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MITSUBISHI
TRANSISTORIZED INVERTER

MITSUBISHI TRANSISTORIZED INVERTER FREQROL-A201E(UL)

BUILT-IN POWER RETURN FUNCTION

FREQROL-A201E(UL)

FR-A221E-5.5K～55K

FR-A241E-5.5K～55K

— INSTRUCTION MANUAL —

MITSUBISHI ELECTRIC

INSTRUCTION MANUAL

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Thank you for choosing this Mitsubishi Inverter.
This manual gives handling, safety and operating instructions.

This section is specifically about safety matters

Read this manual carefully and become familiar with the inverter before operation, pay special attention to the safety information marked Warning.

⚠ WARNING — This warning symbol indicates the presence of dangerous voltage. It informs you of high voltage conditions, situations and locations that may cause death or serious injury if you do not follow precautions.

⚠ CAUTION — This symbol indicates a general warning. Serious injury may occur if precautions are not followed.

Where these Warnings are written, pay special attention to the precautions detailed.

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Operator Safety

1. Electric shock prevention

⚠ WARNING

- ⚠ Do not remove the front cover while there is power supplied to the inverter, there are high voltage terminals which can be accessed. Please check the wiring when the inverter is not powered.
- ⚠ There are high voltage capacitors in the main circuit which remain charged after the inverter has been turned off, wait 10 minutes after the Power Lamp has gone out.
- ⚠ Use good earthing. Earth the inverter before wiring the Power circuits and control circuits.
- ⚠ Do not operate with wet hands.
- ⚠ Do not damage, cut, trap, or degrade the cables.
- ⚠ Do not insert or remove the parameter unit from the inverter or the extension cable without first removing the power from the inverter.

2. Fire Prevention

⚠ CAUTION

- ⚠ Do not mount on or near combustible material (such as wood).
- ⚠ Use a circuit breaker on the supply side of the inverter to prevent high current flow in the case of a fault.

3. Injury Prevention

⚠ CAUTION

- ⚠ Only supply the inverter with the voltage on the nameplate and in the Manual Specification section.
- ⚠ Other voltages may cause the inverter to fail.
- ⚠ Care should be taken when wiring to ensure correct terminals are used. Check polarity etc..
- ⚠ Do not touch the inverter while it is powered as certain parts become hot.

4. Other points

To prevent injury, damage, or product failure please note the following points.
(1) Transportation and mounting

⚠ CAUTION

- ⚠ Take care when carrying products, use correct lifting gear.
- ⚠ Do not stack the inverter boxes higher than the number recommended.
- ⚠ Ensure the installation position and material can with stand the weight of the inverter. Install according to the information in the Instruction Manual.
- ⚠ Do not operate if the inverter is damaged or has parts missing.
- ⚠ Do not lift the inverter with the front cover attached, it may fall off.
- ⚠ Do not stand or rest heavy objects on the inverter.

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⚠ CAUTION

⚠ Check the inverter mounting orientation is correct.

⚠ Prevent any dust, wire fragments or other foreign bodies from dropping into the inverter during wiring up and commissioning.

⚠ Do not drop the inverter, or subject it to impacts.

⚠ Environmental limitations, Check the ambient temperature, humidity, storage temperature, atmosphere, altitude, vibration. –10°C to +50°C (without freezing) –10°C to +40°C for enclosed specification.
Less than 90% Relative Humidity without condensation.
Ensure the environment is –20°C to 65°C (short time storage temperature), no corrosive or flammable gasses, altitude less than 1000m above sea level, vibration is less than 5.9m/s^2 {0.6G} (based on JIS C 0911).

(2) Wiring

⚠ CAUTION

⚠ Do not fit power factor correction capacitor, or RFI filter to the output of the inverter.

⚠ The connection orientation of the output cables U, V, W to the motor will effect the direction of rotation of the motor.

⚠ All electrical connections should be carried out by a qualified electrician and must comply with the requirements of all relevant local and national wiring regulations for installation wiring.

(3) Trial run

⚠ CAUTION

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

(4) Operation

⚠ CAUTION

⚠ When retry function is selected the inverter will try to restart the machine up to 10 times over a 1 hour period. Ensure operator safety with other devices.

⚠ The stop key can only be used at all times to stop the inverter when a parameter has been set, therefore use an external emergency stop button. Switch off start signal when resetting the inverter, failure to do so may start the motor immediately after reset.

⚠ The Electronic motor thermal protection does not guarantee to prevent motor burn out.

⚠ Do not use a contactor in the inverter input for frequent start/stopping of the inverter, use control signals.

⚠ To reduce the effect of mains conducted electromagnetic interference use a RFI noise filter.

⚠ Take care to ensure electromagnetic radiation from the inverter does not damage or effect the operation of nearby electrical equipment.

⚠ Use an input line reactor when the power supply capacity is large, or where harmonics from the inverter will cause problems.

⚠ Take countermeasures to prevent motor insulation damage from micro surge voltages in the supply cable.

⚠ Reset the inverter before starting set-up, initialises the parameters to factory set values.

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⚠ CAUTION
⚠ Do not use the inverter and motor at high speed until the machine has been checked. ⚠ The inverter does not have a holding stop facility. For emergency stop another circuit must be used.

(5) Emergency stop

⚠ CAUTION
⚠ Use a circuit and mechanical brake etc. which will protect the operator of the machine should the inverter fail.

(6) Maintenance and inspection

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

(7) Disposing of the inverter

⚠ CAUTION
⚠ Treat as industrial waste.

(8) General

Many of the diagrams and drawings in the instruction manual show the inverter without a cover, or partially open, never run the inverter like this. Always replace the cover and ensure adequate cooling etc. before using the inverter.

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1. OVERVIEW

2. OPERATION

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4. FUNCTIONS

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6. SELECTION INSTRUCTIONS

7. SPECIFICATIONS

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1. OVERVIEW

This chapter provides an "overview" of the FR-A201E "inverter with built-in power return function".
Always read the precautions and instructions in this chapter before using the equipment.

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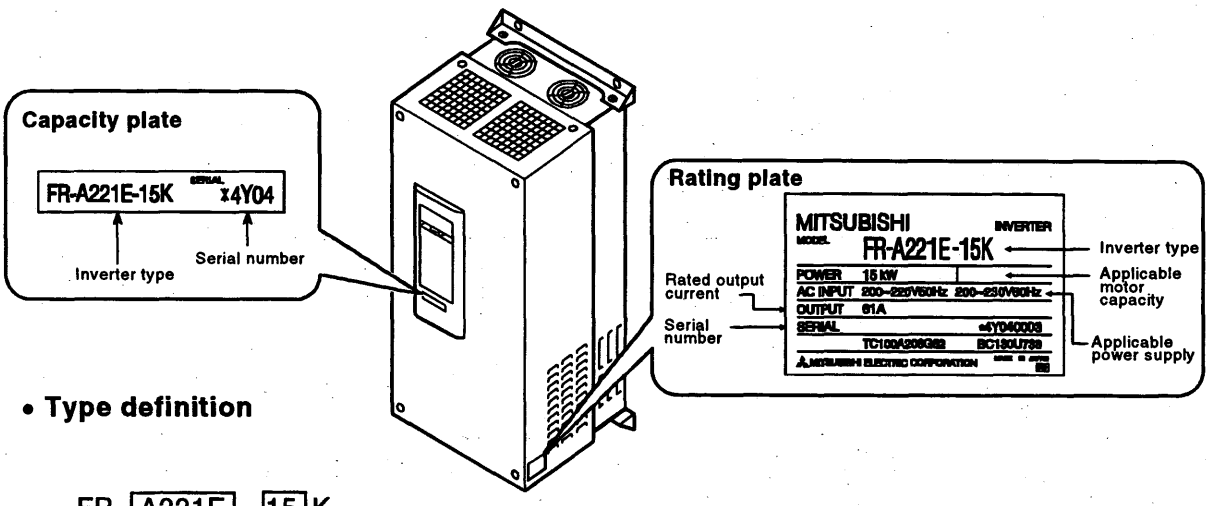
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1.1 PRECAUTIONS FOR OPERATION

1.1.2 Pre-operation Procedure

1. Unpacking and product check

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



- **Type definition**

FR- A221E - 15 K

Symbol	Voltage Series
A221E	200V
A241E	400V

Symbol	Applicable Motor Capacity
5.5 to 55	Capacity in "kW"

- **Accessory.....Instruction manual, hangers (supplied to 11kW or more)**
  If you have found any discrepancy, damage, etc. please contact your sales representative.

2. Preparations of instruments and parts required for operation

Instruments and parts to be prepared depend on how the inverter is operated. For required parts, etc. see Section 5 "INSTRUMENTS AND PARTS TO BE PREPARED FOR OPERATION".

3. Installation

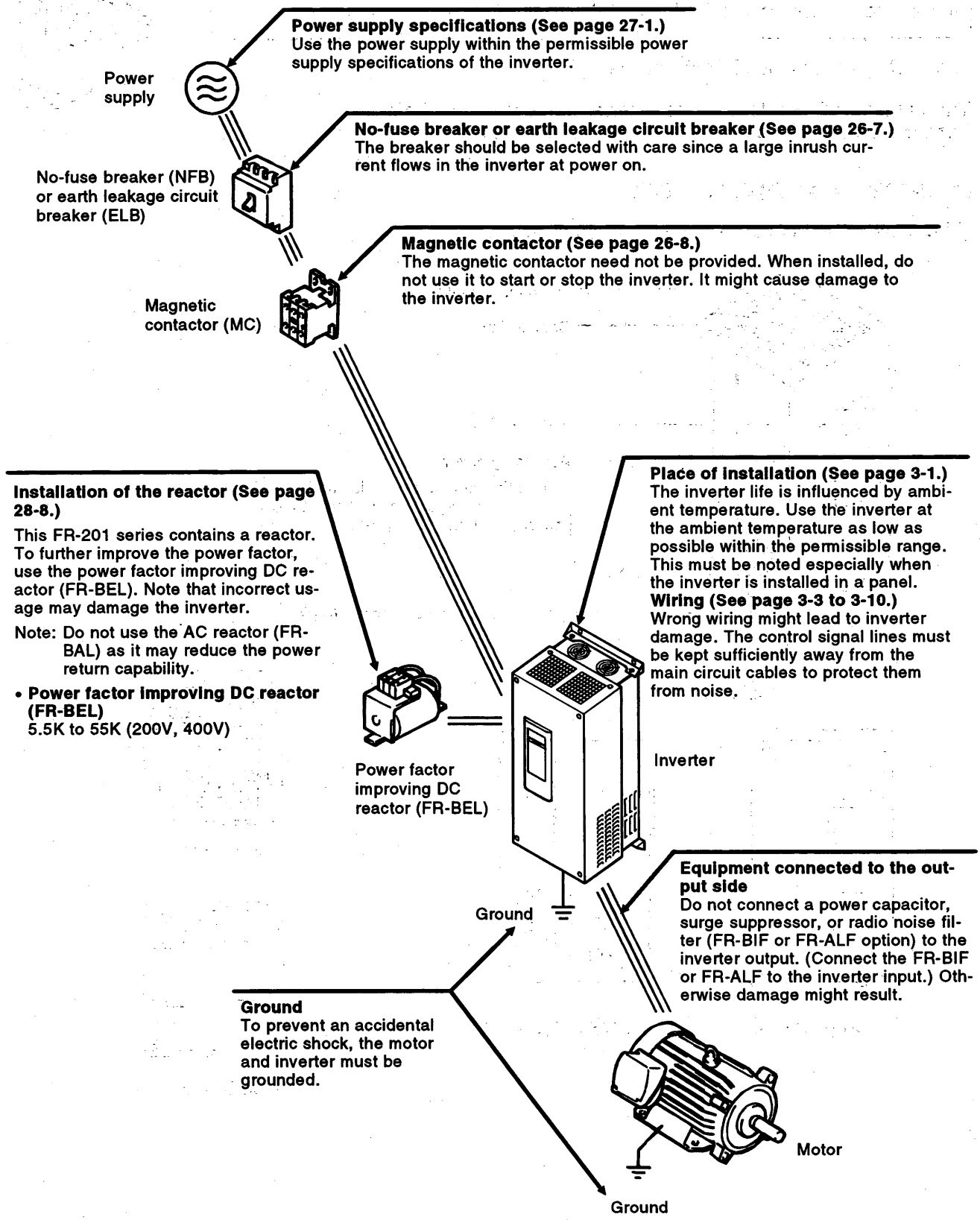
To operate the inverter with high performance for a long time, install the inverter in a suitable place, with correct orientation, and with proper clearances. (See page 3-1.)

4. Wiring

Connect the power supply, motor and operation signals (control signals) to the terminal block. If they are connected improperly, the inverter itself may be damaged. (See page 3-3.)

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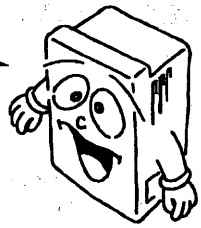
1.1.3 Handling Information



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1.2 STRUCTURE

In this section appearance, part names, component removal and reinstallation, equipment installation and wiring are explained.
In this manual, parts will be described with the following names.

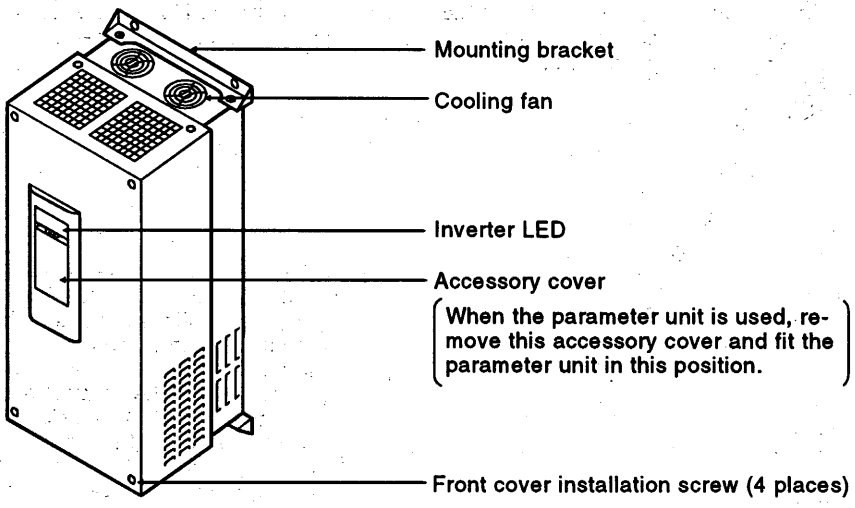


1.2.1 Appearance and Part Names

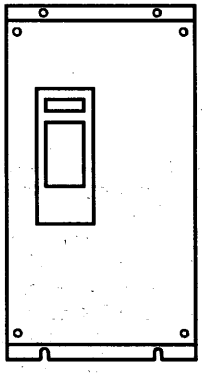
The names and locations of the inverter parts are given below.
For the position of the charge lamp, refer to page 27-8.

■ FR-A221E (A241E)-5.5K to 55K

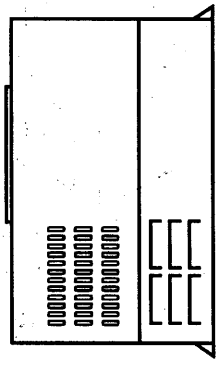
(The chassis and covers are made of steel plates.)



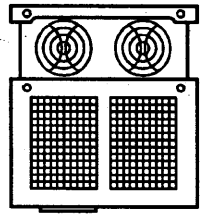
<Appearance>



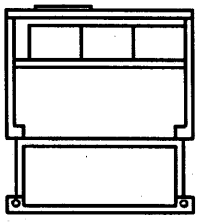
<Front view>



<Side view>



<Top view>



<Bottom view>

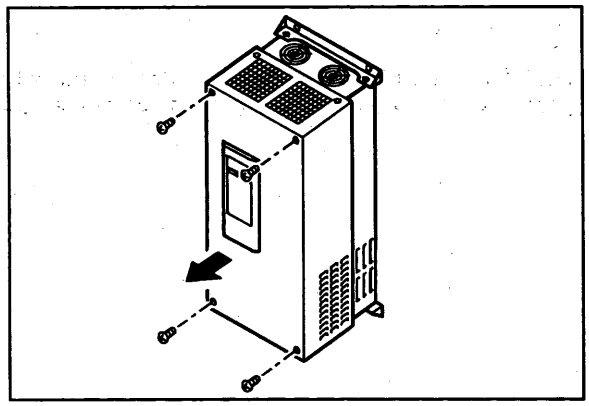
Note: Dimensions differ according to the capacity. For details, refer to page 27-11.

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1.2.2 Removal of the Front Cover

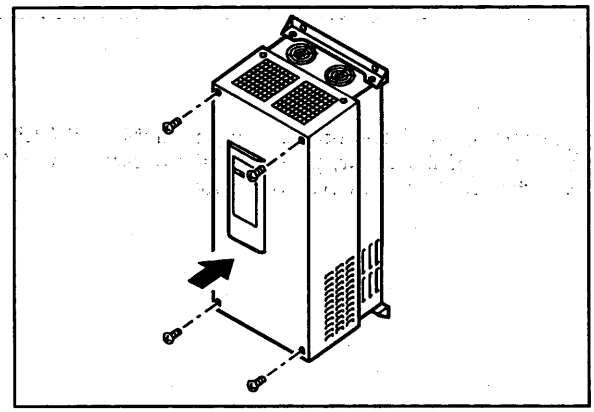
■ **FR-A221E-5.5K to 55K, FR-A241E-5.5K to 55K**

• **Removal**



1) Remove the front cover installation screws (4 places).

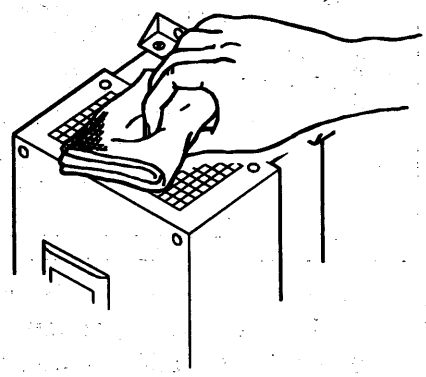
• **Reinstallation**



1) Fix the front cover with the installation screws (4 places).

Note: 1. Check carefully that the front cover has been reinstalled securely.
2. The same serial number is printed on the capacity plate on the front cover and the rating plate on the inverter side face. Before reinstalling the front cover, check the serial numbers.
Example:
Capacity plate A46150
Rating plate A46150 001
3-digit serial number

If the inverter surface is stained with fingermarks, oil, etc. during removal or reinstallation work, gently clean it with a cloth soaked with a neutral detergent or ethanol.



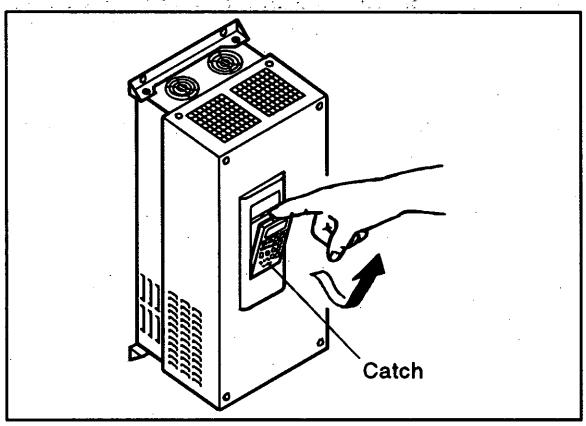
Note: 1. Do not use any solvent, such as acetone, benzene, toluene or alcohol. These will cause the inverter surface to dissolve and the paint to peel.
2. Do not clean the lens of the inverter LED with detergent or alcohol.

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1.2.3 Removal and Reinstallation of the Parameter Unit

To ensure safety, remove and reinstall the parameter unit after switching the power off.

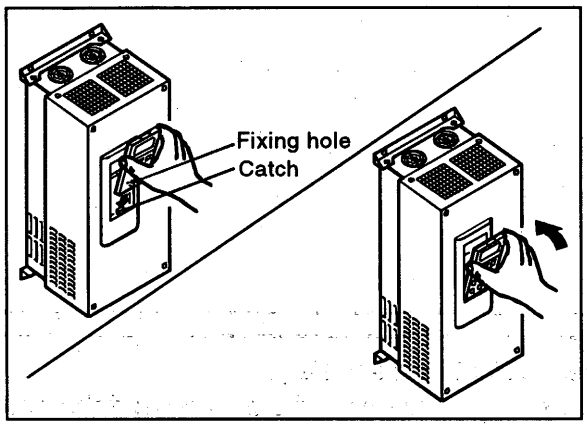
■ Removal



1) Hold down the top button of the parameter unit and pull the parameter unit toward you, using the catch as a support.

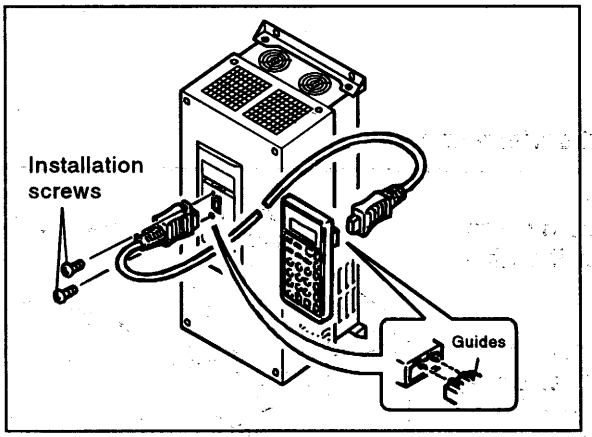
■ Reinstallation

• Direct installation onto the inverter



1) After fitting the fixing hole of the parameter unit (PU) on the catch of the cover, push the parameter unit into the inverter, using the catch as a support.

• Installation using the cable (option)



1) Securely insert one end of the cable into the connector of the inverter and the other into the PU connector.
   Insert the cable connector along the guides of the inverter or PU connector. (If the orientation is incorrect, the inverter may be damaged.)
2) After plugging the cable connector into the inverter connector, fix it securely with the installation screws.

Note: 1. The parameter unit must only be installed on the inverter with the front cover fitted.
2. During installation, do not apply force to the display (liquid crystal).
3. The parameter unit can be used with any of the FR-A100, 100E, 200 and 200E series inverters.

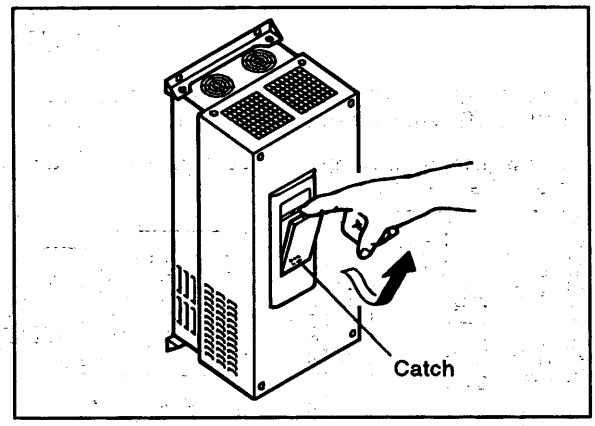
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1.2.4 Removal and Reinstallation of the Accessory Cover

To ensure safety, remove and reinstall the accessory cover after switching the power off.

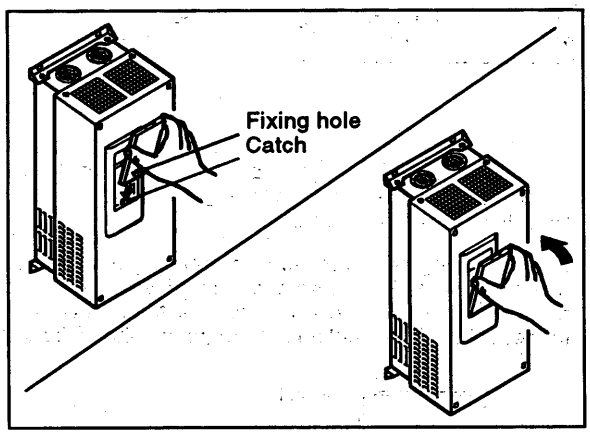
■

- **Removal**



1) As in the removal of the parameter unit, hold down the top button and pull the accessory cover toward you, using the catch as a support.

- **Reinstallation**

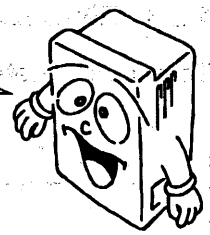


1) After fitting the fixing hole onto the catch of the cover, push it into the inverter.

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1.3 INSTALLATION AND WIRING

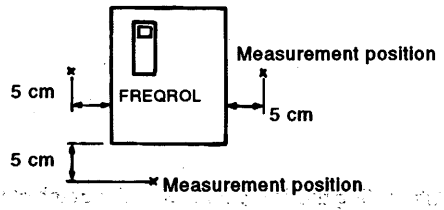
Incorrect installation or connection might cause the inverter to operate incorrectly, and in some cases, might reduce its life considerably. In the worst case, the inverter may be damaged. Please use the inverter in accordance with the information, precautions and instructions in this manual.



1.3.1 Installation Instructions

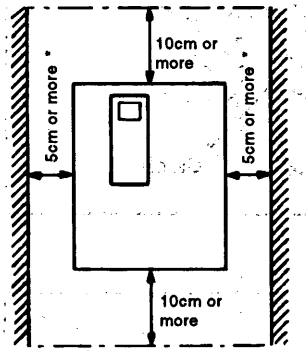
Note on ambient temperature.

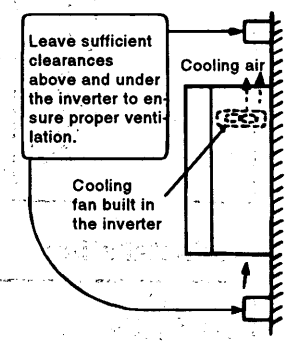
Ambient temperature in the place of installation must not exceed the permissible value (50°C) because it greatly influences the life of the inverter. Check that the ambient temperature is within the permissible range in the positions shown below.



Leave sufficient clearances around the inverter.

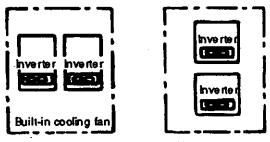
For adequate heat dissipation, leave sufficient clearances around the inverter.





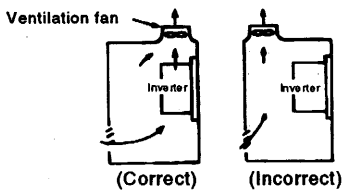
Note: 1. When the inverter is installed in a panel, determine the cooling method and panel dimensions so that the ambient temperature of the inverter is within the permissible range (as specified on page 27-2).

2. When two or more inverters are installed or a ventilation fan is mounted in the panel, extreme care must be taken to keep the ambient temperature of the inverter below the permissible value. If the inverters and/or ventilation fan are installed incorrectly, the ambient temperature will rise and ventilation effect will reduce.



(Correct) (Incorrect)

Installation of Two or More Inverters



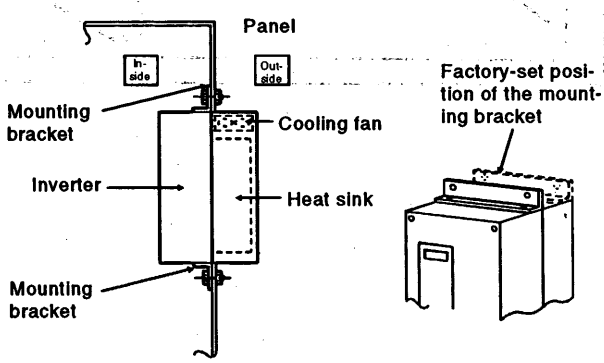
(Correct) (Incorrect)

Position of Ventilation Fan

3. Like the inverter, protect the parameter unit from direct sunlight, high temperature and high humidity. Also avoid oil mist, flammable gases, etc.

The amount of heat generated in the panel can be reduced considerably by placing the heat sink of the inverter outside the panel.

In long-lasting regenerative applications such as winding or a lifting operation where a regenarative torque is applied for a long time, it is recommended to install the inverter with its heat sink placed outside the panel as shown below.



Note: 1. Cut the mounting areas to the panel cutting dimensions on page 27-10.

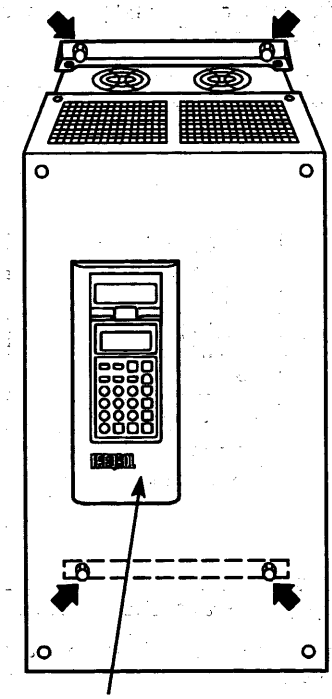
2. As there is a cooling fan in the cooling section placed outside the panel, do not use this style of mounting in an environment where waterdrops, oil mist, dust, etc. exist.

3. When installing the inverter, remove the top and bottom mounting brackets and move them to the required positions.

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Install the inverter securely with bolts.

Install the inverter on an installation surface securely and vertically (so that the letters FR-A201E are located at the front) with screws or bolts.

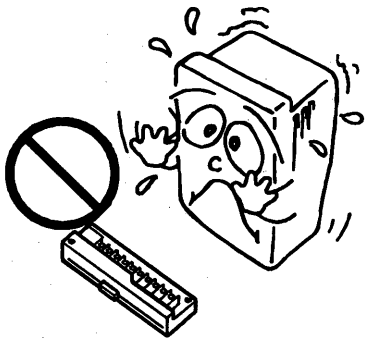


Set this side at front.

Note: The inverter must be installed vertically. Horizontal or side installation may cause the inverter to fail.

Never connect any inboard option designed for exclusive use with the FR-A200 (FR-APA, APB, APC, APD, APE).

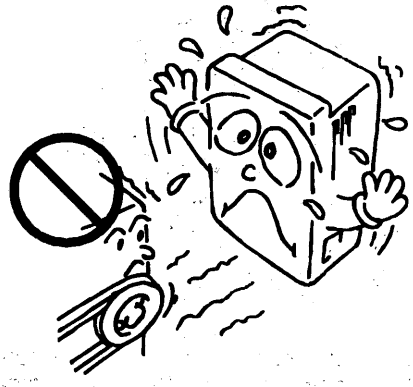
The inboard option designed for exclusive use with the FR-A200 (FR-APA to APE) must not be connected to the FR-A201E. Such connection will damage both the inverter and option.
Use the FR-EPA, EPB, EPC, EPD, EPE, EPG or EPH option.



FR-APA to APE

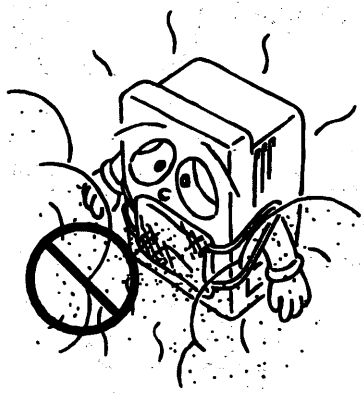
Install the inverter where it is not subjected to vibration.

Also take the vibration of a conveyor, press, etc. into consideration.



Do not install the inverter where it is subjected to oil mist, flammable gases, fluff, dust, dirt, etc.

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



Install the inverter on a non-combustible surface.

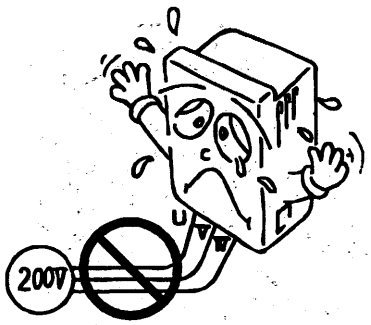
Install the inverter to a non-combustible. A fire may start if the inverter is installed directly to or near a combustible.



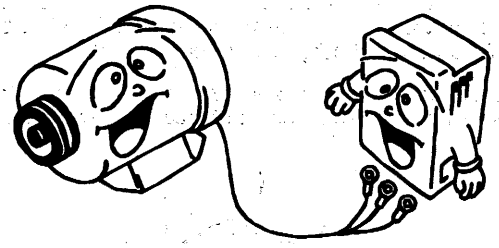
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1.3.2 Wiring Instructions

The power must not be applied to the output terminals (U, V, W), otherwise the inverter will be damaged.

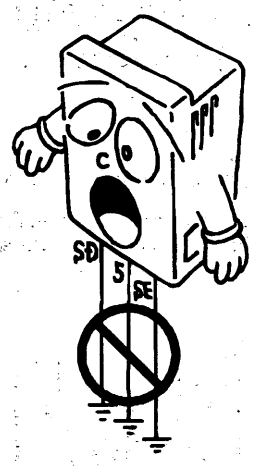


Use sleeved solderless terminals for the power supply and motor cables.



The following terminals are isolated from each other. These terminals must not be connected to each other or grounded.

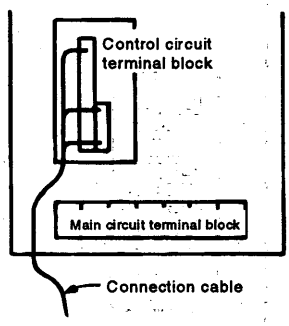
Common terminals SD, 5 and SE of the control circuit.



Use shielded or twisted cables for connection to the control circuit terminals.

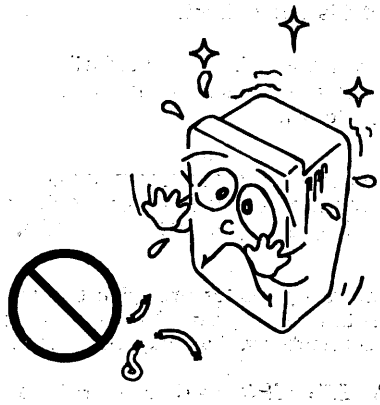
Run them away from the main and power circuits (such as 200V relay sequence circuit).

Run the connection cable using the space on the left-hand side of the main circuit terminal block.



During wiring, do not leave wire offcuts in the inverter.

Wire offcuts may cause a fault, failure or malfunction. Keep the inverter clean.

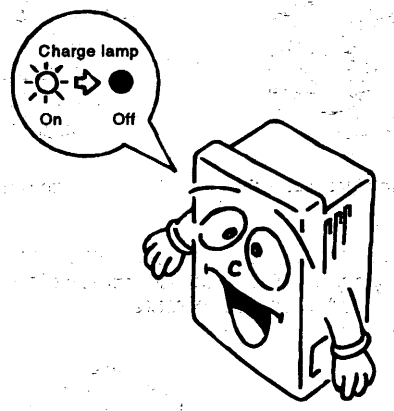


Wire offcuts, etc.

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When rewiring after operation, make sure that the inverter LED has gone off and that the charge lamp on the printed circuit board or beside the terminal block has gone off.

Soon after the power is shut off, there is a dangerous voltage in the capacitor. Before starting work, ensure that the charge lamp is off.



The cable size for connection to the control circuit terminals should be 0.75mm^2.

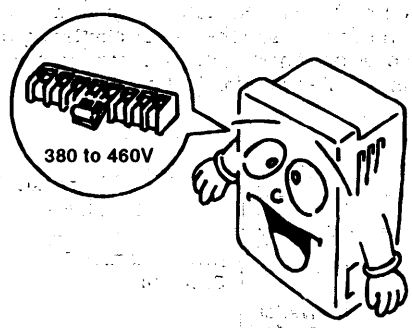
If the cable size used is 1.25mm^2 or more, the front cover may expand, resulting in a contact fault of the parameter unit. This fault is indicated by the following message displayed on the parameter unit and disables operation from the parameter unit. Run the cables so that they do not occupy too much of the control box terminal block space.

Parameter unit display

PU to Inverter comms. Error Inv. Reset ON

When the power supply voltage is special (380 to 460V), change the connection of the jumper in the internal transformer. (400V class)

If the connection is not changed, the inverter will be damaged. (See page 3-7)



When the wiring distance between the inverter and motor is long especially at the time of low frequency output, a voltage drop over the main circuit cables will reduce the motor torque. Use a large gauge for the main circuit cables to keep the voltage drop within 2%.

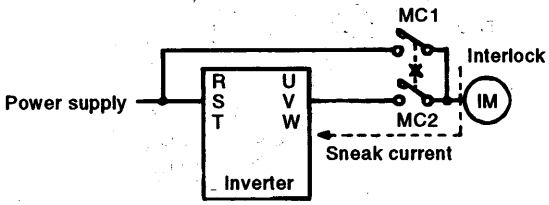
Especially for long-distance wiring, the maximum wiring length should be not more than 500m. Otherwise, the overcurrent protection may be activated accidentally as a result of a charging current generated by the stray capacity of the wiring. For operation under magnetic flux vector control, the inverter-to-motor wiring length should be within 30m. (A selection example at the wiring distance of 20m is given on page 26-7.)

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1.3.3 Design Information to Be Checked

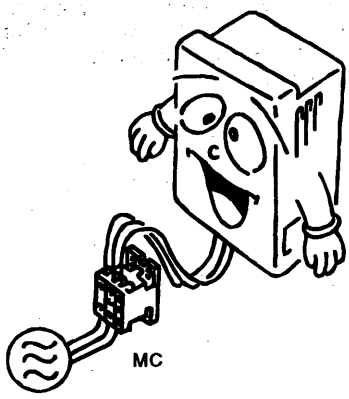
Provide electrical and mechanical interlocks for MC1 and MC2 which are used for commercial power supply-inverter switch-over.

The inverter will be damaged not only by miswiring but also by a sneak current from the power supply due to arcs generated at the time of switch-over or chattering caused by a sequence error, when there is a commercial power supply-inverter switch-over circuit shown below.



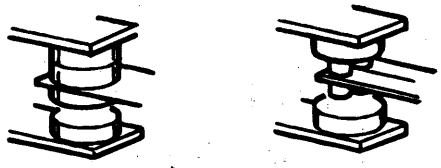
When a machine restart is to be prevented at power restoration after a power failure, provide a magnetic contactor MC in the primary circuit of the inverter and also make up a sequence which will not switch on the start signal.

If the start signal (start switch) remains on after a power failure, the inverter will automatically restart as soon as the power is restored.



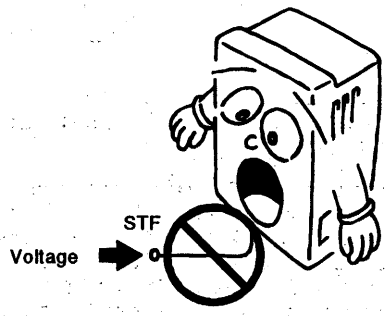
When connecting the control circuit to a power supply separately from the main circuit, make up a circuit so that when the power supply terminals R1, S1 for the control circuit are switched off, the main circuit power supply terminals R, S, T are also switched off.
Refer to 3-6 for connection.

Since input signals to the control circuit are at a low level, use two parallel micro signal contacts or twin contact for contact inputs to prevent a contact fault.



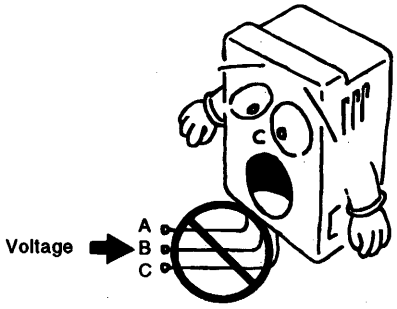
Micro signal contacts Twin contact

Do not apply a voltage to the contact input terminals (e.g. STF) of the control circuit.



Do not apply a voltage directly to the alarm output signal terminals (A, B, C).

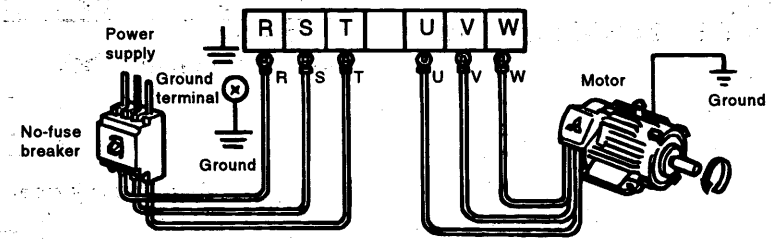
Apply a voltage via a relay coil, lamp, etc. to these terminals.



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1.3.4 Wiring of the Main Circuit
(For the terminal block arrangement, see page 27-8.)

Connection of the power supply and motor



The power supply cables must be connected to R, S, T. If they are connected to U, V, W, the inverter will be damaged.

Phase sequence need not be matched.

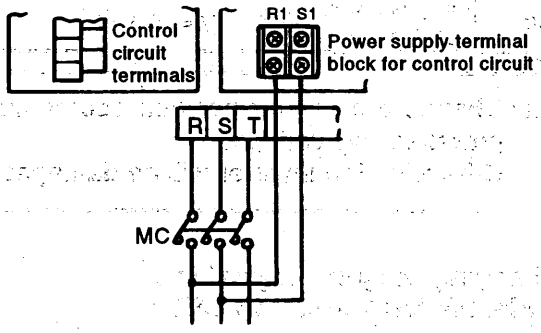
Connect the motor to U, V, W. In the above connection, turning on the forward rotation switch (signal) rotates the motor in the counterclockwise (arrow) direction when viewed from the load shaft.

Connecting the control circuit to a power supply separately from the main circuit

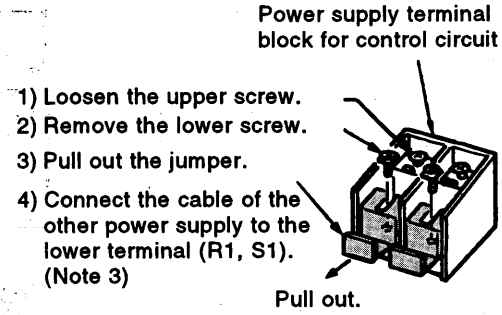
If the magnetic contactor (MC) in the inverter power supply is opened when the protective circuit is operated, the inverter control circuit power is lost and the alarm output signal cannot be kept on. To keep the alarm signal on, terminals R1 and S1 are available. In this case, connect the power supply terminals R1 and S1 of the control circuit to the primary side of the MC.

- **Model FR-A221(241)E-5.5K to 55K**

<Circuit diagram>



<Connection procedure>



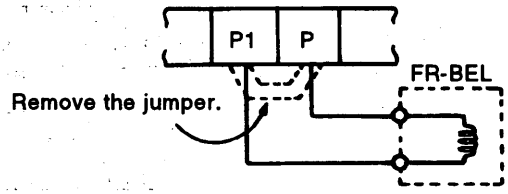
Note: 1. The jumpers between R-R1 and S-S1 must be removed.
2. For a different power supply system which takes the power of the control circuit from other than the primary side of the MC, this voltage should be equal to the main circuit voltage.
3. The power supply cable must not be connected only to the upper terminal to protect the inverter from damage. To use a separate power supply, the jumpers between R-R1 and S-S1 must be removed.

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Connection of the power factor improving DC reactor (option)
(for 5.5K to 55K inverters)

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

<Connection method>



Note: 1. The wiring distance should be within 5m.
2. The size of the cables used should be identical to or larger than that of the power supply cables (R, S, T).

Where the power supply is special (342V or below, 484V or above) for the 400V series inverters

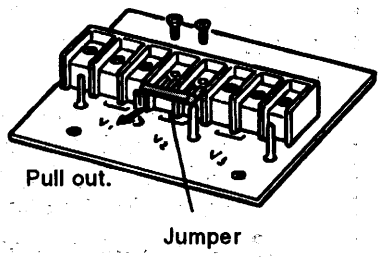
Change the connection of the jumper to the internal transformer according to the operating power supply voltage.

■ Voltage Range vs. Jumper Position

Jumper Position	Operating Power Supply Voltage		Note
	50Hz	60Hz	
V1	323V (380V-15%) to 456.5V (415V+10%)	As on the left	
V2	342V (380V-10%) to 484V (440V+10%)	342V (380V-10%) to 506V (460V+10%)	Factory setting
V3	391V (460V-15%) to 506V (460V+10%)	As on the left	

Note: Change the jumper position according to the operating power supply voltage.
Otherwise the inverter will be damaged.

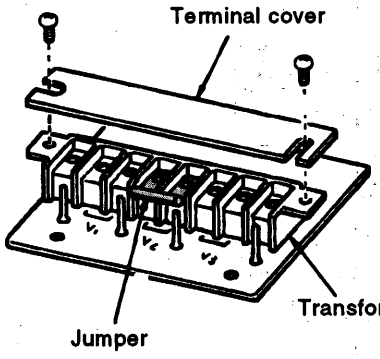
■ Changing the jumper position
• Model FR-A241E-5.5K to 15K



1) Remove the mounting screws of the terminal symbol cover and remove the cover.
2) This reveals the terminal block of the internal transformer. After removing the screws from the jumper in the terminal block, reconnect the jumper in accordance with the operating voltage in the above table.

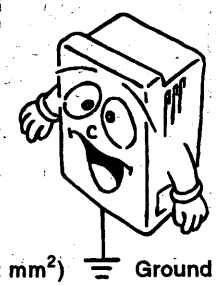
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• Model FR-A241E-18.5K to 55K



1) Remove the terminal cover of the internal transformer.
2) After removing the screws from the jumper in the terminal block, reconnect the jumper in accordance with the operating voltage in the above table.

Notes on Grounding



- The leakage current of the A201 series is larger than that of the other series (Z_{200}, F_{400}). To prevent an accidental electric shock, the motor and inverter must be grounded (200V class...class 3 grounding, grounding resistance must be 100Ω or less, 400V class...special class 3 grounding, grounding resistance must be 10Ω or less).
- Ground the inverter by connecting it to the dedicated ground terminal. (Do not use the screws in the case, chassis, etc.)
- Use the largest possible gauge for the ground cable. The gauge should be equal to or larger than those indicated in the following table. The grounding point should be as near as possible to the inverter to minimize the ground cable length.

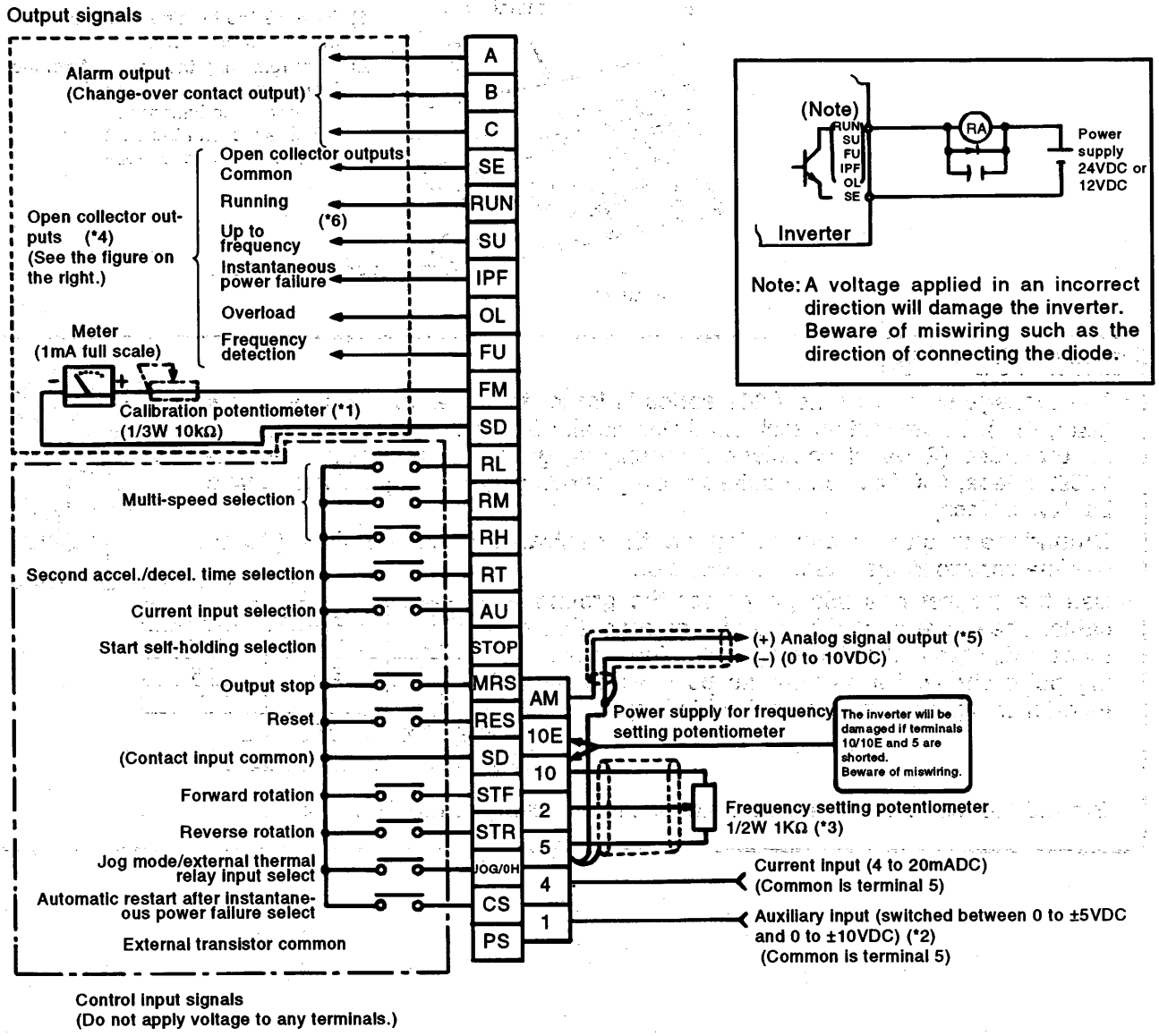
(Unit: mm^2) Ground

Motor Capacity	Ground Cable Gauge	
	200V class	400V class
5.5, 7.5kW	5.5	3.5
11 to 15kW	14	8
18.5 to 37kW	22	14
45, 55kW	38	22

- Ground the motor on the inverter side using one cable of the 4-core cable.

