6.1.1 Precautions for maintenance and inspection

For some short time after the power is switched off, a high voltage remains in the smoothing capacitor. Therefore, when more than 10 minutes have elapsed after power-off, make sure that the voltage across the main circuit terminals P (+) - N (-) of the inverter is 30VDC or less using a meter, etc. Then, access the inverter for inspection.

6.1.2 Check items

(1) Daily inspection

- · Check the following:
 - 1) Motor operation fault
 - 2) Improper installation environment
 - 3) Cooling system fault
 - 4) Unusual vibration and noise
 - 5) Unusual overheating and discoloration
- · During operation, check the inverter input voltages using a meter.

(2) Cleaning

Always run the inverter in a clean state.

When cleaning the inverter, gently wipe dirty areas with a soft cloth immersed in neutral detergent or ethanol.

Note: Do not use solvent, such as acetone, benzene, toluene and alcohol, as they will cause the inverter surface paint to peel off.

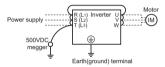
Do not use detergent or alcohol to clean the display and other sections of the operation panel as these sections may deform.

6.1.3 Periodic inspection

Check the areas inaccessible during operation and requiring periodic inspection.

- 1) Cooling system:.....Clean the air filter, etc.
- Screws and bolts:.........These parts may become loose due to vibration, temperature changes, etc. Check that they are tightened securely and retighten as necessary.
- 3) Conductors and insulating materials: Check for corrosion and damage.
- 4) Insulation resistance: Measure.
- 5) Cooling fan, smoothing capacitor: Check and change if necessary.

- Before performing the insulation resistance test using a megger on the external circuit, disconnect the cables from all terminals of the inverter so that the test voltage is not applied to the inverter.
- For the continuity test of the control circuit, use a meter (high resistance range) and do not use the megger or buzzer.
- For the inverter, conduct the insulation resistance test on the main circuit only as shown below and do not perform the test on the control circuit. (Use a 500VDC megger.)



6.1.5 Pressure test

Do not conduct a pressure test. The inverter's main circuit uses semiconductors, which may deteriorate if a pressure test is made.

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6.1.6 Daily and periodic inspection

			Interval		al				
5.5			-		odic*				er's K
Area of Inspection	Inspection Item	Description	Daily	1 year	2 years	Method	Criterion	Instrument	Customer' check
əral	Surrounding environment	Check ambient temperature, humidity, dust, dirt, etc.	0			Refer to page 14.	Ambient temperature: -10°C to +50°C, non-freezing. Ambient humidity: 90% or less, non- condensing.	Thermo- meter, hygrometer, recorder	
General	Overall unit	Check for unusual vibration and noise.	0			Visual and auditory checks.	No fault.		
	Power supply voltage	Check that main circuit voltage is normal.	0			Measure voltage across inverter terminals R-S-T (L1- L2-L3).	Within permissible AC (DC) voltage fluctuation (Refer to page 214)	Meter, digital multimeter	
	General	(1) Check with megger (across main circuit terminals and earth (ground) terminal). (2) Check for loose screws and bolts. (3) Check for overheat on each part. (4) Clean.		0 0 0	0	(1) Disconnect all cables from inverter and measure across terminals R (L1), S (L2), T (L3), U, V, W and earth (ground) terminal with megger. (2) Retighten. (3) Visual check.	(1) 5MΩ or more.(2), (3) No fault.	500VDC class megger	
it	Conductors, cables	Check conductors for distortion. Check cable sheaths for breakage.		0		(1), (2) Visual check.	(1), (2) No fault.		
Main circuit	Terminal block	Check for damage.		0		Visual check	No fault		
Mai	Inverter module Converter module	Check resistance across terminals.			0	Disconnect cables from inverter and measure across terminals R, S, T-P, N (L-1, L2, L3 - +, -), and across U, V, W - P (+), N (-) with a meter with a 100Ω range.	Refer to page 204.	Analog meter	
	Smoothing capacitor	Check for liquid leakage. Check for safety valve projection and bulge. Measure	0	0		(1), (2) Visual check. (3) Measure with	(1), (2) No fault.	Capacity meter	
		electrostatic capacity.		Ĭ		capacity meter.	more of rated capacity.		

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MAINTENANCE/INSPECTION

			In	terv	al				s
ξġ	Inspection			Perio	odic*				
Area of Inspection	Item	Description	Daily	1 year	2 years	Method	Criterion	Instrument	Customer' check
Main circuit	Relay	Check for chatter during operation. Check for rough surface on contacts.		0 0		(1) Auditory check.(2) Visual check.	(1) No fault. (2) No fault.		
Control circuit Protective circuit	Operation check	(1) Check balance of output voltages across phases with inverter operated independently. (2) Perform sequence protective operation test to make sure there is no fault in protective or display circuits.		0		(1) Measure voltage across inverter output terminals U-V-W. (2) Simulate connection of inverter protective circuit output terminals.	(1) Phase-to- phase voltage balance within 4V (8V) for 200V (400V). (2) Fault must occur because of sequence.	Digital multimeter, rectifier type voltmeter	
Cooling	Cooling fan	(1) Check for unusual vibration and noise. (2) Check for loose connection.	0	0		(1) Turn by hand with power off.(2) Visual check.	No unusual vibration and unusual noise.		
ay	Display	(1) Check for LED lamp blown.	0	0		Lamps indicate indicator lamps on panel. Clean with rag.	(1) Check that lamps are lit.		
Display	Meter	Check that reading is normal.	0			Check reading of meters on panel.	Must satisfy specified and management values.	Voltmeter, ammeter, etc.	
Motor	General	Check for unusual vibration and noise. Check for unusual odor.	0 0			(1) Auditory, sensory, visual checks. (2) Check for unusual odor due to overheat, damage, etc.	(1), (2) No fault.		
	Insulation resistance	Check with megger (across terminals and earth (ground) terminal).			0	Disconnect cables from U, V, W, including motor cables.	5M $Ω$ or more.	500V megger	

Note: The values within the parentheses are for the 400V class.

^{*} For periodic inspection, contact you nearest Mitsubishi sales representative.

· Checking the inverter and converter modules

<Preparation>

- Disconnect the external power supply cables (R, S, T (L1, L2, L3)) and motor cables (U, V, W).
- (2) Prepare a meter. (Use 100Ω range.)

<Checking method>

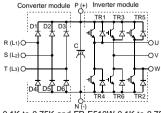
Change the polarity of the meter alternately at the inverter terminals R (L1), S (L2), T (L3), U, V, W, P (+) and N (-), and check for continuity.

Note: 1. Before measurement, check that the smoothing capacitor is discharged.
2. At the time of discontinuity, the measured value is almost ∞. When there is an instantaneous continuity, due to the smoothing capacitor the tester may not indicate ∞. At the time of continuity, the measured value is several to several ten's-of ohms depending on the number of modules, number of parallel modules, circuit tester type, etc. If all measured values are almost the same, the modules are without fault.

