



TRANSISTORIZED INVERTER

FR-F500J INSTRUCTION MANUAL (BASIC)

FR-F520J-0.4K to 15K(F)

FR-F540J-0.4K to 15K(F)

Thank you for choosing this Mitsubishi Transistorized inverter.
If this is the first time for you to use the FR-F500J series, please read through this instruction manual (basic) carefully and use the inverter safely.
If you are going to use the inverter for higher-level applications, the FR-F500J instruction manual (detailed) [IB(NA)-0600130E] is separately available from where you purchased the inverter or your Mitsubishi sales representative.

CONTENTS

| | | |
|----------|--|-----------|
| 1 | CONNECTION OF PERIPHERAL DEVICES (Basic configuration)..... | 3 |
| 2 | INSTALLATION METHOD..... | 5 |
| | 2.1 Installation of the inverter (installation of the filter pack) | 5 |
| | 2.2 Instructions for installation..... | 8 |
| 3 | SPECIFICATIONS OF WIRING AND TERMINALS..... | 10 |
| | 3.1 Terminal connection diagram | 10 |
| | 3.2 Main circuit | 11 |
| | 3.3 Control circuit | 16 |
| 4 | RUN AND OPERATION..... | 23 |
| | 4.1 Setting the frequency to perform operation (example: performing operation at 30Hz) | 25 |
| | 4.2 Using the setting dial like a potentiometer to perform operation | 26 |
| | 4.3 Setting the parameters | 27 |
| | 4.4 Clearing the parameters..... | 29 |
| | 4.5 Monitoring the output current | 30 |
| 5 | ADJUSTMENT OF THE FREQUENCY SETTING POTENTIOMETER AND INDICATOR..... | 31 |
| | 5.1 Changing the output frequency setting of the frequency setting potentiometer (bias and gain of frequency setting voltage (current)) | 32 |
| | 5.2 Adjustment (calibration) of the frequency meter (indicator)..... | 35 |
| 6 | FUNCTION LIST..... | 36 |
| | 6.1 Basic function parameter list | 36 |
| | 6.2 Explanation of the basic function parameters | 37 |
| | 6.3 Extended function parameter list..... | 39 |
| 7 | ERRORS AND PROTECTIVE FUNCTIONS..... | 53 |
| | 7.1 About errors (definitions)..... | 53 |
| | 7.2 To know the operating status at the occurrence of alarm (only when FR-PU04 is used)..... | 56 |
| | 7.3 Correspondence between digital and actual characters | 56 |
| | 7.4 Resetting the inverter | 56 |
| | 7.5 Troubleshooting..... | 57 |
| | 7.6 Precautions for maintenance and inspection | 60 |
| 8 | SPECIFICATIONS..... | 68 |
| | 8.1 Ratings | 68 |
| | 8.2 Common specifications | 70 |
| 9 | OUTLINE DIMENSION DRAWINGS..... | 72 |

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This instruction manual (basic) provides handling information and precautions for use of the equipment.

Please forward this instruction manual (basic) 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 (basic) 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 instruction manual (basic), 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.

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. Also, the inverter's ability to withstand earthquakes will deteriorate.
- Even if power is off, do not remove the front cover except for wiring or periodic inspection. You may access the charged inverter circuits and get an electric shock.
- Before starting wiring or inspection, check to make sure that the 3-digit LED inverter monitor is off, wait for at least 10 minutes after the power supply has been switched off, and check to make sure that there are no residual voltage using a tester or the like.
- This inverter must be earthed (grounded). Earthing (grounding) must conform to the requirements of national and local safety regulations and electrical codes. (NEC section 250, IEC 536 class 1 and other applicable standards)
- Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- Always install the inverter before wiring. Otherwise, you may get an electric shock or be injured.
- Perform setting dial and key operations with dry hands to prevent an electric shock. You may get an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise you may get an electric shock.
- Do not change the cooling fan while power is on. It is dangerous to change the cooling fan while power is on.

2. Fire Prevention

CAUTION

- Install the inverter (filter pack) on an incombustible wall without holes, etc. Mounting it to or near combustible material can cause a fire.
- If the inverter has become faulty, switch off the inverter power. A continuous flow of large current could cause a fire.
- Do not connect the resistor directly to the DC terminals P and N. 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.
- Always connect to the correct terminal to prevent damage, etc.
- Always make sure that polarity is correct to prevent damage, etc.
- While power is on or for some time after power-off, do not touch the inverter (filter pack) or break register 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 install or operate if the inverter (filter pack) is damaged or has parts missing.
- When carrying the inverter, do not hold it by the front cover or setting dial; it may fall off or fail.
- Do not stand or rest heavy objects on the inverter.
- Check the inverter mounting orientation is correct.
- Prevent other conductive bodies as screws and metal fragments or other flammable substance as oil from entering the inverter (filter pack).
- As the inverter (filter pack) is a precision instrument, do not drop or subject it to impact.
- Use the inverter under the following environmental conditions: This could cause the inverter (filter pack) damage.

| | | |
|-------------|-----------------------------|---|
| Environment | Surrounding Air Temperature | -10°C to +50°C (non-freezing) |
| | Ambient humidity | 90%RH maximum (non-condensing) |
| | Storage temperature | -20°C to +65°C *1 |
| | Atmosphere | Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt) |
| | Altitude/vibration | Max.1000m above sea level 5.9m/s ² or less *2 |

*1 Temperatures applicable for a short time, e.g. in transit.

*2 When using with the filter pack installed on the rear panel of the FR-F520J-15K or FR-F540J-15K, do not install this combination on moving objects or places that have vibrations exceeding 1.96m/s².

(2) Wiring

CAUTION

- Do not fit capacitive equipment such as power factor correction capacitor, radio noise filter (option FR-BIF(-H)) 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.
- When the load GD^2 is small (at the motor GD or smaller) for 400V from 1.5K to 3.7K, the output current may vary when the output frequency is in the 20Hz to 30Hz range. If this is a problem, set the Pr.72 "PWM frequency selection" to 6kHz or higher. (When setting the PWM to a higher frequency, check for noise or leakage current problem and take countermeasures against it.)

(4) Operation

WARNING

- When you have chosen the retry function, stay away from the equipment as it will restart suddenly after an alarm stop.
- Since the  key is valid only when functions are set (refer to page 46116), provide a circuit and switch separately to make an emergency stop (power off, mechanical brake operation for emergency stop, etc).
- Make sure that the start signal is off before resetting the inverter alarm. A failure to do so may restart the motor suddenly.
- The load used should be a three-phase induction motor only. Connection of any other electrical equipment to the inverter output may damage the equipment.
- Do not modify the equipment.
- Do not perform parts removal which is not instructed in this manual. Doing so may lead to fault or damage of the inverter.

CAUTION

- The electronic thermal relay function does not guarantee protection of the motor from overheating.
- Do not use a magnetic contactor on the inverter input for frequent starting/stopping of the inverter.
- Use a noise filter to reduce the effect of electromagnetic interference. Otherwise nearby electronic equipment may be affected.
- Take measures to suppress harmonics. Otherwise power supply harmonics from the inverter may heat/damage the power capacitor and generator.
- When a 400V class motor is inverter-driven, please use an insulation-enhanced motor or measures taken to suppress surge voltages. 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, reset the required parameters before starting operations.
- The inverter can be easily set for high-speed operation. Before changing its setting, fully examine the performances of the motor and machine.
- In addition to the inverter's holding function, install a holding device to ensure safety.
- Before running an inverter which had been stored for a long period, always perform inspection and test operation.

(5) Emergency stop

CAUTION

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

(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 (basic) show the inverter without a cover, or partially open. Never run the inverter in this status. Always replace the cover and follow this instruction manual (basic) when operating the inverter.

Harmonic Suppression Guideline

All models of general-purpose inverters used by specific consumers are covered by "Harmonic suppression guideline for consumers who receive high voltage or special high voltage". (For further details, refer to Instruction Manual (detailed).)

Product Checking and Parts Identification

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

● Inverter type

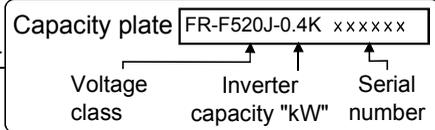
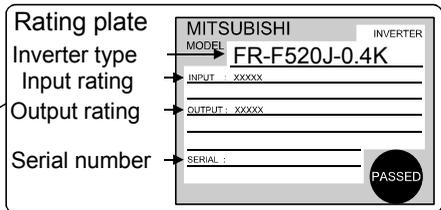
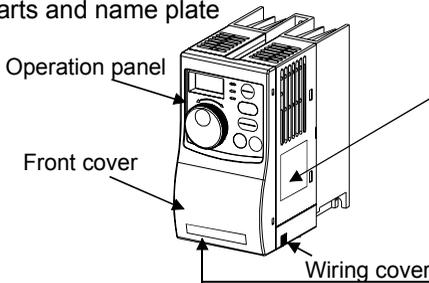
FR - **F520J** - **0.4** K **F**

| Symbol | Voltage Class | Inverter capacity "kW" | Symbol | Filter Pack |
|--------|------------------------|------------------------|--------|-------------|
| F520J | Three-phase 200V class | 0.4 | None | Without |
| F540J | Three-phase 400V class | | F | With |

REMARKS

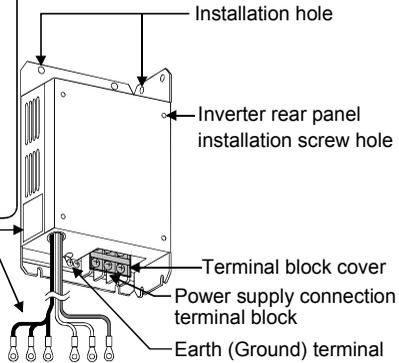
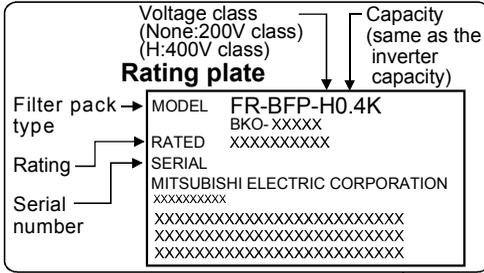
For the product with filter pack (Inverter type indicated on the package has "F" at the end.), an inverter (FR-F5□0J-□K) is provided with a filter pack (FR-BFP-□K)

● Parts and name plate



Filter pack (FR-BFP)

●Parts and name plate



Crimping terminals for the inverter connection

Black cable: For connection to the inverter R, S, T terminal
 Red cable: For connection to the inverter P, P1 terminal
 Green and yellow striped cable: For connection to the earth (ground) terminal

●Accessories

- Screw for leakage current countermeasure and spacer 1 each
 When the earth leakage breaker or earth leakage relay operates unnecessarily due to leakage current, use this screw as a countermeasure. (For details of installation and leakage current, refer to the instruction manual (detailed).)
- Rear panel installation L-bracket (enclosed with the 5.5K or more) (Refer to page 5.) 1
- Inverter rear panel installation screw..... 4
 Use these for installation of the filter pack onto the inverter rear panel. (Refer to page 5.)

| Capacity | Screw size (mm) |
|-----------------|-----------------|
| (H)7.5K or less | M4 × 14 |
| (H)11K, (H)15K | M5 × 20 |

●Removal and reinstallation of the front cover

<0.4K to 3.7K>

Remove the front cover by pulling it toward you in the direction of arrow.
 To reinstall, match the cover to the inverter front and install it straight.



FR-F520J-0.4K,0.75K



FR-F520J-1.5K to 3.7K
FR-F540J-0.4K to 3.7K

<5.5K to 15K>

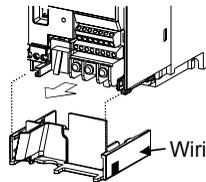
Remove the two screws on the front cover and push the tab in the center in the direction of arrow to remove the cover.
 To reinstall, match the cover to the inverter front and install it straight.



FR-F520J-5.5K to 15K
FR-F540J-5.5K to 15K

● Removal and reinstallation of the wiring cover (0.4K to 3.7K)

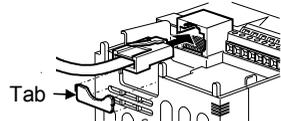
The cover can be removed easily by pulling it toward you.
 To reinstall, fit the cover to the inverter along the guides.



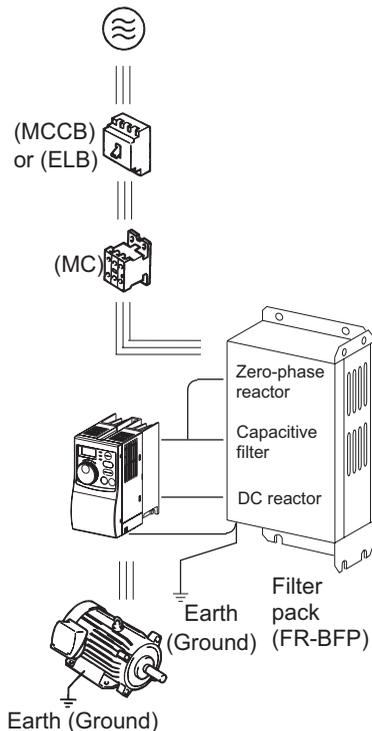
Wiring cover

● RS-485 communication connector

When using the RS-485 connector to wire the cable, you can cut off the tab of the wiring cover to wire it. (For the 0.4K to 3.7K, cutting off the tab will provide protective structure IP10.)



1. CONNECTION OF PERIPHERAL DEVICES (Basic configuration)



Power supply

Use within the permissible power supply specifications of the inverter. (Refer to page 68.)

Moulded case circuit breaker or earth leakage circuit breaker

The breaker must be selected carefully since an in-rush current flows in the inverter at power on.

Magnetic contactor

Install for your safety. Do not use this magnetic contactor to start and stop the inverter. Doing so will cause the inverter life to be shortened. (Refer to page 22.)

Filter pack

Effective for power factor improvement and noise reduction. (when using an inverter with filter pack)

Inverter

The life of the inverter is influenced by ambient temperature. Check the ambient temperature. Especially when mounting the inverter inside an enclosure, take cautions of the ambient temperature. (Refer to page 169.)

Wrong wiring might lead to damage of the inverter.

The control signal wires must be kept fully away from the main circuit to protect them from noise. (Refer to page 10.)

Devices connected to the output

Do not install a power factor correction capacitor, surge suppressor or radio noise filter on the output side of the inverter.

When installing a moulded case circuit breaker on the output side of the inverter, contact each manufacturer for selection of the moulded case circuit breaker.

Earth (Ground)

To prevent an electric shock, always earth (ground) the filter pack, motor and inverter.

For reduction of induction noise from the power line of the inverter, it is recommended to wire the earth (ground) cable by returning it to the earth (ground) terminal of the inverter.

(For details of noise reduction techniques, refer to the instruction manual (detailed).)

Filter pack (Refer to page 15.)

- Zero phase reactor
It has the effect of reducing radiated noise from the input power supply and cable-propagated noise. (For details of noise reduction techniques, refer to the instruction manual (detailed).)
- Capacitive filter
It has the effect of reducing radiated noise from the input power supply and cable-propagated noise. It is especially effective against noise of 10MHz or less. (For details of noise reduction techniques, refer to the instruction manual (detailed).)
- DC reactor (power factor improving reactor)
As the form factor from the input power side is increased and power factor is improved, the power unit capacity can be reduced. (Refer to page 68.) Also it is effective in reducing the input side power harmonic current. (For the power harmonic, refer to the instruction manual (detailed) for details.)

Selection of peripheral devices (selection changes with the power input specifications of the inverter)

<200V class>

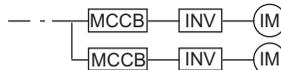
| Motor Output (kW) | Inverter Type | Moulded Case Circuit Breaker (MCCB)(*1, *3) or Earth Leakage Circuit Breaker (ELB) (*2, *3) | | Magnetic Contactor (MC) |
|-------------------|----------------|---|---------------------|-------------------------|
| | | With filter pack | Without filter pack | |
| 0.4 | FR-F520J-0.4K | 30AF/5A | 30AF/5A | S-N10 |
| 0.75 | FR-F520J-0.75K | 30AF/10A | 30AF/10A | S-N10 |
| 1.5 | FR-F520J-1.5K | 30AF/15A | 30AF/15A | S-N10 |
| 2.2 | FR-F520J-2.2K | 30AF/15A | 30AF/20A | S-N10 |
| 3.7 | FR-F520J-3.7K | 30AF/30A | 30AF/30A | S-N20, S-N21 |
| 5.5 | FR-F520J-5.5K | 50AF/40A | 50AF/50A | S-N25 |
| 7.5 | FR-F520J-7.5K | 50AF/50A | 100AF/60A | S-N35 |
| 11 | FR-F520J-11K | 100AF/75A | 100AF/75A | S-N50 |
| 15 | FR-F520J-15K | 100AF/100A | 225AF/125A | S-N65 |

<400V class>

| Motor Output (kW) | Inverter Type | Moulded Case Circuit Breaker (MCCB)(*1, *3) or Earth Leakage Circuit Breaker (ELB)(*2, *3) | | Magnetic Contactor (MC) |
|-------------------|----------------|--|---------------------|-------------------------|
| | | With filter pack | Without filter pack | |
| 0.4 | FR-F540J-0.4K | 30AF/5A | 30AF/5A | S-N10 |
| 0.75 | FR-F540J-0.75K | 30AF/5A | 30AF/5A | S-N10 |
| 1.5 | FR-F540J-1.5K | 30AF/10A | 30AF/10A | S-N10 |
| 2.2 | FR-F540J-2.2K | 30AF/10A | 30AF/15A | S-N10 |
| 3.7 | FR-F540J-3.7K | 30AF/15A | 30AF/20A | S-N20, S-N21 |
| 5.5 | FR-F540J-5.5K | 30AF/20A | 30AF/30A | S-N20, S-N21 |
| 7.5 | FR-F540J-7.5K | 30AF/30A | 30AF/30A | S-N20, S-N21 |
| 11 | FR-F540J-11K | 50AF/40A | 50AF/50A | S-N25 |
| 15 | FR-F540J-15K | 50AF/50A | 100AF/60A | S-N35 |

*1. • Select the MCCB according to the power supply capacity.

• Install one MCCB per inverter.



*2. For installations in the United States or Canada, the circuit breaker must be inverse time or instantaneous trip type.

*3. When the breaker on the inverter primary side trips, check for the wiring fault (short circuit), damage to internal parts of the inverter, etc. Identify the cause of the trip, then remove the cause and power on the breaker.

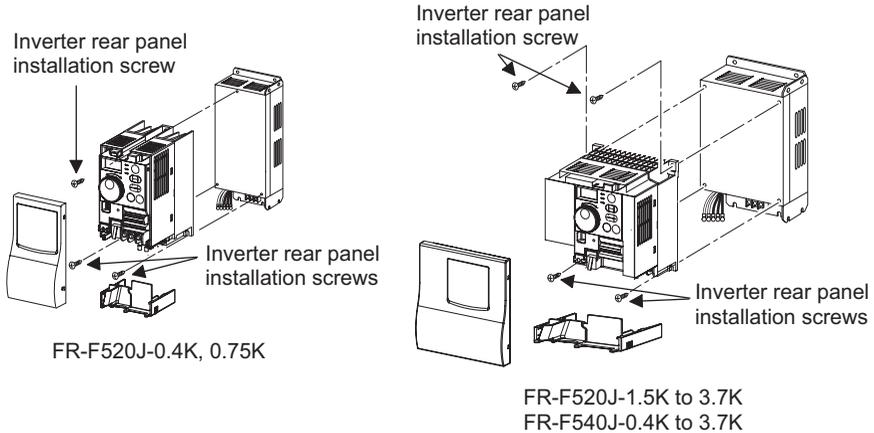
2. INSTALLATION METHOD

2.1 Installation of the inverter (installation of the filter pack)

2.1.1 Installation of the inverter and filter pack (for rear panel installation)

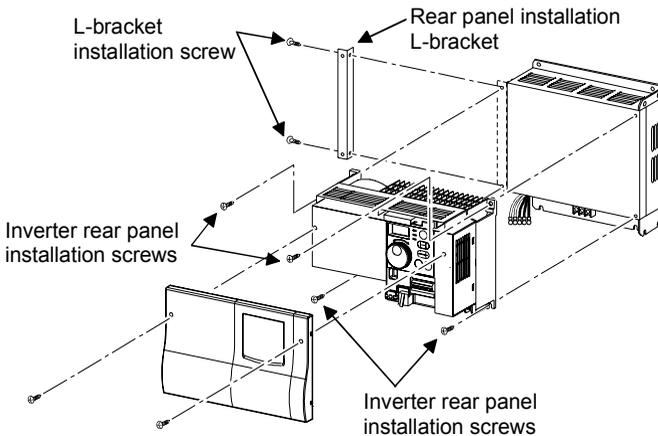
<0.4K to 3.7K>

Remove the front cover and wiring cover to attach the inverter.



<5.5K to 15K>

Remove the L-bracket installation screws from the filter pack (two for the 7.5K or less, three for the 11K or more) and attach the L-bracket enclosed to the filter pack. Remove the front cover to attach the inverter.



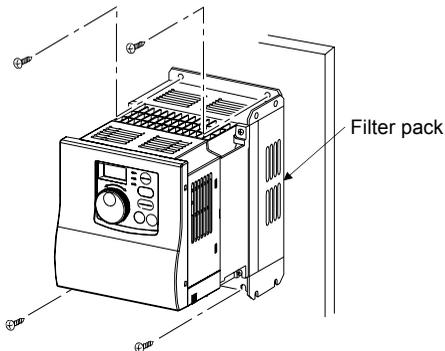
CAUTION

When installing the filter pack to the inverter, use the inverter rear panel installation screws enclosed. Using installation screws that are longer will damage the filter pack.

2.1.2 Installation of the filter pack

The following installation methods are recommended for the filter pack and inverter. For wiring of the filter pack and inverter, refer to page 15.