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1.3.5 Wiring of the Control Circuit
(For the terminal description, see page 27-6.)



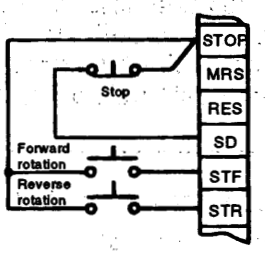
*1. This calibration potentiometer is not required when calibration is from the parameter unit.
*2. Input signal switching can be done from the parameter unit.
*3. 2W 1KΩ is recommended when the frequency setting is changed frequently.
*4. The output terminals other than the running (RUN) terminal allow alarm definition to be output in alarm codes and 10 different functions to be assigned individually. (See Pr. 40 and Pr. 76.)
*5. FM-SD and AM-5 functions can be used simultaneously. (See Pr. 54 and Pr. 158.)
*6. The function of the RUN terminal is changed from the standard feature by setting 7 "brake sequence for lift" in Pr. 60. (Refer to page 9-28.)

Note: 1. Terminals SD, SE and 5 are the common terminals of the I/O signals and are isolated from each other. These common terminals must not be connected to each other or grounded.
2. Use shielded or twisted cables for connection to the control circuit terminals and run them away from the main and power circuits (including the 200V relay sequence circuit).
3. Since the frequency setting signals are micro currents, use two parallel micro signal contacts or a twin contact to prevent a contact fault.

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Using the STOP terminal

Connect as shown below to self-hold the start signal (forward rotation, reverse rotation).



Using the CS terminal

This terminal is used to perform automatic restart after instantaneous power failure and switch-over between commercial power supply and inverter.
<Eample: Automatic restart after instantaneous power failure>
Connect CS-SD and set 0 in parameter 57.

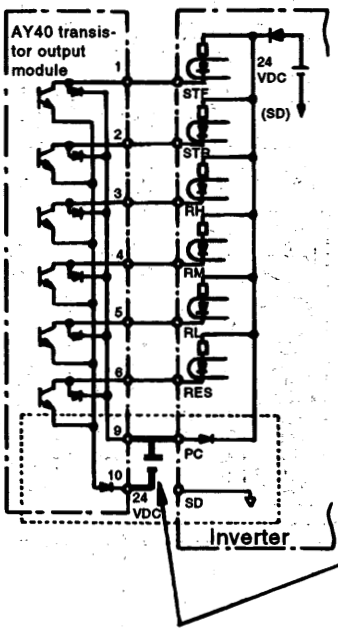


(Connect)

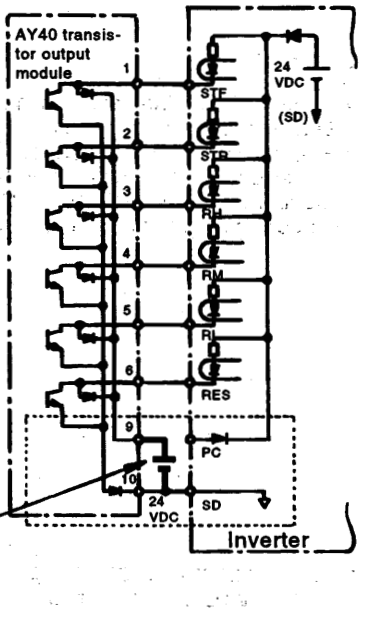
Using the PC terminal

This terminal is used to connect transistor output (open collector output) such as a programmable logic controller (PC). Connecting the external power supply common for transistor output to the PC terminal prevents a faulty operation caused by a sneak current.

<Correct connection>



<Wrong connection>

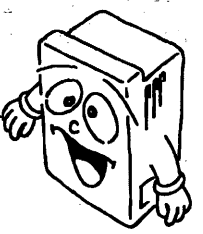


The AY40 module requires a 24VDC power supply.

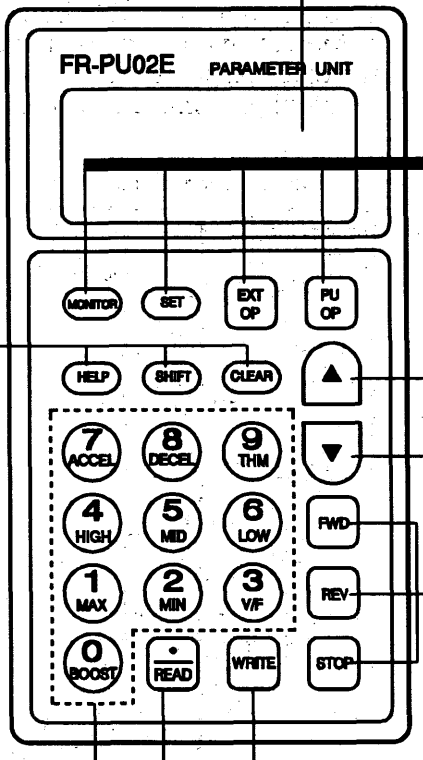
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1.4 PARAMETER UNIT

The FR-PU02 parameter unit is installed directly to the FR-A series inverter or connected to it by a cable (option) and allows operation to be performed, functions to be selected (set values to be read/written), the operating status to be monitored, and alarm definition to be displayed. In addition, the FR-PU02E has a troubleshooting function, help function and parameter graphic display function. The FR-PU02E parameter unit is hereinafter referred to as the PU.



1.4.1 Structure of the Parameter Unit



Help key (See page 7-1.)

- Used to call the help menu screen for selection of any help item.
- Acts as a monitoring list or parameter list display key in the monitoring or setting mode.
- Press this key on any parameter setting screen to call the corresponding parameter graphic display screen.

Clear key

- Used to clear set data or a wrong value in the setting mode.
- Acts as a graphic display stop key. Press this key only to return from the help mode to the previous mode.

Shift key

- Used to shift to the next item in the setting or monitoring mode.
- Press this key and either of the [▲] and [▼] keys together on the menu screen to shift the display screen one page forward or back.

Display

- 13 character x 4 line liquid crystal display screen for showing parameter graphic display and troubleshooting as well as monitoring 20 types of data such as frequency, motor current and I/O terminal states.

Mode select keys

- Used to select the PU operation and external operation (operation using switches, frequency setting potentiometer, etc.), setting mode and monitoring mode.

Frequency change keys

- Used to keep increasing or decreasing the running frequency. Hold down to change the frequency.
- Press either of these keys on the setting mode screen to change the parameter set value sequentially.
- On the monitoring, parameter or help menu screen, these keys are used to move the cursor. Hold down the SHIFT key and press either of these keys to advance or return the display screen one page.

Operation command keys

- Used to give forward rotation, reverse rotation and stop commands in the parameter unit operation mode.

Function and numeral keys

- Used to select the basic functions and enter the frequency, parameter number and set value.

Read key

- Used also as a decimal point key.
- Acts as a parameter number read key in the setting mode.
- Serves as an item select key on the menu screen such as parameter list or monitoring list.
- Acts as an alarm definition display key in the alarm history display mode.
- Serves as a command voltage read key in the calibration mode.

Write key

- Used to write a set value in the setting mode.
- Serves as a clear key in the all parameter clear or alarm history clear mode.
- Acts as a reset key in the inverter reset mode.

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1.4.2 Precautions for Using the Parameter Unit

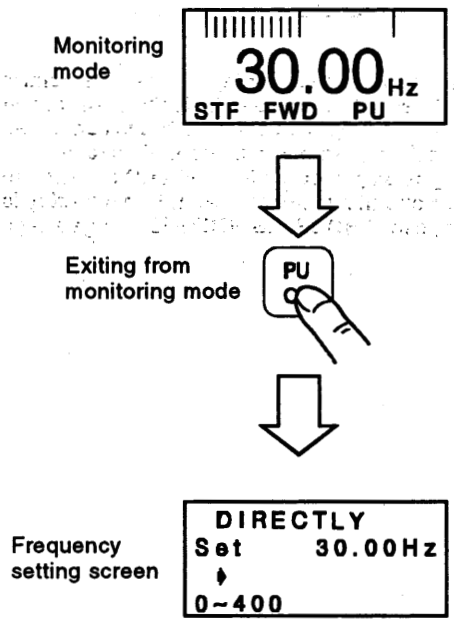
When using the PU, note the following points to make proper settings and enter correct values.

Instructions for operation performed from the PU

- Operation from the PU is only valid when the [PU OP] key is pressed with "0" (factory setting) set in parameter 79 or when PU operation or combined operation is selected in Pr. 79.



- In the monitoring mode, the running frequency cannot be set by direct setting (by entering the frequency directly from the key pad). To set the running frequency, perform step setting (change the frequency sequentially by pressing the [▲]/[▼] key) and press the [WRITE] key, or press the [PU OP] key after exiting from the monitoring mode.



- Jog operation cannot be performed when:
  (1) The motor is running; or
  (2) The jog frequency (Pr. 15) is less than the starting frequency (Pr. 13).

Instructions for monitoring

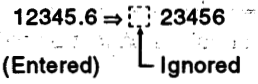
- When the motor is to be run in the PU operation mode, setting the running frequency and then pressing the start key [FWD] or [REV] automatically switches the inverter to the monitoring mode.

Instructions for the operation modes

- If the [PU OP] (or [EXT OP]) key is pressed, the mode cannot be switched when:
  (1) The motor is running;
  (2) The external operation start signal (across terminals STF or STR-SD) is on; or
  (3) The set value of the operation mode select parameter (Pr. 79) is any of 1 to 5 and 7.
- When "0" is in the operation mode select parameter (Pr. 79), switching the inverter power off, then on or resetting the inverter switches it to the external operation mode.

Instructions for the number of digits and decimal point of an input value

- An input value of up to five digits may be entered. If the value entered is in more than five digits, the most significant digit is ignored.



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Instructions for writing set values

- Write the set values when the inverter is at a stop in the PU operation mode or combined operation mode. They cannot be written in the external operation mode. (They may be read in any mode.) Note that some parameters may be written in the external operation mode or during operation. See the following table:

Operation Mode	Write Enabled during Operation	Write Enabled during Stop
External operation mode	Pr. 4 to 6 "three-speed setting" Pr. 24 to 27 "multi-speed setting" Pr. 51 to 56 "display function" Pr. 158 "AM terminal function selection"	Pr. 4 to 6 "three-speed setting" Pr. 24 to 27 "multi-speed setting" Pr. 51 to 56 "display function" Pr. 79 "operation mode selection" Pr. 158 "AM terminal function selection"
PU operation mode and combined operation mode	Pr. 4 to 6 "three-speed setting" Pr. 24 to 27 "multi-speed setting" Pr. 51 to 56 "display function" Pr. 72 "PWM frequency selection" Pr. 77 "parameter write disable selection" Pr. 158 "AM terminal function selection" Pr. 900 "FM terminal calibration" Pr. 901 "AM terminal calibration"	All parameters

- In addition to the above, set values cannot be written when:
  (1) Parameter write disable (Pr. 77) has been selected;
  (2) Any parameter number that does not exist in the parameter list (see page 9-1) has been selected;
  (3) The value entered is outside the setting range; or

- If write is disabled and error " ⊠ " is displayed, press the [SET] (or [CLEAR]) key and restart operation from the beginning.

(Example: Pr. 7 "acceleration time")

```
7 Acc. T1
Setting Error
⊠20000S
<CLEAR>
```

Instructions for setting the running frequency

- When using the, [▲][▼]key to set the frequency (step setting), the frequency may only be set within the range of the maximum and minimum frequencies.

Other Instructions

- When the input power is switched on (or the inverter is reset), the following message is given on the display of the PU for about 1 second. This message indicate that the inverter and FR-PU02 parameter unit are performing communication checks with each other and does not indicate an alarm. Note that if this message does not disappear in about 1 second, see "TROUBLESHOOTING" (page 24-1).

```
PU to   Inverter
comms.  Error
Inv. Reset ON
```

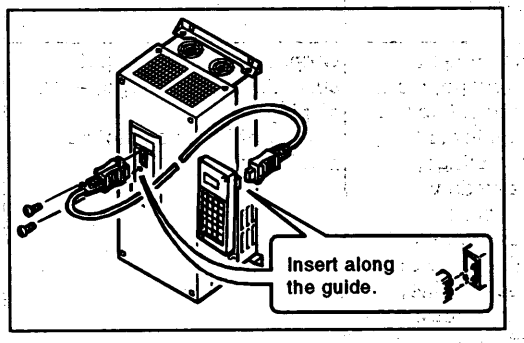
- The above message is also displayed when the control circuit power is switched on later than the main circuit power in a system where the control circuit is connected to a power supply separately from the main circuit. Similarly, Fc-A is displayed on the unit LED instantaneously at power on but it is not an alarm. If this display is kept provided, see "TROUBLESHOOTING" (page 24-1).

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1.4.3 Using the FR-ARW Parameter Copy Unit

Like the FR-PU02E, the FR-ARW parameter copy unit can be installed on the inverter or connected to the inverter by a cable, and allows operation to be performed, functions to be set, and operating status to be monitored. (The [▲] and [▼] keys are different in function from those of the FR-PU02E.) The FR-ARW also allows the parameters of one inverter to be read in batches and easily copied to other inverters.
Note that the parameters may only be copied between the inverters of the same series. They cannot be copied between different models.

1.4.4 Using the FR-PU01 Parameter Unit



The FR-PU01E parameter unit can be used by connection to the inverter by a cable (option). It cannot be installed directly to the inverter.

For the use of the FR-PU01E parameter unit, note the following points.

With the power on, you cannot use the the FR-PU01E and FR-PU02E parameter units by changing them alternately.

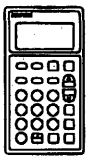
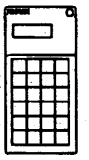
When the FR-PU01E parameter unit is being used, reset the inverter once in either of the following methods, with the parameter unit connected by the cable.

- Switch the power off once, and in more than 0.1 seconds, switch it on again.
- After connecting the reset terminal RES-SD for more than 0.1 seconds, disconnect them.

Note: The inverter recognizes the type of the parameter unit at the time of reset or power-on and does not communicate with any parameter unit other than the one recognized.

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The functions of the inverter are limited by the FR-PU01E. See the function comparison on the right.

Function	 FR-PU02E Parameter Unit	 FR-PU01E Parameter Unit
Operation setting function	Frequency setting 0 to 400Hz Forward rotation, reverse rotation, stop	As on the left
Operation mode setting	PU operation, external operation, jog operation, PU/external combined operation	As on the left
Monitoring function	Output frequency, output current, output voltage, alarm display, frequency set value, running speed, motor torque, converter output voltage, regenerative brake duty, electronic overcurrent protector load factor, output current peak value, converter output voltage peak value, input power, output power, input terminal state, output terminal state, load meter, motor exciting current, position pulse, cumulative operation time, actual operation time	Output frequency, output current, output voltage, alarm display The other items cannot be monitored.
Parameter settting function	Enabled for all of Pr.0 to Pr. 159 and Pr. 200 to Pr. 231.	Limited to Pr. 0 to Pr. 79. Disabled for the gear backlash compensation and 5-point flexible V/F characteristic parameters.
Auto tuning	Pr. 90 to 96 can be set.	All settings disabled.
Calibration function	Pr. 900 to Pr. 905	C1 to C5 Note that C1 cannot be used when any of 101 to 121 (AM terminal) is in Pr. 54. Pr. 901 (AM terminal calibration) cannot be set.
Alarm display clear	Batch clear is performed using "ALARM HISTORY CLEAR" in the help mode.	Batch clear is performed by pressing the CLEAR key when a monitoring error is displayed.
Parameter initialization	Parameter clear (calibration function not cleared) or all parameter clear (calibration function cleared) can be set.	All parameter clear (calibration function not cleared) can only be set.
Alarm display	OV1 to OV3 → OVT PUE, RET, CPU → PE	The alarms indicated on the left are displayed in this way.

In addition, the following functions are not available for the FR-PU01:

- Parameter initial value list
- Parameter change list
- Troubleshooting
- Inverter reset from the parameter unit
- Graphic display of parameter functions

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1.4.5 Using the FR-ZRW Parameter Copy Unit

The FR-ZRW parameter copy unit can be used by connection to the inverter by a cable (option). Like the FR-PU01E, the FR-ZRW limits the inverter functions. In addition, the function of reading and copying a batch of parameters to another inverter cannot be used.

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2. OPERATION

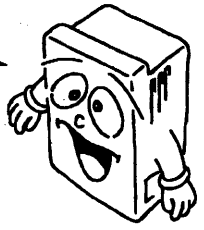
This chapter offers detailed information on the "operation" of the FR-A201E "inverter with built-in power return function".
Always read the precautions and instructions in this chapter before using the inverter.

2.1 OPERATION.....5 – 1

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2.1 OPERATION

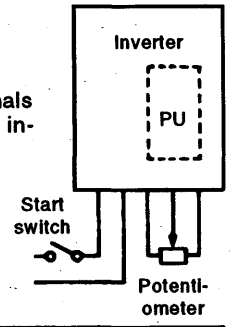
Three modes are available for the operation of the FR-A201E inverter.
Select the appropriate mode for the application and operating conditions and prepare necessary instruments and parts.
For operation modes, refer to page .



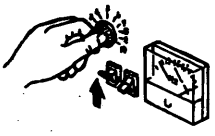
2.1.1 Instruments and Parts to be Prepared before Operation

Instruments and parts to be prepared

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



Note: 1. Not only the start signal but also the frequency setting signal are required to run the inverter.



- Operation using the frequency setting potentiometer and start switch provided externally

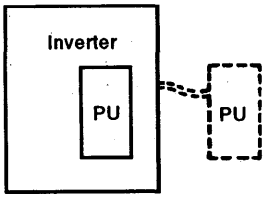
1. External operation mode

The inverter is operated under the control of external operation signals connected to the terminal block.

Instruments and parts to be prepared

- **Parameter unit**
  (FR-PU02E) (See page 28-6)
- **Cable**
  (FR-CBL) (See page 28-9)

Use this cable when the parameter unit is held in hand to perform operation, for example.





- Use the PU to start.
- Direct setting of frequency
- Step setting of frequency
- Jog operation
  Hold down the FWD or REV key to rotate the motor.

2. PU operation mode

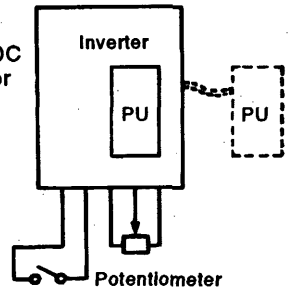
The inverter is operated from the keypad of the parameter unit.

This mode does not require the operation signals and is useful for an immediate start of operation.

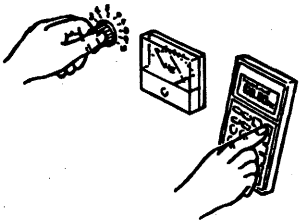
Instruments and parts to be prepared

- **Start signal**
  Switch, relay, etc.
- **Frequency setting signal**
  0 to 5V, 0 to 10V, 4 to 20mA DC signals from a potentiometer or outside the inverter
- **Parameter unit**
  (FR-PU02E) (See page 28-6)
- **Cable**
  (FR-CBL) (See page 28-9)

Use this cable when the parame-ter unit is held in hand to perform operation, for example.







- Use the external signal to start.
- Use the PU to set the frequency.
- Use the operation command keys of the PU to start.
- Use the external frequency setting potentiometer to set the frequency.

3. External/PU combined operation mode

The inverter is operated with the external operation and PU operation modes combined in either of the following two methods.

1) The external signal is used as the start signal and the PU is used to set the frequency.

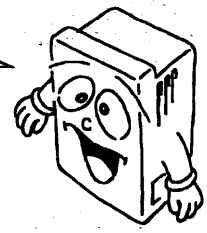
2) The operation command key of the PU is used to start and the external frequency setting potentiometer is used to set the frequency.

*: "PU" stands for the parameter unit.

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2.1.2 Pre-operation Settings

The main items to be set before operation are as follows. Set the required items according to the load and operational specifications. For simple variable-speed operation or the like, use the inverter with the factory setting. For more information and the explanation of the other parameters, see page 9-1. Note that a parameter will be referred to as "Pr.".



■ Setting method

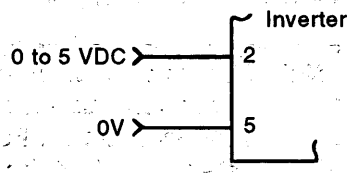
In the PU operation mode, use the parameter unit for setting. (See page 8-1.)
The start signal (STF or STR) must be off to switch from the external operation mode to the PU operation mode, otherwise the inverter cannot be put in the PU operation mode.

Operation using the voltage input signal

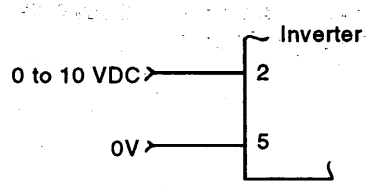
- **Pr. 73 "0 to 5V, 0 to 10V selection"**

When the voltage input signal is used for operation, set the specifications of the frequency setting voltage signal entered across terminals 2-5.

- **0 to 5VDC**
  Set "1" (factory setting) in Pr. 73.



- **0 to 10VDC**
  Set "0" in Pr. 73.



Operation using the current input signal

When the current input signal is used for operation, it is necessary to enter the signal across terminals 4-5 and short terminals AU-SD.

Setting of frequency setting voltage (current) gain (maximum output frequency)

- **Voltage signal**
  Pr. 903 "frequency setting voltage gain"
- **Current signal**
  Pr. 905 "frequency setting current gain"
- **Pr. 1 "maximum frequency"**

When the frequency used for operation is equal to or higher than the factory setting given below, change the setting of the corresponding parameter.
When the frequency used for operation is higher than 120Hz, the setting of Pr. 18 "high-speed maximum frequency" must be changed.

Parameter	Factory Setting
Pr. 903 "frequency setting voltage gain"	60Hz at 5V (or 10V) DC
Pr. 905 "frequency setting current gain"	0Hz at 4mADC, 60Hz at 20mADC
Pr. 1 "maximum frequency"	Up to 120Hz

When the parameter unit is used for operation, the maximum output frequency is up to the maximum frequency (factory setting: 120Hz). (See Pr. 1.) (For details of Pr. 903, Pr. 905, see page 13-1.)

Note: When the frequency meter is connected across terminals FM-SD to monitor the running frequency, the output of terminal FM is saturated if the maximum output frequency reaches or exceeds 100Hz, with the factory-set value unchanged. Hence, the setting of Pr. 55 "frequency monitoring reference" must be changed to the maximum output frequency. (See page 9-25.)

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Setting of maximum frequency
- **Pr. 1 "maximum frequency"**

Set this parameter to define the upper limit of the output frequency or to perform operation at a frequency above 120Hz. Change the setting of this parameter only when the frequency must be limited in addition to the setting of the above-mentioned "frequency setting voltage (current) gain" which allows the frequency to be restricted to below the set value.

Factory setting: 120Hz

Setting of minimum frequency
- **Pr. 2 "minimum frequency"**

Use this parameter to specify the lower limit of the output frequency. When the minimum frequency has been set, merely turning on the start signal starts the motor running at the set frequency (if the frequency setting is 0Hz, no rotation will happen).

Factory setting: 0Hz

Setting of electronic overcurrent protector
- **Pr. 9 "electronic overcurrent protector"**

The factory setting is the rated current value of the inverter. When changing the set value, set the 50Hz current value given on the motor rating plate.

Note: The operation characteristics, which are based on the Mitsubishi standard squirrel-cage motor, do not apply to a special motor. For a special motor, provide a thermal relay to protect the motor. (A constant-torque motor can be selected by the setting of Pr. 71.)

Selection of applied loady
- **Pr. 14 "applied load selection"**

Allows the optimum output characteristic (V/F characteristic) to be selected for application and load characteristic.

Application	Set Value	Remarks
For constant-torque loads (e.g. conveyor, carrier)	0 (factory setting)	——
For variable-torque loads (e.g. fan, pump)	1	——
For lift	2	Boost for forward rotation...Pr. 0 set value Boost for reverse rotation...0%
	3	Boost for forward rotation...0% Boost for reverse rotation...Pr. 0 set value
Applied load selection switching function	4	• Terminal RT ON (Note) As in constant-torque loads. • Terminal RT OFF As in no boost at reverse rotation for lift. No boost for reverse rotation
	5	• Terminal RT ON (Note) As in constant-torque loads. • Terminal RT OFF As in no boost at forward rotation for lift. No boost for forward rotation

Note: When terminal RT is ON, the second control functions (second acceleration/deceleration time, second torque boost and second base frequency) are selected.

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Selection of external thermal relay input

- **Pr. 17 "external thermal relay input"**

When a thermal relay is installed outside the inverter or the motor contains a temperature sensor, this parameter switches the function of the JOG/OH input terminal to OH (external thermal relay input).

Pr. 17 Set Value	JOG/OH Terminal Function		MRS Terminal Function	
	Jog Mode	OH (external thermal relay input)	N/O Input	N/C Input
0 (factory setting)	●	—	●	—
1	—	●	●	—
2	●	—	—	●
3	—	●	—	●

Setting of acceleration and deceleration times

- **Pr. 7 "acceleration time"**
- **Pr. 8 "deceleration time"**
- **Pr. 44 "second acceleration /deceleration time"**
- **Pr. 45 "second deceleration time"**

When an acceleration/deceleration time other than the factory setting is used, change the values of these parameters.

Parameter	Factory Setting
Pr. 7 "acceleration time"	7.5K and down .....5 seconds, 11K and up.....15 seconds
Pr. 8 "deceleration time"	7.5K and down .....5 seconds, 11K and up.....15 seconds
Pr. 44 "second acceleration /deceleration time"	5 seconds
Pr. 45 "second deceleration time"	9999 (same as the value set in Pr. 44)

Calibration of frequency meter

To monitor the output status correctly, calibrate the frequency meter before operation.
Use the parameter unit for calibration to make adjustment with higher accuracy.
(See page 11-1 for the adjustment procedure.)

When an inverter once used is to be used again

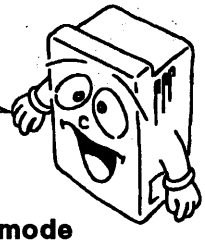
It is assumed that the set values of the parameters may have been changed according to the operational specifications. Before starting operation, initialize the parameters (return the parameter values to the factory setting). Initialization can be made by performing parameter clear operation using the parameter unit. (For the operation procedure, see page 7-11.) Note that the following parameters are not initialized by the parameter clear operation. For these parameters, read their set values and change them to the required values, or perform parameter all clear operation to return to the factory setting.

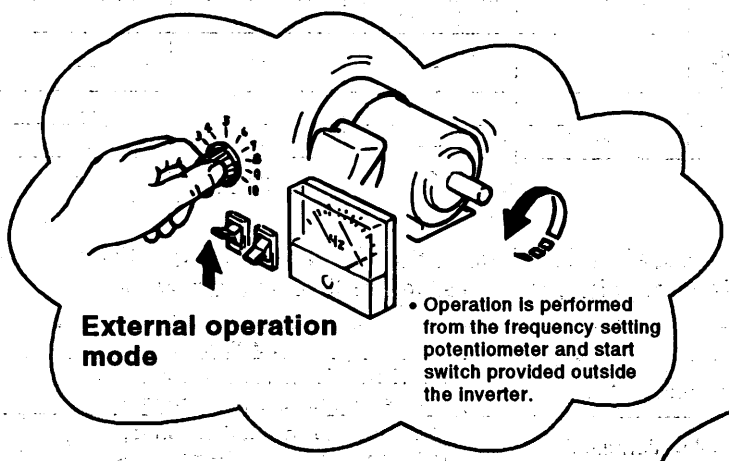
- Pr. 900 "FM terminal calibration"
- Pr. 901 "AM terminal calibration"
- Pr. 902 "frequency setting voltage bias"
- Pr. 903 "frequency setting voltage gain"
- Pr. 904 "frequency setting current bias"
- Pr. 905 "frequency setting current gain"

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2.1.3 Operation Mode

The inverter has three operation modes: "operation using the external input signals" (external operation mode), "operation using the PU" (PU operation mode), and "combined operation using the external input signals and PU" (combined operation mode).



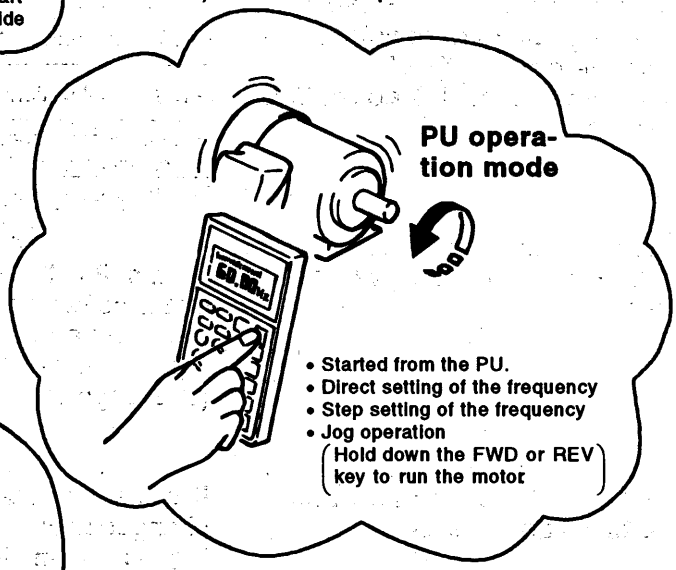


External operation mode

- Operation is performed from the frequency setting potentiometer and start switch provided outside the inverter.

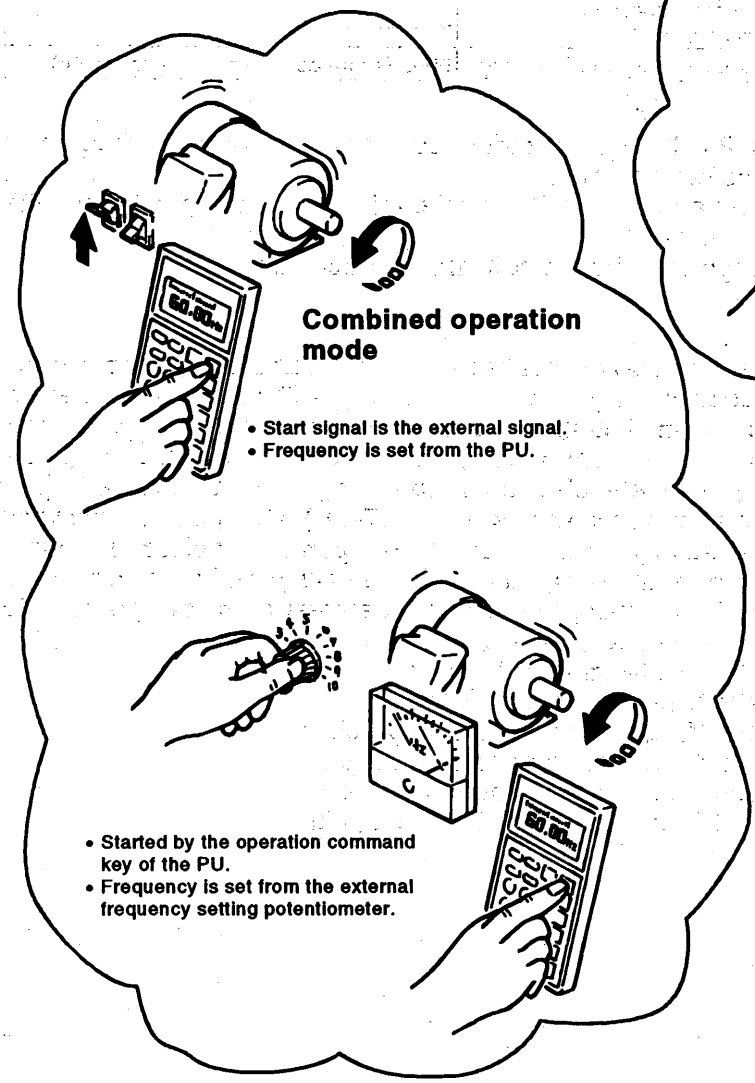
■ Factory-set operation mode

When the input power is switched on (or the inverter is reset), the inverter is set to the mode of "operation using the external input signals". Therefore, as soon as the input power is switched on, the inverter is ready for operation using the external input signals. In this state, turn the start signal (across STF, STR and SD) on to start operation.



PU operation mode

- Started from the PU.
- Direct setting of the frequency
- Step setting of the frequency
- Jog operation
  (Hold down the FWD or REV key to run the motor)



Combined operation mode

- Start signal is the external signal.
- Frequency is set from the PU.

- Started by the operation command key of the PU.
- Frequency is set from the external frequency setting potentiometer.

■ Fixing the operation mode

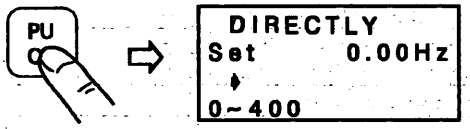
The operation mode at power on may be limited, e.g. operation from the PU is enabled at power on without switching the operation mode with the PU's mode select key.
For full information on the setting procedure, see page 5-7.

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2.1.4 Selection of the Operation Mode

The inverter is factory-set to allow the operation mode to be switched between "external operation" and "PU operation". At power-on, the inverter is placed in the "external operation" mode. Use the PU to switch to the other operation mode.

- **Switching from the external operation mode to the PU operation mode** ..... Check that the external input signal is off (across STF or STR and SD).
  Then, press the [PU OP] key to switch to the PU operation mode, the frequency setting screen is displayed.



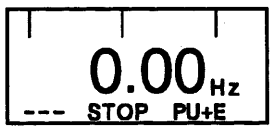
Frequency setting screen

- **Switching from the PU operation mode to the external operation mode** ..... Check that the external input signal is off (across STF or STR and SD) and that the operation command indication is "---".
  Then, press the [EXT OP] key to switch to the external operation mode, "EXT" is displayed as the operation mode indication.



Operation command indication Operation mode indication

- **Switching to the combined operation mode** ..... Change the set value of Pr. 79 "operation mode selection" as indicated below. (For more information on changing the set value, see page 8-1.)
  "PU+E" is displayed at the operation mode indication.



Operation mode indication

Set Value	Description	
	Running Frequency Setting	Start Signal
3	Parameter unit • Direct setting and [▲] [▼] key setting	Terminal signal • STF • STR
4	Terminal signal • 0 to 5VDC across 2-5 • 0 to 10VDC across 2-5 • 4 to 20mADC across 4-5 • Multi-speed selection (Pr. 4 to 6, 24 to 27) • Jog frequency (Pr. 15)	Parameter unit • FWD key • REV key

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Note: If the operation mode cannot be switched properly, check the following:

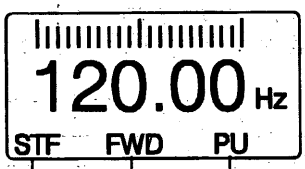
1. External input signal (across STF or STR and SD) — Check that the signal is off. If it is on, the operation mode cannot be switched properly. Look for STF or STR on the PU display.
2. Parameter setting — Check the set value of Pr. 79 "operation mode selection".

Set Value	Description
0	Operation can be performed with the mode switched between PU operation and external operation. (Factory setting)
1	PU operation can only be performed. (Cannot be switched to the other mode.)
2	External operation can only be performed. (Cannot be switched to the other mode.)
3, 4	Combined operation mode
5	Programmed operation mode
7	PU operation interlock
8	External signal-based operation mode switching

3. Limitation of the operation mode — When the set value of Pr. 79 "operation mode selection" is "0" (factory setting), the inverter is put in the external operation mode at input power-on. Press the [PU OP] key to switch to the PU operation mode. For the other set values (1 to 5, 7, 8), the operation mode is limited accordingly.

2.1.5 Operation Mode Indication, Operation Command Indication and Operation Status Indication

The currently selected operation mode, operation status, etc. are displayed at the bottom of the display screen of the parameter unit.



•Operation mode indication

PU: PU operation
EXT: External operation
PUj: PU jog operation
EXTj: External jog operation
NET: Computer, PC link operation
PU+E: PU/external combined operation
PRG: Programmed operation

•Operation status indication

FWD: Forward rotation in progress
REV: Reverse rotation in progress
STOP: At a stop
JOGf: Jog forward rotation in progress
JOGr: Jog reverse rotation in progress

•Operation command indication

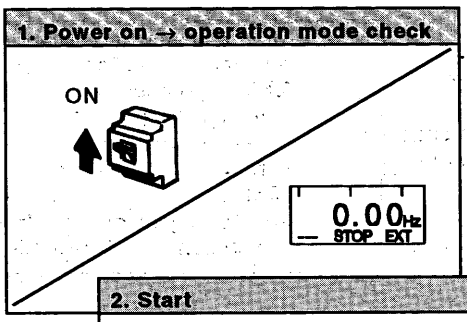
STF: Forward rotation
STR: Reverse rotation
---: No command or both STF and STR "ON"

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2.1.6 External Operation Mode (Operation using the external input signals)

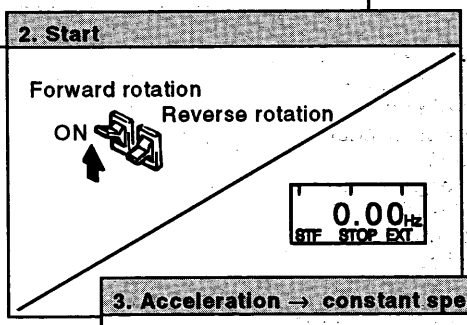
(1) Standard operation

- **Operation procedure (Operation at 60Hz)**

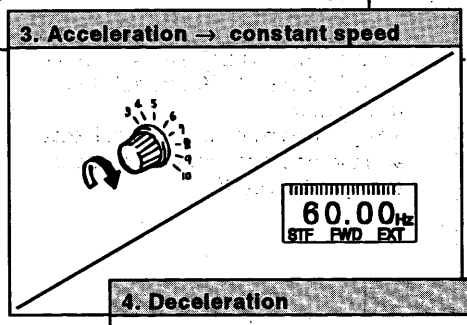


.....**Switch the power on and make sure that "EXT" is shown at the operation mode indication.**
If it is not shown, switch to the external operation mode in accordance with page 5-6.

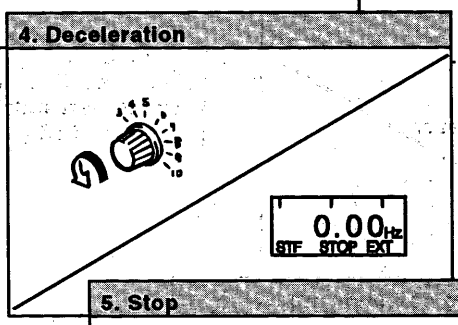
Note 1: If the forward and reverse rotation switches are turned on together, the inverter will not start. Also, if these switches are turned on together during operation, the motor is decelerated to a stop.



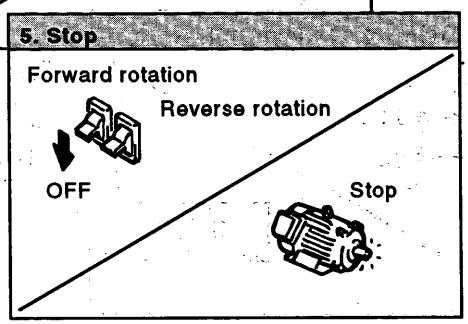
.....**Turn on the start switch (connect terminals STF or STR and SD).** (Note 1)
The operation command indication changes to "STF" or "STR".



.....**Slowly turn the potentiometer (frequency setting potentiometer) full clockwise.**
The frequency shown on the display increases gradually to 60Hz, and the operation status indication changes to output indication (FWD or REV).



.....**Slowly turn the potentiometer (frequency setting potentiometer) counterclockwise.** (Note 2)
The frequency shown on the display decreases gradually to 0Hz.
The motor stops running.



.....**Turn off the start switch (disconnect terminals STF or STR and SD).**

Note 2: If the start switch is turned off with the potentiometer in the full clockwise position, the motor is decelerated to a stop. The DC dynamic brake operated at this time generates high-frequency noise immediately before the stop, this is not a fault.

Potentiometer rating, 1 or 2W, 1kΩ

Note 3: Do not switch power on when the operation command (STF, STR terminal) is on. Switch on the operation command (STF, STR terminal) after 1 second after power-on.

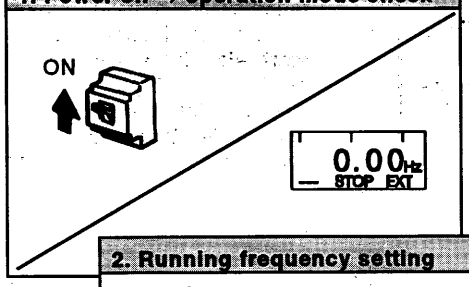
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(2) External jog operation

Keep the start switch on (connect terminals STF or STR and SD) to perform operation, and switch it off to stop. For details of changing the parameter setting, see page 8-1.

- **Operation procedure (Operation at 8Hz)**

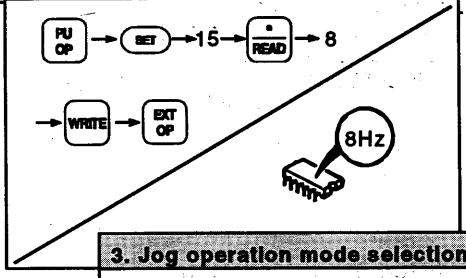
1. Power on → operation mode check



..... **Switch the power on and make sure that "EXT" is shown at the operation mode indication.**
If it is not shown, switch to the external operation mode in accordance with page 5-6.

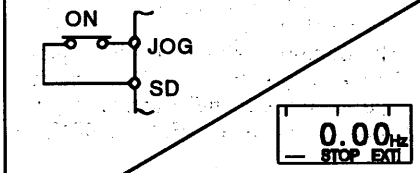
Note 1: The frequency and acceleration/deceleration time for jog operation can be set in the following parameters.
<Factory setting>
- Pr. 15 "jog frequency" ... 5Hz
- Pr. 16 "jog acceleration/deceleration" ... 0.5 seconds

2. Running frequency setting



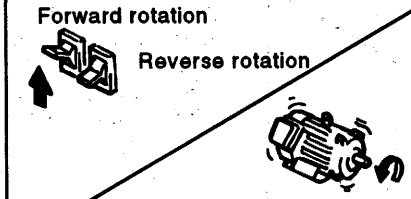
..... **Press the [PU OP] key to switch to the PU operation mode and use parameter 15 "jog frequency" to set.** (Note 1)
After the setting is complete, press the [EXT OP] key to switch to the external operation mode.

3. Jog operation mode selection



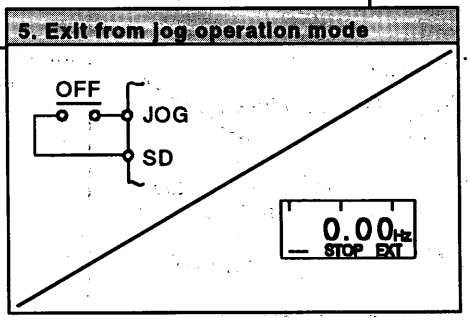
..... **Turn on the signal across terminals JOG and SD (connect these terminals).**
The jog operation mode is selected and the operation mode indication changes to "EXTj".

4. Operation



..... **Turn on the start switch (connect terminals STF or STR and SD).** (Note 2)
Keep the start switch on to perform operation, switch it off (disconnect) to stop.

5. Exit from jog operation mode



..... **Switch off the signal across terminals JOG and SD (disconnect these terminals).**
The inverter exits from the jog operation mode and returns to the ordinary external operation mode.

Note 2: If the motor does not run, check Pr. 13 "starting frequency". If the set value is less than the starting frequency, the motor does not start.

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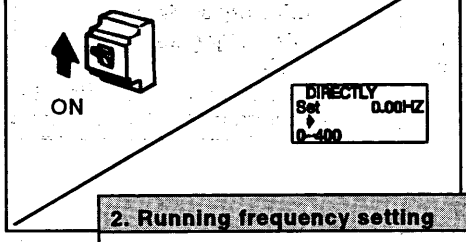
2.1.7 PU Operation Mode (Operation using the PU)

(1) Standard operation

By repeating steps 2 and 3 during motor operation, speed can be changed.

- **Operation procedure (Operation at 60Hz)**

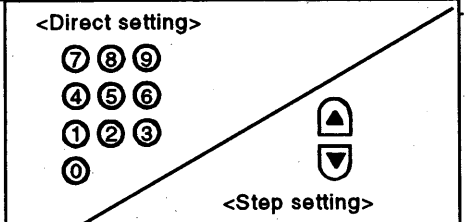
1. Power on → operation mode check



..... **Switch the power on, press the [PU OP] key, and make sure that the frequency setting screen is shown on the display.**
If it is not shown, switch to the PU operation mode in accordance with page 5-6.

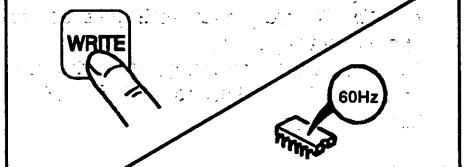
Note 1: After pressing the [PU OP] key, enter the frequency directly with the numeral keys. This setting is not available in the monitoring mode. Press the [PU OP] key to leave the monitoring mode before setting.

2. Running frequency setting



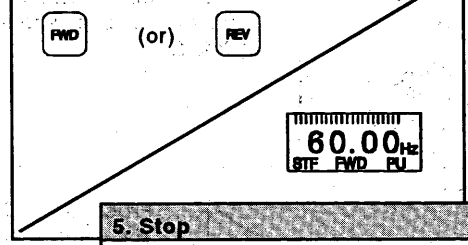
..... **Set the running frequency to 60Hz.**
- Direct setting (Note 1)
- Step setting (Note 2) (Note 3)

3. Frequency write



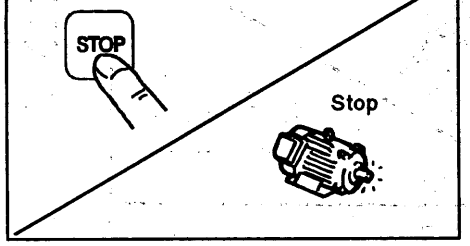
..... **Press the [WRITE] key.**
The [WRITE] key must be pressed, otherwise the frequency is not stored into memory.

4. Start



..... **Press the [FWD] or [REV] key.**
The motor starts running. The inverter is automatically placed in the monitoring mode and the state of the output frequency is displayed.

5. Stop



..... **Press the [STOP] key.**
The motor is decelerated to a stop.

Note 2: Press the [▲]/[▼] key to keep the frequency changing. Hold down the [▲] (or [▼]) key to change the frequency. At the beginning, the frequency changes slowly and this may be used for fine adjustment.

Note 3: Step setting can also be made during inverter operation. However, if the [▲] (or [▼]) key is pressed in the monitoring mode, the frequency does not stop changing when the key is released and rises (or falls) further. (Since the [▲] (or [▼]) key changes the set frequency, switch operation does not match the actual frequency change.)

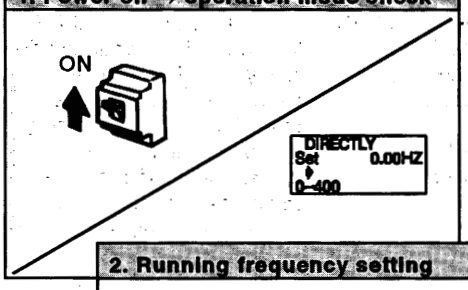
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(2) PU jog operation

Hold down the [FWD] or [REV] key to perform operation, and release it to stop. For details of changing the parameter setting, see page 8-1.

- **Operation procedure (Operation at 8Hz)**

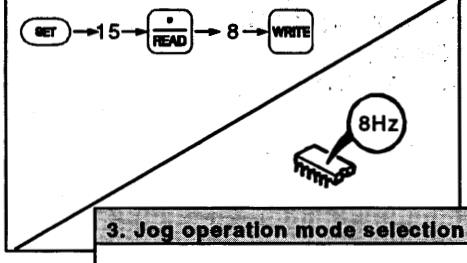
1. Power on → operation mode check



..... **Switch the power on, press the [PU OP] key, and make sure that the frequency setting screen is shown on the display.**
If it is not shown, switch to the PU operation mode in accordance with page 5-6.

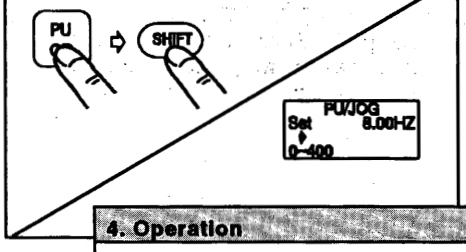
Note 1: The frequency and acceleration/deceleration time for jog operation can be set in the following parameters.
<Factory setting>
- Pr. 15 "jog frequency" ... 5Hz
- Pr. 16 "jog acceleration/deceleration" ... 0.5 seconds

2. Running frequency setting



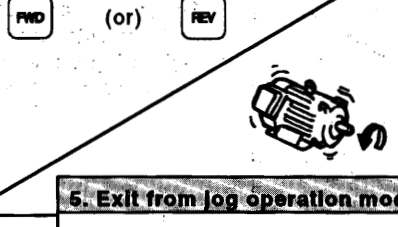
..... **Use parameter 15 "jog frequency" to set.**
(Note 1).

