

MITSUBISHI

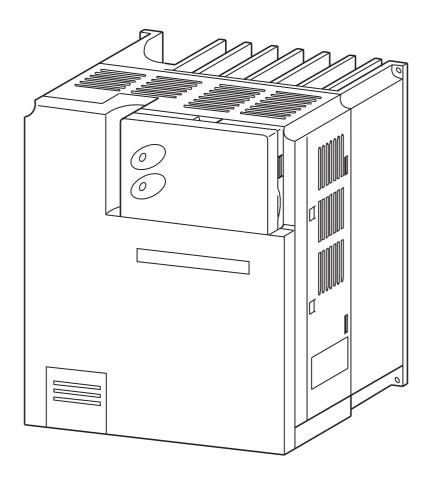
TRANSISTORIZED INVERTER

FR-E500

INSTRUCTION MANUAL

HIGH PERFORMANCE & HIGH FUNCTION

FR-E540-0.4K to 7.5K-EC FR-E520S-0.4K to 2.2K-EC



OUTLINE Chapter 1

INSTALLATION AND WIRING Chapter 2

OPERATION/ CONTROL Chapter 3

PARAMETERS Chapter 4

PROTECTIVE Chapter 5

SPECIFICATIONS Chapter 6

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 CAUTION 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

WARNING

- 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 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, switch power off, wait for more than 10 minutes, and check for residual voltage with a meter (refer to chapter 2 for further details) etc.
- Earth the Inverter.
- 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

A 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 will overheat abnormally due a brake transistor or other fault, resulting in a fire.
- Do not connect a resistor directly to the DC terminals +, -. This could cause a fire.

3. Injury Prevention

! CAUTION

- 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	Constant torque : -10°C to +50°C (non-freezing)		
Environment	Ambient humidity	90%RH or less (non-condensing)		
	Storage	90 /ord For less (non-condensing)		
	temperature	-20°C to +65°C *		
	Ambience	Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt)		
		Maximum 1000m above sea level for standard operation. After		
	Altitude, vibration	that derate by 3% for every extra 500m up to 2500m (91%).		
		5.9m/s ² or less (conforming to JIS C 0911)		

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

(2) Wiring

! CAUTION

- 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.

! CAUTION

- The electronic overcurrent protection 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 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.

(6) Maintenance, inspection and parts replacement

! CAUTION

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

(7) Disposing of the inverter

⚠ CAUTION

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 like this. Always replace the cover and follow this instruction manual when operating the inverter.

CONTENTS

1 OUTLINE	1
1.1 Pre-Operation Information	1
1.1.1 Precautions for operation	1
1.2 Basic Configuration	
1.2.1 Basic configuration	
1.3 Structure	4
1.3.1 Appearance and structure	4
1.3.2 Removal and reinstallation of the front cover	5
1.3.3 Removal and reinstallation of the wiring cover	6
1.3.4 Removal and reinstallation of the accessory co	over 7
1.3.5 Reinstallation and removal of the control pane	
1.3.6 Removal of the operation panel (FR-PA02-02)	front cover10
1.3.7 Exploded view	1c
2 INSTALLATION AND WIRING	
2.1 Installation	
2.1.1 Instructions for installation	
O O M/inim m	13
2.2 Wiring	
2.2.1 Terminal connection diagram (when source lo	gic is selected)13
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)13
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)13 17
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)13 17
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)
2.2.1 Terminal connection diagram (when source lo 2.2.2 Wiring of the Main Circuit	gic is selected)

3 OPERATION/CONTROL	47
3.1 Pre-Operation Information	47
3.1.1 Types of operation modes	47
3.1.2 Power on	49
3.2 About the Control Panel	50
3.2.1 Names and functions of the control panel (FR-PA02-02)	50
3.2.2 Control panel mode is changed by pressing the MODE key	51
3.2.3 Monitoring	51
3.2.4 Frequency setting	52
3.2.5 Parameter setting method	52
3.2.6 Operation mode	54
3.2.7 Help mode	54
3.3 Operation	56
3.3.1 Pre-operation checks	56
3.3.2 External operation mode (Operation using the external	
frequency setting potentiometer and external start signal)	57
3.3.3 PU operation mode (Operation using the control panel)	58
3.3.4 Combined operation mode 1 (Operation using both external	
start signal and control panel)	59
3.3.5 Combined operation mode 2	60
4 PARAMETERS	61
4.1 Parameter List	61
4.1.1 Parameter list	
4.1.2 List of Parameters Classified by Purpose of Use	
4.1.3 Parameters recommended to be set by the user	
4.2 Parameter Function Details	
4.2.1 Torque boost (Pr. 0, Pr. 46)	
4.2.2 Output frequency range (Pr. 1, Pr. 2, Pr. 18)	
4.2.3 Base frequency, base frequency voltage (Pr. 3, Pr. 19, Pr. 47)	
4.2.4 Multi-speed operation	
(Pr. 4, Pr. 5, Pr. 6, Pr. 24 to Pr. 27, Pr. 232 to Pr. 239)	73
4.2.5 Acceleration/deceleration time (Pr. 7, Pr. 8, Pr. 20, Pr. 21, Pr. 44, F	
4.2.6 Electronic overcurrent protection (Pr. 9. Pr. 48)	•

4.2.7 DC injection brake (Pr. 10 to Pr. 12)	77
4.2.8 Starting frequency (Pr. 13)	78
4.2.9 Load pattern selection (Pr. 14)	79
4.2.10 Jog operation (Pr. 15, Pr. 16)	80
4.2.11 Stall prevention (Pr. 22, Pr. 23, Pr. 66)	81
4.2.12 Acceleration/deceleration pattern (Pr. 29)	83
4.2.13 Regenerative brake duty (Pr. 30, Pr. 70)	84
4.2.14 Frequency jump (Pr. 31 to Pr. 36)	85
4.2.15 Speed display (Pr. 37)	86
4.2.16 Frequency at 5V (10V) input (Pr. 38)	87
4.2.17 Frequency at 20mA input (Pr. 39)	87
4.2.18 Up-to-frequency sensitivity (Pr. 41)	88
4.2.19 Output frequency detection (Pr. 42, Pr. 43)	89
4.2.20 Monitor display (Pr. 52, Pr. 158)	90
4.2.21 Monitoring reference (Pr. 55, Pr. 56)	92
4.2.22 Automatic restart after instantaneous power failure (Pr. 57, Pr. 58)	93
4.2.23 Remote setting function selection (Pr. 59)	94
4.2.24 Shortest acceleration/deceleration mode (Pr. 60 to Pr. 63)	95
4.2.25 Retry function (Pr. 65, Pr. 67 to Pr. 69)	97
4.2.26 Applied motor (Pr. 71)	99
4.2.27 PWM carrier frequency (Pr. 72, Pr. 240)	100
4.2.28 Voltage input (Pr. 73)	101
4.2.29 Input filter time constant (Pr. 74)	102
4.2.30 Reset selection/disconnected PU detection/PU stop selection (Pr. 75)	102
4.2.31 Parameter write inhibit selection (Pr. 77)	104
4.2.32 Reverse rotation prevention selection (Pr. 78)	105
4.2.33 Operation mode selection (Pr. 79)	106
4.2.34 General-purpose magnetic flux vector control selection (Pr. 80)	110
4.2.35 Offline auto tuning function (Pr. 82 to Pr. 84, Pr. 90, Pr. 96)	111
4.2.36 Computer link operation (Pr. 117 to Pr. 124)	117
4.2.37 PID control (Pr. 128 to Pr. 134)	128
4.2.38 Output current detection function (Pr. 150, Pr. 151)	136
4.2.39 Zero current detection (Pr. 152, Pr. 153)	137
4.2.40 Stall prevention function and current limit function (Pr. 156)	138
4 2 41 User group selection (Pr. 160, Pr. 173 to Pr. 176)	140

4.2.42 Actual operation hour meter clear (Pr. 171)	142
4.2.43 Input terminal function selection (Pr. 180 to Pr. 183)	142
4.2.44 Output terminal function selection (Pr. 190 to Pr. 192)	144
4.2.45 Cooling fan operation selection (Pr. 244)	145
4.2.46 Slip compensation (Pr. 245 to Pr. 247)	146
4.2.47 Stop selection (Pr. 250)	147
4.2.48 Meter (frequency meter) calibration (Pr. 901)	149
4.2.49 Biases and gains of the frequency setting voltage (current)	
(Pr. 902 to Pr. 905)	151
5 PROTECTIVE FUNCTIONS	157
5.1 Errors (Alarms)	157
5.1.1 Error (alarm) definitions	
5.1.2 To know the operating status at the occurrence of alarm	165
5.1.3 Correspondence between digital and actual characters	165
5.1.4 Resetting the inverter	165
5.2 Troubleshooting	166
5.2.1 Motor remains stopped	166
5.2.2 Motor rotates in opposite direction	166
5.2.3 Speed greatly differs from the setting	167
5.2.4 Acceleration/deceleration is not smooth	167
5.2.5 Motor current is large	167
5.2.6 Speed does not increase	167
5.2.7 Speed varies during operation	167
5.2.8 Operation mode is not changed properly	168
5.2.9 Control panel display is not operating	168
5.2.10 POWER lamp is not lit	168
5.2.11 Parameter write cannot be performed	168
5.3 Precautions for Maintenance and Inspection	169
5.3.1 Precautions for maintenance and inspection	169
5.3.2 Check items	169
5.3.3 Periodic inspection	169
5.3.4 Insulation resistance test using megger	170
5.3.5 Pressure test	170
5.3.6 Daily and Periodic Inspection	171

5.3.7 Replacement of parts	
6 SPECIFICATIONS	180
6.1 Standard Specifications	180
6.1.1 Model specifications	180
6.1.2 Common specifications	182
6.1.3 Outline drawings	184
APPENDIX	186
Appendix 1 Data Code List	186

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
1.2 Basic Configuration	3
1.3 Structure	4

<Abbreviations>

- PU Control panel and parameter unit (FR-PU04)
- Inverter
 Mitsubishi transistorized inverter
 FR-E500 series
- Pr.
 Parameter number

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

OUTLINE

1.1.1 Precautions for operation

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

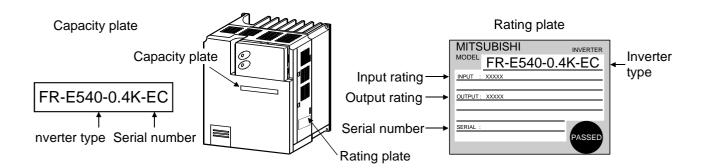
Incorrect handling may cause the inverter to operate incorrectly, causing its life to be reduced considerably, or at the worst, the inverter to be damaged. Handle the inverter properly in accordance with the information in each section as well as the precautions and instructions of this manual to use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

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

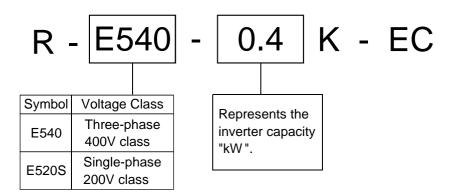
(1) Unpacking and product check

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.

1) Inverter type



Inverter type



2) Accessory

Instruction manual

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 47.)

(3) Installation

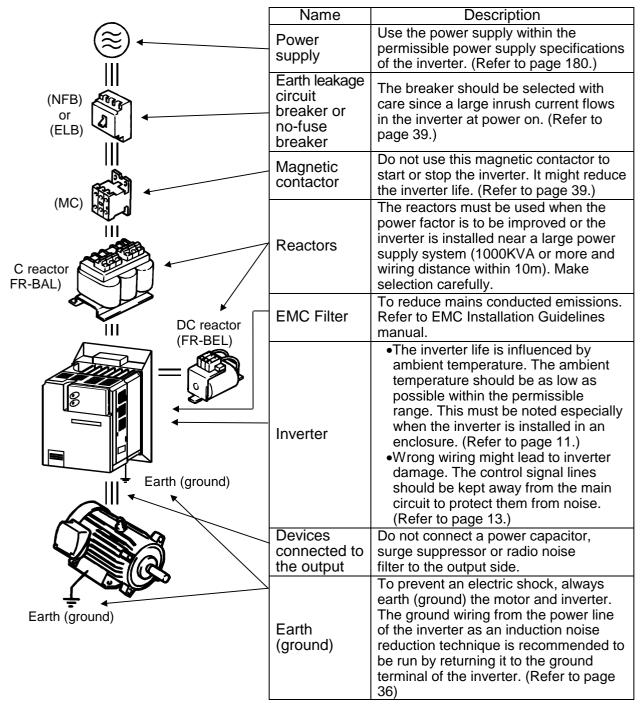
To operate the inverter with high performance for a long time, install the inverter in a proper place, in the correct direction, with proper clearances. (Refer to page 11.)

(4) Wiring

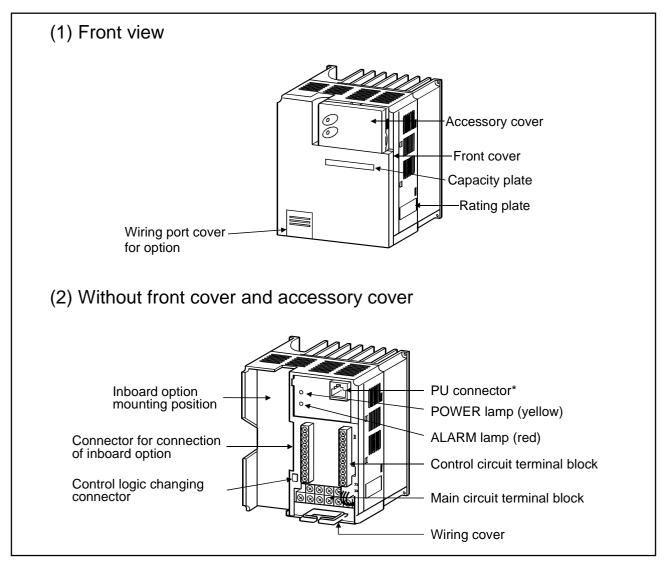
Connect the power supply, motor and operation signals (control signals) to the terminal block. Note that incorrect connection may damage the inverter and peripheral devices. (See page 13.)

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.)



1.3.1 Appearance and structure

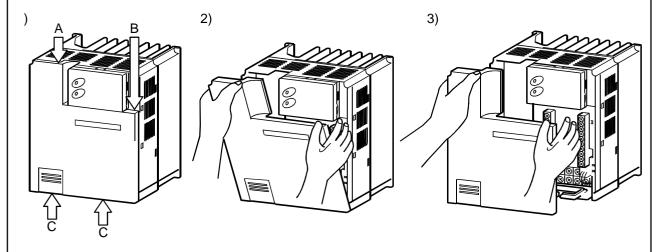


^{*}The PU connector is used for connection of the FR-PA02-02 or FR-PU04 option or to make RS-485 communication.

1.3.2 Removal and reinstallation of the front cover

Removal

The front cover is fixed with catches 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 catches securely. With the front cover removed, do not switch power on.

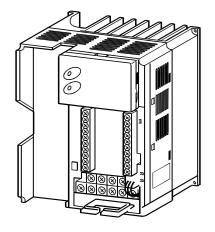
Note: 1. Make sure that the front cover has been reinstalled securely.

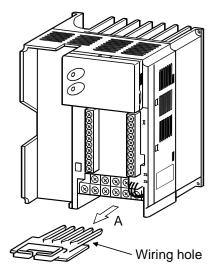
2. The same serial number is printed on the capacity plate of the front cover and the rating plate of the inverter. Before reinstalling the front cover, check the serial numbers to ensure that the cover removed is reinstalled to the inverter from where it was removed.

1.3.3 Removal and reinstallation of the wiring cover

Removal

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





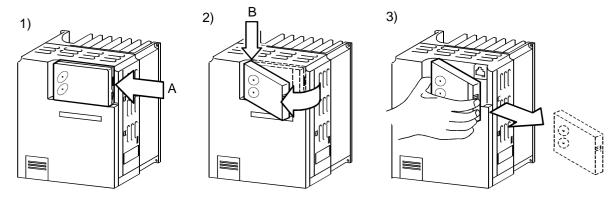
Reinstallation

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

1.3.4 Removal and reinstallation of the accessory cover

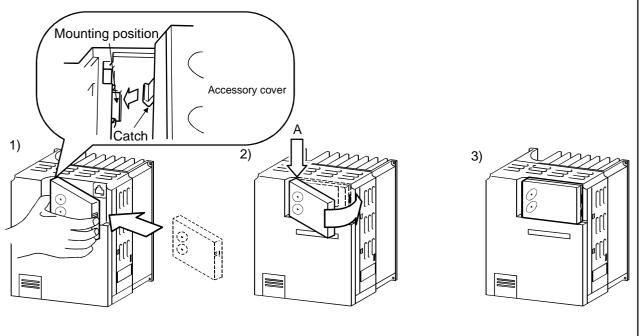
Removal

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 accessory cover to the right.



Reinstallation

Insert the mounting catch (left hand side) of the accessory cover into the mounting position of the inverter and push in the right hand side mounting catch to install the accessory cover.



7

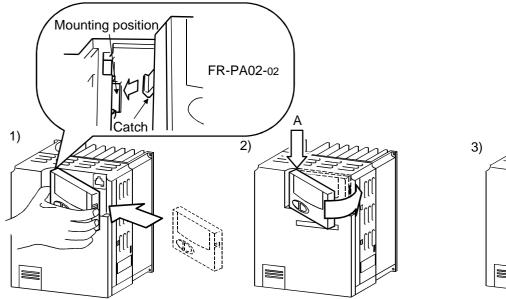
1.3.5 Reinstallation and removal of the control panel

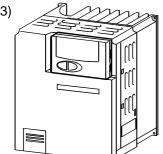
To ensure safety, reinstall and remove the optional control panel (FR-PA02-02) after switching power off.

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

Reinstallation

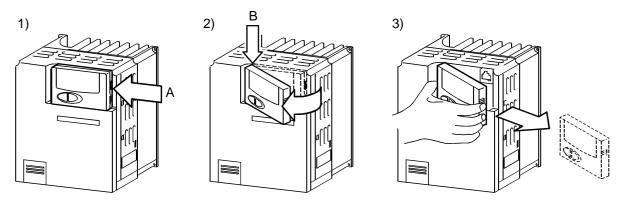
Insert the mounting catch (left hand side) of the accessory cover into the mounting position of the inverter and push in the right hand side mounting catch to install the accessory cover.





Removal of the control panel

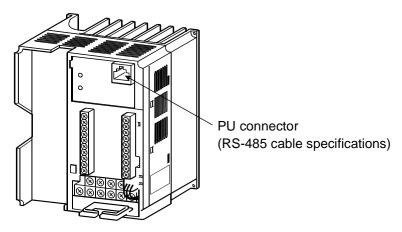
Hold down the portion A indicated by the arrow and lift the right hand side using the portion B indicated by the arrow as a support, and pull out the accessory cover to the right.



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

OUTLINE

- Using the connection cable for operation
 - 1) Fit the rear cover option FR-E5P to the back surface of the control panel.
 - 2) 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 control panel. (For the connection cable of the FR-E5P, refer to page 26.)

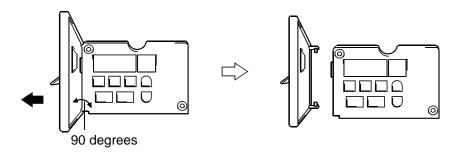


Mounting the control panel on an enclosure

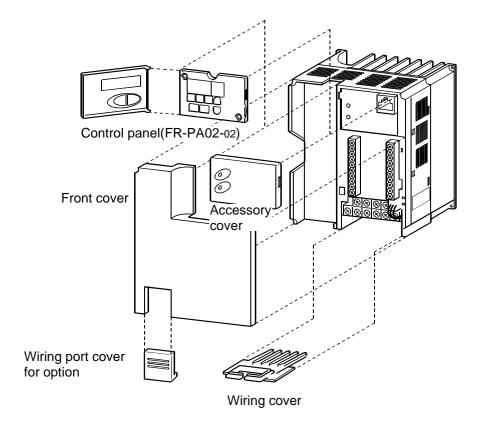
When you open the control panel front cover, the screw mounting guides for fixing the control panel to an enclosure appear on the top left and bottom right. Fit the rear cover of the FR-E5P option, drill holes in the control panel mounting guides, and securely mount the control panel on the enclosure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

1.3.6 Removal of the operation panel (FR-PA02-02) front cover

- 1) Open the control panel front cover to 90 degrees.
- 2) Pull out the control panel front cover to the left to remove it.



1.3.7 Exploded view



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	11
2.2 Wiring	13
2.3 Other Wiring	32

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

INSTALLATION AND WIRING

2.1.1 Instructions for installation

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.

2) 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 ambient temperature.

The inverter life is under great influence of ambient temperature. In the place of installation, ambient temperature must be within the permissible range -10 °C to +50°C. 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.

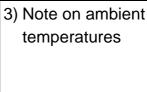
6) Avoid places where the inverter is exposed to oil mist, flammable gases, fluff, dust, dirt etc.

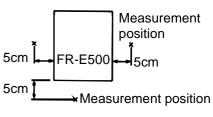
Install the inverter in a clean place or inside a "totally enclosed" panel which does not accept any suspended matter.

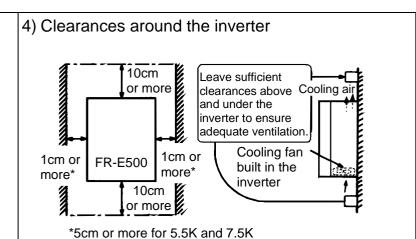
7) Note the cooling method when the inverter is installed in an enclosure.

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 on an installation surface securely and vertically with screws or bolts.

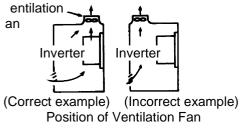


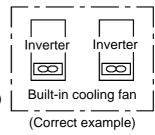


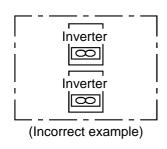


hese clearances are also necessary for changing the cooling fan.

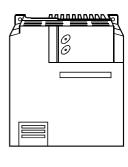
7) For installation in an enclosure

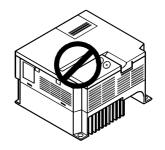


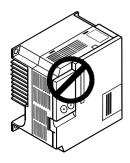




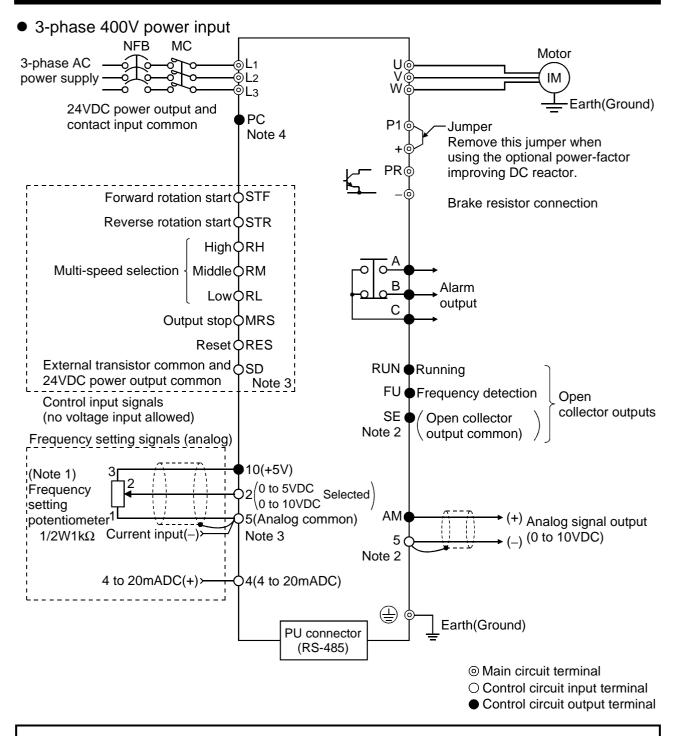
8) Vertical mounting







2.2.1 Terminal connection diagram (when source logic is selected)



- Note: 1. If the potentiometer is to be operated often, use a $2W1k\Omega$ potentiometer.
 - 2. Terminals 5, SD and SE are isolated.
 - 3. Terminals SD and 5 are common terminals. Do not earth them to the ground.
 - 4. 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.

Single-phase 200V power input



- Note: 1. To ensure safety, connect the power input to the inverter via a magnetic contactor and earth 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
L1, L2, L3 (Note)	AC power input	Connect to the commercial power supply. Keep these terminals unconnected when using the high power factor converter.
U, V, W	Inverter output	Connect a three-phase squirrel-cage motor.
+, PR	Brake resistor connection	Connect the optional brake resistor across terminals + - PR.
+, -	Brake unit connection	Connect the optional brake unit or high power factor converter.
+, P1	Power factor improving DC reactor connection	Disconnect the jumper from terminals + - P1 and connect the optional power factor improving DC reactor.
	Earth (Ground)	For earthing the inverter chassis. Must be earthed.

Note: L₁, N terminals for single-phase power input.