●Rear panel installation

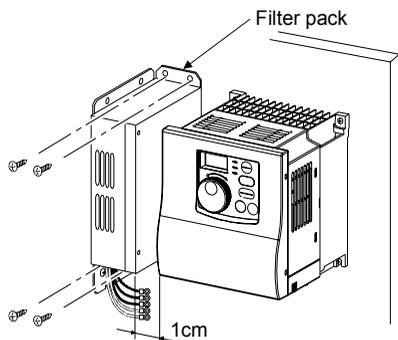


CAUTION

When using with the filter pack installed on the rear panel of the FR-F520J-15K or FR-F540J-15K, do not install this combination on moving objects or places that have vibrations exceeding 1.96m/s^2 .

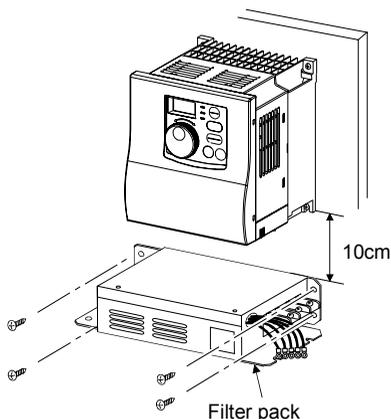
●Side panel installation

To provide heat dissipation space for the inverter and filter pack, leave clearance of 1 cm or more between the inverter and filter pack.



●Underneath installation

To provide space for heat dissipation and fan replacement, leave clearance of 10cm or more between the inverter and filter pack.



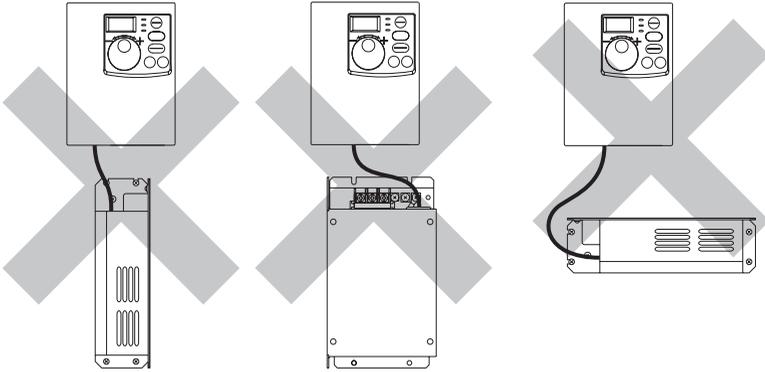
CAUTION

Install the filter pack with the wiring portion facing right.

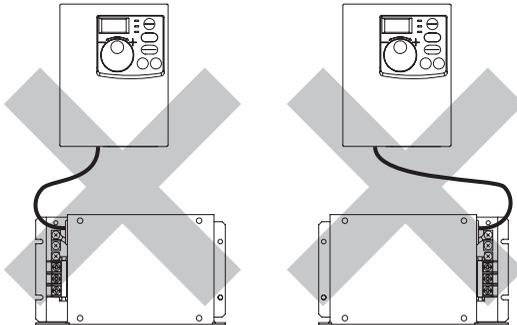
● Installation of the inverter and filter pack

To prevent malfunctions and damages, never perform installations in the following manner. Only install according to the recommended mounting methods. (Refer to page 6 for recommended installations.)

<Invert installation of the filter pack>

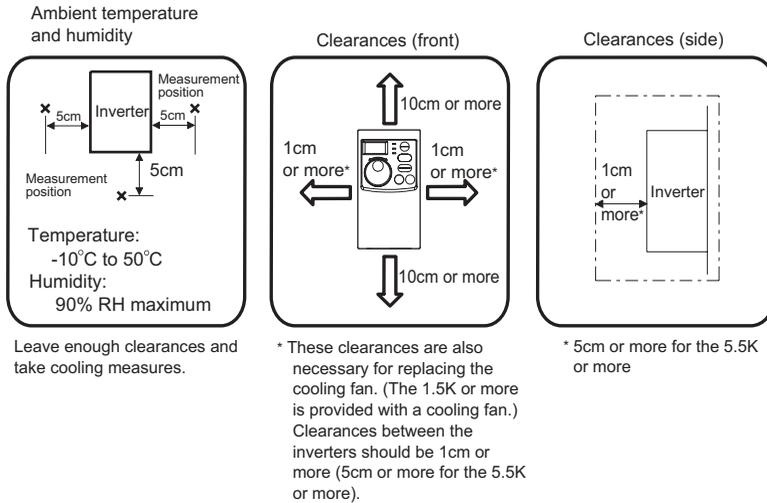


<Rear panel installation of the filter pack>



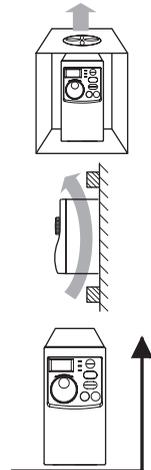
2.2 Instructions for installation

- Install the inverter (filter pack) under the following conditions.

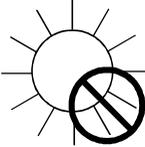
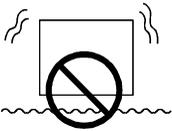
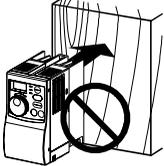


CAUTION

- When mounting inside enclosure, provide cooling measures with a cooling fan, etc.
- Leave enough clearances above and under the inverter to ensure adequate ventilation.
- Install the inverter (filter pack) vertically.



- Inverter (filter pack) consists of precision mechanical and electronic parts. Never install or handle it in any of the following conditions as doing so could cause an operation fault or failure.

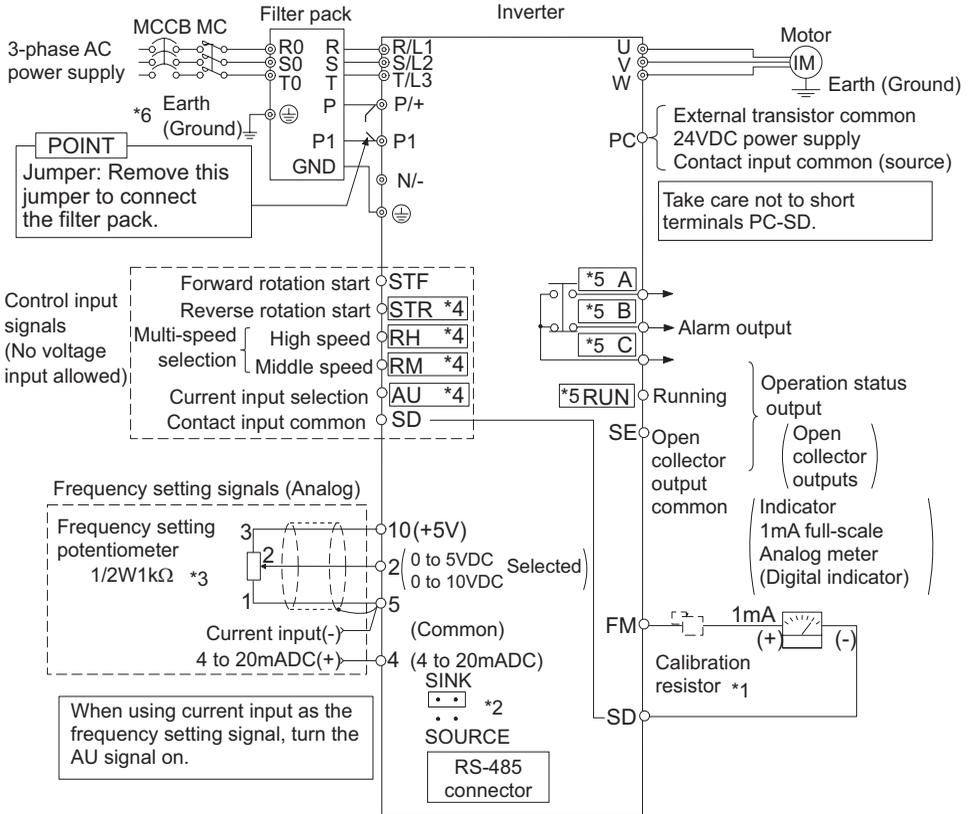
| | | | |
|--|--|--|---|
|  <p>Direct sunlight</p> |  <p>Vibration (5.9m/s^2 or more)</p> |  <p>High temperature, high humidity</p> |  <p>Horizontal placement</p> |
|  <p>Vertical mounting (when mounted inside enclosure)</p> |  <p>Transportation by holding front cover or dial</p> |  <p>Oil mist, flammable gas, corrosive gas, fluff, dust, etc.</p> |  <p>Mounting to combustible material</p> |

- * When using with the filter pack installed on the rear panel of the FR-F520J-15K or FR-F540J-15K, do not install this combination on moving objects or places that have vibrations exceeding 1.96m/s^2 .

3. SPECIFICATIONS OF WIRING AND TERMINALS

3.1 Terminal connection diagram

●With filter pack



◎ Main circuit terminal ○ Control circuit terminal

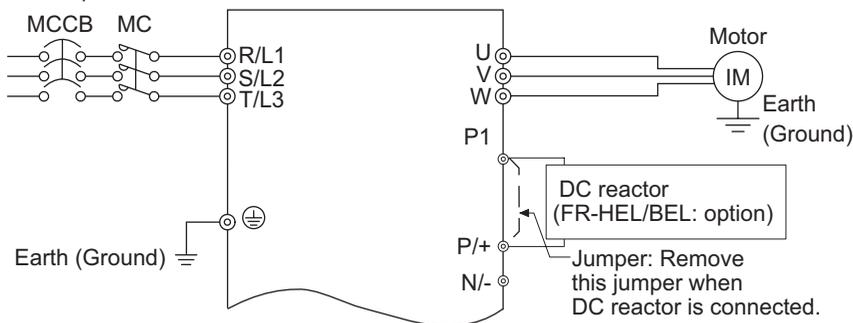
REMARKS

- *1. Not needed when the setting dial is used for calibration. Used when calibration must be made near the frequency meter for such a reason as a remote frequency meter. However, the frequency meter needle may not deflect to full-scale if the calibration resistor is connected. In this case, use this resistor and setting dial together.
- *2. You can switch the position of sink and source logic. Refer to the instruction manual (detailed) for details.
- *3. When the setting potentiometer is used frequently, use a 2W1kΩ potentiometer.
- *4. The terminal functions change with input terminal function selection (Pr. 60 to Pr. 63). (Refer to page 44.) (RES, RL, RM, RH, RT, AU, STOP, MRS, OH, REX, JOG, X14, X16, (STR) signal selection)
- *5. The terminal function changes with the setting of output terminal function selection (Pr. 64, Pr. 65). (Refer to page 45.) (RUN, SU, OL, FU, RY, Y12, Y13, FDN, FUP, RL, Y95, LF, ABC signal selection)
- *6. Connect the GND cable of the filter pack to the earth (ground) terminal of the inverter. Use the earth (ground) terminal of the filter pack to earth (ground). For inverter earthing (grounding), earth (ground) the inverter through the filter pack.

CAUTION

To prevent a malfunction due to noise, keep the signal cables more than 10cm away from the power cables.

- Without filter pack



3.2 Main circuit

3.2.1 Explanation of main circuit terminals

- Inverter

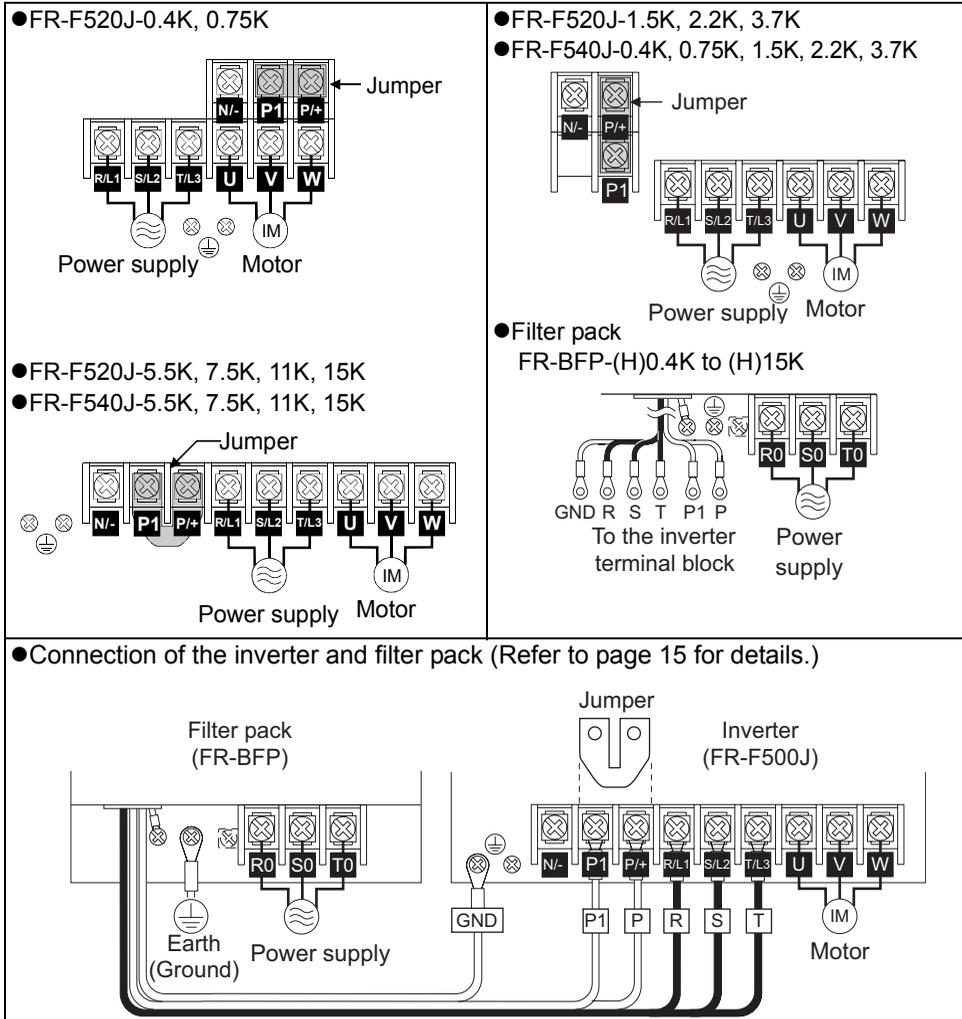
| Terminal Symbol | Terminal Name | Description |
|------------------|------------------------|--|
| R/L1, S/L2, T/L3 | AC power input | Connect the R, S, T cables of the filter pack to these terminals. REMARKS For the inverter without filter pack, connect these to the commercial power supply. |
| U, V, W | Inverter output | Connect to a three-phase squirrel-cage motor. |
| N/- | DC voltage common | DC voltage common terminal. This is not insulated from the power and inverter output. |
| P/+, P1 | Filter pack connection | Remove the jumper across terminals P-P1 and connect the P and P1 cables of the filter pack. REMARKS For the inverter without filter pack, remove the jumper across terminals P-P1 and connect the optional DC reactor (FR-HEL/BEL). |
| ⊕ | Earth (Ground) | For earthing (grounding) the inverter chassis. Connect the GND cable of the filter pack. REMARKS Earth (Ground) the inverter without filter pack. |

● Filter pack

| Terminal Symbol | Terminal Name | Description |
|---|-------------------------------|---|
| R0, S0, T0 | Commercial power supply input | Connect to the commercial power supply. |
|  | Earth (Ground) | For earthing (grounding) the filter pack. Must be earthed (grounded). |

| Crimping Terminal Symbol | Terminal Name | Cable Color | Description |
|--------------------------|------------------------------------|--------------------------|--|
| R, S, T | Inverter power supply | Black | Connect to the R, S, T of the inverter. |
| P, P1 | DC reactor terminal | Red | Remove the jumper across terminals P-P1 and connect to the P and P1 terminals of the inverter. |
| GND | Inverter earth (ground) connection | Green and yellow stripes | Connect to the earth (ground) terminal of the inverter. (Refer to page 10.) |

3.2.2 Terminal block layout



CAUTION

- Make sure the power cables are connected to the R0, S0, T0 of the filter pack (FR-BFP) (If using the inverter without filter pack, connect to the R, S, T of the inverter). Never connect the power cable to the U, V, W of the inverter. (Phase need not be matched)
- Connect the motor to U, V, W. At this time, turning on the forward rotation switch (signal) rotates the motor in the counterclockwise direction when viewed from the motor shaft.
- When connecting the filter pack, make sure the jumper across the terminals P1-P of the inverter is removed.

3.2.3 Cables, wiring length, and crimping terminals

The following table indicates a selection example for the wiring length of 20m. <200V class>

| Applicable Inverter | Terminal Screw size | Tightening Torque N·m | Crimping Terminal | | Cable Sizes | | | | | |
|------------------------|---------------------|-----------------------|-------------------|-------|------------------------------|---------|---------|---------|------------------------------|---------|
| | | | | | HIV Cable (mm ²) | | AWG | | PVC Cable (mm ²) | |
| | | | | | R, S, T | U, V, W | R, S, T | U, V, W | R, S, T | U, V, W |
| FR-F520J-0.4K to 0.75K | M3.5 | 1.2 | 2-3.5 | 2-3.5 | 2 | 2 | 14 | 14 | 2.5 | 2.5 |
| FR-F520J-1.5K, 2.2K | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 14 | 14 | 2.5 | 2.5 |
| FR-F520J-3.7K | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 12 | 12 | 4 | 2.5 |
| FR-F520J-5.5K | M5 | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 |
| FR-F520J-7.5K | M5 | 2.5 | 14-5 | 8-5 | 14 | 8 | 6 | 8 | 16 | 10 |
| FR-F520J-11K | M5 | 2.5 | 14-5 | 14-5 | 14 | 14 | 6 | 6 | 16 | 16 |
| FR-F520J-15K | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 4 | 4 | 25 | 25 |

<400V class>

| Applicable Inverter | Terminal Screw size | Tightening Torque N·m | Crimping Terminal | | Cable Sizes | | | | | |
|-----------------------|---------------------|-----------------------|-------------------|-------|------------------------------|---------|---------|---------|------------------------------|---------|
| | | | | | HIV Cable (mm ²) | | AWG | | PVC Cable (mm ²) | |
| | | | | | R, S, T | U, V, W | R, S, T | U, V, W | R, S, T | U, V, W |
| FR-F540J-0.4K to 3.7K | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 14 | 14 | 2.5 | 2.5 |
| FR-F540J-5.5K | M4 | 1.5 | 5.5-4 | 2-4 | 3.5 | 2 | 12 | 14 | 4 | 2.5 |
| FR-F540J-7.5K | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 12 | 12 | 4 | 4 |
| FR-F540J-11K | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 10 | 10 | 6 | 6 |
| FR-F540J-15K | M6 | 4.4 | 14-6 | 8-6 | 14 | 8 | 6 | 8 | 16 | 10 |

*The terminal screw size of the filter pack (FR-BFP) is the same as that of the inverter. Wiring length

- FR-F540J-0.4K 50m or less
- FR-F520J-0.4K to 3.7K
FR-F540J-0.75K to 3.7K 100m or less
- FR-F520J-5.5K to 15K
FR-F540J-5.5K to 15K 500m or less

CAUTION

- If the wiring length of the FR-F540J-0.4K or 0.75K is 30m or more, use the carrier frequency of 1kHz.
- When automatic torque boost is selected in Pr. 98 "automatic torque boost selection (motor capacity)", the wiring length must be 30m maximum. (Refer to page 48.)
- If the wiring distance between the inverter and motor is long, the motor torque will decrease due to the voltage drop of the main circuit cable (especially at low-frequency output).
Use thick cables so that a voltage drop is 2% or less.

3.2.4 Wiring of the inverter and filter pack

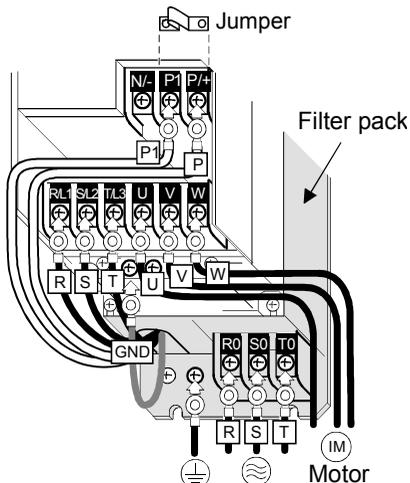
Perform wiring of the inverter and filter pack in the following procedure.

- (1) Connect the commercial power supply to the terminals R0, S0, T0 of the filter pack.
- (2) Connect the earth (ground) cable (green and yellow striped cable) of the filter pack to the inverter earth (ground) terminal.
- (3) Connect the power supply cable (black cable) of the filter pack to the terminals R, S, T of the inverter.

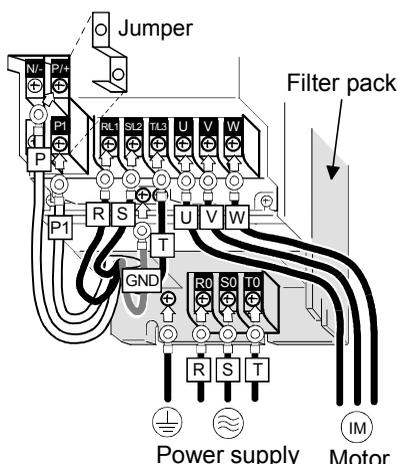
REMARKS

Phase sequence needs not to be matched.

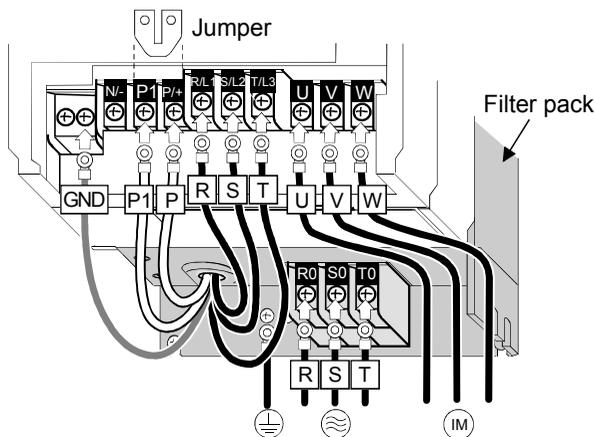
- (4) **Remove the jumper across terminals P-P1** of the inverter and connect the P and P1 cables (red cable) of the filter pack.
- (5) Connect the motor cable to the inverter output terminals (U, V, W). (Match the phase sequence.)