3. Jog operation mode selection



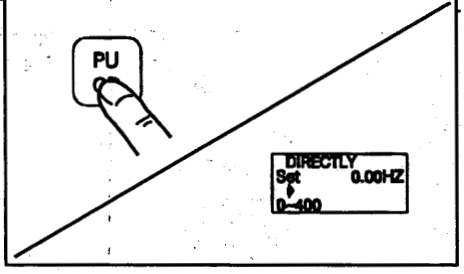
..... **Press the [PU OP] key, then the [SHIFT] key.**
The jog operation mode is selected and the PU JOG frequency setting screen is shown on the display.
To change the frequency, enter the numerical value and press the [WRITE] key.

4. Operation



..... **Press the [FWD] or [REV] key.**
The display changes to the monitor screen. Hold down the key to perform operation and release it to stop.
(Note 2)

5. Exit from jog operation mode



..... **Press the [PU OP] key.**
The inverter exits from the jog operation mode and returns to the standard PU operation mode. To return to jog operation mode, press the [SHIFT] key.

Note 2: If the motor does not run, check Pr. 13 "starting frequency". If the set value is less than the starting frequency, the motor does not start.

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2.1.8 Combined Operation Mode (Operation using the external input signals and PU)

(1) Entering the start signal externally and setting the running frequency from the PU (Pr. 79=3)

The external frequency setting signals and the PU's FWD, REV and STOP keys are not accepted.
For details of changing the parameter setting, see page 8-1.

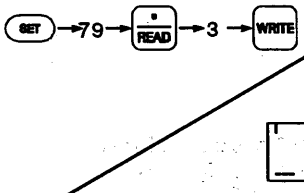
- **Operation procedure (Operation at 60Hz)**

1. Power on



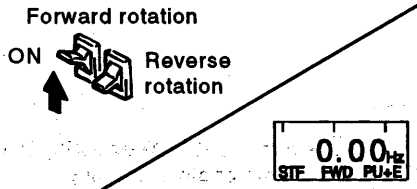
..... **Switch the power on.**

2. Operation mode selection



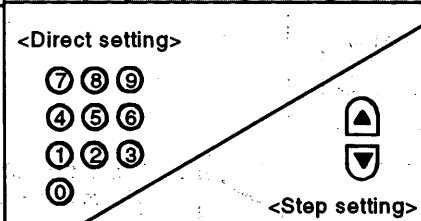
..... **Set "3" in Pr. 79 "operation mode selection".**
The combined operation mode is selected and the operation mode indication on the display changes to "PU+E".

3. Start



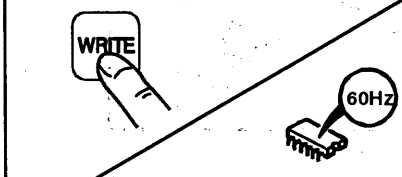
..... **Turn on the start switch (connect terminals STF or STR and SD).** (Note 1)
The operation command indication changes to "STF" or "STR" and the operation status indication changes to output indication (FWD or REV).

4. Running frequency setting



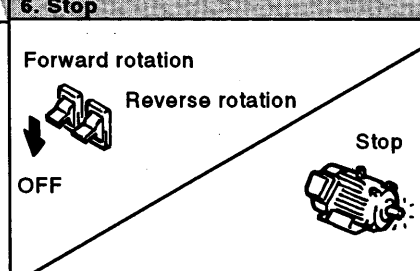
..... **Using the PU, set the running frequency to 60Hz.**
- Direct setting (Note 2)
- Press the [PU OP] key to call the frequency setting screen, and perform step setting. (Note 3)

5. Frequency write



..... **Press the [WRITE] key.**
The [WRITE] key must be pressed, otherwise the frequency is not stored into memory.

6. Stop



..... **Turn off the start switch (disconnect terminals STF or STR and SD).**
The motor is stops running.

Note 1: If the forward and reverse rotation switches are turned on together, the inverter will not start. Also, if these switches are turned on together during operation, the motor is decelerated to a stop.

Note 2: After pressing the [PU OP] key, enter the frequency directly with the numeral keys. This setting is not available in the monitoring mode. Press the [PU OP] key to leave the monitoring mode before setting.

Note 3: Press the [▲]/[▼] key to keep the frequency changing. Hold down the [▲] (or [▼]) key to change the frequency. At the beginning, the frequency changes slowly and this may be used for fine adjustment.

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(2) Entering the running frequency externally and start and stop from the PU (Pr.79=4)

For details of changing the parameter setting, see page 8-1.

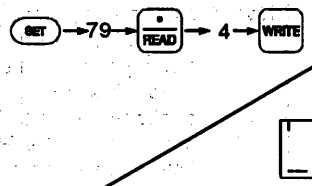
- **Operation procedure**

1. Power on



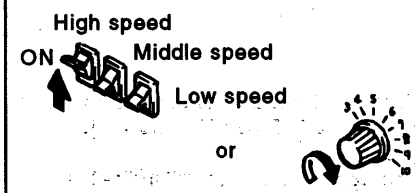
..... **Switch the power on.**

2. Operation mode selection



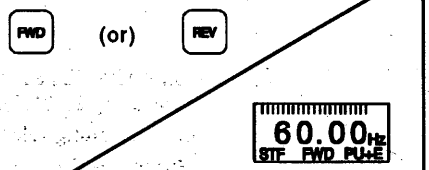
..... **Set "4" in Pr. 79 "operation mode selection".**
The combined operation mode is selected and the operation mode indication on the display changes to "PU+E".

3. Running frequency setting



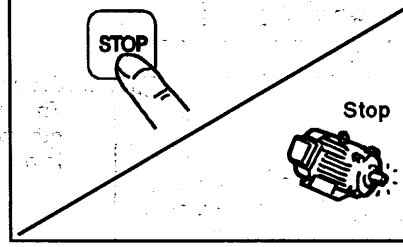
..... **Enter the running frequency signal (select the multi-speed signal or turn the frequency setting potentiometer).**

4. Start



..... **Press the [FWD] or [REV] key.** (Note 1)
The motor starts running.
The state of the output frequency is shown on the display.

5. Stop



..... **Press the [STOP] key of the PU.**
The motor is decelerated to a stop.

Note 1: The starting terminals (STF, STR) of the inverter are invalid.
The inverter cannot be started if the [FWD] or [REV] key is pressed and the level of the frequency setting signal is then raised.

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(3) Entering the start signal and multi-speed signal externally and setting the multiple speeds from the PU

Perform this operation in the external operation mode with "0" (factory setting) set in Pr. 79 "operation mode selection".
For details of changing the parameter setting, see page 8-1.

- **Operation procedure**

1. Power on



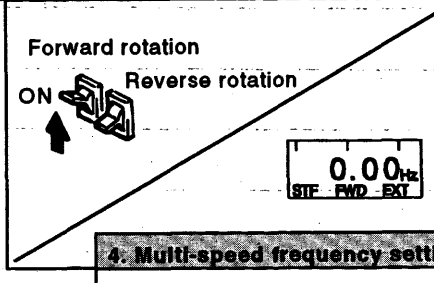
..... **Switch the power on.**

2. Operation mode selection



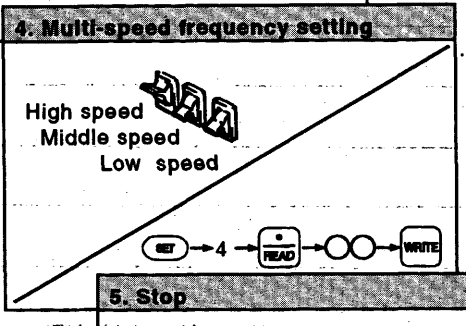
..... **Select the multi-speed signal required for operation (connect terminals RH/RM/RL-SD).**

3. Start



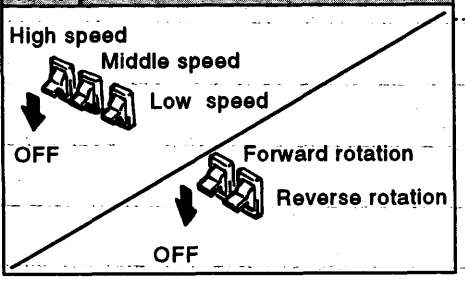
..... **Turn on the start switch (connect terminals STF or STR and SD).**
(Note 1)
The operation command indication changes to "STF" or "STR" the operation status indication changes to output indication (FWD or REV), and the motor starts rotating.

4. Multi-speed frequency setting



..... **Using the PU, change the current multi-speed frequency.**
When high speed has been selected (RH-SD connected), changing the value of the "three-speed setting (high speed)" varies the speed.
(Note 2)

5. Stop



..... **Switch off the multi-speed signal (disconnect terminals RH/RM/RL-SD) and turn off the start switch (disconnect terminals STF or STR and SD).**
The motor stop running.

Note 1: If the forward and reverse rotation switches are turned on together, the inverter will not start. Also, if these switches are turned on together during operation, the motor is decelerated to a stop.
Note 2: The set values of the multiple speeds not being used can also be changed during operation. (See page 9-6.)

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MEMO

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3. PARAMETERS

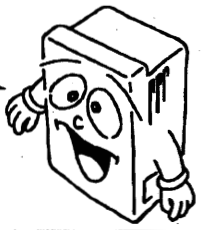
This chapter provides detailed information on the "parameters" of the FR-A201E "inverter with built-in power return function".
Always read the precautions and instructions in this chapter before using the inverter.

3.1 MONITORING FUNCTION ..... 6 – 1
3.2 HELP FUNCTION ..... 7 – 1
3.3 SETTING AND CHANGING THE VALUES IN THE PARAMETERS ..... 8 – 1
3.4 PARAMETERS ..... 9 – 1
3.5 INVERTER RESET ..... 10 – 1

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3.1 MONITORING FUNCTION

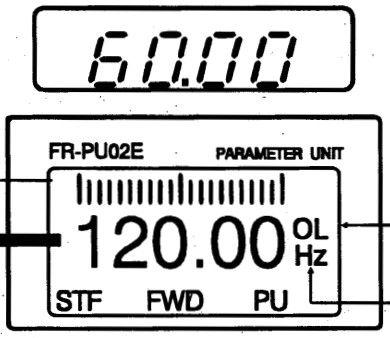
The inverter can be monitored by either the LED (red light emitting diode) display on the inverter, the 5-digit liquid crystal display on the PU (PU main monitor) or the PU level meter. These displays are selected by the following method:



PU level meter

Setting Pr. 53 on the PU allows selection from 15 types of data. (See page 9-23.)

- Factory setting... Pr. 53 = "1" Output frequency indication



Inverter LED display

Setting Pr. 51 on the PU allows selection from 16 types of data. (See page 9-23.)

- Factory setting .... Pr. 51 = "1" Output frequency indication

Indicates that the stall prevention function is activated.

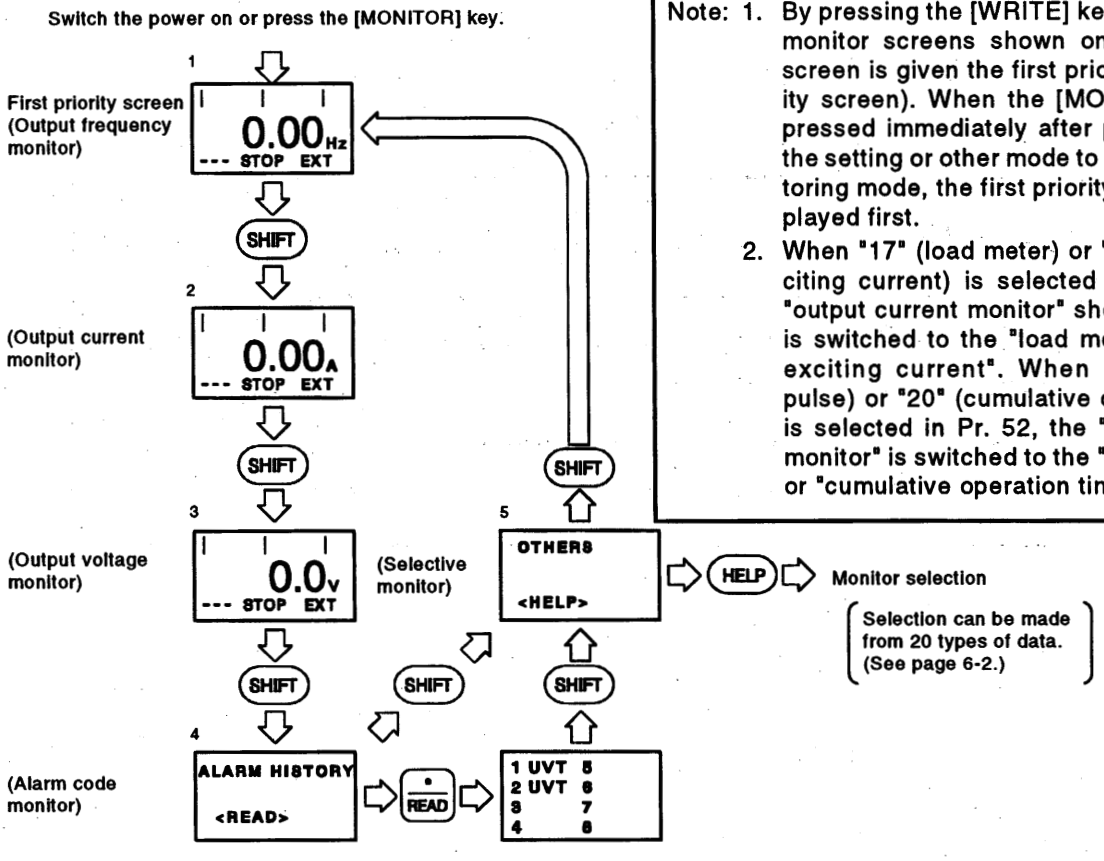
Display unit

PU main monitor

5 types of data can be selected in sequence by the [SHIFT] key.

3.1.1 SHIFT Operation Sequence on the PU Main Monitor

When "0" (factory setting) is set in Pr. 52 "PU main display data selection", merely pressing the [SHIFT] key calls five types of data in sequence. Within the five monitor screens, the fifth monitor screen (selective monitoring) allows selection from 20 types of data such as the frequency set value and running speed.



Note: 1. By pressing the [WRITE] key on any of the monitor screens shown on the left, that screen is given the first priority (first priority screen). When the [MONITOR] key is pressed immediately after power-on or in the setting or other mode to enter the monitoring mode, the first priority screen is displayed first.

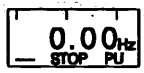
2. When "17" (load meter) or "18" (motor exciting current) is selected in Pr. 52, the "output current monitor" shown on the left is switched to the "load meter" or "motor exciting current". When "19" (position pulse) or "20" (cumulative operation time) is selected in Pr. 52, the "output voltage monitor" is switched to the "position pulse" or "cumulative operation time".

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3.1.2 Selecting the Another Monitor Item in the Selective Monitoring Mode

- **Selection procedure (Example: Select the input terminal state monitor screen.)**

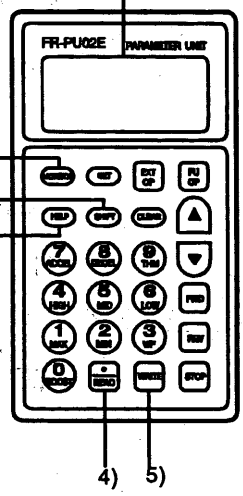
1) Press the [MONITOR] key. .....Parameter unit is placed in the monitoring mode.



2) Press the [HELP] key. .....The monitoring list is displayed.



Display



3) Hold down the [SHIFT] key and press the [▼] key three times, and without pressing the [SHIFT] key, press the [▼] key twice. (Move the cursor to signal In.)

..... Hold down the [SHIFT] key and press the [▼] or [▲] key to advance or return the screen one page.

4) Press the [READ] key. (Note 1) .... The screen shown on the right is displayed.



5) Press the [WRITE] key. (Note 2) ...The screen in step 5) is set as the first priority screen.

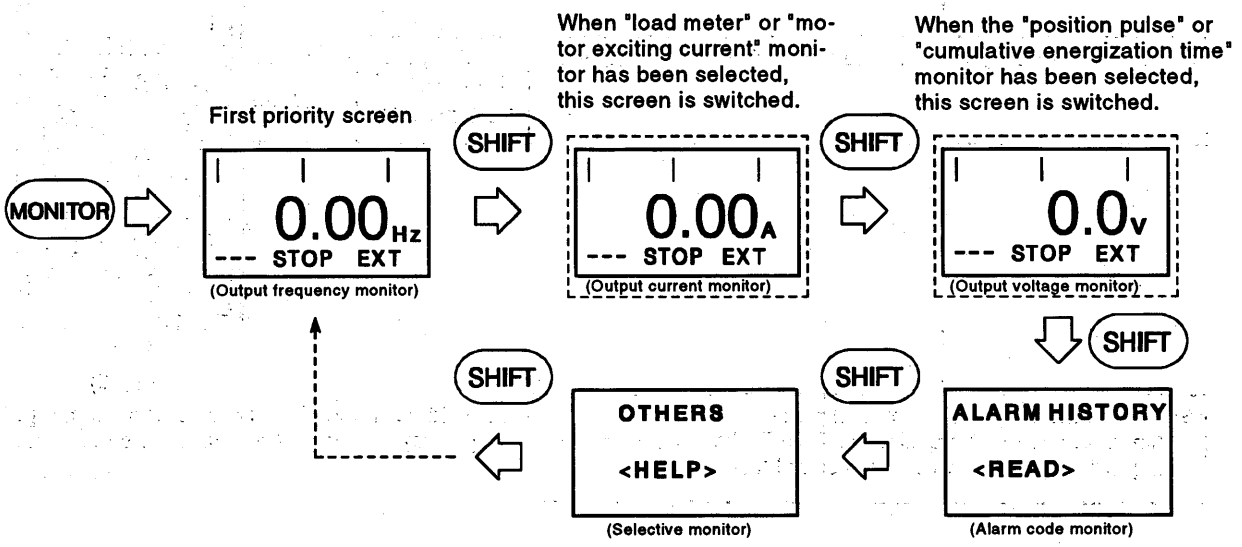
..... Subsequently press the [SHIFT] key to call the other monitor screen.

Note: 1. Since the selective monitor screen is not the first priority screen in the above step 5) where the [READ] key has been pressed, the selected data is erased from the memory as soon as the power is shut off or the other operation mode (such as external operation) is selected.
In this case, the selective monitoring mode must be selected again in the above procedure.
When the first monitor screen has been set by pressing the [WRITE] key, the selected data remains intact in the memory.

2. In step 6) where the [WRITE] key has been pressed in the above setting example, the "I/O terminal states" selected here are first displayed with priority when the other operation mode is switched to the monitoring mode. To give first priority to other data, press the [WRITE] key with the monitor screen being displayed. The first priority screen then switches to that monitor screen.

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- **Selecting any of the monitoring items "load meter", "motor exciting current", "position pulse" and "cumulative energization time"**
  When the "load meter" or "motor exciting current" has been selected, the output current monitor screen is switched to a corresponding screen. When the "position pulse" or "cumulative energization time" has been selected, the output voltage monitor screen is switched to a corresponding screen. When any of these four items has been selected, the output current or output voltage monitor screen cannot be used.

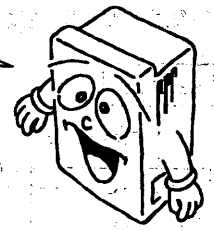


- **Selecting "current monitoring" or "power monitoring"**
  Note that a current less than 5% of the rated current of the inverter cannot be detected and displayed.
  Also note that the electronic thermal relay does not operate at that current. For motor protection, examine the use of an external temperature detector or the like.
  Example: When a small motor (0.4kW motor) is run by a large-capacity inverter (5.5kW), power monitoring is inactive.

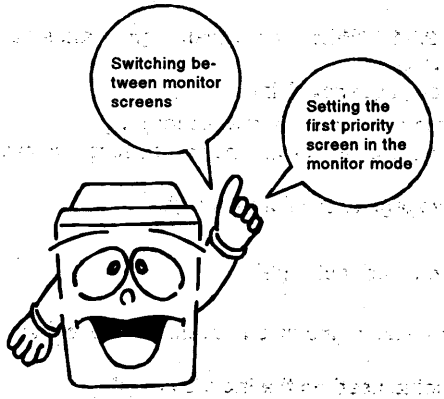
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3.2 HELP FUNCTION

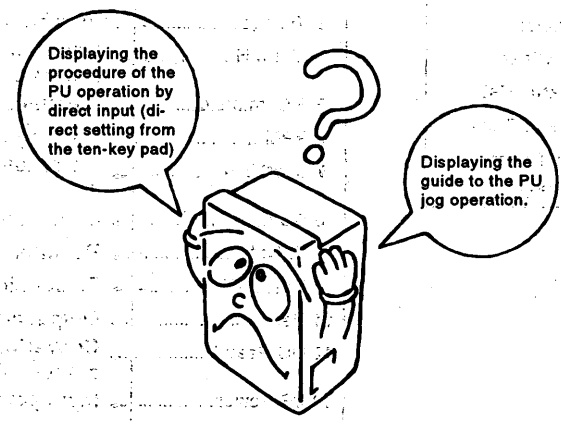
The FR-A201E inverter has a help function to assist you in performing the following.



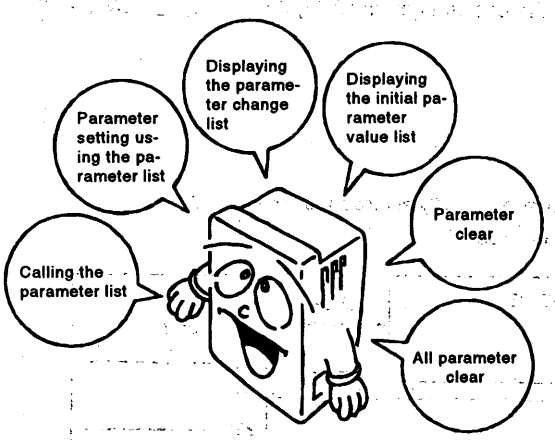
Monitor list display



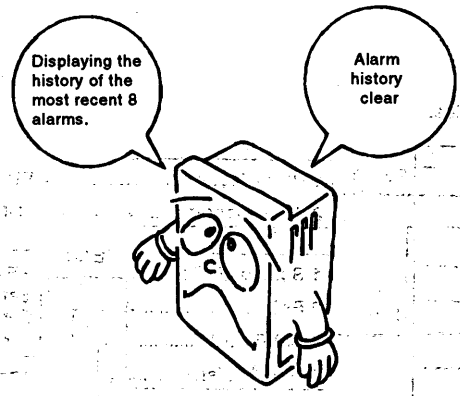
PU operation guide display



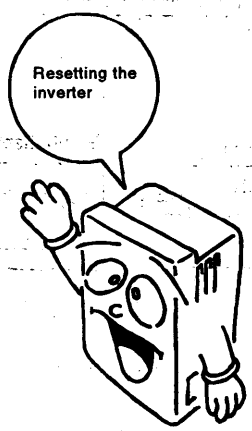
Various parameter settings



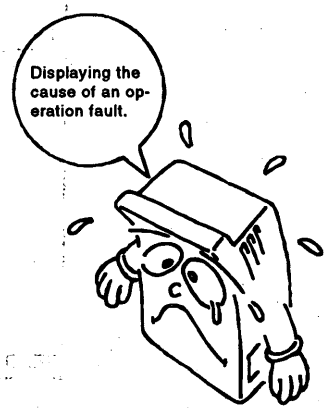
Alarm history



Inverter reset



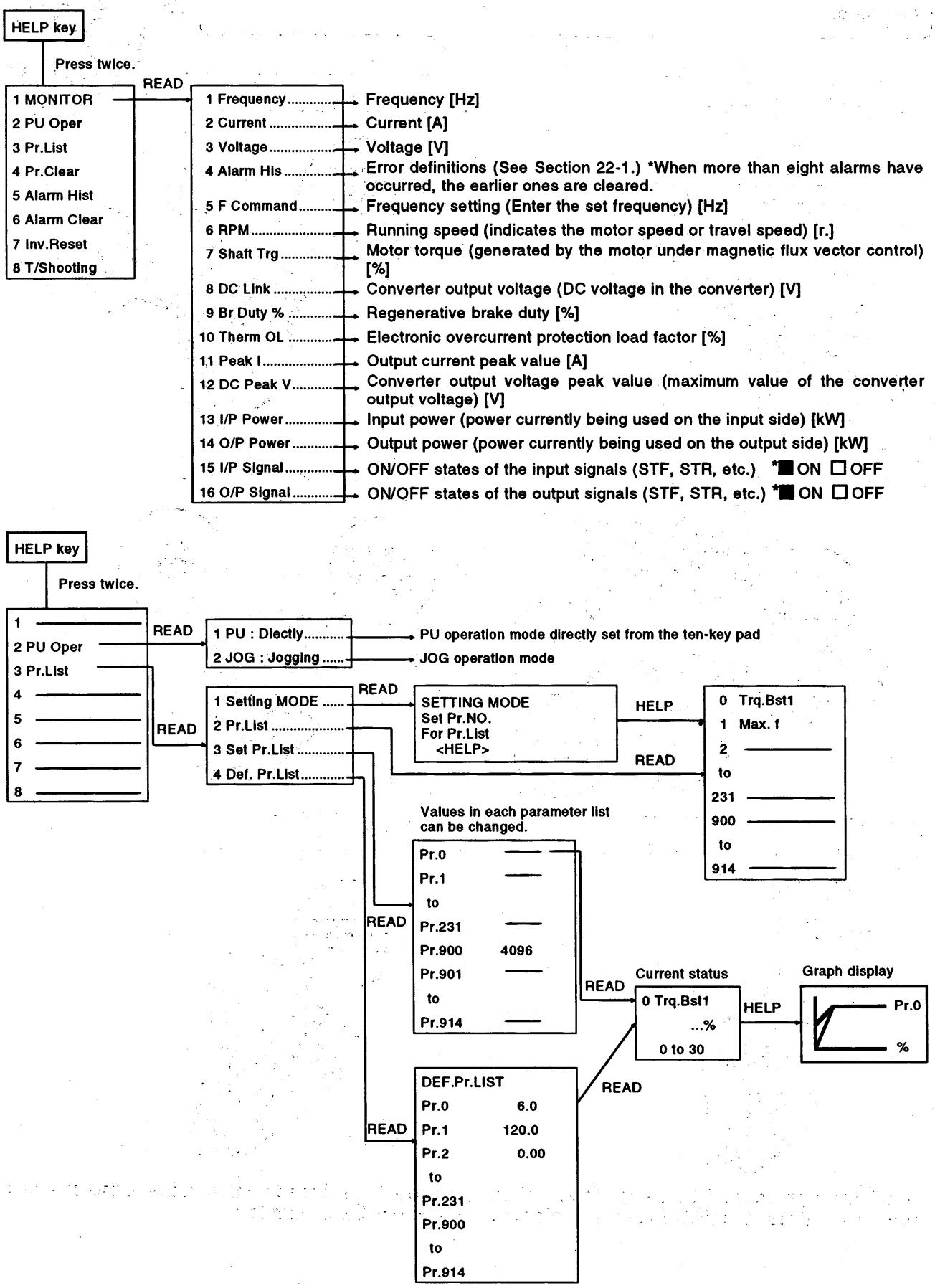
Troubleshooting



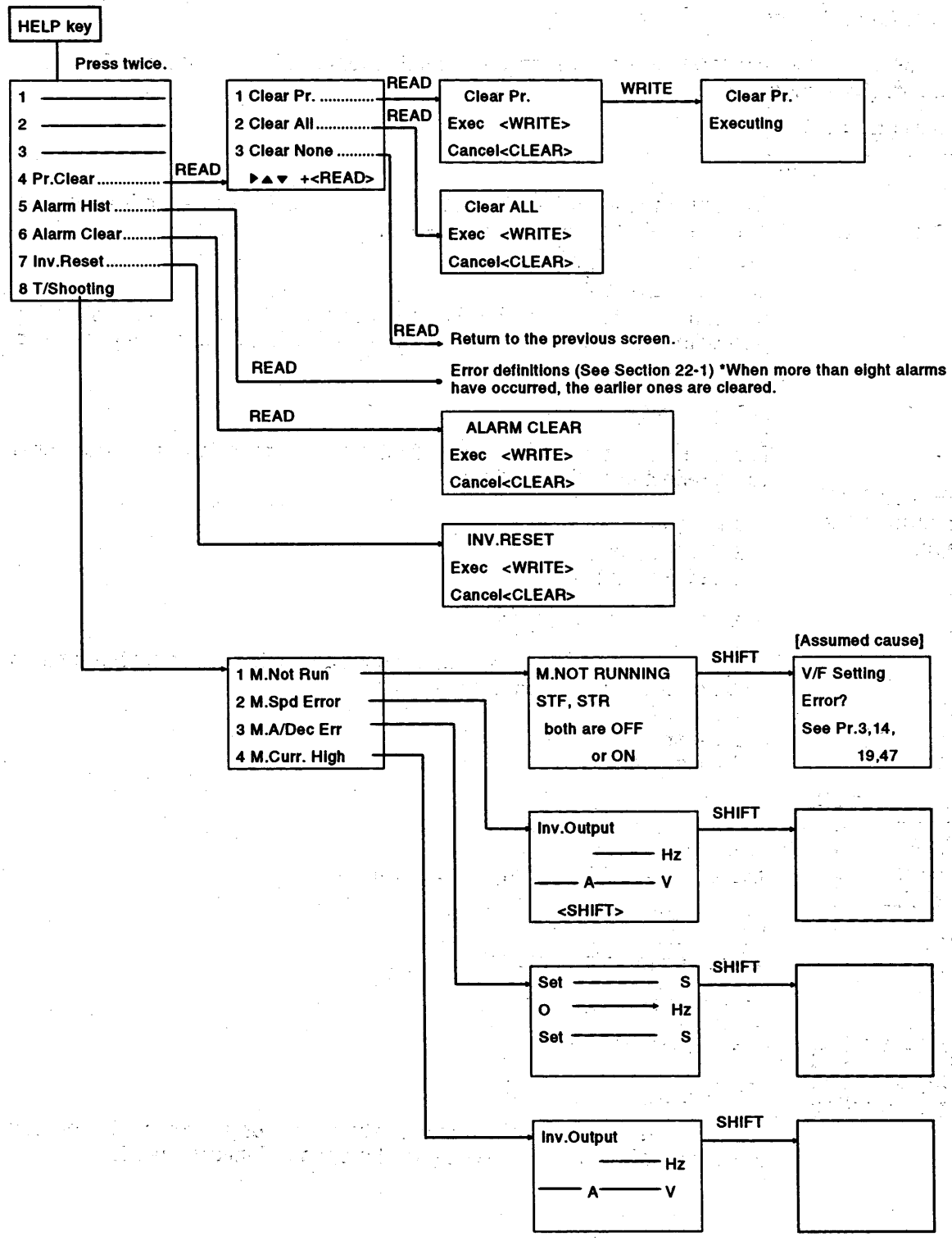
In addition, press the [HELP] key in any of the PU operation modes to call a guide to the operation procedure. Press the [HELP] key for help when you do not know what to do.

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3.2.1 Definitions of the Help Function Displays



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3.2.2 Help Function Menu

Press the [HELP] key twice in any operation mode to call the help menu, with which various functions can be executed. (See page 7-2)

- **Menu screen page 1**



1 MONITOR

Displays the monitoring list and allows the monitor screen to be changed and the first priority screen to be set.

2 PU OPERATION

Informs how to select the PU operation mode and PU-assisted jog operation mode via direct input (direct setting from the ten-key pad) and how to operate the keys.

3 PARAMETER

Displays the parameter menu and allows any of the following four items to be selected and executed:

1 Setting
2 Pr. List
3 Set Pr. List
4 Def. Pr. List

Press [SHIFT] and [▼] together to proceed to the next page.

4 PARAMETER CLEAR

Displays the parameter menu and allows any of the following three items to be selected and executed:

1 Clear Pr.
2 Clear All
3 Clear None

- **Menu screen page 2**



5 ALARM HISTORY

Displays the history of eight past alarms.

6 ALARM HISTORY CLEAR

Clears all the alarm history.

7 INVERTER RESET

Resets the inverter.

Press any of [MONITOR], [SET], [EXT OP] and [PU OP] to switch to the corresponding mode.

8 TROUBLESHOOTING

The inverter displays the most likely cause of mismatch in inverter operation with operation/setting or the cause of inverter fault.

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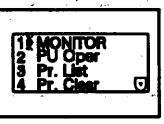
3.2.3 Operation Procedure for Help Function

1 MONITOR

Displays the monitoring list and allows the monitor screen to be changed and the first priority screen to be set.

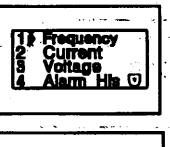
- **Operation procedure 1 (To call the monitoring list from the help function menu)**

1) Press the [HELP] key twice in the monitor mode. ..... The help function menu is called.



2) Make sure that the cursor (⇨) is located at "1 MONITOR". ..... If not, move the cursor with the [▲] [▼] key.

3) Press the [READ] key. .... The monitoring list is called.

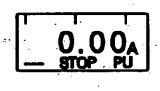


4) Press the [▲] or [▼] key to move the cursor (⇨) to the required item



5) If the required item is not found, press the [SHIFT] key and [▼] key together to shift to the next page.

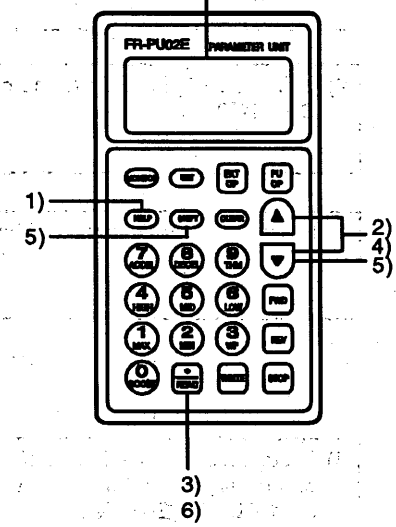
6) Press the [READ] key. .... The monitor screen specified by the cursor is displayed.



..... After pressing the [READ] key, press the [WRITE] key to set that monitor screen as the first priority screen.

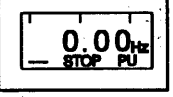
Press any of the [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

Display

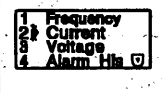


- **Operation procedure 2 (To call the monitoring list directly in the monitoring mode)**

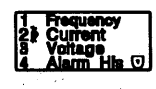
1) Press the [MONITOR] key. (Note) ..... The inverter is put in the monitoring mode.



2) Press the [HELP] key. .... The monitoring list is called.

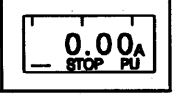


3) Press the [▲] or [▼] key to move the cursor (⇨) to the required item.



4) If the required item is not found, press the [SHIFT] key and [▼] key together to shift to the next page.

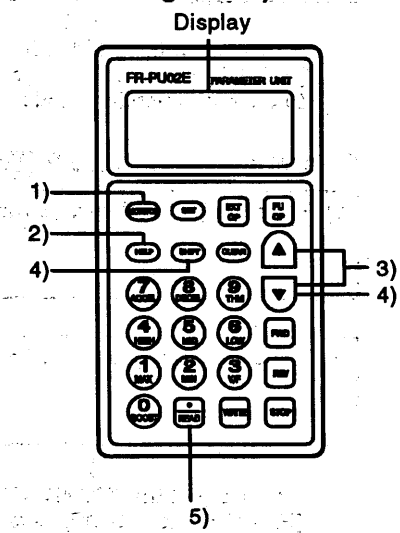
5) Press the [READ] key. .... The monitor screen specified by the cursor is displayed.



.....After pressing the [READ] key, press the [WRITE] key to set that monitor screen as the first priority screen.

Press any of the [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

Display



Note: This key need not be pressed if the inverter is already in the monitoring mode.

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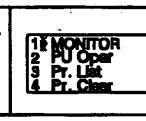
2 PU OPERATION

Informs how to select the PU operation mode and PU-assisted jog operation mode via direct input (direct setting from the ten-key pad) and how to operate the keys.

■ Selection of the PU operation mode (direct input)

• Operation procedure 1 (To call from the help function menu)

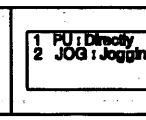
1) Press the [HELP] key ..... The help function menu is called. twice in the monitor mode.



2) Using the [▼] key, move the cursor (⇨) to "2 PU OPERATION".



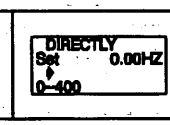
3) Press the [READ] key. .... The menu on the right is displayed.



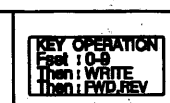
Press the [HELP] key to return to the help function menu.

4) Make sure that the..... If not, move the cursor with the cursor (⇨) is located [▲] [▼] key. at "1 PU: DIRECT IN".

5) Press the [READ] key. .... The PU operation mode is selected and the frequency setting screen is displayed.

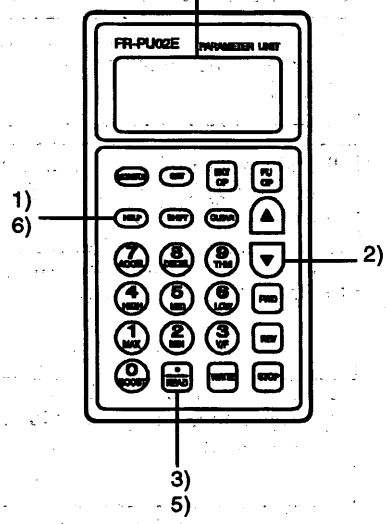


6) Press the [HELP] key. .... The key operation guide is displayed.



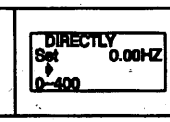
Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

Display

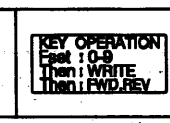


• Operation procedure 2 (To call the key operation guide directly)

1) Press the [PU OP] key. ...The frequency setting screen is displayed.

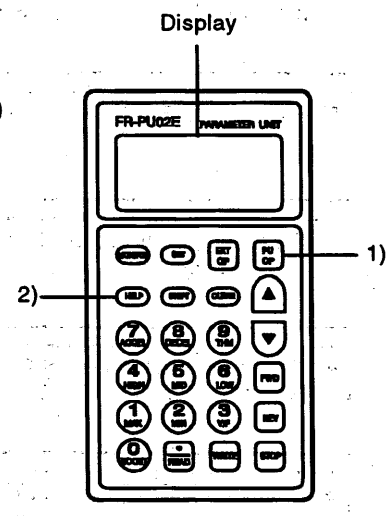


2) Press the [HELP] key. .... The key operation guide is displayed.



Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

Display

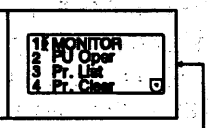


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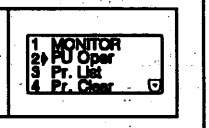
■ Selection of the PU jog operation mode

• Operation procedure 1 (To call from the help function menu)

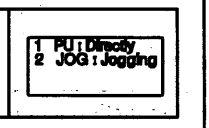
1) Press the [HELP] key twice in the monitor mode. ..... The help function menu is called.



2) Using the [▼] key, move the cursor (⇨) to "2 PU OPERATION".



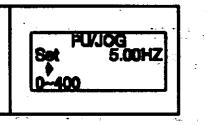
3) Press the [READ] key. .... The menu on the right is displayed.



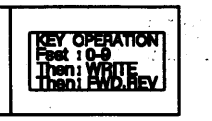
Press the [HELP] key to return to the help function menu.

4) Using the [▼] key, move the cursor (⇨) to "2 JOG".

5) Press the [READ] key. .... The PU jog operation mode is selected and the frequency setting screen is displayed.

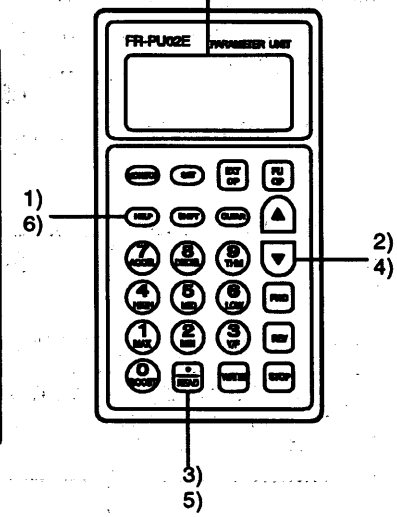


6) Press the [HELP] key. .... The key operation guide is displayed.



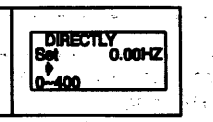
Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

Display

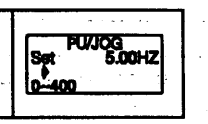


• Operation procedure 2 (To call the key operation guide directly)

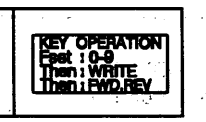
1) Press the [PU OP] key. ... The frequency setting screen is displayed.



2) Press the [SHIFT] key. ... The PU jog operation mode is selected and the frequency setting screen is displayed.

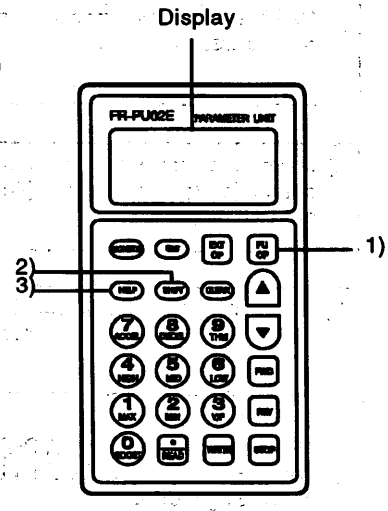


3) Press the [HELP] key. .... The key operation guide is displayed.



Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

Display



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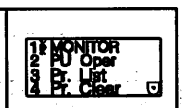
3 PARAMETER

Displays the parameter menu and allows any of the following four items to be selected and executed:

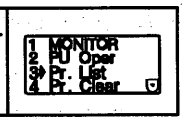
1 Setting..... Switches to the parameter setting mode.
2 Pr. List..... Displays the parameter list in numerical order and allows the values of individual parameters to be read and written.
3 Set Pr. List..... Displays a list of Pr. numbers and set values of only the parameters that have been changed from the factory setting. (For the parameters that have not been changed, their Pr. numbers are only displayed.)
4 Def. Pr. List..... Displays a list of the initial values (default factory setting) of parameters.

• Display of the parameter menu

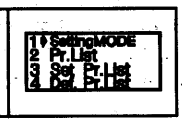
1) Press the [HELP] key ..... The help function menu is called. twice in the operation mode.



2) Using the [▼] key, move the cursor (⇨) to "3 PARAMETER".

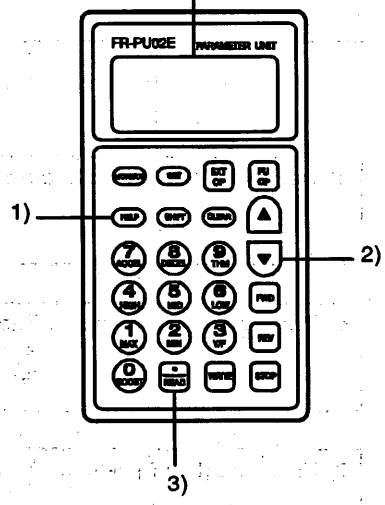


3) Press the [READ] key. .... The parameter menu is displayed.



Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

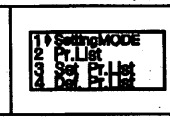
Display



■ Selection and execution of "1 Setting"

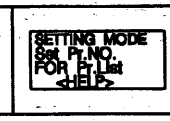
• Operation procedure

1) Call the parameter menu in accordance with the above procedure.



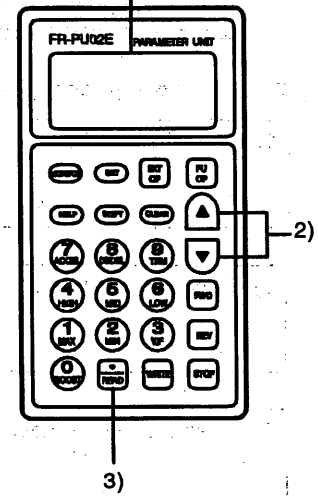
2) Make sure that the cursor (⇨) is located at "1 Setting". ..... If not, move the cursor with the [▲] [▼] key.

3) Press the [READ] key. .... The inverter switches to the set mode.



Press any of the [MONITOR], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

Display

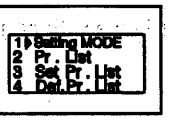


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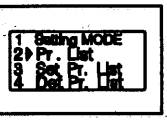
■ Selection and execution of "2 Pr. List"

• Operation procedure

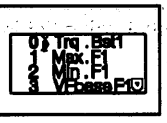
1) Call the parameter menu in accordance with page 7-8.



2) Using the [▼] key, move the cursor (⇨) to "2 Pr. List".



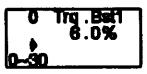
3) Press the [READ] key. .... The parameter list is displayed.



4) Press the [▲] or [▼] key to move the cursor (⇨) to the required item.

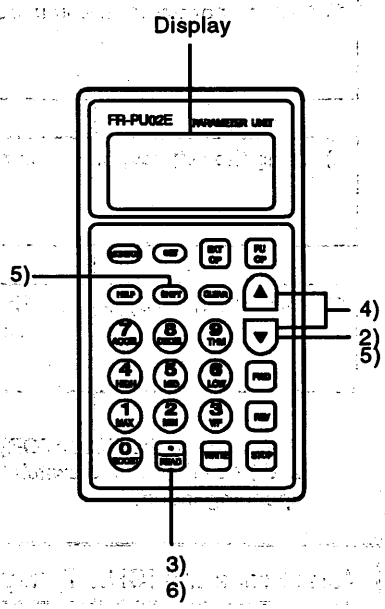
5) If the required item is not found, press the [SHIFT] key and [▼] key together to shift to the next page.

6) Press the [READ] key. .... The parameter specified by the cursor is read and the inverter is put in the parameter setting mode.



Press the [SHIFT] key to move to the next parameter.

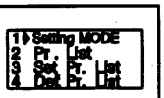
Press any of the [MONITOR], [EXT OP] and [PU OP] keys to switch to the corresponding mode.



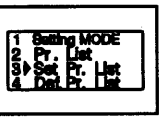
■ Display of "3 Set Pr. List"

• Operation procedure 1 (To call from the help function menu)

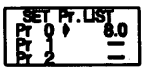
1) Call the parameter menu in accordance with page.



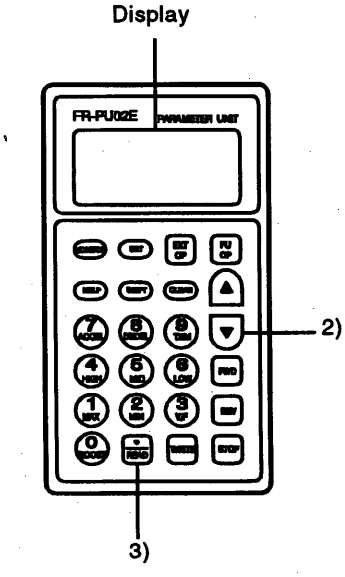
2) Using the [▼] key, move the cursor (⇨) to "3 Set Pr. List".



3) Press the [READ] key. .... The parameter change list is displayed. (Note)



Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.



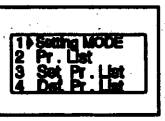
Note: Press the [SHIFT] key and [▼] key together to move to the next page.

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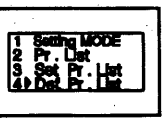
■ Display of "4 Def. Pr. List"

• Operation procedure

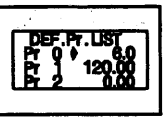
1) Call the parameter menu in accordance with page 7-8.



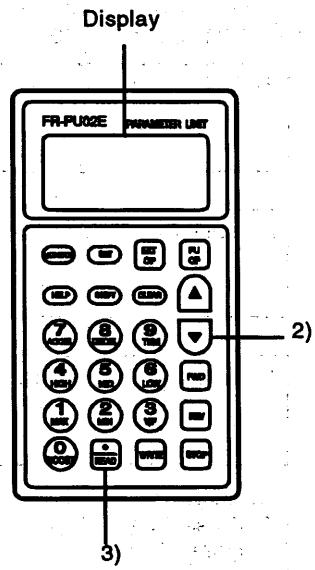
2) Using the [▼] key, move the cursor (⇨) to "4 Def. Pr. List".



3) Press the [READ] key. .... The initial value list is displayed. (Note)



Press any of the [MONITOR], [EXT OP] and [PU OP] keys to switch to the corresponding mode.



Note: Press the [SHIFT] key and [▼] key together to move to the next page.

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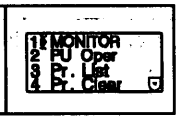
4 PARAMETER CLEAR (To be performed in the PU operation mode)

Press the HELP key twice in any operation mode to call the help menu, with which various functions can be executed.

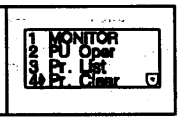
1 Clear Pr. ..... Returns (initializes) the parameter values to the factory setting with the exception of the calibration values in Pr. 900 to 905.
2 Clear All ..... Initializes all parameters.
3 Clear None ..... Does not initialize.

• Display of the parameter clear menu

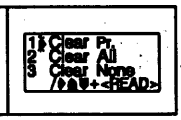
1) Press the [HELP] key twice in the operation mode. ..... The help function menu is called.