(2) Description of the control circuit terminals

Type Symbol Termi		Terminal Name	Description										
		STF	Forward	Turn on the STF signal to start forward									
	-		_		311	rotation start	rotation and turn it off to stop.	and STR signals					
		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.								
	etc	RH, RM,	Multi-speed	Combine the RH, RM and RL signals as	- J								
		ŔĹ	selection	appropriate to select multiple speeds.	Input terminal								
S S	, stop (STOP)	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.	function choices (Pr. 180 to Pr. 183) change								
signs	(STF),	RES	Reset	Used to reset the protective circuit acti RES signal for more than 0.1 second the									
Input signals	Contacts, e.g. start (3	SD	Contact input common and external transistor common (sink*)	RES signal for more than 0.1 second then turn it off. When transistor output (open collector output), such a programmable controller (PLC), is connected, connected external power supply common for transistor output to terminal to prevent a fault caused by leakage current. Common to the contact input terminals. Common outerminal for 24VDC 0.1A power output (PC terminal). This terminal becomes common to the contact interminals when sink logic is selected. Please see page 23 for the logic changing method.									
		PC	Power output Contact input common (source*)	This terminal can be used as a 24 output. This terminal becomes external transis sink logic is selected. Please see page 23 for the logic changing.	stor common when								
Frequency			5VDC, permissible load current 10mA										
Analog	Frequency setting	Frequency setting	Frequency setting	Frequency setting	Frequency setting	Frequency setting	Frequency setting	Frequency setting	ncy setting	2	Frequency setting (voltage)	By entering 0 to 5VDC (0 to 10VDC), the frequency is reached at 5V (or 10 proportional. Use Pr. 73 to switch be 5VDC (factory setting) and 0 to 10VDC $10k\Omega$. Maximum permissible voltage 20	OV) and I/O are etween input 0 to C. Input resistance
									4	Frequency setting (current)	By entering 4 to 20mADC, the maximum is reached at 20mA and I/O are proposignal is valid only when the AU signal resistance 250Ω . Maximum permissible	ortional. This input (Note) is on. Input current 30mA.	
		5	Frequency setting input common	Common terminal for the frequency settin 1 or 4) and analog output terminal AM. Do not connect to the earth (ground).	g signal (terminal 2,								

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 23.)

INSTALLATION AND WIRING

Tv	ре	Symbol	Terminal Name	Desc	ription		
Output signals	Contact	A, B, C	Alarm output	Change-over contact output the output has been stopped protective function activated 30VDC 0.3A. Alarm: disconticontinuity across A-C), no across B-C (discontinuity across	t indicating that d by the inverter d. 230VAC 0.3A, inuity across B-C ormal: continuity	Output terminal	
	Open collector	RUN	Inverter running	Switched low when the frequency is equal to or starting frequency (factory variable). Switched high du injection brake operation (*1) Permissible load 24VDC 0.14	higher than the set to 0.5Hz, ring stop or DC	choices (Pr. 190 to	
		FU	Frequency detection	Switched low when the output reached or exceeded the detection set as appropriate. Switched the detection frequency (*1). Permissible load 24VDC 0.14	ection frequency high when below	functions.	
		SE	Open collector output common	Common to the RUN and FU	terminals.		
	Analog	AM	Analog signal output	output (*2). The output	Factory setting of Frequency Permissible load continuity of the Polymer of the Po	d current 1mA	
Communication	RS-485		PU connector	With the control panel conne made using the RS-485 proto • Conforming Standard : El • Transmission format : M • Communication speed : M	: EIA Standard RS-485 : Multi-drop link		

^{*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.

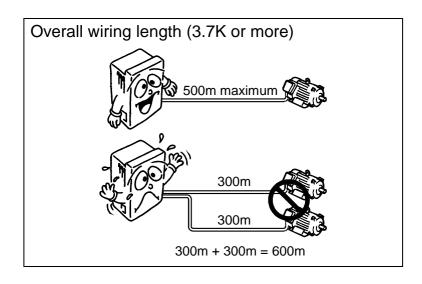
2.2.2 Wiring of the Main Circuit

(1) Wiring instructions

- 1) It is recommended to use insulation-sleeved solderless terminals for power supply and motor wiring.
- 2) Power must not be applied to the output terminals (U, V, W) of the inverter. Otherwise the inverter will be damaged.
- 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 19.)
- 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 fast-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		0.4K	0.75K	1.5K	2.2K	3.7K or more
Non-low acoustic	200V class	300m	500m	500m	500m	500m
noise mode	400V class	200m	200m	300m	500m	500m
Low acoustic noise	200V class	200m	300m	500m	500m	500m
mode	400V class	30m	100m	200m	300m	500m



- 6) Connect only the recommended optional brake resistor between the + PR. These terminals must not be shorted.
- 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) in 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).
- Use the dedicated earth (ground) terminal to earth (ground) the inverter. (Do not use the screw in the case, chassis, etc.) For the earth 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.
- The earth (ground) cable should be as thick as possible. Use the cable whose gauge is equal to or larger than those indicated in the following table, and make its length as short as possible. The earthing (grounding) point should be as near as possible to the inverter to minimize the earth (ground) cable length.

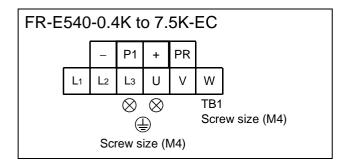
(Unit: mm²)

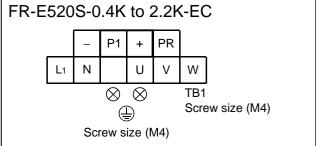
Motor Conneity	Earth Cable Gauge					
Motor Capacity	200V class	400V class				
2.2kW or less	2 (2.5)	2 (2.5)				
3.7kW	_	2 (4)				
5.5kW, 7.5kW	_	3.5 (6)				

To meet the Low Voltage Directive, use PVC insulated cables larger than specified size in brackets ().

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

(2) Terminal block layout





(3) Cables, crimping terminals, etc.

The following table lists the cables and crimping terminals used with the inputs (L_1,L_2,L_3) and outputs (U,V,W) of the inverter and the torques for tightening the screws:

1) FR-E540-0.4K to 7.5K-EC

Applicable Terminal Inverter Screw Type Size	Tight- ening Torque	Crimping Terminals		Cables				PVC Insulated Cables		
				mm ²		AWG		mm ²		
	Size	N⋅m	L1, L2, L3	U, V, W	L1, L2, L3		L1, L2, L3	U, V, W	L1, L2, L3	U, V, W
FR-E540-	N 4 4	1.5	2-4	2-4	2	2	14	14	2.5	2.5
0.4K-EC	M4									
FR-E540-	NA 4	M4 1.5	2-4	2-4	2	2	14	14	2.5	2.5
0.75K-EC	IVI4									
FR-E540-	M4	4 1.5	2-4	2-4	2	2	14	14	2.5	2.5
1.5K-EC	IVI4									
FR-E540-	M4	1.5	2-4	2-4	2	2	14	14	2.5	2.5
2.2K-EC	IVI4									
FR-E540-	NA A	M4 1.5	2-4	2-4	2	2	14	14	2.5	2.5
3.7K-EC	1014									
FR-E540-	M4	1.5	5.5-4	2-4	3.5	2	12	14	4	2.5
5.5K-EC										
FR-E540-	M4	M4 1.5	5.5-4	5.5-4	3.5	3.5	12	12	4	4
7.5K-EC										

INSTALLATION AND WIRING

2) FR-E520S-0.4K to 2.2K-EC

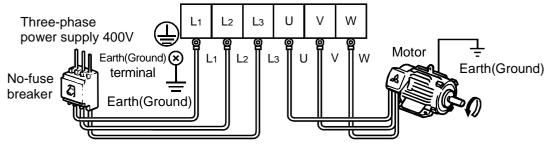
Applicable Terminal Inverter Screw		Tight- ening	Crimping		Cables				PVC Insulated Cables	
	Torque	Terminals		mm²		AWG		mm ²		
Type	Size	N⋅m	L1, N	U, V, W	L1, N	U, V, W	L1, N	U, V, W	L1, N	U, V, W
FR-E520S- 0.4K-EC	M4	1.5	2-3.5	2-3.5	2	2	14	14	2.5	2.5
FR-E520S- 0.75K-EC	M4	1.5	2-4	2-4	2	2	14	14	2.5	2.5
FR-E520S- 1.5K-EC	M4	1.5	2-4	2-4	2	2	14	14	2.5	2.5
FR-E520S- 2.2K-EC	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

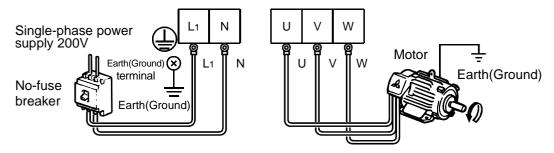


The power supply cables must be connected to L1, L2, L3. If they are connected to U, V, W, the inverter will be damaged.

(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 leakage circuit breaker or no-fuse breaker, and use the magnetic contactor to switch power on-off.
 - 2. The output is three-phase 200V.

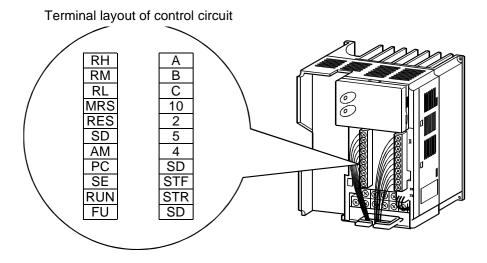
2.2.3 Wiring of the control circuit

(1) Wiring instructions

- 1) Terminals PC, SE and 5 (and SD when sink logic is selected) are common to the I/O signals. These common terminals must not be earthed to the ground.
- 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.
- 5) When bar terminals and solid wires are used for wiring, their diameters should be 0.9mm maximum If they are larger, screw threads may be damaged during tightening.

(2) Terminal block layout

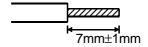
In the control circuit of the inverter, the terminals are arranged as shown below: Terminal screw size: M2.5



(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: 0.25 N·m to 0.49 N·m

* Use a size 0 screwdriver.

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

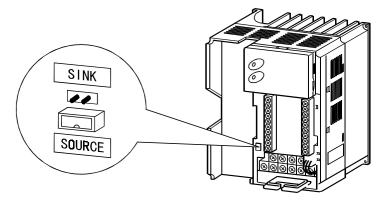
(4) Control logic changing

The input signal logic is factory-set to the source mode.

To change the control logic, the position of the connector beside the control circuit terminal block must be changed.

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

Do this position changing before switching power on.



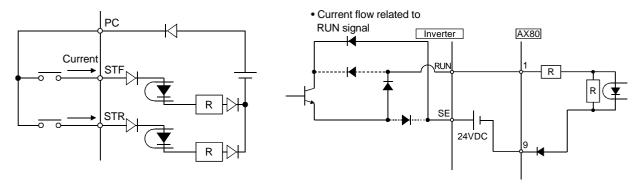
Note: 1. Make sure that the front cover has been installed securely.

- 2. 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.
- 3. Always install the sink-source logic changing connector in either of the positions. If two connectors are installed in these positions at the same time, the inverter may be damaged.

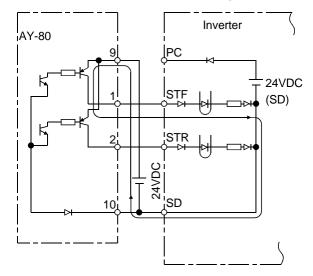
2) Source logic type

• 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 common to the open collector output signals.



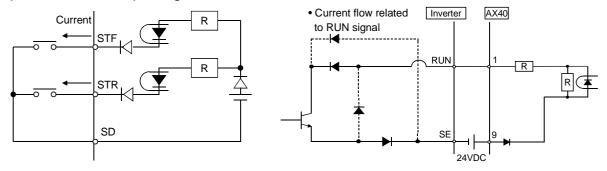
 When using an external power supply for transistor output, use terminal SD as a common to prevent misoperation caused by leakage current.



3) Sink logic type

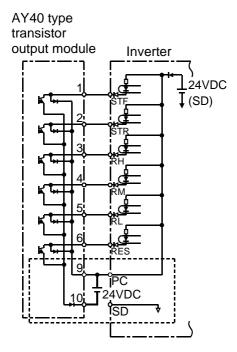
• In this logic, a signal switches on when a current flows out of the corresponding signal input terminal.

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



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

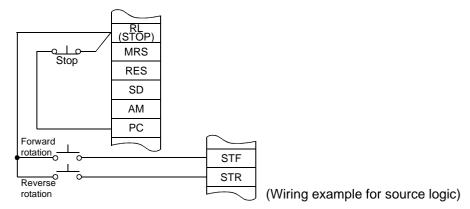
(Do not connect terminal SD of the inverter with terminal 0V of the external power supply. When using terminals PC-SD as a 24VDC power supply, do not install the power supply in parallel outside the inverter. Doing so may cause misoperation due to leakage current.)



(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 control 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, Nippon AMP

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

Example: SGLPEV 0.5mm×4P, MITSUBISHI CABLE INDUSTRIES,

LTD.

<When using the control panel>

Note: The rear cover and junction adaptor are required since the circuit board is exposed in the back of the control panel.

Use the FR-E5P option (cover and adaptor available as a set).

<Maximum wiring length>

- Control panel (FR-PA02-02): 20m
- Parameter unit (FR-PU04): 20m

(2) For RS-485 communication

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 allows the inverter to be run and monitored and the parameter values to be read and written.



1) SG 5) SDA 2) P5S 6) RDB 3) RDA 7) SG 4) SDB 8) P5S

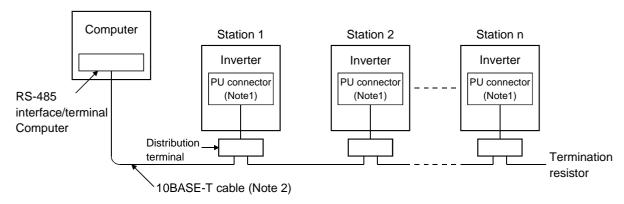
<PU connector pin-outs>

Viewed from the inverter (receptacle side) front

- 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 control panel or parameter unit. Do not use these pins for RS-485 communication.

<System configuration examples>

1) When a computer having a RS-485 interface is used with several inverters



Use the connectors and cables which are available on the market.

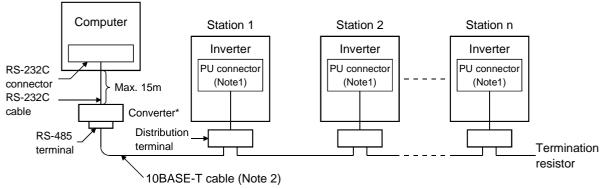
Note: 1. Connector: RJ45 connector

Example: 5-554720-3, Nippon AMP Co., Ltd.

2. Cable : Cable conforming to EIA568 (such as 10BASE-T cable)

Example: SGLPEV 0.5mm × 4P, Mitsubishi Cable Industries, Ltd.

2) When a computer having a RS-232C interface is used with inverters



*Commercially available converter is required. (Note 3)

Use the connectors, cables and converter which are available on the market.

Note: 1. Connector: RJ45 connector

Example: 5-554720-3, Nippon AMP Co., Ltd.

2. Cable : Cable conforming to EIA568 (such as 10BASE-T cable)

Example: SGLPEV 0.5mm × 4P, Mitsubishi Cable Industries, Ltd.

3.*Commercially available converter examples

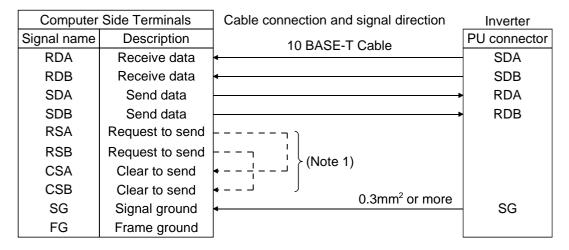
Model: FA-T-RS40

Converter

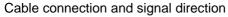
Nagoya Sales Office, Mitsubishi Electric Engineering Co., Ltd.

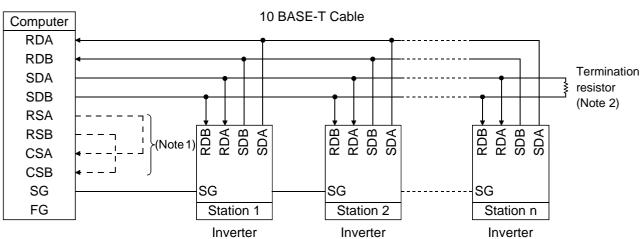
<Wiring methods>

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.
 - 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)

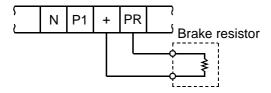
2.2.5 Connection of stand-alone option units

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)

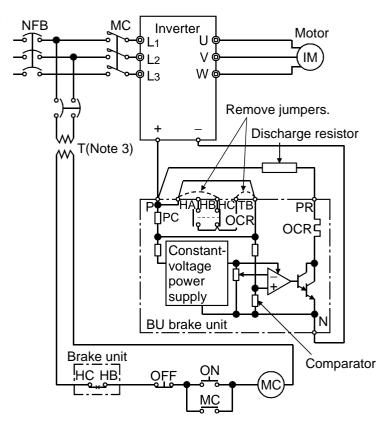
Connect a brake resistor across terminals + and PR. Connect a dedicated brake resistor only.

(For the positions of terminals + and PR, refer to the terminal block layout (page 19).)



(2) Connection of the BU brake unit (option)

Connect the BU brake unit correctly as shown on the right. Incorrect connection will damage the inverter.

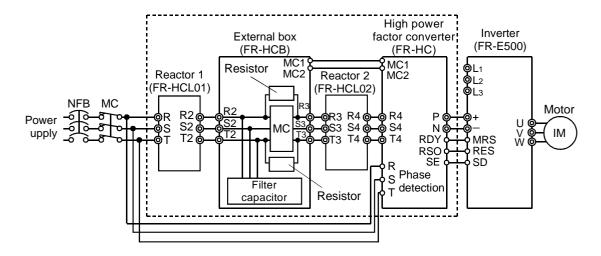


- Note: 1. The wiring distance between the inverter, brake unit and discharge resistor should be within 2m. If twisted wires are used, the distance should be within 5m.
 - 2. If the transistors in the brake unit should fail, the resistor will be extremely hot, causing a fire. Therefore, install a magnetic 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 FR-HC high power factor converter (option unit)

(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 harmonics, wire as shown below. Wrong connection will damage the high power factor converter and inverter.



Note: 1. The power input terminals L₁, L₂, L₃ must be open.

Incorrect connection will damage the inverter. Reverse polarity of terminals

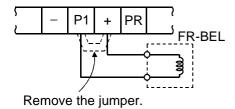
–, + will damage the inverter.

- 2. The voltage phases of terminals L₁, L₂, L₃ and terminals R₄, S₄, T₄ must be matched before connection.
- 3. If the load capacity is less than half of the high power factor converter capacity, satisfactory harmonic suppression effects cannot be produced.

(4) Connection of the power factor improving DC reactor (option)

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

<Connection method>

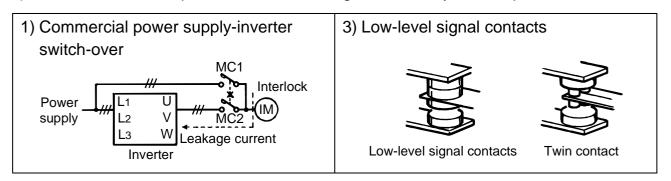


Note: 1. The wiring distance should be within 5m.

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

2.2.6 Design information

- 1) Provide electrical and mechanical interlocks for MC1 and MC2 which are 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.
- 5) 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.



2.3.1 Power supply harmonics

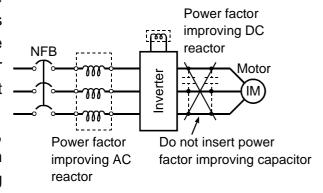
Power supply harmonics may be generated from the converter section of the inverter, affecting the power supply equipment, power capacitor, etc. Power supply harmonics are different in generation source, frequency band and transmission path from radio frequency (RF) noise and leakage currents. Take the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

• The differences between harmonics and RF noises are indicated below:

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

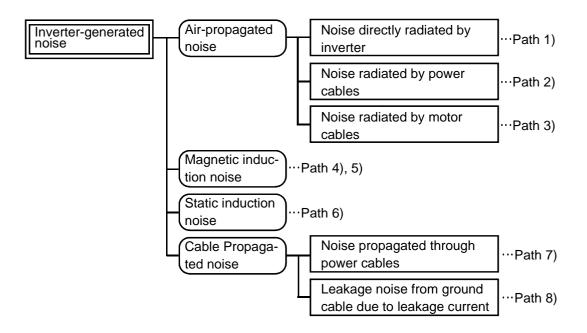
Some noises enter the inverter causing it to incorrectly operate, and others are radiated by the inverter causing misoperation of peripheral devices. Though the inverter is designed to be insusceptible to noise, it handles low-level signals, so it requires the following basic measures to be taken. Also, 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.

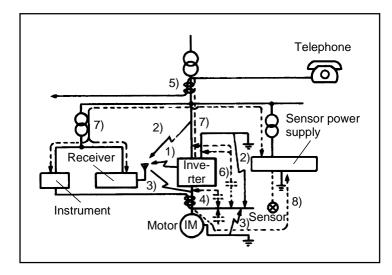
1) Basic measures

- 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 36) to signal cables.
 - Ground the shields of the detector connection and control signal cables with cable clamp metal.

3) 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.



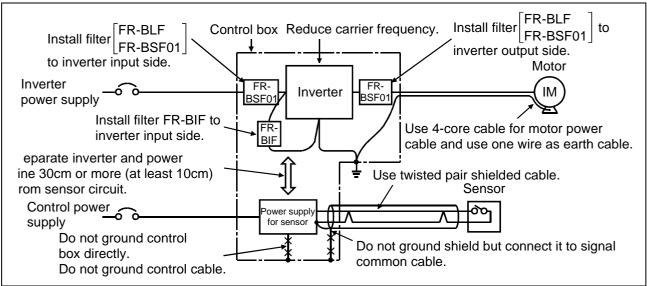


Noise Path	Measures
1), 2), 3)	 When devices which handle low-level signals and are susceptible to misoperation due to noise (such as instruments, receivers and sensors) are installed near the inverter and their signal cables are contained in the same panel as the inverter or are run near the inverter, 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 ground cable of the inverter causing misoperation of the device. In such a case, disconnection of the 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.

Example of counter measures against noise



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

2.3.3 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 leakage circuit breakers and earth leakage relays unnecessarily.

Countermeasures

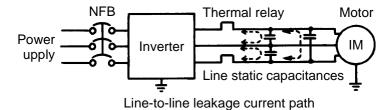
- If the carrier frequency setting is high, decrease the carrier frequency (Pr. 72) of the inverter.
 - Note that motor noise increases. Selection of Soft-PWM (Pr. 240) will make it unoffending.
- By using earth leakage circuit breakers durable against harmonics and surges (e.g. Mitsubishi's Progressive Super Series) in the inverter's own line and other line, operation can be performed with low noise (with the carrier frequency kept high).

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. When the wiring length is long (50m or more) for the 400V class, the external thermal relay is likely to operate unnecessarily because the ratio of the leakage current to the rated motor current increases.



Countermeasures

- Use the electronic overcurrent protection 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 against line-to-line leakage currents, it is recommended to use a temperature sensor to directly detect motor temperature.

2.3.4 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-rectified motor. Specifically

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

(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).

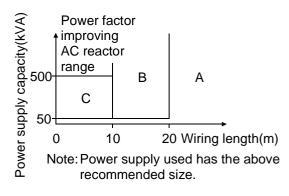
2.3.5 Peripheral devices

(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	No-Fuse Breaker (NFB) or Earth Leakage Circuit		Magn	etic Con	tactor
Invertor Type		Output	Supply	Supply Breaker (NV)		(MC)		
	Inverter Type		Capacity (kVA)	Standard	With power factor improving reactor	Α	В	С
>	FR-E540-0.4K-EC	0.4	1.5	Type NF30, NV30 5A	Type NF30, NV30 5A		S-N10	
4007	FR-E540-0.75K-EC	0.75	2.5	Type NF30, NV30 5A	Type NF30, NV30 5A		S-N10	
	FR-E540-1.5K-EC	1.5	4.5	Type NF30, NV30 10A	Type NF30, NV30 10A		S-N10	
has	FR-E540-2.2K-EC	2.2	5.5	Type NF30, NV30 15A Type NF30, NV30 10A		S-N20		
g-e-	FR-E540-3.7K-EC	3.7	9	Type NF30, NV30 20A Type NF30, NV30 15A			S-N20	
Three-phase	FR-E540-5.5K-EC	5.5	12	Type NF30, NV30 30A	Type NF30, NV30 20A		S-N20	
	FR-E540-7.5K-EC	7.5	17	Type NF30, NV30 30A	30A Type NF30, NV30 30A S-N20		S-N20	
Se	FR-E520S-0.4K-EC	0.4	1.5	Type NF30, NV30 10A	Type NF30, NV30 10A	30, NV30 10A S-N10		
-pha 0V	FR-E520S-0.75K-EC	0.75	2.5	Type NF30, NV30 15A	Type NF30, NV30 15A		S-N10	
Single-phase 200V	FR-E520S-1.5K-EC	1.5	4.5	Type NF30, NV30 20A	Type NF30, NV30 20A		S-N21	
ig	FR-E520S-2.2K-EC	2.2	5.5	Type NF30, NV30 30A	Type NF30, NV30 30A	_	S-N25	

- Note: 1. Select the type of the no-fuse breaker (NFB) in response to the power supply capacity.
 - 2. 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.