Power supply
FR-F520J-0.4K, 0.75K



Power supply Motor
FR-F520J-1.5K to 3.7K
FR-F540J-0.4K to 3.7K



Power supply Motor
FR-F520J-5.5K to 15K
FR-F540J-5.5K to 15K

3.3 Control circuit

3.3.1 Explanation of control circuit terminals

| Symbol | | Terminal Name | Definition | |
|---------------|---------------------------------------|--|---|---|
| Contact input | STF | Forward rotation start | Turn on the STF signal to start forward rotation and turn it off to stop. | When the STF and STR signals are turned on simultaneously, the stop command is given. |
| | STR | Reverse rotation start | Turn on the STR signal to start reverse rotation and turn it off to stop. | |
| | RH RM | Multi-speed selection | Turn on the RH, RM signals in appropriate combinations to select multiple speeds. The priorities of the speed commands are in order of jog, multi-speed setting (RH, RM, RL, REX) and AU. | The terminal functions change with input terminal function selection (Pr. 60 to Pr.63). (*3) |
| | AU | Current input selection | Only when the AU signal is turned on, the inverter can be operated with the 4 to 20mADC frequency setting signal. Turning the AU signal on makes voltage input (across terminals 2-5) invalid. | |
| Input signals | SD (*1, *6) | Contact input common (sink) (initial setting) | Common terminal for contact input terminal (sink logic) and terminal FM. | |
| | | External transistor common (source) | When connecting the transistor output (open collector output), such as a programmable controller, when source logic is selected, connect the external power supply common for transistor output to this terminal to prevent a malfunction caused by undesirable currents. | |
| | | 24VDC power supply common | Common output terminal for 24VDC 0.1A power supply (PC terminal). Isolated from terminals 5 and SE. | |
| | PC (*1) | External transistor common (sink) (initial setting) | When connecting the transistor output (open collector output), such as a programmable controller, when sink logic is selected, connect the external power supply common for transistor output to this terminal to prevent a malfunction caused by undesirable currents. | |
| | | Contact input common (source) | Common terminal for contact input terminal (source logic). | |
| | | 24VDC power supply | Can be used as 24VDC 0.1A power supply. | |
| 10 | Frequency setting power supply | 5VDC, Permissible load current 10mA. | | |

| Symbol | Terminal Name | Definition |
|----------------|---|--|
| Input signals | Frequency setting | 2 Frequency setting (voltage signal) Inputting 0 to 5VDC (or 0 to 10V) provides the maximum output frequency at 5V (10V) and makes input and output proportional. Switch between 5V and 10V using Pr. 73 "0-5V, 0-10V selection". Input resistance 10k Ω . Maximum permissible input voltage 20V |
| | | 4 Frequency setting (current signal) Input 4 to 20mADC. It is factory set at 0Hz for 4mA and at 60Hz for 20mA. Maximum permissible input current 30mA. Input resistance approximately 250 Ω . Turn ON signal AU for current input. Turning the AU signal on makes voltage input invalid. Use any of Pr. 60 to Pr. 63 (input terminal function selection) to set the AU signal. |
| | 5 Frequency setting input common Frequency setting signal (terminal 2, 4) common terminal. Do not earth (ground). | |
| Output signals | Alarm output | A B C Alarm output 1 changeover contact output indicates that the inverter protective function has activated and the output stopped. 230VAC 0.3A, 30VDC 0.3A. Alarm: discontinuity across B-C (continuity across A-C), Normal: continuity across B-C (discontinuity across A-C).(*5) The function of the terminals changes according to the output terminal function selection (Pr. 64, Pr.65). (*4) |
| | | RUN Inverter running Switched low when the inverter output frequency is equal to or higher than the starting frequency (factory set to 0.5Hz variable). Switched high during stop or DC injection brake operation. (*2) Permissible load 24VDC 0.1A (a voltage drop is 3.4V maximum when the signal is on) |
| | SE Open collector common Common terminal for inverter running terminal RUN. (*6) | |
| | Indicator | FM For meter The output signal across terminals FM-SD is factory set to about 1mA at 60Hz and is proportional to the corresponding output frequency. Since output voltage is pulse waveform, a digital meter can be connected. Frequency permissible load current 1mA Pulse specification 1440 pulses/s at 60Hz |
| Communication | — RS-485 connector Using the parameter unit connection cable (FR-CB201 to 205), the parameter unit (FR-PU04) can be connected. Communication operation can be performed using RS-485. For details of RS-485 communication, refer to the separately available instruction manual (detailed). | |

- *1. Do not connect terminals SD and PC each other or to the earth (ground). For sink logic (factory setting), terminal SD acts as the common terminal of contact input. For source logic, terminal PC acts as the common terminal of contact input. (Refer to the separately available instruction manual (detailed) for switching method.)
- *2. Low indicates that the open collector output transistor is on (conducts). High indicates that the transistor is off (does not conduct).
- *3. RL, RM, RH, RT, AU, STOP, MRS, OH, REX, JOG, RES, X14, X16, (STR) signal selection (Refer to page 44.)
- *4. RUN, SU, OL, FU, RY, Y12, Y13, FDN, FUP, RL, Y95, LF, ABC signal selection (Refer to page 45.)
- *5. To be compliant with the European Directive (Low Voltage Directive), the operating capacity of relay outputs (A, B, C) should be 30VDC 0.3A.
- *6. Terminals SD, SE and 5 are isolated from each other. Do not earth (ground). Avoid connecting the terminal SD and 5 and the terminal SE and 5.

3.3.2 Arrangement and wiring of control circuit terminals

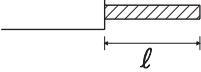
Control circuit terminal block

| | | | | | | |
|----|----|-----|----|---|---|---|
| PC | SE | RUN | 10 | 2 | 5 | 4 |
|----|----|-----|----|---|---|---|

| | | | | | | | |
|----|----|-----|-----|----|----|----|----|
| SD | SD | STF | STR | AU | RM | RH | FM |
|----|----|-----|-----|----|----|----|----|

| | | |
|---|---|---|
| A | B | C |
|---|---|---|

Cable stripping size



Loosen the terminal screw and insert the cable into the terminal.

- ☞ Screw size: M3 (A, B, C terminals), M2 (other than the above)
- ☞ Tightening torque: 0.5N•m to 0.6N•m (A, B, C terminals)
0.22N•m to 0.25N•m (other than the above)

CAUTION

Undertightening can cause cable disconnection or malfunction. Overtightening can cause a short circuit or malfunction due to damage to the screw or unit.

- ☞ Cable size: 0.3mm² to 0.75mm²
- ☞ Screwdriver: Small ⊖ flat-blade screwdriver
Tip thickness: 0.4mm
Tip width: 2.5mm

Wire the stripped cable after twisting it to prevent it from becoming loose.
In addition, do not solder it. *

| | |
|----------------------|-----|
| | l |
| ABC terminals | 6mm |
| Other than the above | 5mm |

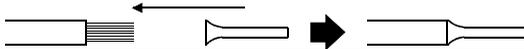
*Introduced products on bar terminals: (as of September, 2006)

| Terminal Screw Size | Wire Size (mm ²) | Bar Terminal Model | | Maker |
|---------------------------|------------------------------|------------------------|---------------------------|--------------------------|
| | | With Insulation Sleeve | Without Insulation Sleeve | |
| M3 (terminal A, B, C) | 0.3 to 0.5 | Al 0,5-6WH | A 0,5-6 | Phoenix Contact Co.,Ltd. |
| | 0.5 to 0.75 | Al 0,75-6GY | A 0,75-6 | |
| M2 (other than the above) | 0.3 to 0.5 | Al 0,5-6WH | A 0,5-6 | |

☞ Bar terminal crimping tool: CRIMPFOX ZA3 (Phoenix Contact Co., Ltd.)

CAUTION

When using the bar terminal (without insulation sleeve), use care so that the twisted wires do not come out.



3.3.3 Connection to RS-485 connector

- (1) When connecting the parameter unit
Use the optional FR-CB2□□. When the parameter unit (FR-PU04) is used, operation from the operation panel is not accepted. ( is valid)
- (2) RS-485 communication
Using the RS-485 connector, you can perform communication operation from a personal computer etc. By connecting the RS-485 connector to computers such as personal computer and FA with a communication cable, you can run/monitor the inverter and read/write parameter values using a user program. For further details, refer to the instruction manual (detailed).
 - Conforming standard: EIA-485 (RS-485)
 - Transmission format: Multi-drop link
 - Communication speed: Maximum 19200 bps
 - Overall extension: 500m

CAUTION

Do not plug the connector to a computer LAN board, fax modem socket, telephone modular connector etc. The inverter and machine could be damaged due to differences in electrical specifications.

3.3.4 Failsafe of the system which uses the inverter

When a fault occurs, the inverter trips to output a fault signal. However, a fault output signal may not be output at an inverter fault occurrence when the detection circuit or output circuit fails, etc. Although Mitsubishi assures best quality products, provide an interlock which uses inverter status output signals to prevent accidents such as damage to machine when the inverter fails for some reason and at the same time consider the system configuration where failsafe from outside the inverter, without using the inverter, is enabled even if the inverter fails.

(1) Interlock method which uses the inverter status output signals

By combining the inverter status output signals to provide an interlock as shown below, an inverter alarm can be detected.

| No | Interlock Method | Check Method | Used Signals | Refer to Page |
|----|--|--|---|---|
| 1) | Inverter protective function operation | Operation check of an alarm contact Circuit error detection by negative logic | Fault output signal (ABC signal) | Refer to the chapter 4 of the Instruction Manual (detailed)). |
| 2) | Inverter running status | Operation ready signal check | Operation ready signal (RY signal) | Refer to the chapter 4 of the Instruction Manual (detailed)). |
| 3) | Inverter running status | Logic check of the start signal and running signal | Start signal (STF signal, STR signal) Running signal (RUN signal) | Refer to the chapter 4 of the Instruction Manual (detailed)). |
| 4) | Inverter running status | Logic check of the start signal and output current | Start signal (STF signal, STR signal) Output current detection signal (Y12 signal) | Refer to the chapter 4 of the Instruction Manual (detailed)). |

(2) Backup method outside the inverter

Even if the interlock is provided by the inverter status signal, enough failsafe is not ensured depending on the failure status of the inverter itself. For example, even if the interlock is provided using the inverter fault output signal, start signal and RUN signal output, there is a case where a fault output signal is not output and RUN signal is kept output even if an inverter fault occurs.

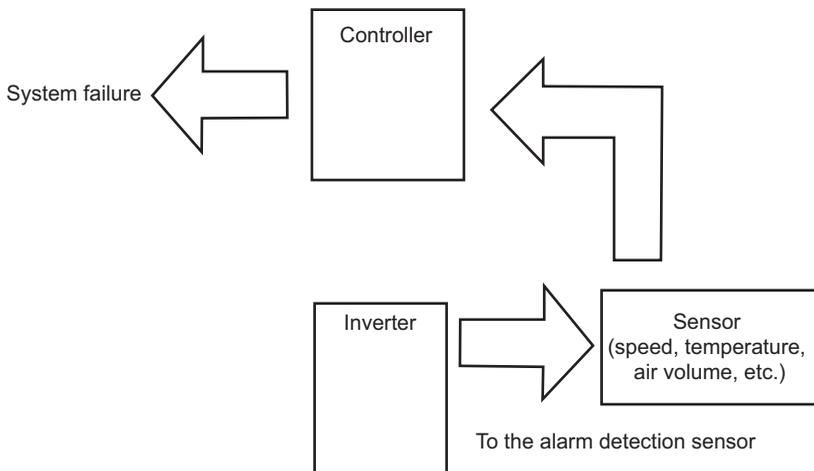
Provide a speed detector to detect the motor speed and current detector to detect the motor current and consider the backup system such as checking up as below according to the level of importance of the system.

1) Start signal and actual operation check

Check the motor running and motor current while the start signal is input to the inverter by comparing the start signal to the inverter and detected speed of the speed detector or detected current of the current detector. Note that the motor current runs as the motor is running for the period until the motor stops since the inverter starts decelerating even if the start signal turns off. For the logic check, configure a sequence considering the inverter deceleration time. In addition, it is recommended to check the three-phase current when using the current detector.

2) Command speed and actual operation check

Check if there is no gap between the actual speed and commanded speed by comparing the inverter speed command and detected speed of the speed detector.



3.3.5 Power-off and magnetic contactor (MC)

(1) Inverter input side magnetic contactor (MC)

On the inverter's input side, it is recommended to provide an MC for the following purposes. (Refer to page 4 for selection)

- 1) To release the inverter from the power supply when the inverter protective function is activated or the drive becomes faulty (e.g. emergency stop operation)
- 2) To prevent any accident due to an automatic restart at restoration of power after an inverter stop made by a power failure
- 3) To rest the inverter for an extended period of time

The control power supply for inverter is always running and consumes a little power. When stopping the inverter for an extended period of time, powering off the inverter will save power slightly.

- 4) To separate the inverter from the power supply to ensure safe maintenance and inspection work

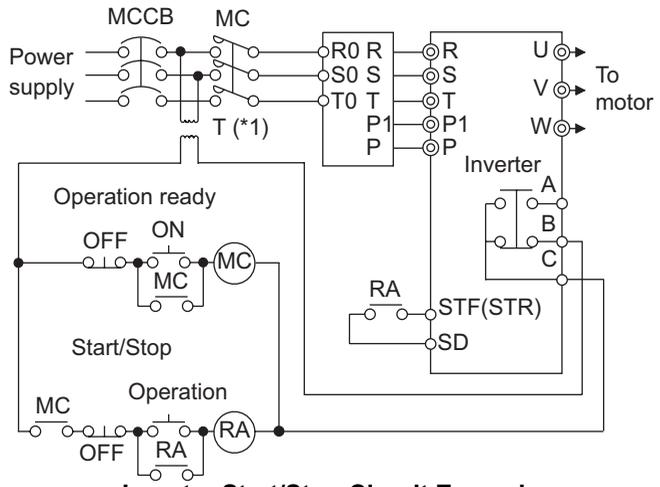
The inverter's input side MC is used for the above purpose, select class JEM1038-AC3 for the inverter input side current when making an emergency stop during normal operation.

REMARKS

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

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

- *1. When the power supply is 400V class, install a step-down transformer.



**Inverter Start/Stop Circuit Example
(with filter pack)**

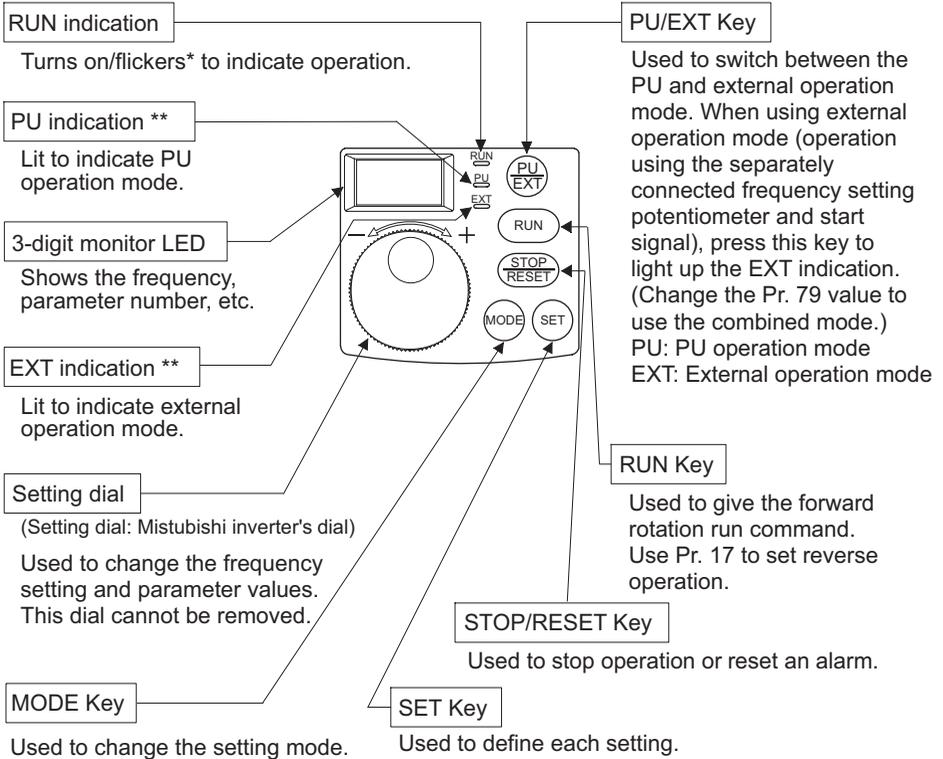
(2) Handling of output side magnetic contactor

In principle, do not provide a magnetic contactor between the inverter and motor and switch it from off to on during operation. If it is switched on during inverter operation, a large inrush current may flow, stopping the inverter due to overcurrent shut-off. When an MC is provided for switching to the commercial power supply, for example, switch it on/off after the inverter and motor have stopped.

4. RUN AND OPERATION

<Operation panel>

The operation panel cannot be removed from the inverter.



* RUN indication

On: Indicates that forward rotation operation is being performed.

Slow flickering (1.4s cycle): Indicates reverse rotation

Fast flickering (0.2s cycle): Indicates that operation is not being performed but the **(RUN)** was pressed or the start command was given.

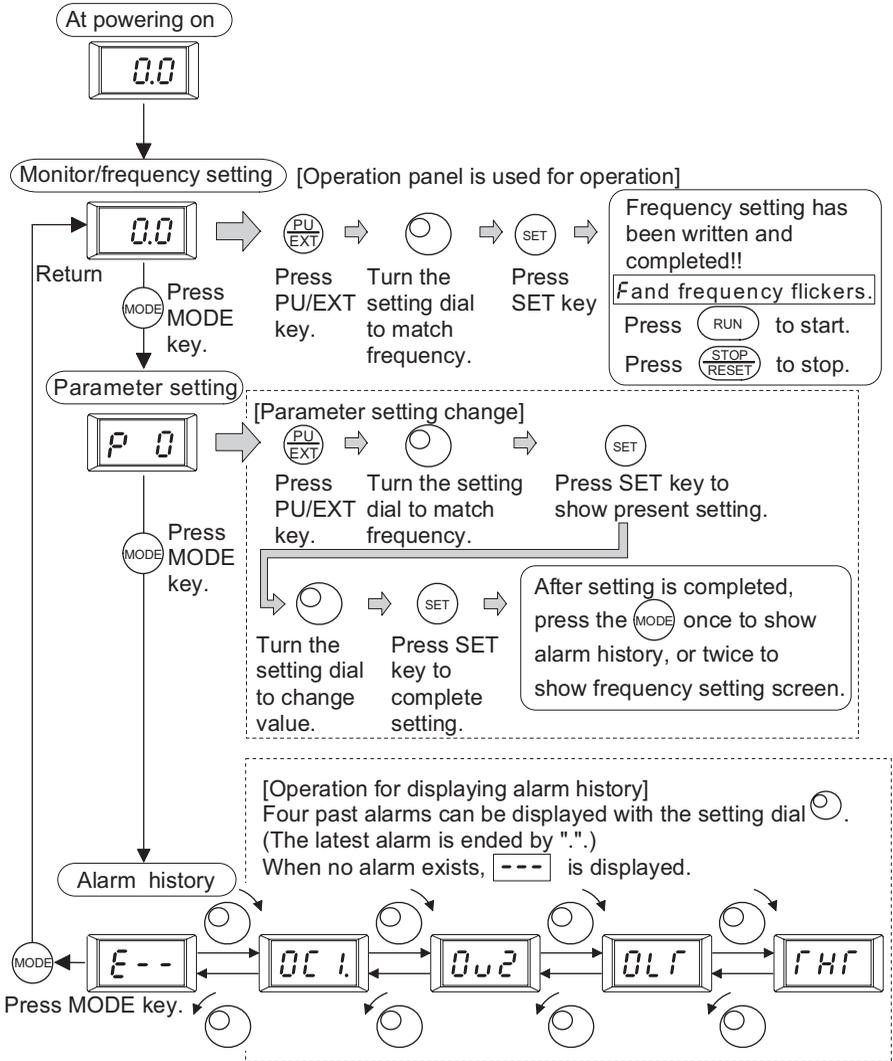
** PU/EXT indication

Flickers slowly in the computer link operation mode.

REMARKS

- When the parameter unit (FR-PU04) is used, operation from the operation panel is not accepted. (**(STOP/RESET)** is valid)

<Basic operation> (factory setting)



4.1 Setting the frequency to perform operation (example: performing operation at 30Hz)

POINT

- Set "0" (setting dial frequency setting mode) in Pr. 53 "frequency setting operation selection".

| Operation | Display |
|--|---|
| 1. Screen at power-on The monitor display appears. | |
| 2. Press the to choose PU operation mode. | → PU indication is lit. |
| 3. Turn the to show the frequency you want to set. Flickers for about 5s. | → Flickers for about 5s. |
| 4. While the value is flickering, press the to set the frequency. (If you do not press the , the value flickers for about 5s and the display then returns to 0.0 (monitor display). At this time, return to "step 3" and set the frequency again.) | → Flicker...Frequency setting complete!! |
| 5. After the value flickered for about 3s, the display returns to 0.0 (monitor display). Press the to start operation. | → 3s later |
| 6. To change the set frequency, perform the operation in above steps 3 and 4. (Starting from the previously set frequency.) | |
| 7. Press the to stop. | → |

? Operation cannot be performed at the set frequency ... Why?

- ☞ Did you carry out step 4 within 5s after step 3?

(Did you press the within 5s after turning the setting dial?)

? Setting of higher than 60Hz cannot be made ... Why?

- ☞ Check to see if the Pr. 1 "maximum frequency" setting is 60Hz.