2) Using the [▼] key, move the cursor (⇨) to "4 Clear Pr.".

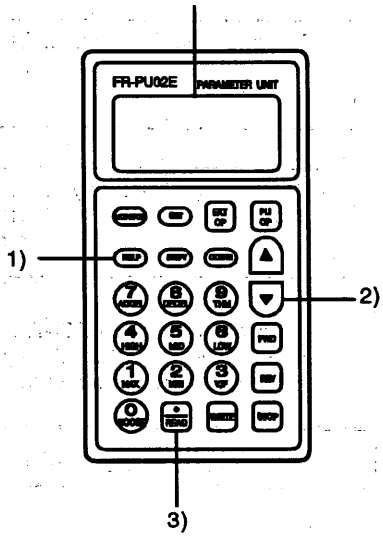


3) Press the [READ] key. .... The parameter clear menu is displayed.



Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

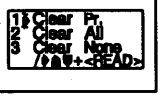
Display



■ Selection and execution of "1 Clear Pr."

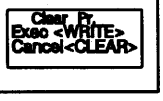
• Operation procedure

1) Call the parameter menu in accordance with the above procedure.

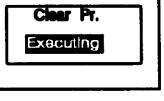


2) Make sure that the cursor (⇨) is located at "1 Setting". ..... If not, move the cursor with the [▲] [▼] key.

3) Press the [READ] key. .... The data on the right is displayed.

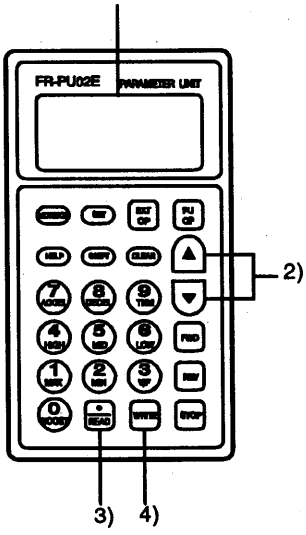


4) Press the [WRITE] key. (Note) ...The data on the right is displayed and the parameters are initialized.



Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

Display



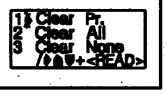
Note: Press the [CLEAR] key to disable parameter clear.

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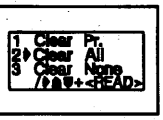
■ Selection and execution of "2 Clear All"

- **Operating procedure**

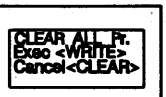
1) Call the parameter clear menu in accordance with page 7-11.



2) Using the [▼] key, move the cursor (⇨) to "2 Clear All".



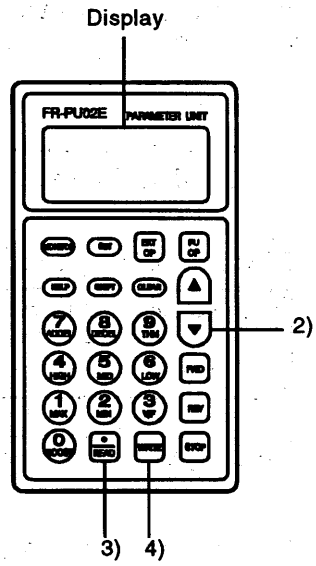
3) Press the [READ] key. .... The data on the right is displayed.



4) Press the [WRITE] key. .. The data on the right is displayed and the parameters are initialized. (Note)



Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.



Note: Press the [CLEAR] key to disable clear All.

■ "3 Clear None"

When "3 Clear None" is selected, the parameters are not initialized.

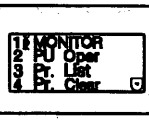
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5 ALARM HISTORY

Displays the history of eight past alarms.

- **Operation procedure**

1) Press the [HELP] key twice in the operation mode. ..... The help function menu is called.



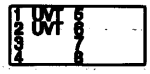
2) Press the [SHIFT] key and [▼] key together. .... The screen moves to the next page.



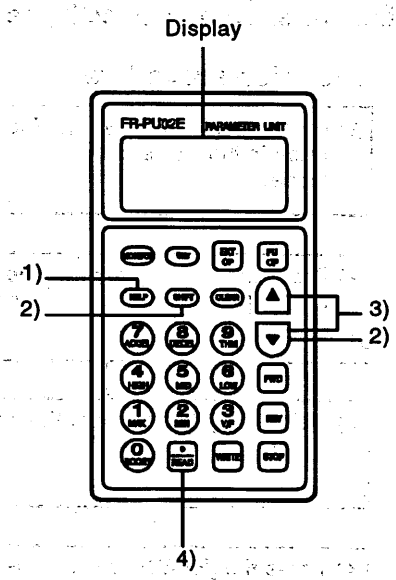
3) Make sure that the cursor (⇨) is located at "5 Alarm Hist". .....If not, move the cursor with the [▲] [▼] key.



4) Press the [READ] key. .... The alarm history is displayed.



Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.



6 ALARM HISTORY CLEAR

Clears all the alarm history.

- **Operation procedure**

1) Press the [HELP] key twice in the operation mode..... The help function menu is called.



2) Press the [SHIFT] key and [▼] key together..... The screen moves to the next page.



3) Using the [▼] key, move the cursor (⇨) to "6 Alarm Clear".



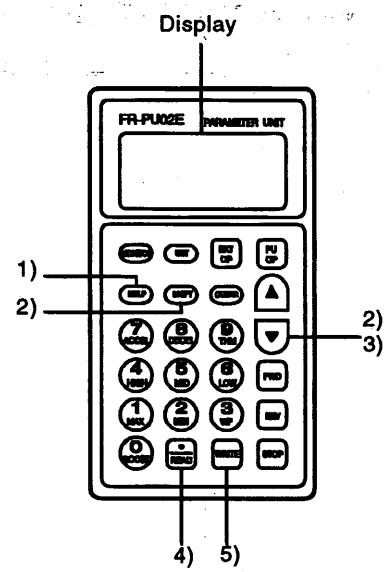
4) Press the [READ] key. .... The data on the right displayed.



5) Press the [WRITE] key. (Note) ...The data on the right is displayed and the alarm history is cleared.



Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.



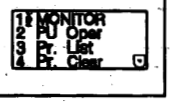
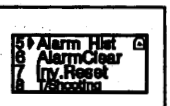
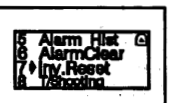
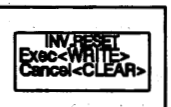
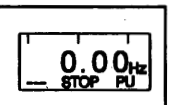
Note: Press the [CLEAR] key to disable Alarm History Clear.

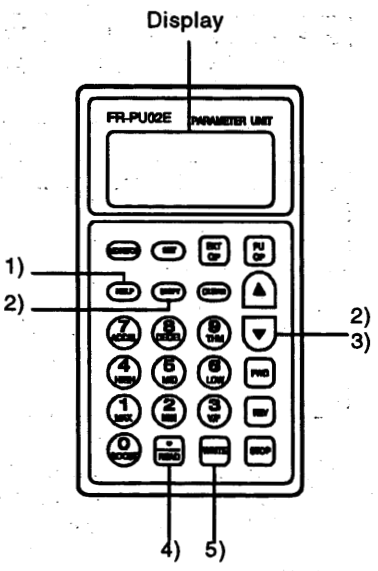
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7 INVERTER RESET

Resets the inverter. If the protective function of the inverter is activated to trip (protect) the inverter, the trip state can be reset by the following operation. The trip state can also be reset by switching the power off or connecting terminals RES-SD.

- **Operation procedure**

1) Press the [HELP] key twice in the operation mode. ..... The help function menu is called.	
2) Press the [SHIFT] key and [▼] key together. .... The screen moves to the next page.	
3) Using the [▼] key, move the cursor (⇨) to "7 Inv. Reset".	
4) Press the [READ] key. .... The data on the right is displayed.	
5) Press the [WRITE] key. (Note) ...The inverter is reset and switches to the monitoring mode.	



Note: By pressing the [CLEAR] key, the inverter is not reset and is switched to the monitoring mode.

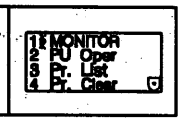
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8 TROUBLESHOOTING

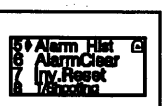
If the inverter appears to operate incorrectly, perform the following operation to display the most likely cause of the fault. This operation may also be performed during inverter operation (PU operation, external operation) or during alarm trip (protection activated).

- **Operation procedure**

1) Press the [HELP] key twice in the operation mode. ..... The help function menu is called.



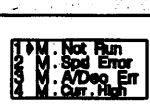
2) Press the [SHIFT] key and [▼] key together. .... The screen moves to the next page.



3) Using the [▼] key, move the cursor (⇨) to "8 T/Shooting".



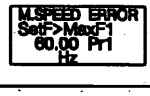
4) Press the [READ] key. .... The alarm phenomenon menu is displayed.

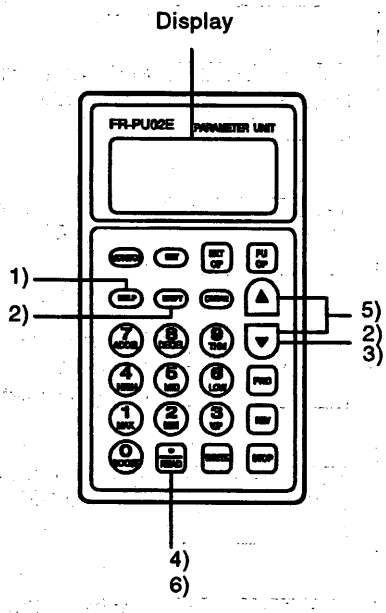


5) Press the [▲] or [▼] key to move the cursor to the required item.



6) Press the [WRITE] key. ...The cause of fault is displayed. (See page 7-16.)





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• Faults

1 M.NOT RUNNING (Motor does not rotate)

M.NOT RUNNING ALARM Indicated <SHIFT>	The inverter has alarm-tripped (protection activated), resulting in output shut-off. Press the [SHIFT] key to display the cause of the trip.
M.NOT RUNNING NO I/P Power or Phase Loss	The main circuit power of the inverter is lost, or open phase has occurred in the power supply. Check the power supply.
M.NOT RUNNING STF,STR both are OFF or ON	Both start signals STF and STR are ON or OFF.
M.NOT RUNNING MRS is ON	The output shut-off input terminal MRS is ON.
M.NOT RUNNING SetF<StartF Pr.13	The inverter starting frequency (Pr. 13) set value is higher than the current set frequency.
M.NOT RUNNING AU is OFF	The current input select terminal AU remains OFF. (Not ON)
M.NOT RUNNING NO Command From PU	Neither of the FWD and REV keys are ON in the PU operation mode.
M.NOT RUNNING MaX.F1<StartF Pr.1 Pr.13	The inverter cannot be started because the inverter starting frequency (Pr. 13) value is higher than the maximum frequency (Pr. 1).
M.NOT RUNNING EnableFR Set See Pr.78	The inverter cannot be started because the forward or reverse rotation has been inhibited by the value set in Pr. 78.
M.NOT RUNNING Current Limit Activated <SHIFT>	The inverter cannot be started since the current limit function is operating. Press the [SHIFT] key to display the assumed cause of activating the current limit function.
M.NOT RUNNING TS Control Standby Mode	The inverter cannot be started because it is the stop period in the programmed operation mode.
M.NOT RUNNING Under PI Control	The inverter is not started because the operation of PI control has resulted in a condition under which the inverter need not be started.
M.NOT RUNNING CS is OFF See Pr.57	Restart cannot be made since the automatic restart after instantaneous power failure select terminal CS is OFF. Currently it is assumed to be after an instantaneous power failure or in the commercial power supply switch-over operation mode.

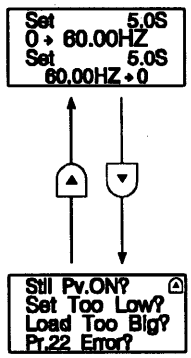
2 M.SPEED ERROR

(Speed does not match the running frequency set value)

M.SPEED ERROR SetF>MaxF1/F2 60.00 Pr1/18 Hz	If the running frequency set value is higher than the maximum frequency (Pr. 1) set value, the running frequency remains at the maximum frequency.
M.SPEED ERROR SetF<Min.F1 60.00 Pr.2 Hz	If the running frequency set value is lower than the minimum frequency (Pr. 2) set value, the running frequency has been risen to the minimum frequency.
M.SPEED ERROR Fjump Working See Pr.31→36 SetF= 60.00Hz	If the running frequency set value is within the frequency jump setting range (Pr. 23), the running frequency has jumped.
M.SPEED ERROR Current Limit Activated <SHIFT>	The current limit function has been activated and forced the running frequency to reduce. Press the [SHIFT] key to display the cause of activating the current limit function.
M.SPEED ERROR Under PI Control	The operation of PI control has caused the running frequency to be offset from the set value.

3 M.A/Dec Err

(Acceleration/deceleration time is longer than the value set in Pr. 7/Pr. 8)



- Acceleration time set value (Pr. 7) is displayed.
- Frequency reached in the above set time (acceleration/deceleration reference frequency, Pr. 20) is displayed.
- Deceleration time set value (Pr. 8) is displayed.
- Frequency from which deceleration is made in the above set time (acceleration/deceleration reference frequency, Pr. 20) is displayed.

Assumed cause of longer acceleration/deceleration time than the set value is displayed.

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4 M.Curr.High
(Inverter output current value is larger than normal)

Inv.Output 60.00HZ 10A 230V <SHIFT>	First, the running frequency, output current and output voltage of the inverter are displayed. Press the [SHIFT] key to display the assumed cause of large output current.
Low Impedance Motor? Reduce TrqBst Pr.0,38,46	Is the motor a special motor other than the general-purpose 3-phase induction motor? If so, reduce the torque boost set value. Related parameters: Pr. 0, 38, 46
Low Trq Motor? Reduce TrqBst Pr.0,38,46	Is the motor a constant-torque motor (motor for inverter)? If so, reduce the torque boost set value. Related parameters: Pr. 0, 38, 46
Trq.Bst Setting Err? See Pr.0,38, 46	Since the torque boost set value may be inappropriate, check the following relevant parameters: Related parameters: Pr. 0, 38, 46
V/F Setting Error? See Pr.3,14, 19,47	Since the V/F pattern setting may be inappropriate, check the following relevant parameters: Related parameters: Pr. 3, 14, 19, 47
Load Too Big? OutPut Phase Loss?	The load may be too heavy. An open phase may have occurred between the inverter and motor.

Note: **If the fault could not be identified by the above operation**
If the cause of the fault could not be found in the inverter, the current running frequency, output current and output voltage are displayed on the screen.

Inv.Output
60.00HZ
10A 230V
<SHIFT>

Press the [SHIFT] key to display the relevant assumed cause.

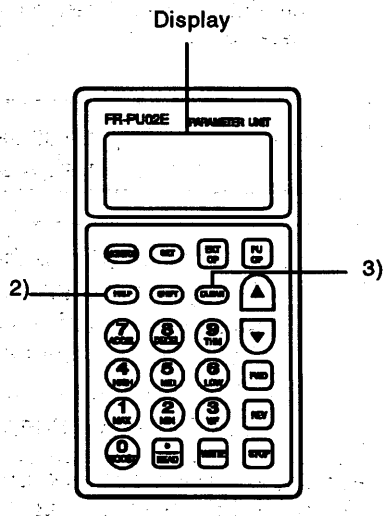
3.2.4 Other Help Function

■ Graphic function

Press the [HELP] key on the parameter setting screen to display the data of the corresponding parameter graphically.

- **Operation procedure (Example: Pr. 3 "starting frequency")**

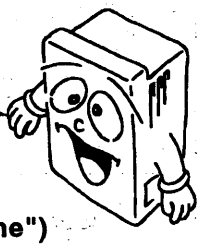
1) Read the required parameter in accordance with page 8-1 or page 7-8.	3 VFbaseF1 60.00Hz 0~400
2) Press the [HELP] key. .....The data of the parameter is displayed graphically.	Pr. 3 60.00 Hz
3) Press the [CLEAR] key. .... The display returns to the previous screen.	3 VFbaseF1 60.00Hz 0~400



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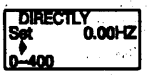
3.3 SETTING AND CHANGING THE VALUES IN THE PARAMETERS

The inverter has many parameters. Using the PU, the required parameters can be selected and their values set and/or changed as appropriate according to the load and running conditions. For more information, see the "Parameter List" (page 9-1). To stop parameters being changed, set "1" in Pr. 77 "parameter write disable". (See page 9-37.)



- **Operation procedure (Reading and writing the value of Pr. 8 "deceleration time")**

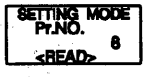
1) Press the [PU OP] key. ..... The frequency setting screen is displayed.



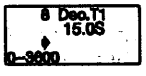
2) Press the [SET] key. ..... The inverter is placed in the parameter setting mode.



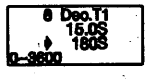
3) Enter the required parameter number. ..... The screen on the right is displayed.



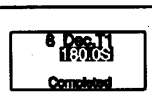
4) Press the [READ] key. .... The current set value is shown on the display.



5) Enter the required value. ..... A new set value is shown on the display.
[Example: To set to 180 seconds]
(Note 1)

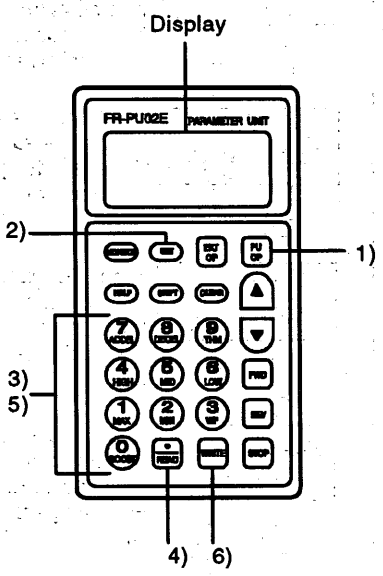


6) Press the [WRITE] key. ... The set value is stored into memory.



..... If an error is displayed by pressing the [WRITE] key, see page 4-3.

7) Press the [SHIFT] key to move to the next parameter (Pr. 9) and call the current set value. Then, press the [SHIFT] key to advance to the next parameter.



Note 1: If a setting error has occurred during the entry of a set value, press the [CLEAR] key to return to the status before that set value was entered.

Note: Set and/or change the parameter values in the PU operation mode. When the PU operation display is not shown, switch to the PU operation mode in accordance with page 5-6.
Note that the values of the following parameters may be set and/or changed in the external operation and combined operation modes:

- 3-speed setting .....Pr. 4 to 6
- Multi-speed setting .....Pr. 24 to 27
- Display function .....Pr. 51 to 56
- Calibration function .....Pr. 900 to 905

In addition to the above procedure, the help function may be used to call the parameter list for setting. For more information, see page 7-8.

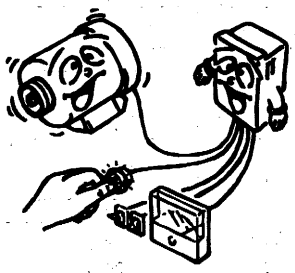
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3.3.1 Overview of the Parameter Unit Functions

By using the PU, the following operations can be performed.

Setting of operation mode (Page 9-38)

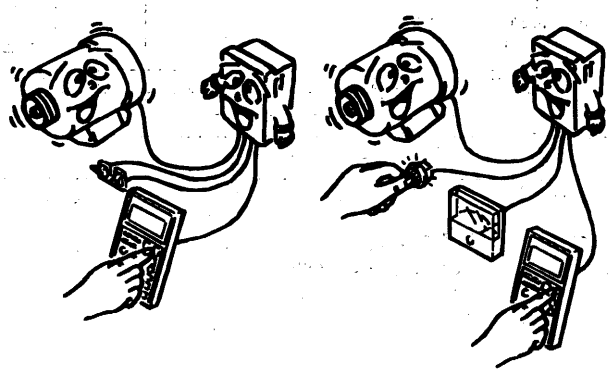
- **External operation mode**
  (Operation is performed from the frequency setting potentiometer, start switch or the like provided outside the inverter.)



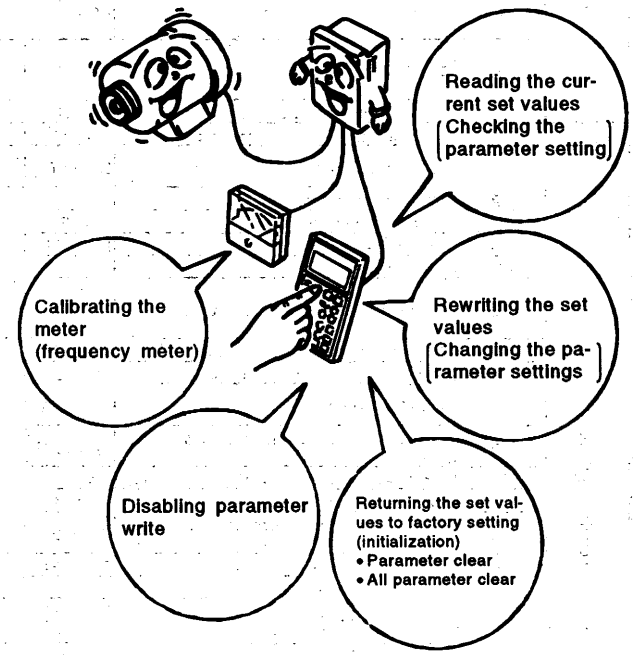
- **PU operation mode**
  (Operation is only performed from the key pad of the PU.)



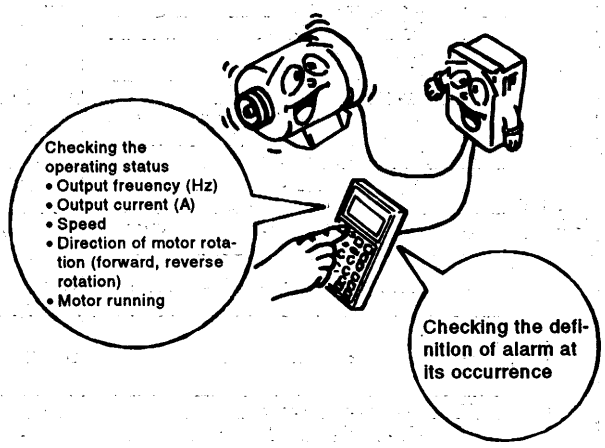
- **Combined operation mode**
  (Operation is performed with the start signal provided by an external signal and the running frequency provided from the PU (and vice versa).)



Setting of parameters (Page 8-1)



Monitoring (Page 6-1)



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3.4 PARAMETERS

3.4.1 Parameter List

Function	Parameter Number	Name	Screen Display	Note 3	Setting Range	Minimum Setting Increment	Factory Setting	Customer Set Value	Refer To:
Basic functions	0	Torque boost(manual)	Trq.Bst1	O	0 to 30%	0.1%	6%/3% (Note 1)		9-4
	1	Maximum frequency	Max.F1		0 to 120Hz	0.01Hz	120Hz		
	2	Minimum frequency	Min.F1		0 to 120Hz	0.01Hz	0Hz		9-5
	3	Base frequency	VFbaseF1		0 to 400Hz	0.01Hz	60Hz		
	4	Multi-speed setting (high speed)	PresetF1		0 to 400Hz	0.01Hz	60Hz		9-6
	5	Multi-speed setting (middle speed)	PresetF2		0 to 400Hz	0.01Hz	30Hz		
	6	Multi-speed setting (low speed)	PresetF3		0 to 400Hz	0.01Hz	10Hz		
	7	Acceleration time	Acc.T1		0 to 3600 seconds/0 to 360 seconds	0.1 seconds/ 0.01 seconds	5 seconds/15 seconds (Note 1)		9-7
	8	Deceleration time	Dec.T1		0 to 3600 seconds/0 to 360 seconds	0.1 seconds/ 0.01 seconds	5 seconds/15 seconds (Note 1)		9-8
	9	Electronic thermal O/L relay	Set THM		0 to 500A	0.01A	Rated output current		
Standard operation functions	10	DC injection brake operation frequency	DC Br.F		0 to 120Hz, 9999	0.01Hz	3Hz		9-9
	11	DC injection brake operation time	DC Br.T		0 to 10 seconds, 8888	0.1 seconds	0.5 seconds		
	12	DC injection brake voltage	DC Br.V		0 to 30%	0.1%	6%/3% (Note 1)		
	13	Starting frequency	Start F		0 to 60Hz	0.01Hz	0.5Hz		
	14	Applied load selection	Load VF	O	0 to 5	1	0		9-10
	15	Jog frequency	JOG F		0 to 400Hz	0.01Hz	5Hz		9-11
	16	Jog acceleration/deceleration time	JOG T		0 to 3600 seconds/0 to 360 seconds	0.1 seconds/ 0.01 seconds	0.5 seconds		
	17	External thermal O/L relay input	JOG/OH		0 to 7	1	0		9-12
	18	High-speed maximum frequency	Max.F2		120 to 400Hz	0.01Hz	120Hz		9-13
	19	Base frequency voltage	VFbase V		0 to 1000V, 8888, 9999	0.1V	9999		
	20	Acceleration/deceleration reference frequency	Acc/DecF		1 to 400Hz	0.01Hz	60Hz		9-7
	21	Acceleration/deceleration time increments	Incr.T		0, 1	1	0		
	22	Stall prevention operation level	Stll Pv1		0 to 200%, 9999	0.1%	150%		9-14
	23	Stall prevention operation level at double speed	Stll Pv2		0 to 200%, 9999	0.1%	9999		
	24 ☆	Multi-speed setting (speed 4)	PresetF4		0 to 400Hz, 9999	0.01Hz	9999		9-6
	25 ☆	Multi-speed setting (speed 5)	PresetF5		0 to 400Hz, 9999	0.01Hz	9999		
	26 ☆	Multi-speed setting (speed 6)	PresetF6		0 to 400Hz, 9999	0.01Hz	9999		
	27 ☆	Multi-speed setting (speed 7)	PresetF7		0 to 400Hz, 9999	0.01Hz	9999		
	28	Multi-speed input compensation	Pre.Comp		0, 1	1	0		9-17
	29	Acceleration/deceleration pattern	Acc/DecP		0, 1, 2, 3	1	0		9-16
	30	Brake sequence error display erasure	———		0	———	0		9-17
	31	Frequency jump 1A	Fjump 1A		0 to 400Hz, 9999	0.01Hz	9999		
	32	Frequency jump 1B	Fjump 1B		0 to 400Hz, 9999	0.01Hz	9999		
	33	Frequency jump 2A	Fjump 2A		0 to 400Hz, 9999	0.01Hz	9999		
	34	Frequency jump 2B	Fjump 2B		0 to 400Hz, 9999	0.01Hz	9999		
	35	Frequency jump 3A	Fjump 3A		0 to 400Hz, 9999	0.01Hz	9999		
	36	Frequency jump 3B	Fjump 3B		0 to 400Hz, 9999	0.01Hz	9999		
	37	Speed display	Dispunit		2 to 10, 11 to 9998	1	4		9-18
	38	Automatic torque boost	A.TrqBst	O	0 to 200%	0.1%	0		9-19
	39	Automatic torque boost operation starting current	NoLoad I	O	0 to 500A	0.01A	0		
Multi-function output terminal functions	40	Output terminal assignment	Selectop		0 to 9999	1	1234		9-20
	41	Up-to-frequency sensitivity	SU Range		0 to 100%	0.1%	10%		
	42	Output frequency detection	SetFU FW		0 to 400Hz	0.01Hz	6Hz		9-21
	43	Output frequency detection at reverse rotation	SetFU RV		0 to 400Hz, 9999	0.01Hz	9999		
Second functions	44	Second acceleration/deceleration time	Ac/DecT2		0 to 3600 seconds/0 to 360 seconds	0.1 seconds/ 0.01 seconds	5 seconds		9-22
	45	Second deceleration time	Dec.T2		0 to 3600 seconds/0 to 360 seconds, 9999	0.1 seconds/ 0.01 seconds	9999		
	46	Second torque boost	Trq.Bst2	O	0 to 30%, 9999	0.1%	9999		
	47	Second V/F (base frequency)	VFbaseF2		0 to 400Hz, 9999	0.01Hz	9999		
	48	Second stall prevention operation current	Stall2 I		0 to 200%	0.1%	150%		
	49	Second stall prevention operation frequency	Stall2 F		0 to 400Hz	0.01Hz	0		
	50	Second output frequency detection	SetFU 2		0 to 400Hz	0.01Hz	30Hz		9-23

Note 1: The set value depends on the inverter capacity: (7.5K and down)/(11K and up).
2: In the Screen Display section, f indicates a frequency, V voltage, I current, and t time.

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Function	Parameter Number	Name	Screen Display	Note 3	Setting Range	Minimum Setting Increment	Factory Setting	Customer Set Value	Refer To:
Display function	51	Inverter LED display data selection	Set LED		1 to 14, 17, 18	1	1		9-23
	52	PU main display data selection	Set Main		0, 17 to 20, 22, 23, 24	1	0		
	53	PU level display data selection	Set Lvl.		0 to 3, 5 to 14, 17, 18	1	1		
	54	FM terminal function selection	Set FM		1 to 3, 5 to 14, 17, 18, 21, 101 to 103, 105 to 108, 110 to 114, 117, 118, 121	1	1		
	55	Frequency monitoring reference	CalbFM F		0 to 400Hz	0.01Hz	60Hz		9-25
	56	Current monitoring reference	CalbFM I		0 to 500A	0.01A	Rated output current		
Automatic restart functions	57	Restart coasting time	RestrtT1		0 to 5 seconds, 9999	0.1 seconds	9999		9-26
	58	Restart cushion time	RestrtT2		0, 1 to 5 seconds	0.1 seconds	1.0 second		
Additional function	59	Remote setting function selection	Rmt Set		0, 1, 2	1	0		9-27
Operation selection functions	60	Intelligent mode selection	Int.Mode		0 to 8	1	0		9-28
	61	Reference I for intelligent mode	Ref I		0 to 500A, 9999	0.01A	9999		9-30
	62	Ref. I for intelligent mode accel.	Acc t/I		0 to 200%, 9999	0.1%	9999		
	63	Ref. I for intelligent mode decel.	Dec t/I		0 to 200%, 9999	0.1%	9999		
	64	Starting I for elevator mode	Elev. st		0 to 10Hz, 9999	0.01Hz	9999		
	65	Retry selection	Retry		0 to 5	1	0		9-31
	66	Stall prevention operation reduction starting frequency	Stll coF		0 to 400Hz	0.01Hz	60Hz		9-14
	67	Number of retries at alarm occurrence	Retry No		0 to 10	1	0		9-32
	68	Retry waiting time	Retry t		0 to 10 seconds	0.1 seconds	1.0 second		
	69	Retry count display erasure	Retry N		0	—	0		
	71	Applied motor	SetMotor		0 to 6, 13 to 16	1	0		9-33
	72	PWM frequency selection	PWM F		0.7 to 14.5kHz	0.1kHz	14.5kHz		9-34
	73	0 to 5V, 0 to 10V selection	Extf/10V		0 to 5, 10 to 15	1	1		9-35
	74	Response time for analog signal	IPfilter		0 to 8	1	1		9-36
	75	Reset selection/PU disconnection detection	RES Mode		0, 1, 2, 3	1	0		
	76	Alarm code output selection	Alarm OP		0, 1, 2, 3	1	0		9-37
	77	Parameter write disable selection	EnableWr		0, 1, 2	1	0		
	78	Reverse rotation prevention selection	EnableFR		0, 1, 2	1	0		
	79	Operation mode selection	ContMode		0 to 5, 7, 8	1	0		9-38
	* 80	Motor capacity	Motor KW		0.4 to 55kW, 9999	0.01kW	9999		9-39
	* 81 ☆	Number of motor poles (Note 7)	Mpole No		2, 4, 6, 12, 14, 16, 9999	1	9999		
Auxiliary functions	* 82 ☆	Parameter set by manufacturer. Do not set.							—
	* 83 ☆	Rated motor voltage	Moter V		0 to 1000V	0.1V	200 (Note 6)		15-1
	* 84 ☆	Rated motor frequency	Motor f		50 to 120.00Hz	0.01Hz	60Hz		
	* 85 to * 95 ☆	Parameters set by manufacturer. Do not set. (Note 8)							—
	* 96	Auto tuning setting/state	AutoTune		0, 1, 101	1	0		15-1
	* 97 to * 99	Parameters set by manufacturer. Do not set.							—
	* 145	Parameter unit language switching (Note 9)	PU Lang		0, 1, 2, 3	1	0		9-39
	* 100 to * 154	Parameters for inboard options. For details, see the option manual. Pr. 100 to 109 for V/F 5-points setting.							—
	152	Open motor circuit detection level			0 to 50%	0.1 seconds	5.0%		9-40
	153	Open motor circuit detection time			0.05 to 1 seconds	0.01 seconds	0.5 seconds		
	* 155	RT activated condition	RT set		0, 1, 10, 11	1	0		9-41
	* 156	Stall prevent. select. at regeneration	Stll Prv		0 to 31, 100	1	0		9-42
	* 157	OL signal waiting time	OL delay		0 to 25 seconds, 9999	0.1 seconds	0		9-43
	* 158	AM terminal function selection	AM set		1 to 3, 5 to 14, 17, 18, 21, 9999	1	9999		9-23
	* 159	PWM f decrease at low speed	PWM3 f		0, 1, 2, 3	1	0		9-43
	* 160 to * 199	Parameters for inboard options.							—
	* 200 to * 231	Parameters set for programmed operation.							

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Function	Parameter Number	Name	Screen Display	Note 3	Setting Range		Minimum Setting Increment	Factory Setting		Customer Set Value	Refer To:
Calibration functions	900	FM terminal calibration	FM Tune		—		—	—	(Note 5)		9-44
	901	AM terminal calibration	AM Tune		—		—	—	(Note 5)		
	902	Frequency setting voltage bias	ExtVbias		0 to 10V	0 to 60Hz	0.01Hz	(0V)	0Hz		9-45
	903	Frequency setting voltage gain	ExtVgain		0 to 10V	1 to 400Hz	0.01Hz	(5V)	60Hz		
	904	Frequency setting current bias	ExtIbias		0 to 20mA	0 to 60Hz	0.01Hz	(4mA)	0Hz		
	905	Frequency setting current gain	ExtIgain		0 to 20mA	1 to 400Hz	0.01Hz	(20mA)	60Hz		

Note 3: Indicates the parameters which are ignored when the magnetic flux vector control mode is selected.

*: When the FR-PU01E is used, read and write of these parameters cannot be performed. (IF performed, Err is displayed.) (Set the calibration function numbers 900 to 905 using C-1 to C-6.)

The parameters marked ☆ have special functions. For more information, refer to the following list.

4: The parameters hatched allow their set values to be changed during operation if 0 (factory setting) has been set in Pr. 77 (parameter write disable). Note that the Pr. 72 setting cannot be changed in the external operation mode.

5: The functions of the FM and AM terminals change according to the set values of Pr. 54 (FM terminal function selection) and Pr. 158 (AM terminal function selection).

6: The factory setting for the FR-A241 (400V) series is 400V.

7: When any of 12, 14 and 16 is selected, the input of the RT signal causes the inverter to shift to V/F control. (During a stop only.)

8: These parameters may only be set under the following conditions: Pr. 77 = 801 or 901, Pr. 80 ≠ 9999, Pr. 81 ≠ 9999 (The settings can be changed during operation.)

9: This parameter may also be set when 801 or 901 is set in Pr. 77. (The setting may also be changed during operation.) (Cannot be cleared from the FR-PU02E.)

The parameters listed below are valid only when the corresponding parameters in Remarks are set.

Function	Parameter Number	Name	Screen Display	Setting Range	Factory Setting	Remarks
Load torque high-speed frequency control	24	High-speed setting maximum current value	——	0 to 200%	50%	Pr. 96 = 6, 7 (Note 13)
	25	Middle-speed setting minimum current value	——	0 to 200%	100%	
	26	Current averaging range	——	0 to 400Hz, 9999	9999	
	27	Current averaging filter constant	——	1 to 4000	16	
Stop-on-contact control	82	Exciting current low-speed multiplying factor for a stop on contact	——	0 to 1000%, 9999	9999	Pr. 96 = 5, 7, (Note 10) Pr. 80, Pr. 81 ≠ 9999
	83	PWM carrier frequency for a stop on contact	——	0.7 to 14.5kHz, 9999	9999	Pr. 96 = 5, 7 (Note 15)
PLG feedback supplement	84	PLG detection speed correction factor	——	0 to 10	0	Pr. 105 ≠ 9999 (Note 11)
Torque control	96	Torque control selection	——	0, 5, 6, 7	0	Pr. 77 = 701 (Note 12)
Brake sequence circuit function	85	Brake release frequency	——	0 to 30Hz	3Hz	Pr. 80, 81 ≠ 9999 Pr. 60 = 7, 8
	86	Brake release current	——	0 to 200%	130%	
	87	Brake release current detection time	——	0 to 2 seconds	0.3 seconds	
	88	Brake operation time at start	——	0 to 5 seconds	0.3 seconds	
	89	Brake engagement frequency	——	0 to 30Hz	6Hz	
	90	Brake operation time at stop	——	0 to 5 seconds	0.3 seconds	
	91	Deceleration detection function selection	——	0.1	0	
	92	Brake release completion signal selection	——	0.1	0	Pr. 80, 81 ≠ 9999 Pr. 60 = 7
	93	Overspeed detection frequency	——	0 to 30Hz, 9999	9999	Pr. 80, 81 ≠ 9999 Pr. 60 = 7, Pr. 105 ≠ 9999 (Note 14)

10: With 701 set in Pr. 77, this parameter can be set under the following conditions: Pr. 96 = 5, 7, Pr. 80 ≠ 9999, Pr. 81 ≠ 9999 (The setting may also be changed during operation.)

11: This parameter can be set and is valid when the inboard option FR-EPA, EPB or EPC is fitted and Pr. 105 ≠ 9999.

12: This parameter can be set when Pr. 77 = 701. (0: standard feature, 5: with stop-on-contact control, without load torque high-speed frequency control, 6: without stop-on-contact control, with load torque high-speed frequency control, 7: with stop-on-contact control, with load torque high-speed frequency control)

13: With 701 set in Pr. 77, these parameters can be set when Pr. 96 = 6 or 7. (The settings may also be changed during operation.) At this time, multi-speeds f (speeds 4 to 7) are valid. (Multi-speed operation can be performed.)

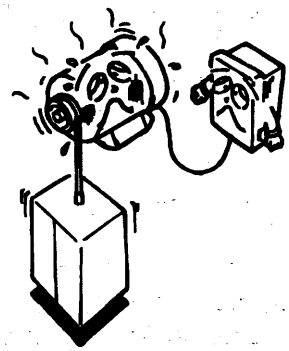
14: This parameter can be set and is valid when Pr. 60 = 7, the FR-EPA, EPB or EPC inboard option is fitted, and Pr. 105 ≠ 9999.

15: With 701 set in Pr. 77, this parameter can be set when Pr. 96 = 5 or 7.

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3.4.2 Setting of Parameters to Improve the Corresponding Operational Functions

Lift or the like requires large starting torque



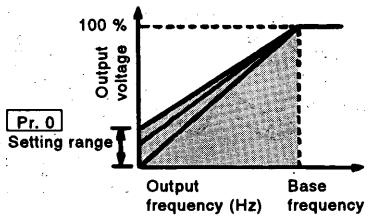
⇨ Pr. 0 "torque boost (manual)"

- Used to adjust the motor voltage during low-frequency operation, thereby increasing the motor torque at the time of start.

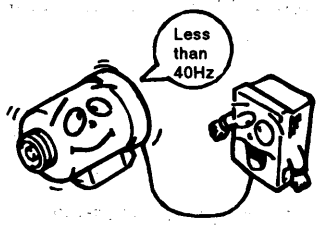
Model	Factory Setting	Setting Range
7.5K and below	6 %	0 to 30 %
11K and above	3 %	

Note: 1. This parameter is ignored when Pr. 80 and Pr. 81 have been set to select the magnetic flux vector control mode.
2. When the inverter-dedicated motor (constant-torque motor) is used, change the setting of this parameter as follows:

7.5 K and down...4 %
11 K and up...2 %



To keep the speed less than the set frequency of the machine

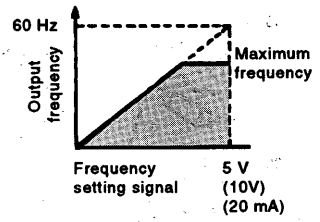


⇨ Pr. 1 "maximum frequency" or Pr. 18 "high-speed maximum frequency"

Allows the upper limit of the output frequency to be clamped.

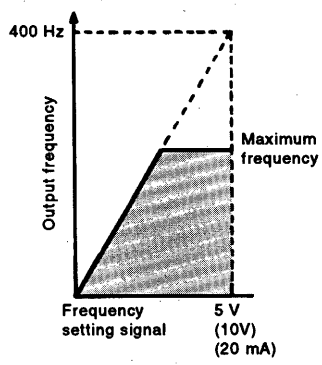
- **The maximum setting is within 120 Hz.**
  Use parameter Pr. 1 "maximum frequency" to set the upper limit of the output frequency.

Factory Setting	Setting Range
120 Hz	0 to 120 Hz



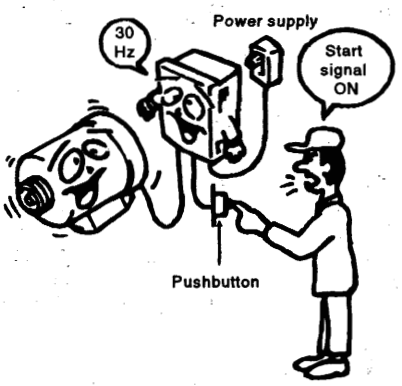
- **The maximum setting is higher than 120 Hz.**
  Use parameter Pr. 18 "highspeed maximum frequency" to set the upper limit of the output frequency. Setting this parameter automatically changes Pr. 1 "maximum frequency" to this setting.

Factory Setting	Setting Range
120 Hz	120 to 400 Hz



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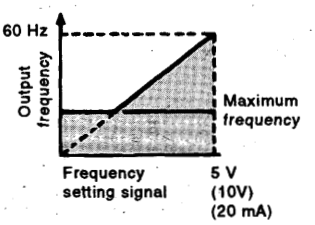
To run the motor as soon as the start signal is switched on, without setting the frequency



⇨ Pr. 2 "minimum frequency"

Allows the lower limit of the output frequency to be clamped.

- By merely turning the start signal on, the motor is run at the set frequency.

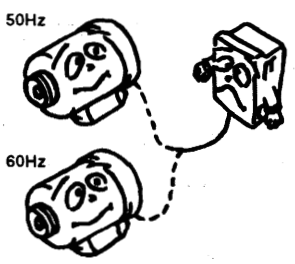


Factory Setting	Setting Range
0 Hz	0 to 120 Hz

⚠ CAUTION

⚠ Note that without the speed command, the motor will start at the preset frequency by merely switching on the start signal.

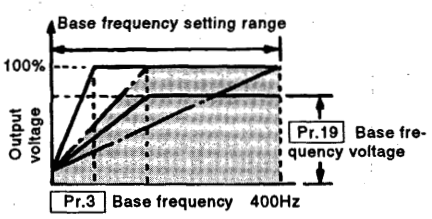
To set the reference frequency (base frequency) at the rated torque of the motor according to the motor rating



⇨ Pr. 3 "base frequency", Pr. 19 "base frequency voltage"

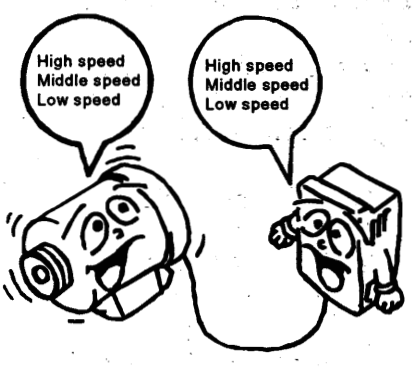
- Allows the base frequency (reference frequency at the rated motor torque) to be set as appropriate between 0 and 400Hz according to the motor rating.

Note: 1. Set the base frequency to 60Hz for use of an inverter-dedicated motor (constant-torque motor).
2. When the magnetic flux vector control mode has been selected in Pr. 80 and Pr. 81, Pr. 19 is regarded as about 200V (or 400V).
3. Setting "9999" (factory setting) in Pr. 19 makes the maximum output voltage identical to the power supply voltage. Setting "8888" in Pr. 19, the maximum is output voltage 95% of the power supply voltage.



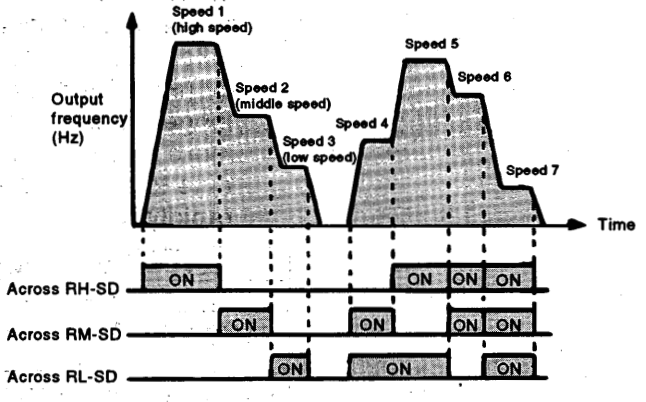
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To set multiple speeds



⇨ Pr. 4 "3-speed setting (high speed)", Pr. 5 "3-speed setting (middle speed)", Pr. 6 "3-speed setting (low speed)", Pr. 24 "multi-speed setting (speed 4)", Pr. 25 "multi-speed setting (speed 5)", Pr. 26 "multi-speed setting (speed 6)", Pr. 27 "multi-speed setting (speed 7)"

- Allows any speed to be selected by switching the external contact signal (across terminals RH/RM/RL and SD).
- Each speed (frequency) may be specified as appropriate between 0 and 400Hz during inverter operation. The speed may also be set using the [▲] and [▼] keys. (On releasing the [▲] and [▼] keys, the set frequency is stored, that is the [WRITE] key need not be pressed.)
- By using these functions with jog frequency (Pr. 15), maximum frequency (Pr. 1) and minimum frequency (Pr. 2), up to 10 speeds can be set.

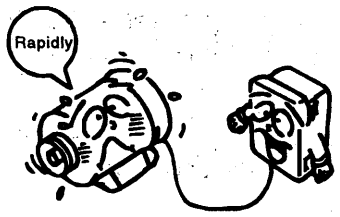


Note: 1. Speeds 4 to 7 are not selected if the setting is "9999" (factory setting).
2. These speeds have priority over the main speed (across terminals 2 and 5, 4 and 5).
3. This setting may be made during PU operation or external operation.
4. With 3-speed setting, if two or three speeds are simultaneously selected, priority is given to the frequency of lower signal.

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To accelerate slowly or rapidly





⇨ **Pr. 7 "acceleration time", Pr. 20 "acceleration/deceleration reference frequency", Pr. 21 "acceleration/deceleration time increments"**

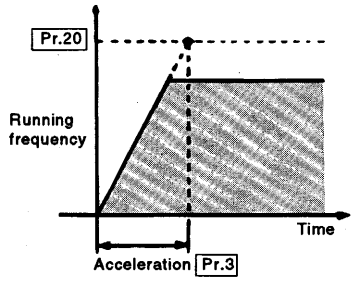
(1) Confirmation of acceleration time setting range and minimum setting increments

Use Pr. 21 "acceleration/deceleration time increments" to set the acceleration time setting range and minimum setting increments. Before setting the acceleration time, the set value must be checked.

Set value "0"..... (factory setting)	0 to 3600 seconds (minimum setting increments: 0.1 seconds)
Set value "1".....	0 to 360 seconds (minimum setting increments: 0.01 seconds)

(2) Setting of acceleration time

In acceleration time (Pr. 7), set a period of time required to reach the acceleration/deceleration reference frequency (Pr. 20) from 0Hz. Set a longer time to accelerate more slowly, and a shorter time to accelerate more rapidly. (Note)

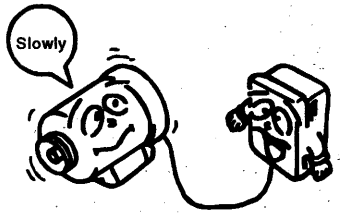


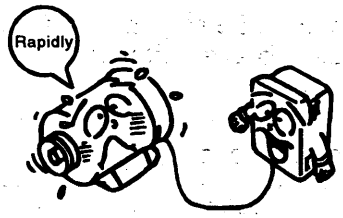
Model	Factory Setting	Setting Range
7.5K and below	5 seconds	0 to 3600 seconds / 0 to 360 seconds
11K and above	15 seconds	0 to 3600 seconds / 0 to 360 seconds

Note: 1. In only S-pattern acceleration/deceleration A (see page 9-16), the set time is a period of time required to reach the base frequency (Pr. 3).
2. If Pr. 20 (acceleration/deceleration reference frequency) setting is changed, the set values of calibration Pr. 903 and Pr. 905 (frequency setting signal gain) remain unchanged. To adjust the gains, adjust calibration Pr. 903 and Pr. 905.
3. When the set value of Pr. 7 is "0", the acceleration time is set to 0.04 seconds.
At this time, set 120Hz or less in Pr. 20 "acceleration/deceleration reference frequency".