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.

Installation and selection of no-fuse breaker

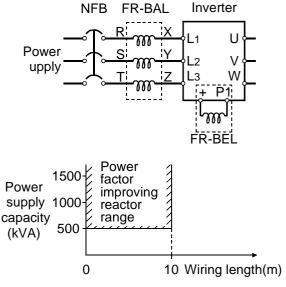
Install a no-fuse breaker (NFB) in the power supply side for protection of the inverter's primary wiring. Refer to the above table and choose the NFB according to the inverter's power supply side power factor (which changes with the power supply voltage, output frequency and load). Especially for a completely 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 leakage circuit breaker used should be our product durable against harmonics/surges (such as the Progressive Super Series).

Power factor improving reactor

	Inverter Model	Power Factor Improving AC Reactor	Power Factor Improving DC Reactor
>	FR-E540-0.4K-EC	FR-BAL-H0.4K	FR-BEL-H0.4K
4007	FR-E540-0.75K-EC	FR-BAL-H0.75K	FR-BEL-H0.75K
	FR-E540-1.5K-EC	FR-BAL-H1.5K	FR-BEL-H1.5K
Three-phase	FR-E540-2.2K-EC	FR-BAL-H2.2K	FR-BEL-H2.2K
e-b	FR-E540-3.7K-EC	FR-BAL-H3.7K	FR-BEL-H3.7K
hre	FR-E540-5.5K-EC	FR-BAL-H5.5K	FR-BEL-H5.5K
	FR-E540-7.5K-EC	FR-BAL-H7.5K	FR-BEL-H7.5K
lle- 200V	FR-E520S-0.4K-EC	FR-BAL-0.75K (Note)	FR-BEL-0.75K (Note)
] 3 20	FR-E520S-0.75K-EC	FR-BAL-1.5K (Note)	FR-BEL-1.5K (Note)
Single- ase 200	FR-E520S-1.5K-EC	FR-BAL-2.2K (Note)	FR-BEL-2.2K (Note)
) bha	FR-E520S-2.2K-EC	FR-BAL-3.7K (Note)	FR-BEL-3.7K (Note)

Note: The power factor may be a little lower.

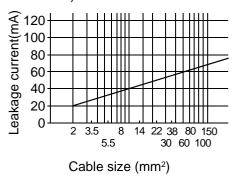
When the inverter is connected near a large-capacity power supply transformer (500kVA or more, wiring length 10m maximum) or there is power capacitor switch-over, excessive peak currents may flow into the power input circuit and damage the converter circuit. In such a case, the power supply improving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

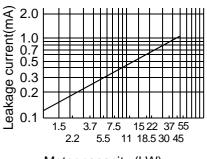


(2) Selecting the rated sensitivity current for the earth leakage circuit breaker

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

xample of leakage current per 1km in able path during commercial power upply operation when the CV cable is outed in metal conduit 200V 60Hz) Leakage current example of 3-phase induction motor during commercial power supply operation (200V 60Hz)





Motor capacity (kW)

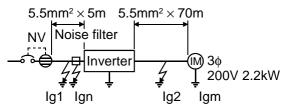
- Progressive Super Series (Type SP, CF, SF, CP)
 Rated sensitivity current: I∆n ≥ 10×(Ig1+Ign+Ig2+Igm)
- Conventional NV series (Type CA, CS, SS produced prior to '91)
 Rated sensitivity current: I∆n ≥ 10×{lg1+lgn+3×(lg2+lgm)}

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

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

Igm : Leakage current of motor during commercial power supply operation

<Example>



- Note: 1. The earth leakage circuit breaker should be installed to the primary (power supply) side of the inverter.
 - 2. Ground fault in the secondary side of the inverter can be detected at the running frequency of 120Hz or lower.
 - 3. In the \downarrow connection neutral point grounded system, the sensitivity current becomes worse for ground faults in the inverter secondary side. Hence, the protective grounding of the load equipment should be 10Ω or less.
 - 4. When the breaker is grounded 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, note that the eddy current and hysteresis loss increase and temperature rises.
 - * For the leakage current value of the noise filter installed on the inverter input side, contact the corresponding filter manufacturer.

INSTALLATION AND WIRING

	Progressive Super Series (Type SP, CF, SF,CP)	Conventional NV (Type CA, CS, SS)	
Leakage current (Ig1) (mA)	$33 \times \frac{5m}{1000m} = 0.17$		
Leakage current (Ign) (mA)	0 (without noise filter)		
Leakage current (Ig2) (mA)	$33 \times \frac{70\text{m}}{1000\text{m}} = 2.31$		
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	

2.3.6 Instructions for compliance with U.S. and Canadian Electrical Codes



(1) Wiring of the power supply and motor

Use the UL-listed cables (rated at 75°C) and round crimping terminals to wire the input (L1, L2, L3) and output (U, V, W) terminals of the inverter. Crimp the terminals with the crimping tool recommended by the terminal manufacturer.

(2) Fuse

On the input side, use any of the UL Class K5 fuses having the ratings as listed below:

Applicable Inverter	Rated	Rated
Type	Voltage	Current(
туре	(V)	A)
FR-E540-0.4K-EC		5
FR-E540-0.75K-EC		8
FR-E540-1.5K-EC		10
FR-E540-2.2K-EC	600	20
FR-E540-3.7K-EC		35
FR-E540-5.5K-EC		45
FR-E540-7.5K-EC		60

Applicable Inverter	Rated	Rated
	Voltage	Current(
Type	(V)	A)
FR-E520S-0.4K-EC		10
FR-E520S-0.75K-EC	250	20
FR-E520S-1.5K-EC	230	30
FR-E520S-2.2K-EC		40

(3) Short circuit ratings

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

2.3.7 Instructions for compliance with the European standards

(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, but the machines/equipment into which they have been incorporated are covered by the EMC Directive and 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 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.

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 leakage circuit breaker as an electric shock protector without connecting the equipment to the earth (ground).
- * Wire the earth terminal independently. (Do not connect two or more cables to one terminal.)
- * The wire size on pages 18 and 19 are shown for following conditions.
 - Ambient Temp: 40°C maximum
 - Wire installation: On wall without duct 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 EN51078)

- * Use the inverter under the conditions of overvoltage category II and contamination level 2 or higher specified in IEC664.
- * On 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.

INSTALLATION AND WIRING

* The terminals indicated as the input and output terminals for control circuit on page 13 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	47
3.2 About the Control Panel	50
3.3 Operation	56

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

3.1 Pre-Operation Information

OPERATION/CONTROL

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 53.

(1) External operation mode

(factory setting, Pr. 79 "operation mode selection" = 0)

Pr. 79 "operation mode selection" is factory-set to 0 and the external operation mode is selected at power-on.

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



Preparation

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

Note: 1. Operation cannot be started by the start signal alone. Both the start signal and frequency setting signal are required to run the inverter.

(2) PU operation mode (Pr. 79 "operation mode selection" = 1)

How to perform operation using the optional control panel or parameter unit.

Preparation

- Operation unit...... Control panel (FR-PA02-02) or parameter unit (FR-PU04)
- Connection cable To be prepared for use of the control panel (FR-PA02-02) away from the inverter or for use of the parameter unit (FR-PU04).

FR-CB2□□ (option)

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

3

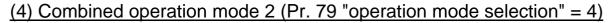
(3) Combined operation mode 1 (Pr. 79 "operation mode selection" = 3)

The start signal is an external signal.

The frequency setting signal is made setting using the optional control panel or parameter unit.

Preparation

- Start signal Switch, relay, etc.
- Operation unit...... Control panel (FR-PA02-02) or parameter unit (FR-PU04)
- Connection cable ... Refer to (1) PU operation mode.
- FR-E5P (option) Refer to (1) PU operation mode.



<u>The start signal</u> is entered from the operation command key of the optional control panel.

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

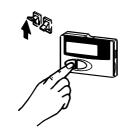
Preparation

- Frequency 0 to 5V, 0 to 10V or 4 to 20mA DC
 - setting signal signals from an external

potentiometer or from outside the

inverter

- Operation unit...... Control panel (FR-PA02-02) or parameter unit (FR-PU04)
- Connection cable Refer 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.

Preparation

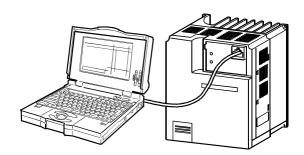
Connection cableConnector: RJ45 connector

Cable: Cable conforming to EIA568

(e.g. 10BASE-T cable)

Personal computer

 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 correct place. (Refer to page 11.)

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 13.)

Switch power on

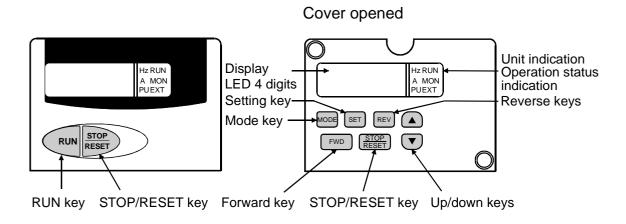
Power-on is complete if the POWER lamp is lit and the ALARM lamp is off.

3.2 About the Control Panel

OPERATION/CONTROL

With the optional control panel (FR-PA02-02), 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 control panel (FR-PA02-02)



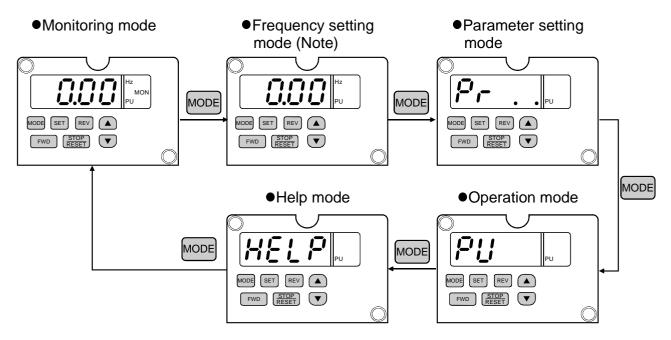
Key indication

Key	Description		
RUN key	Used to give a start rotation command.		
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 RESET 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 the frequency.
Α	Lit to indicate the current.
RUN	Lit while the inverter is operating. Lit to indicate forward rotation, and flickers to
KUN	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 Control panel mode is changed by pressing the MODE key



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

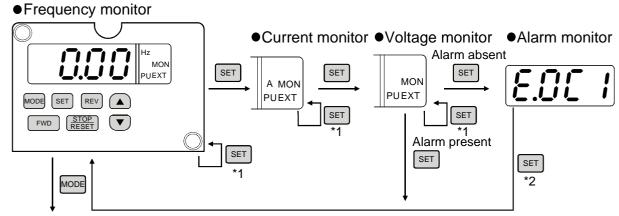
3.2.3 Monitoring

• 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.

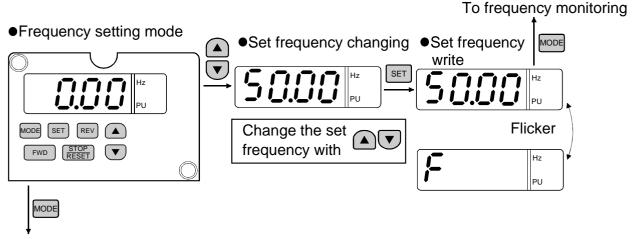


To 3.2.4 Frequency setting mode (Note3)

- Note: 1. Hold down the set key marked *1 for more than 1.5 seconds to change the current monitor to the power-on monitor.
 - 2. Hold down the set key marked *2 for more than 1.5 seconds to display four errors including the most recent one.
 - 3. To the parameter setting mode when in the external operation mode.

3.2.4 Frequency setting

Set the frequency value used for operation performed under the operation command given by the RUN key (FWD) or REV key) in the PU operation mode. This mode is displayed only in PU operation.



To 3.2.5 Parameter setting mode

3.2.5 Parameter setting method

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

- 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 setting key for about 1.5 seconds.

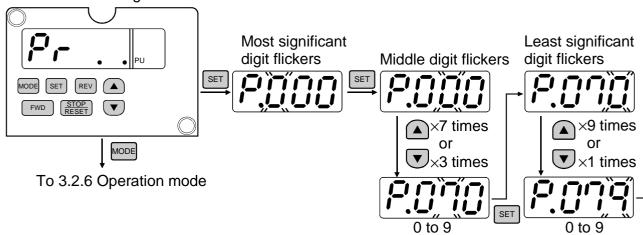
Note: If parameter write cannot be performed, refer to page 168.

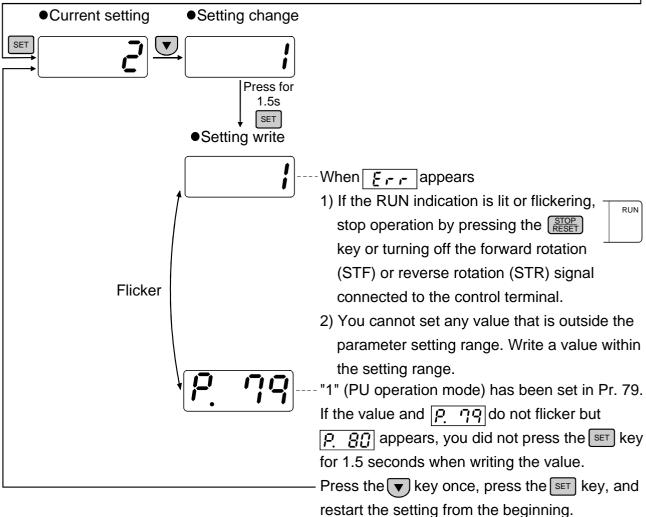
(1) Example: To change the Pr. 79 "operation mode selection" setting from "2" (external operation mode) to "1" (PU operation mode)

(For details of Pr. 79, refer to page 106.)

Press the MODE key, to choose the parameter setting mode.

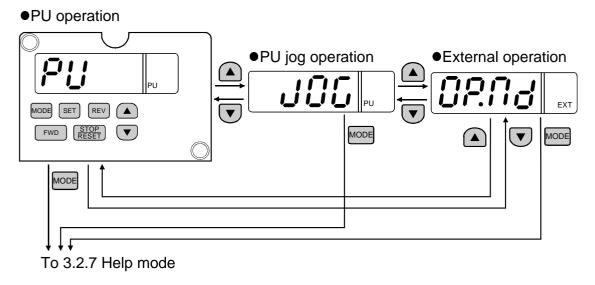
Parameter setting mode





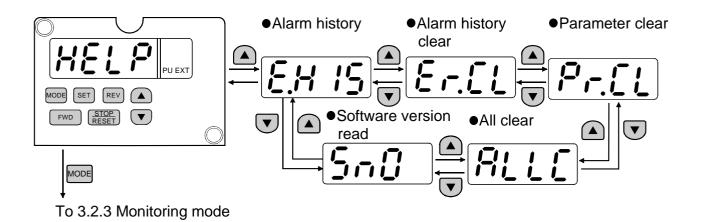
3.2.6 Operation mode

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 168.

3.2.7 Help mode

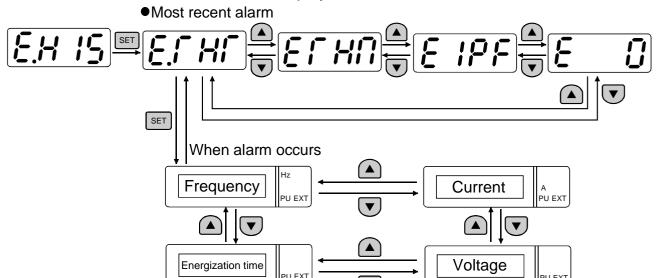


(1) Alarm history

Four past alarms can be displayed with the **A**/**v** key.

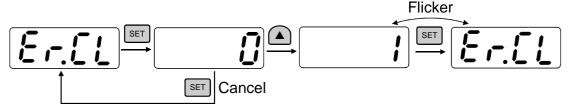
("." is appended to the most recent alarm.)

When no alarm exists, E._ _0 is displayed.



(2) Alarm history clear

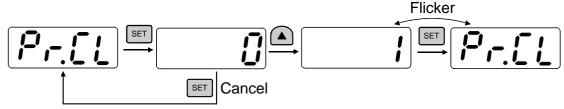
Clears all alarm history.



(3) Parameter clear

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

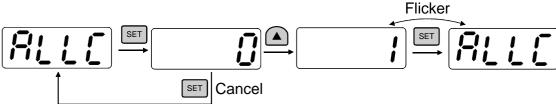
(Parameter values are not cleared by setting "1" in Pr. 77 "parameter write disable selection")



Note: The Pr. 75 "reset selection/disconnected PU detection/PU stop selection" value is not initialized.

(4) All clear

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



Note: The Pr. 75 "reset selection/disconnected PU detection/PU stop selection" value is not initialized.

3

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

(1) Operation at 50Hz

Operation command: Externally connected start signal

Frequency setting: Externally connected frequency setting potentiometer

Step	Description	Image
1	Power on → Operation mode check With the factory setting, the external operation mode is selected and the [EXT] indication is lit when power is switched on. If the [EXT] indication is not lit, refer to page 52 and set "2" in Pr. 79.	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 (frequency setting potentiometer) fully clockwise. The frequency shown on the display increases gradually to 50.00Hz.	External potentiometer 5000
4	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
5	Stop Turn off the start switch (STF or STR).	Forward rotation Reverse rotation Stop

<Reference> If other frequency is required at fully clockwise position, change Pr. 38 "Frequency at 5V (10V)" setting. (Refer to page 151)

3.3.3 PU operation mode (Operation using the control panel)

(1) Using the control panel (FR-PA02-02) for operation at 50Hz with digital frequency setting

Operation command: (FR-PA02-02) FWD / REV key

Frequency setting: (A) / V key

Related parameters: Pr. 79 "operation mode selection"

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

Step	Description	Image
1	Power on → Operation mode check Switch power on, refer to page 52, and set "1" in Pr. 79 "operation mode selection". The [PU] indication is lit.	ON PU
2	 Running frequency setting Set the running frequency to 50Hz. 1) Refer to page 51 and select the frequency setting mode with the work key. 2) Refer to page 52, change the setting with the ▲ / ▼ key, and write the new setting with the set key. 	(or) V 5000 has the second of
3	Start Press the key (or 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.	FWD / REV 5000 and
4	Stop Press the RESET key. The motor is decelerated to a stop. The [RUN] indication goes off.	Hz MON PU

(2) PU jog operation

Hold down the (or (or key) 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 54.)
- 3) Hold down the (or FWD or REV) 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.

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

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

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

Operation command: externally connected start signal

Frequency setting: A / V key of the control panel (FR-PA02-02) or multi-speed command (multi-speed command has priority) Refer to page 73.

Step	Description	Image
1	Power on Switch power on.	ON
2	Operation mode selection Refer to page 53 and set "3" in Pr. 79 "operation mode selection". The [PU] and [EXT] indications are lit.	Flicker
3	Start Turn on the start switch (STF or STR). 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. The [RUN] indication is lit to indicate forward rotation, or flickers to indicate reverse rotation.	Forward rotation Reverse rotation ON Hz RUN MON PUEXT
4	Running frequency setting Set the running frequency to 60.00Hz with the 🔺 / 🔻 key.	Step setting>
5	Stop Turn off the start switch (STF or STR). The motor stops. The [RUN] indication goes off.	Hz MON PUEXT

Note: The RESET 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 $\mathbb{R}^{\mathbb{R}}$ key of the control panel (FR-PA02-02). (Pr.79 = 4)

Operation command: (key (or key) of the control panel (FR-PA02-02)

Frequency setting: Externally connected frequency setting potentiometer or multi-speed command (multi-speed command has priority) Refer to page 73.

Step	Description	Image
1	Power on Switch power on.	ON
2	Operation mode selection Refer to page 52 and set "4" in Pr. 79 "operation mode selection". The [PU] and [EXT] indications are lit.	Flicker 🕽
3	Start Press the key (or key) of the control panel. The [RUN] indication is lit to indicate forward rotation, or flickers to indicate reverse rotation.	RUN 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 50.00Hz.	External potentiometer 50.00
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 STOP key. The operation command indication RUN goes off.	Hz MON PUEXT

<Reference> If other frequency is required at fully clockwise position, change Pr. 38 "Frequency at 5V (10V)" setting. (Refer to page 151)

CHAPTER 4 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.

4.1 Parameter List614.2 Parameter Function Details70

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.

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

4.1.1 Parameter list

Func- tion	Para- meter 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 8)	70	
	1	Maximum frequency	0 to 120Hz	0.01Hz (Note 3)	120Hz	71	
	2	Minimum frequency	0 to 120Hz	0.01Hz (Note 3)	0Hz	71	
	3	Base frequency (Note 1)	0 to 400Hz	0.01Hz (Note 3)	50Hz	72	
tions	4	Multi-speed setting (high speed)	0 to 400Hz	0.01Hz (Note 3)	50Hz	73	
Basic functions	5	Multi-speed setting (middle speed)	0 to 400Hz	0.01Hz (Note 3)	30Hz	73	
Basic	6	Multi-speed setting (low speed)	0 to 400Hz	0.01Hz (Note 3)	10Hz	73	
	7	Acceleration time	0 to 3600 s/ 0 to 360 s	0.1 s/0.01 s	5 s/10s (Note 4)	74	
	8	Deceleration time	0 to 3600 s/ 0 to 360 s	0.1 s/0.01 s	5 s/10s (Note 4)	74	
	9 Electronic thermal O/L relay		0 to 500A	0.01A	Rated output current (Note 5)	76	
	10	DC injection brake operation frequency	0 to 120Hz	0.01Hz (Note 3)	3Hz	77	
	11	DC injection brake operation time	0 to 10 s	0.1 s	0.5 s	77	
	12	DC injection brake voltage	0 to 30%	0.1%	6%	77	
	13	Starting frequency	0 to 60Hz	0.01Hz	0.5Hz	78	
	14	Load pattern selection (Note 1)	0 to 3	1	0	79	
	15	Jog frequency	0 to 400Hz	0.01Hz (Note 3)	5Hz	80	
tions	16	Jog acceleration/ deceleration time	0 to 3600 s/ 0 to 360 s	0.1 s/ 0.01 s	0.5 s	80	
Standard operation funct	18	High-speed maximum frequency	120 to 400Hz	0.01Hz	120Hz	71	
ation	19	Base frequency voltage (Note 1)	0 to 1000V, 8888,9999	0.1V	8888	72	
obei	20	Acceleration/deceleration reference frequency	1 to 400Hz	0.01Hz (Note 3)	50Hz	74	
ndard	21	Acceleration/deceleration time increments	0, 1	1	0	74	
Star	22	Stall prevention operation level	0 to 200%	0.1%	150%	81	
	23	Stall prevention operation level compensation factor at double speed (Note 6)	0 to 200%, 9999	0.1%	9999	81	
	24	Multi-speed setting (speed 4)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	
	25	Multi-speed setting (speed 5)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	
	26	Multi-speed setting (speed 6)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	

Func- tion	Para- meter Name Number		Setting Range	Minimum Setting Increments	Factory Setting	Refer To:	Custo- mer Setting
	27	Multi-speed setting (speed 7)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	
	29	Acceleration/deceleration pattern	0, 1, 2	1	0	83	
	30	Regenerative function selection	0, 1	1	0	84	
ions	31	Frequency jump 1A	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	85	
funct	32	Frequency jump 1B	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	85	
Standard operation functions	33	Frequency jump 2A	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	85	
oper	34	Frequency jump 2B	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	85	
ıdard	35	Frequency jump 3A	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	85	
Star	36	Frequency jump 3B	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	85	
	37	Speed display	0, 0.01 to 9998	0.001 r/min	0	86	
	38	Frequency at 5V (10V) input	1 to 400Hz	0.01Hz (Note 3)	50Hz (Note 2)	87	
	39	Frequency at 20mA input	1 to 400Hz	0.01Hz (Note 3)	50Hz (Note 2)	87	
	41	Up-to-frequency sensitivity	0 to 100%	0.1%	10%	88	
Output terminal functions	42	Output frequency detection	0 to 400Hz	0.01Hz (Note 3)	6Hz	89	
fun te	43	Output frequency detection for reverse rotation	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	89	
	44	Second acceleration/ deceleration time	0 to 3600 s/ 0 to 360 s	0.1 s/0.01 s	5 s/10 s (Note 10)	74	
nctions	45	Second deceleration time	0 to 3600 s/ 0 to 360 s, 9999	0.1 s/0.01 s	9999	74	
Second fu	46	Second torque boost (Note 1)	0 to 30%, 9999	0.1%	9999	70	
Seco	47	Second V/F (base frequency) (Note 1)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	72	
	48	Second electronic overcurrent protection	0 to 500A, 9999	0.01A	9999	76	
tions	52	Control panel/PU main display data selection	0,23,100	1	0	90	
func	55	Frequency monitoring reference	0 to 400Hz	0.01Hz (Note 3)	50Hz	92	
Display functions	56	Current monitoring reference	0 to 500A	0.01A	Rated output current	92	
natic art ions	57	Restart coasting time	0 to 5 s, 9999	0.1 s	9999	93	
Automatic restart functions	58	Restart cushion time	0 to 60 s	0.1 s	1.0 s	93	
Additional function	59	Remote setting function selection	0, 1, 2	1	0	94	