? The frequency does not change by turning the setting dial ... Why?

- ☞ Check to see if the operation mode selected is external operation mode.

REMARKS

Pressing the setting dial shows the set frequency.



- The setting dial can also be used like a potentiometer to perform operation. (Refer to page 26.)

4.2 Using the setting dial like a potentiometer to perform operation

POINT

- Set "1" (extended function parameter valid) in Pr. 30 "extended function display selection".
- Set "1" (setting dial potentiometer mode) in Pr. 53 "frequency setting operation selection".

Operation example Changing the frequency from 0Hz to 60Hz during operation

Operation

1. Mode/monitor check.

- Choose monitor/frequency monitor. (MODE)
- The inverter must be in PU operation mode. (Press the PU/EXT.)
- Pr. 30 must be set to "1".
- Pr. 53 must be set to "1".

Display



2. Press the RUN to start the inverter.



3. Turn the clockwise until "60.0" appears. The flickering frequency is the set frequency.



Flickers for 3s.

You need not press the SET.

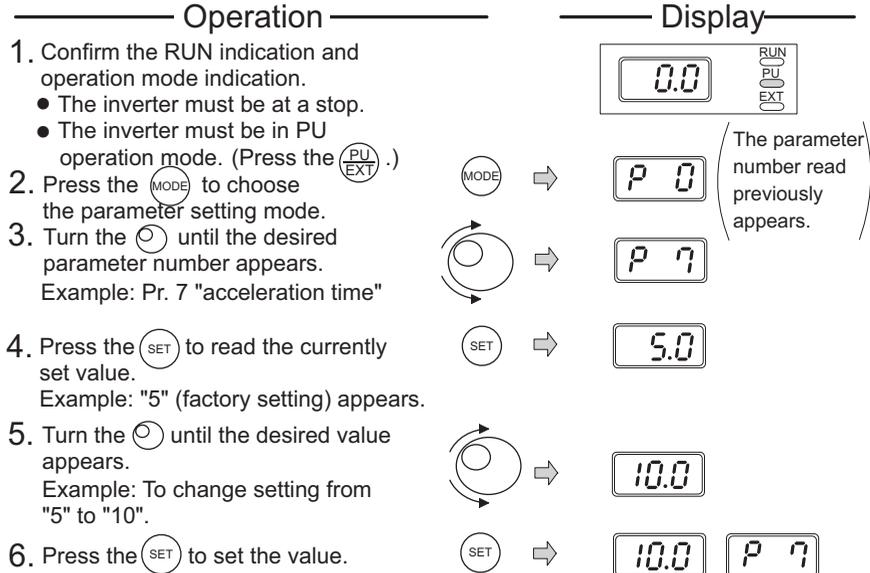
REMARKS

- If flickering "60.0" turns to "0.0", the Pr. 53 "frequency setting operation selection" setting may not be "1".
- Independently of whether the inverter is running or at a stop, the frequency can be set by merely turning the dial.

4.3 Setting the parameters

4.3.1 Example: Changing the Pr. 7 setting from "5s" to "10s"

(For parameter details, refer to the instruction manual (detailed).)



The parameter number read previously appears.

Flicker...Parameter setting complete!!

- By turning the , you can read another parameter.
- Press the  to show the setting again.
- Press the  twice to show the next parameter.

After parameter setting is complete, press the  once to show the alarm history or twice to return to the monitor display. To change the setting of another parameter, perform the operation in above steps 3 to 6.

? Error display?

-  Er-1 • If write was performed with "1" set in Pr. 77
- If the operation panel does not have the write precedence
-  Er-2 • If write was performed during operation
- If write was performed in the external operation mode

REMARKS

- If the setting has not been changed, the value does not flicker and the next parameter number appears.
- Either step 1 or 2 may be carried out first.
- Convenient usage

After carrying out steps 1 and 2 to choose the parameter setting mode, you can read a series of parameter numbers in due order every time you press the .

4.3.2 Example: Changing the Pr. 30 setting from "0" to "1"

(The extended parameters are made valid by setting "1" in Pr. 30 "extended function display selection". Refer to page 39 for the extended function parameter list and to the instruction manual (detailed) for details.)

| Operation | Display |
|--|---|
| <p>1. Confirm the RUN indication and operation mode indication. ● The inverter must be at a stop. ● The inverter must be in PU operation mode. (Press the .)</p> |  |
| <p>2. Press the  to choose the parameter setting mode.</p> |  →  |
| <p>3. Turn the  until P30 (Pr. 30) appears.</p> |  →  |
| <p>4. Press the  to read the currently set value. "0" (factory setting) appears.</p> |  →  |
| <p>5. Turn the  to change it to the set value of "1".</p> |  →  |
| <p>6. Press the  to set the value.</p> |  →  →  |

Flicker...Parameter setting complete!!

The parameter number read previously appears.

- By turning the , you can read another parameter.
- Press the  to show the setting again.
- Press the  twice to show the next parameter.

After parameter setting is complete, press the  once to show the alarm history or twice to return to the monitor display. To change the setting of another parameter, perform the operation in above steps 3 to 6.

? Error display?

-  Er 1 • If the operation panel does not have the write precedence
-  Er 2 • If write was performed during operation.
- If write was performed in the external operation mode

REMARKS

If the setting has not been changed, the value does not flicker and the next parameter number appears.

4.4 Clearing the parameters

POINT

- The clear parameter CLr is an extended parameter. Set "1" in Pr. 30 and turn the dial to show it. (Refer to page 28.)
- The parameters can be cleared by setting  "1" in CLr "parameter clear".

Operation ————— Display

1. Confirm the RUN indication and operation mode indication.

- The inverter must be at a stop.

- The inverter must be in PU operation mode. (Press the .)



2. Press the  to choose the parameter setting mode.



(The parameter number read previously appears.)

3. Turn the  until "CLr" appears.



- Pr. 30 must be set to "1"
(For details, refer to steps 3 to 6 on page 28 .)

4. Press the  to show "0"



5. Turn  to change it to "1".



6. Press the .



Flicker...Parameter setting complete!!

- By turning the , you can read another parameter.

- Press the  to show Pr. 0 ().

| CLr Setting | Definition |
|-------------|---|
| 0 | Not executed. |
| 1 | Parameter clear *1 (Calibration parameters C1 to C7 are not cleared.) |
| 10 | All clear *2 (All set values including those of calibration parameters C1 to C7 are returned to factory settings.) |

*1. Parameters are not cleared when "1" is set in Pr. 77 "parameter write disable selection", Pr. 75 "reset selection/PU stop selection", Pr. 38, Pr. 39, Pr. 53, Pr. 60 to Pr. 65, Pr. 99, maintenance parameters H1, H2, calibration parameters C1 to C7 and communication parameters n13, n 15 are not cleared.

*2. Pr. 75 "reset selection/PU stop selection", maintenance parameter H1 "maintenance timer" and communication parameter n13 "PU display language selection" are not cleared.

4.5 Monitoring the output current

POINT

The output current appears while the  is pressed in the monitor mode.

Operation

Display

1. Press the  to choose the output frequency monitor mode.



2. Independently of whether the inverter is running in any operation mode or at a stop, the output current appears while the  is pressed.



Hold down

 (1.0A)

3. Release the  to return to the output frequency monitor mode.





Remarks

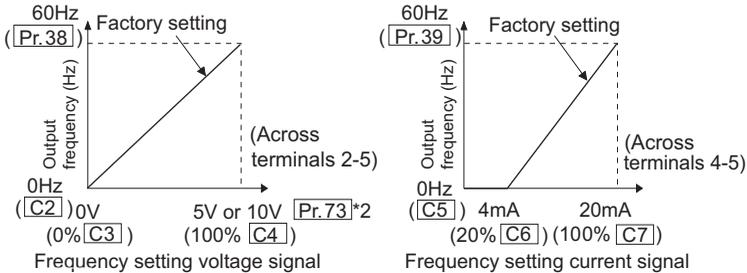
When Pr. 52 = "1", the output current is displayed in the monitor mode and the output frequency appears while the  is pressed.

5. ADJUSTMENT OF THE FREQUENCY SETTING POTENTIOMETER AND INDICATOR

●Related parameters

| Parameter | Name | Setting Range | Factory Setting |
|-----------|--|---------------|-----------------|
| 38 | Frequency setting voltage gain frequency | 1 to 120Hz | 60Hz |
| 39 | Frequency setting current gain frequency | 1 to 120Hz | 60Hz |
| C2 | Frequency setting voltage bias frequency | 0 to 60Hz | 0Hz |
| C3 | Frequency setting voltage bias | 0 to 300% | 0% *1 |
| C4 | Frequency setting voltage gain | 0 to 300% | 96% *1 |
| C5 | Frequency setting current bias frequency | 0 to 60Hz | 0Hz |
| C6 | Frequency setting current bias | 0 to 300% | 20% *1 |
| C7 | Frequency setting current gain | 0 to 300% | 100% *1 |

*1. Settings may differ because of calibration parameters.



*2. Pr. 73 "0-5V/0-10V selection" changes the specifications of terminal "2".

POINT

- Bias setting for 0 to 5VDC (0 to 10VDC) input ➔ Use the calibration parameter C2, C3 for setting
 - Gain setting for 0 to 5VDC (0 to 10VDC) input ➔ Use Pr. 38, calibration parameter C4 for setting.
 - Bias setting for 4 to 20mADC input ➔ Use the calibration parameter C5, C6 for setting.
 - Gain setting for 4 to 20mADC input ➔ Use Pr. 39, calibration parameter C7 for setting.
- For 4 to 20 mADC input, please turn the AU signal on.

5.1 Changing the output frequency setting of the frequency setting potentiometer (bias and gain of frequency setting voltage (current))

POINT

Pr. 38, Pr. 39 and calibration parameters "C1 to C7" can be made to be read by setting "1" (extended function parameter valid) in Pr. 30 "extended function display selection".

The bias/gain of the frequency setting voltage (current) may be adjusted in any of the following methods:

- (1) Changing the highest frequency
- (2) Adjusting the deviation of the highest frequency from the Pr. 38 (Pr. 39) setting
 - (2)-1) Make adjustment with a voltage applied across terminals 2-5 (with a current flowing across terminals 4-5)
 - (2)-2) Make adjustment at any point without a voltage applied across terminals 2-5 (without a current flowing across terminals 4-5) (For the setting method, refer to the instruction manual (detailed).)

Changing example

When you want to use the 0 to 5VDC input frequency setting potentiometer to change the 5V-time frequency from 60Hz (factory setting) to 50Hz.

POINT

- Pr. 38 is an extended function parameter. Pr. 30 must be set to "1". (Refer to page 28.)
- Change Pr. 38 "frequency setting voltage gain frequency" to 50Hz.

(1) Changing the highest frequency

| Operation | Display |
|---|---|
| 1. Confirm the RUN indication and operation mode indication. <ul style="list-style-type: none"> • The inverter must be at a stop. • The inverter must be in the PU operation mode. (Press the ) |  |
| 2. Press the  to choose the parameter setting mode. |  |
| 3. Turn the  until Pr. 38 "frequency setting voltage gain frequency" appears. <ul style="list-style-type: none"> • Pr. 30 must be set to "1" (Refer to steps 3 to 6 on page 28 for the parameter setting method.) |  |
| 4. Press the  to display the currently set value. (60Hz) |  |
| 5. Turn the  to change it to "50.0". (50Hz) |  |
| 6. Press the  to set the value. |  |

Flicker...Parameter setting complete!!

- By turning the , you can read another parameter.
- Press the  to show the setting again.
- Press the  twice to show the next parameter.

? **The monitor/frequency setting indication cannot be changed to just 50Hz ...Why?**

 The calibration parameter C4 "frequency setting voltage gain" value must be set. (Refer to page 34.)

REMARKS

To change the value to more than 60Hz, Pr. 1 "maximum frequency" must be set to more than 60Hz.

Changing example Changing the calibration parameter C4 "frequency setting voltage gain"

POINT

The calibration parameter C4 is an extended function parameter. Pr. 30 must be set to "1".

- (2) Adjusting a deviation of the highest frequency from the Pr. 38 (Pr. 39) setting.
 (2)-1) Making adjustment with a voltage applied directly across terminals 2-5 (with a current flowing across terminals 4-5)

Operation

1. Confirm the RUN indication and operation mode indication.
 - The inverter must be at a stop.
 - The inverter must be in PU operation mode. (Press the .)

Display



2. Press the to choose the parameter setting mode.



(The parameter number read previously appears.)

3. Turn the until "C . ." appears.



• Pr. 30 must be set to "1".
 (For details, refer to steps 3 to 6 on page 28.)

4. Press the to show "C - ".



When adjusting Pr. 38

5. Turn the until the calibration parameter C4 "frequency setting voltage gain" appears.



6. Press the to show the analog voltage value (%).



(Analog voltage value (%) across terminals 2-5)

7. Apply a 5V voltage.
 (Turn the external potentiometer connected to across terminals 2-5 to the maximum (any position).)



*The value is nearly 100 (%) in the maximum position of the potentiometer.

CAUTION

After performing operation in step 7, do not touch the until completion of calibration.

8. Press the to set the value.



Flicker ... Parameter setting complete!!
 (Adjustment complete)

*The value is nearly 100 (%) in the maximum position of the potentiometer.

- By turning the , you can read another parameter.
- Press the to return to the "C - " indication (step 4).
- Press the twice to show the next parameter (C L r).

? The frequency meter (indicator) connected to across terminals FM-SD does not indicate just 50Hz ... Why?

The calibration parameter C1 "FM terminal calibration" value must be set. (Refer to page 35.)

? When write is performed, an error (Er 3) is displayed.

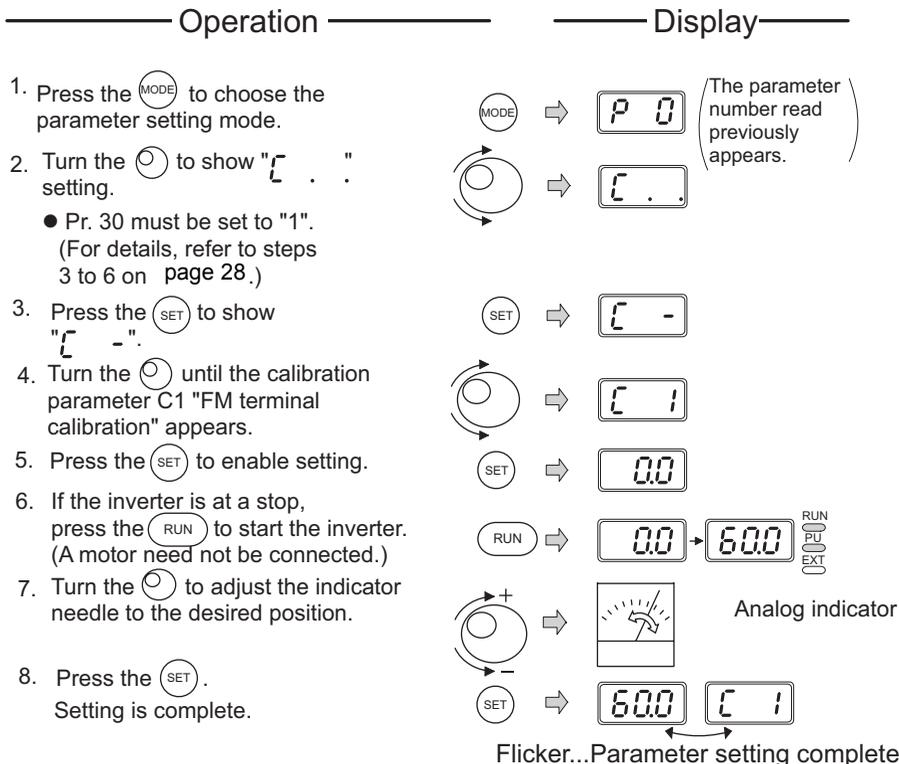
The gain and bias frequency settings are too close.

5.2 Adjustment (calibration) of the frequency meter (indicator)

Changing example Deflecting the meter (analog indicator) to full-scale (1mA) at the preset frequency of 60Hz.
(Refer to page 25 for frequency setting.)

POINT

- The calibration parameters "C1" can be made to be read by setting "1" (extended function parameter valid) in Pr. 30 "extended function display selection".
- Set the value of the calibration parameter C1 "FM terminal calibration".



Flicker...Parameter setting complete!!

- By turning the , you can read another parameter.
- Press the  to return to the "C -" indication (step 3).
- Press the  twice to show the next parameter (C L r).

REMARKS

- Depending on the set value, it may take some time for the needle to move.
- If "1" is set in Pr. 30 "extended function display selection", the calibration parameter C1 "FM terminal calibration" can also be set in external operation mode.

POINT

By setting the Pr. 54 "FM terminal function selection" value, preset Pr. 55 "frequency monitoring reference" or Pr. 56 "current monitoring reference" to the running frequency or current value at which the output signal is 1440 pulses/s. At 1440 pulses/s, the meter generally deflects to full-scale.

6. FUNCTION LIST

6.1 Basic function parameter list

| Parameter | Name | Indication | Setting Range | Minimum Setting Increments | Factory Setting | Customer Setting |
|-----------|-------------------------------------|------------|---------------|----------------------------|------------------------|------------------|
| 0 | Torque boost | P 0 | 0 to 15% | 0.1% | 6%/5%/4%/3%/2% *1 | |
| 1 | Maximum frequency | P 1 | 0 to 120Hz | 0.1Hz | 60Hz | |
| 2 | Minimum frequency | P 2 | 0 to 120Hz | 0.1Hz | 0Hz | |
| 3 | Base frequency | P 3 | 0 to 120Hz | 0.1Hz | 60Hz | |
| 4 | Multi-speed setting (high speed) | P 4 | 0 to 120Hz | 0.1Hz | 60Hz | |
| 5 | Multi-speed setting (middle speed) | P 5 | 0 to 120Hz | 0.1Hz | 30Hz | |
| 6 | Multi-speed setting (low speed) | P 6 | 0 to 120Hz | 0.1Hz | 10Hz | |
| 7 | Acceleration time | P 7 | 0 to 999s | 0.1s | 5s/15s*2 | |
| 8 | Deceleration time | P 8 | 0 to 999s | 0.1s | 10s/30s*2 | |
| 9 | Electronic thermal O/L relay | P 9 | 0 to 100A | 0.1A | Rated inverter current | |
| 30 | Extended function display selection | P30 | 0, 1 | 1 | 0 | |
| 79 | Operation mode selection | P79 | 0 to 4, 7, 8 | 1 | 0 | |

*1 Factory setting value differs according to the inverter capacity and voltage class.

<200V class>

0.4K to 3.7K: 6%, 5.5K, 7.5K: 4%, 11K, 15K: 3%

<400V class>

0.4K, 0.75K: 6%, 1.5K, 2.2K: 5%, 3.7K: 4%, 5.5K, 7.5K: 3%, 11K, 15K: 2%

*2 Factory setting value differs according to the inverter capacity.

Pr. 7 7.5K or less: 5s, 11K or more: 15s

Pr. 8 7.5K or less: 10s, 11K or more: 30s

REMARKS

- Setting "1" in Pr. 30 "extended function display selection" makes the extended function parameters valid. (Refer to page 28.)
- The decimal places of a value of 100 or more (3 digits or more) cannot be set to be displayed.

6.2 Explanation of the basic function parameters

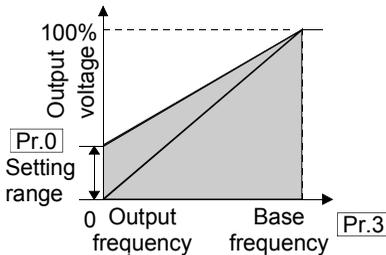
For details, refer to the separately available instruction manual (detailed).

Pr. 0 "torque boost"

- Allows the motor torque in the low speed range to be adjusted according to the load. Make adjustment when stall prevention is operated when starting.
- When a constant-torque motor is used, set the following value:

| | | | | | | |
|------------|----------------|------------|------------|------------|---------------|-------------|
| | 0.4K, 0.75K | 1.5K | 2.2K | 3.7K | 5.5K, 7.5K | 11K, 15K |
| 200V class | 6% | 4% (6%) | | | 3% (4%) | 2% (3%) |
| 400V class | 6% | 4% (5%) | 3% (5%) | 3% (4%) | 2% (3%) | 2% |

Values in parenthesis are factory-set



CAUTION

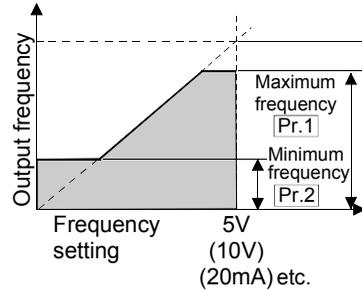
- A too large setting may cause the motor to overheat or result in an overcurrent trip. The guideline is about 10% at the greatest.

Pr. 3 "base frequency"

- Set the base frequency (reference frequency at rated motor torque) within the range 0 to 120Hz according to the motor.
- Check the motor rating plate. If a frequency given on the rating plate is "50Hz" only, always set Pr. 3 "Base frequency" to "50Hz". Leaving the base frequency unchanged from "60Hz" may make the voltage low and the torque insufficient. It may result in an inverter trip (E.OC□) due to overload. If the frequency given on the rating plate is both "50Hz/60Hz", always set Pr. 3 "Base frequency" to "60Hz".

Pr. 1 "maximum frequency", Pr. 2 "minimum frequency"

- Clamp the upper and lower limits of the output frequency.



Pr. 4 "multi-speed setting (high speed)" Pr. 5 "multi-speed setting (middle speed)" Pr. 6 "multi-speed setting (low speed)"

- You can select any speed (RH, RM, RL) by simply switching the external contact signal.

| | | | |
|--------------|-----|-----|-----|
| | RH | RM | RL |
| high-speed | ON | OFF | OFF |
| middle speed | OFF | ON | OFF |
| low speed | OFF | OFF | ON |

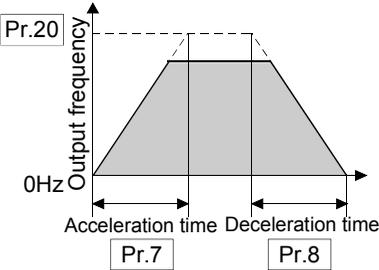
- Each speed (frequency) can be set to any value within the range 0 to 120Hz if the inverter is running.
- The extended functions enable setting of up to 15 speeds.