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To decelerate slowly or rapidly





⇨ **Pr. 8 "deceleration time", Pr. 20 "acceleration/deceleration reference frequency", Pr. 21 "acceleration/deceleration time increments"**

(1) Confirmation of deceleration time setting range and minimum setting increments

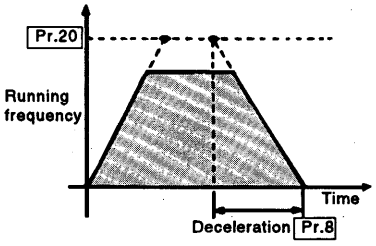
Use Pr. 21 "acceleration/deceleration time increments" to set the deceleration time setting range and minimum setting increments. Before setting the deceleration time, the set value must be checked.

Set value "0" ..... (factory setting) 0 to 3600 seconds (minimum setting increments: 0.1 seconds)

Set value "1"..... 0 to 360 seconds (minimum setting increments: 0.01 seconds)

(2) Setting of deceleration time

In deceleration time (Pr. 8), set a period of time required to reach 0Hz from the acceleration/deceleration reference frequency (Pr. 20). Set a longer time to decelerate more slowly, and a shorter time to decelerate more rapidly. (Note)



Model	Factory Setting	Setting Range
7.5K and below	5 seconds	0 to 3600 seconds / 0 to 360 seconds
11K and above	15 seconds	0 to 3600 seconds / 0 to 360 seconds

Note: When the set value of Pr. 8 is "0", the deceleration time is set to 0.04 seconds.

Motor overheat protection



⇨ **Pr. 9 "electronic overcurrent protection"**

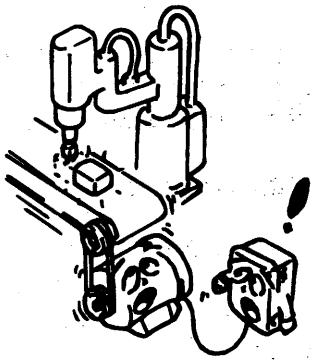
- The set value for motor overheat protection may be set as a current value (A). Normally set the rated current value of the motor at 50Hz. This function provides an optimum protective characteristic including a reduction in motor cooling capability in low-speed operation.
- Setting of "0" makes the motor protective function invalid. (The inverter output transistor protective function is valid.)
- When Mitsubishi's constant-torque motor is used, set "1" or any of "13" to "16" in Pr. 71 "applied motor" to select the 100% continuous torque characteristic during low speed operation, and set the rated motor current in Pr. 9 "electronic overcurrent protection".

Factory setting of Pr. 9 ..... [rated output current of the inverter]

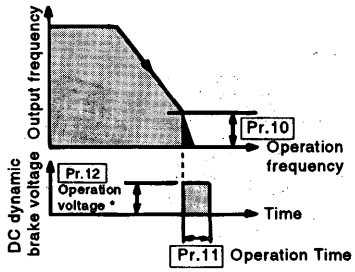
Note: When two or more motors are run simultaneously, provide a thermal relay for each motor.

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To adjust the stopping accuracy of positioning operation, etc. according to the load



Pr. 10 "DC dynamic brake operation frequency", Pr. 11 ⇨ "DC dynamic brake operation time", Pr. 12 "DC dynamic brake voltage"



- Setting the stopping DC dynamic brake voltage (torque), operation time and operation starting frequency allows the stopping accuracy of positioning operation, etc. to be adjusted according to the load.

<When load is large>
Set a short time in Pr. 11 "DC dynamic brake operation time".
Set a large value in Pr. 12 "DC dynamic brake voltage".

<When load is small>
Set a long time in Pr. 11 "DC dynamic brake operation time".
Set a small value in Pr. 12 "DC dynamic brake voltage".

Parameter	Factory Setting	Setting Range
Pr.10	3Hz	0 to 120Hz, 9999 (Note 1)
Pr.11	0.5 seconds	0 to 10 seconds, 8888 (Note 2)
Pr.12	7.5K and below...6%, 11K and above...3%	0 to 30%

Note: 1. Setting 9999 in Pr. 10 allows the DC dynamic brake to start at the frequency set in Pr. 13 (starting frequency).
2. When 8888 is set in Pr. 11, connection of terminal MRS-SD starts the DC dynamic brake. At this time, the essential function (output stop) of terminal MRS is invalid.
3. When an inverter-dedicated motor (constant-torque motor) is used, change the setting of Pr. 12 "DC dynamic brake operation frequency" as described below:
7.5K and below.....4%, 11K and above.....2%

⚠ CAUTION

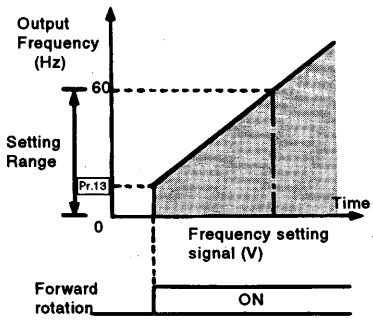
⚠ Do not set 8888 in Pr. 11.
The motor may not stop correctly during orientation.

⚠ Install a mechanical brake.
There is no holding torque at stop.

To limit the running frequency at start



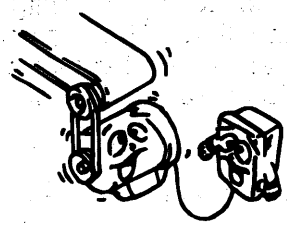
⇨ Pr. 13 "starting frequency"

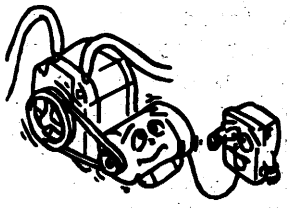


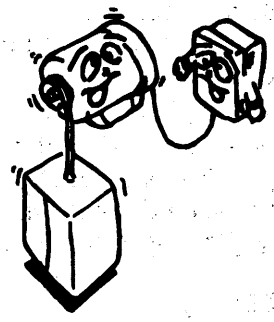
- Allows the starting frequency to be set between 0 and 60Hz.
For example, when the starting frequency setting is 5Hz, the motor starts running as soon as the frequency setting signal reaches 5Hz.
Also, when the setting is higher than 5Hz, entering the start signal causes the frequency output to start from 5Hz.

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To select the optimum output characteristic (V/F characteristic) for application and load characteristic

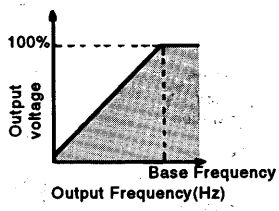




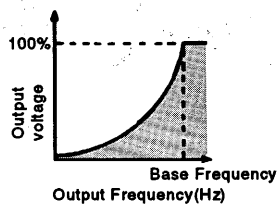


⇨ **Pr. 14 "applied load selection"**

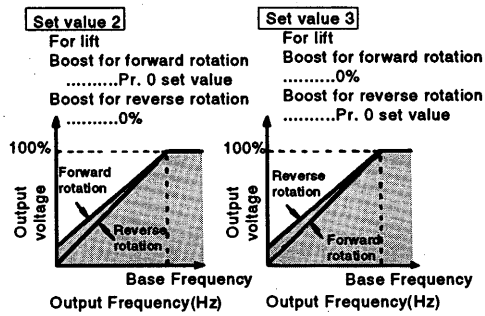
- **Conveyor, carrier, etc. (for constant-torque loads)**
  Set "0" (factory setting).



- **Fan and pump (for variable-torque loads)**
  Set "1".
  The inverter accelerates slowly until the motor starts running to prevent the inverter from being stopped by the overcurrent protection function.
  Since an overvoltage is more likely to occur in this load characteristic than in the constant-torque load characteristic, set a longer deceleration time.



- **For lift**
  Set "2" or "3".
  Set "2" to select a boost for forward rotation, and set "3" to select a boost for reverse rotation.



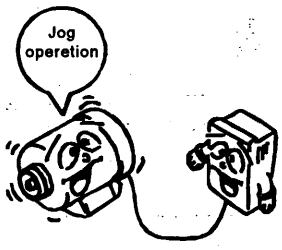
- **Applied load selection switching function according to RT terminal signal ON/OFF**
  By setting "4" or "5" in Pr. 14, the output characteristic can be changed as indicated below according to the ON/OFF state of the RT terminal (second acceleration/deceleration time select terminal) signal.

Set Value	ON (Note)	OFF
4	For constant-torque loads (Pr. 14=0)	For lift No boost for reverse rotation (Pr14=2)
5	For constant-torque loads (Pr. 14=0)	For lift No boost for forward rotation (Pr14=3)

Note: When the RT terminal signal is on, the second control functions (second acceleration/deceleration time, second torque boost, second base frequency) are selected. When the magnetic flux vector control mode has been selected in Pr. 80 and Pr. 81, the setting of this parameter is ignored.

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To set the frequency and acceleration/deceleration time for jog operation



⇨ Pr. 15 "jog frequency", Pr. 16 "jog acceleration/deceleration time", Pr. 20 "acceleration/deceleration reference frequency", Pr. 21 "acceleration/deceleration time increments"

- Allows jog operation to be started and stopped by selecting the jog mode (connecting terminals JOG and SD) and turning on/off the start signal (terminals STF,STR). Jog operation may also be performed by using the parameter unit. For full information on the operation procedure, see page 5-11.

- **Setting of frequency and acceleration/deceleration time**

(1) Confirmation of acceleration/deceleration time setting range and minimum setting increments

Use Pr. 21 "acceleration/deceleration time increments" to set the acceleration/deceleration time setting range and minimum setting increments. Before setting the acceleration/deceleration time, the set value must be checked.

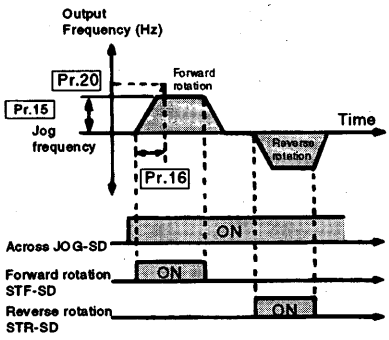
Set value "0"..... 0 to 3600 seconds
(factory setting) (minimum setting increments: 0.1 seconds)

Set value "1"..... 0 to 360 seconds
(minimum setting increments: 0.01 seconds)

(2) Setting of acceleration/deceleration time

In Pr. 16 "jog acceleration/deceleration time", set acceleration/deceleration time for jog operation. Acceleration time is a period of time required to reach the acceleration /deceleration reference frequency (Pr. 20) from 0Hz.

Deceleration time is a period of time required to reach 0Hz from the acceleration/deceleration reference frequency (Pr. 20). Set a longer time to accelerate or decelerate more slowly, and a shorter time to accelerate or decelerate more rapidly. (Note 1, 2)



Factory Setting	Setting Range
0.5 seconds	0 to 3600 seconds/ 0 to 360 seconds

Note: 1. In S-pattern acceleration/deceleration A (see page 9-16), the set time is a period of time required to reach the base frequency (Pr. 3).
2. If Pr. 20 (acceleration/deceleration reference frequency) setting is changed, the set values of calibration Pr. 903 and Pr. 905 (frequency setting signal gain) remain unchanged. To adjust the gains, adjust calibration Pr. 903 and Pr. 905.

(3) Setting of frequency

In Pr. 15 (jog frequency), set the running frequency for jog operation.

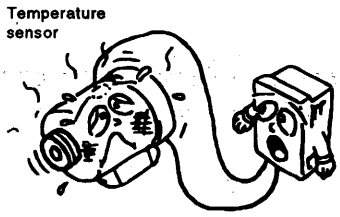
Factory Setting	Setting Range
5Hz	0 to 400Hz

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To select a thermal relay in the outside of the inverter



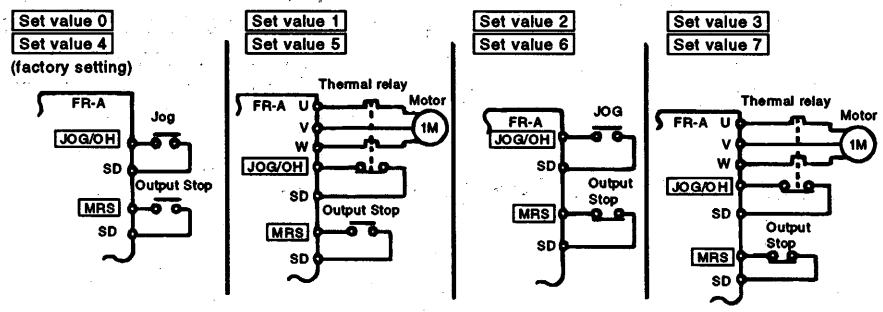
External thermal relay



⇨ Pr. 17 "external thermal relay input"

- Change the set value to "1" or "3" to switch the function of the input terminal JOG/OH from the factory setting of the jog mode to OH (external thermal relay input). OH is used to input the signal contact of a thermal relay installed outside the inverter or that of a temperature sensor built in the motor. Change the set value to "2" or "3" to switch the function of the MRS terminal to N/C contact input specification (normally closed input).
  Also, when any of 4 to 7 is set in this parameter, the output terminal to which "9" was set in Pr. 40 (output terminal assignment) acts as the zero current detection signal terminal.

Pr. 17 Set Value	JOG/OH Terminal Function		MRS Terminal Function		Output Terminal Signal to Which "9" Was Set in Pr. 40
	Jog mode	OH (external thermal relay input)	N/O input	N/C input	
0 (factory setting)	●	—	●	—	During PU operation
1	—	●	●	—	
2	●	—	—	●	
3	—	●	—	●	
4	●	—	●	—	Open motor circuit detection (For details, refer to page 9-40.)
5	—	●	●	—	
6	●	—	—	●	
7	—	●	—	●	

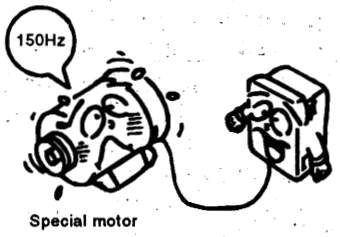


⚠ CAUTION

⚠ With the external thermal relay connected, do not switch to jog operation.
The motor will start with the start signal only.

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To run at the frequency over 120Hz



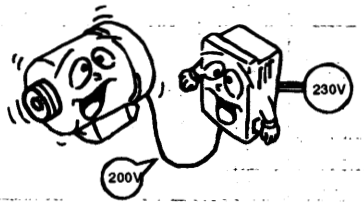
Special motor

⇨ Pr. 18 "high-speed maximum frequency"

- This inverter is factory-set to the maximum running frequency of 120Hz. To run at the frequency over 120Hz, set a value of grater than 120Hz in Pr. 18 "high-speed maximum frequency". Pr. 1 "maximum frequency" is automatically changed to this set value.

Factory Setting	Setting Range
120Hz	120 to 400Hz

To use the motor of 200V rating with a 230V power supply



⇨ Pr. 19 "base frequency voltage"

- By setting 200V in Pr. 19 "base frequency voltage", a motor of rated voltage lower than the power supply voltage to the inverter can be used.

Factory Setting	Setting Range
9999	0 to 1000V, 8888,9999

Note: 1. Setting "9999" (factory setting) in Pr. 19 makes the maximum output voltage identical to the power supply voltage.
2. When the magnetic flux vector control mode has been selected in Pr. 80 and Pr. 81, Pr. 19 is regarded as about 200V (or 400V).
3. By setting "8888" in Pr. 19, the maximum output voltage is 95% of the power supply voltage. (Set "8888" in Pr. 19 when using a special motor of other than a Japanese manufacturer, for example.)

■ **<Pr. 20, Pr. 21 ⇨ See the section of Pr. 7>**

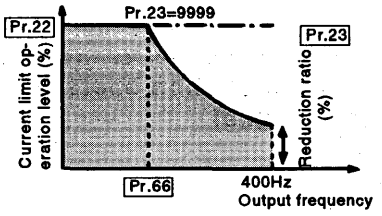
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To set the stall prevention (current limit) operation level



⇨ **Pr. 22 "stall prevention operation level"**
Pr. 23 "stall prevention operation level at double speed"
Pr. 66 "stall prevention operation level reduction starting frequency"

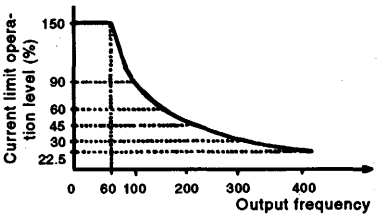
- In Pr. 22 "stall prevention operation level", set the stall prevention (current limit) operation level. Normally set to 150% (factory setting).



> Note: The set value (%) indicates a ratio of the current value to the rated output current of the inverter.

- When operation is performed at high speed at or over 60Hz, acceleration may not be possible because the motor current does not increase. To improve the operation characteristic of the motor in such a case, the current limit level in the high-frequency range can be reduced. When operation is performed in the high-frequency range, the current in the locked motor state is smaller than the rated output current of the inverter and the inverter does not result in an alarm (protective function not activated).

Setting example
(Pr.22=150%, Pr.23=100%, Pr.66=60Hz)



Pr. 66 is the reduction starting frequency, and Pr. 23 the reduction ratio correction coefficient.

- By setting "9999" (factory setting) in Pr. 23, the stall prevention (current limit) level is kept constant at the Pr. 22 set value up to 400Hz.
- **Calculation expression for current limit operation level**

Current limit operation level (%)

$$= A + B \times \left(\frac{Pr.22 - A}{Pr.22 - B}\right) \times \left(\frac{Pr.23 - 100}{100}\right)$$

where, $A = \left(\frac{Pr.66(Hz) \times Pr.22\,(\%)}{\text{output frequency (Hz)}}\right)$, $B = \left(\frac{Pr.66(Hz) \times Pr22(\%)}{400\,(Hz)}\right)$

- When "0" is set in Pr. 22, the stall prevention operation is not performed.
- When "9999" is set in Pr. 22, the stall prevention level can be changed by terminal No. 1. A specific method is given below.

⚠ CAUTION

⚠ Do not set a too small value as the stall prevention operation current.
Torque generated will reduce.

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- Set "9999" in Pr. 22 to change the stall prevention operation level according to the voltage applied to terminal 1. (The fast-response current limit level remains unchanged.)

Setting method

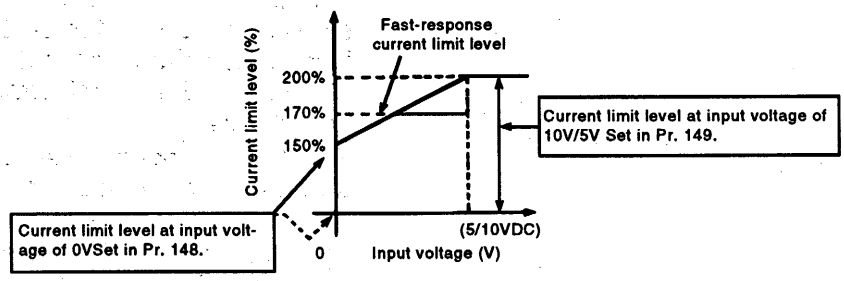
Set "9999" in Pr. 22 "stall prevention operation level".

Stall prevention operation level signal

Enter 0 to 5V (or 0 to 10V) into terminal 1.
(Setting "9999" in Pr. 22 automatically switches the function of the auxiliary input terminal to a stall prevention operation level signal input.)

Functions

Parameter Number	Description	Setting Range	Minimum Increment	Factory Setting	Remarks
22	Stall prevention level	0 to 200%, 9999	0.1%	150%	9999: Analog input
22 (Note 1)	Fast-response current limit level	0,1,2,3	0,1,2,3	2	0: No limit 1:150% 2:170% 3:190%
148 (Note 1)	Current limit level at the input voltage of 0V	0 to 200%	0.1%	150%	(Bias)
149 (Note 1)	Current limit level at the input voltage of 10V/5V	0 to 200%	0.1%	200%	(Gain)

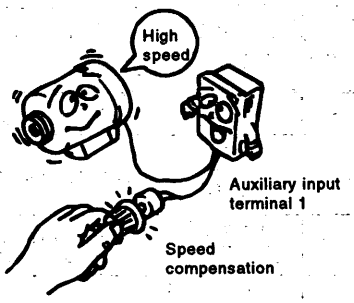


Note: 1. Set 701 in Pr. 77 to enable read and write.
(When Pr. 77 = 701, Pr. 22 acts as a parameter for fast-response current limit level.)
2. Use Pr. 73 to switch the terminal 1 input voltage between 0 to 5V and 0 to 10V.
3. When 9999 is set in Pr. 22, the terminal 1 input is dedicated to stall prevention level setting. Therefore, the auxiliary input and override functions of terminal 1 are made invalid.
4. The setting of this parameter is ignored when the magnetic flux vector control mode has been selected using Pr. 80 and Pr. 81.
5. The fast-response current limit level is factory-set to 170%.

■ <Pr. 24, Pr. 25, Pr. 26, Pr. 27 ⇨ See the section of Pr. 4>

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To compensate for speeds during multi-speed operation



⇨ Pr. 28 "multi-speed input compensation"

- By entering a compensation signal into the auxiliary input terminal 1 (Note), the speeds (frequencies) of multi-speed settings selected by the RH, RM and RL terminals can be compensated for.

Set value	Compensation by Auxiliary Input
0	No compensation (factory setting)
1	Compensation available

(Note) When any of 4, 5, 14 and 15 is set in Pr. 73, the compensation signal is entered into terminal 2.

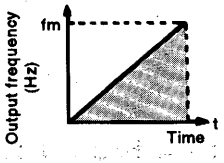
To select the optimum acceleration/deceleration pattern for application

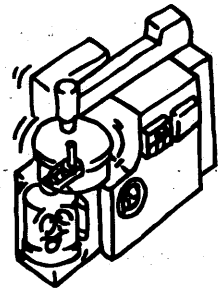


⇨ Pr. 29 "acceleration/deceleration pattern"

- **General application**
  Set "0" (factory setting). A general acceleration/deceleration pattern (linear acceleration/deceleration) is achieved.
  Generally this setting is used for operation.

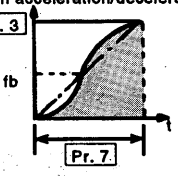
Set value 0
[Linear acceleration/deceleration]



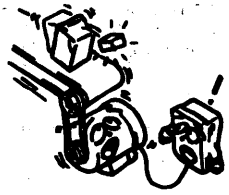


- **For machine tool spindles**
  Set "1". This setting is used when it is necessary to make acceleration/deceleration in a short time up to the 60Hz or higher speed range (S-pattern acceleration/deceleration A). In this acceleration/deceleration pattern, fb (base frequency) is always the inflection point of an S shape, allowing acceleration/deceleration time to be set according to the reduction in motor torque in the 60Hz or higher constant-output operation range (Pr. 7, Pr. 8).

Set value 1
[S-pattern acceleration/deceleration A]



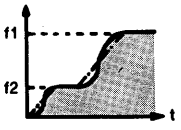
Note: For the acceleration/deceleration time, set the time required to reach the base frequency (Pr. 3), not the acceleration/deceleration reference frequency (Pr. 20).





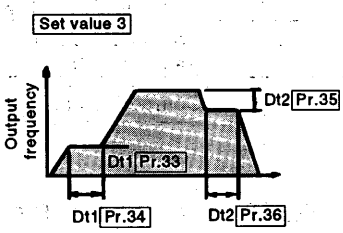
- **Prevention of cargo collapse on conveyor, etc.**
  Set "2" to provide an S-pattern acceleration/deceleration from f2 (current frequency) to f1 (target frequency), easing acceleration/deceleration shock. This pattern has an effect on the prevention of cargo collapse, etc.

Set value 2
[S-pattern acceleration/deceleration B]



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- **Backlash compensation for reduction gear, etc.**
  Set "3". This function stops the output frequency change temporarily during acceleration/deceleration, reducing shock (backlash) generated when a reduction gear backlash is eliminated suddenly. Use Pr. 33 to 36 for the setting.

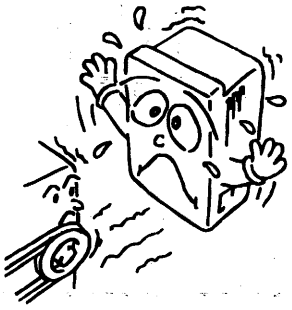


Pr. Number	Function Name	Setting Range	Factory Setting
33	Backlash acceleration stopping frequency	0 to 400Hz	1Hz (9999)
34	Backlash acceleration stopping time	0 to 360 seconds	0.5 seconds (9999)
35	Backlash deceleration stopping frequency	0 to 400Hz	1Hz (9999)
36	Backlash deceleration stopping time	0 to 360 seconds	0.5 seconds (9999)

Note: Pr. 31 and 32 only are implemented as frequency jump function.

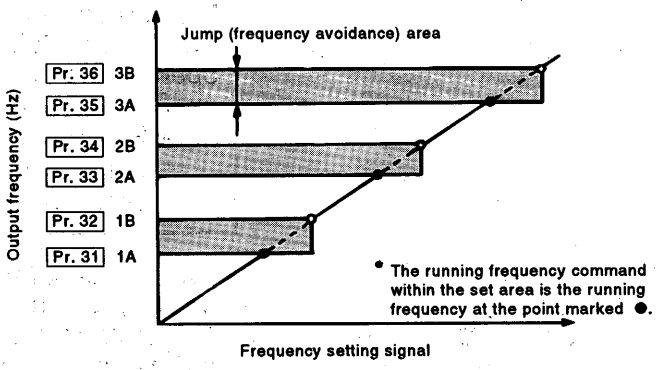
■ <Pr. 30 ⇨ See page 22-2>

To avoid the resonant points of a machine



Pr. 31 "frequency jump 1A", Pr. 32 "frequency jump 1B"
⇨ Pr. 33 "frequency jump 2A", Pr. 34 "frequency jump 2B"
Pr. 35 "frequency jump 3A", Pr. 36 "frequency jump 3B"

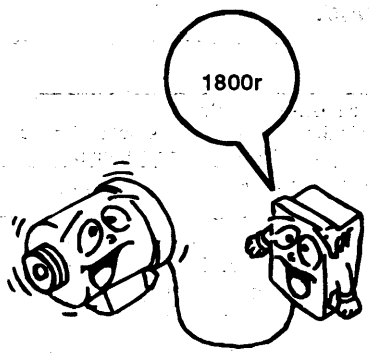
- Allows a mechanical resonant point to be jumped. Up to three areas may be set, with the jump frequency top and bottom point set for each area.
- The value set to 1A, 2A or 3A is a jump point and operation is performed at this frequency.



Note: 1. Frequency jump is not made when the set value is "9999" (factory setting).
2. Setting "3" in Pr. 29 switches Pr. 33 to 36 into the backlash compensation setting functions. But Pr. 33 to 36 setting ranges are not displayed on the PU screen. And the set values of the frequency jump parameters are displayed in the parameter change list and initial value list, that is, when Pr. 29 is set to 3, the set values of Pr. 33 to 36 are not displayed in the lists.
(Pr. 31 and 32 are valid as frequency jump functions.)
3. During acceleration/deceleration, the running frequency within the set area is valid.

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To change the speed display to motor speed display (r/min) or machine speed display (m/min)



Pr. 37 "speed display"
⇨ Pr. 51 "inverter LED display data selection"
Pr. 52 "PU main display data selection"
Pr. 53 "PU level display data selection"

- **To change the inverter LED display**
  (1) Set "6" (running speed) in Pr. 51 "inverter LED display data selection".
  (2) Set Pr. 37 "speed display" in accordance with the following table:

Pr. 37 Set Value	Running Speed Display
2 to 10	• The set value is the number of motor poles. • The displayed value is the motor speed. Example: When the set value is "2", 3600 (r/min) is displayed at the output of 60Hz.
11 to 9998	• Set the machine speed at 60Hz operation. Example: When the set value is 150 (m/min), 150 (without display unit) is displayed at the output of 60Hz.

Note: 1. Only the display unit is set in this parameter. For the other frequency-related parameters (such as Pr. 1), set a frequency unit.
2. In the V/F control mode, the motor speed is converted into the output frequency and does not match the actual speed. When the magnetic flux vector control mode has been selected in Pr. 80 and 81, this display shows the actual speed (estimated value resulting from the compensation of motor slip).
3. The factory setting is "4" (poles) (1800 r/min is displayed at the output of 60Hz).

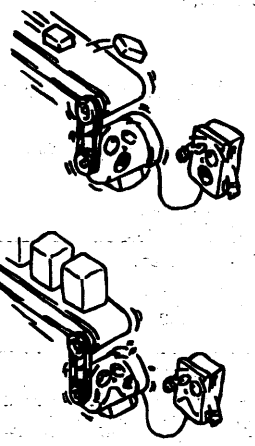
- **To change the PU level meter (PU level display)**
  (1) Set "6" (running speed) in Pr. 53 "PU level display data selection".
  (2) Set Pr. 37 "speed display" with reference to the above table.
- **To change the PU main monitor (PU main display)**
  (1) Set "0" (factory setting) in Pr. 52 "PU main display data selection".
  (2) Press the [HELP] key to call the selective monitor (other monitor) screen.
  (3) Move the cursor (⇨) to "6 rpm" and press the [READ] key to call the speed monitor screen (unit: r/min).
  (4) Then press the [WRITE] key to define the speed monitor screen as the first priority screen.

⚠ CAUTION

⚠ Always set the number of motor poles in Pr. 37. Otherwise, the motor may run at overspeed, damaging the machine.

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To automatically control the output voltage (torque) according to the load



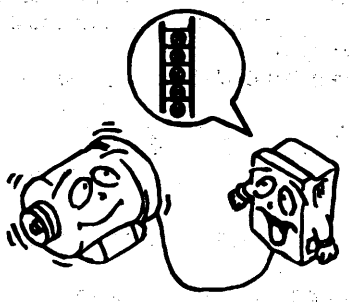
⇨ Pr. 38 "automatic torque boost"
Pr. 39 "automatic torque boost starting current"

• Automatically controls the inverter output voltage (torque) according to the load current detected.

Parameter Number	Factory Setting	Set Value
Pr. 38	0%	Set the boost compensation value (%). Set "0" to disable the automatic torque boost. Normally set "100"(%) to operate the automatic torque boost.
Pr. 39	0A	Set the automatic torque boost starting current (A). Normally set "0"(A).

Note: When the magnetic flux vector control mode has been selected in Pr. 80 and 81, the setting of the automatic torque boost is ignored.

To change the functions of the output terminals SU, IPF, OL, FU



⇨ Pr. 40 "output terminal assignment"

• Any of 9 functions can be reassigned to the SU, IPF, OL and FU output terminals individually.
Set a 4-digit integer in Pr. 40.
The value in each digit indicates the function of the corresponding terminal.

Pr. 40 : 1st digit | 2nd digit | 3rd digit | 4th digit
↑ SU ↑ IPF ↑ OL ↑ FU

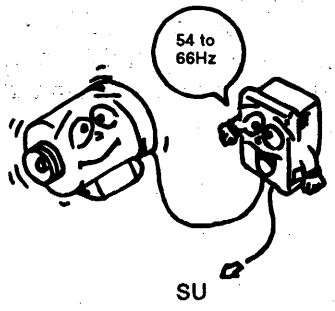
• **Factory setting....."1234"**
Terminal SU : SU (up-to-frequency) signal
Terminal IPF : IPF/UVT (instantaneous power failure or undervoltage) signal
Terminal OL : OL (overload alarm) signal
Terminal FU : FU1 (frequency detection) signal

Set Value	Function Code	Function Name	Operation	Related Pr.
0	RUN	Inverter running	Output during operation when the inverter output frequency reaches or exceeds the starting frequency.	—
1	SU	Up-to-frequency	Output when the output frequency reaches ±10% of the set frequency. (Note 4) (Note 5)	Pr. 41
2	IPF/UVT	Instantaneous power failure or undervoltage	Output when instantaneous power failure or undervoltage occurs.	—
3	OL	Overload alarm	Output while the current limit function is operating.	Pr. 22, 23
4	FU1	Frequency detection	Output when the output frequency reaches or exceeds the specified detection frequency. (Note 4)	Pr. 42, 43
5	FU2	Second frequency detection	Output when the output frequency reaches or exceeds the specified detection frequency. (Note 4)	Pr. 50
7	THP	Electronic overcurrent protection alarm	Output when the electronic overcurrent protection cumulative value reaches 85% of the set level.	Pr. 9
8	PRG	Program mode	Output in the program mode. (Note 6)	Pr. 79
9	PU	PU operation mode	Output when the PU operation mode is selected. (Note 8)	—

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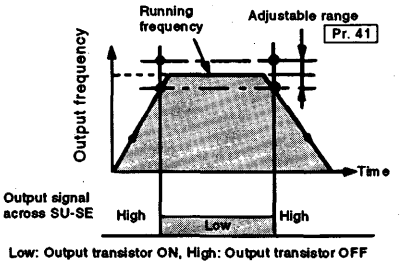
Note: 1. "0" set in the first digit of the four digits is not displayed. However, "0" set only in one digit is displayed.
2. The function of terminal RUN (output during inverter running) is fixed. This function cannot be changed by using Pr. 40.
3. "Output" indicates that the built-in transistor for open collector output is turned on (conducts).
4. In the PLG feedback control mode, the operations of up-to-frequency (SU) and frequency detection (FU1, FU2) are as described below:
   SU, FU1 : Output when the actual speed (frequency) under the control of the PLG feedback signal reaches or exceeds the specified detection frequency.
   FU2 : Output when the inverter output frequency reaches or exceeds the specified detection frequency.
5. When the frequency setting is changed by the analog signal or the [▲]/[▼] key of the PU, the output of the SU (up to frequency) signal may alternate between ON and OFF depending on the speed of that change and the timing of the changing speed determined by the setting of the acceleration/deceleration time. (Such alternation does not take place when the acceleration/deceleration time setting is "0 seconds".)
6. Output when the inverter is switched to the external operation mode (goes into the programmed mode), with "5" set in Pr. 79 "operation mode".
7. 6 cannot be set.
8. By setting "9" in this parameter, the function of the output terminal changes to a zero current detection signal when any of 4 to 7 has been set in Pr. 17 (external thermal relay input).

To adjust the ON range of the up-to-frequency signal



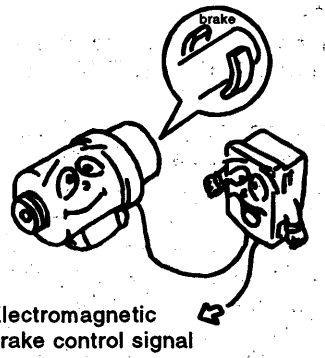
⇨ Pr. 41 "up-to-frequency sensitivity"

- Allows the output signal ON range to be adjusted between 0 and ± 100% of the running frequency when the output frequency reaches the running frequency.



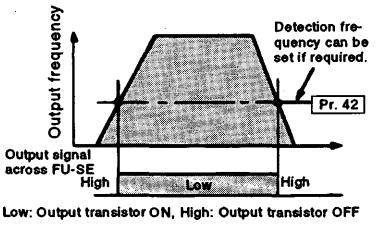
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To set the operation and open signals of the electromagnetic brake, etc.



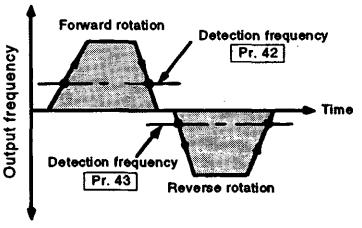
⇨ Pr. 42 "output frequency detection", Pr. 43 "output frequency detection at reverse rotation"

- The signal across terminals FU and SE is switched low when the output frequency reaches or exceeds the selected detection frequency (value set in "output frequency detection", Pr. 42), and is switched high when it drops below the detection frequency. This function can be used for electromagnetic brake operation, open and other signals.



Low: Output transistor ON, High: Output transistor OFF

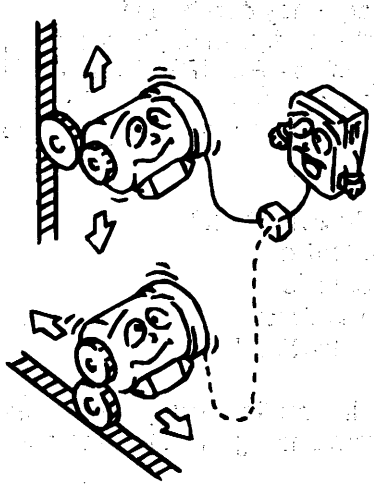
- Setting a value in Pr. 43 "output frequency detection at reverse rotation" allows the frequency to be detected exclusively for the reverse rotation. (In this case, the set value in Pr. 42 is for the forward rotation only.) This function is effective for switching the timing of electromagnetic brake operation between forward rotation (rise) and reverse rotation (fall) during elevating operation. This parameter is factory-set to "9999". In this state, the detection frequency is the Pr. 42 set value for both the forward rotation and reverse rotation.



Note: When the inboard option unit is used to exercise PLG feedback control, use the RUN (running) signal for brake release. (If the FU (output frequency detection) signal is used, the brake may not be released.)

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To switch between two motors different in conditions



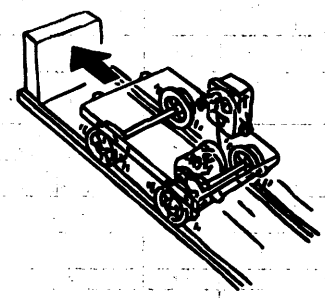
⇨ Pr. 44 "second acceleration/deceleration time", Pr. 45 "second deceleration time" Pr. 46 "second torque boost", Pr. 47 "second V/F (base frequency)"

- The external contact signal (across terminals RT-SD) allows the acceleration and deceleration times, boost setting, etc. to be changed together.
  Effective for switching between two motors with different parameter setting, e.g. elevating and traversing.

Set Function	Parameter number	Signal across Terminals RT-SD OFF	ON
Acceleration time	Pr. 7	●	
	Pr. 44		●
Deceleration time	Pr. 8	●	
	Pr. 45		●
Torque boost (manual)	Pr. 0	●	
	Pr. 46		●
Base frequency	Pr. 3	●	
	Pr. 47		●

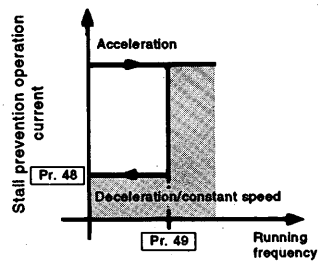
Note: 1. Setting "9999" (factory setting) in Pr. 45 causes both the second acceleration time and deceleration time to be the value set in Pr. 44.
2. When the magnetic flux vector control mode has been selected in Pr. 80 and Pr. 81, the setting of Pr. 46 is ignored.
3. The second acceleration/deceleration time is the time taken for acceleration to the frequency set in Pr. 20 "acceleration/deceleration reference frequency", as in Pr. 7 "acceleration time" and Pr. 8 "deceleration time".

To stop a trolley or the like on contact with an end stop



⇨ Pr. 48 "second stall prevention operation current" Pr. 49 "second stall prevention operation frequency"

- Allows the stall prevention (current limit) operation level to be changed within the range from 0Hz to the frequency set in Pr. 49. The setting of a low value is effective for a stop on contact, which requires low torque at low speed.
- This function is not valid during acceleration and is only valid during deceleration or at constant speed.



- This function is invalid when "0" is set in Pr. 49 (factory setting).

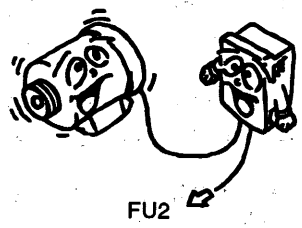
Note: 1. The set value (%) indicates a ratio of the current value to the rated output current of the inverter.
2. To make a stop upon contact on a higher level, refer to page 19-1.

⚠ CAUTION

⚠ Do not set a too small value to the second stall prevention operation current. The torque generated will reduce.

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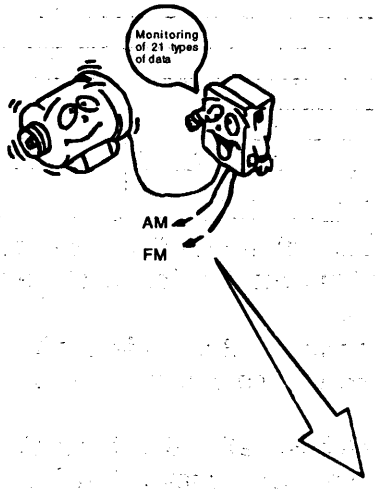
To set the second output frequency detection



⇨ Pr. 50 "second output frequency detection"

- In addition to the detected output frequencies set in Pr. 42 and Pr. 43, another detected output frequency can be set.
- By setting "5" (FU2) in any of the first to fourth digits of Pr. 40, the signal can be output from any of the SU, IPF, OL and FU terminals. The terminal signal is turned on at or above the set frequency (the built-in transistor is switched on). (See the section of Pr. 42 and Pr. 43.)

Selection of monitor and output signals



⇨ Pr. 51 "inverter LED display data selection"
Pr. 52 "PU main display data selection"
Pr. 53 "PU level display data selection"
Pr. 54 "FM terminal function selection"
Pr. 158 "AM terminal function selection"

- By setting any of the numbers in the following table, the required signal can be selected from among the 21 signals for the monitor and output signals.
- There are two types of signal outputs: FM pulse train output terminal and AM analog output terminal. Different signals can be output at the same time. Select the signals using Pr. 54 and Pr. 158.

  <Factory setting>
  Pr. 51..."1", Pr. 52..."0", Pr. 53..."1", Pr. 54..."1", Pr. 158..."9999"

	Signal Type	Display Unit	Parameter Set Value						Full-Scale Value of FM, AM, Level Meter
			Pr. 51	Pr. 52	Pr. 53	Pr. 54		Pr. 158	
			Inverter LED	PU main monitor	PU level meter	FM terminal	AM terminal	AM terminal	
	No display	—	×	×	0	×	×	×	—
	Output frequency	Hz	1	0	1	1	101	1	Pr. 55
	Output current	A	2	0	2	2	102	2	Pr. 56
	Output voltage	V	3	0	3	3	103	3	400V or 800V
	Alarm display	—	4	0	×	×	×	×	—
☆	Frequency set value	Hz	5	*	5	5	105	5	Pr. 55
☆	Running speed	(r/min)	6	*	6	6	106	6	Value converted from Pr. 55 by Pr. 37 value
☆	Motor torque**	%	7	*	7	7	107	7	Rated torque of applied motor ×2
☆	Converter output voltage	V	8	*	8	8	108	8	400V or 800V
☆	Electronic overcurrent protection load factor	%	10	*	10	10	110	10	Protection operation level
☆	Output current peak value	A	11	*	11	11	111	11	Pr. 56
☆	Converter output voltage peak value	V	12	*	12	12	112	12	400V or 800V
☆	Inverter input power	kW	13	*	13	13	113	13	Rated power of applied motor ×2
☆	Inverter output power	kW	14	*	14	14	114	14	Rated power of applied motor ×2
	Input terminal status	—	×	*	×	×	×	×	—
	Output terminal status	—	×	*	×	×	×	×	—
☆	Load meter	%	17	17	17	17	117	17	Pr. 56
☆	Motor exciting current	A	18	18	18	18	118	18	Pr. 56
	Position pulse	—	×	19	×	×	×	×	—
	Cumulative energization time	hr	×	20	×	×	×	×	—
☆	Reference voltage output	—	×	×	×	21	121	21	1440Hz is output to FM terminal. Full-scale voltage is output to AM terminal.
	Orientation status	—	×	22	×	×	×	×	—
	Actual operation time	hr	×	23	×	×	×	×	—
	Motor load factor	%	×	24	×	×	×	×	Rated load of applied motor ×2

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Note: 1. Monitor cannot be selected for items marked ×.
2. Setting "0" in Pr. 52 "PU main monitor" allows the monitoring of "output frequency to alarm display" to be selected in sequence by the SHIFT key. (Factory setting)
3. The load meter is displayed in %, with the current set in Pr. 56 regarded as 100%.
4. * "Frequency set value to output terminal status" on the PU main monitor are selected by "other monitor selection" of PU operation.
5. ** "Motor torque" display is valid only in the magnetic flux vector control mode.
6. When any of the signals marked ☆ has been selected in Pr. 54 "FM terminal function selection", the outputs of the FM and AM terminals are zero while the inverter is at stop or alarm.
7. Setting "1, 2, 5, 6, 11, 17 or 18" in Pr. 53 or Pr. 54 allows the full-scale value to be set in Pr. 55 or Pr. 56.
8. The cumulative energization time is calculated from 0 to 65535 hr, is then cleared, and is recalculated from 0.
9. By setting "0" in Pr. 53, the level meter display of the PU can be switched off.
10. For the actual operation time, the length of time when the inverter is running is calculated. (The time when the inverter is at a stop is not calculated.)
11. When the fast-response current limit function is activated, the outputs of terminals FM and AM are zeroed. (To prevent this, make the fast-response current limit function invalid or use the extension analog output of the FR-EPA or EPE option.)
12. The orientation status functions properly when the FR-EPA option is used. If the option is not used, "22" may be set in Pr. 52 but the orientation status does not function and "0" is displayed.

- Use Pr. 54 and Pr. 158 to select the function of the AM terminal in accordance with the following table:

Pr. 158 Set Value	Pr. 54 Set Value	FM, AM Terminal Output Status	Remarks
9999 (factory setting)	1 to 21	Both the FM and AM terminals output the signal set in Pr. 54.	The calibration Pr. 900 value may only be read and written.
	101 to 121		The calibration Pr. 901 value may only be read and written.
1 to 21	1 to 21*	The FM terminal outputs the signal set in Pr. 54. The AM terminal outputs the signal set in Pr. 158.	Both the calibration Pr. 900 and Pr. 901 values can be read and written.
	101 to 121*		

*: When any of "1 to 21" has been set in Pr. 158, setting either any of "1 to 21" or any of "101 to 121" in Pr. 54 causes the same signal to be output from the FM terminal.

<Setting example>

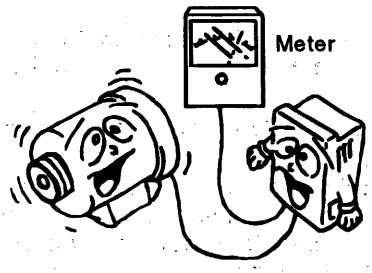
To output the output frequency from the FM terminal and the output current from the AM terminal

- Set 1 in Pr. 54 (adjust the full-scale value in Pr. 55).
- Set 2 in Pr. 158 (adjust the full-scale value in Pr. 56).

For adjustment, see pages 11-1 to 11-3.

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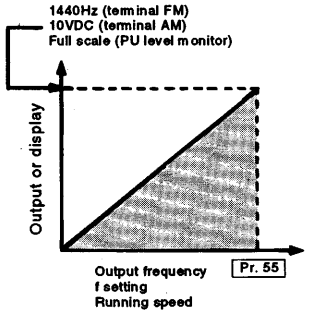
To set the frequency and current referenced for the display of the level meter

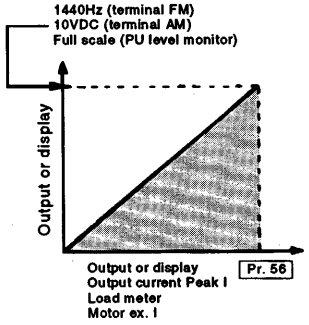


⇨ Pr. 55 "frequency monitoring reference" Pr. 56 "current monitoring reference"

- Set the frequency or current which is referenced for display when the frequency or current is selected for the FM and AM terminals and PU level meter display.

Monitoring Reference Setting Pr.	Monitor Screen Selection (Setting unit)	Level Meter Pr. 53 Setting	FM, AM Terminal Function Selection Pr. 54 Setting	
f monitoring reference Pr. 55	Output f (Hz)	1	1	101
	f setting (Hz)	5	5	105
	Running speed (Pr. 37)	6	6	106
I monitoring reference Pr. 56	Output I (A)	2	2	102
	Peak I (A)	11	11	111
	Load meter (%)	17	17	117
	Motor exciting I (A)	18	18	118
Setting method using Pr. 55, Pr. 56		PU level meter indication at full-scale.	Terminal FM output at 1440Hz.	Terminal AM output at 10V.

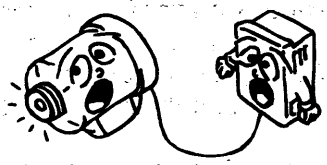


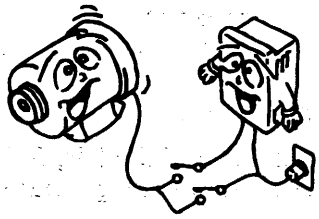


Note: 1. FM maximum output f is 2400Hz. Hence, adjust Pr. 55. If Pr. 55 is not adjusted, the output of terminal FM will be stabilized.
2. AM maximum output voltage is 10VDC.

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To automatically restart operation after instantaneous power failure/commercial power supply-inverter switch-over





Pr. 57 "coasting time for automatic restart after instantaneous power failure/commercial power supply-inverter switch-over"
⇨ Pr. 58 "rise time for automatic restart after instantaneous power failure/commercial power supply-inverter switch-over"

- Allows the inverter to be restarted without stopping the motor (with the motor coasting) when the commercial power supply is switched to the inverter operation or when the power is restored after an instantaneous power failure. (When automatic restart operation is set, the alarm output signal will not be switched on at the occurrence of an instantaneous power failure.)

- **Pr. 57 "coasting time for automatic restart after instantaneous power failure/commercial power supply-inverter switch-over"**

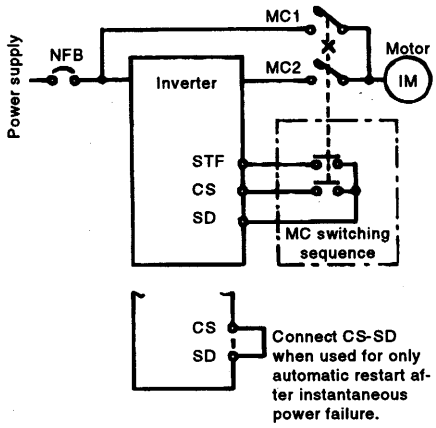
Set Value	Automatic Restart Operation Enable/Disable
9999 (factory setting)	Disable
0, 1 to 5 seconds *	Enable

Coasting time indicates a waiting time for automatic restart after power restoration.