<Module device numbers and terminals to be checked>

		Tester	Polarity	Measured		Tester	Polarity	Measured
		⊕	\ominus	Value		⊕	\ominus	Value
	D1	R (L1)	P (+)	Discontinuity	D4	R (L1)	N (-)	Continuity
e fe	Di	P (+)	R (L1)	Continuity	D4	N (-)	R (L1)	Discontinuity
Converter module	D2	S (L2)	P (+)	Discontinuity	D5	S (L2)	N (-)	Continuity
no no	DZ	P (+)	S (L2)	Continuity	Do	N (-)	S (L2)	Discontinuity
o -	D3	T (L3)	P (+)	Discontinuity	D6	T (L3)	N (-)	Continuity
	DS	P (+)	T (L3)	Continuity	Do	N (-)	T (L3)	Discontinuity
lle	TR1	U	P (+)	Discontinuity	TR4	U	N (-)	Continuity
odt	IKI	P (+)	U	Continuity	111/4	N (-)	U	Discontinuity
Ĕ	TR3	V	P (+)	Discontinuity	TR6	V	N (-)	Continuity
ter	113	P (+)	V	Continuity	INO	N (-)	V	Discontinuity
Inverter module	TR5	W	P (+)	Discontinuity	TR2	W	N (-)	Continuity
드	CAL	P (+)	W	Continuity	1132	N (-)	W	Discontinuity

(Assumes the use of an analog meter.)



Note: The FR-E520S-0.1K to 0.75K and FR-E510W-0.1K to 0.75K do not have T (L₃), D3 and D6.

6.1.7 Replacement of parts

The inverter consists of many electronic parts such as semiconductor devices. The following parts may deteriorate with age because of their structural or physical characteristics, leading to reduced performance or failure of the inverter. For preventive maintenance, the parts must be changed periodically.

Part Name	Standard Replacement Interval	Description
Cooling fan	2 to 3 years	Replace (as required)
Smoothing capacitor in main circuit	8 years *	Replace (as required)
Smoothing capacitor on control board	8 years *	Replace the board (as required).

^{*} The design life of electrolytic capacitor is about eight years (50000h) if used for 20 hours a day and 300 days a year in the average yearly ambient temperature of 35°C.
Note: For part replacement, contact the nearest Mitsubishi FA center.

(1) Cooling fan

The cooling fan cools heat-generating parts such as the main circuit semiconductor devices. The life of the cooling fan bearing is usually 10,000 to 35,000 hours. Hence, the cooling fan must be changed every 2 to 3 years if the inverter is run continuously. When unusual noise and/or vibration is noticed during inspection, the cooling fan must be replaced immediately. When you need to change the cooling fan, contact the nearest Mitsubishi FA Center.

Inverter Model No.	Fan Type
FR-E520-0.75K	MMF-04C24DS BKO-CA1382H01
FR-E520-1.5K, 2.2K, 3.7K FR-E520S-0.75K	MMF-06D24DS BKO-C2461H07
FR-E520-5.5K, 7.5K	MMF-06D24ES BKO-CA1027H08
FR-E540-1.5K, 2.2K, 3.7K	MMF-06D24ES-FC4 BKO-CA1027H09
FR-E540-5.5K, 7.5K	MMF-06D24ES-FC5 BKO-CA1027H10

Removal

(For the FR-E520-0.75K to 3.7K, FR-E520S- 0.75K)

- 1) Remove the wiring cover. (Refer to page 8.)
- 2) Unplug the fan connector.

The cooling fan is plugged into the cooling fan connector beside the inverter terminal block. Unplug the connector and separate the inverter from the cooling fan.

- 3) Remove the cooling fan cover.
 - Push the cover in the direction of arrow and pull it down.
- 4) Remove the cooling fan and cooling fan cover. The cooling fan is secured by the fixing hooks. Disengage the fixing catches to remove the cooling fan and cooling fan cover.

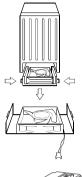
(For the FR-E520-5.5K and 7.5K)

- Remove the cooling fan cover from the inverter. (Push the cover in the direction of arrow A and pull it down in the direction of B.)
 Take care of connection cables of the cooling fan and inverter.
- 2) Remove the cooling fan connectors.

The cooling fan is connected to the inverter with a connector.

Slide the connector cover out of the way to remove the connector.

3) Remove the cooling fan. The cooling fan is secured by the fixing hooks. Disengage the fixing hooks to remove the cooling fan and cooling fan cover.





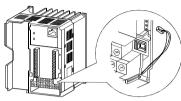




(For the FR-E540-1.5K to 7.5K)

- 1) Remove the front cover (Refer to page 6).
- Unplug the fan connector.
 The cooling fan is connected to the cooling fan connector beside the main circuit terminal block of the inverter.

Unplug the connector.



Fan connector

Remove the inverter and cooling fan.

Push in the direction of arr.

Push in the direction of arrow A and pull out in the direction of arrow B.





4) Remove the cooling fan and cooling fan cover.

The cooling fan is secured by the fixing hooks.

You can remove the cooling fan and cooling fan cover by disengaging the fixing hooks.





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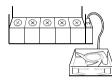
Reinstallation

(For the FR-E520-0.75K to 7.5K, FR-E520S-0.75K)

 After confirming the orientation of the fan, reinstall the fan to the cover so that the arrow on the left of "AIR FLOW" faces in the opposite direction of the fan cover.

Note: If the air flow is set in the wrong direction, the inverter life can be shorter.

- Reinstall the fan cover to the inverter. Run the cable through the wiring groove to prevent it from being caught between the chassis and cover.
- 3) Reconnect the cable to the connector.
- 4) Reinstall the wiring cover.





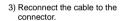
(For 5.5K, 7.5K)

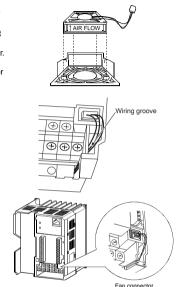
*Wire the cables using care so that they are not caught by the cooling fan.

(For the FR-E540-1.5K to 7.5K)

- After confirming the orientation of the fan, reinstall the fan to the cover so that the arrow on the left of "AIR FLOW" faces in the opposite direction of the fan cover. Note: If the air flow is set in the wrong direction, the inverter life can be shorter.
- Reinstall the fan cover to the inverter.
 Run the cable through the wiring.

Run the cable through the wiring groove to prevent it from being caught between the chassis and cover.





4) Reinstall the front cover.

(2) Smoothing capacitors

A large-capacity aluminum electrolytic capacitor is used for smoothing the DC in the main circuit, and an aluminum electrolytic capacitor is also used for stabilizing the control power in the control circuit.