CAUTION

The RL signal needs to be assigned with Pr. 60 and Pr. 63.

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

- As the acceleration time, set the time taken to reach the acceleration/deceleration reference frequency in Pr. 20 from 0Hz (factory set to 60Hz), and as the deceleration time, set the time taken to reach 0Hz from the Pr. 20 value (factory set to 60Hz).



Pr. 9 "electronic thermal O/L relay"

- You can set a current value for protection of the motor from overheating. Normally, set the rated motor current at 50Hz as it is.
- At the setting of 0A, motor protection does not function. (The output transistor protection of the inverter functions.)
- When connecting multiple motors to the inverter, provide external thermal relays to individual motors.
- For the 0.75K or less, this value is factory-set to 85% of the rated inverter current.

Pr. 30 "extended function display selection"

- Set this parameter when showing/setting the extended function parameters.

| Setting | Definition |
|---------|-------------------------------------|
| 0 | Only basic functions are displayed. |
| 1 | All parameters are displayed. |

Pr. 79 "operation mode selection"

- The inverter has two different operation modes: operation under control of external command signals and operation from the PU (setting dial, ) . You can use either or both operation modes.

| Setting | Definition | |
|---------|--|---|
| 0 | PU (setting dial, ) operation or external operation can be selected by the  . | |
| 1 | PU (setting dial, ) operation may be performed. | |
| 2 | Only external operation may be performed. | |
| 3 | Frequency command | Start command |
| | <ul style="list-style-type: none"> • Setting made by the setting dial • Multi-speed selection • 4 to 20mA (Made valid when the AU signal turns on) | External terminal (STF/STR) |
| 4 | Frequency command | Start command |
| | External terminal signals (multi-speed, 0 to 5VDC, etc.) |  |
| 7 | PU operation interlock (Switching to the PU operation mode is enabled/disabled by turning the MRS signal ON/OFF) | |
| 8 | Operation mode external signal switching (disabled during operation) Turn the X16 signal ON/OFF to choose operation mode. | |

6.3 Extended function parameter list

Setting "1" in Pr. 30 "extended function display selection" makes the extended function parameters valid. (Refer to the separately available instruction manual (detailed).)

| Parameter | | Name | Description | Factory Setting | | | |
|---|------------|--|---|-----------------|--------------------------|------------------------|--------------------------------------|
| | Indication | | | | | | |
| For parameters 0 to 9, refer to the basic function parameters. (page 36.) | | | | | | | |
| 10 | P 10 | DC injection brake operation frequency | Set the timing of switching to DC injection brake (0 to 120Hz), the time to apply DC injection brake (0 to 10s), and the braking torque at DC injection brake start (0 to 15%). Factory setting value of DC injection brake voltage (Pr. 12) differs according to the inverter capacity. Set values in the table below when a constant-torque motor is used. | 3Hz | | | |
| 11 | P 11 | DC injection brake operation time | | 0.5s | | | |
| 12 | P 12 | DC injection brake voltage | | 4%/2% | | | |
| | | | | | Inverter Capacity | Factory Setting | Constant Torque Motor Setting |
| | | | | | 0.4K to 3.7K | 4% | 4% (without change) |
| | | | | | 5.5K, 7.5K | 4% | 2% |
| 11K, 15K | 2% | 2% (without change) | | | | | |
| 13 | P 13 | Starting frequency | Frequency which is output by the inverter first at a start and gives great influence to the starting torque. About 1 to 3Hz for vertical lift applications, or up to 5Hz to the maximum. For other than vertical lift applications, factory setting of about 0.5Hz is recommended. 0 to 60Hz | 0.5Hz | | | |
| 14 | P 14 | Load pattern selection | Choose the output frequency and output voltage patterns according to the application (load characteristic). 0: For constant-torque loads (when relatively large torque is needed at low to high speeds) 1: For variable-torque loads (for applications where torque is small at low speed, e.g. fans and pumps) 2: For vertical lifts (for elevators at reverse rotation boost of 0%) 3: For vertical lifts (for elevators at forward rotation boost of 0%) | 1 | | | |

| Parameter | Indication | Name | Description | Factory Setting | | | | | | | | | | | | | | | | | | | | |
|-----------|------------|--|---|-----------------|----|----|----|---------|-----|----|----|---------|----|-----|----|---------|----|----|-----|---------|----|----|----|-----|
| | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | P15 | Jog frequency | Speed command (0 to 120Hz) and acceleration/deceleration slope (0 to 999s) for jog (inching) operation | 5Hz | | | | | | | | | | | | | | | | | | | | |
| 16 | P16 | Jog acceleration/deceleration time | When the FR-PU04 is connected, these parameters can be read as the basic parameters. | 0.5s | | | | | | | | | | | | | | | | | | | | |
| 17 | P17 | RUN key rotation direction selection | The  of the operation panel can be used to choose the direction of rotation for operation. 0: Forward rotation, 1: Reverse rotation | 0 | | | | | | | | | | | | | | | | | | | | |
| 19 | P19 | Base frequency voltage | Indicates the magnitude of the output voltage at the base frequency (Pr.3) 888: 95% of power supply voltage ---: Same as power supply voltage 0 to 800V, 888, --- | --- | | | | | | | | | | | | | | | | | | | | |
| 20 | P20 | Acceleration/deceleration base frequency | Indicates the frequency to be referenced for acceleration from or deceleration to 0Hz in the time set in Pr. 7 "acceleration time" or Pr. 8 "deceleration time". 1 to 120Hz | 60Hz | | | | | | | | | | | | | | | | | | | | |
| 21 | P21 | Stall prevention function selection | Stall prevention is a function designed to suspend a frequency increase during acceleration, decrease frequency during constant speed or suspend a frequency decrease during deceleration if the preset current (0 to 150%) is exceeded, in order to prevent an overcurrent alarm. | 0 | | | | | | | | | | | | | | | | | | | | |
| 22 | P22 | Stall prevention operation level | Pr. 21 allows you to select whether to use stall prevention or not according to the acceleration/deceleration status. Since the high response current limit value is 140%, torque will not be developed if Pr. 22 is set to more than 140%. In that case, set "1" in Pr. 21. | 120% | | | | | | | | | | | | | | | | | | | | |
| 23 | P23 | Stall prevention operation level compensation factor at double speed | Used to reduce the stall prevention level at or above the base frequency. Setting other than "---" specifies the current level at 120Hz which is lower than the Pr. 22 value of the stall prevention level at base frequency. 0 to 200%, --- | --- | | | | | | | | | | | | | | | | | | | | |
| 24 | P24 | Multi-speed setting (speed4) | Setting other than "---" specifies speeds 4 to 7. | --- | | | | | | | | | | | | | | | | | | | | |
| 25 | P25 | Multi-speed setting (speed 5) | By combining ON and OFF of the contact signals (RH, RM, RL signals), the running speed can be changed step-by-step. | --- | | | | | | | | | | | | | | | | | | | | |
| 26 | P26 | Multi-speed setting (speed 6) | <table border="1" data-bbox="554 1364 789 1492"> <thead> <tr> <th></th> <th>RH</th> <th>RM</th> <th>RL</th> </tr> </thead> <tbody> <tr> <td>Speed 4</td> <td>OFF</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>Speed 5</td> <td>ON</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>Speed 6</td> <td>ON</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>Speed 7</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table> | | RH | RM | RL | Speed 4 | OFF | ON | ON | Speed 5 | ON | OFF | ON | Speed 6 | ON | ON | OFF | Speed 7 | ON | ON | ON | --- |
| | RH | RM | | RL | | | | | | | | | | | | | | | | | | | | |
| Speed 4 | OFF | ON | ON | | | | | | | | | | | | | | | | | | | | | |
| Speed 5 | ON | OFF | ON | | | | | | | | | | | | | | | | | | | | | |
| Speed 6 | ON | ON | OFF | | | | | | | | | | | | | | | | | | | | | |
| Speed 7 | ON | ON | ON | | | | | | | | | | | | | | | | | | | | | |
| 27 | P27 | Multi-speed setting (speed 7) | 0 to 120Hz, --- | --- | | | | | | | | | | | | | | | | | | | | |

| Parameter | Indication | Name | Description | Factory Setting |
|--|------------|---|--|-----------------|
| | | | | |
| 28 | P28 | Stall prevention operation reduction starting frequency | You can reduce the stall prevention level in the high frequency range. 0 to 120Hz | 60Hz |
| 29 | P29 | Acceleration/ deceleration pattern | Determines the frequency changing pattern for acceleration/deceleration. 0: Linear acceleration/deceleration 1: S-pattern acceleration/deceleration A (e.g. machine tool spindle applications) 2: S-pattern acceleration/deceleration B (for prevention of load shifting in conveyor and other applications.) | 0 |
| For parameter 30, refer to the basic function parameters. (page 36.) | | | | |
| 31 | P31 | Frequency jump 1A | Set the frequency range you want to evade during constant-speed operation to avoid resonance with a machine. 0 to 120Hz, - - - | - - - |
| 32 | P32 | Frequency jump 1B | | - - - |
| 33 | P33 | Frequency jump 2A | | - - - |
| 34 | P34 | Frequency jump 2B | | - - - |
| 35 | P35 | Frequency jump 3A | | - - - |
| 36 | P36 | Frequency jump 3B | | - - - |
| 37 | P37 | Speed display | You can convert the frequency monitor/set frequency of the operation panel into the load speed and display it. Setting 0 shows the output frequency, and setting 0.1 to 999 shows the load speed. (Set the speed for 60Hz operation.) 0, 0.1 to 999 | 0 |
| 38 | P38 | Frequency setting voltage gain frequency | You can set as desired the magnitude (slope) of the output frequency to the external frequency setting voltage signal (0 to 5V or 0 to 10V). 1 to 120Hz | 60Hz |
| 39 | P39 | Frequency setting current gain frequency | You can set as desired the magnitude (slope) of the output frequency to the external frequency setting current signal (4 to 20mA). 1 to 120Hz | 60Hz |
| 40 | P40 | Start-time earth (ground) fault detection selection | Set whether an earth (ground) fault is to be detected or not at a start. 0: Not detected 1: Detected | 0 |

| Parameter | | Name | Description | Factory Setting |
|------------|-----|--|---|-----------------|
| Indication | | | | |
| 41 | P41 | Up-to-frequency | You can adjust the ON range of the up-to-frequency signal (SU) to be output when the output frequency reaches the running frequency. You can use this function to ensure that the running frequency has been reached or use it as the operation start signal etc. for related equipment. Use Pr. 64 or Pr. 65 to assign the terminal used for SU signal output. 0 to 100% | 10% |
| 42 | P42 | Output frequency detection | Set the reference value at which the signal (FU) is output when the output frequency rises to or above a certain value. This function can be used for electromagnetic brake operation, open signal, etc. Use Pr. 64 or Pr. 65 to assign the terminal used for the FU signal. 0 to 120Hz | 6Hz |
| 43 | P43 | Output frequency detection for reverse operation | Set the reference value at which the signal (FU) is output when the output frequency rises to or above a certain value. This function is valid for reverse operation. 0 to 120Hz, --- | --- |
| 44 | P44 | Second acceleration/ deceleration time | Second function of the acceleration/ deceleration time set in Pr. 7, Pr. 8. 0 to 999s | 5s |
| 45 | P45 | Second deceleration time | Second function for the deceleration time set in Pr. 8. 0 to 999s, --- | --- |
| 46 | P46 | Second torque boost | Second function for the torque boost set in Pr. 0. 0 to 15%, --- | --- |
| 47 | P47 | Second V/F (base frequency) | Second function for the base frequency set in Pr. 3 0 to 120Hz, --- | --- |
| 48 | P48 | Output current detection level | Set the level at which the output current detection signal (Y12) is output. 0 to 150% | 120% |
| 49 | P49 | Output current detection signal delay time | When the output current is at or above the output current detection level (Pr. 48) for longer than this period (Pr. 49), the output current detection signal (Y12) is output. 0 to 10s | 0s |

| Parameter | Indication | Name | Description | Factory Setting |
|-----------|------------|--|---|------------------------|
| | | | | |
| 50 | P50 | Zero current detection level | Set the level at which the zero current detection signal (Y13) is output. 0 to 150% | 5% |
| 51 | P51 | Zero current detection period | When the output current is at or below the zero current detection level (Pr. 50) for longer than this period (Pr. 51), the zero current detection signal (Y13) is output. 0.05 to 1s | 0.5s |
| 52 | P52 | Operation panel display data selection | You can choose the data displayed on the operation panel. 0: Output frequency 1: Output current 100: Set frequency during stop/output frequency during operation | 0 |
| 53 | P53 | Frequency setting operation selection | You can use the setting dial like a potentiometer to perform operation. 0: Setting dial frequency setting mode 1: Setting dial potentiometer mode | 0 |
| 54 | P54 | FM terminal function selection | You can choose the indicator connected to the FM terminal. 0: Output frequency monitor 1: Output current monitor | 0 |
| 55 | P55 | Frequency monitoring reference | Set the reference value of frequency monitoring. 0 to 120Hz | 60Hz |
| 56 | P56 | Current monitoring reference | Set the reference value of current monitoring. 0 to 100A | Rated inverter current |

| Parameter | | Name | Description | Factory Setting |
|------------|-----|-----------------------------------|--|-----------------|
| Indication | | | | |
| 57 | P57 | Restart coasting time | At power restoration after an instantaneous power failure, you can restart the inverter without motor being stopped (with the motor coasting). The inverter begins to restart after this period (Pr. 57) has elapsed after power restoration. When you set "--", a restart is not made. "0" setting generally does not pose a problem but you can adjust the time (0 to 5s, ---) according to the magnitude of the load. | --- |
| 58 | P58 | Restart cushion time | When the restart coasting time (Pr. 57) has elapsed, the output voltage is risen gradually. Set this cushion time (Pr. 58) (0 to 60s). Operation may be performed generally at the factory setting, but you can adjust the time according to the magnitude of the load. <div style="text-align: center;">CAUTION</div> Keep the starting signal (STF/STR) on during instantaneous power failure when using automatic restart after instantaneous power failure function (Pr. 57 ≠ ---). If the starting signal turns off during instantaneous power failure, the inverter starts at 0Hz. | 1s |
| 59 | P59 | Remote setting function selection | You can set the remote setting function which is used when the operation panel is away from the enclosure, for example. 0: Without remote setting function 1: With remote setting function With frequency setting storage function 2: With remote setting function Without frequency setting storage function | 0 |
| 60 | P60 | AU terminal function selection | You can select the following input signals. 0: RL (multiple low-speed run command) 1: RM (multiple middle-speed run command) 2: RH (multiple high-speed run command) 3: RT (second function selection) 4: AU (current input selection) 5: STOP (start self-holding selection) 6: MRS (output stop) 7: OH (external thermal relay input) 8: REX (15 multi-speed selection) 9: JOG (jog operation selection) 10: RES (reset) 14: X14 (PID control valid terminal) 16: X16 (PU operation/external operation switching) ---: STR (reverse rotation start (may be assigned to only STR terminal)) | 4 |
| 61 | P61 | RM terminal function selection | | 1 |
| 62 | P62 | RH terminal function selection | | 2 |
| 63 | P63 | STR terminal function selection | | --- |

| Parameter | | Name | Description | Factory Setting |
|------------|-----|---------------------------------------|---|-----------------|
| Indication | | | | |
| 64 | P54 | RUN terminal function selection | You can select the following input signals. 0: RUN (inverter running) 1: SU (up-to-frequency) 3: OL (overload warning) 4: FU (output frequency detection) 11: RY (operation ready) 12: Y12 (output current detection) 13: Y13 (zero current detection) 14: FDN (PID lower limit signal) 15: FUP (PID upper limit signal) 16: RL (PID forward/reverse rotation signal) | 0 |
| 65 | P55 | A, B, C terminal function selection | 95: Y95 (maintenance timer alarm) 98: LF (minor failure output) 99: ABC (alarm output) | 99 |
| 66 | P56 | Retry selection | You can choose the retry alarm to be activated when the protective function is activated. 0: OC1 to 3, OV1 to 3, THM, THT, GF, OHT, OLT, PE, OPT 1: OC1 to 3, 2: OV1 to 3, 3: OC1 to 3, OV1 to 3 | 0 |
| 67 | P57 | Number of retries at alarm occurrence | You can set the number of retries to be made when the protective function is activated. 0: No retry 1 to 10: Without alarm output during retry operation 101 to 110: With alarm output during retry operation | 0 |
| 68 | P58 | Retry waiting time | You can set the waiting time from when the protective function is activated until a retry is made. 0.1 to 360s | 1s |
| 69 | P59 | Retry count display erase | You can display the cumulative number of successful restarts made by retries when the protective function is activated. 0: Cumulative count erase | 0 |

| Parameter | | Name | Description | Factory Setting | | | | | | | | | | | | | | | |
|------------|---|---|--|-----------------|-------------------|-------------------|---|------------------|---|---|---|---------|------------------|---------|------|---|------|------|----|
| Indication | | | | | | | | | | | | | | | | | | | |
| 70 | P70 | Soft-PWM setting | <p>You can select whether to exercise Soft-PWM control and long wiring mode. When Soft-PWM is valid, you can change the metallic motor tone into an unoffending complex tone. Surge voltage is suppressed regardless of wiring length if the long wiring mode is set for the 400V class.</p> <table border="1"> <thead> <tr> <th></th> <th>Soft-PWM</th> <th>Long Wiring Mode</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>without</td> <td>without</td> </tr> <tr> <td>1</td> <td>with</td> <td>without</td> </tr> <tr> <td>10</td> <td>without</td> <td>with</td> </tr> <tr> <td>11</td> <td>with</td> <td>with</td> </tr> </tbody> </table> <p>When Pr. 72 "PWM frequency selection" = 1 or more, the PWM carrier frequency is constant at 1kHz. (When "0" is set, the PWM carrier frequency is constant at 0.7kHz.)</p> | | Soft-PWM | Long Wiring Mode | 0 | without | without | 1 | with | without | 10 | without | with | 11 | with | with | 11 |
| | | | | Soft-PWM | Long Wiring Mode | | | | | | | | | | | | | | |
| 0 | without | without | | | | | | | | | | | | | | | | | |
| 1 | with | without | | | | | | | | | | | | | | | | | |
| 10 | without | with | | | | | | | | | | | | | | | | | |
| 11 | with | with | | | | | | | | | | | | | | | | | |
| 71 | P71 | <p>Applied motor</p> <p>Set the motor to be used. 0: Thermal characteristic for Mitsubishi standard motor 1: Thermal characteristic for Mitsubishi constant-torque motor</p> | 0 | | | | | | | | | | | | | | | | |
| 72 | P72 | <p>PWM frequency selection</p> <p>You can change the PWM carrier frequency. Increasing this value reduces the motor audible noise, but increases noise and leakage current. The setting is in [kHz]. 0: 0.7kHz, 15: 14.5kHz 0 to 15 (Remarks) Metallic sound may be generated from the motor at sudden deceleration but it is not a fault.</p> | 1 | | | | | | | | | | | | | | | | |
| 73 | P73 | <p>0-5V/0-10V selection</p> <p>You can set the input voltage specification of terminal "2". 0: For 0 to 5VDC input 1: For 0 to 10VDC input</p> | 0 | | | | | | | | | | | | | | | | |
| 74 | P74 | <p>Input filter time constant</p> <p>Valid for eliminating noise of the frequency setting circuit. A larger set value increases the time constant. 0 to 8</p> | 1 | | | | | | | | | | | | | | | | |
| 75 | P75 | Reset selection/PU stop selection | <p>You can choose the function of the  on the operation panel.</p> <table border="1"> <thead> <tr> <th></th> <th>Reset Input</th> <th>PU Stop Key Input</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Normally enabled</td> <td rowspan="2">Invalid (Valid only in the PU operation mode or combined operation mode (Pr. 79=4))</td> </tr> <tr> <td>1</td> <td>Reset input is enabled only when the protective function is activated</td> </tr> <tr> <td>14</td> <td>Normally enabled</td> <td rowspan="2">Valid</td> </tr> <tr> <td>15</td> <td>Reset input is enabled only when the protective function is activated</td> </tr> </tbody> </table> | | Reset Input | PU Stop Key Input | 0 | Normally enabled | Invalid (Valid only in the PU operation mode or combined operation mode (Pr. 79=4)) | 1 | Reset input is enabled only when the protective function is activated | 14 | Normally enabled | Valid | 15 | Reset input is enabled only when the protective function is activated | 14 | | |
| | | | | Reset Input | PU Stop Key Input | | | | | | | | | | | | | | |
| 0 | Normally enabled | Invalid (Valid only in the PU operation mode or combined operation mode (Pr. 79=4)) | | | | | | | | | | | | | | | | | |
| 1 | Reset input is enabled only when the protective function is activated | | | | | | | | | | | | | | | | | | |
| 14 | Normally enabled | Valid | | | | | | | | | | | | | | | | | |
| 15 | Reset input is enabled only when the protective function is activated | | | | | | | | | | | | | | | | | | |