* Setting "0" in Pr. 57 sets the coasting time to the following standard time. Most applications can be satisfied with this setting. This time may be adjusted between 1 and 5 seconds according to the magnitude of load inertia (GD) and torque.

5.5K / 7.5K ..... 1.0 second
11K and up ..... 3.0 seconds

- **Pr. 58 setting of "rise time for auto matic restart after instantaneous powerfailure/commercial power supply-inverter switch-over"**
Normally, operation is satisfactory with this parameter remaining at the factory setting of 1.0 second. The output voltage rise time for restart control may also be adjusted between 0.1 and 5 seconds according to the magnitude of load specifications (inertia, torque).



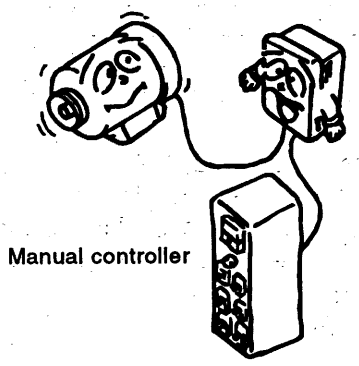
Note: When any value other than 9999 is set in Pr. 57, disconnection of terminals CS and SD will make the inverter inoperative.

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⚠ CAUTION

⚠ Provide mechanical interlocks between MC1 and MC2. The inverter will be damaged if power is input to the inverter output section.
After occurrence of an instantaneous power failure, the motor will start suddenly (after reset time has passed).
⚠ When the automatic restart after instantaneous power failure function has been selected, keep away from the motor and machine.
When the automatic restart after instantaneous power failure function has been selected, apply the supplied CAUTION seal to an easily identified place.

To perform remote setting



Manual controller

⇨ Pr. 59 "remote setting function selection"

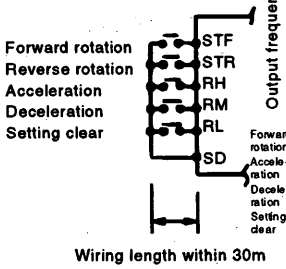
- By setting "1" or "2" in Pr. 59, the functions of the RH, RM and RL terminals can be changed to the remote setting input functions.
- Merely setting this parameter provides the acceleration, deceleration and setting clear setting functions of the FR series FR-FK motorized speed setter (option).
- RH (acceleration) and RM (deceleration) allow the frequency to be varied in the range 0 to the maximum frequency (set value in Pr. 1 or Pr. 18)
- When the remote function is used, the frequency output by the inverter can be corrected as indicated below:
  In the external operation mode: Frequency set by RH/RM operation + external operation frequency except multi-speeds
  In the PU operation mode: Frequency set by RH/RM operation + PU operation frequency

Pr. 59 Set Value	Operation	
	Remote setting function	Frequency set value storage function (*)
0	×	—
1	O	O
2	O	×

×:no, O:yes

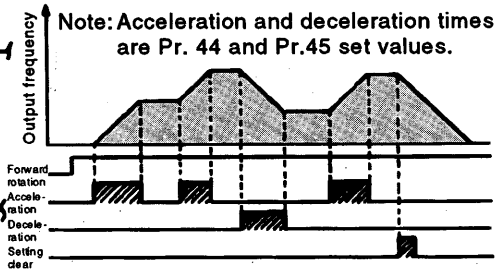
* As soon as RH-SD and RM-SD are kept open for more than about one minute or the STF (or STR) signal is switched off, the remote setting frequency (frequency set by RH/RM operation) is stored into memory. If power is switched off once and then switched on again, operation is resumed with this set value.

Connection



Wiring length within 30m

Operation example



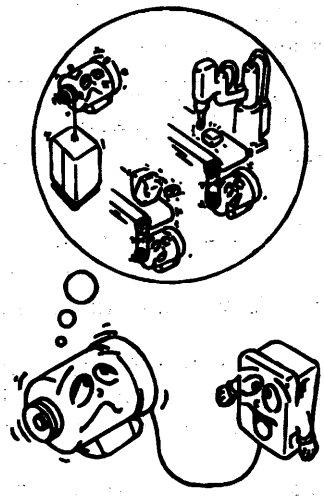
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Note: The frequency set value up/down times are set in Pr. 44 and Pr. 45, but the output f acceleration/deceleration times set in Pr. 7 and Pr. 8. Therefore, the actual acceleration/deceleration times become the longer set values respectively.

⚠ CAUTION

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

To perform intelligent mode operation

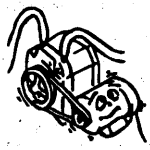


⇨ Pr. 60 "intelligent mode selection"

- By selecting this parameter, the inverter is automatically adjusted as if the appropriate value had been set in each parameter, without needing to set the acceleration and deceleration times and V/F pattern. This operation mode is useful to perform operation immediately without making fine parameter settings. (Note 1)
  The inverter automatically selects appropriate parameters.

	Pr. 60 Set Value	Set Function	Operation	Automatically Set Parameters
	0 (factory setting)	Ordinary operation mode	—	—
	1, 2	Shortest acceleration/deceleration mode	Set when it is desired to accelerate/decelerate the motor in the shortest time. The inverter makes acceleration/deceleration in the shortest time using its full capabilities. During deceleration, an insufficient brake capability may cause the overvoltage alarm (E.OV3). • Set value "1": current limit value 150% • Set value "2": current limit value 180%	Pr. 7 (Shortest) Pr. 8 (Shortest)
	3	Optimum acceleration/deceleration mode	The self-learning system automatically sets the boost value, acceleration and deceleration times so that the current during acceleration /deceleration is lower than the rated current of the inverter. Optimum operation can be carried out by fully utilizing the inverter capabilities in the rated continuous range. Appropriate for applications where the load will not vary largely. (Note 2)	Pr. 0 Pr. 7 Pr. 8

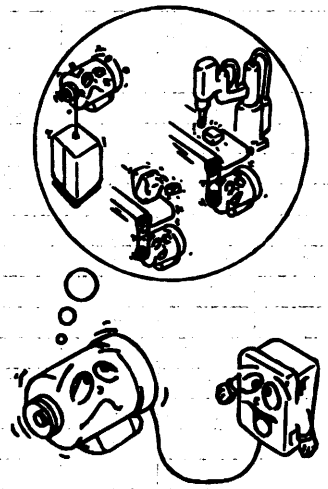
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	Pr. 60 Set Value	Set Function	Operation	Automatically Set Parameters
	4	Energy-saving mode	Tunes the inverter output voltage online so that the inverter output voltage is minimized during constant-speed operation. (Note 6) Appropriate for energy-saving applications such as fan and pump.	Output voltage
	5, 6	Elevator mode	Automatically controls the inverter output voltage so that the maximum torque can be delivered in the driving and regenerative modes. Appropriate for a counterbalanced elevator. • Set value "5": current limit value 150% • Set value "6": current limit value 180%	Pr. 0 Pr. 13 (2Hz) Pr. 19
——	7.8	Brake sequence mode	• The function of the output terminal changes to brake release.	——

Note: 1. When more accurate control is required for application, set parameters manually.
2. Because of the learning system, this control is not valid the first time.
3. When the magnetic flux vector control has been selected using Pr. 80 and Pr. 81, the settings of the energy-saving mode and elevator mode are ignored. (Magnetic flux vector control has priority.)
4. If an overvoltage (OV3) trip has occurred during operation in the optimum acceleration/deceleration mode, reset Pr. 8 "deceleration time" to a slightly larger value and restart operation in this mode.
5. When any of "1 to 8" has been set in Pr. 60, the parameters dedicated to intelligent mode Pr. 61 to 64 are valid.
Pr. 61 to 64, which need not be set unless required, may be set to improve performance. Set "0" in Pr. 60 to automatically set "9999" (factory setting) in Pr. 61 to 64.
6. When the motor is decelerated to a stop in the energy-saving mode, the deceleration time may become longer than the setting.
Also, since an overvoltage is more likely to occur in this mode than in the constant-torque load characteristic, set a longer deceleration time.
7. The optimum acceleration/deceleration mode is only valid for the frequency setting of 30.01Hz or higher.

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To perform the intelligent mode operation with higher performance



⇨ **Pr. 61 "reference current"**
Pr. 62 "reference current for acceleration"
Pr. 63 "reference current for deceleration"
Pr. 64 "starting frequency for elevator mode"

- Set these parameters to improve performance in the intelligent mode.

Note: These parameters are valid only when any of "1 to 6" has been selected in Pr. 60.

Pr. 61 Reference current (A)

Set Value	Reference Current
9999 (factory setting)	Rated inverter current
0 to 500A	Set value (rated motor current)

Pr. 62 Reference current for acceleration (%)

The reference value setting can be changed.
(The reference value differs between the shortest acceleration/deceleration mode and optimum acceleration/deceleration mode.)

Set Value	Reference Value	Remarks
9999 (factory setting)	150% (180%) is the limit value.	Shortest acceleration/deceleration mode
	100% is the optimum value.	Optimum acceleration/deceleration mode
0 to 200%	The set value of 0 to 200% is the limit value.	Shortest acceleration/deceleration mode
	The set value of 0 to 200% is the optimum value.	Optimum acceleration/deceleration mode

Pr. 63 Reference current for deceleration (%)

(The reference value differs between the shortest acceleration/deceleration mode and optimum acceleration/deceleration mode.)

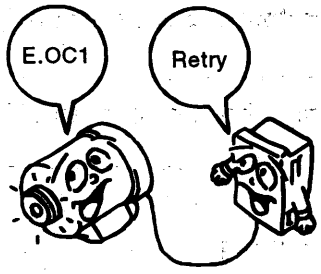
Set Value	Reference Value	Remarks
9999 (factory setting)	150% (180%) is the limit value.	Shortest acceleration/deceleration mode
	100% is the optimum value.	Optimum acceleration/deceleration mode
0 to 200%	The set value of 0 to 200% is the limit value.	Shortest acceleration/deceleration mode
	The set value of 0 to 200% is the optimum value.	Optimum acceleration/deceleration mode

Pr. 64 Starting frequency for elevator mode

Set Value	Set Frequency
9999 (factory setting)	2Hz is the starting frequency.
0 to 10Hz	The set value of 0 to 10Hz is the starting frequency.

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To limit the errors reset for retry



⇨ Pr. 65 "retry selection"

- This parameter allows the selection of the errors reset for retry.

Errors Reset for Retry		Set Values					
Inverter LED display	Parameter unit display	0 (factory setting)	1	2	3	4	5
E.OC1	OC During Acc	●	●		●	●	●
E.OC2	Stedy Spd Oc	●	●		●	●	
E.OC3	Oc During Dec	●	●		●	●	●
E.OV1	Ov during Acc	●		●	●	●	
E.OV2	Stedy Spd Ov	●		●	●	●	
E.OV3	Ov During Dec	●		●	●	●	
E.IPF	Inst. Pwr. Loss	●				●	
E.UVT	Under Voltage	●				●	
E. BE	Br. Cct. Fault	●				●	
E. GF	Ground Fault	●				●	
E.OLT	Stll Prev STP	●				●	
E.OPT	Option Fault	●				●	
E. PE	Corrupt Memry	●				●	
E. THM	Motor Overload	●					
E. THT	Inv. Overload	●					
E. OHT	OH Fault	●					
E. RET	Retry No. Over						
E. CPU	CPU Fault						

Note: indicates the errors selected for retry.

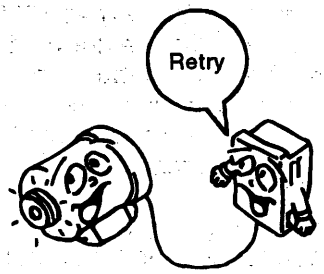
⚠ CAUTION

⚠ When the retry function has been selected, keep away from the motor and machine unless necessary. The motor will start suddenly (after a predetermined time has passed) after occurrence of an alarm.
When the retry function has been selected, apply the supplied CAUTION seal to an easily identified place.

■ <Pr. 66 ⇨ See the section of Pr. 22>

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To use the retry function



Pr. 67 "number of retries at trip occurrence"
⇨ Pr. 68 "retry waiting time"
Pr. 69 "retry count display erasure"

- Retry is a function which causes the inverter to automatically reset a trip at its occurrence, make a restart, and continue operation.
- In Pr. 67, set the number of retries at trip occurrence.

Pr. 67 Set Value	Number of Retries	Alarm Signal
0 (factory setting)	Retry is not made.	—
1 to 10	1 to 10 times	Not output.
101 to 110	1 to 10 times	Output.

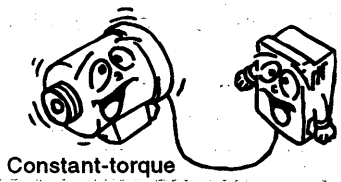
Note: The setting range of 0 to 10, 9999 is displayed on the setting display screen of the PU. 101 to 110 is not displayed.

- Using Pr. 68, a waiting time between alarm occurrence and restart can be set in the range 0 to 10 seconds.
- By reading the value of Pr. 69, the cumulative number of restart times made by retry is provided. The set value of "0" erases the cumulative number of times.

Note: 1. Since the inverter automatically starts operation after the retry waiting time set in Pr. 68 has elapsed, this function must be used with care so as not to jeopardize the operator.
2. The cumulative number in Pr. 69 is incremented by "1" when retry operation is regarded as successful, i.e. when normal operation is continued without any alarm occurring during a period four time longer than the time set in Pr. 68 "retry waiting time" after the start of the retry.
3. If alarms have occurred successively during the above period for a time longer than the waiting time setting, different displays may be provided on the inverter LED and PU; the most recent display on the inverter LED and the first retry display on the PU.
For errors occurring at retries, the definition of only the alarm that occurred at the first retry is stored.
4. When the inverter trip is reset at the restart time, the data of the electronic overcurrent protection, regenerative brake duty, etc. is not reset. (Different from the power-on reset.)

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To use a Mitsubishi constant-torque motor



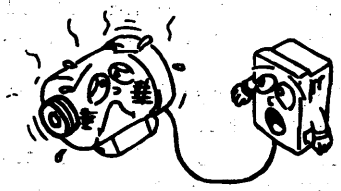
Constant-torque motor

Pr. 0 "torque boost (manual), Pr. 3 "base frequency"
⇨ Pr. 9 "electronic overcurrent protection"
Pr. 71 "applied motor"

- Mitsubishi's new constant-torque motor (SF-JRCA) and previous constant-torque motor can be run continuously at 100% torque down to low speed under magnetic flux vector control and V/F control, respectively. Without requiring the load torque to be reduced at low speed, they can be run continuously at constant torque (100% torque) over a 10:1 speed ratio (6 to 60Hz). The settings for magnetic flux vector control are given on page 14-1.
  When Mitsubishi's previous constant-torque motor is used, the settings of the following parameters must be changed:
  Pr. 0 "torque boost (manual)"
  .....7.5K and below-4%, 11K and above-2%
  Pr. 3 "base frequency"
  .....60Hz (factory setting)
  Pr. 9 "electronic overcurrent protection"
  .....rated current of motor
  Pr. 71 "applied motor"
  .....set value "1"

Note: When the old type 200V series 4-pole constant-torque motor (SF- JRC) is to be used, the special parameters must also be set in addition to the above parameters. For full information on the setting method, see page .

To match the thermal characteristic of the electronic overcurrent protection with the motor used



⇨ Pr. 71 "applied motor"

- In accordance with the following table, set this parameter for the motor used:

Pr. 71 Set Value	Characteristic of Electronic Overcurrent Protection		
0	For a general-purpose motor (factory setting)		
1	For Mitsubishi constant-torque motor		
2 (Note 1)	For a general-purpose motor 5-point flexible v/f characteristic		
3	Standard motor	"Auto tuning setting" is selected	
13	Constant-torque motor		
4	Standard motor	Auto tuning data read/change setting is enabled	
14	Constant-torque motor		
5	Standard motor	Star connection	Direct input of motor constants is enabled
15	Constant-torque motor		
6	Standard motor	Delta connection	
16	Constant-torque motor		

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Note: 1. For the adjustment of the 5-point flexible v/f characteristic, refer to page 17-1.
The ratio of the output voltage to the output frequency of the inverter (V/F characteristic) can be set as desired.
2. When "9999" has been set in Pr. 19, "2" cannot be set in Pr. 71. When "2" is selected in Pr. 71, set the appropriate value (other than "9999") in Pr. 19.
3. When "2" has been set in Pr. 71, the setting ranges of Pr. 100 to Pr. 109 are not displayed on the PU screen. At this time, if the set value of any of Pr. 100 to Pr. 109 is changed, the new set value is not dis-played in the "INITIAL VALUE LIST" and "CHANGE LIST".
4. Set "3" or "13" for auto tuning.
5. For full information on "4 to 6, 14 to 16" settings, see page 15-2.
6. 20, 23 and 24 are also available for setting but should not be set as they are only for setting by the manufacturer.

⚠ CAUTION

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

To lower the PWM carrier frequency so that noise and leakage current are reduced



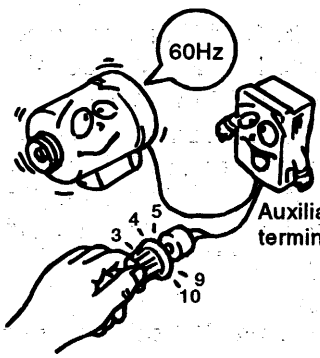
⇨ Pr. 72 "PWM frequency selection"

- The FR-A series PWM carrier frequency of 14.5KHz can be changed by using Pr. 72 when this frequency must be changed due to the effect of motor/mechanical system resonance. Lowering the PWM carrier frequency will increase motor noise but reduce inverter-generated noise and leakage current.
- During operation, the set value may only be changed or written in either of the following ranges:
(1) 0.7kHz to 2.0kHz
(2) 2.1kHz to 14.5kHz

Note: Any value outside the ranges (1) and (2) cannot be written during operation and should be written during a stop.

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To perform main speed setting using the auxiliary frequency setting terminal 1



⇨ Pr. 73 "0 to 5V, 0 to 10V selection"

- Select the override function to make the main speed setting using the auxiliary frequency setting terminal 1. Set the input specifications of terminals 1, 2, and 4 and the presence/absence of the override function.

Pr. 73 Set Value	Terminal AU Signal	Terminal 2 Input Voltage	Terminal 1 Input Voltage *1	Terminal 4 Input, 4 to 20mA	Override Function *2	Polarity Reversible
0	No	✱ 0 to 10V	0 to ± 10V	×	×	*3
1		✱ 0 to 5V	0 to ± 10V			
2		✱ 0 to 10V	0 to ± 5V			
3		✱ 0 to 5V	0 to ± 5V			
4		0 to 10V	✱ 0 to ± 10V		○	
5		0 to 5V	✱ 0 to ± 5V			
10		✱ 0 to 10V	0 to ± 10V		×	○
11		✱ 0 to 5V	0 to ± 10V			
12		✱ 0 to 10V	0 to ± 5V			
13		✱ 0 to 5V	0 to ± 5V			
14		0 to 10V	✱ 0 to ± 10V		○	
15		0 to 5V	✱ 0 to ± 5V			
0	Yes	×	0 to ± 10V	✱ ○	×	*3
1			0 to ± 10V			
2			0 to ± 5V			
3			0 to ± 5V			
4		0 to 10V	×		○	
5		0 to 5V				
10		×	0 to ± 10V		×	○
11			0 to ± 10V			
12			0 to ± 5V			
13			0 to ± 5V			
14		0 to 10V	×		○	
15		0 to 5V				

*1: The value of terminal 1 (auxiliary frequency setting input) is added to the main speed setting signal of terminal 2 or 4.

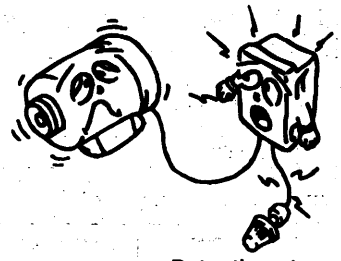
*2: When override has been selected, terminal 1 or 4 is for the main speed setting and 2 is for the override signal (50 to 150% at 0 to 5V or 0 to 10V).

*3: Indicates that a negative-polarity frequency command signal is not accepted.

Note: 1. × indicates that a signal is not accepted.
2. To change the maximum output frequency when the maximum frequency command voltage (current) has been input, use the frequency setting voltage (current) gain, Pr. 903 (Pr. 905).
At this time, the command voltage (current) need not be input.
Also, the acceleration/deceleration time, is not affected by the change of Pr. 73 setting.
3. The set value hatched is the factory setting. The ✱ indicates the main speed setting.
4. When the set value of Pr. 22 is "9999", the value of terminal 1 is for the stall prevention level setting.

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Stable operation cannot be performed due to noise



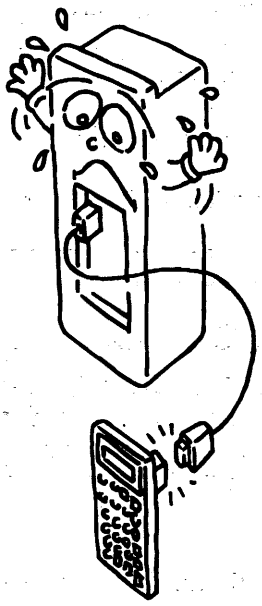
Potentiometer

⇨ Pr. 74 "input filter time constant"

- Allows the setting of the built-in filter time constant in the external voltage or current frequency setting signal input section. Effective for eliminating noise in the frequency setting circuit.
- Increases the filter time constant if stable operation cannot be performed due to noise. A larger set value results in lower response.

To select PU disconnection detection





⇨ Pr. 75 "reset selection/PU disconnection detection

- Detecting that the PU (parameter unit) has been disconnected from the inverter, this function brings the inverter to an alarm stop. Also, this function allows the reset (terminal RES) function to be selected.
- **Operation**
  When this parameter has been set to detect the disconnection of the PU, and the PU is disconnected, the inverter comes to an alarm stop.

Pr. 75 Set Value	Description	
0 (factory setting)	Reset input normally enabled. *	Operation will be continued with the PU disconnected.
1	Reset input enabled only when the protective function is activated.	
2	Reset input normally enabled.	When the PU is disconnected, an error is displayed and the inverter output is shut off. (Note)
3	Reset input enabled only when the protective function is activated.	

* By short-circuiting across terminals RES and SD during operation, the inverter shuts off output while the signal is on, the data of electronic overcurrent protection and regenerative brake duty is reset, and the motor is coasted to a stop.

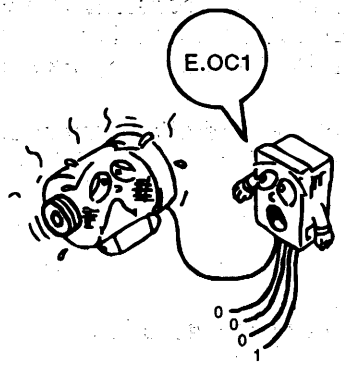
Note: 1. If the PU had been disconnected from initial start, this is not defined as an alarm.
2. This disconnection detection judges that the PU is disconnected when the PU is removed for more than 1 second.
3. When the FR-PU01E is used, this function can also be used. Note that the alarm display of the FR-PU01E is "E.PE" and that of the inverter LED is "E.PUE".
4. To resume operation, reset the inverter after checking that the PU is connected securely.
5. The motor is decelerated to a stop when the PU is disconnected during PU jog operation with "2" or "3" set in Pr. 75. The motor is not brought to a stop at occurrence of the PU disconnection alarm.

⚠ CAUTION

⚠ Do not reset the inverter with a start signal on.
When reset is actioned, the motor will start instantaneously, creating a hazardous condition.

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To output the alarm code at its occurrence



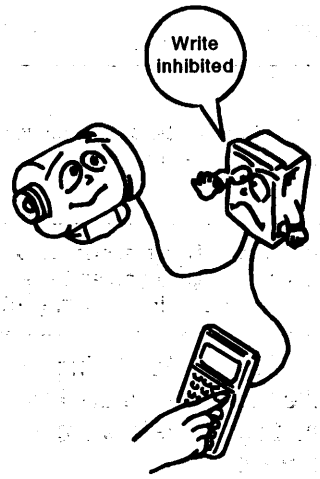
⇨ Pr. 76 "alarm code output selection"

- When alarm occurs, its code can be output as a 4-bit digital signal from the open collector output terminals. When programmed operation has been selected, this parameter also serves as a group operation signal output.

Set Value	Output Terminals			
	SU	IPF	OL	FU
0 (factory setting)	Depends on the output terminal assignment (Pr. 40).			
1	Alarm code bit 3	Alarm code bit 2	Alarm code bit 1	Alarm code bit 0
2	Normal operation..... Operation status signal (same as set value "0") Alarm occurrence.....Alarm code signal			
3 (programmed operation output)	Output at time-out	Group 3 operation	Group 2 operation	Group 1 operation

Note: For alarm codes, see page 23-4.

To set parameter write disable



⇨ Pr. 77 "parameter write disable selection"

- Prevents parameter values from being written from the parameter unit.

Set Value	Write Disable Function
0 (factory setting)	Parameter write enable (only at stop in PU operation mode) (Note 1)
1	Parameter write disable (Note 2)
2	Parameter write also enabled during operation in PU operation or external operation mode (Note 3)

Note: 1. Monitor-related parameters Pr. 51 to Pr. 56 can be set at any time.
2. Write is allowed for Pr. 77 and Pr. 79 "operation mode selection".
3. Write is disallowed during operation for Pr. 22, 23, 48, 49, 60, 66, 71 and 79 to 81.

⚠ CAUTION

⚠ During operation, do not change the parameter settings unnecessarily, the new settings may cause an alarm may occur in the inverter, causing the motor to coast.

To prevent reverse rotation



⇨ Pr. 78 "reverse rotation selection"

- Set Pr. 78 to prevent any reverse rotation fault resulting from the mis-input of the start signal.

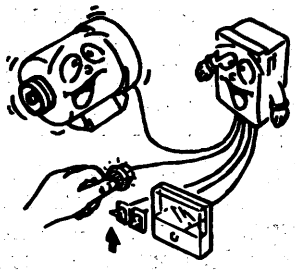
Set Value	Direction of Rotation
0	Both forward and reverse rotations allowed (factory setting)
1	Reverse rotation disallowed
2	Forward rotation disallowed

Note: This function is valid for both the parameter unit and external operations.

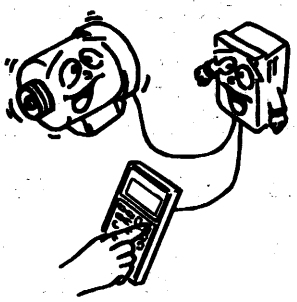
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To select the operation mode

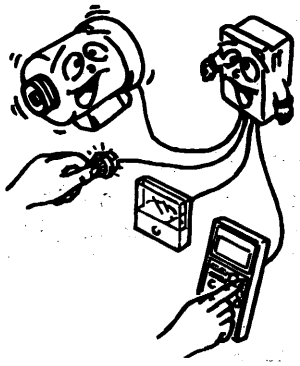
External operation mode

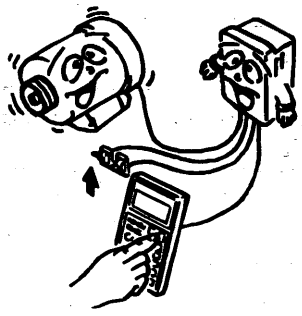


PU operation mode



Combined operation mode





⇨ Pr. 79 "operation mode selection"

- Allows operation to be performed in either or both of the external signal and parameter unit operation modes of the inverter.

Set Value	Description
0 (factory setting)	Operation can be switched between the parameter unit and external operation modes.
1	Operation is only allowed in the parameter unit operation mode.
2	Operation is only allowed in the external operation mode.
3 (Note 1)	Running frequency....Set from the parameter unit Start signal.....External signal input
4 (Note 1)	Running frequency....External signal input Start signal.....Input from the parameter unit
5 (Note 2)	Programmed operation Operation start...STF, timer reset...STR, group selection...RH, RM, RL
7 (Note 4)	PU operation interlock
8 (Note 4)	External signal-based operation mode switching

Note: 1. In the parameter unit/external signal combined operation mode, the following signals are made valid:

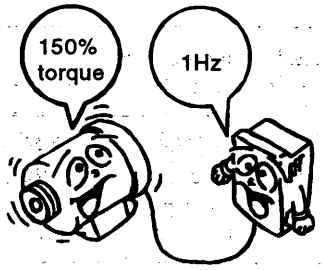
Set Value	Operation Frequency	Start Signal
3	Parameter unit • Direct setting and [▲]/[▼] key setting	Terminal symbol • STF • STR
4	Terminal signal • Across 2-5 0 to 5VDC • Across 2-5 0 to 10VDC • Across 4-5 4 to 20mADC Across 1-5 0 to ± 5VDC 0 to ± 10VDC • Jog frequency (Pr. 15) (JOG/OH) • Multi-speed selection (Pr. 4 to 6, 24 to 27)	Parameter unit • Forward rotation key • Reverse rotation key

2. For the adjustment of the programmed operation function, see page 16-1.
3. This function number can also be rewritten in the external operation mode.
   The settings of the other parameters cannot be changed. To change any of the other settings, set "0" or "1" in Pr. 79 to switch to the PU operation mode.
4. For full information on the PU operation interlock function available with the set value of "7" and the external signal-based operation mode switching function available with the set value of "8", see page 18-1.

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- The programmed operation function allows 10 types of operation starting time of day, direction of rotation and running frequency to be set individually for each of the selected three groups. This function allows the inverter to be automatically run in the preset operation schedule and operation pattern. If a power failure occurs, operation can be continued without corrupting the set schedule by installing the FR-EPD automatic control compatible unit. This unit contains a backup battery.
- When the PU operation interlock signal is switched off, the PU operation interlock function forcibly switches the operation mode to the external operation mode. This function prevents the inverter from not starting operation under the external command if the mode is left unswitched from the PU operation mode.

To achieve 150% torque for operation at 1Hz



⇨ Pr. 80 "motor capacity", Pr. 81 "number of motor poles"

- Set these parameters to perform operation in the magnetic flux vector control mode. To select the magnetic flux vector control mode, set the applied motor capacity in Pr. 80 and the number of motor poles (2, 4, 6) in Pr. 81.
  When a constant-torque motor is used, set "1" (constant-torque motor) in Pr. 71 "applied motor".
  For more information, see page 14-1.
- When any of "12", "14" and "16" is set in Pr. 81, the input of the RT signal shifts the inverter to V/F control. The RT terminal can be used for stop-on-contact control (during a stop only).

■ <Pr. 83, Pr. 84, Pr. 96 ⇨ For the setting method, see page 15-1>

To change the language displayed on the parameter unit

⇨ Pr. 145 "parameter unit language switching"

- Allows selection of the language displayed on the FR-PU02ER/FR-ARWER four-language parameter (copy) unit (option).

Set Value	Language Displayed
0	English (factory setting)
1	German
2	French
3	Spanish

Note: This function is not valid for the FR-PU02, FR-PU02E or FR-ARW parameter (copy) units.

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To output a signal when output current = 0

⇨ **Pr. 152 "open motor circuit detection level"**
Pr. 153 "open motor circuit detection time"

- As torque is not generated when the inverter output current of "0", a load drop may take place when the inverter is used in a vertical lift application. To prevent this, the output current [0] signal can be output from the inverter so that the mechanical brake is engaged when the output current becomes [0].
- If the output current detected during motor operation remains lower than the value set in Pr. 152 "open motor circuit detection level" for longer than the time set in Pr. 153 "open motor circuit detection time", the open motor circuit detection signal is output as an open collector signal from the output terminal PU of the inverter (Pr. 40 "output terminal assignment" = 7).

Parameter Number	Name	Setting Range	Factory Setting	Remarks
152	Open motor circuit detection level	0 to 50%	5%	100%: rated current value
153	Open motor circuit detection time	0.05 to 1 second	0.5 seconds	
17	External thermal relay input	0 to 7	0	

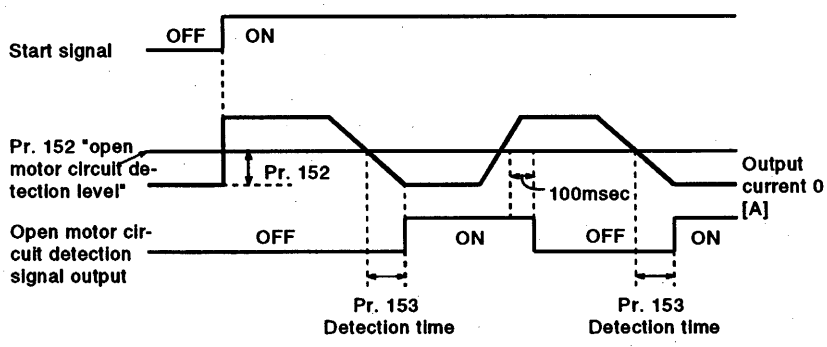
(1) **Setting of the open motor circuit detection level**
In Pr. 152 "open motor circuit detection level", set the ratio (%) of the output current to the rated current relative to 0[A], at which the open motor circuit is detected.

(2) **Setting of the open motor circuit detection time**
Set a period of time from when the "open motor circuit detection level" set in Pr. 152 is reached to when the open motor circuit detection signal is output to the terminal PU.

Pr. 17 Setting	JOG/OH		MRS Terminal		Pr. 40 : 9	
	JOG	OH	Normally open input	Normally closed input	PU signal	Zero current detection
0	●	—	●	—	●	—
1	—	●	●	—		
2	●	—	—	●		
3	—	●	—	●		
4	●	—	●	—	—	●
5	—	●	●	—		
6	●	—	—	●		
7	—	●	—	●		

* To output the open motor circuit detection signal, set 9 (PU operation mode) in Pr. 40 "output terminal assignment" and further set any of 4 to 7 in Pr. 17 "external thermal relay input".

• Timing chart



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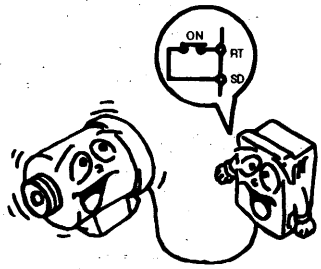
Note: When the current rises above the preset detection level, the open motor circuit detection signal remains on for about 100ms.

⚠ CAUTION

⚠ Do not set a too large value to the open motor circuit detection level or open motor circuit detection time. When the output current is low and torque is not generated, the detection signal may not be output.

⚠ If the open motor circuit detection signal is used, provide a safety backup, such as an emergency brake, to prevent the machine and equipment from resulting in hazardous conditions.

To change the condition activated by the second control function selection (terminal RT)



⇨ **Pr. 155 "terminal RT activated condition selection"**

- The condition activated by the second control function selection (terminal RT) can be selected.

Pr. 155 Set Value	Second Control Function Condition
0 (factory setting)	Immediately activated and deactivated according to the signal ON/OFF of terminal RT.
10	Activated only when the signal of terminal RT is ON at constant speed. (The function is not activated during acceleration/deceleration if the signal of terminal RT is ON.)

Note: "1" or "11" is for exclusive use by the manufacturer and must not be set.

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Selection of the stall prevention function



⇨ Pr. 156 "stall prevention operation selection"

- By setting Pr. 156, stall prevention (overcurrent stall prevention) and fast response current limit can be disabled for different situations.

Pr. 156 Set Value	Fast-Response Current Limit Function Selection O.... Activated ●.... Not activated	Stall Prevention Selection O.... Activated ●.... Not activated			OL Signal Output O.... Operation continued ●.... Operation not continued *	Factory Setting
		During acceleration	During constant speed	During deceleration		
0	O	O	O	O	O	0
1	●	O	O	O	O	
2	O	●	O	O	O	
3	●	●	O	O	O	
4	O	O	●	O	O	
5	●	O	●	O	O	
6	O	●	●	O	O	
7	●	●	●	O	O	
8	O	O	O	●	O	
9	●	O	O	●	O	
10	O	●	O	●	O	
11	●	●	O	●	O	
12	O	O	●	●	O	
13	●	O	●	●	O	
14	O	●	●	●	O	
15	●	●	●	●	O	
16	O	O	O	O	●	
17	●	O	O	O	●	
18	O	●	O	O	●	
19	●	●	O	O	●	
20	O	O	●	O	●	
21	●	O	●	O	●	
22	O	●	●	O	●	
23	●	●	●	O	●	
24	O	O	O	●	●	
25	●	O	O	●	●	
26	O	●	O	●	●	
27	●	●	O	●	●	
28	O	O	●	●	●	
29	●	O	●	●	●	
30	O	●	●	●	●	
31	●	●	●	●	●	
100 D	O	O	O	O	O	
100 R	●	●	●	●	O	

D: Driving R: Regenerative

Note: 1. When "Operation not continued at the time of OL signal output" has been selected, the "E.OLT" alarm code (stop by stall prevention) is displayed and operation stopped.

2. The output voltage reduces during stall prevention operation. When high torque is required (e.g. for an elevator), set the parameter in the following procedure:
   1. Record the Pr. 77 value in advance.
   2. Set "701" in Pr. 77.
   3. Set "1" in Pr. 156.
   4. Return Pr. 77 to the previous value.

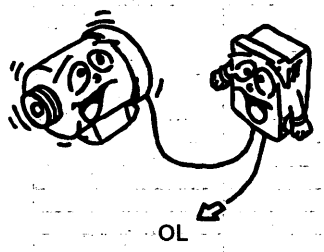
   This completes the setting.

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⚠ CAUTION

⚠ Always perform test operation.
Stall prevention operation performed during acceleration may cause acceleration time to be longer.
Stall prevention operation performed during constant speed may cause speed to be vary suddenly.
Stall prevention operation performed during deceleration may cause deceleration time (and deceleration distance) to be longer.

To output the overload alarm (OL) signal only when the signal has persisted for more than a given time



⇨ Pr. 157 "OL signal output waiting time"

- The overload alarm (OL) signal can be output when the time set in Pr. 157 is exceeded.

Pr. 157 Set Value	Output Signal
0 (factory setting)	Output according to overload (OL).
0.1 to 25 seconds	Output after the set time has elapsed.
9999	Overload (OL) alarm signal is not output.

■ <Pr. 158 ⇨ See the section of Pr. 51>

You care about speed fluctuation



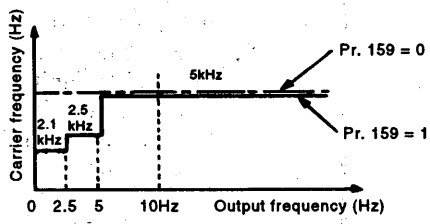
⇨ Pr. 159 "PWM frequency decrease at low speed"

- Slow speed operation (10Hz or less) can be smoothed to correct speed fluctuation. (To be set only when you care about speed fluctuation.)

Pr. 159 Set Value	Description	
	Improvement of speed fluctuation	Correction at high speed
0 (factory setting)	No	No
1	Yes	No
2	No	Yes
3	Yes	Yes

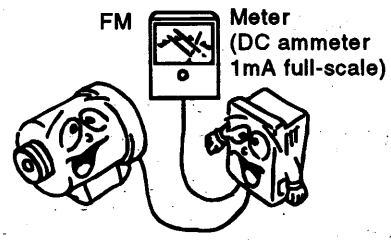
Note: Since the carrier frequency reduces at the set value of "1" or "3", motor noise increases in the low range.

<Example: Pr. 72 = 5kHz > carrier frequency



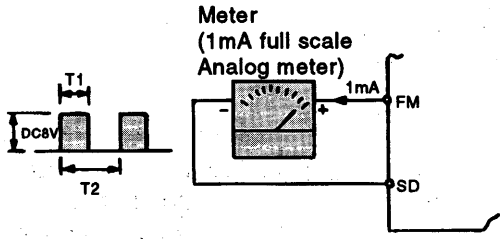
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To make the output calibration of terminal FM



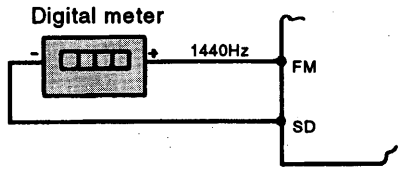
⇨ Pr. 900 "FM terminal calibration"

- Allows a meter connected to terminal FM to be calibrated from the parameter unit. Common to all monitored data selected in Pr. 54.
- Terminal FM provides the pulse output as shown below. The setting of Pr. 900 allows the meter connected to the inverter to be calibrated from the parameter unit without providing a calibration resistor.
  (For information on the adjusting method, see page 11-1.)



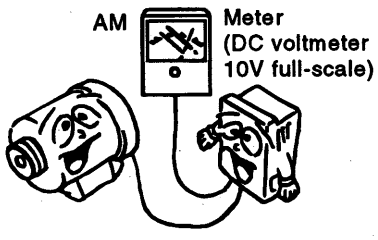
Pulse width T1 : Adjusted with Pr. 900
Pulse period T2 : Set in Pr. 55 (valid for frequency monitoring only)

- **Monitoring using a digital meter**
  Allows a digital value to be displayed on a digital counter using the pulse train signal from the FM terminal. 1440Hz output is provided at the full scale value explained in the section of Pr. 54. When the running frequency has been selected for monitoring, the ratio of this FM output frequency can be set in Pr. 55.



Note: At 60Hz, the parameter is factory-set to 1mA full-scale and 1440Hz FM output frequency.
The maximum output frequency of FM is 2400Hz.

To make the output calibration of terminal AM

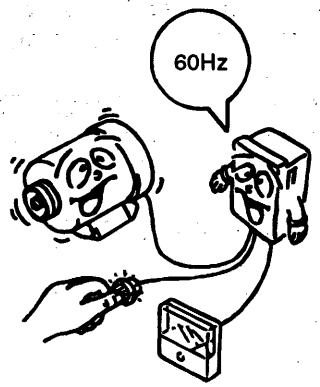


⇨ Pr. 901 "AM terminal calibration"

- Used when any of "101 to 118" has been set in Pr. 54 to select analog output to terminal AM and when any of "1 to 21" has been set in Pr. 158 to use the outputs of terminals FM and AM separately.
  As explained in the section of Pr. 54, the analog output is factory-set to 10VDC in the full-scale of each monitored data. This parameter allows the output voltage ratio (gain) to be adjusted according to the meter reading. Note that the maximum output voltage is 10VDC.
  (For details of the adjustment, see page 11-2.)

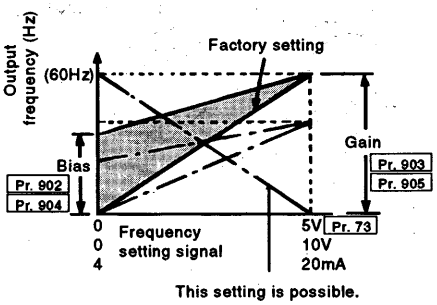
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To adjust the gain and bias of the frequency setting signals



⇨ **Pr. 902 "frequency setting voltage bias"**
Pr. 903 "frequency setting voltage gain"
Pr. 904 "frequency setting current bias"
Pr. 905 "frequency setting current gain"

- Allows the output frequency to be set in relation to the frequency setting signal (0 to 5V, 0 to 10V or 4 to 20mA DC).
  (For the adjustment method, see page 13-1.)



Note: If the gain adjustment (Pr. 903, Pr. 905) is changed, the acceleration/deceleration reference frequency (Pr. 20) does not change. The signal to the terminal 1 (aux. input) is added to the frequency setting signal.

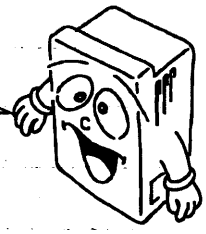
⚠ CAUTION

⚠ Take care when setting any value other than "0". Without the speed command, the motor will start at the preset frequency by switching on the start signal.

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3.5 INVERTER RESET

The inverter can be reset by any of the following four operations. Note that resetting clears (erases) the cumulative internal heat value of the electronic overcurrent protector and the number of retries.



Operation 1

Using the help function, reset the inverter. For details, see "7 INVERTER RESET" on page 7-14.

Operation 2

Switch the power off once. After more than 0.1 seconds, switch it on again.

Note: When the Pr. 57 (coasting time for automatic restart after instantaneous power failure/commercial power supply-inverter switch-over) setting is other than "9999", this operation is mistaken for an automatic restart after instantaneous power failure and the inverter cannot be reset. Hence, the power should be switched on again about 5 seconds after the control power has been lost.

Operation 3

Connect the reset terminal RES-SD for more than 0.1 seconds, then disconnect.

Note: Do not remove the jumper from across the terminal RES and RES1 on the internal printed circuit board.

Operation 4

When an alarm has occurred while the PU operation interlock function is being used, press the STOP key in the PU operation mode.

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MEMO

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4. FUNCTIONS

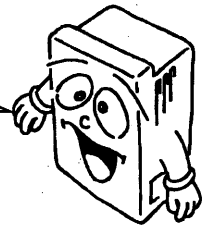
This chapter offers detailed information on the "functions" of the FR-A201E "inverter with built-in power return function".
Always read the precautions and instructions in this chapter before using the equipment.

4.1 CALIBRATION OF THE METER (FREQUENCY METER) ..... 11 – 1
4.2 PU DISCONNECTION DETECTION FUNCTION ..... 12 – 1
4.3 ADJUSTMENT OF THE FREQUENCY SETTING SIGNALS "BIAS" AND "GAIN" ..... 13 – 1
4.4 SELECTION OF MAGNETIC FLUX VECTOR CONTROL ..... 14 – 1
4.5 AUTO TUNING ..... 15 – 1
4.6 PROGRAMMED OPERATION FUNCTION ..... 16 – 1
4.7 5-POINT FLEXIBLE V/F CHARACTERISTIC ..... 17 – 1
4.8 PU OPERATION INTERLOCK FUNCTION AND EXTERNAL SIGNAL-BASED OPERATION MODE SWITCHING FUNCTION ..... 18 – 1
4.9 STOP-ON-CONTACT CONTROL ..... 19 – 1
4.10 LOAD TORQUE-BASED HIGH-SPEED FREQUENCY CONTROL FUNCTION ..... 20 – 1
4.11 DETECTED SPEED CORRECTION FOR PLG FEEDBACK CONTROL ..... 21 – 1
4.12 BRAKE SEQUENCE ..... 22 – 1

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4.1 CALIBRATION OF THE METER (FREQUENCY METER)

The PU allows the calibration (adjustment) of a meter connected across the meter connection terminal FM-SD or AM-5 of the inverter. When a digital meter is used, the PU allows the frequency of the pulse train output signal to be adjusted. The motor need not be connected for calibration.



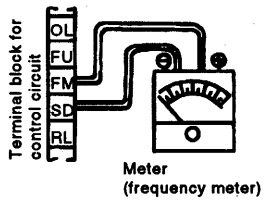
4.1.1 Calibration of the FM-SD Output

- **Preparation**

(1) Connect a meter (frequency meter) across inverter terminals FM and SD. (Note the polarity. FM is the positive terminal.)

(2) When a calibration resistor has already been connected, adjust the resistance value to zero or remove the resistor.

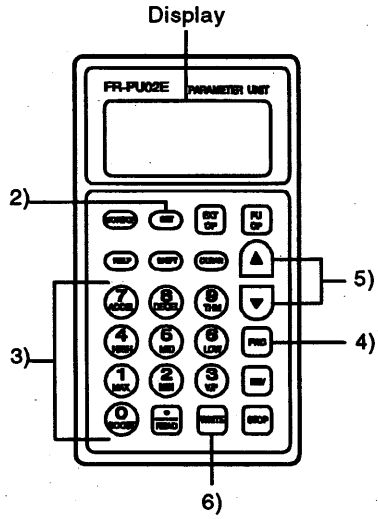
(3) Set any of 1 to 3, 5 to 14, 17, 18 and 21 in Pr. 54 (FM terminal function selection". When the running frequency or inverter output current has been selected as the output signal, preset in Pr. 55 or Pr. 56 the running frequency or current value at which the output signal is 1440Hz. This 1440Hz normally makes a full-scale deflection.



- **Calibration procedure (Example: To calibrate the meter to the running frequency of 60Hz)**

1) Press the [SET] key in the PU operation mode.	.... The inverter is placed in the parameter setting mode.
2) Type 900 and press the [READ] key.	..... The current PU set frequency is displayed.
3) Type 60.	..... The value shown on the right is displayed.
4) Press the [FWD] key to start forward operation at 60Hz.	.. The motor need not be connected.
5) Using the [▲] or [▼] key, adjust the meter reading to a predetermined position.	..... The meter reading moves. (It takes a long time until the meter reading moves.)
6) Press the [WRITE] key.	... Calibration is complete.

Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.



Note:
This calibration (Pr. 900) is only valid when any of 1 to 3, 5 to 14, 17, 18 and 21 has been set in Pr. 54 to output a signal to terminal FM. When any other value has been set (signal output to terminal AM has been selected in Pr. 54), the absence of Pr. 900 is displayed on the screen as soon as this parameter is selected by the above operation.

Note : When the frequency meter is connected across terminals FM and SD to monitor the running frequency, the output of terminal FM is saturated if the maximum output frequency reaches or exceeds 100Hz, with the factory-set value unchanged.
Hence, the setting of Pr.55 "frequency monitoring reference" must be changed to the maximum output frequency. (See page 9-25.)