Their characteristics are adversely affected by ripple current, etc. When the inverter is operated in an ordinary, air-conditioned environment, change the capacitors about every 5 years. When 5 years have elapsed, the capacitors will deteriorate more rapidly. Check the capacitors at least every year (less than six months if the life will be expired soon). Check the following:

- Case (side faces and bottom face for expansion)
- 2) Sealing plate (for remarkable warp and extreme crack)
- Appearance, external cracks, discoloration, leakage.
 When the measured capacitance of the capacitor has reduced below 80% of the rating, replace the capacitor.

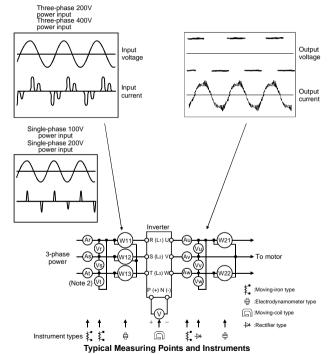
The capacitor life alarm is output to give an indication of replacement time. (Refer to page 169.)

6.1.8 Measurement of main circuit voltages, currents and powers

Measurement of voltages and currents

Since the voltages and currents on the inverter power supply and output sides include harmonics, accurate measurement depends on the instruments used and circuits measured

When instruments for commercial frequency are used for measurement, measure the following circuits using the instruments given on the next page.



Note: 1. Use FFT (Fast Fourier Transforms) to measure the output voltage accurately.

It cannot be measured accurately with a meter or general instrument.

For FR-E520S-0.1K to 0.75K and FR-E510W-0.1K to 0.75K do not use At, As. Vt. Vs. W12 and W13.

MAINTENANCE/INSPECTION

Measuring Points and Instruments

Item	Measuring Point	Measuring Instrument	Remarks (Reference Measured Value)		
Power supply voltage (V1)	Across R-S (L1-L2), S-T (L2- L3) and T-R (L3-L1)	Moving-iron type AC voltmeter	Is the commercial power supply permissible variation of AC volta (Refer to page 214)	within ige	
Power supply side current (I1)	R, S and T line currents (L1, L2 and L3 line currents)	Moving-iron type AC ammeter			
Power supply side power (P1)	At R (L1), S (L2) and T (L3), and across R-S (L1-L2), S-T (L2-L3) and T-R (L3-L1)	Electrodynamic type single-phase wattmeter	P1 = W11 + W12 + W13 (3-wattmeter method)		
	Calculate after measuring pow power.	er supply voltage, power su	pply side current and power supp	ly side	
Power supply side power factor	For three-phase power supply	[For single-phase po	ower supply]		
(Pf1)	$Pf1 = \frac{P1}{\sqrt{3}V \times 11} \times 100\%$	$Pf1 = \frac{P1}{V1 \times I1} >$	<100%		
Output side voltage (V2)	Across U-V, V-W and W-U	(Note 1) (Cannot be measured by moving-iron type)	Difference between phases is w ±1% of maximum output voltage		
Output side current (I2)	U, V and W line currents	Moving-iron type AC ammeter (Note 2)	Current should be equal to or les rated inverter current.Difference between phases is 10% or lowe		
Output side power (P2)	At U, V and W, and across U-V and V-W	Electrodynamic type single-phase wattmeter	P2 = W21 + W22 2-wattmeter method (or 3-wattm method)	eter	
Output side power factor (Pf2)	Calculate in similar manner to $Pf2 = \frac{P2}{\sqrt{3}V2 \times 12} \times 100\%$	power supply side power fac	ctor.		
Converter output	Across P-N (+)	Moving-coil type (such as tester)	Inverter LED display is lit. 1.35 : Maximum 380V (760V) during regenerative operation	× V1	
Frequency setting	Across 2 (positive)-5		0 to 5V/0 to 10VDC	ċ.	
signal	Across 4 (positive)-5		4 to 20mADC	"5" is mmor	
Frequency setting power supply	Across 10 (positive)-5		5VDC	"5" is common	
Frequency meter signal	Across FM (positive)-SD Across STF, STR, RH, RM,	Moving-coil type (Meter, etc. may be used) (Internal resistance: 50Ω or larger)	Approximately SVDC at maximum frequency (without frequency meter) T1 SVDC Pulse width T1: Adjusted with Pr. 900 Pulse cyclet Pr. S5 (Valid for frequency monitoring only)	SD is common.	
Start signal Select signal Reset	Across STF, STR, RH, RM, RL, MRS, RES-SD Across RES (positive)-SD	Moving-coil type (Meter, etc. may be used)	20 to 30VDC when open.ON	SD is common.	
Output stop	Across RES (positive)-SD Across MRS (positive)-SD	(Internal resistance: 50kΩ or larger)	voltage: 1V or less	Sor	
Output StOp	Across witto (positive)-ob	5.7	Continuity check	0	
Alarm signal Note: 1. Use FF	Across A-C Across B-C	Moving-coil type (such as a meter)	<normal> <faul Across A-C: Discontinuity Continuity</faul </normal>	nuity ntinuity	

Note: 1. Use FFT to measure the output voltage accurately. It can not be measured accurately with a meter or general instrumentation.

If the carrier frequency exceeds 5kHz, do not use this instrument since using it may increase eddycurrent loss produced in metal parts inside the instrument, leading to burnout. In this case, use an approximate effective value type instrument.

*The value within the parentheses is for the 400V class.

MEMO

CHAPTER 7 SPECIFICATIONS

This chapter explains the "protective functions" of this product. Always read the instructions before using the equipment.

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

7.1 Standard Specifications

7.1.1 Model specifications

(1) 3-phase 200V power supply

	Type FR-E520- K(C) (Note 8)		0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5
	oplicable motor capacity W) (Note 1)	0.1	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5
	Rated capacity (kVA) (Note 2)	0.3	0.6	1.2	2.0	3.2	4.4	7.0	9.5	13.1
Output	Rated current (A) (Note 6)	0.8 (0.8)	1.5 (1.4)	3 (2.5)	5 (4.1)	8 (7)	11 (10)	17.5 (16.5)	24 (23)	33 (31)
õ	Overload capacity (Note 3)			(inv	150% 6 erse-tir		% 0.5s acterist	ics)		
	Voltage (Note 4)									
>	Rated input AC (DC) voltage, frequency		Three phase, 200V to 240V 50Hz/60Hz (280VDC, Note 7)							
supply	Permissible AC (DC) voltage fluctuation		170 to 264V 50Hz/60Hz (252 to 310VDC, Note 7)							
Power	Permissible frequency fluctuation		±5%							
ď	Power supply system capacity (kVA)(Note 5)	0.4	0.8	1.5	2.5	4.5	5.5	9	12	17
(JI	otective structure EM1030)		Enclosed type (IP20), IP40 for totally enclosed structure series							
	ooling system		Self-cooling Forced air cooling							
Ap	proximate weight (kg)	0.6	0.6	0.8	1.0	1.7	1.7	2.2	4.4	4.9

- Note:1. The applicable motor capacity indicated is the maximum capacity applicable when a Mitsubishi 4-pole standard motor is used.
 - 2. The rated output capacity indicated assumes that the output voltage is 230V.
 - The overload capacity indicated in % is the ratio of the overload current to the inverter's rated current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.
 - 4. The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the pulse voltage value of the inverter output side voltage remains unchanged at about \(\frac{1}{2} \) that of the power supply.
 - The power supply capacity changes with the values of the power supply side inverter impedances (including those of the input reactor and cables).
 - 6. The rated output current in the parentheses applies when low acoustic noise operation is to be performed at the ambient temperature higher than 40°C(30°C for the totally enclosed structure) with the Pr. 72 (PWM frequency selection) value set to 2kHz or higher.
 - 7. When using a DC power supply
 - (1) The guideline for the power supply voltage fluctuation range is 280VDC ±10%, and usually use the power supply at or below 300VDC.
 - (2) When DC power is switched on, a larger inrush current flows than in AC power. The number of power-on times should be minimized.
 - (3) 300VDC must be reserved to make the torque characteristic equal to when AC power supply is used.
 - 8. The type code of the dirt-protection structure series ends with C.