Func- tion	Para- meter Number	Name	Setting Range	Minimum Setting Increments	Factory Setting	Refer To:	Custo- mer Setting
	60	Shortest acceleration/ deceleration mode	0, 1, 2, 11, 12	1	0	95	
	61	Reference I for intelligent mode	0 to 500A, 9999	0.01A	9999	95	
	62	Ref. I for intelligent mode accel	0 to 200%, 9999	1%	9999	95	
	63	Ref. I for intelligent mode decel	0 to 200%, 9999	1%	9999	95	
	65	Retry selection	0, 1, 2, 3	1	0	97	
	66	Stall prevention operation level reduction starting frequency (Note 6)	0 to 400Hz	0.01Hz (Note 3)	50Hz	81	
SI	67	Number of retries at alarm occurrence	0 to 10, 101 to 110	1	0	97	
ijor	68	Retry waiting time	0.1 to 360 s	0.1 s	1 s	97	
nct	69	Retry count display erasure	0	1	0	97	
on fu	70	Special regenerative brake duty	0 to 30%	0.1%	0%	84	
Operation selection functions	71	71 Applied motor (Note 6)		1	0	99	
	72	PWM frequency selection	116,123 0 to 15	1	1	100	
	73	0-5V/0-10V selection	0, 1, 10, 11 (Note 9)	1	0	101	
	74	Filter time constant	0 to 8	1	1	102	
	75	Reset selection/ disconnected PU detection/ PU stop selection	0 to 3, 14 to 17	1	14	102	
	77	Parameter write disable selection	0, 1, 2	1	0	104	
	78	Reverse rotation prevention selection	0, 1, 2	1	0	105	
	79	Operation mode selection (Note 6)	0 to 4,6 to 8	1	0	106	
etic	80	Motor capacity	0.2 to 7.5kW, 9999	0.01kW	9999	110	
nagn ıtrol	82	Motor exciting current	0 to 500A, 9999	0.01A	9999	111	
ose r or cor	83	Rated motor voltage	0 to 1000V	0.1V	200V/ 400V	111	
General-purpose magnetic flux vector control	84	Rated motor frequency	50 to 120Hz	0.01Hz (Note 3)	50Hz	111	
neral flux	90	Motor constant (R1) (Note 6)	0 to 50Ω, 9999	0.001Ω	9999	111	
Ge	96	Auto-tuning setting/status (Note 6)	0, 1	1	0	111	

Func- tion	Para- meter Number	Name	Setting Range	Minimum Setting Increments	Factory Setting	Refer To:	Custo- mer Setting
	117	Station number	0 to 31	1	0	117	
suc	118	Communication speed	48, 96, 192	1	192	117	
Communication functions	119	Stop bit length	0, 1 (data length 8) 10, 11 (data length 7)	1	1	117	
unica	120	Parity check presence/ absence	0, 1, 2	1	2	117	
nmuc	121	Number of communication retries	0 to 10,9999	1	1	117	
Ö	122	Communication check time interval	0 to 999.8 s, 9999	0.1 s	9999	117	
	123	Waiting time setting	0 to 150, 9999	1	9999	117	
	124	CR·LF presence/absence selection	0, 1, 2	1	1	117	
	128	PID action selection	0, 20, 21	1	0	128	
	129	PID proportional band	0.1 to 1000%, 9999	0.1%	100%	128	
trol	130	PID integral time	0.1 to 3600 s, 9999	0.1 s	1 s	128	
PID control	131	Upper limit	0 to 100%, 9999	0.1%	9999	128	
	132	Lower limit	0 to 100%, 9999	0.1%	9999	128	
	133	PID action set point for PU operation	0 to 100%	0.01%	0%	128	
	134	PID differential time	0.01 to 10.00 s, 9999	0.01 s	9999	128	
ional	145	Parameter for option (FR-PU0	04).				
Additional function	146	Parameter set by manufacture	er. Do not set.				
	150	Output current detection level	0 to 200%	0.1%	150%	136	
Current detection	151	Output current detection period	0 to 10 s	0.1 s	0	136	
၂၀ခ	152	Zero current detection level	0 to 200.0%	0.1%	5.0%	137	
	153	Zero current detection period	0.05 to 1 s	0.01 s	0.5 s	137	
Sub function	156	Stall prevention operation selection	0 to 31,100	1	0	138	
Sulfunc	158	AM terminal function selection	0, 1, 2	1	0	90	

Func- tion	Para- meter Number	Name	Setting Range	Minimum Setting Increments	Factory Setting	Refer To:	Custo- mer Setting
nal On	160	User group read selection	0, 1, 10, 11	1	0	140	
Additional function	168 169	Parameters set by manufactu	rer. Do not set	t.			
Initial monitor	171	Actual operation hour meter clear	0		0	142	
SU	173	User group 1 registration	0 to 999	1	0	140	
User functions	174	User group 1 deletion	0 to 999,9999	1	0	140	
ir fc	175	User group 2 registration	0 to 999	1	0	140	
Use	176	User group 2 deletion	0 to 999,9999	1	0	140	
	180	RL terminal function selection	0 to 8, 16, 18	1	0	142	
Suc	181	RM terminal function selection	0 to 8, 16, 18	1	1	142	
al ınctic	182	RH terminal function selection	0 to 8, 16, 18	1	2	142	
Terminal assignment functions	183	MRS terminal function selection	0 to 8, 16, 18	1	6	142	
Te ignm	190	RUN terminal function selection	0 to 99	1	0	144	
ass	191	FU terminal function selection	0 to 99	1	4	144	
	192	A, B, C terminal function selection	0 to 99	1	99	144	
	232	Multi-speed setting (speed 8)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	
	233	Multi-speed setting (speed 9)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	
ratior	234	Multi-speed setting (speed 10)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	
edo p	235	Multi-speed setting (speed 11)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	
sbee	236	Multi-speed setting (speed 12)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	
Multi-speed operation	237	Multi-speed setting (speed 13)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	
	238	Multi-speed setting (speed 14)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	
	239	Multi-speed setting (speed 15)	0 to 400Hz, 9999	0.01Hz (Note 3)	9999	73	
	240	Soft-PWM setting	0, 1	1	1	100	
suo	244	Cooling fan operation selection	0, 1	1	0	145	
Sub functions	245	Rated motor slip	0 to 50%, 9999	0.01%	9999	146	
Sub f	246	Slip compensation response time	0.01 to 10 s	0.01 s	0.5 s	146	
	247	Constant-output region slip compensation selection	0, 9999	1	9999	146	

Func- tion	Para- meter Number	Name	Setting Range		Minimum Setting Increments	Factory Setting		Refer To:	Custo- mer Setting
Stop selection function	250	Stop selection	0 to 100 s, 1000 to 1100 s, 8888, 9999		1	9999		147	
	901	AM terminal calibration		_		_		149	
	902	Frequency setting voltage bias	0 to 10V	0 to 60Hz	0.01Hz	OV	0Hz	151	
ınctions	903	Frequency setting voltage gain	0 to 10V	1 to 400 Hz	0.01Hz	5V	50 Hz	151	
Calibration functions	904	Frequency setting current bias	0 to 20 mA	0 to 60Hz	0.01Hz	4 mA	0Hz	151	
Calib	905	Frequency setting current gain	0 to 20 mA	1 to 400 Hz	0.01Hz	20 mA	50 Hz	151	
	990 991	Parameter for option (FR-PU04).							

Note: 1. Indicates the parameter of which setting is ignored when the general-purpose magnetic flux vector control mode is selected.

- 2. 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 50Hz.
- 3. When the control panel is used and the setting is 100Hz or more, the setting increments are 0.1Hz.
- 4. The setting depends on the inverter capacity: (0.4K to 3.7K)/(5.5K to 7.5K).
- 5. Set to 85% of the rated inverter current for the 0.4K, 0.75K.
- 6. If "2" is set in Pr. 77 (parameter write inhibit selection), the setting cannot be changed during operation.
- 7. The half-tone screened parameters allow their settings to be changed during operation if "0" (factory setting) has been set in Pr. 77 (parameter write inhibit selection). (However, the Pr. 72 and Pr. 240 values may be changed during PU operation only.)
- 8. The setting depends on the inverter capacity: 4% for the FR-E540-5.5K and 7.5K-EC.
- 9. To set "10" or "11" in Pr. 73, first "801" must set in Pr. 77.
- 10. The FR-E540-5.5K and 7.5K-EC are factory-set to 10 s.

PARAMETERS

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			
	Fulpose of Ose	Parameter numbers which must be set			
	Operation mode selection	Pr. 79			
	Acceleration/deceleration time/pattern adjustment	Pr. 7, Pr. 8, Pr. 20, Pr. 21, Pr. 29			
	Selection of output characteristics optimum for load characteristics	Pr. 3, Pr. 14, Pr. 19			
	Output frequency restriction (limit)	Pr. 1, Pr.2, Pr.18			
_	Operation over 50Hz	Pr. 1, Pr. 18, Pr. 38, Pr. 39, Pr. 903, Pr. 905			
atior	Adjustment of frequency setting signals and outputs	Pr. 38, Pr. 39, Pr. 73, Pr. 902 to Pr. 905			
) el	Motor output torque adjustment	Pr. 0, Pr. 80			
0	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,			
<u>8</u>	In a second Cons	Pr. 235, Pr. 236, Pr. 237, Pr. 238, Pr. 239			
ď	Jog operation	Pr. 15, Pr. 16			
	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			
	General-purpose magnetic flux vector control operation	Pr. 80			
ation	Electromagnetic brake operation timing	Pr. 42, Pr. 190 to Pr. 192			
ا في	Offline auto tuning setting	Pr. 82 to Pr. 84, Pr. 90, Pr. 96			
d to appli operation	Sub-motor operation	Pr. 0, Pr. 3, Pr. 7, Pr. 8, Pr. 9, Pr. 44, Pr. 45, Pr. 46, Pr. 47, Pr. 48			
d tc	Regenerative function selection	Pr. 30, Pr. 70			
Related to application operation	Operation in communication with personal computer	Pr. 117 to Pr. 124			
Re	Operation under PID control	Pr. 73, Pr. 79, Pr. 128 to Pr. 134, Pr. 180 to Pr. 183, Pr. 190 to Pr. 192			
	Noise reduction	Pr. 72, Pr. 240			

Purpose of Use		Parameter Numbers
	Pulpose of Ose	Parameter numbers which must be set
	Frequency meter calibration	Pr. 55, Pr. 56, Pr. 158, Pr. 901
Related to monitoring	Monitor display on control panel (FR-PA02-02) or parameter unit (FR-PU04)	Pr. 55, Pr. 56, Pr. 158, Pr. 901
e e	Display of speed, etc.	Pr. 37, Pr. 52
₩ E	Clearing of inverter's actual operation time	Pr.171
ect ion	Function write prevention	Pr. 77
corre	Reverse rotation prevention	Pr. 78
Related to incorrect operation prevention	Parameter grouping	Pr. 160, Pr. 173 to Pr. 176
eratic	Current detection	Pr. 150 to Pr. 153, Pr. 190 to Pr. 192
P. Qo	Motor stall prevention	Pr. 22, Pr. 23, Pr. 66, Pr. 156
	Input terminal function assignment	Pr. 180 to Pr. 183
Ø	Output terminal function assignment	Pr. 190 to Pr. 192
Others	Increased cooling fan life	Pr. 244
=======================================	Motor protection from overheat	Pr. 9, Pr. 71
	Automatic restart operation at alarm stop	Pr. 65, Pr. 67, Pr. 68, Pr. 69
	Inverter reset selection	Pr. 75

PARAMETERS

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	Nome	Application
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.
901	AM terminal calibration	Used to calibrate the meter connected across terminals AM-5.
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 signal
904	Frequency setting current bias	(0 to 5V, 0 to 10V or 4 to 20mA DC) as desired.
905	Frequency setting current gain	

4.2 Parameter Function Details

PARAMETERS

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

Pr. 0 "torque boost"

Pr. 46 "second torque boost"

Related parameters

Pr. 3 "base frequency"

Pr. 19 "base frequency voltage"

Pr. 71 "applied motor"

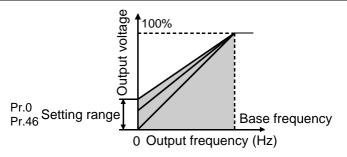
Pr. 80 "motor capacity"

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

Increase the setting when the inverter-to-motor 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.

Parameter Number	Factory Setting	Setting Range	Remarks
0	6%/4% (Note)	0 to 30%	(Note) FR-E520S-0.4K to 2.2K-EC FR-E540-0.4K to 3.7K-EC 6%
	(* ****)		FR-E540-5.5K, 7.5K-EC: 4%
46	9999	0 to 30%, 9999	9999: Function invalid



<Setting>

- 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:

FR-E540-0.4K, 0.75K-EC, FR-E520S-0.4K, 0.75K-EC.......6%

FR-E540-1.5K to 3.7K-EC, FR-E520S-1.5K, 2.2K-EC.......4%

If you leave the factory setting as it is and change the Pr. 71 value to the setting for 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.
 - 2. A large setting may result in an overheated motor or overcurrent trip. The guideline for the largest value for this parameter is about 10%.
 - 3. The RT signal serves as the second function selection signal and makes the other second functions valid. Refer to page 142 for Pr. 180 to Pr. 183 (input terminal function selection).

Related parameters

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

Pr. 39 "frequency at 20mA input"
Pr. 79 "operation mode selection"

Pr. 13 "starting frequency"

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

Pr. 1 "maximum frequency"

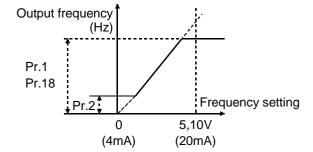
Pr. 2 "minimum frequency"

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.

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

Parameter	Factory	Setting
Number	Setting	Range
1	120Hz	0 to 120Hz
2	0Hz	0 to 120Hz
4.0	42011-	120 to
18	120Hz	400Hz



<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 50Hz, change the value of Pr. 38 (or Pr. 39 for use of the potentiometer connected across terminals 4-5). If the Pr. 1 or Pr. 18 value is only changed, the motor cannot run beyond 50Hz.

/ CAUTION

When the Pr. 2 setting is higher than the Pr. 13 "starting frequency" value, note that the motor will run at the set frequency by merely switching the start signal on, without entering 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) "

Related parameters

Pr. 71 "applied motor"

Pr. 80 "motor capacity"

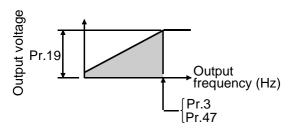
Pr. 83 "rated motor voltage"

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

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 the base frequency to the same value as the power supply frequency.

Parameter	Factory	Setting	Remarks
Number	Setting	Range	Remarks
3	50Hz	0 to 400Hz	
19	8888	0 to 1000V,	8888: 95% of power supply voltage
19	0000	8888, 9999	9999: Same as power supply voltage
47	9999	0 to 400Hz,	9999: Function invalid
47	9999	9999	



<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 motor.

- 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.
- 3. The RT signal serves as the second function selection signal and makes the other second functions valid. Refer to page 142 for Pr. 180 to Pr. 183 (input terminal function selection).

PARAMETERS

4.2.4 Multi-speed operation (Pr. 4, Pr. 5, 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)"

Used to switch between the predetermined running speeds.

Related parameters

Pr. 1 "maximum frequency"

Pr. 2 "minimum frequency"

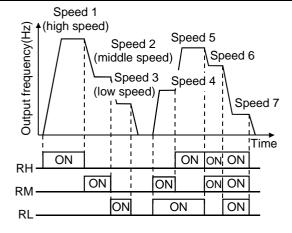
Pr. 29 "acceleration/deceleration pattern"

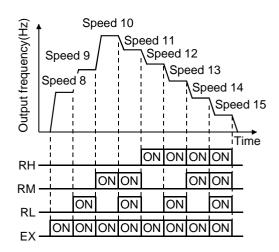
Pr. 79 "operation mode selection"

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

- 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 = 4).

Parameter Number	Factory Setting	Setting Range	Remarks
4	50Hz	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 🍙 / 🔻 key. In this case, when you release the 🝙 / 🔻 key, press the 🖭 key (write 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 multi-speed settings override the main speeds (across terminals 2-5, 4-5).

2. The multi-speeds can also be set in the PU or external operation mode.

- 3. 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.
- 6. 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 setting.

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

Pr. 7 "acceleration time"

Related parameters

Pr. 3 "base frequency"

Pr. 8 "deceleration time"

Pr. 29 "acceleration/deceleration pattern"

Pr. 20 "acceleration/deceleration reference frequency"

Pr. 21 "acceleration/deceleration time increments"

Pr. 44 "second acceleration/deceleration time"

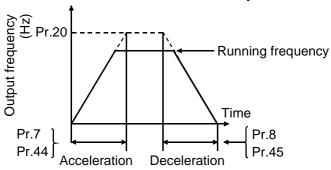
Pr. 45 "second deceleration time"

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	0.4K to 3.7K 5.5K, 7.5K	5s 10s	0 to 3600s/0 to 360s	
8	0.4K to 3.7K 5.5K, 7.5K	5s 10s	0 to 3600s/0 to 360s	
20	50Hz		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-EC and 7.5K-EC are factory-set to 10 s.



PARAMETERS

<Setting>

- Use Pr. 21 to set the acceleration/deceleration time and minimum setting increments:
 - Set value "0" (factory setting)0 to 3600 s (minimum setting increments: 0.1 s) Set value "1"....... 0 to 360 s (minimum setting increments: 0.01 s)
- 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.
- 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 83), the set time is the period required to reach the base frequency set in Pr. 3.
 - Acceleration/deceleration time calculation expression 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

- 2. 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.
- 3. When the setting of Pr. 7, Pr. 8, Pr. 44 or Pr. 45 is "0", the acceleration/deceleration time is 0.04 seconds. At this time, set 120Hz or less in Pr. 20.
- 4. When the RT signal is on, the other second functions such as second torque boost are also selected.
- 5. 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.

4.2.6 Electronic overcurrent protection (Pr. 9, Pr. 48)

Pr. 9 "electronic thermal O/L relay"

Pr. 48 "second electronic overcurrent protection"

Set the current of the electronic overcurrent protection to protect the motor from overheat.

Related parameter

Pr. 71 "applied motor"

Pr. 180 to Pr. 183
"input terminal function selection"

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

^{*0.4}K and 0.75K are set to 85% of the rated inverter current.

<Setting>

- Set the rated current [A] of the motor.
- Setting "0" makes the electronic overcurrent protection (motor protective function) invalid. (The inverter's protective function is valid.)
- When using a Mitsubishi constant-torque motor, first set "1" in Pr. 71 to choose the 100% continuous torque characteristic in the low-speed range. Then, set the rated motor current in Pr. 9.
- Pr. 48 "Second electronic overcurrent protection" 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.
 - 2. When the difference between the inverter and motor capacities is large and the setting is small, the protective characteristics of the electronic overcurrent protection will be deteriorated. In this case, use an external thermal relay.
 - 3. A special motor cannot be protected by the electronic overcurrent protection. Use an external thermal relay.
 - 4. The RT signal serves as the second function selection signal and makes the other second functions valid. Refer to page 142 for Pr. 180 to Pr. 183 (input terminal function selection).

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

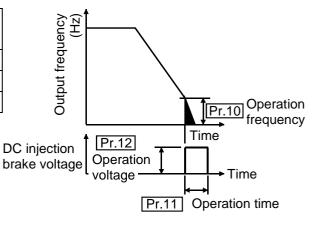
Pr. 10 "DC injection brake operation frequency"

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	Factory	Setting
Number	Setting	Range
10	3Hz	0 to 120Hz
11	0.5 s	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.
- When using an inverter-dedicated motor (constant-torque motor), set 6% (factory setting) in Pr. 12.



4.2.8 Starting frequency (Pr. 13)

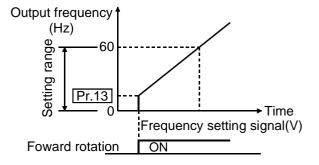
Pr. 13 "starting frequency"

Related parameter -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 Number	Factory Setting	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.

!CAUTION

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

PARAMETERS

4.2.9 Load pattern selection (Pr. 14)

Pr. 14 "load pattern selection"

Related parameter

Pr. 0 "torque boost"

Pr.46 "second torque boost"

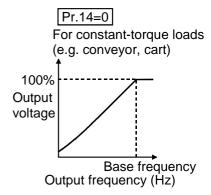
Pr. 80 "motor capacity"

Pr.180 to Pr.183

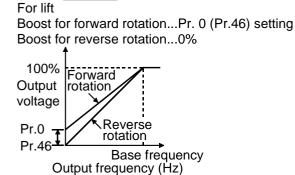
(input terminal function selection)

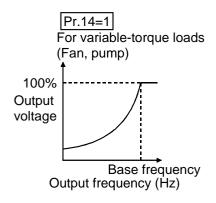
You can select the optimum output characteristic (V/F characteristic) for the application and load characteristics.

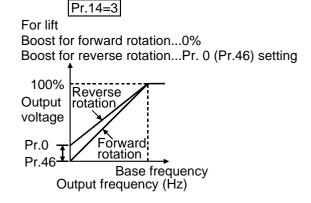
Parameter Number	Factory Setting	Setting Range
14	0	0 to 3



Pr.14=2







Note: 1. This parameter setting is ignored when the general-purpose magnetic flux vector control mode has been selected.

2. 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 142 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"

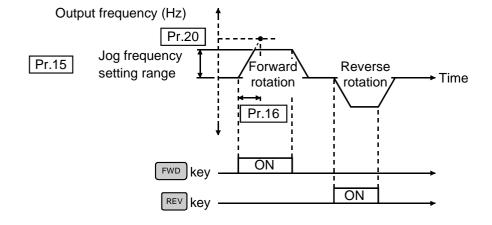
Related parameters -

- 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 control panel and pressing and releasing the key (FWD), REV key).

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

Parameter Number	Factory Setting	Setting Range	Remarks
15	5Hz	0 to 400Hz	
16	0.5.0	0 to 3600 s	When Pr. 21 = 0
16	0.5 s	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.
 - 2. The acceleration time and deceleration time cannot be set separately for jog operation.
 - 3. 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 (Pr. 22, Pr. 23, Pr. 66)

Pr. 22 "stall prevention operation level"

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

Related parameters

Pr. 9 "electronic thermal O/L relay"

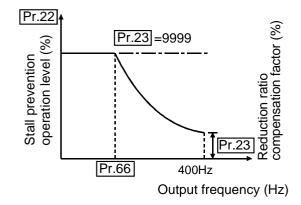
Pr. 48 "second electronic overcurrent protection"

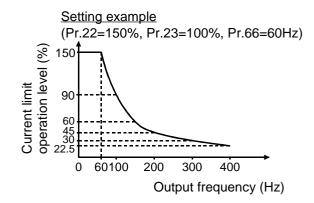
Pr. 73 "0-5V/0-10V selection"

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

- Set the output current level at which the output frequency is adjusted to prevent the inverter from coming to an alarm stop 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 50Hz 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.

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	50Hz	0 to 400Hz	





<Setting>

- 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.

Calculation expression for stall prevention operation level

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

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

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

Note: When the fast-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.

CAUTION

- ② 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)

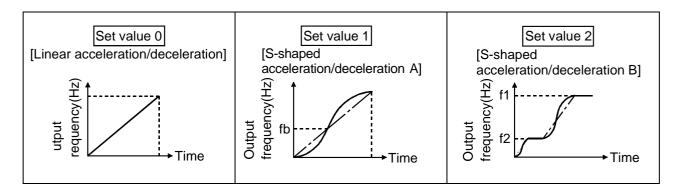
Pr. 29 "acceleration/deceleration pattern"

Set the acceleration/deceleration pattern.

Parameter Number	Factory Setting	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 so 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. For details, refer to Pr. 7 and Pr. 8.

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.

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

<Setting>

- (1) When using the brake resistor (MRS), brake unit, high power factor converter
 - 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.
 - 2. 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)



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"

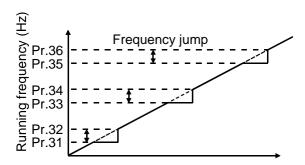
Pr. 34 "frequency jump 2B"

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.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 "control panel/PU main display data selection"

The unit of the output frequency display of the control panel (FR-PA02-02) and PU (FR-PU04) can be changed from the frequency to the motor speed or machine speed.

Parameter Number	Factory Setting	Setting Range	Remarks
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 control panel monitor (PU main display), refer to Pr. 52 and Pr. 53.
- 3. As the control 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.
- 5. 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.