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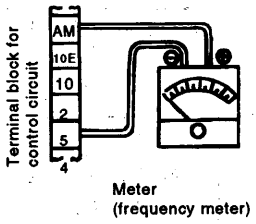
4.1.2 Calibration of the AM-5 Output

- **Preparation**

(1) Connect a meter of 0-10VDC across inverter terminals AM and 5. (Note the polarity. AM is the positive terminal.)

(2) Set any of 101 to 103, 105, 106, 108, 110 to 114, 117 and 121 in Pr. 54. When the running frequency or inverter output current has been selected as the output signal, preset in Pr. 55 or Pr. 56 the running frequency or current value at which the output signal is 10V.

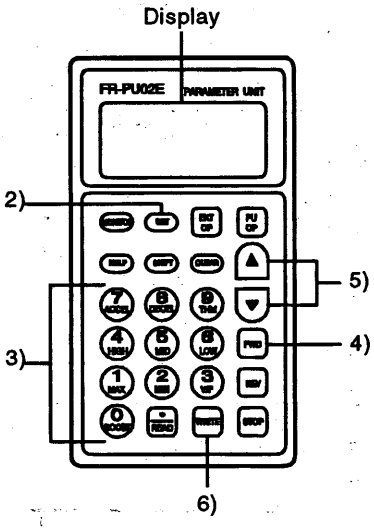
(3) As in the setting of Pr. 54, set any of 1 to 3, 5, 6, 8, 10 to 14, 17 and 21 in Pr. 158 (AM terminal function selection) to use both of the FM and SD output and AM-5 output simultaneously.



- **Calibration procedure 1 (Example: To calibrate the meter to the running frequency of 60Hz)**

1) Press the [SET] key in the PU operation mode. ..... The inverter is placed in the parameter setting mode.	SETTING MODE Set Pr.NO. FOR PR.List <HELP>
2) Type 901 and press the [READ] key. ..... The current PU set frequency is displayed.	901 AM Tune Run Inverter Set 0.00Hz PU
3) Type 60. ..... The value shown on the right is displayed.	901 AM Tune Run Inverter Set 60.00Hz PU
4) Press the [FWD] key to start forward operation at 60Hz. ... The motor need not be connected.	901 AM Tune MntrF 60.00Hz <WRITE>PU
5) Using the [▲] or [▼] key, adjust the meter reading to a predetermined position. ..... The meter reading moves.	
6) Press the [WRITE] key. ... Calibration is complete.	901 AM Tune Completed <MONITOR>

Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.



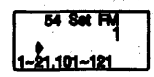
Note:
This calibration (Pr. 901) is only valid when any of 101 to 103, 105, 106, 108, 110 to 114, 117 and 121 has been set in Pr. 54 or the required value set in Pr. 158 to output a signal to terminal AM. When any other value has been set (signal output to terminal FM has been selected in Pr. 54), the absence of Pr. 901 is displayed on the screen as soon as this parameter is selected by the above operation.

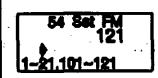
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- **Calibration procedure 2 (Example: Output current)**
  To output the output current or other item which is not easily allowed to reach 100% if operation is performed, adjust the reference voltage output (when the set value of Pr. 54 "FM and AM terminal function selection" is "121"), then select any of the choices displayed.

Setting of reference voltage output

1) Press the [SET] key in the PU operation mode. .... The inverter is placed in the parameter setting mode.
   

2) Type 54 and press the [READ] key. .... The current set value in Pr. 54 is displayed.
   

3) Type 121 and press the [WRITE] key. ..... The setting of reference voltage output is complete.
   

4) Press the [SET] key. .....The inverter is put in the parameter setting mode.
   

5) Type 901 and press the [READ] key. ..... The current set value in Pr. 901 is displayed.
   

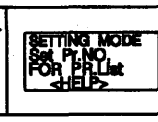
6) Type 60 and press the [WRITE] key. .....The setting of maximum running frequency is complete.
   

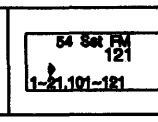
7) Press the [FWD] key. .....Forward operation is performed at 60Hz. The motor need not be connected for adjustment.

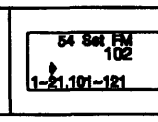
8) Using the [▲] or [▼] key, adjust the voltage across terminals AM-5 to 10V and press the [WRITE] key. ..... Setting is complete.
   

   ..... When the output is 100%, the output voltage is 10V. The voltage is not stored unless the [WRITE] key is pressed.

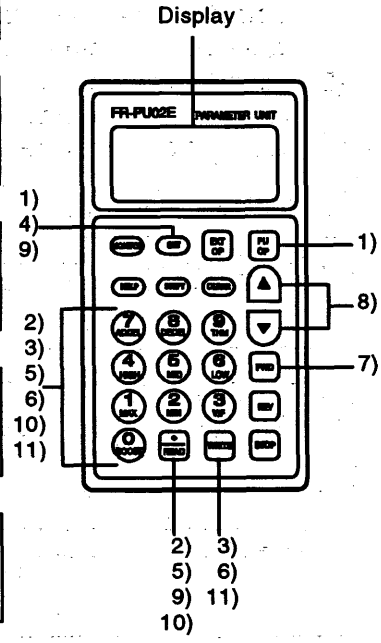
Setting of output current

9) Press the [SET] key. .....The inverter is put in the parameter setting mode.
   

10) Type 54 and press the [READ] key. .... The current set value in Pr. 54 is displayed.
    

11) Type 102 and press the [WRITE] key. ... The setting of output current is complete.
    

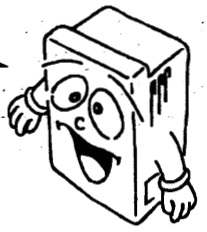
    ..... The current value set in Pr. 56 "current monitoring reference" is 100% and the output at this point is 10V.



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4.2 PU DISCONNECTION DETECTION FUNCTION

This function detects that the parameter unit (PU) has been disconnected from the inverter and brings the inverter to an alarm stop.



- **Operation**

When Pr. 75 "reset selection/PU disconnection detection" has been set to detect the disconnection of the PU, this function detects that the PU has been disconnected from the inverter, switches the PU display (when re-connected) and inverter LED to the indication of the corresponding error, and brings the inverter to an alarm stop.

Set Value	Reset Condition	PU Disconnection Detection
0	Reset input normally enabled. (Factory setting)	—
1	Reset input enabled only when the protective function is activated.	—
2	Reset input normally enabled.	O
3	Reset input enabled only when the protective function is activated.	O

Note: When the inverter comes to an alarm stop, the error messages displayed are as follows:
- PU display..... PU DISCONNECTED Inverter (when re-connected)
- LED..... E.PUE

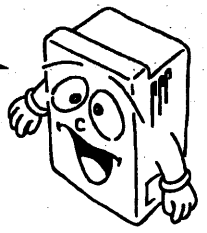
- **Setting instructions**

(1) If the PU had been disconnected from initial start, this is not defined as an alarm.
(2) This disconnection detection judges that the PU is disconnected when the PU is removed for more than 1 second.
(3) When the FR-PU01E is used, this function can also be used but its alarm display is "E.PE".
(4) To resume operation, reset the inverter (see page 10-1) after checking that the PU is connected securely.

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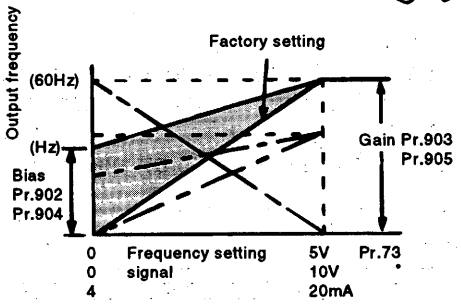
4.3 ADJUSTMENT OF THE FREQUENCY SETTING SIGNALS "BIAS" AND "GAIN"

The bias and gain functions are used to adjust the relationship between the input signal entered externally and the output frequency, e.g. 0 to 5VDC, 0 to 10VDC or 4 to 20mADC.



The following parameters are used for this adjustment:

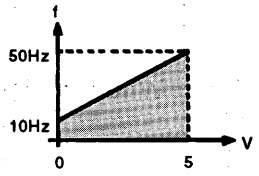
- Pr. 902 "frequency setting voltage bias"
- Pr. 903 "frequency setting voltage gain"
- Pr. 904 "frequency setting current bias"
- Pr. 905 "frequency setting current gain"



Any of three procedures may be used for the adjustment: adjustment is made without a voltage applied across terminals 2-5 (adjustment procedure 1); any point is adjusted with a voltage applied (adjustment procedure 2); or any point is adjusted without a voltage applied (adjustment procedure 3).

■ Adjustment example

Example: Pr. 902 "frequency setting voltage bias"..... Set the output frequency to 10Hz at the set voltage of 0V.
Pr. 903 "frequency setting voltage gain"..... Set the output frequency to 50Hz at the set voltage of 5V.

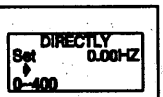


Before making adjustment, make sure that the set value of Pr. 73 "0 to 5V, 0 to 10V selection" is "0" (factory setting: 0 to 5V).

• Adjustment procedure 1 (without a voltage applied across terminals 2 and 5)

(1) Setting of the frequency setting voltage bias

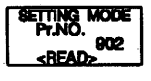
1) Press the [PU OP] key. ...The frequency setting screen is displayed.



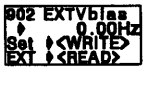
2) Press the [SET] key. .....The inverter is put in the parameter setting mode.



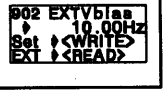
3) Using the numeral keys, enter 902. .....The data on the right is displayed.



4) Press the [READ] key. ....The current set value of Pr. 902 is displayed.

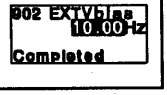


5) Using the numeral keys, enter 10. ..... The data on the right is displayed.

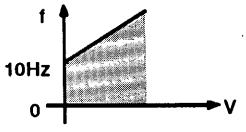


..... The voltage need not be applied across terminals 2 and 5.

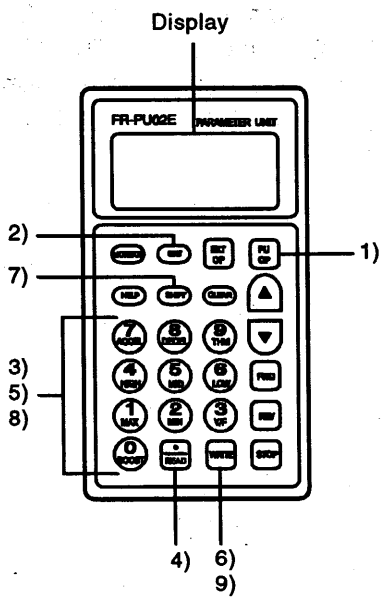
6) Press the [WRITE] key. ..... The set value is stored into memory and bias setting is complete.



..... The bias setting is 10Hz.



If the voltage is being applied across terminals 2 and 5 at this time, the bias setting as shown above.



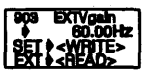
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(2) Setting of the frequency setting voltage gain

7) Press the [SHIFT] key. .... The current set value of Pr. 903 is displayed.



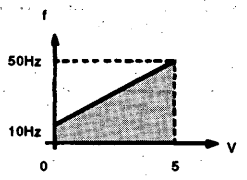
8) Using the numeral keys, enter 50. ..... The data on the right is displayed.



..... The voltage need not be applied across terminals 2 and 5.
At this time, the 5V (10V) in the inverter is used as the set voltage.

9) Press the [WRITE] key. ..... The set value is stored into memory and gain setting is complete.





The adjustment of the frequency setting voltage bias and gain is complete.

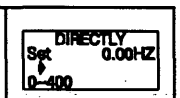
Note: 1. The current input (Pr. 904, Pr. 905) can also be set in a similar manner.
2. Pr. 903 remains unchanged if the value set in Pr. 20 "acc./dec. reference frequency" is changed.
3. The FR-PU01 may also be used to adjust the frequency setting voltage bias and gain and current bias and gain (C-2 to C-5). For full information, see the FR-Z series instruction manual.

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• Adjustment procedure 2 (any point is adjusted with a voltage applied across terminals 2 and 5)

(1) Setting of the frequency setting voltage bias

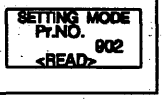
1) Press the [PU OP] key. ... The frequency setting screen is displayed.



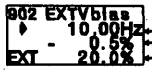
2) Press the [SET] key. ..... The inverter is put in the parameter setting mode.



3) Using the numeral ..... keys, enter 902. The data on the right is displayed.

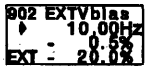


4) Press the [READ] key ..... twice. The current set value of Pr. 902 is displayed.

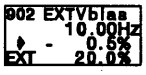


The preceding set value is displayed.
The current set voltage across terminals 2-5 is displayed in %.
The displayed value is changed according as the set voltage.
(In this example, the voltage of 1V is applied.)
[The value "0" selected in Pr. 73 (5V in this example) is 100%.]

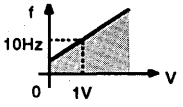
5) Using the numeral ..... keys, enter 10. The data on the right is displayed.



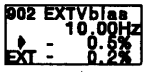
6) Press the [WRITE] key. ..... The cursor (⇨) moves to the set voltage.



..... Adjust the set voltage.
When the voltage set is 1V, the bias setting is as follows:



7) Apply the voltage of 0V.

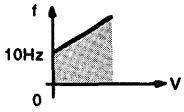


..... Since 10Hz is set against 0V in this example, 0V is applied.
(The % value for EXT changes.)

8) Press the [WRITE] key. ..... The set value is stored into memory and bias setting is complete.

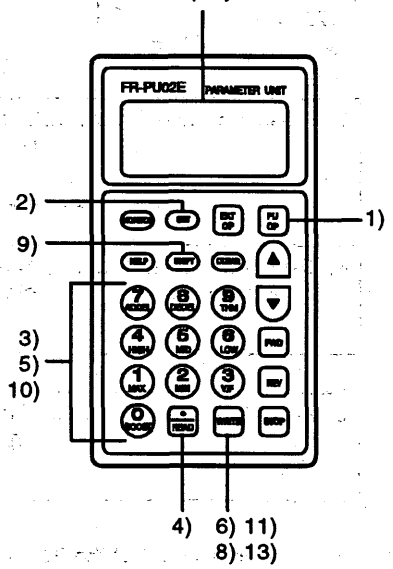


The bias setting is complete as shown below:



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Display

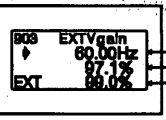


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(2) Setting of the frequency setting voltage gain

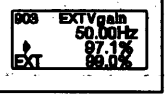
9) Press the [SHIFT] key, then the [READ] key. ... The current set value of Pr. 903 is displayed.



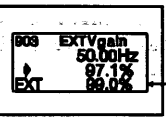
The preceding set value is displayed.

The current set voltage across terminals 2 and 5 is displayed in %.
The displayed value is changed according as the set voltage.
(The value selected in Pr. 73 (5V in this example) is 100%.)

10) Using the numeral keys, enter 50. ..... The data on the right is displayed.

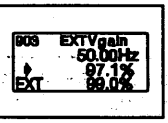


11) Press the [WRITE] key. .. The cursor (⇨) moves to the set voltage.



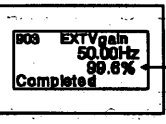
Increase the voltage across terminals 2 and 5 until 100% is achieved.

12) Apply the voltage of 5 V.

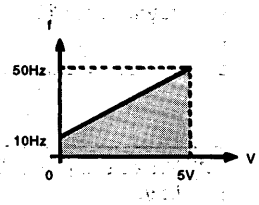


..... Since 50Hz is set against 5V in this example, 5V is applied.

13) Press the [WRITE] key. .. The set value is stored into memory and gain setting is complete.



100.0% may not be displayed. The setting is complete as shown below:



The adjustment of the frequency setting voltage bias and gain is complete.

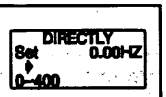
Note: 1. The current input (Pr. 904, Pr. 905) can also be set in a similar manner.
2. Pr. 903 remains unchanged if the value set in Pr. 20 "acc./dec. reference frequency" is changed.

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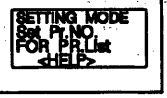
• Adjustment procedure 3 (any point is adjusted without a voltage applied across terminals 2 and 5)

(1) Setting of the frequency setting voltage bias

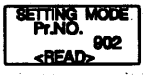
1) Press the [PU OP] key. ... The frequency setting screen is displayed.



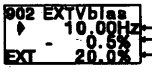
2) Press the [SET] key. ..... The inverter is put in the parameter setting mode.



3) Using the numeral ..... keys, enter 902. The data on the right is displayed.

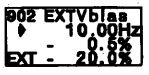


4) Press the [READ] key ..... twice. The current set value of Pr. 902 is displayed.

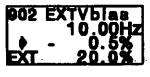


The preceding set value is displayed.
The current set voltage across terminals 2-5 is displayed in %.
The displayed value is changed according as the set voltage.
(The value selected in Pr. 73 (5V in this example) is 100%.)

5) Using the numeral ..... keys, enter 10. The data on the right is displayed.

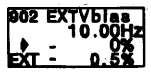


6) Press the [WRITE] key. ..... The cursor (⇨) moves to the set voltage.



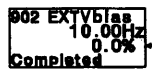
..... The voltage need not be applied across terminals 2-5.

7) Using the numeral key, enter 0.

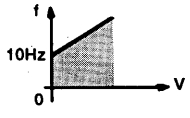


..... Since 10Hz is set against 0V (0%) in this example, 0% is entered.

8) Press the [WRITE] key. ..... The set value is stored into memory and bias setting is complete.

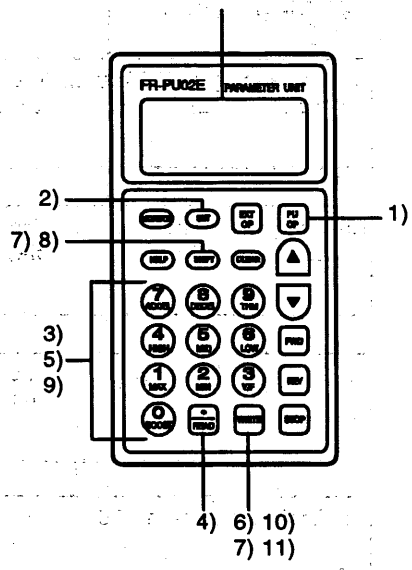


The bias setting is as follows:



(To the next page)

Display

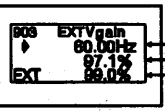


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(From the preceding page)

(2) Setting of the frequency setting voltage gain

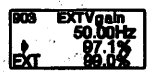
9) Press the [SHIFT] key, then the [READ] key. ... The current set value of Pr. 903 is displayed.



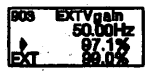
The preceding set value is displayed.

The current set voltage across terminals 2 and 5 is displayed in %.
The displayed value is changed according as the set voltage.
(The value selected in Pr. 73 (5V in this example) is 100%.)

10) Using the numeral keys, enter 50. ..... The data on the right is displayed.

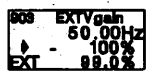


11) Press the [WRITE] key. .. The cursor (⇨) moves to the set voltage.



..... The voltage need not be applied across terminals 2 and 5.

12) Using the numeral keys, enter 100.

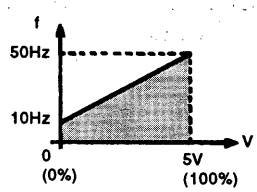


..... Since 50Hz is set against 5V (100%) in this example, 100% is entered.

13) Press the [WRITE] key. .. The set value is stored into memory and gain setting is complete.



The setting is complete as shown below:



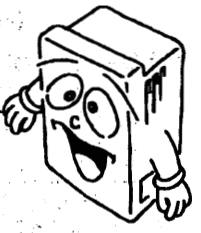
The adjustment of the frequency setting voltage bias and gain is complete.

Note: 1. The current input (Pr. 904, Pr. 905) can also be set in a similar manner.
2. Pr. 903 remains unchanged if the value set in Pr. 20 "acc./dec. reference frequency" is changed.

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4.4 SELECTION OF MAGNETIC FLUX VECTOR CONTROL

Magnetic flux vector control can be selected by setting the capacity, number of poles, and type of the motor used.
Magnetic flux vector control is effective when large starting and low-speed torque is required or when the load varies considerably.



Conditions for selecting magnetic flux vector control

When the following conditions are met, magnetic flux vector control can be utilized efficiently. When any of the following conditions cannot be satisfied, faults such as torque shortage and speed fluctuation may occur. In this case, select V/F control.

<Conditions>

- The motor capacity is equal to or one rank lower than the inverter capacity.
- The type of the motor is the Mitsubishi standard motor (3.7kW or more) or Mitsubishi constant-torque motor (200V class 4-pole motor is used with 3.7kW to 55kW). When another motor is used, use the auto tuning function on page 14-2.
- The number of motor poles is of 2, 4, or 6. (4 poles only for the constant-torque motor)
- Single-motor operation (one motor for one inverter) is performed.
- The wiring length between the inverter and motor is less than 30m.

(If the length is over 30m, see page 14-3.)

Magnetic flux vector control selection method

Set motor rated kW (a value other than 9999) in Pr. 80 (motor capacity) and number of poles in Pr. 81 (number of poles) to select the magnetic flux vector control. (When 9999 has been set to either of Pr. 80 and Pr. 81, V/F control is selected.)
When a Mitsubishi constant-torque motor (SF-JRCA, SF-JRC) is used, set "1" in Pr. 71 "applied motor".
When the previous Mitsubishi constant-torque motor (SF-JRC) is used, special parameters or auto tuning must be set in addition to the above parameters. For more information, see page 15-1.
By switching on/off the signal across terminals RT and SD during a stop, operation can be switched between the V/F control and magnetic flux vector control. Switch the signal off to select the magnetic flux vector control (Pr. 71 = 12, 14, 16).

Note: Precautions for magnetic flux vector control

1. The degree of speed fluctuation correction is slightly lower than in V/F control.
2. There is a delay of 0.1 to 0.2 sec at start.

<Applications appropriate for magnetic flux vector control>

- Machines which require large starting torque
- Machines which require low speed torque
- Machines where the load fluctuates widely

(Magnetic flux vector control is not appropriate for machines where speed fluctuation at low speed is not allowed, e.g. grinder, wrapping machine.)

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Parameters related to magnetic flux vector control

Parameter Number	Parameter Name	Setting Range	Set Value	Description			Factory Setting
80	Motor capacity	9999, 5.5 to 55kW	9999	V/F control is selected.			O
			5.5 to 55	Motor capacity (kW) is set.			—
81	Number of motor poles	9999, 2, 4, 6, 12, 14, 16	9999	V/F control is selected.			O
			2, 4, 6	Number of motor poles is selected.			—
			12, 14, 16	Switch on the signal across terminals RT-SD to select V/F control if the number of motor poles has been set. (Control is switched at a stop.) • 12: 2-pole motor • 14: 4-pole motor • 16: 6-pole motor			—
71	Applied motor *	0 to 6, 13 to 16, 20 **, 23, 24	0	Standard motor			O
			1	Constant-torque motor			—
			2	Standard motor (5-point flexible V/F characteristic)			
			3	Standard motor	"Auto tuning setting" is selected		
			13	Constant-torque motor			
			4	Standard motor	Auto tuning data read/change setting is enabled		
			14	Constant-torque motor			
			5	Standard motor	Star connection	Direct input of motor constants is enabled	
			15	Constant-torque motor			
			6	Standard motor	Delta connection		
			16	Constant-torque motor			

* The electronic overcurrent protection characteristic is also set simultaneously.

** 20, 23 and 24 are also available for setting but must not be set as they are used for setting by the manufacturer.

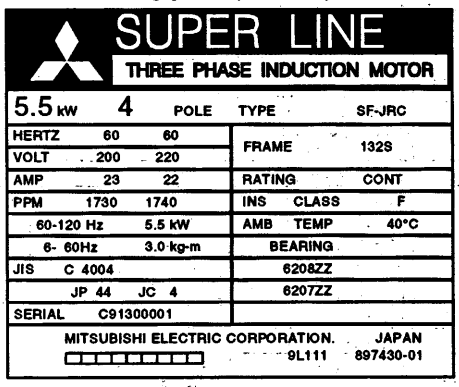
Note: The output torque may reduce when the optional noise reduction reactor (FR-BOL) or surge voltage suppressing filter (FR-ASF-H) is connected between the inverter and the motor. (See page 28-10)

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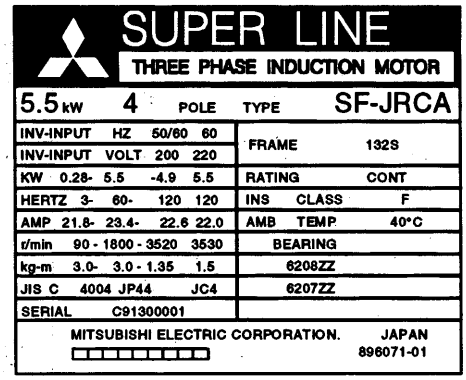
■ Compatibility with the Mitsubishi constant-torque motor

When a Mitsubishi constant-torque motor is used, the setting depends on the motor type (there are two types). Check the type of the motor used.

Rating plate (SF-JRC)



Rating plate (SF-JRCA)



(1) Selection method

Mitsubishi Constant-Torque Motor Type	Parameter Set Value			
	Pr. 71 (applied motor)	Pr. 80 (motor capacity)	Pr. 81 (number of motor poles)	Special Setting
SF-JRC	1 (constant-torque motor)	Set the capacity of the motor used.	4	Required (see below)
SF-JRCA	1 (constant-torque motor)	Set the capacity of the motor used.	4	—

(2) Special parameter set values for use of the SF-JRC constant-torque motor

Set the parameters to the values indicated below according to the capacity of the constant-torque motor. Note that if the values set are not as indicated below, torque shortage or overcurrent alarm may occur.

SF-JRC Capacity (kW)	Parameter Set Values					
	Pr. 71 (applied motor)	Pr. 80 (motor capacity)	Pr. 81 (number of motor poles)	Pr. 89	Pr. 90	Pr. 90 (Wiring length 30 to 100m)
3.7	1	3.7	4	82.6	0.305	0.305+0.004926x
5.5	1	5.5	4	122.8	0.181	0.181+0.003248x
7.5	1	7.5	4	126.5	0.105	0.105+0.002144x
11	1	11	4	99.0	0.059	0.059+0.001231x
15	1	15	4	80.9	0.036	0.036+0.0007836x
18.5	1	18.5	4	130.3	0.031	0.031+0.0005747x
22	1	22	4	130.0	0.026	0.026+0.0005747x
30	1	30	4	142.7	0.024	0.024+0.000343x
37	1	37	4	188.1	0.015	0.015+0.0002193x
45	1	45	4	164.7	0.016	0.016+0.0002193x

Note: 1. Applied motor: Mitsubishi's previous type 200V series 4-pole constant-torque motor (SF-JRC) only
2. Wiring length of over 30m: Calculate the value (Ω) of Pr. 90 with reference to the above table, assuming that x = 30 to 100m.
3. If the parameters are set as listed above, torque shortage or over current alarm may occur according to the motor used. In such a case, make fine adjustment of the Pr. 89 and Pr. 90 settings.

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(3) Setting method of the special parameters

The special parameters must be set in the following procedure, otherwise the values of Pr. 86 to Pr. 90 cannot be read.

1) Set 801 in Pr. 77. (Note)
2) Change the setting of the special parameters in (2).
3) Set 0 or 1 in Pr. 77 (return to the previous set value).

Note: When 801 is set in Pr. 77, the values of Pr. 82 to 99 are also displayed together, but these parameters must not be changed.
Otherwise, the inverter may be damaged.

Precaution:

Note that a sufficient motor torque may not be provide depending on the inverter control method.

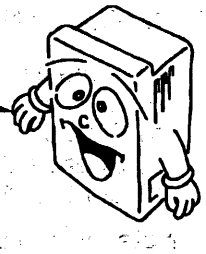
Constant-Torque Motor	Magnetic Flux Vector Control (FR-A201)	V/F Control (All inverter models)
SF-JRC (old type)	Operable by special setting ((2) on preceding page)	Operable by torque boost adjustment (Torque shortage or overcurrent occurs in the standard setting)
SF-JRCA (new type)	Operable by standard setting (Pr. 80, Pr. 81, Pr. 71)	Operable by standard setting (Pr. 71)

(Pr. 80: motor capacity, Pr. 81: number of motor poles, Pr. 71: constant-torque motor selection)

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4.5 AUTO TUNING

If the motor used is not Mitsubishi's standard motor (5.5kW or more) or Mitsubishi's constant-torque motor (4-pole, 5.5kW to 55kW), the auto tuning function allows the motor to be run with optimum operation characteristics under magnetic flux vector control.
Also, tuning data (motor constants) can be copied to another inverter with the FR-ARWE parameter copy unit.
Note that a special motor, e.g. a high-slip motor or a high-speed motor, cannot be tuned. Also, the maximum speed is 120Hz.



<Operation procedure>

1. Checking the wiring and load

Before performing auto tuning, check the following:

(1) The motor is connected. The motor must be at a stop at the start of tuning.

(2) Auto tuning can be performed if the motor is connected with a load (e.g. friction, steady load). Note that if the load is smaller, tuning accuracy is higher. Also note that if inertia is large, tuning accuracy remains unchanged.

(3) When "101" (auto tuning is performed with the motor rotated) has been set in Pr. 96 (auto tuning setting/state), note the following:
   1) The motor is free to rotate.
   2) The motor is run at about the rated motor frequency (set value of Pr. 84).
   3) The brake must be released, if fitted.
   4) No force is applied to rotate the motor.

(4) If "1" (tuning without motor rotating) is set in Pr. 96, the motor may run slightly. Therefore, fix the motor securely with a mechanical brake and ensure that motor rotation will not compromise safety.
   * The motor should be fixed securely especially for an elevator.
   Note that slight rotation of the motor will not affect the tuning performance.

(5) Auto tuning is not performed properly when the optional noise reduction reactor (FR-BOL) or surge voltage suppressing filter (FR-ASF- H) is connected between the inverter and the motor. Disconnect before starting auto tuning.

2. Selection of magnetic flux vector control

Select the magnetic flux vector control in accordance with page 14-1.

3. Setting of parameters

Set the following parameters in accordance with the parameter settings on this page.

(1) Pr. 96 "auto tuning setting/state" ..... Set "1" or "101".
   •Set value "1" ..... Tuned without the motor rotated.
   •Set value "101" ..... Tuned with the motor rotated.

(2) Pr. 83 "rated motor voltage" (Note) ..... Set the rated motor voltage (V).

(3) Pr. 84 "rated motor frequency" (Note)... Set the rated motor frequency (Hz).

(4) Pr. 71 "applied motor" ..... Select the set value in accordance with the following table:

   •Standard motor ..... Set "3".
   •Constant-torque motor... Set "13".

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Note: Pr. 83 and Pr. 84 are displayed only when magnetic flux vector control has been selected (Pr. 80, Pr. 81). Set these parameters according to the rating plate of the motor. When there are two or more rated values for a standard motor, etc., set 200V/60Hz or 400V/60Hz.

Parameter settings

Parameter Number	Name	Setting Range	Set Value	Description			Factory Setting
71	Applied motor *1	0 to 6, 13 to 16, 20	0	Standard motor (more than 1.5kW)			O
			1	Constant-torque motor			—
			2	Standard motor (5-point flexible V/F characteristic)			
			3	Standard motor	"Auto tuning setting" is selected		
			13	Constant-torque motor			
			4	Standard motor	Auto tuning data read/ change setting is enabled		
			14	Constant-torque motor			
			5	Standard motor	Star connection	Direct input of motor constants is enabled	
			15	Constant-torque motor			
			6	Standard motor	Delta connection		
			16	Constant-torque motor			
83	Rated motor voltage	0 to 1000V	0 to 1000V	"No auto tuning" is selected. Rated motor voltage (V) is set.			*4 200
84	Rated motor frequency	50 to 120Hz	50 to 120Hz	Rated motor frequency (Hz) is set.			60
90	Motor constant R1	9999, 0 to 10.000Ω	9999	Tuning data *2			O
			0 to 10.000Ω				—
91	Motor constant R2	9999, 0 to 10.000Ω	9999				O
			0 to 10.000Ω				—
92	Motor constant L1	9999, 0 to 1000.0mH	9999				O
			0 to 1000.0mH				—
93	Motor constant L2	9999, 0 to 1000.0mH	9999				O
			0 to 1000.0mH				—
94	Motor constant X	9999, 0 to 100%	9999				O
			0 to 1000%				—
96	Auto tuning setting/ state	0, 1, 101 *3	0	"No auto tuning" is selected.			O
			1	Auto tuning is performed without the motor rotated.			—
			101*3	Auto tuning is performed with the motor rotated.			—

*1: The electronic overcurrent protection characteristic is selected at the same time.
*2: The values measured by auto tuning are set automatically.
*3: Select "101" to increase tuning accuracy.
*4: The factory setting for the FR-A241 (400V) series is 400V.

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4. Switching the auto tuning command ON

In the PU operation mode, press the [FWD] or [REV] key.
In the external operation mode, turn on the start switch (connect terminals across STF or STR and SD).

Note: 1. When "101" is set in Pr. 96, be careful to avoid hazard because the motor rotates.

2. During auto tuning, the input/output terminals are made valid/invalid as indicated below:

Input terminals	Valid Terminals	Invalid Terminals
	STOP OH MRS RT, JOG, CS RES STF/STR	RH/RM/RL 2, 1, 4 AU

Output terminals	Valid Terminals	Invalid Terminals
	RUN OL IPF FM, AM A, B, C	SU FU

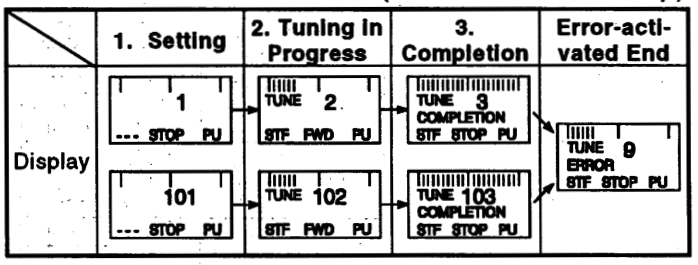
- To force the motor to stop during tuning Terminate tuning use the MRS terminal, RES terminal, or [STOP] key.

3. Be careful especially when the RUN signal has been used to create a mechanical brake releasing sequence.

5. Tuning state monitoring

During tuning, the value of Pr. 96 is displayed on the main monitor and level meter of the PU as indicated below. As on the PU, 1, 2, 3, 9, 91, 92, 93, 102 or 103 is shown on the inverter LED. (When Pr. 51 = "1" (factory setting))

•PU main monitor (In case of inverter trip)



•PU level meter

Indicates tuning progress with 0% (start) to full-scale 100% (end).

•Inverter LED (In case of inverter trip)

	1. Setting	2. Tuning in Progress	3. Completion	Error-activated End
Displayed value	1 →	2 →	3	9
	101 →	102 →	103	

Reference: Auto tuning time (factory setting)

Auto Tuning Setting	Time
1: Mode in which the motor does not rotate	Approx. 10 seconds
101: Mode in which the motor rotates	Approx. 25 seconds *1

*1: The auto tuning time changes as indicated below according to the variation of the acceleration/deceleration time:
Auto tuning time = acceleration time + deceleration time + approx. 15 seconds

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6. Auto tuning end

Check the value of Pr. 96.
•Normal end..... "3" or "103" is displayed.
•Error-activated end..... Any of "9", "91", "92" and "93" is displayed.

When tuning came to a normal end in the PU operation mode, press the [STOP] key. When in the external operation mode, turn off the start switch (disconnect terminals STF or STR and SD). This operation resets auto tuning and returns the PU monitor to an ordinary display.
Note that if this operation is not performed, next operation cannot be stared.
When tuning resulted in an error-activated end, auto tuning did not come to a normal end and the motor constants were not set. In this case, reset the inverter (see page 10-1) and restart from operation step 1.

• Definition of Display at Error-Activated End

Error Display	Cause	Corrective Action
9	Inverter trip	Set again.
91	The current limit (stall prevention) function has been activated.	Increase the acceleration/deceleration time.
92	The converter output voltage has dropped to 75% of the rated value.	Check the variation of the power supply voltage.
93	Calculation error	Set again.

Note: If OL (stall prevention) occurs during auto tuning, auto tuning cannot be performed.

[Optional Setting of Motor Constants]

The motor constants (Pr. 82, Pr. 90 to 94) may either be set as appropriate by reading and changing the data measured by auto tuning, or without using the auto tuning data:

■ Setting the motor constants by reading and changing the auto tuning data

<Operation procedure>

1. Change the set value of Pr. 77 "parameter write disable selection" to "801". Only when the settings of Pr. 80 and Pr. 81 are other than "9999", the parameters of the motor constants (Pr. 82, Pr. 90 to 94) can be displayed.
   Though the parameters (Pr. 83 to 99) other than the motor constants (Pr. 82, Pr. 90 to 94) may also be displayed, they are to be set by the manufacturer and must therefore be set carefully without mistake.
2. Set Pr. 71 "applied motor" as indicated below:
   Standard motor: Set "4". Constant-torque motor: Set "14".
3. In the parameter setting mode, read the following parameters and set the required values (Note 1):

Parameter Number	Name	Setting Range (Note 4)	Minimum Setting Increment	Factory Setting
Pr. 90	Motor constant R1	0 to ****, 9999	1	9999
Pr. 91	Motor constant R2	0 to ****, 9999	1	9999
Pr. 92	Motor constant L1	0 to ****, 9999	1	9999
Pr. 93	Motor constant L2	0 to ****, 9999	1	9999
Pr. 94	Motor constant X	0 to ****, 9999	1	9999
Pr. 82	Motor constant exciting current	0 to ****, 9999	1	9999

4. Return the setting of Pr. 77 to the original value.

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Note: 1. Only when the settings of Pr. 80 and Pr. 81 are other than "9999" (magnetic flux vector control is selected), Pr. 82, Pr. 90 to 94 can be read.
2. Set "9999" in Pr. 82, Pr. 90 to 94 to use the standard motor constants (including the constant-torque motor).
3. Set "3" (standard motor) or "13" (constant-torque motor) in Pr. 71 to use the motor constants measured by auto tuning. If "4" or "14" has been set in Pr. 71 and the motor constants changed, the original data measured by auto tuning remain changed.
4. The motor constants measured by auto tuning have been converted into internal data (****). When setting the motor constants, see the following setting example:
Setting example:
When the Pr. 90 "motor constant R1" value displayed is 2516 and it is desired to increase the Pr. 90 value slightly (5%), set 2642 (i.e. 2516 × 1.05 = 2641.8) in Pr. 90. (The value displayed has been converted into internal data for internal use. Hence, there is no significance if an optional value is simply added to the displayed value.)

■ Setting the motor constants without using the auto tuning data

The motor constants of Pr. 92 and 93 may either be entered in [Ω] or [mH]. Check the unit of the motor constants before starting the setting operation.

• Entering the motor constants of Pr. 92 and 93 in [Ω]

<Operation procedure>

1. Change the set value of Pr. 77 "parameter write disable selection" to "801". Only when the settings of Pr. 80 and Pr. 81 are other than "9999", the parameters of the motor constants (Pr. 90 to 94) can be displayed. Though the parameters (Pr. 82 to 99) other than the motor constants (Pr. 90 to 94) may also be displayed, they are to be set by the manufacturer and must therefore be set carefully without mistake.
2. Set Pr. 71 "applied motor" as indicated below:

		Star Connection Motor	Delta Connection Motor
Set value	Standard motor	5	6
	Constant-torque motor	15	16

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

Pr. No.	Name	Setting Range	Minimum Setting Increment	Factory Setting
Pr. 90	Motor constant r1	0 to 10Ω, 9999	0.001Ω	9999
Pr. 91	Motor constant r2	0 to 10Ω, 9999	0.001Ω	9999
Pr. 92	Motor constant x1	0 to 10Ω, 9999	0.001Ω	9999
Pr. 93	Motor constant x2	0 to 10Ω, 9999	0.001Ω	9999
Pr. 94	Motor constant xm	0 to 500Ω, 9999	0.01Ω	9999

4. Set Pr. 84 "rated motor frequency" with reference to the following table:

Pr. No.	Name	Range	Increment	Factory Setting
Pr. 84	Rated motor frequency	50 to 120Hz, 9999	0.01Hz	9999

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

Note: 1. Only when the settings of Pr. 80 and Pr. 81 are other than "9999" (magnetic flux vector control is selected), Pr. 90 to 94 can be read.
2. Set "9999" in Pr. 90 to 94 to use the standard motor constants (including the constant-torque motor).
3. If the "star connection" or "delta connection" selected in Pr. 71 does not match the actual motor, proper magnetic flux vector control will not be carried out.

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- **Entering the motor constants of Pr. 92 and 93 in [mH]**

<Operation procedure>

1. Change the set value of Pr. 77 "parameter write disable selection" to "801". Only when the settings of Pr. 80 and Pr. 81 are other than "9999", the parameters of the motor constants (Pr. 90 to 94) can be displayed. Though the parameters (Pr. 82 to 99) other than the motor constants (Pr. 90 to 94) may also be displayed, they are to be set by the manufacturer and must therefore be set carefully without mistake.
2. Set Pr. 71 "applied motor" as indicated below:
   - Standard motor: Set "0".
   - Constant-torque motor: Set "1".
3. In the parameter setting mode, read the following parameters and set the required values:

Pr. No.	Name	Setting Range	Minimum Setting Increment	Factory Setting
Pr. 90	Motor constant r1	0 to 10Ω, 9999	0.001Ω	9999
Pr. 91	Motor constant r2	0 to 10Ω, 9999	0.001Ω	9999
Pr. 92	Motor constant x1	0 to 1000mH, 9999	0.1mH	9999
Pr. 93	Motor constant x2	0 to 1000mH, 9999	0.1mH	9999
Pr. 94	Motor constant x	0 to 100%, 9999	0.1%	9999

4. Set Pr. 84 "rated motor frequency" with reference to the following table:

Pr. No.	Name	Range	Increment	Factory Setting
Pr. 84	Rated motor frequency	50 to 120Hz, 9999	0.01Hz	9999

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

Note: 1. Only when the settings of Pr. 80 and Pr. 81 are other than "9999" (magnetic flux vector control is selected), Pr. 90 to 94 can be read.
2. Set "9999" in Pr. 90 to 94 to use the standard motor constants or constant-torque motor constants.

⚠ CAUTION

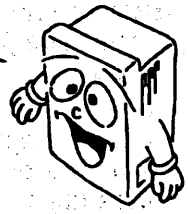
⚠ Be careful as the motor may run suddenly.

⚠ When auto tuning is used in vertical lift applications, there is a possibility that a load may drop due to torque shortage.

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4.6 PROGRAMMED OPERATION FUNCTION

In programmed operation, automatic operation is performed under the control of the internal timer in accordance with the desired time of day, running frequency and direction of rotation set in advance.

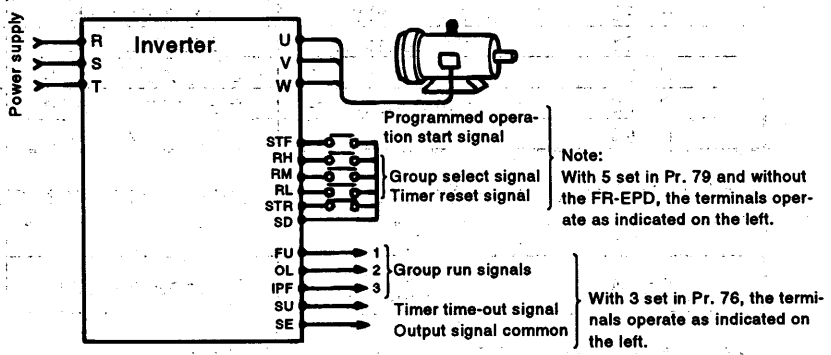


4.6.1 Preparation

Setting of operation mode and output terminals (Pr. 79, Pr. 76)

To perform programmed operation, set "5" (programmed operation) in Pr. 79 "operation mode selection" and "3" (programmed operation output) in Pr. 76 "alarm code output selection".

Wiring



When "5" (programmed operation) is set in Pr. 79, the following terminals are made valid and invalid and are used for programmed operation:

Valid Terminals	Invalid Terminals	Terminals Used
RES	AU	STF
MRS	STOP	STR
RT	No. 2	RH
OH	No. 4	RM
	No. 1	RL
	JOG	

Note: When the battery pack for programmed operation (FR-EPD) is fitted, note that the terminals used for programmed operation are not as indicated above. (For details, see the option instruction manual.)

During programmed operation, the inverter cannot be operated in any other operation mode. When the programmed operation start signal (STF) and timer reset signal (STR) are ON, the operation mode cannot be switched between PU operation and external operation. When "5" is set in Pr. 79, the following functions are unavailable if the corresponding inboard option is fitted:

(1) Orientation control
(2) 12-bit digital input
(3) PI control

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Programmed operation time unit selection (Pr. 200)

Set the time unit for programmed operation. Select either of "minute/second" and "o'clock/minute" in Pr. 200.

Set Value	Description
0 (factory setting)	Minute/second unit (voltage monitor)
1	O'clock/minute unit (voltage monitor)
2	Minute/second unit (reference time of day monitor)
3	O'clock/minute unit (reference time of day monitor)

Note: When 2 or 3 is set in Pr. 200, the reference time-of-day monitor screen is displayed instead of the voltage monitor screen.

Setting of reference time of day (Pr. 231)

The FR-A201E has an internal timer (RAM). When the reference time of day is set in Pr. 231, programmed operation is started at this time of day.

(1) Setting range

The time unit depends on the set value of Pr. 200.

Pr. 200 Set Value	Pr. 231 Setting Range	Pr. 200 Set Value	Pr. 231 Setting Range
0 (factory setting)	Max. 99 minutes 59 seconds	2	Max. 99 minutes 59 seconds
1	Max. 99 o'clock 59 minutes	3	Max. 99 o'clock 59 minutes

Note: The reference time-of-day timer starts the timing of the reference time of day when both the start signal and group select signal are entered. Set the reference time of day in Pr. 231 when both signals are on.

(2) Resetting the reference time of day

The reference time of day is cleared (returns to "0") by switching on the timer reset signal (STR) or resetting the inverter (see page 10-1). Note that the reference time-of-day value set in Pr. 231 is also reset to "0".

(3) Timer accuracy

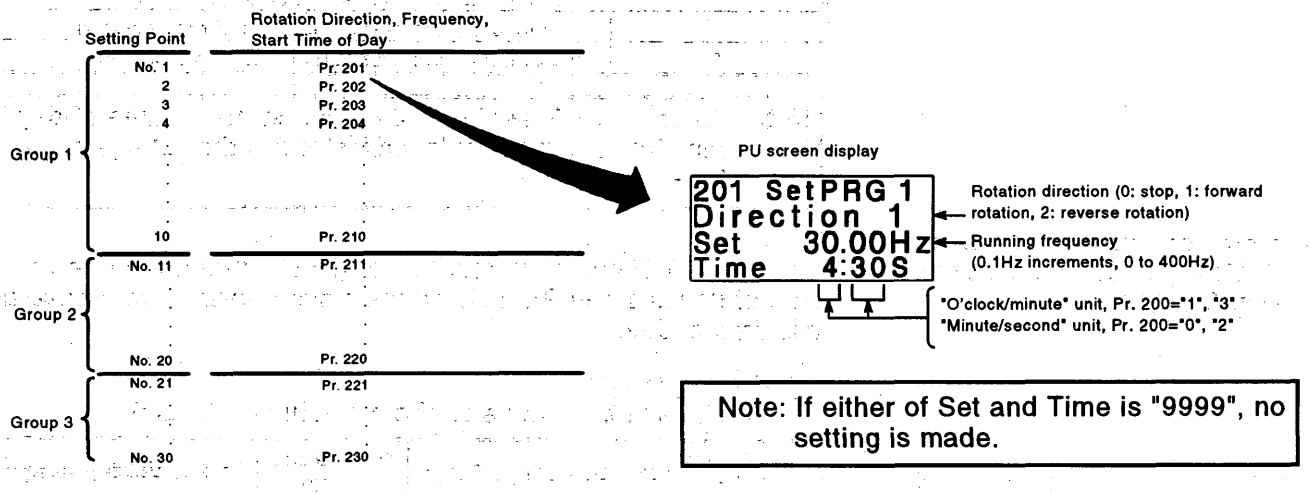
- Instantaneous error: ±0.16s
- Cumulative error: ±50ppm (according to the accuracy of the crystal oscillator)

FR-A201E independent error: Max. 4.5s per day
(24Hr×60×60×50ppm=4.32s)

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4.6.2 Program Setting (Pr. 201 to 230)

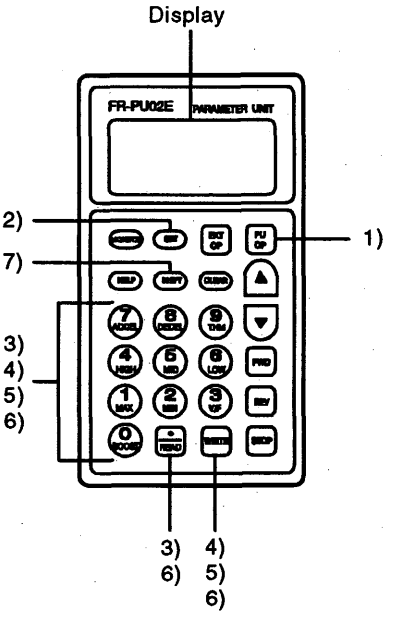
The rotation direction, running frequency and start time of day are defined as one point and every 10 points are grouped into three. Pr. 201 to Pr. 230 are used for this setting. Note that when the setting of Pr. 200 has been changed independently, the units of Pr. 201 to 230 change (the numerals do not change).