| Parameter | Indication | Name | Description | Factory Setting | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|------------|---------------------------------------|---|-----------------|--|----|----|----|-----|---------|-----|-----|-----|----|---------|-----|-----|----|----|----------|-----|----|-----|----|----------|-----|----|----|----|----------|----|-----|-----|----|----------|----|-----|----|----|----------|----|----|-----|----|----------|----|----|----|----|
| 76 | P76 | Cooling fan operation selection | You can control the operation of the cooling fan built in the inverter. (Operates in power-on status.) 0: The fan normally operates at power on of the inverter. 1: The fan is normally on during inverter operation. The fan switches on/off according to the temperature during a stop of the inverter whose status is monitored. | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 77 | P77 | Parameter write disable selection | You can choose whether to enable or disable parameter write. 0: Write is enabled only during a stop in PU operation mode 1: Write disabled (except some parameters) 2: Write during operation enabled (external mode and during operation) | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 78 | P78 | Reverse rotation prevention selection | You can prevent trouble during reverse operation due to false input of the start signal. 0: Both forward rotation and reverse rotation enabled 1: Reverse rotation disabled 2: Forward rotation disabled | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| For parameter 79, refer to the basic function parameters. (page 36.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 80 | P80 | Multi-speed setting (speed 8) | Setting other than "-" specifies speeds 8 to 15. By combining ON and OFF of the contact signals (RH, RM, RL, REX signals), the running speed can be changed step-by-step. Use Pr. 60 and Pr. 63 to assign the RL and REX signal. | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 81 | P81 | Multi-speed setting (speed 9) | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 82 | P82 | Multi-speed setting (speed 10) | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 83 | P83 | Multi-speed setting (speed 11) | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 84 | P84 | Multi-speed setting (speed 12) | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 85 | P85 | Multi-speed setting (speed 13) | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 86 | P86 | Multi-speed setting (speed 14) | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 87 | P87 | Multi-speed setting (speed 15) | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>RH</th> <th>RM</th> <th>RL</th> <th>REX</th> </tr> </thead> <tbody> <tr> <td>Speed 8</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>Speed 9</td> <td>OFF</td> <td>OFF</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>Speed 10</td> <td>OFF</td> <td>ON</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>Speed 11</td> <td>OFF</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>Speed 12</td> <td>ON</td> <td>OFF</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>Speed 13</td> <td>ON</td> <td>OFF</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>Speed 14</td> <td>ON</td> <td>ON</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>Speed 15</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table> | | | | | | RH | RM | RL | REX | Speed 8 | OFF | OFF | OFF | ON | Speed 9 | OFF | OFF | ON | ON | Speed 10 | OFF | ON | OFF | ON | Speed 11 | OFF | ON | ON | ON | Speed 12 | ON | OFF | OFF | ON | Speed 13 | ON | OFF | ON | ON | Speed 14 | ON | ON | OFF | ON | Speed 15 | ON | ON | ON | ON |
| | RH | RM | RL | REX | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Speed 8 | OFF | OFF | OFF | ON | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Speed 9 | OFF | OFF | ON | ON | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Speed 10 | OFF | ON | OFF | ON | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Speed 11 | OFF | ON | ON | ON | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Speed 12 | ON | OFF | OFF | ON | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Speed 13 | ON | OFF | ON | ON | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Speed 14 | ON | ON | OFF | ON | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Speed 15 | ON | ON | ON | ON | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 88 | P88 | PID action selection | Used to choose the operation of PID control. 20: PID reverse action, 21: PID forward action | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 89 | P89 | PID proportional band | Used to set the proportional band for PID control. 0.1 to 999%, --- | 100% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 90 | P90 | PID integral time | Used to set the integral time for PID control. 0.1 to 999s, --- | 1s | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 91 | P91 | PID upper limit | Used to set the upper limit value for PID control. 0 to 100%, --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Extended function parameter list

| Parameter | | Name | Description | Factory Setting |
|-----------|------------|---|--|-----------------|
| | Indication | | | |
| 92 | P92 | PID lower limit | Used to set the lower limit value for PID control. 0 to 100%, --- | --- |
| 93 | P93 | PID action set point for PU operation | Used to set the PID action set point for PU operation. 0 to 100% | 0% |
| 94 | P94 | PID differential time | Used to set the differential time for PID control. 0.01 to 10s, --- | --- |
| 95 | P95 | Rated motor slip | Used to set the rated motor slip to make slip compensation. 0 to 50%, --- | --- |
| 96 | P96 | Slip compensation time constant | Used to set the response time of slip compensation. 0.01 to 10s | 0.5s |
| 97 | P97 | Constant-power range slip compensation selection | Used to choose whether slip compensation is made or not in the constant-power range. 0, --- | --- |
| 98 | P98 | Automatic torque boost selection (Motor capacity) | You can set the motor capacity and exercise automatic torque boost control. When you set "---", V/F control is exercised. Set the motor capacity used. <ul style="list-style-type: none"> • The motor capacity should be equal to or one rank lower than the inverter capacity. • The number of motor poles should be 2, 4 or 6. (Only 4 poles for constant-torque motor) • Single-motor operation (one motor run by one inverter) should be performed. • Wiring length from inverter to motor should be within 30m. When using a constant-torque motor, set "1" in Pr. 71. <Example> For 1.5kW, set "1.5". 0.2 to 15kW, --- | --- |
| 99 | P99 | Motor primary resistance | You can set the motor's primary resistance value. (Normally, this parameter need not be set.) 0 to 50Ω, --- | --- |

●Maintenance parameters

| Parameter | | Name | Description | Factory Setting |
|-----------|------------|---|--|-----------------|
| | Indication | | | |
| H1 | <i>H 1</i> | Maintenance timer | Display the maintenance timer (cumulative energization time) in 1000h increments. Parameter write is not enabled. 0 to 999 | 0 |
| | (503) | | | |
| H2 | <i>H 2</i> | Maintenance timer alarm output set time | When the maintenance timer has elapsed the time set in H2, the Y95 signal is output. Assign the Y95 signal with Pr. 64 or Pr. 65. 0 to 999, --- | 87 (87000h) |
| | (504) | | | |
| H8 | <i>H 8</i> | Output phase failure protection selection | You can select whether to enable/disable the output phase failure protection function that stops the inverter output if one of the inverter output side (load side) three phases (U, V, W) opens at motor start. 0:Without output phase failure protection 1:With output phase failure protection | 0 |
| | (251) | | | |

● Calibration parameter

| Parameter | | Name | Description | Factory Setting |
|------------|------------|---|---|-----------------|
| | Indication | | | |
| C1 | [1 | FM terminal calibration | You can calibrate the indicator connected to across terminals FM-SD. — | — |
| | (900) | | | |
| C2 | [2 | Frequency setting voltage bias frequency | You can set as desired the magnitude (slope) of the output frequency to the external frequency setting voltage signal (0 to 5V or 0 to 10V). (Bias frequency) 0 to 60Hz | 0Hz |
| | (902) | | | |
| C3 | [3 | Frequency setting voltage bias | Used to adjust the analog voltage value of the frequency set in calibration parameter C2. (Bias %) 0 to 300% | 0%* |
| | (902) | | | |
| C4 | [4 | Frequency setting voltage gain | Used to adjust the analog voltage value of the frequency set in Pr. 38. (Gain %) 0 to 300% | 96%* |
| | (903) | | | |
| C5 | [5 | Frequency setting current bias frequency | You can set as desired the magnitude (slope) of the output frequency to the external frequency setting current signal (4 to 20mA). 0 to 60Hz | 0Hz |
| | (904) | | | |
| C6 | [6 | Frequency setting current bias | Used to adjust the analog current value of the frequency set in calibration parameter C5. (Bias %) 0 to 300% | 20%* |
| | (904) | | | |
| C7 | [7 | Frequency setting current gain | Used to adjust the analog current value of the frequency set in Pr. 39 (Gain %) 0 to 300% | 100%* |
| | (905) | | | |
| C8 | [8 | Parameter for manufacturer setting. Do not set. | | |
| | (269) | | | |
| CLr | [L r | Parameter clear | 0: Not executed 1: Initialization of parameters other than calibration values (parameter clear) 10: Initialization of parameters including calibration values (all clear) | 0 |
| ECL | [E L | Alarm history clear | 0: Not cleared 1: Alarm history clear | 0 |

*Settings may differ because of calibration parameters.

●Communication parameters

POINT

To make RS-485 communication between the inverter and personal computer, the operation mode must be set to the "computer link operation mode".
Pr. 79 "operation mode selection" ≠ "1, 3, 4"
and
communication parameter n10 "link startup mode selection" = "1"

| Parameter | Indication | Name | Description | Factory Setting |
|-----------|------------|-----------------------------------|--|-----------------|
| n1 | <i>n 1</i> | Communication station number* | Set the station number for communication from the RS-485 connector. 0 to 31: Specify the station number of the inverter. | 0 |
| (331) | | | | |
| n2 | <i>n 2</i> | Communication speed* | 48: 4800bps 96: 9600bps 192: 19200bps | 192 |
| (332) | | | | |
| n3 | <i>n 3</i> | Stop bit length* | 0: Stop bit length 1 bit/data length 8 1: Stop bit length 2 bits/data length 8 10: Stop bit length 1 bit/data length 7 11: Stop bit length 2 bits/data length 7 | 1 |
| (333) | | | | |
| n4 | <i>n 4</i> | Parity check presence/absence* | 0: Absent 1: With odd parity check 2: With even parity check | 2 |
| (334) | | | | |
| n5 | <i>n 5</i> | Number of communication retries | Set the permissible number of retries at occurrence of a data receive error. When you set "--", the inverter will not come to an alarm stop if a communication error occurs. 0 to 10, --- | 1 |
| (335) | | | | |
| n6 | <i>n 6</i> | Communication check time interval | Set the interval of communication check time. If a no-communication status persists for longer than the permissible time, the inverter will come to an alarm stop. 0: No communication 0.1 to 999s ---: Check suspended To make communication, set any value other than 0 in the communication parameter n6 "communication check time interval". | 0s |
| (336) | | | | |
| n7 | <i>n 7</i> | Waiting time setting* | Set the waiting time from when data is transmitted to the inverter until response is made. 0 to 150ms ---: Set in communication data | --- |
| (337) | | | | |
| n8 | <i>n 8</i> | Run command source | You can choose whether the run command is given by the computer or the external terminal. 0: Command source is computer 1: Command source is external terminal | 0 |
| (338) | | | | |
| n9 | <i>n 9</i> | Speed command source | You can choose whether the speed command is given by the computer or the external terminal. 0: Command source is computer 1: Command source is external terminal | 0 |
| (339) | | | | |

| Parameter | | Name | Description | Factory Setting |
|-----------|------------|-------------------------------------|--|-----------------|
| n | Indication | | | |
| n10 | n 10 | Link startup mode selection | You can choose the operation mode at power on or at power restoration after instantaneous power failure. Set "1" to select the computer link operation mode. 0: Mode set in Pr. 79 is established. 1: Started in computer link mode. | 0 |
| (340) | | | | |
| n11 | n 11 | CR/LF selection* | 0: Without CR/LF 1: With CR, without LF 2: With CR/LF | 1 |
| (341) | | | | |
| n12 | n 12 | E ² PROM write selection | 0: Write to RAM and E ² PROM 1: Write to RAM only (When a reset is performed, the parameter value will be the value of E ² PROM.) | 0 |
| (342) | | | | |

* Perform a reset after setting parameter. The set values are reflected after a reset.

●Parameters for the PU

When the parameter unit (FR-PU04) is used, operation from the operation panel is not accepted. (STOP/RESET is valid)

| Parameter | | Name | Outline | Factory Setting |
|-----------|------------|---|--|-----------------|
| n | Indication | | | |
| n13 | n 13 | PU display language selection | 0: Japanese, 1: English, 2: German 3: French, 4: Spanish, 5: Italian 6: Swedish, 7: Finnish | 0 |
| (145) | | | | |
| n14 | n 14 | PU buzzer control | 0: Without sound, 1: With sound | 1 |
| (990) | | | | |
| n15 | n 15 | PU contrast adjustment |  0 (Light) 63(Dark) | 58 |
| (991) | | | | |
| n16 | n 16 | PU main display screen data selection | 0: Selectable between output frequency and output current 100:Set frequency (during stop) Output frequency (during operation) | 0 |
| (992) | | | | |
| n17 | n 17 | Disconnected PU detection/PU setting lock | 0: Without PU disconnection error/PU operation valid 1: Error at PU disconnection/PU operation valid 10: Without PU disconnection error/PU operation invalid | 0 |
| (993) | | | | |

REMARKS

- The parameter number in parentheses is the one for use with the parameter unit (FR-PU04).
- Set "9999" when setting a value "- - -" using the parameter unit (FR-PU04).
- Pr. stands for a parameter number.

7. ERRORS AND PROTECTIVE FUNCTIONS

7.1 About errors (definitions)

When an alarm occurs in the inverter, the protective function is activated to bring the inverter to an alarm stop and the PU display automatically changes to any of the following error (alarm) indications.

For details, refer to the separately available instruction manual (detailed).

(1) Major failures

| Operation Panel Indication | Function Name | Definition |
|----------------------------|---|---|
| <i>OC 1</i> (OC1) | Overcurrent shut-off during acceleration | The inverter output current rose to or above about 150% of the rated inverter current during acceleration. |
| <i>OC 2</i> (OC2) | Overcurrent shut-off during constant speed | The inverter output current rose to or above about 150% of the rated inverter current during constant speed operation. |
| <i>OC 3</i> (OC3) | Overcurrent shut-off during deceleration | The inverter output current rose to or above about 150% of the rated inverter current during deceleration. |
| <i>Ov 1</i> (OV1) | Regenerative overvoltage shut-off during acceleration | Excessive regenerative energy or surge voltage occurred during acceleration. |
| <i>Ov 2</i> (OV2) | Regenerative overvoltage shut-off during constant speed | Excessive regenerative energy or surge voltage occurred during constant speed. |
| <i>Ov 3</i> (OV3) | Regenerative overvoltage shut-off during deceleration or stop | Excessive regenerative energy or surge voltage occurred during deceleration or stop. |
| <i>THN</i> (THM) | Motor overload shut-off (Electronic thermal relay function) (*1) | Overload or reduced cooling capability during low-speed operation Protection against burnout due to motor temperature rise |
| <i>THF</i> (THT) | Inverter overload shut-off (Electronic thermal relay function) (*1) | Current more than 120% of the rated inverter current flew and overcurrent shut-off did not occur. Output transistor protection from overheat |
| <i>FIN</i> (FIN) | Fin overheat | Temperature rise of the heatsink. |
| <i>GF</i> (GF) | Start-time output side earth (ground) fault overcurrent (*2) | Earth (Ground) fault occurred on the inverter's output side at a start. |
| <i>LF</i> (LF) | Output phase failure protection | This function stops the inverter output if one of the three phases (U, V, W) on the inverter's output side (load side) opens at motor start. |

*1. Resetting the inverter initializes the internal thermal integration data of the electronic thermal relay function.

*2. Activated only when "1" is set in Pr. 40 "start-time earth (ground) fault detection selection".

| Operation Panel Indication | Function Name | Definition |
|----------------------------|--------------------------------|---|
| <i>OHT</i> (OHT) | External thermal relay (*3) | External thermal relay provided for protection from overheat was actuated (contact open). |
| <i>OLT</i> (OLT) | Stall prevention (overload) | Stall prevention was activated to drop the running frequency to 0. (OL appears while stall prevention is activated.) |
| <i>OPT</i> (OPT) | Communication error | <ul style="list-style-type: none"> • Communication errors occurred consecutively more than the permissible number of retries when the RS-485 connector is used and communication parameter n5 ≠ "- - -". • RS-485 communication error occurred. • Communication has broken for a period set in communication parameter n6. |
| <i>PE</i> (PE) | Parameter storage device alarm | Error occurred in the parameter stored. |
| <i>PUE</i> (PUE) | PU disconnected | PU was disconnected when communication parameter n17 = "1". |
| <i>RET</i> (RET) | Retry count over | Operation could not be resumed properly within the preset number of retries. |
| <i>CPU</i> (CPU) | CPU error | Arithmetic operation of the built-in CPU does not end within the predetermined time. |

*3. Activated only when any of Pr. 60 to Pr. 63 (input terminal function selection) is set to OH.

(2) Minor failures

| Operation Panel Indication | Function Name | Definition |
|----------------------------|---------------|---|
| <i>FN</i> (FN) | Fan trouble | The cooling fan built in the inverter failed (stopped). |

(3) Warnings

| Operation Panel Indication | Function Name | Definition |
|------------------------------------|-------------------------------------|--|
| <i>OL</i> (OL) | Stall prevention (overcurrent) (*4) | Current more than 120% of the rated inverter current flew in the motor and operation is being performed to prevent the inverter from resulting in overcurrent shut-off. |
| <i>oL</i> (oL) | Stall prevention (overvoltage) | Regenerative energy of the motor became excessive and operation is being performed to stop the frequency from decreasing to prevent overvoltage shut-off. |
| <i>PS</i> (PS) | PU stop | Pr. 75 "reset selection/PU stop selection" had been set and a stop was made by pressing the  key of the operation panel or parameter unit (FR-PU04). Restarting method with PS shown (PU stop) 1) Switch STF (STR) off. 2) Press the  key to change to PU (PS cancel). 3) Press the  key to return to EXT. 4) Switch STF (STR) on. |
| <i>Uu</i> (UV) <i>F5J</i> (F5J) | Undervoltage | Power supply voltage of the inverter dropped. |
| <i>Err.</i> (Err) | During reset | During inverter reset (RES signal is ON) |

*4. The stall prevention operation current may be set to any value. It is factory set to 120%.

(4) Write errors

| Operation Panel Indication | Function Name | Definition |
|----------------------------|--|--|
| <i>Er 1</i> (Er1) | Write disable error | <ul style="list-style-type: none"> Write was performed with "1" set in Pr. 77 Frequency jump setting range overlapped. Parameter write was performed though the operation panel does not have the write precedence. |
| <i>Er 2</i> (Er2) | Write-while-running error/mode designation error | <ul style="list-style-type: none"> Write was performed during operation. An attempt was made to change the Pr. 79 setting to the operation mode where the run command has been input. Write was performed in external operation mode. |
| <i>Er 3</i> (Er3) | Calibration error | Analog input bias and gain calibration values are too close. |

- Major failure: When the protective function is activated, the inverter output is shut-off and an alarm output is provided.
- Minor failure: When the protective function is activated, the output is not shut off. The minor failure signal can be output by making parameter setting. (Set "98" in Pr. 64 or Pr. 65 (output terminal function selection). Refer to page 45 .)

7.2 To know the operating status at the occurrence of alarm (only when FR-PU04 is used)

When any alarm has occurred, the display automatically switches to the indication of the corresponding protective function (error). By pressing the **(MON)** 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. After resetting, you can confirm the definitions in "Alarm History". (For details, refer to the instruction manual of the parameter unit (FR-PU04).)

7.3 Correspondence between digital and actual characters

There are the following correspondences between the actual alphanumeric characters and the digital characters displayed on the operation panel:

| Actual | Display | Actual | Display | Actual | Display |
|--------|---------|--------|---------|--------|---------|
| 0 | 0 | A | A | M | 7 |
| 1 | 1 | B | b | N | n |
| 2 | 2 | C | C | O | 0 |
| 3 | 3 | D | d | o | o |
| 4 | 4 | E | E | P | P |
| 5 | 5 | F | F | S | 5 |
| 6 | 6 | G | G | T | 7 |
| 7 | 7 | H | H | U | U |
| 8 | 8 | I | I | V | V |
| 9 | 9 | J | J | r | r |
| | | L | L | - | - |

7.4 Resetting the inverter

The inverter can be reset by performing any of the following operations. Note that the internal thermal integrated value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the inverter.

Recover about 1s after reset is cancelled.

F5J(F5J) and **Err**.(Err) appears alternately on the operation panel during reset.

- Operation 1 Using the operation panel, perform a reset with the **(STOP RESET)**.
(Enabled only when the inverter protective function is activated (major failure))
- Operation 2 Switch power off once, then switch it on again after the LED on the operation panel turns off.
- Operation 3 Turn on the reset signal (RES). (Assign this signal using any of Pr. 60 to Pr. 63.) (Refer to page 44.)

7.5 Troubleshooting

POINTS

If the cause is still unknown after every check, it is recommended to initialize the parameters (return to factory setting) then reset the required parameter values and check again.

7.5.1 Motor remains stopped

1) Check the main circuit

- Check that a proper power supply voltage is applied (operation panel display is provided).
- Check that the motor is connected properly.
- Check that the jumper across P-P1 is connected.
(Check that P-P1 of the filter pack are connected correctly.)

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 simultaneously.
- Check that the frequency setting signal is not zero.
- Check that the AU signal is on when the frequency setting signal is 4 to 20mA.
- Check that the output stop signal (MRS) or reset signal (RES) is not on.
(Assign signals MRS and RES using Pr. 60 to Pr. 63 (input terminal function selection).)
- Check that the sink or source jumper connector is fitted securely.

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 (C2 to C7) 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.

4) Check the load

- Check that the load is not too heavy.
- Check that the shaft is not locked.

5) Others

- Check that the operation panel display does not show an error (e.g. OC1).
- Check that the Pr. 15 "jog frequency" setting is not lower than the Pr. 13 "starting frequency" value.

7.5.2 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.
- Check the setting of Pr. 17 "RUN key rotation direction selection".

7.5.3 Speed greatly differs from the setting

- Check that the frequency setting signal is correct. (Measure the input signal level.)
- Check that the following parameter settings are correct (Pr. 1, Pr. 2, Pr. 19, Pr. 38, Pr. 39, Pr. 95, C2 to C7).
- Check that the input signal lines are not affected by external noise. (Use shielded cables)
- Check that the load is not too heavy.

7.5.4 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.

7.5.5 Motor current is large

- Check that the load is not too heavy.
- Check that the torque boost setting is not too large.
- Check that the rated motor frequency is set in the Pr. 3 "base frequency".

7.5.6 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.

7.5.7 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.
- Check for a malfunction due to an undesirable current when the transistor output unit is connected.

3) Others

- Check that the wiring length is not too long.
- Check that GD² load is not small. (at the motor GD² or smaller)
..... FR-F540J-1.5K to 3.7K
If so, set the Pr. 72 "PWM frequency selection" to 6kHz or higher.
(Check for noise or leakage current problem.)

7.5.8 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 Pr. 79 "operation mode selection" setting is "0", switching input power on places the inverter in external operation mode. Press the  to switch to PU operation mode. For other settings (1 to 8), the operation mode is limited accordingly. (For details of Pr. 79, refer to page 38.)

7.5.9 Operation panel display is not operating

- Make sure that terminals PC-SD are not shorted.
- Make sure that the connector is fitted securely across terminals P-P1. (Check that P-P1 of the filter pack are connected correctly.)