LCAUTION

! 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 -

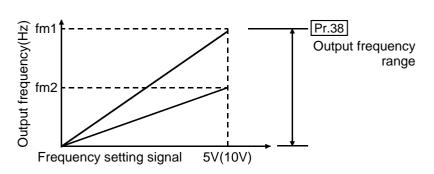
Pr. 73 "0-5V/0-10V selection"

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	50Hz	1 to 400Hz

4.2.17 Frequency at 20mA input (Pr. 39)

Pr. 39 "frequency at 20mA input"

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

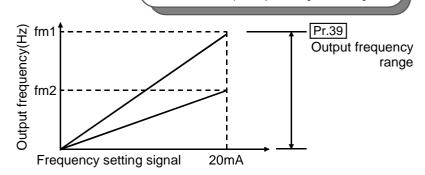
-Related parameters

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

Pr. 79 "operation mode selection"

Pr. 904 "frequency setting current bias"

Pr. 905 "frequency setting current gain"



Parameter Number	Factory Setting	Setting Range	
39	50Hz	1 to 400Hz	

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

Pr. 41 "up-to-frequency sensitivity"

Related parameters

Pr. 190 "RUN terminal function selection"

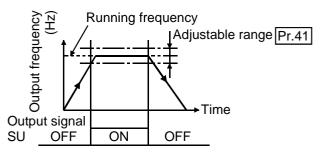
Pr. 191 "FU terminal function selection"

Pr. 192 "A, B, C 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	Factory	Setting
Number	Setting	Range
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 144 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"

Pr. 43 "output frequency detection for reverse rotation"

The output frequency detection signal (FU) is

Related parameters

Pr. 190 "RUN terminal function selection"

Pr. 191 "FU terminal function selection"

Pr. 192 "A, B, C terminal function selection"

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

output when the output frequency reaches or exceeds the setting. This function can be

etc. Parameter Factory Setting Range Remarks Number Setting 0 to 400Hz 6Hz 42

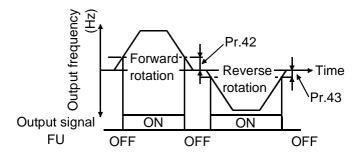
43 9999 0 to 400Hz, 9999 9999: Same as Pr. 42 setting

<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 144 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.

4

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. 158)

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

Pr. 158 "AM 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. 901 "AM terminal calibration"

You can select the signals shown on the control panel (FR-PA02-02) /parameter unit (FR-PU04) main display screen and the signal output to the AM terminal.

• The analog output terminal AM is provided for signal output. Select the signal using Pr. 158.

Parameter Number	Factory Setting	Setting Range
52	0	0, 23, 100
158	0	0, 1, 2

PARAMETERS 1

<Setting>

Set Pr. 52 and Pr. 158 in accordance with the following table:

		Parameter Setting			
Cional Tuna	Unit	Pr. 52		Pr. 158	Full-Scale Value of
Signal Type	Offic	Control	PU main	AM	AM Level Meter
		panel LED	monitor	terminal	
Output frequency	Hz	0/100	0/100	0	Pr. 55
Output current	Α	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:

	Pr. 52		
	0	0 100	
	During operation/during stop	During stop	During operation
Output frequency	Output frequency	Set frequency	Output frequency
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.
 - 2. 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 state key.
- 3. Running speed on the PU main monitor is selected by "other monitor selection" of the parameter unit (FR-PU04).
- 4. 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.
- 5. 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.
- 6. The actual operation time is not calculated if the inverter has not operated for more than 1 hour continuously.
- 7. When the control 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"

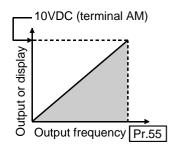
Related parameters

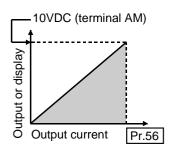
Pr. 158 "AM terminal function selection"

Pr. 901 "AM terminal calibration"

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

Parameter Number	Factory Setting	Setting Range
55	50Hz	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. 158 = 0 and Pr. 56 is set when Pr. 158 = 1.

In Pr. 55 and Pr. 56, set the frequency and current at which the output voltage of terminal AM will be 10V.

Note: The maximum output voltage of terminal AM is 10VDC.

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	Setting		Description	
57	0	0.4K to 1.5K	0.5 s coasting time	Generally use this setting.
		2.2K to 7.5K	1.0 s coasting time	
	0.1 to 5 s		Waiting time for inverter-triggered restart after power is restored from an instantaneous power failure. (Set this time between 0.1 s and 5 s 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).			

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-A024S/A044, 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 0.2 s, the frequency before the instantaneous power failure cannot be stored and the inverter will start at 0Hz.

2. The SU and FU signals are not output during restart but are output after the restart cushion time has elapsed.

!CAUTION

! 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.

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). Related parameters –

Pr. 1 "maximum frequency"

Pr. 7 "acceleration time"

Pr. 8 "deceleration time"
Pr. 18 "high-speed maximum

frequency"
Pr. 44 "second acceleration/
deceleration time"

Pr. 45 "second deceleration time"

• When the remote function is used, the output frequency of the inverter can be compensated for as follows:

External operation mode

Factory

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

frequency command

Setting

PU operation mode

Forward rotation (STF)

Parameter

Frequency set by RH/RM operation plus PU's digitallyset frequency

l	Number	Setting	g Rang	e				
	59	0	0, 1,	2				
	Acceleration (RH eceleration (RM lear (RL)	Output frequency	lote) OHz ON ON		ON	 DN_		• When Pr. 59=1 • When Pr. 59=2 • •

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

Pr. 59	Оро	Operation		
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
 - Frequency at the time when the RH (acceleration) and RM (deceleration) signals have remained off for more than 1 minute

- 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.
 - 3. If the start signal (STF or STR) is off, turning on the acceleration (RH) or deceleration (RM) signal varies the set frequency.

/ CAUTION

Mhen 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 I for intelligent mode"

Pr. 62 "ref. I for intelligent mode accel"

Pr. 63 "ref. I for intelligent mode decel"

Related parameters

Pr. 7 "acceleration time"

Pr. 8 "deceleration time"

The inverter automatically sets appropriate parameters 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 to start operation immediately without making fine parameter settings.

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	Automatically Set Parameters
0	Ordinary operation mode		
1, 2, 11, 12	Shortest acceleration/ deceleration mode	Set to accelerate/decelerate the motor in the shortest time. The inverter makes acceleration/deceleration in the shortest time using its full capabilities. During deceleration, an insufficient brake capability may cause the regenerative overvoltage alarm (E.OV3). "1": Stall prevention operation level 150% "2": Stall prevention operation level 180% "11": Stall prevention operation level 150% when brake resistor or brake unit is used "12": Stall prevention operation level 180% when brake resistor or brake unit is used	Pr. 7, Pr. 8

<Setting>

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

(1) Pr. 61 "reference I for intelligent mode"

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

(2) Pr. 62 "ref. I for intelligent mode accel"

The reference current setting can be changed.

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 "ref. I for intelligent mode decel"

The reference current setting can be changed.

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.	

Note: Pr. 61 to Pr. 63 are only valid when any of "1, 2, 11, 12" are selected for Pr. 60.

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		Set	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. 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 360 seconds.
- 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 control 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.
 - 3. When an inverter alarm is reset by the retry function at the retry time, the stored data of the electronic over current protection, etc. are not cleared. (Different from the power-on reset.)

/ CAUTION

!\text{\text{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 seals in 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"

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 the motor used.

When using the Mitsubishi constant-torque motor, set "1" in Pr. 71 for either V/F control or general-purpose magnetic flux vector control.
 The electronic overcurrent protection is set to the thermal characteristic of the constant-torque motor.

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.

Dr. 71	Pr. 71 Thermal Characteristics of Electronic etting Overcurrent Protection			Applied motor	
Setting				Standard	Constant- Torque
0, 100	Thermal characteristics	matching a sta	andard motor	0	
1, 101	Thermal characteristics matching the Mitsubishi constant-torque motor				0
3, 103	Standard motor			0	
13, 113	Constant-torque motor	Select "offlin	Select "offline auto tuning		0
23, 123	Mitsubishi general- purpose motor SF- JR4P (1.5kW or less)	setting".	e auto turning	0	
5, 105	Standard motor	Star Motor		0	
15, 115	Constant-torque motor	1	constants can		0
6, 106	Standard motor		be entered	0	
16, 116	Constant-torque motor		directly.		0

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

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

CAUTION

! 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 (Pr. 72, Pr. 240)

Pr. 72 "PWM frequency selection"

Pr. 240 "Soft-PWM setting"

You can change the motor tone.

- 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.

Parameter Number	Factory Setting	Setting Range	Remarks
72	1	0 to 15	0 : 0.7kHz, 15 : 14.5kHz
240	1	0, 1	1: Soft-PWM valid

<Setting>

Refer to the following list and set the parameters:

Parameter Number	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.
240	0	Soft-PWM invalid
240	1	When any of "0 to 5" is set in Pr. 72, Soft-PWM is made valid.

- 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 180 (depending upon the inverter.)
 - 2. An increased PWM frequency will decrease motor noise but noise and leakage current will increase. Take proper action (refer to pages 32 to 37).

4.2.28 Voltage input (Pr. 73)

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

Related parameters —

Pr. 22 "stall prevention operation level"

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

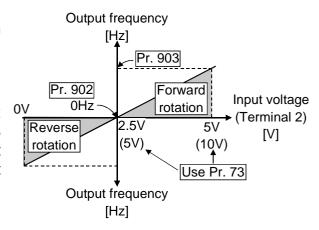
• You can change the input (terminal 2) specifications in response to the frequency setting voltage signal. When entering 0 to 10VDC, always make this setting.

Parameter Number	Factory Setting	Setting Range
73	0	0, 1, 10, 11 (Note)

Note: To set "10" or "11" in Pr. 73, first "801" must be set in Pr. 77.

Setting	Terminal 2 Input Voltage	Polarity Reversible
0	For 0 to 5VDC input (factory setting)	No
1	For 0 to 10VDC input	No
10	For 0 to 5VDC input	Volid
11	For 0 to 10VDC input	Valid

- 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.
- 1) Set the output frequency using Pr. 902 "frequency setting voltage bias" and Pr. 903 "frequency setting voltage gain". The output frequency is 0Hz at the factory-set input voltage of 2.5V (5V).
- 2) When Pr. 73 = "10" as factory-set, Pr. 902 = 2.5V. When Pr. 73 = "11", Pr. 902 = 5V.



Note: To calibrate the input voltage value at 0Hz, use Pr. 902 "frequency setting voltage bias".

⟨Ŷ⟩ WARNING

Do not design the wiring and facility which will make the voltage lower than the Pr. 902 setting suddenly.

Doing so can cause the inverter to provide reverse rotation output if the analog signal wiring is disconnected or the speed command analog signal turns to 0V, resulting in hazardous conditions.

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 Number	Factory Setting	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, control panel (FR-PA02-02) 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 control panel (FR-PA02-02)

/PU (FR-PU04) is disconnected from the inverter for more than 1 second, 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 RESET key.

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

<Setting>

Pr. 75 Setting	Reset Selection	PU Disconnection Detection	PU Stop Selection
0	Reset input normally enabled. Reset input enabled only when the protective function is activated.	If the PU is disconnected, operation will be continued.	Pressing the STOP Key
2	Reset input normally enabled.	When the PU is	decelerates the 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	Reset input normally enabled.	If the PU is disconnected,	Pressing the
15	Reset input enabled only when the protective function is activated.	operation will be continued.	STOP RESET Key decelerates the
16	Reset input normally enabled.		inverter to a stop
17	Reset input enabled only when the protective function is activated.	When the PU is disconnected, an error is displayed on the PU and the inverter output is shut off.	in any of the PU, external and communication operation modes.

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

(1) Control panel (FR-PA02-02)

- 1) After completion of deceleration to a stop, switch off the STF or STR signal.
- 2) Press the Model key two times* to display $\mathbf{GP.\Pid}$.

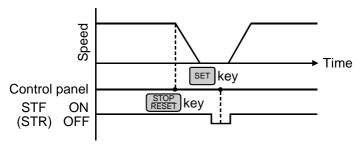
Note: When Pr. 79 = 3, press the MoDE key three times to display ₱Џ. Then, press the ▼ key and proceed to step 3).

(For the monitor screen).....Refer to page 51 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.
- 2) Press the EXT key.
- 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 power-reset 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 overcurrent protection and regenerative brake duty are reset, and the motor coasts.
 - 2. The PU disconnection detection function judges that the PU is disconnected when it is removed from the inverter for more than 1 second. If the PU had been disconnected before power-on, it is not judged as an alarm.
 - 3. To resume operation, reset the inverter after confirming that the PU is connected securely.
 - 4. 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.
 - 5. 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

1 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 inhibit selection (Pr. 77)

Related parameters

Pr. 77 "parameter write disable selection"

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.

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

<Setting>

Pr. 77 Setting	Function
0	Parameter values may only be written during a stop in the PU operation mode. (Note 1)
1	Write disabled. Values of Pr. 75, Pr. 77 and Pr. 79 "operation mode selection" may be written.
2	Write enabled even during operation.

Note: 1. The parameters half-tone screened in the parameter list can be set at any time.

- 2. If Pr. 77 = "2", the values of Pr. 23, Pr. 66, Pr. 71, Pr. 79, Pr. 90, 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.
- 3. By setting "1" in Pr. 77, the following clear operations can be inhibited:
 - Parameter clear
 - All clear

4.2.32 Reverse rotation prevention selection (Pr. 78)

Pr. 78 "reverse rotation prevention selection"

Related parametersPr. 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 Number	Factory Setting	Setting Range
78	0	0, 1, 2

<Setting>

Pr. 78 Setting	Function
0	Both forward and reverse
U	rotations allowed
1	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 control panel or parameter unit (PU operation), with external signals (external operation), or by combination of

Related parameters -

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

Pr. 232 to Pr. 239

"multi-speed operation"

Pr. 180 to Pr. 183

(input terminal function selection)

PU operation and external operation (external/PU combined operation).

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

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

<Setting>

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

Pr. 79	Function				
Setting	When power is switched on the external operation made is collected				
0	PU or external ope	When power is switched on, the external operation mode is selected. PU or external operation can be selected by pressing the keys of the control panel or parameter unit. (Refer to page 54) For these modes, refer to the setting 1 and 2 below.			
	Operation mode	Running frequency	Start signal		
1	PU operation mode	Digital setting made by the key operation of the control panel or parameter unit	control panel or FWD or REV key of parameter unit		
2	External operation mode	External signal input (across terminals 2 (4)-5, multi-speed selection)	External signal input (terminal STF, STR)		
3	External/PU combined operation mode 1	Digital setting made by the key operation of the control 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 control 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 running.				
7	External operation mode (PU operation interlock) MRS signal ONAble to be switched to PU operation mode (output stop during external operation) MRS signal OFFSwitching to PU operation mode inhibited				
8	X16 signal	than external operation mode (disa ONSwitched to external op OFFSwitched to PU operation	eration mode		

Note: Either "3" or "4" may be set to select the PU/external combined operation. These settings differ in starting method.

(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 control 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 control 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.

(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 142 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. Parameter values can be rewritten in PU operation mode. 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	Opera-			_	Switching to
Operation mode	Status	MRS Signal	tion Mode (Note 4)	Operating Status	Parameter Write	PU Operation Mode
	During stop	$ ON \rightarrow OFF $ (Note 3)		During stop	Allowed → disallowed	Disallowed
PU	During operation	ON → OFF (Note 3)	External	If external operation frequency setting and start signal are entered, operation is performed in that status.	Allowed → disallowed	Disallowed
	During stop	$OFF \to ON$		During stop	Disallowed → disallowed	Allowed
External	During Stop	$ON \to OFF$	External		Disallowed → disallowed	Disallowed
External	During	$OFF \to ON$	External	During operation → output stop	Disallowed → disallowed	Disallowed
	operation	$ON \to OFF$		Output stop → During operation	Disallowed → disallowed	Disallowed

- 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.
 - 2. 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 step key of the control panel.
 - 4. 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

1) 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 142 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"

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

vector control.General-purpose magnetic flux vector control

Related parameters

Pr. 71 "applied motor"

Pr. 83 "rated motor voltage"

Pr. 84 "rated motor frequency"

Pr. 96 "auto-tuning setting/status"

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

Parameter Number	Factory Setting	Setting Range	Remarks
80	9999	0.2kW to 7.5kW, 9999	9999: V/F control

Provides large starting torque and sufficient low-speed torque.

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	
	9999	V/F control	
80	80 0.2 to 7.5		General-
		Set the motor capacity applied.	purpose magnetic flux
			vector control

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

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

Pr. 82 "motor exciting 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"

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 general-purpose magnetic flux vector control can be used without using the offline auto tuning function but if the motor used is not Mitsubishi's standard motor or Mitsubishi's constant-torque motor (e.g. motor of another company make) or the wiring distance is long, the motor can be run with the optimum operating characteristics by using the offline auto tuning function.
- 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. (As the load is smaller, tuning accuracy is higher. Tuning accuracy does not change if inertia is large.)
- The offline auto tuning status can be monitored with the control panel (FR-PA02-02) 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	50Hz	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.

 - 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 overcurrent protection" 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	s suitable for M	itsubishi's constant-	
	1, 101	torque motor			
	3, 103	Standard motor			
	13, 113	Constant-torque motor	Constant-torque motor Select "offline auto		
71 (Note)	22 122	Mitsubishi's SF-JR4P standard motor		tuning setting"	
	23, 123	(1.5kW or less)			
	5, 105	Standard motor	Star connection	Direct input of	
	15, 115	Constant-torque motor	Star Connection		
	6, 106	Standard motor	Delta connection	motor constants	
	16, 116	Constant-torque motor	Della connection	Chabled	
83	0 to 1000V	Set the rated motor volta	age (V).		
84	50 to 120Hz	Set the rated motor frequency (Hz).			
90	0 to 50Ω, 9999	Tuning data			
90	0 10 3022, 9999	(Values measured by offline auto tuning are set automatically			
96	0	Offline auto tuning is not performed.			
90	1	Offline auto tuning is per	rformed.		

Note: The electronic overcurrent protection characteristics are also selected simultaneously. By setting any of "100 to 123", the electronic overcurrent protection 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 STOP 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, AM, A, B, C
- 3. 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 control panel is used, the same value as on the PU is only displayed:

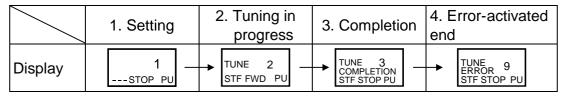
Control panel (FR-PA02-02) display

(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)



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

(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.)

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.	
	Current limit (stall prevention) function was	Increase	
91	activated.	acceleration/deceleration time.	
	activated.	Set "1" in Pr. 156.	
92	Converter output voltage reached 75% of	Check for fluctuation of power	
92	rated value.	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 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 in the offline auto tuning is stored as a parameter and its data is held until the offline auto tuning is performed again.
 - 2. 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.
 - 3. 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 in vertical lift application, 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 "801" in Pr. 77. Only when the Pr. 80 setting is other than "9999", the parameter value of the motor constant (Pr. 90) can be displayed. Though the parameter values of other than the motor constant (Pr. 90) can also be displayed, they are parameters for manufacturer setting and should be handled carefully without misuse.
- 2. Set any of the following values in Pr. 71:

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

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

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 exciting current	0 to 500A, 9999	0.01A	9999
90	Motor constant (R1)	0 to 10Ω, 9999	0.001Ω	9999

4. 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	50Hz

5. Return the Pr. 77 setting to the original value.

Note: 1. The Pr. 90 value may only be read when general-purpose magnetic flux vector control has been selected.

- 2. Set "9999" in Pr. 90 to use the standard motor constant (including that for the constant-torque motor).
- 3. 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.

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

Pr. 117 "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"

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

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

Communication specifications

Confo	Conforming standard		RS-485	
Numb	er of inverters	connected	1:N (maximum 32 inverters)	
Comn	nunication spe	ed	Selectable between 19200, 9600 and 4800bps	
Contro	ol protocol		Asynchronous	
Comn	nunication me	thod	Half-duplex	
on	Character sy	stem	ASCII (7 bits/8 bits) selectable	
äti	Stop bit leng	th	Selectable between 1 bit and 2 bits.	
nic Sat	Terminator		CR/LF (presence/absence selectable)	
l Eij	Check	Parity check	Selectable between presence (even/odd) and absence	
l E	system	Sum check	Present	
S Is	Character system Stop bit length Terminator Check System Sum check Waiting time setting		Selectable between presence and absence	

• For the data codes of the parameters, refer to Appendix 1 "Data Code List" (page 186).

Parameter Number	Factory Setting	Setting Range	
117	0	0 to 31	
118	192	48, 96	5, 192
119	1	Data length 8	0, 1
119	I	Data length 7	10, 11
120	2	0, 1	1, 2
121	1	0 to 10), 9999
122	9999	0 to 999.	8 s, 9999
123	9999	0 to 15	0, 9999
124	1	0, 1	1, 2

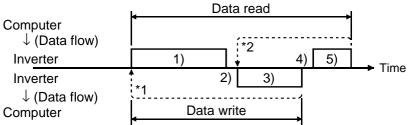
<Setting>

Parameter Number	Name	Setti	ng	Description
117	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.
	Communica-	48	1	4800 bps
118	tion speed	96		9600 bps
	tion speed	192	2	19200 bps
	Stop hit	8 data	0	Stop bit length 1 bit
119	Stop bit length/data	bits	1	Stop bit length 2 bits
119	length	7 bits	10	Stop bit length 1 bit
	longui	7 0113	11	Stop bit length 2 bits
	Parity check	0		Absent
120	presence/	1		Odd parity present
	absence	2		Even parity present
				Set the permissible number of retries at occurrence
				of a data receive error.
	Number of			If the number of consecutive errors exceeds the
				permissible value, the inverter will come to an alarm
				stop.
121	communica-			If a communication error occurs, the inverter will not
	tion retries	999	0	come to an alarm stop. At this time, the inverter can be coasted to a stop by MRS or RESET input.
		(6553		During an error, the light fault signal (LF) is given to
		(000	55)	the open collector output. Allocate the used terminal
		0		with any of Pr. 190 to Pr. 192 (multi-function outputs).
				No communication
				Set the communication check time [seconds]
	Communica-			interval.
122	tion check	0.1 to 9	99.8	If a no-communication state persists for longer than
	time interval			the permissible time, the inverter will come to an
				alarm stop.
		999	9	Communication check suspension
	Waiting time	0 to 1	50	Set the waiting time between data transmission to
123	setting			the inverter and response.
	Setting		9	Set with communication data.
	CR, LF	0		Without CR/LF
124	instruction presence/	1		With CR, without LF
	absence	2		With CR/LF
	absence 2			· - *

<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.	Ор	Operation			Running Frequency	Parameter Write	Inverter Reset	Monitor- ing	Parame- ter Read
1)	Communication request is sent to the inverter in accordance with the user program in the computer.			A'	A (A")Note	A (A")Note	А	В	В
2)	Inverter data	proc	essing time	Present	Present	Present	Absent	Present	Present
3)	Reply data No err from the Requestion accept		uest	С	С	С	Absent	E,E' (E")Note	E
	(Data 1) is checked for error.		n error uest rejected	D	D	D	Absent	F	F
4)	Computer processing delay time			Absent	Absent	Absent	Absent	Absent	Absent
Answer from computer in response to re	eply	No error No processing	Absent	Absent	Absent	Absent	G	G	
	data 3). (Data is checked for error)	13)	With error 3)	Absent	Absent	Absent	Absent	Н	Н

Note: Data format is A" or E" when you set any of "0.01 to 9998" in Pr. 37 "Speed display" and "1" in data code "HFF".

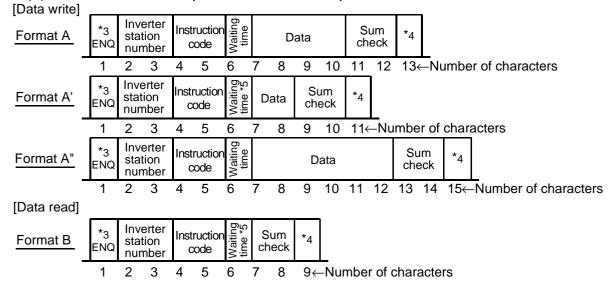
(3) Data format

Data used is hexadecimal.

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

1) Data format types

(1) Communication request data from computer to inverter



- Note: 1. The inverter station numbers may be set between H00 and H1F (stations 0 and 31) in hexadecimal.
 - 2. *3 indicates the control code.
 - *4 indicates the CR or 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.

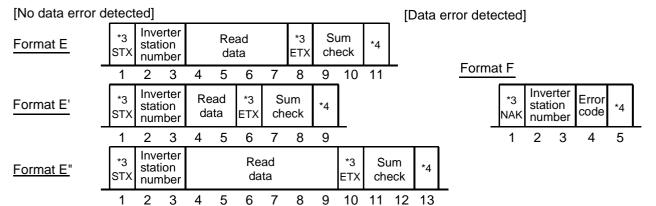
Also, the presence and absence of the CR and LF codes can be selected using Pr. 124.

4. At *5, when Pr. 123 "waiting time setting" ≠ 9999, create the communication request data without "waiting time" in the data format. (The number of characters is decremented by 1.)