(2) 3-phase 400V power supply

Tv	pe FR-E540 K (C)	(Note 7)	0.4	0.75	1.5	2.2	3.7	5.5	7.5
Ap	plicable motor capacity ote 1)	0.4	0.75	1.5	2.2	3.7	5.5	7.5	
	Rated capacity (kVA)	(Note 2)	1.2	2.0	3.0	4.6	7.2	9.1	13.0
Output	Rated current (A)	(Note 6)	1.6 (1.4)	2.6 (2.2)	4.0 (3.8)	6.0 (5.4)	9.5 (8.7)	12	17
Out	Overload capacity	(Note 3)		(ir		60s 200 me char	% 0.5s acteristic	s)	
	Voltage	(Note 4)		Three p	hase, 3	80V to 4	80V 50H	lz/60Hz	
_	Rated input AC voltage frequency	Э,		Three phase, 380V to 480V 50Hz/60Hz					
supply	Permissible AC voltag fluctuation	е			325V to	528V 50	Hz/60Hz		
Power	Permissible frequency fluctuation					±5%			
ш	Power supply system capacity (kVA) (Note 5)			2.5	4.5	5.5	9.5	12	17
Pro	Protective structure (JEM1030)			ed type ((IP20), IF	P40 for to series	otally end	closed st	ructure
Cooling system			Self-cooling Forced air cooling						
Ap	proximate weight (kg)		1.9	1.9	2.0	2.1	2.1	3.8	3.8

Note: 1. The applicable motor capacity indicated is the maximum capacity applicable when a Mitsubishi 4-pole standard motor is used.

- 2. The rated output capacity indicated assumes that the output voltage is 440V.
- The overload capacity indicated in % is the ratio of the overload current to the inverter's rated current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.
- 4. The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the pulse voltage value of the inverter output side voltage remains unchanged at about √2 that of the power supply.
- The power supply capacity changes with the values of the power supply side inverter impedances (including those of the input reactor and cables).
- 6. The rated output current in the parentheses applies when low acoustic noise operation is to be performed at the ambient temperature higher than 40°C (30°C for the totally enclosed structure) with the Pr. 72 (PWM frequency selection) value set to 2kHz or higher.
- 7. The type code of the dirt-protection structure series ends with C.

(3) Single-phase 200V power supply

T	ED E5000	0.4	0.0	0.4	0.75
ıy	pe FR-E520S- C K	0.1	0.2	0.4	0.75
	plicable motor capacity (kW) ote 1)	0.1	0.2	0.4	0.75
	Rated capacity (kVA) (Note 2)	0.3	0.6	1.2	2.0
Ħ	Rated output current (A)	0.8	1.5	3.0	5.0
Outpi	(Note 6)	(0.8)	(1.4)	(2.5)	(4.1)
ō	Overload capacity (Note 3)	150% 60s	200% 0.5s (inv	erse-time char	acteristics)
	Rated output voltage (Note 4)	Three	e phase, 200V	to 240V 50Hz/	60Hz
_	Rated input AC voltage, frequency	Single phase, 200V to 240V 50Hz/60Hz			
supply	Permissible AC voltage fluctuation	Single phase, 170 to 264V 50Hz/60Hz			
Power	Permissible frequency fluctuation		Within	n ±5%	
а.	Power supply capacity (kVA) (Note 5)	0.5	0.9	1.5	2.5
Pro	otective structure (JEM1030)		Enclosed	type (IP20)	
Co	oling system		Self-cooling		Forced air cooling
Ap	proximate weight (kg)	0.6	0.6	1.0	1.7

Note: 1. The applicable motor capacity indicated is the maximum capacity applicable when a Mitsubishi 4-pole standard motor is used.

Normally, the rated current (at 50Hz) of the motor applied should not exceed the rated current.

- 2. The rated output capacity indicated assumes that the output voltage is 230V.
- The overload capacity indicated in % is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.
- 4. The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the pulse voltage value of the inverter output side voltage remains unchanged at about √2 that of the power supply.
- The power supply capacity changes with the values of the power supply side inverter impedances (including those of the input reactor and cables). Prepare the power supply capacity which is not less than the indicated.
- The rated output current in the parentheses applies when low acoustic noise operation is to be performed at the ambient temperature higher than 40°C with the Pr. 72 (PWM frequency selection) value set to 2kHz or higher.

(4) Single-phase 100V power supply

Ту	pe FR-E510W- K		0.1	0.2	0.4	0.75	
	plicable motor capacity (k' ote 1)	W)	0.1	0.2	0.4	0.75	
	Rated capacity (kVA) (N	lote 2)	0.3	0.6	1.2	2	
Ħ	Rated output current (A)		0.8	1.5	3.0	5.0	
Output	(Note 7)		(0.8)	(1.4)	(2.5)	(4.1)	
ō	Overload capacity (N	lote 3)	150% 60s	200% 0.5s (inv	erse-time char	acteristics)	
	Rated output voltage (N	lote 4)	Three phas	se, 200V to 230	OV 50Hz/60Hz	(Note 4, 8)	
>	Rated input AC voltage, frequency		Single phase, 100V to 115V 50Hz/60Hz				
supply	Permissible AC voltage fluctuation		Single phase, 90 to 132V 50Hz/60Hz				
Power	Permissible frequency fluctuation			Withir	n ±5%		
	Power supply capacity (k (Note 5)	VA)	0.5	0.9	1.5	2.5	
Pre	otective structure (JEM103	30)	Enclosed type (IP20)				
Co	oling system			Self-c	ooling		
Αp	proximate weight (kg)		0.6	0.6	1.0	1.7	

- Note:1. The applicable motor capacity indicated is the maximum capacity applicable when the Mitsubishi 4-pole standard motor is used. Normally, the rated current (at 50Hz) of the motor applied should not exceed the rated current.
 - 2. The rated output capacity indicated assumes that the output voltage is 230V.
 - The overload capacity indicated in % is the ratio of the overload current to the inverter's rated current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.
 - 4. For single-phase 100V power input, the output voltage provided cannot be twice or more than the power supply voltage. The pulse voltage value of the inverter output side voltage remains unchanged at about √2 that of the power supply.
 - The power supply capacity changes with the values of the power supply side inverter impedances (including those of the input reactor and cables). Prepare the power supply capacity which is not less than the indicated.
 - Load applied to the motor will reduce the output voltage about 10 to 15%. When using a general-purpose motor, it must be used under reduced load.
 - The rated output current in the parentheses applies when low acoustic noise operation is to be performed at the ambient temperature higher than 40°C with the Pr. 72 "PWM frequency selection" value set to not less than 2kHz.
 - For single-phase 100V power input, the application of motor load reduces the output voltage about 10 to 15%. Therefore, the load must be reduced when a general-purpose motor is used.