7.5.10 Parameter write cannot be performed

- Make sure that operation is not being performed (signal STF or STR is not ON).
- Check that the  () was pressed.
- 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 external operation mode.
- Check Pr. 77 "parameter write disable selection".

7.5.11 Motor produces annoying sound

- Check the Pr. 70 "Soft-PWM setting" and Pr. 72 "PWM frequency selection" settings.
- Make sure that the deceleration time is not too short.

7.6 Precautions for maintenance and inspection

The inverter is a static unit mainly consisting of semiconductor devices. Daily inspection must be performed to prevent any fault from occurring due to the adverse effects of the operating environment, such as temperature, humidity, dust, dirt and vibration, changes in the parts with time, service life, and other factors.

7.6.1 *Precautions for maintenance and inspection*

For some short time after the power is switched off, a high voltage remains in the smoothing capacitor. When accessing the inverter for inspection, wait for at least 10 minutes after the power supply has been switched off, and then make sure that the voltage across the main circuit terminals P-N of the inverter is not more than 30VDC using a tester, etc.

7.6.2 *Inspection item*

(1) Daily inspection

- Basically, check for the following faults during operation.
 - 1) Motor operation fault
 - 2) Improper installation environment
 - 3) Cooling system fault
 - 4) Abnormal vibration, abnormal noise
 - 5) Abnormal overheat, discoloration
- During operation, check the inverter input voltages using a tester.

(2) Cleaning

Always run the inverter in a clean status.

When cleaning the inverter, gently wipe dirty areas with a soft cloth immersed in neutral detergent or ethanol.

CAUTION

Do not use solvent, such as acetone, benzene, toluene and alcohol, as they will cause the inverter surface paint to peel off.

7.6.3 *Periodic inspection*

Check the areas inaccessible during operation and requiring periodic inspection. Consult us for periodic inspection.

- 1) Cooling system fault. Clean the air filter, etc.
- 2) Tightening check and retightening The screws and bolts may become loose due to vibration, temperature changes, etc. Check and tighten them. Tighten them according to the specified tightening torque.
- 3) Check the conductors and insulating materials for corrosion and damage.
- 4) Measure insulation resistance.
- 5) Check and replace the cooling fan, smoothing capacitor and relay.

7.6.4 Daily and periodic inspection

| Area of Inspection | Inspection Item | Inspection Item | Interval | | Corrective Action at Alarm Occurrence | Customer's Check |
|--------------------|---|---|----------|------------------|--|------------------|
| | | | Daily | Periodic *2 | | |
| General | Surrounding environment | Check the ambient temperature, humidity, dirt, corrosive gas, oil mist, etc | ○ | | Improve environment | |
| | Overall unit | Check for unusual vibration and noise | ○ | | Check alarm location and retighten | |
| | Power supply voltage | Check that the main circuit voltages and control voltages are normal *1 | ○ | | Inspect the power supply | |
| Main circuit | General | (1) Check with megger (across main circuit terminals and earth (ground) terminal). (2) Check for loose screws and bolts. (3) Check for overheat traces on the parts. (4) Check for stain | | ○ ○ ○ ○ | Contact the manufacturer Retighten Contact the manufacturer Clean | |
| | Conductors, cables | (1) Check conductors for distortion. (2) Check cable sheaths for breakage and deterioration (crack, discoloration, etc.) | | ○ ○ | Contact the manufacturer Contact the manufacturer | |
| | Transformer/ reactor | Check for unusual odor and abnormal increase in whining sound. | ○ | | Stop the device and contact the manufacturer. | |
| | Terminal block | Check for damage. | | ○ | Stop the device and contact the manufacturer. | |
| | Smoothing aluminum electrolytic capacitor | (1) Check for liquid leakage. (2) Check for safety valve projection and bulge. | | ○ ○ | Contact the manufacturer Contact the manufacturer | |
| | Relay/ contactor | Check that the operation is normal and no chatter is heard. | | ○ | Contact the manufacturer | |
| | Resistor | (1) Check for crack in resistor insulation. (2) Check for a break in the cable. | | ○ ○ | Contact the manufacturer Contact the manufacturer | |

Precautions for maintenance and inspection

| Area of Inspection | Inspection Item | Inspection Item | Interval | | Corrective Action at Alarm Occurrence | Customer's Check |
|--------------------------------------|------------------|--|---|-------------|---|------------------|
| | | | Daily | Periodic *2 | | |
| Control circuit / protective circuit | Operation check | (1) Check that the output voltages across phases with the inverter operated alone is balanced | | ○ | Contact the manufacturer | |
| | | (2) Check that no fault is found in protective and display circuits in a sequence protective operation test. | | ○ | Contact the manufacturer | |
| | Parts check | Overall | (1) Check for unusual odor and discoloration. (2) Check for serious rust development | | ○ ○ | |
| Aluminum electrolytic capacitor | | Check for liquid leakage in a capacitor and deformation trace | | ○ | Contact the manufacturer | |
| Cooling system | Cooling fan | (1) Check for unusual vibration and noise. (2) Check for loose screws and bolts (3) Check for stain | ○ | ○ ○ ○ | Replace the fan Retighten Clean | |
| | Heatsink | (1) Check for clogging (2) Check for stain | | ○ ○ | Clean Clean | |
| | Air filter, etc. | (1) Check for clogging (2) Check for stain | | ○ ○ | Clean or replace Clean or replace | |
| Display | Indication | (1) Check that display is normal. (2) Check for stain | ○ | ○ | Contact the manufacturer Clean | |
| | Meter | Check that reading is normal | ○ | | Stop the device and contact the manufacturer. | |
| Load motor | Operation check | Check for vibration and abnormal increase in operation noise | ○ | | Stop the device and contact the manufacturer. | |

*1 It is recommended to install a device to monitor voltage for checking the power supply voltage to the inverter.

*2 One to two years of periodic inspection cycle is recommended. However, it differs according to the installation environment.
Consult us for periodic inspection.

7.6.5 Replacement of parts

The inverter consists of many electronic parts such as semiconductor devices. The following parts may deteriorate with age because of their structures or physical characteristics, leading to reduced performance or fault of the inverter. For preventive maintenance, the parts must be replaced periodically.

| Part Name | Standard Replacement Interval | Description |
|----------------------------------|-------------------------------|---------------------------------|
| Cooling fan | 2 to 3 years | Replace (as required) |
| Main circuit smoothing capacitor | 10 years * | Replace (as required) |
| On-board smoothing capacitor | 10 years * | Replace the board (as required) |
| Relays | — | Replace as required |

*The design life of electrolytic capacitor is about ten years (87000h) if used for 24 hours a day and 365 days a year in the average yearly ambient temperature of 40°C .

CAUTION

For parts replacement, consult the nearest Mitsubishi FA Center.

(1) Cooling fan

The cooling fan is used to cool heat-generating parts such as the main circuit semiconductors. The life of the cooling fan bearing is usually 10,000 to 35,000 hours. Hence, the cooling fan must be replaced every 2 to 3 years if the inverter is run continuously. When unusual noise and/or vibration is noticed during inspection, the cooling fan must be replaced immediately.

<1.5K to 7.5K>

| | |
|---------------------------|-------------------------------|
| FR-F520J-1.5K, 2.2K, 3.7K | MMF-06D24DS BKO-C2461H07 |
| FR-F540J-1.5K, 2.2K, 3.7K | MMF-06D24ES-FC4 BKO-CA1027H09 |
| FR-F520J-5.5K, 7.5K | MMF-06D24ES-FC6 BKO-CA1027H17 |
| FR-F520J-11K, 15K | MMF-08C24ES-RM1 BKO-CA1321H01 |
| FR-F540J-11K, 15K | |

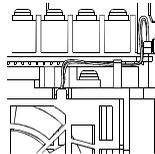
●Removal

1) Remove the front cover and wiring cover.

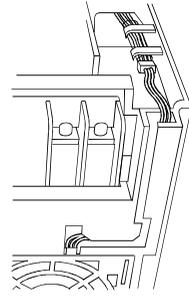
2) Unplug the fan connectors.
The cooling fan is connected to the cooling fan connector beside the main circuit terminal block of the inverter.
Unplug the connector and separate the inverter from the cooling fan.

3) Remove the cooling fan cover.
Disengage the fixing hooks pointed by arrows to remove the cooling fan cover.

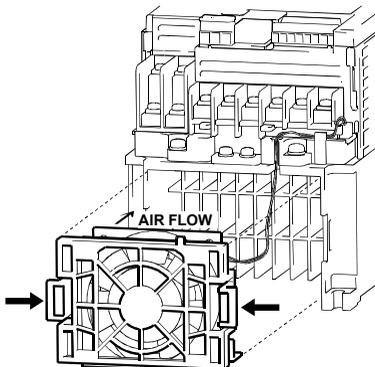
4) Remove the cooling fan and cooling fan cover.
The cooling fan is secured by the fixing hooks.
Disengage the fixing hooks to remove the cooling fan and cooling fan cover.



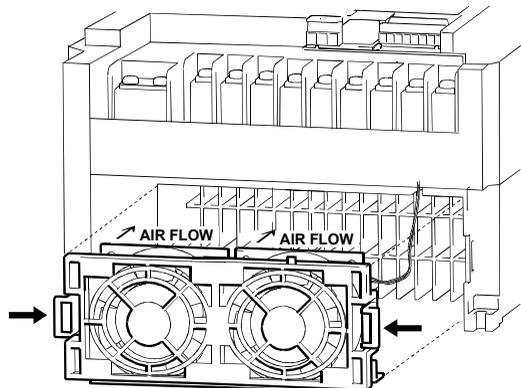
1.5K to 3.7K



5.5K, 7.5K



1.5K to 3.7K



5.5K, 7.5K

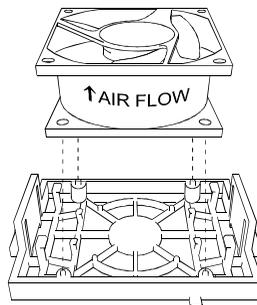
<1.5K to 7.5K>

●Reinstallation

- 1) After confirming the orientation of the fan, reinstall the fan so that the arrow on the left of "AIR FLOW" faces up.

CAUTION

Installing the fan in the opposite air flow direction can cause the inverter life to be shorter.

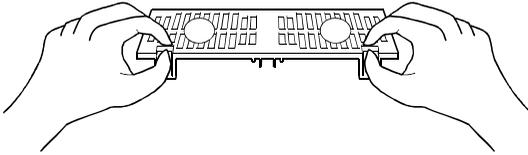


- 2) Reinstall the fan cover to the inverter.
Run the cable through the wiring groove to prevent it from being caught between the chassis and cover.
- 3) Reconnect the cable to the connector. (Refer to "Removal" on the previous page for the position of the connector.)
- 4) Reinstall the wiring cover.

<11K, 15K>

●Removal

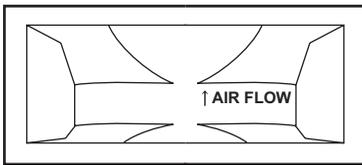
- 1) Push the hooks from above and remove the fan cover.



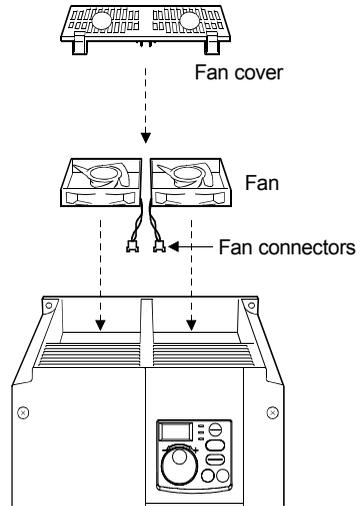
- 2) Disconnect the fan connectors.
- 3) Remove the fan.

●Reinstallation

- 1) After confirming the orientation of the fan, reinstall the fan so that the arrow on the left of "AIR FLOW" faces up.



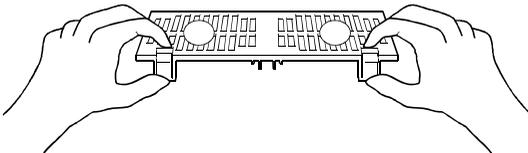
<Fan side face>



CAUTION

Installing the fan in the opposite air flow direction can cause the inverter life to be shorter.

- 2) Reconnect the fan connectors.
When wiring, use care to avoid the cables being caught by the fan.
- 3) Reinstall the fan cover.



(2) Smoothing capacitors

A large-capacity aluminum electrolytic capacitor is used for smoothing in the main circuit DC section, and an aluminum electrolytic capacitor is used for stabilizing the control power in the control circuit. Their characteristics are deteriorated by the adverse effects of ripple currents, etc. The replacement intervals greatly vary with the ambient temperature and operating conditions. When the inverter is operated in air-conditioned, normal environment conditions, replace the capacitors about every 10 years.

When a certain period of time has 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).

The appearance criteria for inspection are as follows:

- 1) Case: Check the side and bottom faces for expansion
- 2) Sealing plate: Check for remarkable warp and extreme crack.
- 3) Check for external crack, discoloration, fluid leakage, etc. Judge that the capacitor has reached its life when the measured capacitance of the capacitor reduced below 85% of the rating.

(3) Relays

To prevent a contact fault, etc., relays must be replaced according to the cumulative number of switching times (switching life).

8. SPECIFICATIONS

8.1 Ratings

(1) Three-phase 200V power supply

| Inverter | | | | | | | | | | | |
|-------------------------------------|---|--|------|-----|--------------------|------|------------------|------|------|------|----|
| Type FR-F520J-□K | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | |
| Applicable motor capacity (kW) (*1) | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | |
| Output | Rated capacity (kVA) (*2) | 1.0 | 1.6 | 2.8 | 4.0 | 6.6 | 9.1 | 12.1 | 17.1 | 22.1 | |
| | Rated current (A) | 2.5 | 4.1 | 7.0 | 10 | 16.5 | 23.8 | 31.8 | 45 | 58 | |
| | Overload current rating (*3) | 120% 60s, 150% 0.5s (inverse time characteristics) | | | | | | | | | |
| Voltage (*4) | | Three-phase 200 to 240V | | | | | | | | | |
| Power supply | Rated input AC voltage/frequency | Three-phase 200 to 240V 50Hz/60Hz | | | | | | | | | |
| | Permissible AC voltage fluctuation | 170 to 264V 50Hz/60Hz | | | | | | | | | |
| | Permissible frequency fluctuation | Within ±5% | | | | | | | | | |
| | Power supply system capacity (kVA) (*5) | Without filter pack | 1.2 | 2.1 | 4.0 | 5.0 | 8.8 | 12 | 17 | 20 | 27 |
| | | With filter pack | 0.8 | 1.2 | 2.6 | 3.4 | 5.5 | 8.4 | 11 | 16 | 19 |
| Protective structure (JEM1030) | | Enclosed type (IP20) (*6) | | | | | Open type (IP00) | | | | |
| Cooling system | | Self-cooling | | | Forced air cooling | | | | | | |
| Approximate mass (kg) | | 0.8 | 0.9 | 1.5 | 1.5 | 2.1 | 3.8 | 3.8 | 5.1 | 7.5 | |

| Filter pack | | | | | | | | | | |
|--------------------------------|-------------------|---|------|-----|-----|-----|-----|-----|-----|-----|
| Type FR-BFP-□K | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 |
| Approximate mass (kg) | | 1.3 | 1.4 | 2.0 | 2.2 | 2.8 | 3.8 | 4.5 | 6.7 | 7.0 |
| Power factor improving reactor | | Install the DC reactor on the DC side. (93% to 95% of power supply power factor under 100% load) | | | | | | | | |
| Noise filter | Common mode core | Install a ferrite core on the input side | | | | | | | | |
| | Capacitive filter | About 4mA of capacitor leakage current (*7) | | | | | | | | |

- *1. The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi 4-pole standard motor.
- *2. The rated output capacity indicated assumes that the output voltage is 220V.
- *3. The % value of the overload current rating indicated 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. You can set the maximum output voltage to any value below the power supply voltage. However, the pulse voltage value of the inverter output side voltage remains unchanged at about $\sqrt{2}$ that of the power supply.
- *5. The power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).
- *6. The inverter with filter pack is open type (IP00).
- *7. The leakage current indicated is equivalent to one-phase of cable for the three-phase three wire  connection.

(2) Three-phase 400V power supply

| Inverter | | | | | | | | | | | |
|-------------------------------------|---|--|------|-----|--------------------|-----|------------------|------|------|------|----|
| Type FR-F540J-□K | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | |
| Applicable motor capacity (kW) (*1) | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | |
| Output | Rated capacity (kVA) (*2) | 0.9 | 1.6 | 2.8 | 3.7 | 6.2 | 9.1 | 12.4 | 17.5 | 22.5 | |
| | Rated current (A) | 1.1 | 2.1 | 3.7 | 4.8 | 8.1 | 12 | 16.3 | 23 | 29.5 | |
| Overload current rating (*3) | | 120% 60s, 150% 0.5s (inverse time characteristics) | | | | | | | | | |
| Voltage (*4) | | Three-phase 380 to 480V | | | | | | | | | |
| Power supply | Rated input AC voltage/frequency | Three-phase 380 to 480V 50Hz/60Hz | | | | | | | | | |
| | Permissible AC voltage fluctuation | 325 to 528V 50Hz/60Hz | | | | | | | | | |
| | Permissible frequency fluctuation | Within ±5% | | | | | | | | | |
| | Power supply system capacity (kVA) (*5) | Without filter pack | 1.1 | 2.2 | 4.2 | 4.8 | 8.6 | 12 | 17 | 20 | 28 |
| With filter pack | | 0.7 | 1.3 | 2.7 | 3.3 | 5.4 | 8.5 | 11 | 16 | 19 | |
| Protective structure (JEM1030) | | Enclosed type (IP20) (*6) | | | | | Open type (IP00) | | | | |
| Cooling system | | Self-cooling | | | Forced air cooling | | | | | | |
| Approximate mass (kg) | | 1.5 | 1.5 | 1.5 | 1.6 | 1.7 | 3.8 | 3.8 | 5.0 | 7.5 | |

| Filter pack | | | | | | | | | | |
|--------------------------------|-------------------|---|------|-----|-----|-----|-----|-----|-----|-----|
| Type FR-BFP-H□K | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 |
| Approximate mass (kg) | | 1.6 | 1.7 | 1.9 | 2.3 | 2.6 | 4.5 | 5.0 | 7.0 | 8.2 |
| Power factor improving reactor | | Install the DC reactor on the DC side. (93% to 95% of power supply power factor under 100% load) | | | | | | | | |
| Noise filter | Common mode core | Install a ferrite core on the input side | | | | | | | | |
| | Capacitive filter | About 8mA of capacitor leakage current (*7) | | | | | | | | |

- *1. The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi 4-pole standard motor.
- *2. The rated output capacity indicated assumes that the output voltage is 440V.
- *3. The % value of the overload current rating indicated 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. You can set the maximum output voltage to any value below the power supply voltage. However, the pulse voltage value of the inverter output side voltage remains unchanged at about $\sqrt{2}$ that of the power supply.
- *5. The power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).
- *6. The inverter with filter pack is open type (IP00).
- *7. The leakage current indicated is equivalent to one-phase of cable for the three-phase three wire Δ connection.

8.2 Common specifications

| | | | |
|--|--|--|---|
| Control specifications | Control method | | Selectable between Soft-PWM control and high carrier frequency PWM control, V/F control or automatic torque boost control are selectable. |
| | Output frequency range | | 0.5 to 120Hz (starting frequency variable between 0 and 60Hz) |
| | Frequency setting resolution | | 5VDC input: 1/500 of max. set frequency, 10V, 4 to 20mADC input: 1/1000 of max. set frequency Digital input: 0.1Hz (less than 100Hz), 1Hz (100Hz or higher) |
| | Frequency accuracy | | Analog input: Within $\pm 1\%$ of max. output frequency($25^{\circ}\text{C}\pm 10^{\circ}\text{C}$) Digital input: Within $\pm 0.5\%$ of set output frequency (when set by the setting dial) |
| | Torque boost | | Manual torque boost, automatic torque boost |
| | Acceleration/deceleration time setting | | 0, 0.1 to 999s (acceleration and deceleration can be set individually), linear or S-pattern acceleration/deceleration mode can be selected. |
| | Braking torque | Regeneration | 15% torque/continuity |
| | | DC injection brake | Operation frequency (0 to 120Hz), operation time (0 to 10s), operation voltage (0 to 15%) |
| | Frequency setting signal | Analog input | 0 to 5VDC, 0 to 10VDC, 4 to 20mA |
| | | Digital input | Entered from operation panel |
| | Start signal | STF, STR | Forward and reverse rotation, start signal automatic self-holding input (3-wire input) can be selected. |
| | Reset | | Reset the alarm output when the protective function is activated |
| | Multi-speed selection | | Up to 15 speeds can be selected. (Each speed can be set between 0 and 120Hz, running speed can be changed during operation from the operation panel.) |
| | Second function selection | | Used to select second functions (acceleration time, deceleration time, torque boost, base frequency, electronic thermal relay function). |
| Output stop | | Instantaneous shut-off of inverter output (frequency, voltage) | |
| Current input selection | | Used to select second functions (acceleration time, deceleration time, torque boost, base frequency, electronic thermal relay function). | |
| External thermal relay input | | Thermal relay contact input for use when the inverter is stopped by the thermal relay. | |
| Jog signal | | Jog operation mode selection | |
| PID control valid | | Selection for exercising PID control | |
| PU operation-external operationswitching | | Used to switch between PU operation and external operation from outside the inverter. | |
| | | | Use Pr. 60 to Pr. 63 for selection |

| | | | | |
|-----------------------------|--------------------------|---|---|-------------------------------------|
| Control specifications | Operational functions | Maximum and minimum frequency settings, frequency jump operation, external thermal relay input selection, automatic restart after instantaneous power failure, forward/reverse rotation prevention, slip compensation, operation mode selection, PID control, computer link operation (RS-485). | | |
| | Output signals | Operating Status | 1 open collector signal can be selected from among inverter running, up-to-frequency, frequency detection, overload warning, zero current detection, output current detection, PID upper limit, PID lower limit, PID forward/reverse rotation, operation ready, maintenance timer, minor failure and alarm. 1 changeover contact output (1 changeover contact, 230V 0.3AAC, 30V 0.3ADC) signal can be selected. | Use Pr. 64 and Pr. 65 for selection |
| | | For meter | 1 signal can be selected from between output frequency and motor current. Pulse train output (1440 pulses/s, 1mA full scale) | |
| Protective/warning function | | Overcurrent shut-off (during acceleration, deceleration, constant speed), regenerative overvoltage shut-off (during acceleration, deceleration, constant speed), overload shut-off (electronic thermal relay function), heatsink overheat, fan failure (*2), stall prevention, start-time output side earth (ground) fault protection (*3), output phase failure, external thermal relay (*4), parameter storage device alarm, PU disconnection, retry count excess, CPU error, PU stop (*5), undervoltage (*1) | | |
| Environment | Ambient temperature | -10°C to +50°C (non-freezing) | | |
| | Ambient humidity | 90%RH or less (non-condensing) | | |
| | Storage temperature (*6) | -20°C to +65°C | | |
| | Atmosphere | Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt etc.) | | |
| | Altitude, vibration | Maximum 1000m above sea level, 5.9m/s ² or less (*7) | | |

- *1. When undervoltage occurs, no alarm output is provided but the output is shut off. After power restoration, the inverter may be run as it is. Depending on the running status (e.g. load magnitude), however, overcurrent, regenerative overvoltage or other protection may be activated at power restoration. (in external operation mode)
- *2. Compatible with only the product having the built-in cooling fan.
- *3. Activated only when "1" is set in Pr. 40 "start-time earth (ground) fault detection selection".
- *4. Activated only when external thermal relay input (OH) is selected in any of Pr. 60 to Pr. 63 (input terminal function selection).
- *5. This function is activated only when "14 or 15" is set in Pr. 75 "reset selection/PU stop selection".
- *6. Temperature applicable for a short period such as transportation.
- *7. When using with the filter pack installed on the rear panel of the FR-F520J-15K or FR-F540J-15K, do not install this combination on moving objects or places that have vibrations exceeding 1.96m/s².