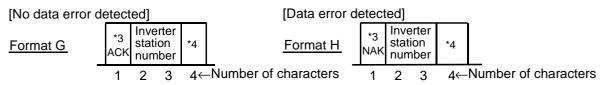
2) Send data from inverter to computer during data write

[No data error detected] [Data error detected] Inverter Inverter Error *3 Format C station Format D station code ACK number number 4←Number of characters 5←Number of characters

3) Reply data from inverter to computer during data read



4) Send data from computer to inverter during data read



(4) Data definitions

1) Control codes

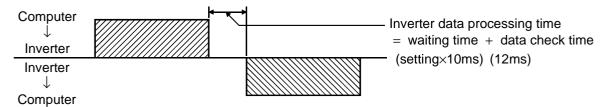
Signal	ASCII Code	Description
STX	H02	Start of Text (Start of data)
ETX	H03	End of Text (End of data)
ENQ	H05	Enquiry (Communication request)
ACK	H06	Acknowledge (No data error detected)
LF	H0A	Line Feed
CR	H0D	Carriage Return
NAK	H15	Negative Acknowledge (Data error detected)

- 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 186.)

- 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 186.)
- 5) Waiting time

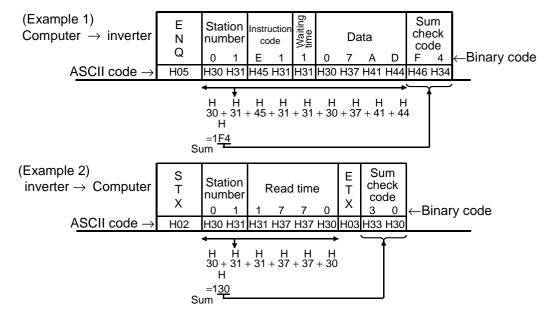
Specify the waiting time between the receipt of data at the inverter from the computer and the transmission of reply data. Set the waiting time in accordance with the response time of the computer between 0 and 150ms in 10ms increments (e.g. 1 = 10ms, 2 = 20ms).



Note: If the Pr. 123 "waiting time setting" value is not 9999, create the communication request data with no "waiting time" in the data format. (The number of characters is decremented by 1.)

6) 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.



7) 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 126.)

- Note: 1. When the data from the computer has an error, the inverter will not accept that data.
 - 2. 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.
 - 3. When accessing the parameter settings, data for link parameter expansion setting differs between the parameters as indicated below:

		Instruction Code	Data
	Read	H7F	H00: Pr. 0 to Pr. 96 values are accessible.
Link parameter expansion setting	Write	HFF	H01: Pr. 100 to Pr. 158 and Pr. 901 to Pr. 905 values are accessible. H02: Pr. 160 to Pr. 196 and Pr. 232 to Pr. 250 values are accessible. H03: Pr.338 to Pr. 340 values are accessible. H09: Pr. 990, Pr. 991 values are accessible.

! CAUTION

- ! 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.
- ① 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.

No.	Item			Instruction Code	Description	Number of Data Digits
1	Operation mode	n	Read Write	H7B HFB	H0001: External operation H0002: Communication operation H0001: External operation H0002: Communication operation	4 digits
		Output frequency [speed]		H6F	H0000 to HFFFF:Output frequency (hexadecimal) in 0.01Hz increments [Speed (hexadecimal) in r/min increments if Pr. 37 = 1 to 9998]	4 digits
	Outpu	ut curre	nt	H70	H0000 to HFFFF: Output current (hexadecimal) in 0.01A increments	4 digits
	Outpu	ut voltaç	ge	H71	H0000 to HFFFF: Output voltage (hexadecimal) in 0.1V increments	4 digits
2	Alarm definition		H74 to H77	H0000 to HFFFF: Two most recent alarm definitions Alarm definition display example (instruction code H74) b15	4 digits	
3	Run command HFA			HFA	b7	2 digits

No.	Item	Instruction Code	Description	Number of Data Digits
4	Inverter status monitor	Н7А	b7 b0 b0: Inverter running (RUN) b1: Forward rotation b2: Reverse rotation b3: Up to frequency (SU) [Example 1] H02 During forward rotation b5: —— [Example 2] H80 Stop due to alarm b6: Frequency detection (FU) b7: Alarm occurrence	2 digits
	Set frequency read (E ² PROM)	H6E	Reads the set frequency (RAM or E ² PROM).	4 dicito
	Set frequency read (RAM)	H6D	H0000 to H2EE0: 0.01Hz increments (hexadecimal)	4 digits
5	Set frequency write (E ² PROM)	HEE	H0000 to H9C40: 0.01Hz increments (hexadecimal) (0 to 400.00Hz)	4 digits
	Set frequency write (RAM)	HED	To change the set frequency consecutively, write data to the inverter RAM. (Instruction code: HED)	4 digits
6	Inverter reset	HFD	H9696: Resets the inverter. As the inverter is reset on start of communication by the computer, the inverter cannot send reply data back to the computer.	4 digits
7	Alarm definition batch clear	HF4	H9696: Batch clear of alarm history	4 digits
8	All parameter clear	HFC	All parameters return to the factory settings. Any of four different all clear operations is performed according to the data. Pr. Communication Pr. HEC HF3 Pr. HFF H9696 O × O O H9966 O O O O H5A5A × × O O H55AA × O O 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.	4 digits
9	Parameter write	H80 to	Refer to the "Data Code List" (page 186) and write and/or read the values as required.	4 digits
10	Parameter read	H00 to H7B	Note that some parameters may not be accessible.	

No.	ltem l		Instruction Code	Description	Number of Data Digits
	Link parameter expansion setting	Read	H7F	H00 to H6C and H80 to HEC parameter values are changed. H00: Pr. 0 to Pr. 96 values are accessible. H01: Pr. 117 to Pr. 158 and Pr. 901 to Pr. 905	2.9
11		Write	values are accessible. H02: Pr. 160 to Pr. 192 and Pr. 232 to Pr. 250 values are accessible. HFF H03: Pr. 338 to Pr. 340 values are accessible. H09: Pr. 990 and Pr. 991 values are accessible.	2 digits	
12	Second parameter changing (Code HFF=1)	Read	H6C	When setting the bias/gain (data codes H5E to H6A, HDE to HED) parameters	2 digits
12		• •	Write	HEC	H00: Offset/gain H01: Analog H02: Analog value of terminal

<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	
НО	Computer NAK error	The number of errors consecutively detected in communication request data from the computer is greater than allowed number of retries.		
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.	stop (E.PUE) if error occurs continuously more than the allowable	
H3	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.		
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 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 received data but is not brought to alarm	
НВ	Instruction code error	The specified command does not exist.		
НС	Data range error	Invalid data has been specified for parameter write, frequency setting, etc.		
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)	Enable	Disable
		Enable	Enable
	Running frequency setting		(Combined operation
Computer user			mode)
program via	Monitoring	Enable	Enable
PU connector	Parameter write	Enable (*2)	Disable (*2)
	Parameter read	Enable	Enable
	Inverter reset	Enable	Enable
	Stop command (*1)	Enable	Enable
Control circuit	Inverter reset	Enable	Enable
terminal	Run command	Disable	Enable
terriniai	Running frequency setting	Disable	Enable

^{*1} As set in Pr. 75.

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

(6) Operation at alarm occurrence

	Description		Operation Mode		
Fault Location			Communication Operation	External Operation	
			(PU connector)		
Inverter fault	Inverter operation		Stop	Stop	
inverter fault	Communication	PU connector	Continued	Continued	
Communication	Inverter operation		Stop/continued (*3)	Continued	
error (Communication from 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 (Communication from PU connector)	Not displayed	Error code is E.PUE

^{*2} As set in Pr. 77.

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"

Related parameters

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

Pr. 79 "operation mode selection"

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

Pr. 191 to Pr. 192 (output terminal function selection)

Pr. 902 to Pr. 905 (frequency setting voltage (current) biases and gains)

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

Pr. 134 "PID differential time"

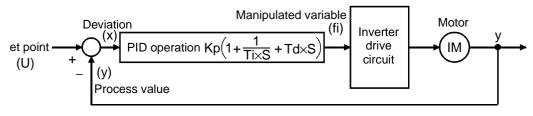
The inverter can be used to exercise process control, e.g. flow rate, air volume or pressure.

• 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: Proportional constant

Ti: Integral time
S: Operator
Td: Differential time

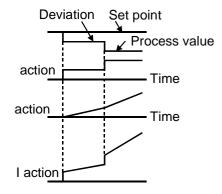
(2) PID action overview

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: PI action is the sum of P and I actions.

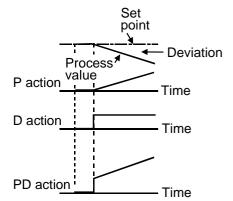


2) PD action

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.



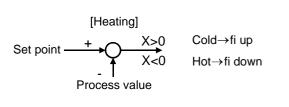
3) PID action

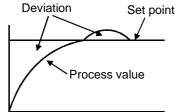
The PI action and PD action are combined to utilize the advantages of both actions for control.

Note: The PID action is the sum of P, I and D actions.

4) Reverse action

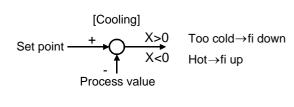
Increases the manipulated variable (output frequency) if deviation X (set point - process value) is positive, and decreases the manipulated variable if deviation is negative.

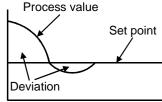




5) Forward action

Increases the manipulated variable (output frequency) if deviation X (set point - process value) is negative, and decreases the manipulated variable if deviation is positive.





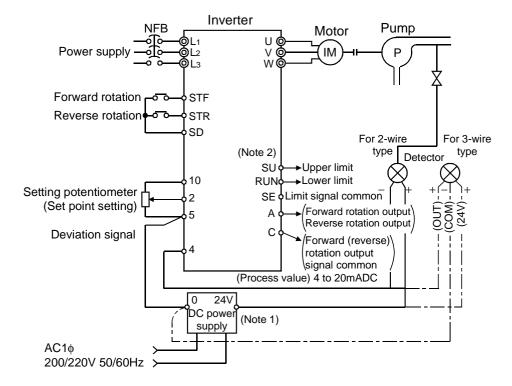
Relationships between deviation and manipulated variable (output frequency)

	Deviation			
	Positive Negative			
Reverse	7	¥		
action	• ,	J		
Forward	y	7		
action	•			

PARAMETERS

(3) Wiring example

- 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	Process value input		Process value input	Enter the 4 to 20mADC process value signal from the detector.	
	FUP		Upper limit output	Output to indicate that the process value signal exceeded the upper limit value.	
ont	FDN Depending on	Lower limit output	Output to indicate that the process value signal exceeded the lower limit value.		
Output	Pr. 190 to Pr. 192 RL		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.

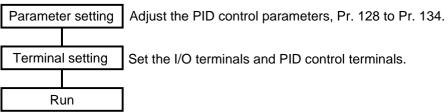
Item	Entry	Description		
	Lacross terminals 2-5	Set 0V as 0% and	When "0" is set in Pr. 73 (5V	
Set point		5V as 100%.	selected for terminal 2).	
		Set 0V as 0% and	When "1" is set in Pr. 73 (10V	
		10V as 100%.	selected for terminal 2).	
Set point	Pr. 133	Set the set point (%) in Pr. 133.		
Process value	Across terminals 4-5	4mA DC is equivalent to 0% and 20mA DC to 100%.		

PARAMETERS

(5) Parameter setting

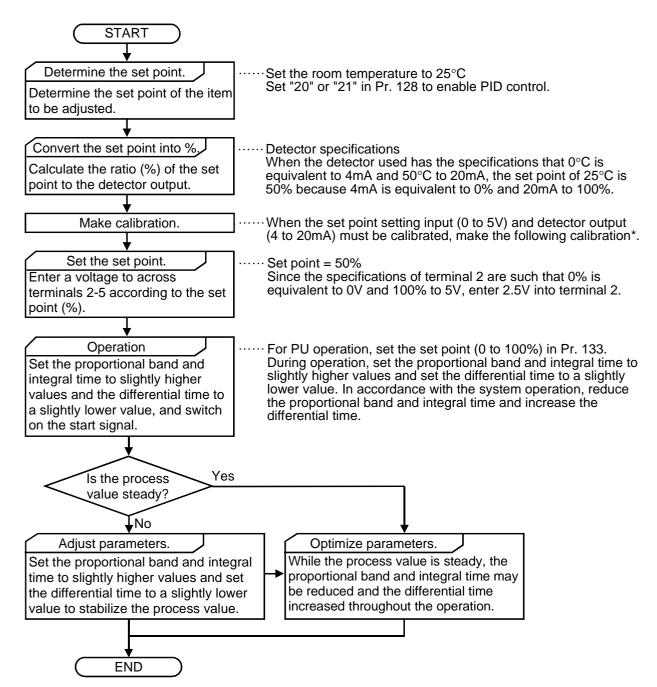
Parameter Number	Setting	Name	Description			
	0	PID	No PID action			
128 20		action selection	For heating, pressure control, etc.	PID reverse action		
	21	Selection	For cooling, etc.	PID forward action		
129	0.1 to 1000%	PID propor- tional band	If the proportional band is narrow (parameter set is small), the manipulated variable varies grewith a slight change of the process value. Hence the proportional band narrows, the responsensitivity (gain) improves but the state deteriorates, e.g. hunting occurs. Gain Kp = 1/proportional band			
	9999		No proportional control	(1)		
130	0.1 to 3600 s	PID integral time	Time required for the integral (the same manipulated variab proportional (P) action. As decreases, the set point is in hunting occurs more easily.	le as that for the the integral time		
9999			No integral control.			
131	0 to 100%	Upper limit	Set the upper limit. If the feedback value except the setting, the FUP signal is output. (Process vof 4mA is equivalent to 0% and 20mA to 100%.)			
	9999		No function			
132			Set the lower limit. (If the process value goes out of the setting range, an alarm can be output. In this case, the process value of 4mA is equivalent to 0% and 20mA to 100%.)			
	9999		No function			
133	0 to 100%	PID action set point for PU operation	Only valid for the PU command in the PU operation or PU/external combined operation mode. For external operation, the voltage across 2-5 is the set point. (Pr. 902 value is equivalent to 0% and Pr. 903 value)			
134	0.01 to 10.00 s PID differential		Time required for the differential (D) action to provide the same process value as that for the proportional (P) action. As the differential time increases, greater response is made to a deviation change.			
	9999	time	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 to Pr. 905 to calibrate the detector output and set point setting input in the PU mode during an inverter stop. PARAMETERS

<Set point input calibration>

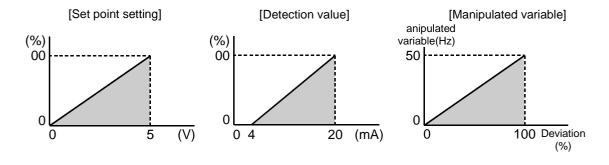
- 1. Apply the input voltage of 0% set point setting (e.g. 0V) to across terminals 2-5.
- 2. Make calibration using Pr. 902. At this time, enter the frequency which should be output by the inverter at the deviation of 0% (e.g. 0Hz).
- 3. Apply the voltage of 100% set point setting (e.g. 5V) to across terminals 2-5.
- 4. 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. 50Hz).

<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. If the multi-speed (RH, RM, RL) signal or jog operation (jog) signal is entered, PID control is stopped and multi-speed or jog operation is started.

- 2. 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.
- 3. 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 settings of Pr. 1 "maximum frequency" and Pr. 2 "minimum frequency" are also valid.)

4.2.38 Output current detection function (Pr. 150, Pr. 151)

Pr. 150 "output current detection level"

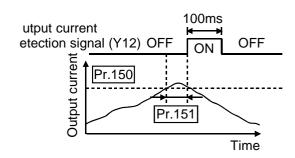
Pr. 151 "output current detection period"

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	0	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. The output current detection signal is held on for about 100ms (at least) if it switches on once when the output current rises to or above the preset detection level.
 - 2. This function is also valid during execution of offline auto tuning.
 - 3. 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.

4.2.39 Zero current detection (Pr. 152, Pr. 153)

Pr. 152 "zero current detection level"

Pr. 153 "zero current detection period"

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

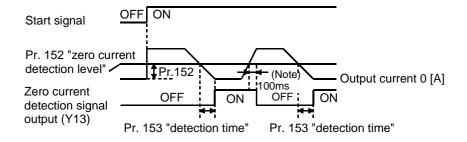
When the inverter's output current falls to "0", torque will not be generated. This may cause a gravity drop when the inverter is used in vertical lift application.

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 falls below 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.
 - 3. 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.

∕!_ CAUTION

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.

4.2.40 Stall prevention function and current limit function (Pr. 156)

Pr. 156 " stall prevention operation selection"

Related parameters -

Pr. 22 "stall prevention operation level" Pr. 23 "stall prevention operation level compensation factor at double speed"

You can make settings to disable stall prevention caused by overcurrent and to disable the inverter from an overcurrent trip if an excessive current occurs due to sudden load variation or turning the inverter's output side ON-OFF (to disable the fast-response current limit which limits the current).

Parameter Number	Factory Setting	Setting Range
156	0	0 to 31, 100

<Setting>

Refer to the following tables and set the parameter as required.

Pr. 156	Fast- Response Current Limit	Stall Prevention Operation Voltage O: Activated •: Not activated			OL Signal Output O: Operation continued
Setting	O: Activated •: Not activated	Acceleratio n	Constant speed	Decelerati on	Operation not continued (Note 1)
0	0	0	0	0	0
1	•	0	0	0	0
2	0	•	0	0	0
3	•	•	0	0	0
4	0	0	•	0	0
5	•	0	•	0	0
6	0	•	•	0	0
7	•	•	•	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

Pr. 156 Setting		Fast- Response Current Limit O: Activated •: Not activated	Stall Prevention Operation Voltage O: Activated •: Not activated			OL Signal Output O: Operation continued
			Acceleratio n	Constant speed	Decelerati on	Operation not continued (Note 1)
16	3	0	0	0	0	•
17	7	•	0	0	0	•
18	3	0	•	0	0	•
19	9	•	•	0	0	•
20)	0	0	•	0	•
2		•	0	•	0	•
22		0	•	•	0	•
23	3	•	•	•	0	•
24		0	0	0	•	•
2	5	•	0	0	•	•
20		0	•	0	•	•
27	7	•	•	0	•	•
28		0	0	•	•	•
29	9	•	0	•	•	•
30		0	•	•	•	•
3	1	•	•	•	•	•
	Driving	0	0	0	0	0
100	Regenerative Driving	•	•	•	•	0

- Note 1: When "Operation not continued for OL signal output" is selected, the "E.OLT" alarm code (stopped by stall prevention) is displayed and operation stopped. (Alarm stop display "E.OLT")

 2: If the load is heavy, the lift is predetermined, or the acceleration/deceleration
 - 2: 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 stall prevention operation level.

! CAUTION

Always perform test operation.

Stall prevention operation performed during acceleration may increase the acceleration time.

Stall prevention operation performed during constant speed may cause sudden speed changes.

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

Pr. 158 → Refer to *Pr.* 52.

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"

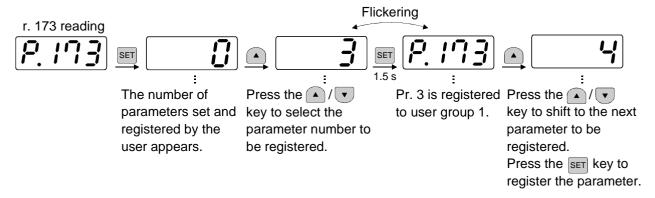
Pr. 176 "user group 2 deletion"

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.

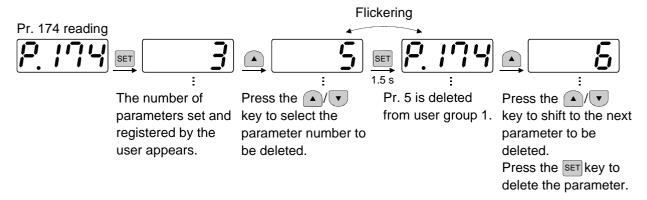
Parameter Number	Factory Setting	Setting Range	Remarks
160	0	0, 1, 10, 11	
173	0	0 to 999	
174	0	0 to 999, 9999	9999: Batch deletion
175	0	0 to 999	
176	0	0 to 999, 9999	9999: Batch deletion

<Setting examples show the use of the control panel (FR-PA02-02)>

(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)



PARAMETERS

(3) Set the required value in Pr. 160 to make the user group or groups valid or invalid.

Pr. 160 Setting	Description
0	Previous parameters read
1	User group 1's parameters read
10	User group 2's parameters read
11	User group 1 and 2 parameters read

Note: 1. The Pr. 77, Pr. 160 and Pr. 991 values may always be read independently of the user group setting.

- 2. 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.
- 3. 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.
- 4. 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 "control panel/PU main display data selection"

You can clear the actual operation hour of the monitoring function.

Parameter Number	Factory Setting	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 selection		
5	STOP	Start self-holding terminal		
6	MRS	Output shut-off terminal		
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 157.		
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-purpose magnetic flux vector-V/F switch- over (OFF: general-purpose magnetic flux vector Pr. 80 control, ON: V/F control) (Note 3)		

[:] 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.
 - 2. 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 secondry 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.
 - 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).

^{**:} 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
98	LF	Minor fault output	Output when a minor fault occurs.	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.

PARAMETERS

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 0.75K or more.

(whether there is a cooling fan or not depends on the models. Refer to the outline dimensional drawings (Refer to page 184).

Parameter Number	Factory Setting	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 control 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 or the fan starts during fan OFF 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 made

<Setting>

Parameter Number	Setting	Function
245	0 to 50%	Used to set the rated motor slip.
245	9999	Slip compensation is not made.
246	0.01 to 10 s	Used to set the slip compensation response time. (Note)
247	0	Slip compensation is not made in the constant output range (frequency range above the frequency set in Pr. 3).
	9999	Slip compensation is made in the constant output range.

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 Stop selection (Pr. 250)

Pr. 250 "stop selection"

Related parameters

Pr. 7 "acceleration time"

Pr. 8 "deceleration time"

Pr. 44 "second acceleration/ deceleration time"

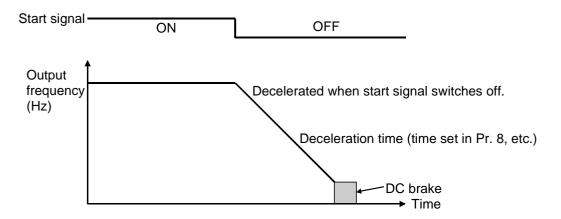
Pr. 45 "second deceleration time"

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	9999	0 to 100 s, 1000 to 1100 s, 8888, 9999

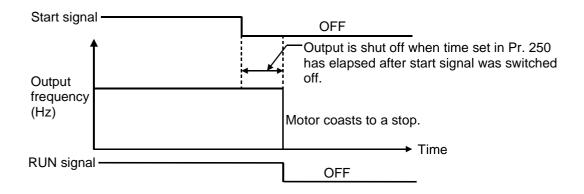
(1) Pr. 250 = "9999"

When the start signal switches off, the motor is decelerated to a stop.



(2) Pr. 250 = 0 to 100 seconds (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 was switched off. The motor coasts to a stop.



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	Ctos
OFF	ON	Stop
ON	OFF	Forward rotation
ON	ON	Reverse rotation

When the Pr. 250 value is any of 1000 to 1100 seconds, 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. 1000 seconds) have elapsed.

Note: 1. The RUN signal switches off when the output stops.

- 2. 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.

4.2.48 Meter (frequency meter) calibration (Pr. 901)

Pr. 901 "AM terminal calibration"

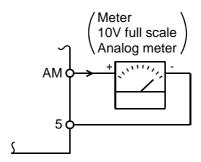
Related parameters

Pr. 55 "frequency monitoring reference"

Pr. 56 "current monitoring reference"

Pr. 158 "AM terminal function selection"

- By using the control panel or parameter unit, you can calibrate a meter connected to terminal AM to full scale deflection.
- Terminal AM is factory-set to provide a 10VDC output in the full-scale state of each monitored data. Pr. 901 allows the output voltage ratio (gain) to be adjusted according to the meter reading. Note that the maximum output voltage is 10VDC.

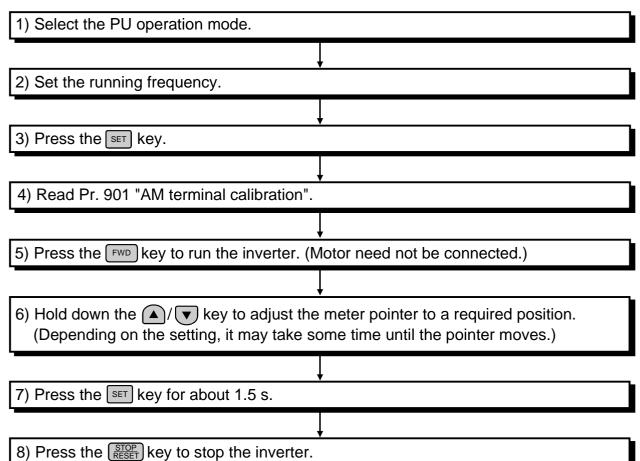


(1) Calibration of terminal AM

- 1) Connect a 0-10VDC meter (frequency meter) across inverter terminals AM-5. (Note the polarity. AM is the positive terminal.)
- 2) Set any of "0, 1, 2" in Pr. 158. 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 10V.