7.1.2 Common specifications

	Cor	ntrol system		Soft-PWM control/high carrier frequency PWM control can be selected. V/F control or general-purpose magnetic flux vector control can be selected.				
	Out	put frequency	range	0.2 to 400Hz (starting frequency variable between 0 and 6	60Hz)			
		quency	Analog input	Across terminals 2-5: 1/500 of maximum set frequency (5VDC input), 1/1000 (10VDC, 4-20mADC input), 1/256 (when operation panel potentiometer is used)				
	sett	olution		Frequency setting potentiometer: 1/256 of maximum set for				
			Digital input	0.01Hz (less than 100Hz), 0.1Hz (100Hz or more) when d is made using the operation panel	igital setting			
	Free	quency	Analog input	Within ±0.5% of maximum output frequency (25°C ±10°C)				
		uracy	Digital input	Within 0.01% of set output frequency when setting is operation panel.				
	Volt	age/frequency	y characteristic	Base frequency set as required between 0 and 400H torque or variable torque pattern can be selected.				
	Star	ting torque		150% or more (at 1Hz), 200% or more (at 3Hz) when gene magnetic flux vector control or slip compensation is select				
		que boost		Manual torque boost, 0 to 30% may be set.				
	Acceleration/deceleration time setting			0.01, 0.1 to 3600 s (acceleration and deceleration can be set i linear or S-pattern acceleration/deceleration mode can be sele				
	Resking torque (Note 3) 1.5K 50%, 2.2K, 3.7K, 5.5K, 7.5K 2		0.1K, 0.2K 150%, 0.4K, 0.75K 100%, 1.5K 50%, 2.2K, 3.7K, 5.5K, 7.5K 20%					
	Dia	ung torque	DC injection	Operation frequency (0 to 120Hz), operation time (0 to 10				
SU	C	rent stall prev	brake	operation voltage (0 to 30%) variable Operation current level can be set (0 to 200% variable),				
atio		ration level	ention	absence can be selected.	presence or			
Control specifications		age stall prev	ention	Operation level is fixed, presence or absence can be selected.				
gs	Higl	h-response cu	rrent limit level	Operation level is fixed, presence or absence can be sele	cted.			
ontrol		Frequency setting	Analog input	0 to 5VDC, 0 to 10VDC, 4 to 20mADC, built-in frequency settin potentiometer.				
ŏ		signal	Digital input	Entered from operation panel.				
		Start signal		Forward rotation and reverse rotation, start signal self-h (3-wire input) selectable.	olding input			
		Alarm reset		Used to reset alarm output provided when protective activated.	function is			
	sli	Multi-speed	selection	Up to 15 speeds can be selected. (Each speed can be set between 0 and 400Hz, running speed can be changed during operation from the operation panel.)				
	Input signals	Second func	tion selection	Used to select second functions (acceleration time, deceleration time, torque boost, base frequency, electronic overcurrent protection).				
	ū	Output stop		Instantaneous shut-off of inverter output (frequency, voltage).	Use Pr. 180 to			
	Current input selection			Used to select input of frequency setting signal 4 to 20mADC (terminal 4).	Pr. 183 for selection.			
			mal relay input	Thermal relay contact input for use when the inverter is				
		PU operation operation sw		Used to switch between PU operation and external operation from outside the inverter.				
		V/F-general- magnetic flux		Used to switch between V/F control and general-purpose magnetic flux vector control from outside the inverter.				

SPECIFICATIONS

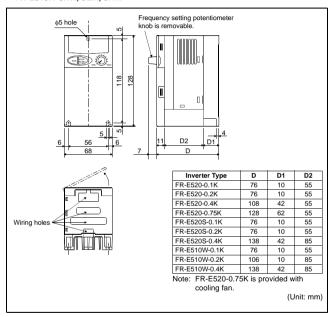
ations	Operation functions			Maximum/minimum frequency setting, frequency jump operation, external thermal relay input selection, automatic restant operation after instantaneous power failure, forward/reverse rotation prevention, slip compensation, operation mode selection, offline auto tuning function, PID control, computer link operation (RS-485)			
Control specifications	Operating status Operating status			2 open collector output signals can be selected from inverter running, up to frequency, frequency detection, overload alarm, zero current detection, output current detection, PID upper limit, PID lower limit, PID forward/reverse rotation, operation ready, capacitor life alarm, minor fault and alarm, and 1 contact output (230VAC 0.3A, 30VDC 0.3A) can be selected.			
	For meter			1 signal can be selected from output frequency, output current and output voltage. Pulse train output (1440 pulses/s/full scale).			
зy	Ope	Operating status				Output voltage, output current, set frequency, running.	
Display	display Alarm definition			Alarm definition is displayed when protective function is activated. 4 alarm definitions are stored.			
	LEC	display		Power application (POWER), Alarm (ALARM)			
Prof	Protective/alarm functions		ions	Overcurrent shut-off (during acceleration, deceleration, constant speed), regenerative overvoltage shut-off, undervoltage (Note 1), instantaneous power failure (Note 1), overload shut-off (electronic overcurrent protection), brake transistor alarm, output short circuit, stall prevention, brake resistor overheat protection, heatisk overheat, fan failure (Note 4), parameter error, PU disconnection, output phase failure protection, earth (ground) fault overcurrent protection (400V class), starting-time earth (ground) fault overcurrent protection (other than 400V class), option alarm (400V class), 24VDC power supply short circuit (400V class)			
ant	Ambient temperature			-10°C to +50°C (non-freezing) (-10°C to +40°C for totally-enclosed structure feature)			
Ě	Amb	pient humidity		90%RH or less (non-condensing)			
Environment		age temperat	ure (Note 2)	-20°C to +65°C			
Ē		oience		Indoors (no corrosive and flammable gases, oil mist, dust and dirt.)			
1	Altit	ude, vibration		Maximum 1000m above sea level for standard operation.			