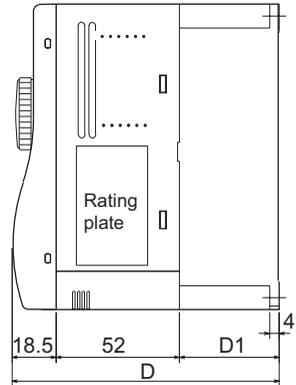
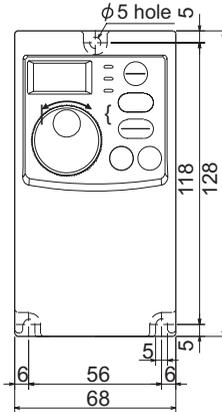
9. OUTLINE DIMENSION DRAWINGS

● FR-F520J-0.4K,0.75K

• Three-phase 200V power supply

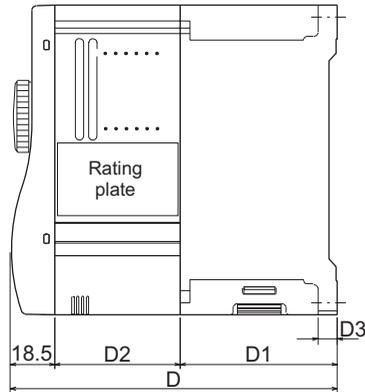
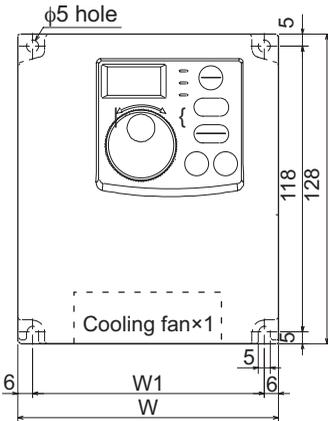
| Capacity | D | D1 |
|----------|-------|----|
| 0.4K | 112.5 | 42 |
| 0.75K | 132.5 | 62 |

(Unit: mm)



● FR-F520J-1.5K,2.2K,3.7K

● FR-F540J-0.4K,0.75K,1.5K,2.2K,3.7K



• Three-phase 200V power supply

| Capacity | W | W1 | D | D1 | D2 | D3 |
|-----------|-----|-----|-------|----|----|----|
| 1.5K,2.2K | 108 | 96 | 135.5 | 65 | 52 | 8 |
| 3.7K | 170 | 158 | 142.5 | 72 | 52 | 5 |

• Three-phase 400V power supply

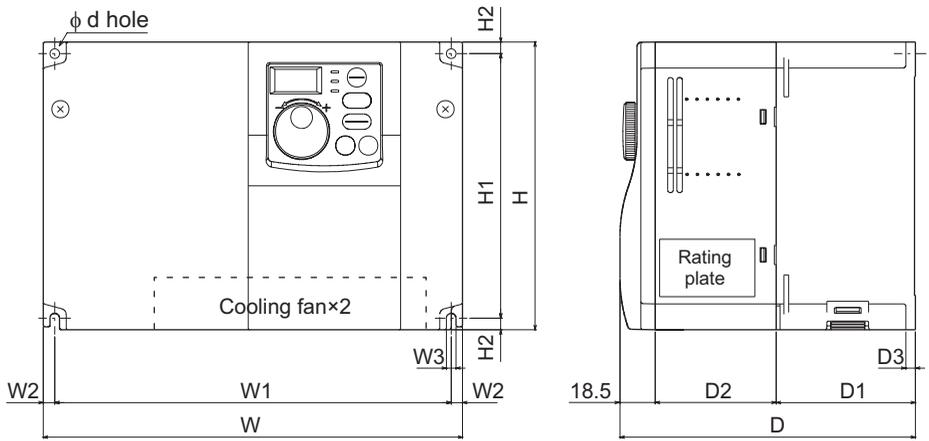
| Capacity | W | W1 | D | D1 | D2 | D3 |
|------------|-----|----|-------|----|----|----|
| 0.4K,0.75K | 108 | 96 | 129.5 | 59 | 52 | 5 |
| 1.5K | 108 | 96 | 135.5 | 65 | 52 | 8 |
| 2.2K | 108 | 96 | 155.5 | 65 | 72 | 8 |
| 3.7K | 108 | 96 | 165.5 | 65 | 82 | 8 |

(Unit: mm)

REMARKS

The FR-F540-J-0.4K and 0.75K are not provided with a cooling fan.

- FR-F520J-5.5K,7.5K,11K,15K
- FR-F540J-5.5K,7.5K,11K,15K



• Three-phase 200V,400V power supply

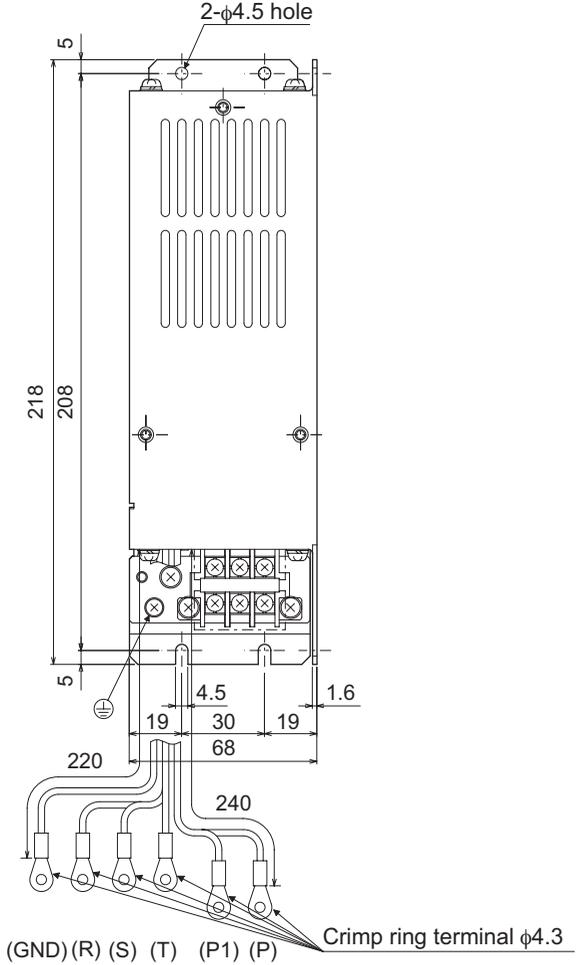
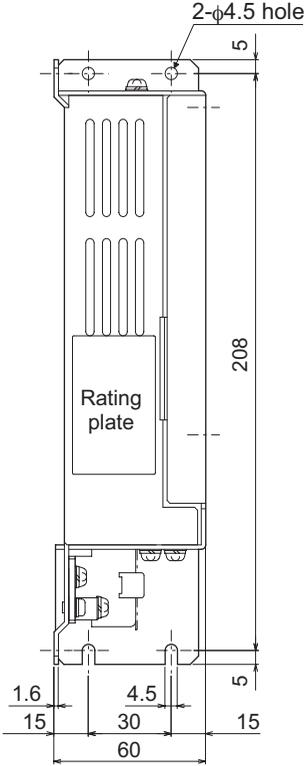
| Capacity | W | W1 | W2 | W3 | H | H1 | H2 | d | D | D1 | D2 | D3 |
|-----------|-----|-----|------|----|-----|-----|-----|---|-----|----|------|----|
| 5.5K,7.5K | 220 | 208 | 6 | 5 | 150 | 138 | 6 | 5 | 155 | 73 | 63.5 | 5 |
| 11K,15K | 220 | 195 | 12.5 | 6 | 260 | 245 | 7.5 | 6 | 190 | 90 | 81.5 | 10 |

(Unit: mm)

REMARKS

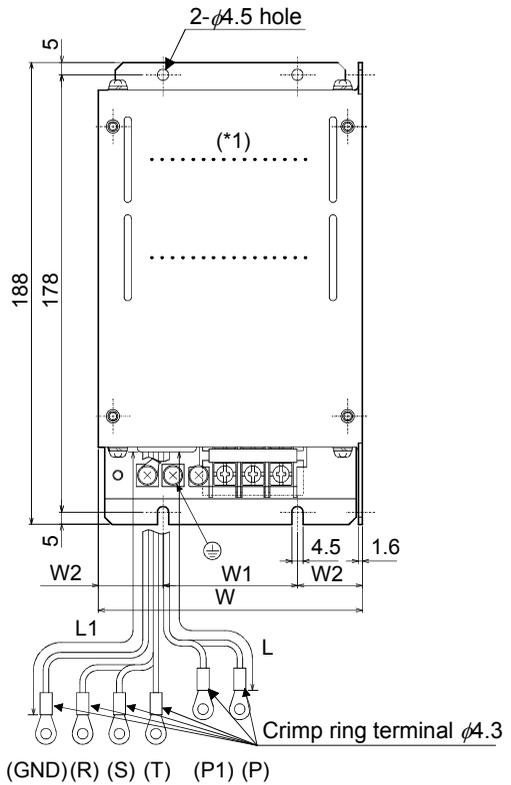
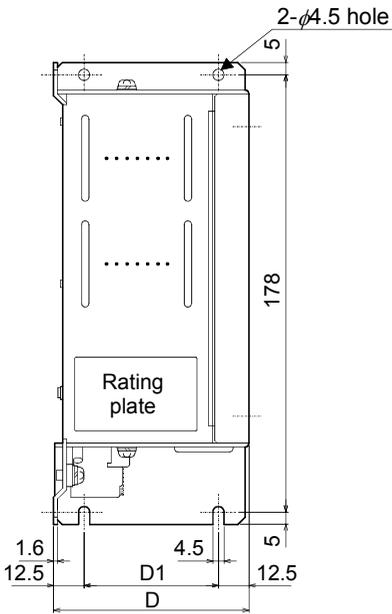
The 11K and 15K have a cooling fan in the upper part.

● FR-BFP-0.4K,0.75K



(GND) (R) (S) (T) (P1) (P) Crimp ring terminal $\phi 4.3$
 (Unit: mm)

- FR-BFP-1.5K, 2.2K, 3.7K
- FR-BFP-H0.4K, H0.75K, H1.5K, H2.2K, H3.7K



●200V power supply

| Capacity | W | W1 | W2 | D | D1 | L | L1 |
|------------|-----|-----|------|----|----|-----|-----|
| 1.5K, 2.2K | 108 | 55 | 26.5 | 80 | 55 | 200 | 220 |
| 3.7K | 170 | 120 | 25 | 65 | 40 | 220 | 240 |

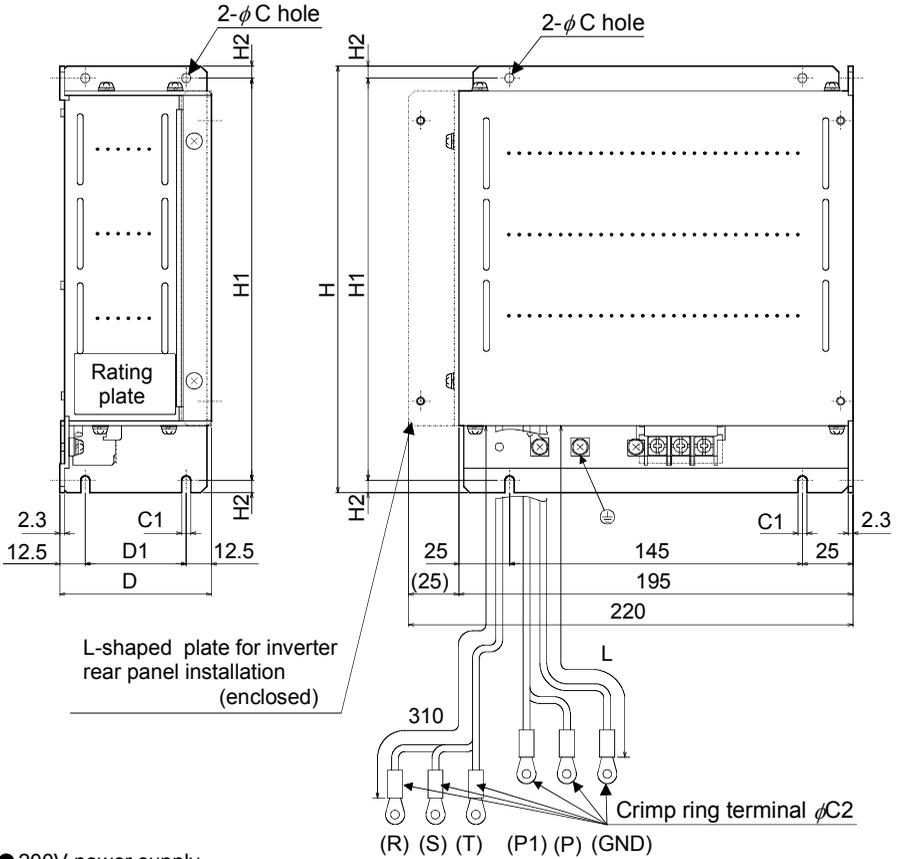
●400V power supply

| Capacity | W | W1 | W2 | D | D1 | L | L1 |
|---------------------|-----|----|------|----|----|-----|-----|
| H0.4K, H0.75K | 108 | 55 | 26.5 | 55 | 30 | 200 | 220 |
| H1.5K, H2.2K, H3.7K | 108 | 55 | 26.5 | 80 | 55 | 200 | 220 |

(Unit: mm)

*1 The 400V class H0.4K and H0.75K have no slit.

- FR-BFP-5.5K, 7.5K, 11K, 15K
- FR-BFP-H5.5K, H7.5K, H11K, H15K



●200V power supply

| Capacity | H | H1 | H2 | D | D1 | C | C1 | C2 | L |
|------------|-----|-----|-----|----|----|-----|-----|-----|-----|
| 5.5K, 7.5K | 210 | 198 | 6 | 75 | 50 | 4.5 | 4.5 | 5.3 | 270 |
| 11K | 320 | 305 | 7.5 | 85 | 60 | 6 | 6 | 5.3 | 280 |
| 15K | 320 | 305 | 7.5 | 85 | 60 | 6 | 6 | 6.4 | 260 |

(Unit: mm)

●400V power supply

| Capacity | H | H1 | H2 | D | D1 | C | C1 | C2 | L |
|--------------|-----|-----|-----|----|----|-----|-----|-----|-----|
| H5.5K, H7.5K | 210 | 198 | 6 | 75 | 50 | 4.5 | 4.5 | 4.3 | 270 |
| H11K | 320 | 305 | 7.5 | 85 | 60 | 6 | 6 | 4.3 | 280 |
| H15K | 320 | 305 | 7.5 | 85 | 60 | 6 | 6 | 6.4 | 260 |

(Unit: mm)

Appendix 1 Instructions for compliance with the European Directive

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

(1) EMC Directive

1) Our view of transistorized inverters for the EMC Directive

A transistorized inverter is a component designed for installation in an enclosure and for use with the other equipment to control the equipment/device. Therefore, we understand that the EMC Directive does not apply directly to transistorized inverters. For this reason, we do not place the CE mark on the transistorized inverters. (The CE mark is placed on inverters in accordance with the Low Voltage Directive.) The European power drive manufacturers' organization (CEMEP) also holds this point of view.

2) Compliance

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

3) Outline of installation method

Install an inverter using the following methods:

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

CAUTION

The filter pack (FR-BFP) does not conform to the EMC Directive. For conformity to the EMC Directive, use a European Standard-compliant noise filter.

(2) Low Voltage Directive

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

Transistorized inverters are covered by the Low Voltage Directive (Standard to conform to: EN50178).

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

* For the 400V class inverter, the rated input voltage range is three phase 380V to 415V 50Hz/60Hz.

* Do not use an earth leakage circuit breaker as an electric shock protector without connecting the equipment to the earth. Connect the equipment to the earth securely.

* Wire the earth terminal independently. (Do not connect two or more cables to one terminal.)

* Use the cable sizes on page 14 under the following conditions.

· Ambient temperature: 40°C maximum

· Wire installation: On wall without ducts or conduits

If conditions are different from above, select appropriate wire according to EN60204 ANNEX C TABLE 5.

* Use the moulded case circuit breaker and magnetic contactor which conform to the EN or IEC Standard.

* Use the breaker of type B (breaker which can detect both AC and DC). If not, provide double or enhanced insulation between the inverter and other equipment, or put a transformer between the main power supply and inverter.

* 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.

* Control circuit terminals on page 10 are safely isolated 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 | 1,000m | 1,000m | 10,000m |

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

Appendix 2 Instructions for UL and cUL

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



1. Installation

The F500J is UL-listed as a product for use in an enclosure.

Design the enclosure so that the ambient temperature, humidity and ambience of the inverter will satisfy the above specifications. (Refer to page 8)

Branch circuit protection

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

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

2. Wiring of the power supply and motor

For wiring the input (R, S, T) and output (U, V, W) terminals of the inverter, use the UL-listed copper wires (rated at 75°C) and round crimping terminals. Crimp the crimping terminals with the crimping tool recommended by the terminal maker.

3. Short circuit ratings

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

4. Motor overload protection

These inverters provide solid state motor overload protection.

Set Pr. 9 using the following instructions,
(Pr. 9 "electronic thermal O/L relay").

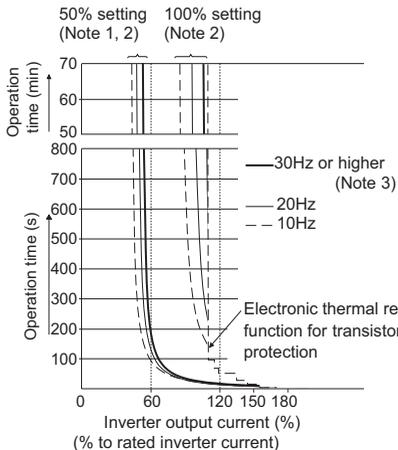
<Setting>

- Set the rated current [A] of the motor in Pr. 9.
- Setting "0" in Pr. 9 disables electronic thermal relay function (motor protective function). (The protective function of the inverter is activated.)
- When using a Mitsubishi constant-torque motor, first set "1" in Pr. 71 "applied motor". (This provides a 100% continuous torque characteristic in the low-speed range.) Then, set the rated current of the motor in Pr. 9 "electronic thermal O/L relay".

CAUTION

- When two or more motors are connected to the inverter, they cannot be protected by the electronic thermal relay function. Install an external thermal relay to each motor.
- When a difference between the inverter and motor capacities is large and the setting becomes less than half amount of the inverter rated current, the protective characteristics of the electronic thermal relay function will be deteriorated. In this case, use an external thermal relay.
- A special motor cannot be protected by the electronic thermal relay function. Use an external thermal relay.

Reference: Motor overload protection characteristics



- Protection activating range
Range on the right of characteristic curve
- Normal operating range
Range on the left of characteristic curve

(Note 1) When you set the 50% value (current value) of the rated inverter current.

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

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

MEMO

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

| Print Date | *Manual Number | Revision |
|------------|-------------------|--|
| Oct., 2002 | IB(NA)-0600129E-A | First edition |
| Dec., 2002 | IB(NA)-0600129E-B | <div style="border: 1px solid black; padding: 2px; display: inline-block;">Addition</div> Three phase 200V power supply input specifications |
| Dec., 2006 | IB(NA)-0600129E-C | <div style="border: 1px solid black; padding: 2px; display: inline-block;">Addition</div> H8 "output phase failure protection selection" Output phase failure protection function (LF) |
| Sep., 2008 | IB(NA)-0600129E-D | <div style="border: 1px solid black; padding: 2px; display: inline-block;">Modification</div> Partial modification |
| | | |

 **For Maximum Safety**

- Mitsubishi transistorized inverters are not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.
- When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace, atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi sales representative.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to prevent serious accidents when it is used in facilities where breakdowns of the product are likely to cause a serious accident.
- Please do not use this product for loads other than three-phase induction motors.