<Operation procedure>

When using the control panel (FR-PA02-02)



4.2.49 Biases and gains of the frequency setting voltage (current) (Pr. 902 to Pr. 905)

Pr. 902 "frequency setting voltage bias"

Pr. 903 "frequency setting voltage gain"

Pr. 904 "frequency setting current bias"

Related parameters

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

Pr. 39 "frequency at 20mA input"

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

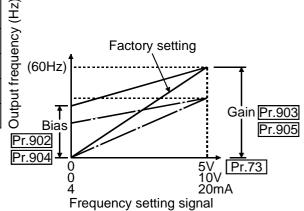
Pr. 79 "operation mode selection"

Pr. 905 "frequency setting current gain"

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.

Parameter Number	Factory Setting		Setting	Range
902	0V 0Hz		0 to 10V	0 to 60Hz
903	5V	50Hz	0 to 10V	1 to 400Hz
904	4mA	0Hz	0 to 20mA	0 to 60Hz
905	20mA	50Hz	0 to 20mA	1 to 400Hz



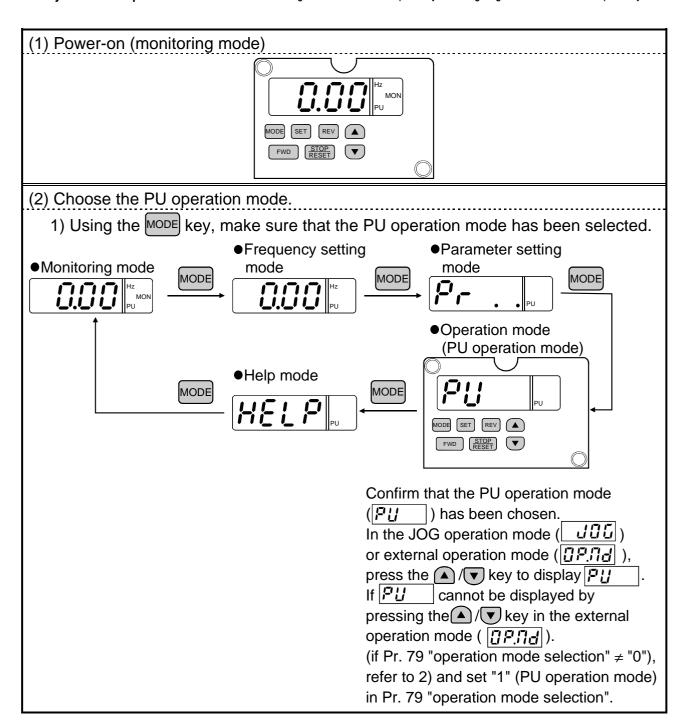
<Setting>

- (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).
 - 2) Any point can be adjusted with no voltage applied across terminals 2-5 (with no current flowing across terminals 4-5).
 - 3) Only the bias and gain frequencies are adjusted and the voltage (current) is not adjusted.

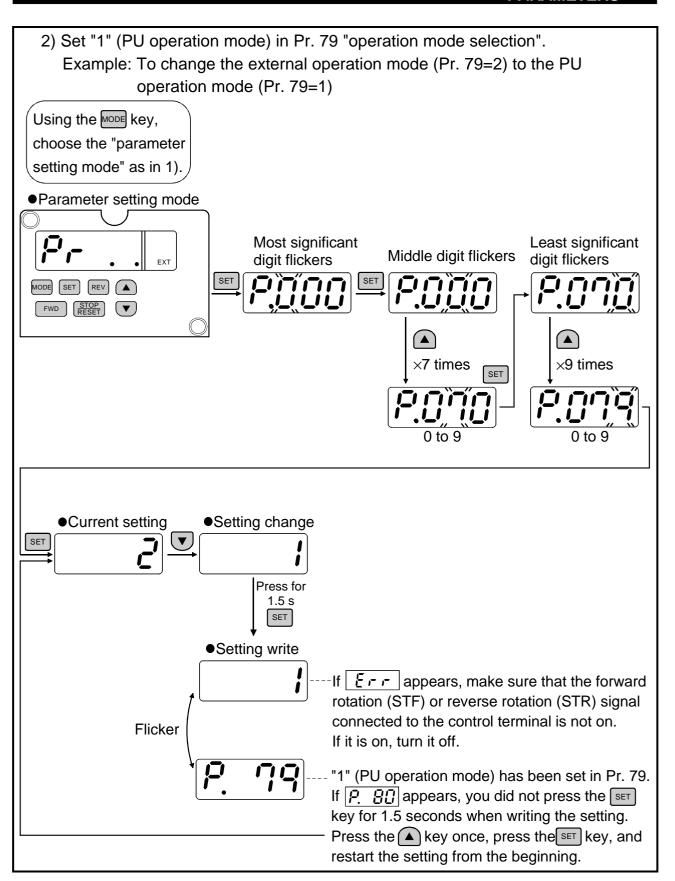
Pr. 903 "frequency setting voltage gain"

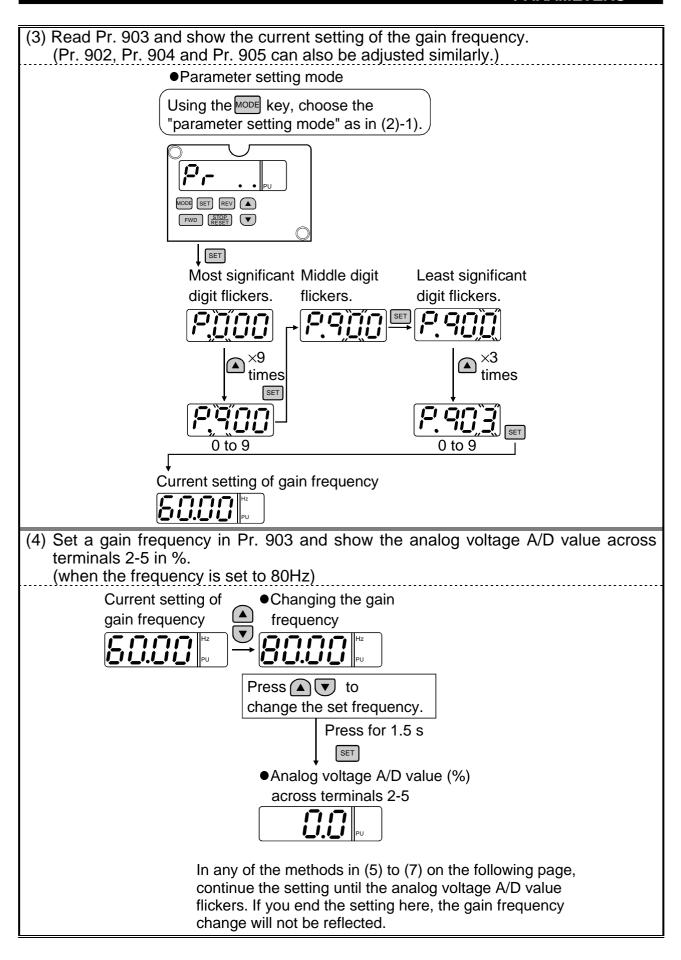
(Pr. 902, Pr. 904, Pr. 905 can also be adjusted similarly.)

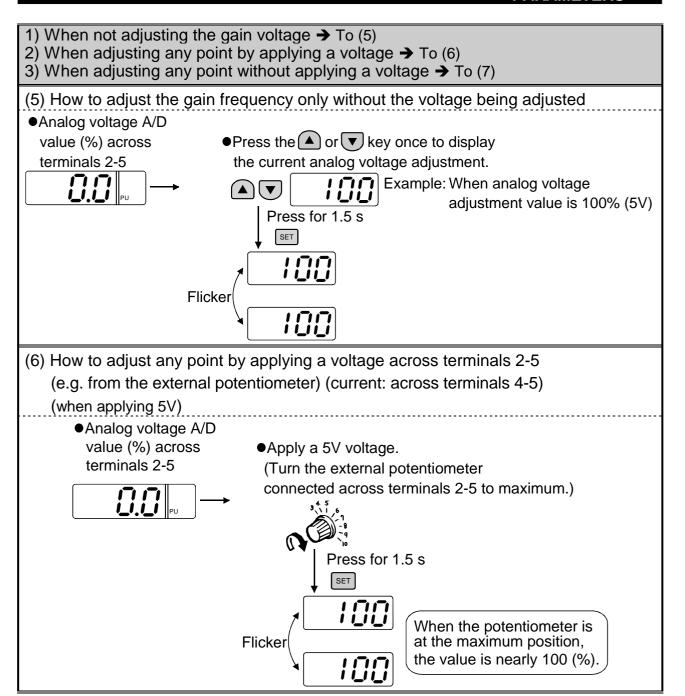
< Adjustment procedure > When using an external frequency setting signal to set the frequency.



PARAMETERS







- (7) 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%)) ● Set the gain voltage (%) with Analog voltage A/D the ▲/▼ key. ●Press the or key value (%) across [0(%) for 0V (0mA), 100(%) for once to display the current terminals 2-5 5V (10V, 20mA)] analog voltage calibration value. **►** (▲) (▼) **(**▲**)**/(▼) **_____**PU Press for 1.5 s SET **Flicker** 100 (8) Press the [SET] key to shift to the next parameter.
- Note: 1. If the Pr. 903 or Pr. 905 (gain adjustment) value is changed, the Pr. 20 value does not change.

(9) Re-set Pr. 79 "operation mode selection" according to the operation mode to be

used.

2. 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.

/!\CAUTION

De 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.

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)	157
5.2 Troubleshooting	166
5.3 Precautions for Maintenance and Inspection	169

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

appears (flickers) to indicate that the inverter is

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 optional control panel or the parameter unit 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 signalWhen 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 indicationWhen the protective function is activated, the operation panel display automatically switches to the above indication.
 Resetting methodWhen 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 0.1 seconds. Kept on, "Err."
- When the protective function is activated, take the corresponding corrective action, then reset the inverter, and resume operation.

being reset.

5.1.1 Error (alarm) definitions

(1) Major faults

Operation Panel Indication	E. OC1 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 for output short-circuit/ground fault.		
Corrective action	Increase the acceleration time.		

Operation Panel Indication	E. OC2 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/ground fault.		
Corrective action	Keep load stable.		

Operation Panel Indication	E. OC3 F. 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/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 FR-PU04 OV During Acc			
Name	Regenerative overvoltage shut-off during acceleration			
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 too slow acceleration.			
Corrective action	Decrease the acceleration time.			

Operation Panel Indication	E. OV2 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 or high power factor converter (FR-HC) as required. 			

Operation Panel Indication	E. OV3 FR-PU04 OV During Dec			
Name	Regenerative overvoltage shut-off during 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 sudden speed reduction.			
Corrective action	 Increase the deceleration time. (Set the deceleration time which meets the inertia moment of the load.) Decrease the braking duty. Use the brake unit or high power factor converter (FR-HC) as required. 			

Operation Panel Indication	E. THM	E.CHO	FR-PU04	Motor Overload
Name	Motor overload shut-off (electronic overcurrent protection) (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 in the output side of the inverter.			
Check point	Check the motor for use under overload.			
Corrective action	 Reduce the load weight. For the constant-torque motor, change the Pr. 71 setting to the constant-torque motor setting. 			

Operation Panel Indication	E. THT FR-PU04 Inv. Overload		
Name	Inverter overload shut-off (electronic overcurrent protection) (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 overcurrent protection 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 overcurrent protection.

Operation Panel Indication	E. FIN FR-PU04 H/Sink O/Temp		
Name	Fin overheat		
Description	If the cooling fin overheats, the overheat sensor is actuated to stop the inverter output.		
Check point	 Check for too high ambient temperature. Check for cooling fin clogging. 		
Corrective action	Set the ambient temperature to within the specifications.		

Operation Panel Indication	E. BE FR-PU04 Br. Cct. Fault (Note)			
Name	Brake transistor alarm detection (Note 2)			
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.			

Note: 2 This function is activated only when the optional brake resistor is connected.

Operation Panel Indication	E. GF	E.	<u> </u>	FR-PU04	Ground Fault
Name	Output side ground fault overcurrent protection				
Description	This function stops the inverter output if a ground fault overcurrent flows due to a ground fault which occurred in the inverter's output (load) side.				
Check point	Check for a ground fault in the motor and connection cable.				
Corrective action	Remedy the ground fault portion.				

Operation Panel Indication	E. OHT FR-PU04 OH Fault				
Name	External thermal relay operation (Note 3)				
Description	If the external thermal relay designed 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:3 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.OL F	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 FR-PU04 Option Fault				
Name	Option alarm				
Description	Stops the inverter output if the inverter station is disconnected from the system in the NET mode. Also stops the inverter output if the dedicated option used in the inverter results in setting error or connection (connector) fault.				
Check point	Check that the plug-in option connector is plugged securely.				
Corrective action	Connect the plug-in option securely. Please contact your sales representative.				
Operation Panel Indication	E. PE F. PE FR-PU04 Corrupt Memry				
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 E.F'LIE FR-PU04 PU Leave Out				
Name	Parameter unit disconnection				
Description	This function stops the inverter output if communication between the inverter and PU is suspended, e.g. the PU is disconnected, when "2", "3", "16" or "17" was set in Pr. 75. This function stops the inverter output if the number of successive communication errors is greater than the number of permissible retries when the Pr. 121 value is "9999" for RS-485 communication from the PU connector.				
Check point	 Check for loose fitting of the operation panel (FR-PA02-02) or FR-PU04. Check the Pr. 75 setting. 				
Corrective action	Fit the operation panel (FR-PA02-02) and FR-PU04 securely.				
Operation Panel Indication	E. RET 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. [P] 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.				
01 1 1	· · · · ·				

Please contact your sales representative.

Check point

Corrective action

Operation Panel Indication	E. 6 E FR-PU04 Fault 6			
Operation Failer indication	E. 7 [F. 7] FR-F004 Fault 7			
Name	CPU error			
Description	This function stops the inverter output if a communication error occurs in the built-in CPU.			
Check point				
Corrective action	Please contact your sales representative.			

Operation Panel Indication	E. LF FR-PU04 E. LF			
Name	Output phase failure protection			
Description	This function stops the inverter output if one of the three phases (U, V, W) on the inverter's output side (load side)			
Description	results in open phase.			
Check point	Check the wiring (Check the motor for a fault.)			
Corrective action	Wire the cables properly.			

(2) Minor fault

Operation Panel Indication	FN	Fn	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	Change the fan.			

(3) Warnings

Operation Panel Indication	OL		•	FR-PU04	OL (Stll Prev STP)
Name	Stall prevention (over current)		
	During acceleration During constant-speed operation		the mot freq redu resu ove	rated inveror, this functions untiled unces to produce in over rload current function in the contraction in	ore than 150% (Note 4) of ter current flows in the tion stops the increase in the overload current event the inverter from current shut-off. When the has reduced below 150%, increases the frequency
Description			the mot until prev over this	rated inver or, this fund I the overl vent overcui rload current	ore than 150% (Note 4) of ter current flows in the tion lowers the frequency oad current reduces to trent shut-off. When the has reduced below 150%, reases the frequency up to
During deceleration		the mot freq redu resu ove	rated inveror, this functuency untiluces to proulting in over rload current	ore than 150% (Note 4) of ter current flows in the tion stops the decrease in the overload current event the inverter from current shut-off. When the has reduced below 150%, decreases the frequency	
Check point	Check the motor for use under overload.				erload.
Corrective action	Increase prevention	the stal	l prevation	ention opera	may change. ation level with Pr. 22 "stall sable stall prevention with selection".

Note:4 The stall prevention operation current can be set as desired. It is factory-set to 150%.

Operation Panel Indication	oL	oL	•	FR-PU04	oL
Name	Stall prevention (overvoltage)				
Description	During deceleration		If the regenerative energy of the motor increases too much to exceed the brake capability, this function stops the decrease in frequency to prevent overvoltage shutoff. As soon as the regenerative energy has reduced, deceleration resumes.		
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	<i>P</i> 5	FR-PU04	PS
Name	PU stop			
Description	A stop made by pressing the STOP key of the PU has been set in Pr. 75 "PU stop selection".			
Check point	Check for a stop made by pressing the RESET key of the operation panel during external operation.			
Corrective action	Refer to page 102.			

Operation Panel Indication	Err.	Err.
Description	 The R You a operate You a operate You a setting You a (while You a 	rm appears if: ES signal is on; Ittempted to set any parameter value in the external tion mode; attempted to change the operation mode during tion; attempted to set any parameter value outside its grange. Ittempted to set any parameter value during operation signal STF or STR is ON). Ittempted to set any parameter value while parameter is being inhibited in Pr. 77 "parameter write inhibit
Corrective action	Perform	operation correctly.

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 key 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. It is also possible to know the current in the same manner. However, these values are not stored in memory and are erased when the inverter is reset.

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 control panel (FR-PA02-02):

Actual	Display
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Actual	Display
A	
B	
C	
D	
E	
F	
G	
H)/ /
J	
L	

Actual	Display
M	<i>[</i> 7]
N	
0	
0	
P	
S	
U	
∇	
r	
-	<u> </u>

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.

Operation 1: Using the control panel (FR-PA02-02), press the STOP RESET key 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).

PROTECTIVE FUNCTIONS

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.

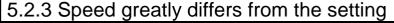
5.2.1 Motor remains stopped (1) Check the main circuit Check that a proper power supply voltage is applied (control panel display is provided). Check that the motor is connected properly. Check that the conductor across P1-+ is connected. (2) Check the input signals Check that the start signal is input. - 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 Check that the output stop signal (MRS) or reset signal (RES) is not on. (3) 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 bias and gain (Pr. 902 to Pr. 905) settings are correct. - 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. Check that the manufacturer setting parameter Pr. 146 = 1. (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 control 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 "starting frequency" value.

5.2.2 Motor rotates in opposite direction

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.

PROTECTIVE FUNCTIONS



- 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. 38, Pr. 39, Pr. 245, Pr. 902 to Pr. 905, Pr. 19).
- 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 function.
- Check that the brake resistor is not connected to terminals + P1 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.

(1) 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.

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.

5.2 Troubleshooting

PROTECTIVE FUNCTIONS

5.2.8 Operation mode is not changed properly

If the operation mode does not change correctly, check the following:

1. External input signal Check that the STF or STR signal is off.

When it is on, the operation mode cannot be

changed.

2. 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 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 106.)

5.2.9 Control panel display is not operating

Make sure that the control panel is connected securely with the inverter.

5.2.10 POWER lamp is not lit

- Make sure that the wiring and installation are correct.
- Check for a short circuit across terminals PC-SD.

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 seconds.
- Make sure that you are not attempting to set the parameter outside the setting range.
- Make sure that you are not attempting to set the parameter in the external operation mode.
- Check Pr. 77 "parameter write inhibit selection".

5

5.3 Precautions for Maintenance and Inspection

PROTECTIVE FUNCTIONS

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.

5.3.1 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 + - of the inverter is 30VDC or less using a meter, etc. Then, access the inverter for inspection.

5.3.2 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 control panel as these sections do not like them.

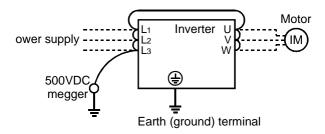
5.3.3 Periodic inspection

Check the areas inaccessible during operation and requiring periodic inspection.

- (1) Cooling system: Clean the air filter, etc.
- (2) 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.

5.3.4 Insulation resistance test using megger

- (1)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.
- (2) For the continuity test of the control circuit, use a meter (high resistance range) and do not use the megger or buzzer.
- (3) 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.)



5.3.5 Pressure test

Do not conduct a pressure test. The inverter's main circuit uses semiconductors, which may deteriorate if a pressure test is made.

5.3.6 Daily and Periodic Inspection

- u	_ G			nterv				
Area of Inspection	Inspection Item	Description	Daily	1 year	2 years	Method	Criterion	Instrument
General	Surrounding environment	Check ambient temperature, humidity, dust, dirt, etc.	0			Refer to page 11.	Ambient temperature: -10°C to +50°C, non-freezing. Ambient humidity: 90% or less, non- condensing.	Thermo- meter, hygrometer, recorder
Ge	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 L1-L2-L3.	Within permissible AC voltage fluctuation (see page 180)	Meter, digital multimeter
	General	 (1) Check with megger (across main circuit terminals and 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 L ₁ , L ₂ , L ₃ , U, V, W and ground terminal with megger. (2) Retighten. (3) Visual check.	(1) 5MΩ or more.(2), (3) No fault.	500VDC class megger
cuit	Conductors, cables	(1) Check conductors for distortion.(2) 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	
Main	Inverter module Converter module	Check resistance across terminals.			0	Disconnect cables from inverter and measure across terminals L_1 , L_2 , L_3 \leftrightarrow +, -, and across U, V, W \leftrightarrow +, - with a meter with a 100 Ω range.	Refer to page 173.	Analog meter
	Smoothing capacitor	 (1) Check for liquid leakage. (2) Check for safety valve projection and bulge. (3) Measure electrostatic capacity. 	0 0	0		(1), (2) Visual check. (3) Measure with capacity meter.	(1), (2) No fault. (3) 85% or more of rated capacity.	Capacity meter

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PROTECTIVE FUNCTIONS

tion				nterv	al			
spec	Inspection	Description		Periodic*		Mothod	Criterion	Instrument
Area of Inspection	İtem	Description	Daily 1 year 2 years 2 years		Criterion	Institutient		
Main circuit	Relay	(1) Check for chatter during operation.(2) 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) Phase-to-phase voltage balance within 8V (4V) for 400V (200V). (2) Fault must occur because of sequence.	Digital multimeter, rectifier type voltmeter			
Cooling system	Cooling fan (1) Check for unusual vibration and noise. (2) Check for loose connection.		0		(1) Turn by hand with power off.(2) Visual check.	No unusual vibration and unusual noise.		
olay	Display	(1) Check for LED lamp blown. (2) Clean.	0	0		(1) Lamps indicate indicator lamps on panel.(2) 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	(1) Check for unusual vibration and noise.(2) Check for unusual odor.	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 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 200V class.

^{*} For periodic inspection, contact you nearest Mitsubishi sales representative.

Checking the inverter and converter modules

<Preparation>

- (1) Disconnect the external power supply cables (L₁, L₂, L₃) and motor cables (U, V, W).
- (2) Prepare a meter. (Use 100Ω range.)

<Checking method>

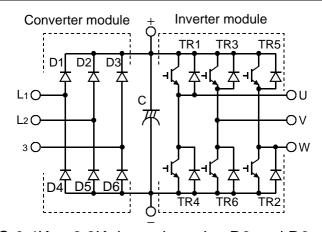
Change the polarity of the meter alternately at the inverter terminals L₁, L₂, L₃, U, V, W, + and –, and check for continuity.

Note: 1. Before measurement, check that the smoothing capacitor is discharged.

2. 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		Management Value		Tester	Polarity	Measured
		\oplus	\oplus	Measured Value		\oplus	\ominus	Value
	L1 + Dis		Discontinuity	D4	L1		Continuity	
e c	D1	+	L1	Continuity	D4	_	L1	Discontinuity
ert Jule	D2	L2	+	Discontinuity	D5	L2		Continuity
Converter module	DZ	+	L2	Continuity	מם	_	L2	Discontinuity
0	D3	Lз	+	Discontinuity	D6	Lз	_	Continuity
	DS	+	Lз	Continuity	DO	_	Lз	Discontinuity
Ф	TR1	U	+	Discontinuity	TR4	U	_	Continuity
module	IKI	+	U	Continuity	1174	_	U	Discontinuity
	TR3	V	+	Discontinuity	TR6	V		Continuity
ter	INS	+	V	Continuity	170	_	V	Discontinuity
nverter	TR5	W	+	Discontinuity	TD2	W	_	Continuity
lr	CAI	+	W	Continuity	TR2	_	W	Discontinuity



Note: The FR-E520S-0.4K to 2.2K do not have L3, D3 and D6.

5.3.7 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	Change (as required)	
Smoothing capacitor in main circuit	5 years	Change (as required)	
Smoothing capacitor on control board	5 years	Change the board (as required).	

Note: For part replacement, contact the nearest Mitsubishi FA center.

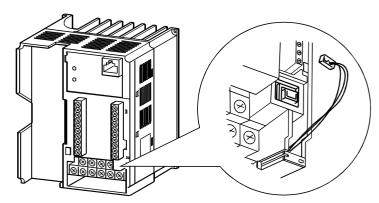
(1) Cooling fan

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 changed immediately.

Inverter Model No.	Fan Type
FR-E540-1.5K to 3.7K-EC FR-E520S-1.5K, 2.2K-EC	MMF-06D24ES-FC4 BKO-CA1027H09
FR-E540-5.5K, 7.5K-EC	MMF-06D24ES-FC5 BKO-CA1027H10

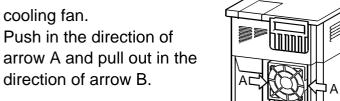
Removal

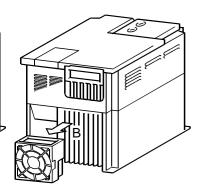
- 1) Remove the front cover (refer to page 5).
- 2) Unplug the fan connector. The cooling fan is connected to the cooling fan connector beside the main circuit terminal block of the inverter. Unplug the connector.