- Note: 1. When undervoltage or instantaneous power failure has occurred, alarm display or alarm output is not provided but the inverter itself is protected. Overcurrent, regenerative overvoltage or other protection may be activated at power restoration according to the operating status (load size, etc.)
 - 2. Temperature applicable for a short period in transit, etc.
 - 3. The braking torque indicated is a short-duration average torque (which varies with motor loss) when the motor alone is decelerated from 60Hz in the shortest time and is not a continuous regenerative torque. When the motor is decelerated from the frequency higher than the base frequency, the average deceleration torque will reduce. Since the inverter does not contain a brake resistor, use the optional brake resistor when regenerative energy is large. (The optional brake resistor cannot be used with 0.1K and 0.2K.) A brake unit (BU) may also be used.
 - 4. Not provided for the FR-E540-0.4K, 0.75K, FR-E520(S)-0.1K to 0.4K and FR-E510W-0.1K to 0.75K which are not equipped with a cooling fan.

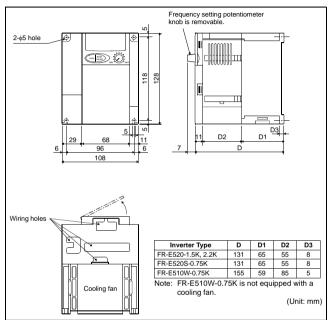
7.1.3 Outline drawings

(1) 200V class, 100V class

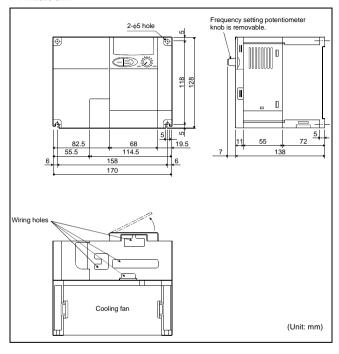
- FR-E520-0.1K, 0.2K, 0.4K, 0.75K
- FR-E520S-0.1K, 0.2K, 0.4K
- FR-E510W-0.1K, 0.2K, 0.4K



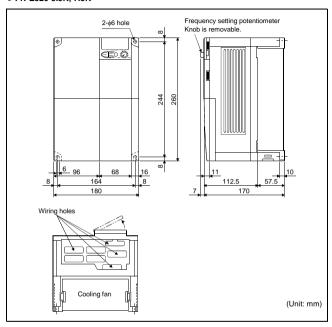
- FR-E520-1.5K, 2.2K
- FR-E520S-0.75K
- FR-E510W-0.75K



FR-E520-3.7K

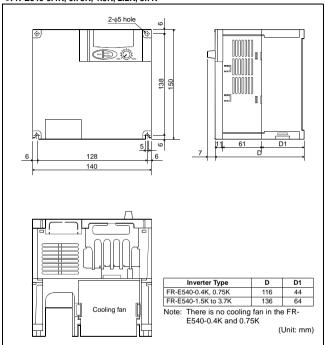


• FR-E520-5.5K, 7.5K

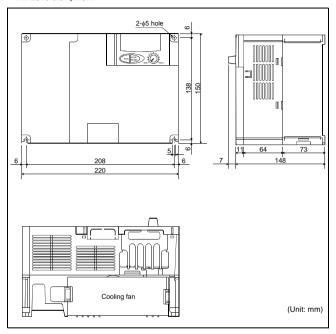


(2) 400V class

●FR-E540-0.4K, 0.75K, 1.5K, 2.2K, 3.7K



• FR-E540-5.5K, 7.5K



MEMO

This chapter provides "supplementary information" for use of this product.

Always read the instructions before using the equipment.

APPENDIX 1	Instruction Code List	228
APPENDIX 2	When using the communication	
	option. (400V class only)	232

APPENDIX 1 Instruction Code List

Func-	Parameter	Name		ction de	Link Parameter Extension Setting
tion	Number	Name	Read	Write	(Instruction Code 7F/FF)
	0	Torque boost	00	80	0
	1	Maximum frequency	01	81	0
o o	2	Minimum frequency	02	82	0
Basic functions	3	Base frequency	03	83	0
i d	4	Multi-speed setting (high speed)	04	84	0
c fc	5	Multi-speed setting (middle speed)	05	85	0
asi	6	Multi-speed setting (low speed)	06	86	0
ш	7	Acceleration time	07	87	0
	8	Deceleration time	08	88	0
	9	Electronic thermal O/L relay	09	89	0
	10	DC injection brake operation frequency	0A	8A	0
	11	DC injection brake operation time	0B	8B	0
	12	DC injection brake voltage	0C	8C	0
	13	Starting frequency	0D	8D	0
	14	Load pattern selection	0E	8E	0
	15	Jog frequency	0F	8F	0
	16	Jog acceleration/deceleration time	10	90	0
	18	High-speed maximum frequency	12	92	0
	19	Base frequency voltage	13	93	0
	20	Acceleration/deceleration reference frequency	14	94	0
Suc	21	Acceleration/deceleration time increments	15	95	0
čţi	22	Stall prevention operation level	16	96	0
Standard operation functions	23	Stall prevention operation level compensation factor at double speed	17	97	0
ā	24	Multi-speed setting (speed 4)	18	98	0
edc	25	Multi-speed setting (speed 5)	19	99	0
5	26	Multi-speed setting (speed 6)	1A	9A	0
g	27	Multi-speed setting (speed 7)	1B	9B	0
Star	29	Acceleration/deceleration pattern	1D	9D	0
,	30	Regenerative function selection	1E	9E	0
l	31	Frequency jump 1A	1F	9F	0
	32	Frequency jump 1B	20	A0	0
	33	Frequency jump 2A	21	A1	0
	34	Frequency jump 2B	22	A2	0
	35	Frequency jump 3A	23	A3	0
	36	Frequency jump 3B	24	A4	0
	37	Speed display	25	A5	0
	38	Frequency at 5V (10V) input	26	A6	0
	39	Frequency at 20mA input	27	A7	0
us ar	41	Up-to-frequency sensitivity	29	A9	0
Output terminal functions	42	Output frequency detection	2A	AA	0
fe o	43	Output frequency detection for reverse rotation	2B	AB	0
	44	Second acceleration/deceleration time	2C	AC	0
pc Su	45	Second deceleration time	2D	AD	0
Second	46	Second torque boost	2E	AE	0
S ju	47	Second V/F (base frequency)	2F	AF	0
	48	Second electronic thermal O/L relay	30	ВО	0

Func-	Parameter	Name		iction ide	Link Parameter Extension Setting
tion	Number			Write	(Instruction Code 7F/FF)
_ 0	52	Operation panel/PU main display data selection	34	B4	0
Display functions	54	FM terminal function selection	36	B6	0
Disi	55	Frequency monitoring reference	37	B7	0
- 2	56	Current monitoring reference	38	B8	0
Automatic restart functions	57	Restart coasting time	39	В9	0
Auto res func	58	Restart cushion time	3A	BA	0
Additional function	59	Remote setting function selection	3B	ВВ	0
	60	Shortest acceleration/deceleration mode	3C	BC	0
l i	61	Reference current	3D	BD	0
	62	Reference current for acceleration	3E	BE	0
	63	Reference current for deceleration	3F	BF	0
	65	Retry selection	41	C1	0
Operation selection functions	66	Stall prevention operation level reduction starting frequency	42	C2	0
or I	67	Number of retries at alarm occurrence	43	C3	0
₽	68	Retry waiting time	44	C4	0
i i	69	Retry count display erasure	45	C5	0
ele	70	Special regenerative brake duty	46	C6	0
S L	71	Applied motor	47	C7	0
atic	72	PWM frequency selection	48	C8	0
per	73	0-5V/0-10V selection	49	C9	0
0	74	Filter time constant	4A	CA	0
	75	Reset selection/disconnected PU detection/PU stop selection	4B	СВ	0
	77	Parameter write disable selection	4D	CD	0
	78	Reverse rotation prevention selection	4E	CE	0
	79	Operation mode selection	4F	CF	0
Φ	80	Motor capacity	50	D0	0
pos Tro	82	Motor excitation current	52	D2	0
General-purpose magnetic flux vector control	83	Rated motor voltage	53	D3	0
al- gnet	84	Rated motor frequency	54	D4	0
ane mag	90	Motor constant (R1)	5A	DA	0
ğ - >	96	Auto-tuning setting/status	60	E0	0
	117	Communication station number	11	91	1
ے ا	118	Communication speed	12	92	1
Communication functions	119	Stop bit length	13	93	1
nmunicat functions	120	Parity check presence/absence	14	94	1
in the	121	Number of communication retries	15	95	1
E J	122	Communication check time interval	16	96	1
0	123	Waiting time setting	17	97	1
	124	CR • LF presence/absence selection	18	98	1

Func-	Parameter	Name	Instru Co		Link Parameter Extension Setting
tion	Number	- Tamb	Read	Write	(Instruction Code 7F/FF)
	128	PID action selection	1C	9C	1
-	129	PID proportional band	1D	9D	1
ž	130	PID integral time	1E	9E	1
PID control	131	Upper limit	1F	9F	1
₽.	132	Lower limit	20	A0	1
	133	PID action set point for PU operation	21	A1	1
	134	PID differential time	22	A2	1
Additional function	145	PU display language selection	2D	AD	1
Addi	146	Frequency setting command selection	2E	AE	1
_ c	150	Output current detection level	32	B2	1
Current	151	Output current detection period	33	B3	1
efe	152	Zero current detection level	34	B4	1
	153	Zero current detection period	35	B5	1
Sub function	156	Stall prevention operation selection	38	B8	1
Additional function	160	User group read selection	00	80	2
Initial	171	Actual operation hour meter clear	0B	8B	2
so.	173	User group 1 registration	0D	8D	2
User functions	174	User group 1 deletion	0E	8E	2
US D	175	User group 2 registration	0F	8F	2
ے	176	User group 2 deletion	10	90	2
SL	180	RL terminal function selection	14	94	2
흕	181	RM terminal function selection	15	95	2
n al	182	RH terminal function selection	16	96	2
Ferminal ment fun	183	MRS terminal function selection	17	97	2
Terminal assignment functions	190	RUN terminal function selection	1E	9E	2
sigi	191	FU terminal function selection	1F	9F	2
as	192	A, B, C terminal function selection	20	A0	2
_	232	Multi-speed setting (speed 8)	28	A8	2
. <u>ē</u>	233	Multi-speed setting (speed 9)	29	A9	2
96.5	234	Multi-speed setting (speed 10)	2A	AA	2
5	235	Multi-speed setting (speed 11)	2B	AB	2
9	236	Multi-speed setting (speed 12)	2C	AC	2
-S-	237	Multi-speed setting (speed 13)	2D	AD	2
Multi-speed operation	238	Multi-speed setting (speed 14)	2E	AE	2
-	239	Multi-speed setting (speed 15)	2F	AF	2
	240	Soft-PWM setting	30	B0	2
ous	244	Cooling fan operation selection	34	B4	2
ncti	245	Rated motor slip	35	B5	2
Sub functions	246	Slip compensation response time	36	B6	2
Sut	247	Constant-output region slip compensation selection	37	B7	2
	249	Earth (ground) fault detection at start	39	B9	2

Func-	Parameter	Name		uction ide	Link Parameter Extension Setting
tion Number			Read	Write	(Instruction Code 7F/FF)
Stop selection function	250	Stop selection	ЗА	ВА	2
Aditional	251	Output phase failure protection selection	3В	ВВ	2
-	338*	Operation command source	26	A6	3
npute link nction	339*	Speed command source	27	A7	3
Computer link function	340*	Link startup mode selection	28	A8	3
ŭ =	342	E ² PROM write selection	2A	AA	3
Ĕ.,	345*	DeviceNet address startup data (lower byte)	2D	AD	3
DeviceNetm functions	346*	DeviceNet baudrate startup data (lower byte)	2E	AE	3
rice	347*	DeviceNet address startup data (higher byte)	2F	AF	3
ē ₽	348*	DeviceNet baudrate startup data (higher byte)	30	B0	3
	387*	Initial communication delay time	57	D7	3
LONWORKS [®] functions	388*	Send time interval at hart beat	58	D8	3
NWORKS	389*	Minimum sending time at hart beat	59	D9	3
INC Inct	390*	% setting reference frequency	5A	DA	3
선 구	391*	Receive time interval at hart beat	5B	DB	3
	392*	Event driven detection width	5C	DC	3
اعا	500*	Communication error recognition waiting time	00	80	5
ctic	501*	Communication error occurrence count display	01	81	5
Additional Function	502*	Stop mode selection at communication error	02	82	5
	900	FM terminal calibration	5C	DC	1
	902	Frequency setting voltage bias	5E	DE	1
	903	Frequency setting voltage gain	5F	DF	1
E s	904	Frequency setting current bias	60	E0	1
atic	905	Frequency setting current gain	61	E1	1
Salibration	922	Built-in frequency setting potentiometer bias	16	96	9
ΰΞ	923	Built-in frequency setting potentiometer gain	17	97	9
	990	PU buzzer control	5A	DA	9
	991	PU contrast adjustment	5B	DB	9

^{*}For only the 400V class fitted with the communication option.

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When using the communication option. (400V class only)

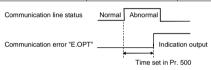
Operation at Communication Error Occurrence

The extended functions for E.OPT error and E. 3 error have been added to this instruction manual. (Pr. 500 to Pr. 502)

(1) Pr. 500 "communication error execution waiting time"

You can set the waiting time from occurrence of a communication line fault to communication error indication "E.OPT".

Parameter Number	Setting Range	Minimum Setting Increment	Factory Setting	
500	0 to 999.8 s	0.1 s	0	



If a communication line fault still persists after the time set in Pr. 500 has elapsed, it is recognized as a communication error and the communication error indication "E.OPT" is output. If communication is restored to normal during the set time, operation is continued without a communication error indication.