Fan connector

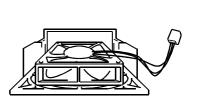
3) Remove the inverter and cooling fan. Push in the direction of

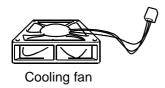


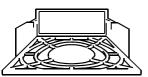


4) Remove the cooling fan and cooing fan cover. The cooling fan is secured by the fixing catches.

You can remove the cooling fan and cooling fan cover by disengaging the fixing catches.







Cooling fan cover

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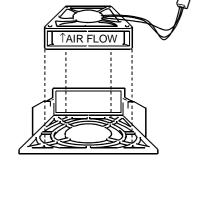
Reinstallation

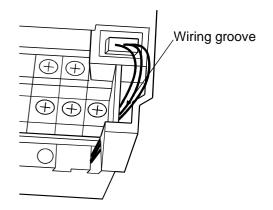
1) After confirming the orientation of the fan, reinstall the fan to the cover so that the arrow on the left of "AIR FLOW" faces in the opposite direction of the fan cover.

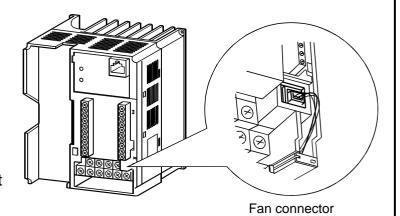
Note: If the air flow is set in the wrong direction, the inverter life can be

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 inverter 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:

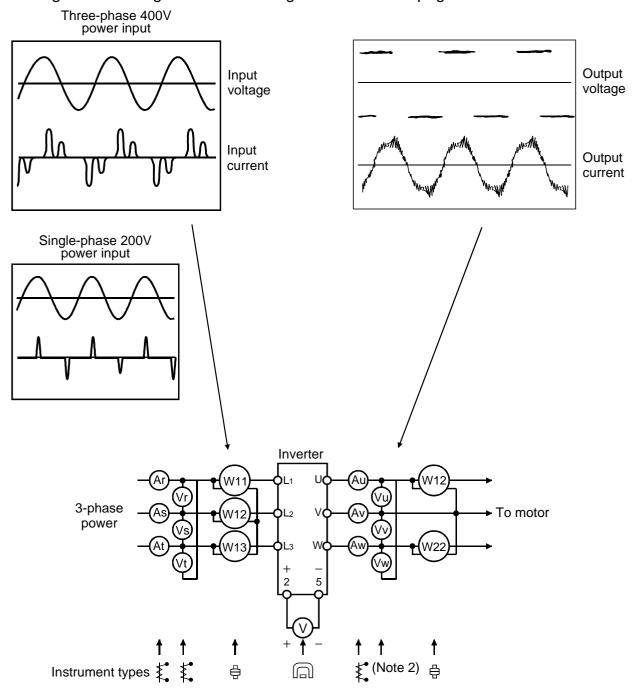
- 1) Case (side faces and bottom face for expansion)
- 2) Sealing plate (for remarkable warp and extreme crack)
- 3) Appearance, external cracks, discoloration, leakage.

 When the measured capacitance of the capacitor has reduced below 85% of the rating, change the capacitor.

5.3.8 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.



Typical Measuring Points and Instruments

- Note: 1. Use FFT (Fast Fourier Transforms) to measure the output voltage accurately.
 - It cannot be measured accurately with a meter or general instrument.
 - 2. For FR-E520S-0.4K to 2.2K do not use At, Vt, Vs and W13.

PROTECTIVE FUNCTIONS

Measuring Points and Instruments

Item	Measuring Point	Measuring Instrument	Remarks (Reference Measured Value)				
Power supply voltage (V1)	Across L ₁ -L ₂ , L ₂ -L ₃ , L ₃ -L ₁	Moving-iron type AC voltmeter	Is the commercial power supply within permissible variation of voltage (Refer to page 180)				
Power supply side current (I1)	L ₁ , L ₂ and L ₃ line currents	Moving-iron type AC ammeter					
Power supply side power (P1)	At L ₁ , L ₂ and L ₃ , and across L ₁ -L ₂ , L ₂ -L ₃ and L ₃ -L ₁	Electrodynamic type single-phase wattmeter	P1 = W11 + W12 + W13 (3-wattmeter method)				
Power supply side power factor (Pf1) Calculate after measuring power supply voltage, power supply side current and power supply side power. Pf1 = $\frac{P_1}{\sqrt{3}V_1 \times 1} \times 100 \%$							
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 ±1% of maximum output voltage.	within			
Output side current (I2)	U, V and W line currents	Moving-iron type AC ammeter (Note 2)	Current should be equal to or less rated inverter current. Difference between phases is 10 lower.				
Output side power (P2)	At U, V and W, and across U-V and V-W Electrodynamic type single-phase wattmeter Electrodynamic type single-phase wattmeter method) P2 = W21 + W22 2-wattmeter method (or 3-wattmeter method)						
Output side power factor (Pf2)	Calculate in similar manner to p $Pf2 = \frac{P2}{\sqrt{3}V2\times I2} \times 100 \%$	ower supply side power fac					
Converter output	Across +	Moving-coil type (such as tester)	Inverter LED display is lit. 1.35 × \ Maximum 760V (380V) during regenerative operation	/ 1			
Frequency setting	Across 2 (positive)-5 Across 4 (positive)-5		0 to 5V/0 to 10VDC 4 to 20mADC				
signal Frequency setting	Across 4 (positive)-5 Across 10 (positive)-5	Moving-coil type	5VDC	OU.			
Frequency meter signal	Across AM (positive)-5	(Meter, etc. may be used) (Internal resistance: 50kΩ or larger)	Approximately 10VDC at maximum frequency (without frequency meter)	"5" is common.			
Start signal Select signal	Across STF, STR, RH, RM, RL, MRS, RES-SD	Moving-coil type (Meter, etc. may be used)	20 to 30VDC when open.	SD is common.			
Reset	Across RES (positive)-SD	(Internal resistance:	ON voltage: 1V or less	SE			
Output stop	Across MRS (positive)-SD	50kΩ or larger)					
Alarm signal	Across A-C Across B-C	Moving-coil type (such as a meter)	Continuity check <normal> <fault> Across A-C: Discontinuity Continuity Across B-C: Continuity Discontinuity</fault></normal>				

Note: 1. Use FFT to measure the output voltage accurately. It can not be measured accurately with a meter or

general instrumentation.

2. If the carrier frequency exceeds 5kHz, do not use this instrument since using it may increase eddy-current 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 200V class.

CHAPTER 6 SPECIFICATIONS

This chapter provides the "specifications" of this product. Always read the instructions before using the equipment

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Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

6.1 Standard Specifications

SPECIFICATIONS

6.1.1 Model specifications

(1) 3-phase 400V power supply

Type FR-E540- K-EC			0.4	0.75	1.5	2.2	3.7	5.5	7.5
App	olicable motor capacity	(kW) (Note 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
ξ	Rated current (A)	(Note 6)	1.6(1.4)	2.6(2.2)	4(3.8)	6(5.4)	9.5(8.7)	12	17
Output	Overload capacity	(Note 3)		(i		60 s 2009 me chara	% 0.5 s acteristics	5)	
	Voltage (Note 4)		Three	phase, 3	80V to 48	30V 50Hz	z/60Hz		
<u>></u>	Rated input AC voltage frequency	Three phase, 380V to 480V 50Hz/60Hz							
supply	Permissible AC voltage fluctuation		325 to 528V 50Hz/60Hz						
ower	Permissible frequenc fluctuation				±5%				
ď	Power supply system (kVA)	n capacity (Note 5)	1.5	2.5	4.5	5.5	9.5	12	17
Protective structure (JEM1030)			Enclosed type (IP20)						
Cod	oling system		Self-c	ooling		Ford	ed air co	oling	
App	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.
 - 3. 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 cannot exceed the power supply voltage. The maximum output voltage may be set as desired below the power supply voltage.
 - 5. 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 with the Pr. 72 (PWM frequency selection) value set to 2kHz or higher.

(2) Single-phase 200V power supply

Тур	e FR-E520S- K-EC	0.4	0.75	1.5	2.2	
App	olicable motor capacity (kW) (Note 1)	0.4	0.75	1.5	2.2	
	Rated capacity (kVA) (Note 2)	0.95	1.5	2.7	3.8	
Output	Rated output current (A)	2.5	4	7	10	
Ott	Overload capacity (Note 3)	150% 60 s	200% 0.5 s (ir	verse-time cha	racteristics)	
	Rated output voltage(Note 4)	Thre	Three phase, 200V to 240V 50Hz/60Hz			
<u>></u>	Rated input AC voltage, frequency	Single phase, 200V to 240V 50Hz/60Hz				
supply	Permissible AC voltage fluctuation	Single phase, 170 to 264V 50Hz/60Hz				
ower	Permissible frequency fluctuation	Within ±5%				
P	Power supply capacity (kVA) (Note 5)	1.5	2.3	4.0	5.2	
Pro	tective structure (JEM1030)	Enclosed type (IP20)				
Cod	oling system	Self-c	ooling	Forced air cooling		
App	proximate weight (kg)	1.9	1.9	2.0	2.0	

- 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 220V.
 - 3. 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 may be set as desired below the power supply voltage.
 - 5. The power supply capacity changes with the values of the power supply side inverter impedances (including those of the input reactor and cables). Use the power supply capacity larger than the indicated.

6.1.2 Common specifications

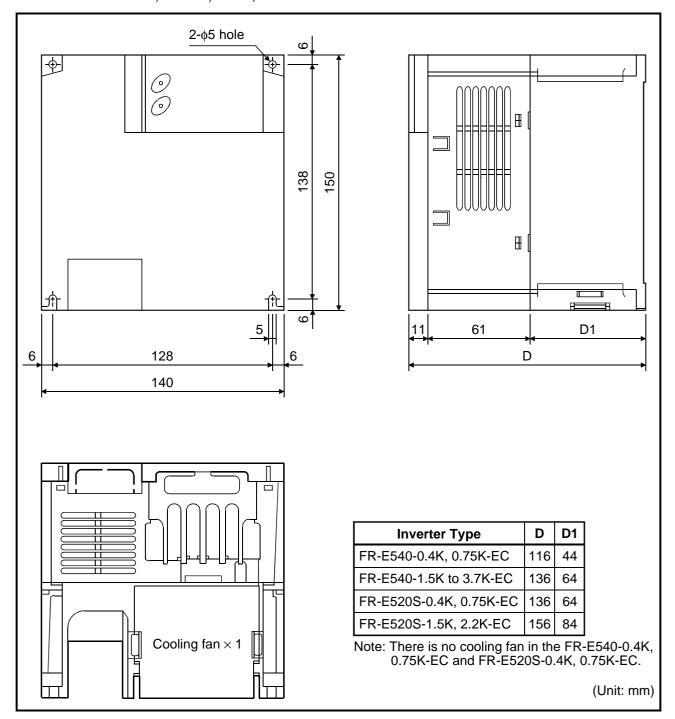
	Control system				Soft-PWM control/high carrier frequency PWM control can V/F control or general-purpose magnetic flux vector conselected.		
	Out	itput frequency range		nae	0.2 to 400Hz (starting frequency variable between 0 and 60)Hz)	
	Free	quency Analog in			Across terminals 2-5: 1/500 of maximum set frequency (5 1/1000 (10VDC, 4-20mADC input).		
	resc	olution Digital in		l input	0.01Hz (less than 100Hz), 0.1Hz (100Hz or more) when c is made using the control panel.	ligital setting	
	Fred	quency	Analo	g input	Within ±0.5% of maximum output frequency (25°C ±10°C)		
	accı	uracy		l input	Within 0.01% of set output frequency when setting is control panel.		
		age/freque racteristic	ency		Base frequency set as required between 0 and 400Hz. Constant torque or variable torque pattern can be selected.		
	Star	rting torque	Э		150% or more (at 1Hz), 200% or more (at 3Hz) when general magnetic flux vector control or slip compensation is selected		
	Torque boost				Manual torque boost, 0 to 30% may be set.		
	Acc		leceler	ation time	0.01, 0.1 to 3600 s (acceleration and deceleration can be s individually), linear or S-pattern acceleration/deceleration m selected.		
	Bral	king	Rege (Note	nerative	0.4K, 0.75K100%, 1.5K50%, 2.2K, 3.7K, 5.5K, 7.5K20%		
	torq			jection	Operation frequency (0 to 120Hz), operation time (0 to 10	s), operation	
Control specifications		rent stall p	revent		voltage (0 to 30%) variable. Operation current level can be set (0 to 200% variable), presence or		
cifica	Volt	ration leve age stall p	revent	ion	absence can be selected. Operation level is fixed, presence or absence can be selected.		
be		ration leve			· · · · · · · · · · · · · · · · · · ·		
ıtrol s	Fast-response current limit level				Operation level is fixed, presence or absence can be selec	ted.	
Cor		Analog Frequency input			0 to 5VDC, 0 to 10VDC, 4 to 20mADC.		
		setting sig	gnal Digital input		Entered from control panel (optional FR-PA02-02).		
		Start signal			Forward rotation and reverse rotation, start signal automatic self-holding input (3-wire input) selectable.		
		Alarm reset			Used to reset alarm output provided when protective activated.	function is	
	Input signals	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 control panel.)		
		Second function selection		selection	Used to select second functions (acceleration time, deceleration time, torque boost, base frequency, electronic overcurrent protection).		
		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).		
		External t input	herma	l relay	Thermal relay contact input for use when the inverter is stopped by the external thermal relay.		
		PU opera	tion-ex	kternal	Used to switch between PU operation and external		
		operation	switch	ning	operation from outside the inverter.		
		V/F-gene			Used to switch between V/F control and general-purpose		
]	magnetic	tlux s	vitching	magnetic flux vector control from outside the inverter.		

fications	Operation functions			Maximum/minimum frequency setting, frequency jump operation, external thermal relay input selection, automatic restart 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	Output signals	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, minor fault and alarm, and 1 contact output (230VAC 0.3A, 30VDC 0.3A) can be selected.		
	nO	For meter		1 signal can be selected from output frequency, output current and output voltage. Analog output (0 to 10VDC).		
зу	Con	itrol panel	Operating status	Output voltage, output current, set frequency, running.		
Display	disp	olay [*]	Alarm definition	Alarm definition is displayed when protective function is activated. 4 alarm definitions are stored.		
	LEC) display		Power application (POWER), Alarm (ALARM).		
Pro	tectiv	/e/alarm functic	ons	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, fin overheat, fan failure (Note 4), parameter error, PU disconnection, ground fault over current protection.		
	Ambient temperature			-10°C to +50°C (non-freezing)		
r		bient humidity		90%RH or less (non-condensing)		
Environment		rage temperatu te 2)	re	-20°C to +65°C		
Nir.	Aml	bience		Indoors (No corrosive and flammable gases, oil mist, dust and dirt.)		
Ē	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/s ² or less (conforming to JIS C 0911)		

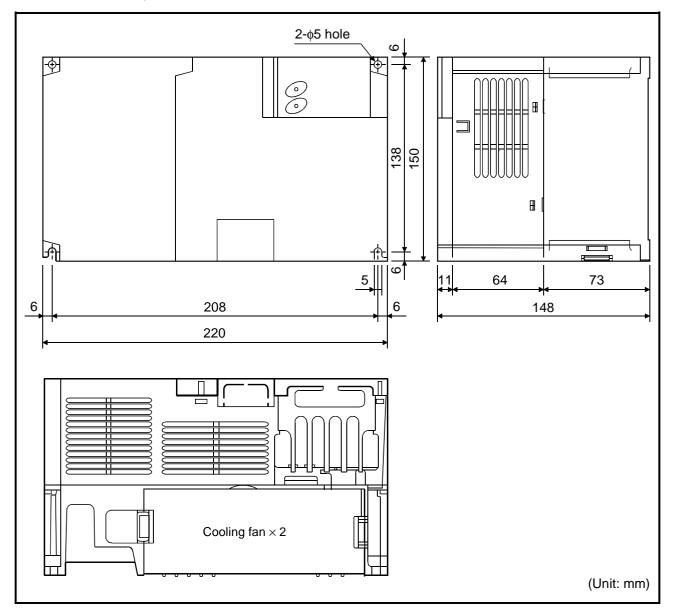
- Note: 1. When undervoltage or instantaneous power failure has occurred, alarm display or alarm output is not provided but the inverter itself is protected. Overcurrent, regenerative overvoltage or other protection may be activated at power restoration according to the operating status (load size, etc.)
 - 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 50Hz 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. A brake unit (BU) may also be used.
 - 4. Not provided for the FR-E540-0.4K, 0.75K-EC, FR-E520S-0.1K to 0.4K-EC which are not equipped with a cooling fan.

6.1.3 Outline drawings

- FR-E540-0.4K, 0.75K, 1.5K, 2.2K, 3.7K-EC
- FR-E520S-0.4K, 0.75K, 1.5K, 2.2K-EC



• FR-E540-5.5K, 7.5K-EC



APPENDIX

This chapter provides "supplementary information" for use of this product.

Always read the instructions before using the equipment.

Appendix 1 Data Code List	,	186	6
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APPENDIX

Func-	Parameter	I INIAMA		Link Parameter Extension Setting (Data Code 7F/FF)	
tion	Number	Namo	Read	Write	(Data Code 7F/FF)
	0	Torque boost	00	80	0
	1	Maximum frequency	01	81	0
"	2	Minimum frequency	02	82	0
io io	3	Base frequency	03	83	0
nct	4	Multi-speed setting (high speed)	04	84	0
c fu	5	Multi-speed setting (middle speed)	05	85	0
Basic functions	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
SU	20	Acceleration/deceleration reference frequency	14	94	0
ınctio	21	Acceleration/deceleration time increments	15	95	0
n fc	22	Stall prevention operation level	16	96	0
Standard operation functions	23	Stall prevention operation level compensation factor at double speed	17	97	0
obe	24	Multi-speed setting (speed 4)	18	98	0
ard	25	Multi-speed setting (speed 5)	19	99	0
and	26	Multi-speed setting (speed 6)	1A	9A	0
Sts	27	Multi-speed setting (speed 7)	1B	9B	0
	29	Acceleration/deceleration pattern	1D	9D	0
	30	Regenerative function selection	1E	9E	0
	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

Func-	Parameter			Code	Link Parameter Extension Setting
tion	Number	Name _	Read	Write	(Data Code 7F/FF)
t Es	41	Up-to-frequency sensitivity	29	A9	0
tion:	42	Output frequency detection	2A	AA	0
Output terminal functions	43	Output frequency detection for reverse rotation	2B	AB	0
Second functions	44	Second acceleration/deceleration time	2C	AC	0
nct	45	Second deceleration time	2D	AD	0
1 1	46	Second torque boost	2E	AE	0
ouo	47	Second V/F (base frequency)	2F	AF	0
	48	Second electronic overcurrent protection	30	В0	0
Display functions	52	Control panel/PU main display data selection	34	B4	0
)isp nct	55	Frequency monitoring reference	37	B7	0
1,2	56	Current monitoring reference	38	B8	0
atic	57	Restart coasting time	39	B9	0
Automatic restart functions	58	Restart cushion time	3A	ВА	0
Additional	59	Remote setting function selection	3B	BB	0
	60	Shortest acceleration/deceleration mode	3C	ВС	0
	61	Reference I for intelligent mode	3D	BD	0
	62	ref. I for intelligent mode accel	3E	BE	0
	63	ref. I for intelligent mode decel	3F	BF	0
	65	Retry selection	41	C1	0
ions	66	Stall prevention operation level reduction starting frequency	42	C2	0
Operation selection functions	67	Number of retries at alarm occurrence	43	C3	0
o	68	Retry waiting time	44	C4	0
ecti	69	Retry count display erasure	45	C5	0
sel	70	Special regenerative brake duty	46	C6	0
o	71	Applied motor	47	C7	0
rati	72	PWM frequency selection	48	C8	0
be	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

Func-	Parameter	arameter Name		Code	Link Parameter Extension Setting
tion	Number	iname	Read	Write	(Data Code 7F/FF)
	80	Motor capacity	50	D0	0
General-purpose magnetic flux vector control	82	Motor exciting current	52	D2	0
eneral-purpos magnetic flux vector control	83	Rated motor voltage	53	D3	0
al-p net	84	Rated motor frequency	54	D4	0
ner nag ect	90	Motor constant (R1)	5A	DA	0
Ge _ >		, ,			
	96	Auto-tuning setting/status	60	E0	0
	117 118	Station number Communication speed	11 12	91 92	1 1
٦	119	Stop bit length	13	93	1
s tio	120	Parity check presence/absence	14	94	1
9 5	121	Number of communication retries	15	95	1
Communication functions	122	Communication check time	16	96	1
mg		interval			
Ö	123	Waiting time setting	17	97	1
	124	CR·LF presence/absence selection	18	98	1
	128	PID action selection	1C	9C	1
	129	PID proportional band	1D	9D	1
ţ	130	PID integral time	1E	9E	1
ÜQ	131	Upper limit	1F	9F	1
PID control	132	Lower limit	20	A0	1
₫	133	PID action set point for PU operation	21	A1	1
	134	PID differential time	22	A2	1
ional	145	Parameter unit language switch- over	2D	AD	1
Additional function	146	Parameter set by manufacturer. Do	not set.		
Current detection	150	Output current detection level	32	B2	1
	151	Output current detection period	33	B3	1
l fe	152	Zero current detection level	34	B4	1
0 8	153	Zero current detection period	35	B5	1
Sub function	156	Stall prevention operation selection	38	B8	1
Sund	158	AM terminal function selection	3A	BA	1
Additional function	4dditional function and function and function are selection and function are selection and function and function are selection are selection and function are selection are selection and function are selection are selection are selection and function are selection are selection and function are selection are selection are selection and selection are selection are selection and selection are selection		80	2	
Initial monitor	Teiting 171 Actual operation hour meter clear 0B		8B	2	
	173	User group 1 registration	0D	8D	2
User functions	174	User group 1 deletion	0E	8E	2
Use	175	User group 2 registration	0F	8F	2
₽	176	User group 2 deletion	10	90	2
	.,,	Coo. group 2 dolotion		30	_

Func-	Parameter	Parameter Name Data Code		Code	Link Parameter Extension Setting
tion	Number	ivanie	Read	Write	(Data Code 7F/FF)
	180	RL terminal function selection	14	94	2
ions	181	RM terminal function selection	15	95	2
nal unct	182	RH terminal function selection	16	96	2
Terminal ment fun	183	MRS terminal function selection	17	97	2
Terminal assignment functions	190	RUN terminal function selection	1E	9E	2
ıssiç	191	FU terminal function selection	1F	9F	2
0	192	A, B, C terminal function selection	20	A0	2
	232	Multi-speed setting (speed 8)	28	A8	2
ion	233	Multi-speed setting (speed 9)	29	A9	2
erat	234	Multi-speed setting (speed 10)	2A	AA	2
do	235	Multi-speed setting (speed 11)	2B	AB	2
Multi-speed operation	236	Multi-speed setting (speed 12)	2C	AC	2
ti-sp	237	Multi-speed setting (speed 13)	2D	AD	2
Mul	238	Multi-speed setting (speed 14)	2E	AE	2
	239	Multi-speed setting (speed 15)	2F	AF	2
	240	Soft-PWM setting	30	В0	2
ons	244	Cooling fan operation selection	34	B4	2
ncti	245	Rated motor slip	35	B5	2
Sub functions	246	Slip compensation response time	36	В6	2
Sul	247	Constant-output region slip compensation selection	37	В7	2
Stop selection function	250	Stop selection	ЗА	ВА	2
ter	338	Operation command right	26	A6	3
Computer link function	339	Speed command right	27	A7	3
Q Ę	340	Link start mode selection	28	A8	3
w	901	AM terminal calibration	5D	DD	1
tion	902	Frequency setting voltage bias	5E	DE	1
nuc	903	Frequency setting voltage gain	5F	DF	1
on fi	904	Frequency setting current bias	60	E0	1
rati	905	Frequency setting current gain	61	E1	1
Calibration functions	990	Buzzer control	5A	DA	9
	991	LCD contrast	5B	DB	9

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Date	*Manual Number	Revision
Mar., 1999	IB(NA)-0600002-A	First edition
Apr., 1999	IB(NA)-0600002-B	Modifications
		•Instructions for compliance with the UL and CSA
		standards
		Factory setting of Pr. 4 "Multi-speed setting (high speed)"
Jun., 1999	IB(NA)-0600002-C	Modifications
		Pr. 73 "0-5V/0-10V selection" = "10", "11" setting method
Mar., 2000	IB(NA)-0600002-D	Modifications
		●Alarm indications (E. 6, E. 7)
		Control circuit terminal screw tightening torque
		•Instructions for compliance with U.S. and Canadian Electrical Codes
		Partial additions
		Pr. 12 "DC injection brake voltage"
		Pr. 73 "0-5V/0-10V selection"