(2) Pr. 501 "communication error occurrence count indication"

You can display the cumulative number of communication line faults that occurred. Write "0" to Pr. 501 to clear the communication error occurrence count.

Parameter Number	Setting Range	Minimum Setting Increment	Factory Setting
501	0	1	0

Count timing according to communication line status



At the time when a communication line fault occurs, one count is made in Pr. 501 "communication error occurrence count indication".

Note: The communication error occurrence count indication is temporarily stored in RAM. As it is reflected to E²PROM per hour only, performing power-on reset or inverter reset causes the last value stored in E²PROM to display as the value of Pr. 501.

(3) Pr. 502 "stop mode selection at communication error"

You can select inverter operation to be performed in the occurrence of a communication line fault or an option error.

Parameter Number	Setting Range	Minimum Setting Increment	Factory Setting
502	0, 1, 2	1	0

(About the settings)

Fault	Pr. 502 Setting	At Occurrence of Fault			Error Recognition after Elapse of Pr. 500 Time			At Resolution of Fault		
rauit		Operating status	Indi- cation	Alarm output	Operating status	Indi- cation	Alarm output	Operating status	Indi- cation	Alarm output
line	0	Continued	No	Not provided	Coasting to stop	E.OPT lit	Provided	Stop held	E.OPT kept lit	Provided
Communication line	1	Continued	No	Not provided	Decele- ration to stop	E.OPT lit after stop	Provided after stop	Stop held	E.OPT kept lit	Provided
Comm	2	Continued	No	Not provided	Decele- ration to stop	E.OPT lit after stop	Not provided	Restart	E.OPT kept lit	Not provided
	0	Coasting to stop	E.3 lit	Provided	Coasting to stop	E.3 lit	Provided	Stop held	E.3 kept lit	Provided
Option error	1	Decele- ration to stop	E.3 lit after stop	Provided after stop	Decele- ration to stop	E.3 lit after stop	Provided after stop	Stop held	E.3 kept lit	Provided
	2	Decele- ration to stop	E.3 lit after stop	Provided after stop	Decele- ration to stop	E.3 lit after stop	Provided after stop	Stop held	E.3 kept lit	Provided

- Note: 1. A communication error [E.OPT (fault data: A0H)] is a fault on the communication line, and a communication error [E. 3 (fault data: F3H)] is a communication error inside the inverter.
 - 2. The alarm output is the ABC contact output or alarm bit output.
 - 3. If the Pr. 502 setting is 1 or 2, the deceleration time is the ordinary deceleration time setting (Pr. 8, Pr. 44, Pr. 45).
 - The acceleration time at restart is the ordinary acceleration time setting (Pr. 7, Pr. 44).
 - If the Pr. 502 setting is 2, the operation command/speed command at restart follows the command before occurrence of a fault.
 - 6. For the setting of alarm output, the fault definition is stored in the alarm history. (Write to the alarm history is performed when the alarm output is provided.) If the alarm output is not provided, the fault definition overwrites the alarm indication of the alarm history temporarily but is not stored. After the fault is cleared, the alarm indication is reset and returns to the ordinary monitor and the alarm history returns to the original alarm history.
 - When a communication line fault, which occurred at the Pr. 502 setting of 2, is cleared during deceleration, acceleration restarts at that point. (Acceleration does not restart at occurrence of a Option fault.)

Switching mode between the PU operation mode and network operation mode (when used with a communication option)

You can switch operation between the PU operation and network operation from the operation panel or parameter unit (FR-PU04) during starting up in the network operation mode.

Pr. 340		Operation Mode	Mode at Power On or at Restoration from Instantaneous Power Failure		
Setting	Pr. 79				
	0	PU or network operation	Inverter operates in the network operation mode. Operation mode can be switched between the PU operation and the network operation.		
	1	PU operation	Inverter operates in the PU operation mode.		
	2	Network operation	Inverter operates in the network operation mode.		
	3	External/PU combined operation	Input running frequency from the PU and the start signal from outside.		
	4 External/PU combine operation		Input running frequency from outside and the start signal from the PU.		
10	6	Switch-over	Inverter operates in the network operation mode. Operation mode can be switched between the PU operation and the network operation.		
	7*	PU operation interlock	MRS signal ONInverter operates in the external operation mode. (Operation mode can be switched to the PU operation mode by the parameter unit.) MRS signal OFF Inverter operates in the external operation mode.		
	8*	Operation mode switch- over by the external signal	X16 signal ONInverter operates in the external operation mode. X16 signal OFFInverter operates in the PU operation mode.		

^{*} When Pr. 79 = "7 or 8", the inverter operates in the same manner as when Pr. 340 = "0". (The inverter will not operate in the network operation mode at powering on.)



When Pr. 340="10" and Pr. 79="0 or 6", operation can be switched between the PU operation and network operation from the operation panel or parameter unit (FR-PU04).

Operation panel

Shifts to the PU operation mode when PU is displayed on the operation mode switching menu and shifts to the network operation when DP. To is displayed.

• FR-PU04

Shifts to the PU operation mode when PU is displayed and to the network operation mode when **EXT** is displayed.

REMARKS

- Change of the Pr. 340 setting is made valid when powering on or resetting the inverter.
- When copying parameters to the inverter which is not available with Pr. 340="10", the inverter operates in the same manner as when Pr. 340 ="0". For Pr. 340="0, 1", refer to the instruction manual of each communication option.



For Maximum Safety

- Mitsubishi general-purpose inverters are not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life
- When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace. atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi sales representative.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to prevent serious accidents when it is used in facilities where breakdowns of the product are likely to cause a serious accident.
- Please do not use this product for loads other than 3-phase induction motors.

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Date	*Manual Number	Revision
Nov., 1997	IB(NA)-66813-A	First edition
Jun., 1998	IB(NA)-66813-B	Additions Single-phase 200V power input specifications Response to Standard-compliant models FR-E520-5.5K, 7.5K Pr. 146 "frequency setting command selection" Pr. 249 "earth (ground) fault detection at start"
		Corrections to clerical errors Factory setting of Pr. 79 "operation mode selection"
Jul., 1999	IB(NA)-66813-C	Additions Three-phase 400V power input specifications Single-phase 100V power input specifications Modifications Control circuit terminal screw tightening torque
Nov., 2000	IB(NA)-66813-D	Additions
Jul., 2001	IB(NA)-66813-E	[Modifications] • Pr. 342 "E ² PROM write selection" • Alarm indications (E. 3)
Jul., 2003	IB(NA)-66813-F	Additions Pr. 503 "capacitor life timer" Pr. 504 "capacitor life alarm output set time Modifications The setting range of Pr.240 "Soft-PWM setting" The setting range of Pr.340 "link start up mode selection"
May, 2004	IB(NA)-66813-G	Additions Control logic change function for the 100V/200V class