Note: If either of Set and Time is "9999", no setting is made.

■ Setting procedure (Example: Setting point No. 1, forward rotation, 30Hz, 4 o'clock 30 minutes)

1) Press the [PU OP] key. ..... The frequency setting screen is displayed.	DIRECTLY Set 0.00HZ 0-400
2) Press the [SET] key. ..... The inverter is put in the parameter setting mode.	SETTING MODE Set Pr.NO. FOR PR.List <HELP>
3) Type 201 and press the [READ] key. The current set value is shown on the display.	201 SetPRG 1 Direction 9999 Set 9999Hz Time 9999S
4) Type 1 (forward rotation) and press the [WRITE] key. (Note 1) ..... "1" is displayed at Direction and stored into memory.	201 SetPRG 1 Direction 1 Set 9999Hz Time 9999S
5) Type 30 (30Hz) and press the [WRITE] key. (Note 1) ..... "30.00Hz" is displayed at Set and stored into memory.	201 SetPRG 1 Direction 1 Set 30.00Hz Time 9999S
6) Using the numeral keys and [READ] key, enter 4.30 and press the [WRITE] key. (Note 2) ..... "4.30" is displayed at Time, the set value is stored into memory, and setting is complete.	201 SetPRG 1 Direction 1 Set 30.00Hz Time 4:30S



..... Max. setting: 99:59
Press [READ] to enter ":" at Time.

7) Press the [SHIFT] key to move to the next parameter (Pr. 202), and press the [READ] key to display the current set value. Then, press the [SHIFT] key to advance to the next parameter.

Note : 1. To make a stop, write "0" in the rotation direction and frequency. Set "9999" for no setting.
2. An error will result if 4.80 is entered (in excess of 59 minutes or 59 seconds).

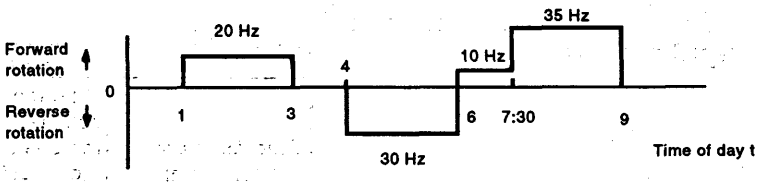
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Operation pattern

Assuming that operation has been programmed as indicated in the following table, the operation pattern is as shown in the figure below:

No.	Operation	Parameter Setting
1	Forward rotation, 20Hz, 1 o'clock 0 minutes	Pr. 201=1, 20, 1:00
2	Stop, 3 o'clock 0 minutes	Pr. 202=0, 0, 3:00
3	Reverse rotation, 30Hz, 4 o'clock 0 minutes	Pr. 203=2, 30, 4:00
4	Forward rotation, 10Hz, 6 o'clock 0 minutes	Pr. 204=1, 10, 6:00
5	Forward rotation, 35Hz, 7 o'clock 30 minutes	Pr. 205=1, 35, 7:30
6	Stop, 9 o'clock 0 minutes	Pr. 206=0, 0, 9:00

<Operation pattern>



4.6.3 Details of the Functions

Parameters used

Pr. No.	Name	Range	Increments/ Unit	Factory Setting	Remarks
200	Programmed operation minute/second selection	0 to 3	1	0	0-minute/second unit/ voltage monitor 1-o'clock/minute unit/ voltage monitor 2-minute/second unit/ reference time of day monitor 3-o'clock/minute unit/ reference time of day monitor
201 to 230	Programmed operation program setting	0 to 2	1	9999	Rotation direction setting 0-stop, 1-forward rotation, 2-reverse rotation
		0 to 400Hz	0.1Hz		Frequency setting
		0 to 99:59	Minutes or seconds		Time of day setting
231	Timer setting	0 to 99:59	—	0	Reference time-of-day timer (RAM) (Note1)

Note: 1. When both the start signal and group select signal are entered, the set value of Pr. 231 "timer setting" returns to "0". Set the optional time of day with both signals on. Note that if the start signal and group select signals are entered after setting the optional time of day, the Pr. 231 set value returns to "0" again.
2. Note that when the setting of Pr. 200 has been changed independently, the units of Pr. 231 and Pr. 201 to 230 change.
3. When 2 or 3 is set in Pr. 200, the reference time-of-day monitor screen is displayed instead of the voltage monitor screen.

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Input signals

Name	Description	Signal Level	Remarks
Group select signal (RH (group 1) RM (group 2) RL (group 3))	Used to select the group for programmed operation.	Photocoupler isolated	May also be driven by transistor. When ic=10mA, Vec<0.5V should be satisfied.
Terminal reset signal (STR)	Input to zero the reference time of day.	Photocoupler isolated	
Programmed operation start signal (STF)	Input to start programmed operation.	Photocoupler isolated	

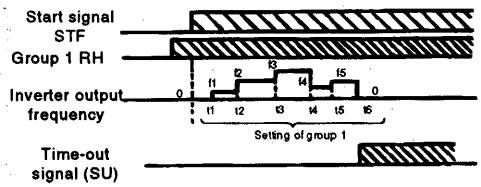
Output signals

Name	Description	Signal Level	Remarks	
Time-out signal Inverter terminal (SU)	Output on completion of the operation of the selected group and cleared on timer reset.	Open collector output (isolated)	Permissible load 24VDC, 0.1A	Only when Pr. 76=3
Group select signal Inverter terminal (FU, OL, IPF)	Output during operation of corresponding group's program and cleared on timer reset.	Open collector output (isolated)	Permissible load 24VDC, 0.1A	

4.6.4 Operation

Ordinary operation

After completion of all preparations and settings, turn on the desired group select signal (any of RH (group 1), RM (group 2) and RL (group 3)), then turn on the start signal (STF). This causes the internal timer (reference time of day) to be reset automatically and the operation of that group to be performed in sequence in accordance with the settings. When the operation of the group ends, a signal is output from the time-out output terminal. (The open collector signal of SU is turned on.)



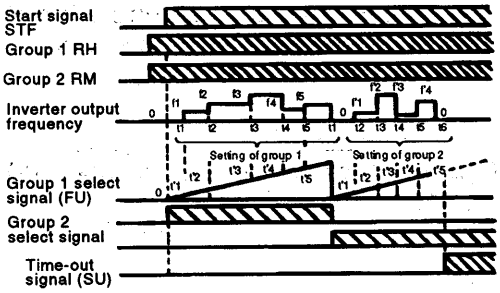
Note that the operation is not started if the timer reset (STR) is on.

Note: Use the programmed operation function with "5" set in Pr. 79. Programmed operation will not be performed if any of the group select signals is switched on during PU operation or data link operation.

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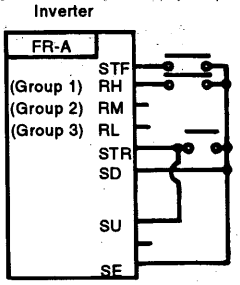
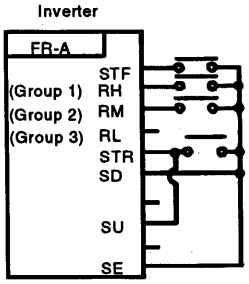
Multi-group select operation

When two or more groups are selected at the same time, the operations of the selected groups are executed in sequence of group 1, group 2 and group 3.
For example, if group 1 and group 2 have been selected, the operation of group 1 is first carried out, and after that operation ends, the reference time of day is reset, the operation of group 2 is started, and the time-out signal (SU) is output after the operation of group 2 ends.



Repeated operation

To repeat the operation of the same group, reset the timer using the time-out signal as shown below.

1) To repeat the operation of only group 1	2) To repeat the operation of groups 1and 2
	

Note: If the inverter is powered down, then up (including a power failure or an instantaneous power failure) during the execution of the programmed operation, the internal timer is reset and the inverter does not restart if the power is restored. To resume the operation, turn the programmed operation start signal (terminal STF) off, then on again. (At this time, the reference time of day is zeroed. When it is required to set the reference time of day, switch the start signal on before setting.)

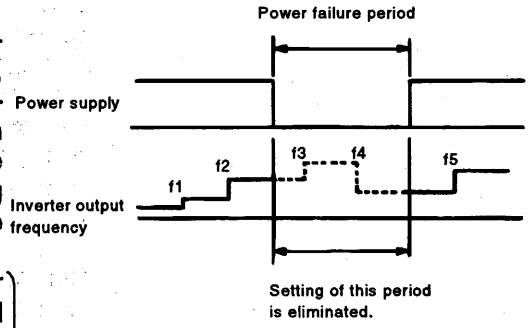
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4.6.5 Programmed Operation Battery Backup (FR-EPD option)

To continue programmed operation at the occurrence of an instantaneous power failure, install this unit (FR-EPD) and start programmed operation.

Operation at occurrence of instantaneous power failure

(1) When a power failure has occurred, operation is continued as shown on the right with the operation during the power failure period eliminated.
(The internal timer for programmed operation continues timing.)



(2) If the group selected has been changed during the power failure, the operation of the group selected is started from the beginning after the power is restored.

(3) The battery is guaranteed for 10 years. If the BAT.E lamp is lit, change the battery.

(4) The operation is not performed if the power is restored when or after the time-out signal is output.

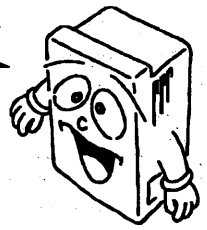
(5) If the power is restored after a long power failure period, programmed operation is not resumed. Perform group selection and time setting again.

- Max. permissible power failure period..... 18 hours when Pr. 200 = "0" or "2" (minute/second selection).
  30 days when Pr. 200 = "1" or "3" (o'clock/minute selection)

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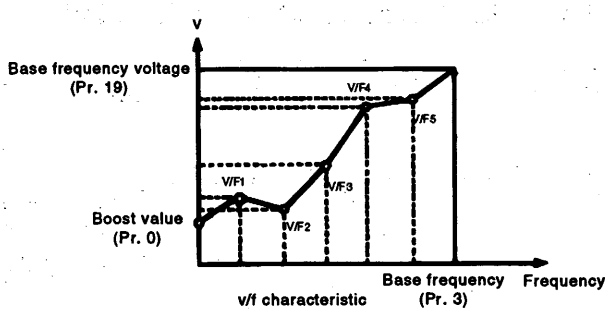
4.7 5-POINT FLEXIBLE V/F CHARACTERISTIC

The V/F (frequency Voltage/Frequency) characteristic can be changed by linear interpolation made between five points set from V/F1 to V/F5.



- **Operation**

An optional V/F characteristic can be set by setting V/F1 (first frequency voltage/first frequency), V/F2, V/F3, V/F4 and V/F5 in the corresponding parameter.



- **Setting**

(1) After setting Pr. 19 "base frequency voltage", set "2" in Pr. 71 "applied motor".
(2) Set the desired frequencies and voltages in Pr. 100 to Pr. 109.
The setting must satisfy the following relationship: F1≠F2≠F3≠F4≠F5≠base frequency.
If the set frequencies are the same, a write error occurs.
If "9999" is set in any frequency, it is ignored.

Note: 1. The V/F 5-point flexible characteristic functions for V/F control only.
2. The V/F 5-point flexible characteristic does not function when Pr. 60 (intelligent mode selection) is selected.
3. The frequency voltage may be set optionally between 0 and 1000V, but output voltage is clamped at the base frequency voltage if output frequency is beyond the base frequency.
4. Pr. 19 (base frequency voltage) must be set. (When Pr. 19 = 9999, Pr. 71 cannot be set to 2 (5-point flexible V/F characteristic).)
5. If "2" is set in Pr. 71, Pr. 47 (second V/F (base frequency)) does not function.
6. When "2" is set in Pr. 71, the electronic overcurrent protection is calculated for a general-purpose motor.

- **V/F1 to 5 setting range**

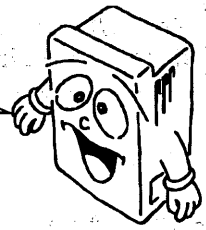
Parameter Number	Applied Motor Selection (Pr. 71) = other than 2		Applied Motor Selection (Pr. 71) = 2			
	Function Name	Setting Range	Function Name	Setting Range	Minimum Increments	Factory Setting
Pr. 100	BCD input (offset)	0 to 400Hz	V/F1 (first frequency)	0 to 400Hz, 9999	0.01	9999
Pr. 101	BCD input (gain)	0 to 400Hz, 9999	V/F1 (first frequency voltage)	0 to 1000V	0.1	0
Pr. 102	Binary input (offset)	0 to 400Hz	V/F2 (second frequency)	0 to 400Hz, 9999	0.01	9999
Pr. 103	Binary input (gain)	0 to 400Hz, 9999	V/F2 (second frequency voltage)	0 to 1000V	0.1	0
Pr. 104	BCD/binary selection	0, 1, 2, 3, 9999	V/F3 (third frequency)	0 to 400Hz, 9999	0.01	9999
Pr. 105	Speed feedback range	0 to 400Hz, 9999	V/F3 (third frequency voltage)	0 to 1000V	0.1	0
Pr. 106	Feedback gain	0 to 100	V/F4 (fourth frequency)	0 to 400Hz, 9999	0.01	9999
Pr. 107	Stop position command selection	0, 1, 9999	V/F4 (fourth frequency voltage)	0 to 1000V	0.1	0
Pr. 108	Orientation speed	0 to 30Hz	V/F5 (fifth frequency)	0 to 400Hz, 9999	0.01	9999
Pr. 109	Creep speed	0 to 10Hz	V/F5 (fifth frequency voltage)	0 to 1000V	0.1	0

Note: The set values of Pr. 100 to Pr. 109 set when Pr. 71 is other than "2" are stored internally and remain unchanged if the set values are written with "2" set in Pr. 71. When the inboard option is added with "2" set in Pr. 71, the parameters set when Pr. 71 is other than "2" are made valid and the option operates with these parameters.

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4.8 PU OPERATION INTERLOCK FUNCTION AND EXTERNAL SIGNAL-BASED OPERATION MODE SWITCHING FUNCTION

The PU operation interlock function allows PU operation to be interlocked depending on the ON-OFF of the terminal MRS signal.
The external signal-based operation mode switching function allows the operation mode to be fixed depending on the ON-OFF of the terminal RH signal.
These functions prevent the inverter from not starting operation under external command if the operation mode is left unswitched from the PU operation mode.



4.8.1 PU Operation Interlock Function

Setting method

Set "7" in Pr. 79 "operation mode selection".

PU operation interlock signal

The input signal MRS is assigned as the PU operation interlock signal. (When "7" is set in Pr. 79, MRS automatically operates as the PU operation interlock signal.)

Functions

- In the PU operation interlock mode, the following functions are made valid:

Set Value	Terminals MRS-SD	Function, Operation
7	Connected	• Output stopped during external operation. • Switchable to the PU mode. • Parameter setting can be changed in the PU mode. • PU operation allowed.
	Disconnected	• Forces the operation mode to be switched to the external operation mode. • External operation allowed. • Switching to the PU operation mode disabled.

The following table lists the functions and operations performed by switching on (connecting)/off (disconnecting) the external signal (across terminals MRS):

Operation Mode	Operation Status	Terminals MRS-SD	Mode Switching	Status	Parameter Write	Remarks
PU	Stop	Connected ↓ Disconnected	Forcibly switched to the external operation mode. (Note 1)	Remains stopped.	Enable ↓ Disable	• Unswitchable to the PU operation mode. Note 1: Switched independently of the external start signal.
	Running	Connected ↓ Disconnected	Forcibly switched to the external operation mode. (Note 1)	If the frequency setting and start signals of external operation are on, operation is performed accordingly.	Enable ↓ Disable (Note 2)	• Unswitchable to the PU operation mode. Note 2: Limited to parameters that may be rewritten during operation.
External	Stop	Disconnected ↓ Connected	Remains in the external operation mode. (Note 3)	Remains stopped.	Disable ↓ Disable	• Switchable to the PU operation mode. Note 3: Output stopped.
		Connected ↓ Disconnected	Remains in the external operation mode.	Remains stopped.	Disable ↓ Disable	• Unswitchable to the PU operation mode.
	Running	Disconnected ↓ Connected	Remains in the external operation mode. (Note 3)	Running ↓ Output stop	Disable ↓ Disable	• Unswitchable to the PU operation mode.
		Connected ↓ Disconnected	Remains in the external operation mode.	Output stop ↓ Run (Note 4)	Disable ↓ Disable	• switchable to the PU operation mode. Note 4: If the frequency setting signal is on, operation is performed accordingly.

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Note: 1. When the signal across terminals MRS and SD is switched on and the value of Pr. 79 is then changed to other than 7 in the PU operation mode, that signal functions as the ordinary signal (output stop), not as the edit enable signal. Also, as soon as the value of Pr. 79 is changed, the ordinary mode switching is carried out.

2. When Pr. 79 = 7, the link operation (computer link, PC link) function cannot be used. Also, the inverter is put in the external operation mode if Pr. 125 = 1 (link mode at power on).

3. If the signal across STF or STR and SD is on, the external operation mode cannot be switched to the PU operation mode when the signal across MRS and SD is on.

4. When 7 is set in Pr. 79 and the signal across terminals MRS and SD is switched on and is then switched off during PU operation, the inverter is switched to the external operation mode independently of the external terminal (STF, STR) signal state. Therefore, when the signal across terminals MRS and SD is switched off with either of the STF and STR signals on, the motor is run in the external operation mode.

5. The ordinary MRS function is invalid for the PU operation mode.

6. The above description all applies to a case where Pr. 17 = 0 or 1 (MRS terminal normally disconnected). When Pr. 17 = 2 or 3, ON changes to OFF and OFF changes to ON in the above table and description.

7. When the PU operation mode is forcibly switched to the external operation mode, the PU is internally reset once to secure the monitor screen.

8. The above function is not available for the FR-PU01E and "7" cannot be written to Pr. 79.

9. At the occurrence of any alarm, press the STOP key in the PU operation mode to reset the inverter. The inverter cannot be reset in the external operation mode and must be reset in the PU operation mode.

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4.8.2 External Signal-Based Operation Mode Switching Function

Setting method

Set "8" in Pr. 79 "operation mode selection".

External signal-based operation mode switching signal

The input signal RH is assigned as the external signal-based operation mode switching signal. (When "8" is set in Pr. 79, RH automatically operates as the external signal-based operation mode switching signal.)

Functions

- In the external signal-based operation mode switching mode, the following functions are made valid:

Set Value	Terminals RH-SD	Fixed Mode	Remarks
8	Connected	External operation mode	Cannot be switched to the PU operation mode.
	Disconnected	PU operation mode	Cannot be switched to the external operation mode.

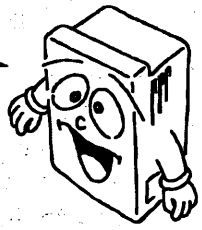
Connection of RH-SD in the PU operation mode forces the inverter to switch to the external operation mode. Disconnection of RH-SD switches the inverter to the PU operation mode. Note that this switching can be done only during an inverter stop and cannot be done during operation.

Note: 1. Setting "8" in Pr. 79 changes the function of terminal RH (three-speed setting (high speed)) to the operation mode switching function. At this time, the function of terminal RH (three-speed setting (high speed)) is invalid.
2. This function is not available for the FR-PU01E parameter unit.

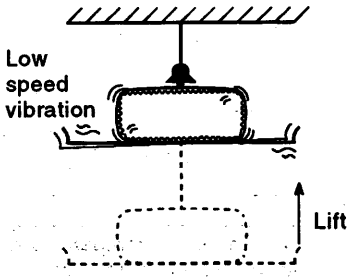
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4.9 STOP-ON-CONTACT CONTROL

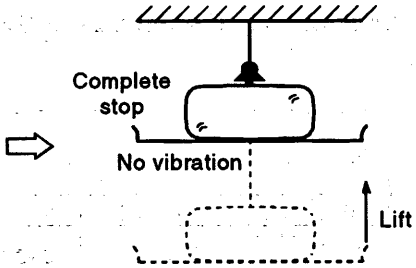
To ensure uniform, precision positioning, this function suppresses vibration which is liable to occur when a load is stopped upon contact in vertical motion applications.



<Without stop-on-contact control>

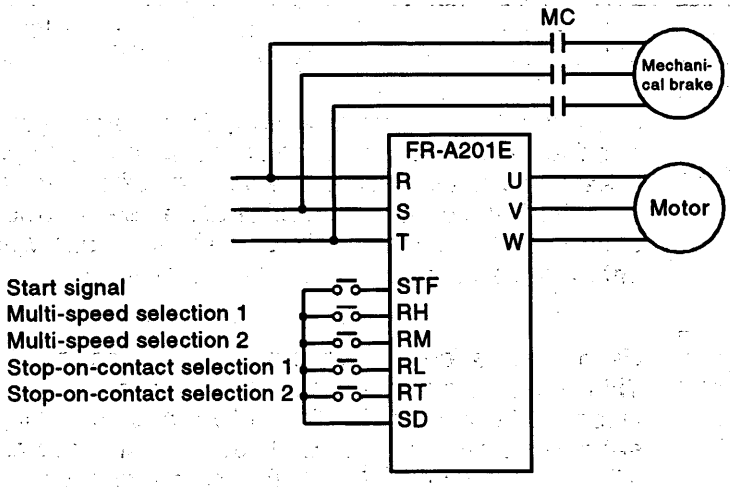


<With stop-on-contact control>



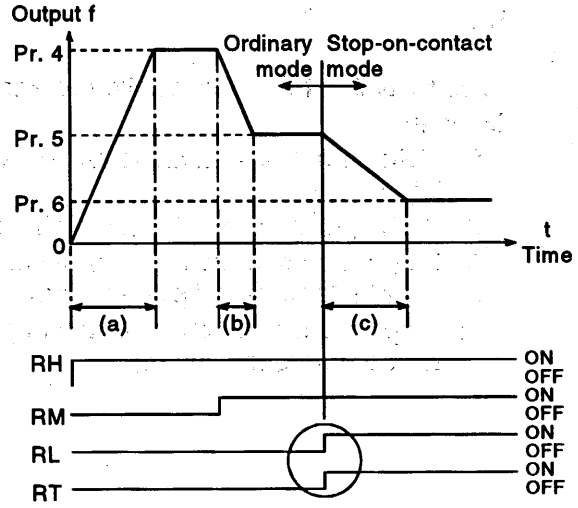
When using stop-on-contact control, select magnetic flux vector control.

4.9.1 Wiring Example



4.9.2 Operation Example (external mode, multiple speeds (3 speeds))

To ensure accurate positioning at the upper limit of a lift, stop-on-contact control causes a mechanical brake to engage while a motor is developing a holding torque to keep a load in contact with a mechanical stopper or the like.



When both RL and RT are switched on, the inverter shifts to the stop-on-contact mode.

(RL and RT may be switched on in any sequence and with any delay between them.)

- The inverter enters the stop-on-contact mode when both the RT and RL terminals are switched on with 5 or 7 set in Pr. 96 "torque control selection". In this mode, operation is performed at the frequency set in Pr. 6 "multi-speed setting (low speed)" independently of the preceding speed.
  Pr. 96 = 5: Stop-on-contact control
  Pr. 96 = 7: Stop-on-contact control + load torque high-speed frequency control

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4.9.3 Setting

(1) Select magnetic flux vector control. (Refer to page 14-1.)
(2) Set 701 in Pr. 77 "parameter write disable selection". Pr. 96 can be accessed.
(3) Set "5" or "7" in Pr. 96 "torque control selection". (Stop-on-contact control is selected.)
When the RL and RT signals are switched on, the inverter shifts to stop-on-contact control.
(4) Refer to the following function explanations and set the parameters:

- **Parameter setting**

Parameter Number	Description	Setting Range	Minimum Setting Increment	Factory Setting	Remarks
6	Multi-speed setting (low speed)	0 to 400Hz	0.01Hz	10Hz	
82	Exciting current low-speed multiplying factor for a stop on contact	0 to 1000%, 9999	1%	9999	9999: Current is not compensated for by multiplying factor.
83	PWM carrier frequency for a stop on contact	0.7 to 14.5kHz, 9999	0.1kHz	9999	9999: Carrier frequency is as set in Pr. 72.
96	Torque control selection	0, 5, 6, 7	1	0	Set 5 or 7 to select a stop on contact.

Pr. 6 Multi-speed setting (low speed)

Used to set the output frequency for stop-on-contact control.
The frequency set should be as low as possible (about 2Hz). If it is set to more than 30Hz, the operating frequency will be 30Hz.
When stop-on-contact control is to be used during PLG feedback control, PLG feedback control is made invalid when the inverter enters the stop-on-contact control mode.

Pr. 82 "exciting current low-speed multiplying factor for a stop on contact"

Used to set a force for stop-on-contact control.
This parameter may be set (may also be set during operation) when Pr. 80 ≠ 9999, Pr. 81 ≠ 9999, and Pr. 96 = 5 or 7. Usually set a value between 130 and 180% in this parameter.
When 9999 is set in Pr. 82, the current is not compensated for.

Pr. 83 "PWM carrier frequency for a stop on contact"

Used to set a PWM carrier frequency for a stop on contact.
This parameter may be set when Pr. 96 = 5 or 7 and only appiies when the output frequency is 3Hz or less.
When 9999 is set in Pr. 83, the carrier frequency is as set in Pr. 72.

Pr. 96 "torque control selection"

Used to switch from one function to another.
Set value
0: Multi-speeds + automatic restart after instantaneous power failure
6: Multi-speeds + load torque high-speed frequency control
5: Stop-on-contact control + multi-speeds + automatic restart after instantaneous power failure
7: Stop-on-contact control + multi-speeds + load torque high-speed frequency control

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Operation Mode (External)	Ordinary Operation		Stop-on-Contact Control		Remarks
RL, RT terminals / Main function	RL	RT	RL	RT	
	Either is OFF		ON	ON	
Output frequency for a stop on contact	Multi-speeds 0 to 5V, 0 to 10V 4 to 20mA		Pr. 6 "low-speed frequency"		
Exciting current low-speed multiplying factor			The current is compensated for by the multiplying factor (0 to 1000%) set in Pr. 82 before RL and RT are switched on.		When RL and RT are switched on, Pr. 49 (second stall prevention operation frequency) is invalid.
Carrier frequency	Pr. 72 (0.7 to 14.5kHz)		Pr. 83 (0.7 to 14.5kHz, 9999)		

- Frequencies set in the stop-on-contact control mode (Pr. 96 = 5 or 7) (In the external operation mode)
  The frequencies set by multiple selection of the input terminals (RH, RM, RL, RT, JOG/OH) are listed below:

Selected Terminals					Set Frequency		Stop-on-Contact Control Function	Remarks
RH	RM	RL	RT	JOG/OH				
O					Speed 1 (high speed)	Pr. 4		
	O				Speed 2 (middle speed)	Pr. 5		
		O			Speed 3 (low speed)	Pr. 6		
			O		According to 0-5V, 0-10V, 4-20mA			
				O	Jog frequency	Pr. 15		
O	O				Speed 6	Pr. 26		Middle speed when Pr. 26 = 9999
O		O			Speed 5	Pr. 25		Low speed when Pr. 25 = 9999
O			O		Speed 1 (high speed)	Pr. 4		
O				O	Jog frequency	Pr. 15		
	O	O			Speed 4	Pr. 24		Low speed when Pr. 24 = 9999
	O		O		Speed 2 (middle speed)	Pr. 5		
	O			O	Jog frequency	Pr. 15		
		O	O		Speed 3 (low speed, stop-on-contact frequency)	Pr. 6	◎	
		O		O	Jog frequency	Pr. 15		
			O	O	Jog frequency	Pr. 15		
		O	O	O	Jog frequency	Pr. 15		
	O		O	O	Jog frequency	Pr. 15		
	O	O		O	Jog frequency	Pr. 15		
	O	O	O		Speed 3 (low speed, stop-on-contact frequency)	Pr. 6	◎	
O			O	O	Jog frequency	Pr. 15		
O		O		O	Jog frequency	Pr. 15		
O		O	O		Speed 3 (low speed, stop-on-contact frequency)	Pr. 6	◎	
O	O			O	Jog frequency	Pr. 15		
O	O		O		Speed 6	Pr. 26		Middle speed when Pr. 26 = 9999
O	O	O			Speed 7	Pr. 27		Low speed when Pr. 27 = 9999
	O	O	O	O	Jog frequency	Pr. 15		
O		O	O	O	Jog frequency	Pr. 15		
O	O		O	O	Jog frequency	Pr. 15		
O	O	O		O	Jog frequency	Pr. 15		
O	O	O	O		Speed 3 (low speed, stop-on-contact frequency)	Pr. 6	◎	
O	O	O	O	O	Jog frequency	Pr. 15		
					According to 0-5V, 0-10V, 4-20mA			

* ◎ indicates that the function is selected.

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Note: 1. O indicates that the terminal is on.
2. Indicates that the remote setting function is not selected. (The remote setting function disables stop-on-contact control.)
3. The selection of the 12-bit digital speed (inverter with FR-EPA or EPE) makes the above list invalid.
Note that when both RL and RT are on, the frequency is as set in Pr. 6 and stop-on-contact control is exercised.
4. JOG/OH in the above list indicates the jog function (Pr. 17 = 0, 2).
(When Pr. 17 = 1 or 3, JOG/OH in the list is regarded as off.)
5. The jog frequency has the highest priority.

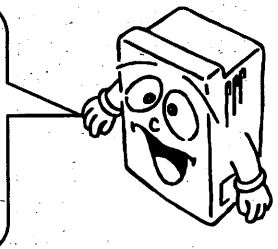
- **Precautions**

1. Pr. 96 should be accessed after 701 is set in Pr. 77.
2. If the setting of the exciting current low-speed multiplying factor for stop on contact is too large, the overcurrent (OCT) alarm is liable to occur and/or the machine may vibrate in a stop-on-contact state.
3. Unlike the servo lock function, the stop-on-contact function cannot be used to hold a load at a stop for an extended period of time.
The continuation of stop-on-contact control may cause the motor to overheat, a mechanical brake should be used to hold the load immediately after a stop.

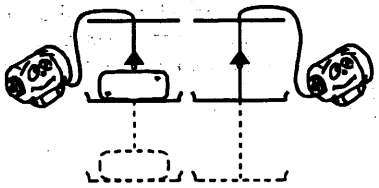
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4.10 LOAD BASED FREQUENCY CONTROL FUNCTION

This function automatically changes the maximum operating frequency according to the load.
Specifically, after the load is started its magnitude is calculated from the average current, if it is judged to be light operation will occur at a frequency higher than the preset.
Under a light load, speed can be increased automatically to reduce incoming/outgoing time for a multi-story parking garage or the like.

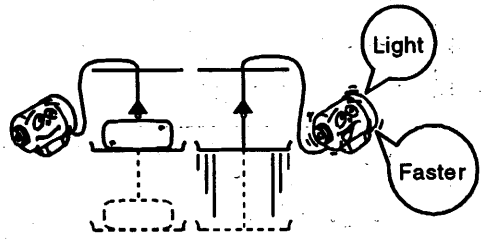


<Without high-speed frequency control>



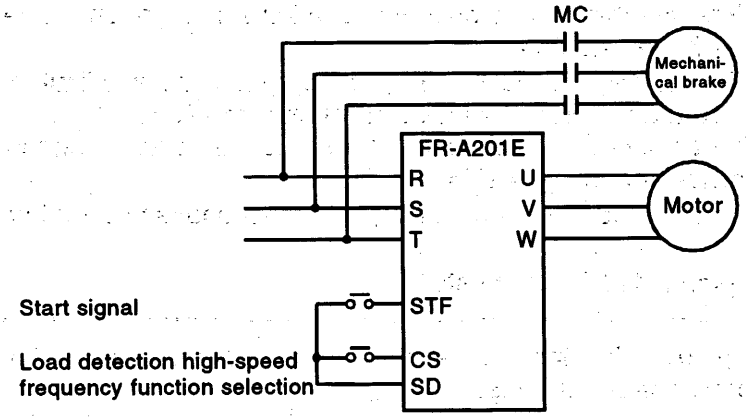
Whether there is a load or not, the lift is moved vertically at the same speed.

<With high-speed frequency control>



The lift with a light load or without a load is moved faster than the lift with a load.
(The output frequency is increased.)

4.10.1 Wiring Example



4.10.2 Operation Example

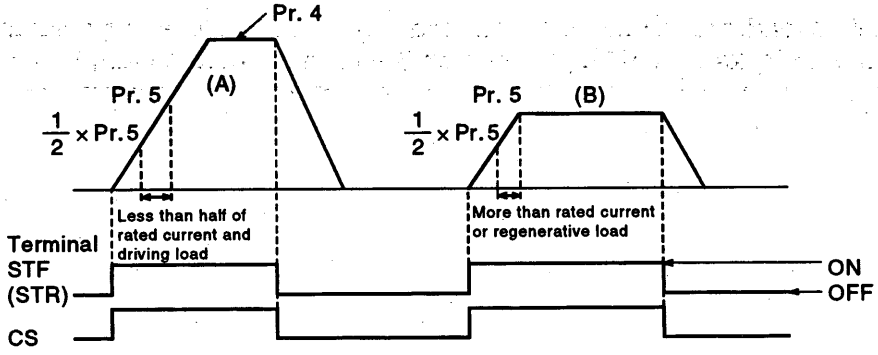


Fig. 4-1

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- When operation is performed with 6 or 7 set in Pr. 96 "torque control selection" and the CS terminal (load detection high-speed frequency function selection) switched on, the inverter varies the maximum frequency automatically as shown below between the settings of Pr. 4 "multi-speed setting (high speed)" and Pr. 5 "multi-speed setting (middle speed)" according to the magnitude of an average current during acceleration from half the setting of Pr. 5 to the frequency set in Pr. 5.

  Example: 1. If the average current is less than half the rated current of the inverter, the maximum frequency is Pr. 4 as in A in Fig. 4-1.
  2. If the average current is more than the rated current of the inverter, the maximum frequency is Pr. 5 as in B in Fig. 4-1.

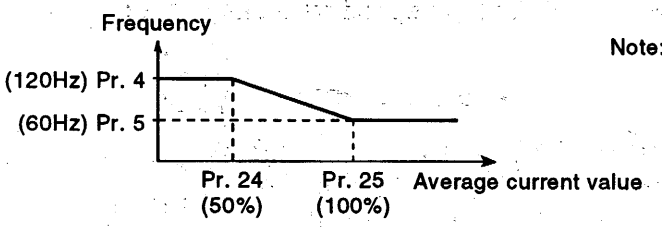


Fig. 4-2

Note: When a current averaging region includes a constant-output area above 60Hz, the output current may become larger in the constant-output area. Note that when the current is low, the frequency and deceleration time increases.

In this example, the frequency varies according to the current, e.g. 60Hz at a 100% current and 120Hz at a 50% current.

Note: 1. With 6 or 7 set in Pr. 96 "torque control selection", the function of the CS terminal changes to a load torque high-speed frequency control feature and the automatic restart after instantaneous power failure function is inactive.
2. With 6 or 7 set in Pr. 96 "torque control selection", this feature is valid only in the external operation mode. Note that this feature does not function when the remote setting function (Pr. 59 = 1 or 2) has been selected.
3. When this feature is selected (Pr. 96 = 6 or 7), the output frequency limit is 120Hz. If the frequency set is more than 120Hz, the output frequency is 120Hz.
   Also, the carrier frequency setting range is 1.1 to 14.5kHz. If its setting is between 0.7 and 1.0kHz, the carrier frequency is 1.1kHz.
4. When this feature is selected (Pr. 96 = 6 or 7), the fast-response current limit function is invalid.
5. This function is implemented for every start.

Note: When a current averaging region includes a constant-output area, the output current may become larger in the constant-output area.

⚠ WARNING

⚠ Under a light load, the frequency may increase up to 120Hz, creating a hazardous condition. Adequate interlocks should be provided on the machine before starting operation.

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4.10.3 Setting

(1) Set 701 in Pr. 77 "parameter write disable selection", Pr. 96 is accessible.
(2) Set "6" or "7" in Pr. 96 "torque control selection". When the CS terminal is switched on, the inverter shifts to the load torque control mode. (Load based frequency control is selected.)
(3) Refer to the following function explanations and set the parameters:

- **Parameter setting**

Parameter Number	Description	Setting Range	Minimum Setting Increment	Factory Setting
4	Multi-speed setting (high speed)	0 to 400Hz	0.01Hz	60Hz
5	Multi-speed setting (middle speed)	0 to 400Hz	0.01Hz	30Hz
24	High-speed setting maximum current value	0 to 200%	0.1%	50%
25	Middle-speed setting minimum current value	0 to 200%	0.1%	100%
26	Current averaging range	0 to 400Hz, 9999	0.01Hz	9999
27	Current averaging filter constant	1 to 4000	1	16

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

- Pr. 4 is used to set the high-speed (light load) for load based frequency control, and Pr. 5 is used to set the low-speed (standard load) frequency. (Refer to Fig. 4-2.)

Pr. 24 "high-speed setting maximum current value"
Pr. 25 "middle-speed setting minimum current value"

- Used to set the maximum and minimum current values for high and middle speeds. (Refer to Fig. 4-2.)

Pr. 26 "current averaging range"
Pr. 27 "current averaging filter constant"

- By setting a value other than 9999 in Pr. 26 "current averaging range", currents during acceleration from (Pr. 26 × 1/2)Hz to (Pr. 26)Hz can be averaged.
- Pr. 27 "current averaging filter constant" is used to set the time constant of a filter relative to the output current. (Time constant [ms] = 0.5 × Pr. 27 and the factory setting is 8ms.) Increasing the set value stabilizes the current but deteriorates response performance.

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- **Frequencies set in the load based frequency control mode (Pr. 96 = 6, 7)**
  The frequencies set by multiple selection of the load based frequency control selection terminal (CS) and multi-speed terminals (RH, RM, RL) are listed below:

Terminals Selected				Set Frequency
CS	RH	RM	RL	
O				Under load based frequency control
	O			Speed 1 (high speed) Pr. 4
		O		Speed 2 (middle speed) Pr. 5
			O	Speed 3 (low speed) Pr. 6
O	O			Speed 1 (high speed) Pr. 4
O		O		Speed 2 (middle speed) Pr. 5
O			O	Speed 3 (low speed) Pr. 6
	O	O		Speed 6 Pr. 26
	O		O	Speed 5 Pr. 25
		O	O	Speed 4 Pr. 24
O	O	O		Speed 6 Pr. 26
O		O	O	Speed 4 Pr. 24
	O	O	O	Speed 7 Pr. 27
O	O		O	Speed 5 Pr. 25
O	O	O	O	Speed 7 Pr. 27
				Setting by terminals 1, 2, 4, JOG

Note: 1. O indicates that the terminal is on.
2. Indicates that the inverter is in the external operation command mode and the remote setting function is not selected.
3. Valid when Pr. 96 = 6 or 7. (When Pr. 96 = 0 or 5, the CS terminal acts as the automatic restart after instantaneous power failure function.
4. When 9999 is set in Pr. 24 to 27 (multi-speeds 4 to 7) when Pr. 96 = 0 or 5, speeds 4 to 7 are invalid.
5. The multi-speeds override the main speeds (across terminals 2-5, 4-5, 1-5).
6. The selection of the 12-bit digital speed input (inverter with the FR-EPA or EPE) makes the above list invalid. (The 12-bit digital speed input has the highest priority.) (Note that the CS terminal is valid.)
7. Jog operation has higher priority than the above list.

- **Function list (The following features function in the external operation mode.)**

Pr. 96	Load Based Frequency Control (CS)	Stop-on-Contact Control (RL, RT)	Multi-Speed (Speed 7) (RH, RM, RL)	Automatic Restart after Instantaneous Power Failure (CS)
0	×	×	O	O
5	×	O	O	O
6	O	×	O	×
7	O	O	O	×

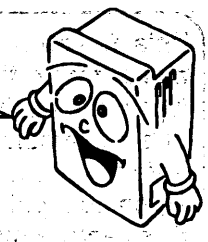
O: Indicates that the feature is valid.

Restrictions on setting of 5, 6 or 7 in Pr. 96
Under the following conditions, the functions available when 5, 6 or 7 is set in Pr. 96 are not valid:
- PU operation
- Programmed operation
- PU + external combined operation
- PI control (with FR-EPD or EPH inboard option)
- Remote setting function mode
- Orientation control (with FR-EPA inboard option)
- Jog operation (PU or external operations)

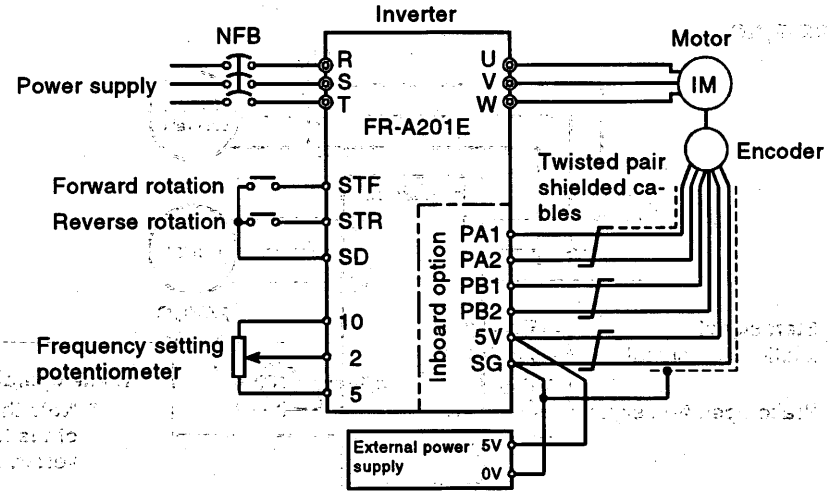
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4.11 DETECTED SPEED CORRECTION FOR PLG FEEDBACK CONTROL

When the inboard option (FR-EPA, EPB, EPC) is used with the inverter for PLG feedback control, this function converts and corrects the number of pulses from a speed detector (encoder) of that is not 1024PPR to 1024PPR.



4.11.1 Wiring Example



When a motor with brake is used, brake release timing must be noted.

4.11.2 Operation

By setting the conversion factor K found by the following formula in Pr. 84, control is possible when a non-1024PPR encoder is used.

K = 1024/N
where, N = number of pulses of the speed detector used [PPR]

Example: When a 500PPR encoder is used, set 2.048 (=1024/500) in Pr. 84.

Note : Pr. 84 is inaccessible when the inboard option (FR-EPA, EPB, EPC) is not fitted to the inverter.

4.11.3 Specifications

The speed of the detected encoder input signal is multiplied by the factor to make correction.

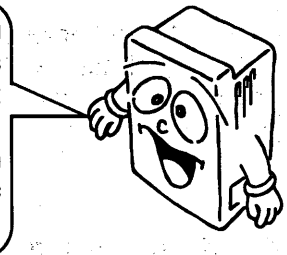
Parameter Number	Description	Setting Range	Minimum Setting Increment	Factory Setting	Remark
84	PLG detection speed correction factor	0 to 10	0.001	0	0: No correction

Note : The number of motor poles must be set in Pr. 37 "speed display".
Example: For a 4-pole motor, set 4 in Pr. 37.

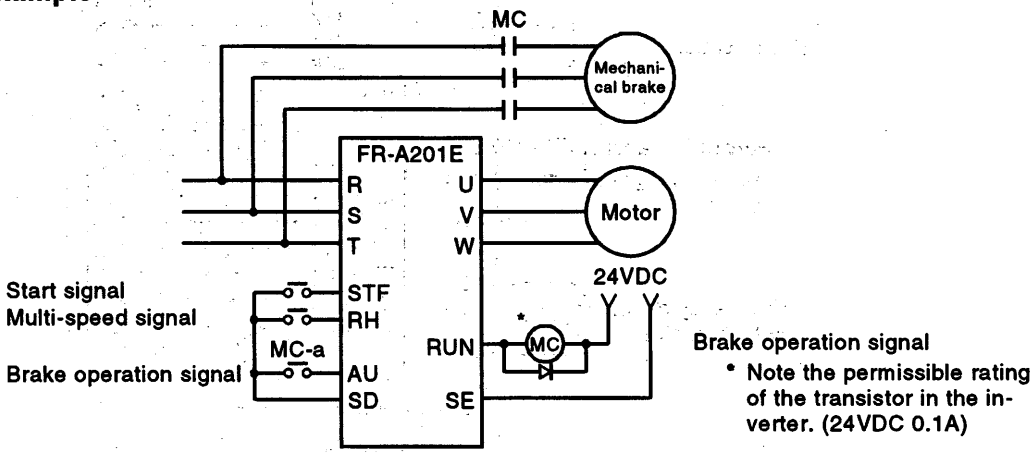
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4.12 BRAKE SEQUENCE

This function of the inverter outputs a mechanical brake operation timing signal for vertical motion applications. This function allows safe operation as it prevents a drop during start due to a mechanical brake operation timing fault or an overcurrent alarm at a stop.
This feature may be used whether a mechanical brake operation confirmation signal is input to the inverter or not. This function is valid only when magnetic flux vector control is selected.



4.12.1 Wiring Example



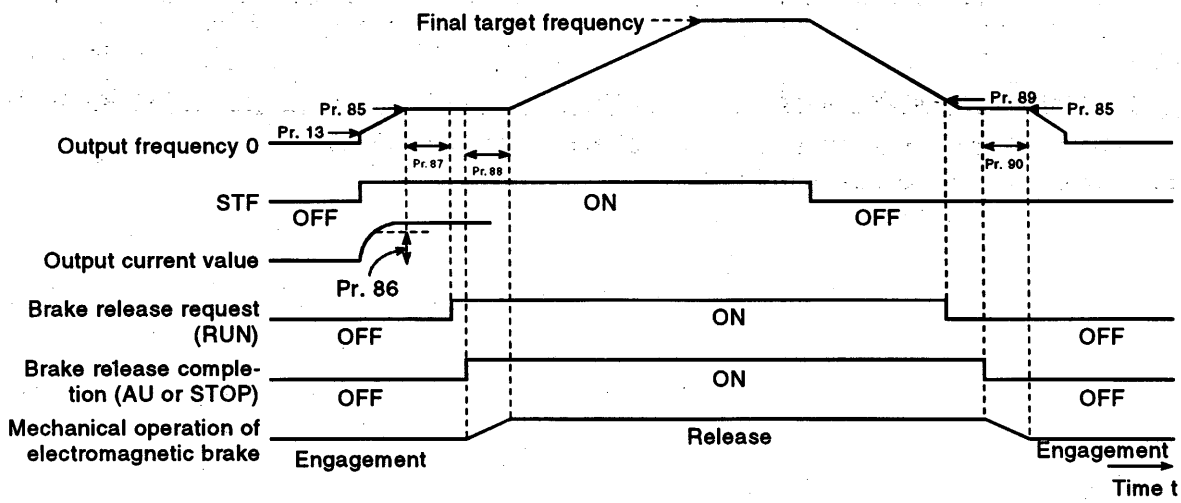
4.12.2 Operation Example

- At start : When the start signal is input to the inverter, the starting frequency is output. On arrival at a given frequency (Pr. 85), the inverter outputs the brake release signal (RUN).
  In a given time (Pr. 88) after the input of the brake operation completion signal (AU or STOP) (Note), the output frequency is increased to the preset speed.
- At stop : When the inverter has decelerated to a given frequency (Pr. 89), the brake release signal (RUN) is switched off. In a given time (Pr. 90) after the brake operation signal (AU or STOP) (Note) has switched off, the inverter output is switched off.

  Note: When the mechanical brake operation confirmation signal is not input, the brake operation completion signal is replaced by the brake release signal.

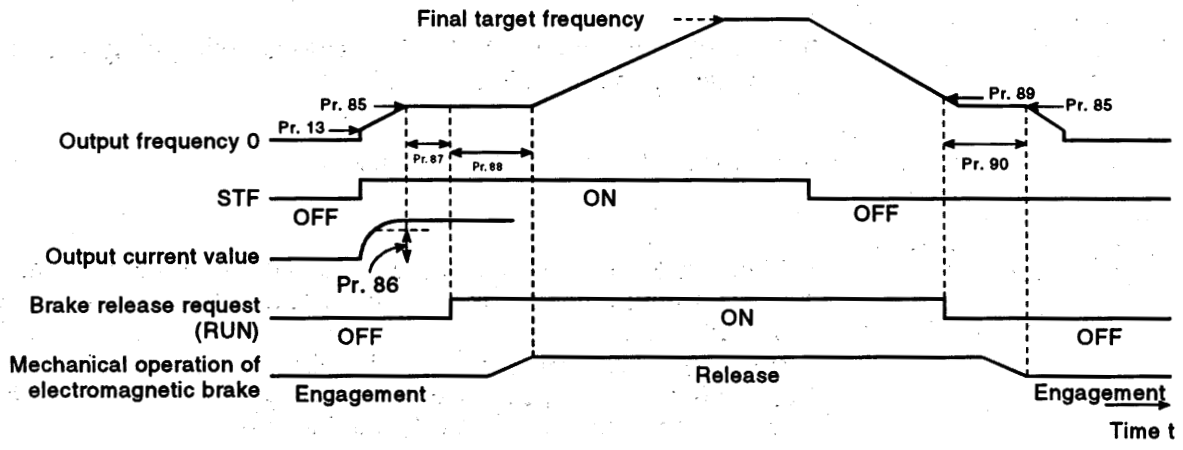
* This function is valid when 7 or 8 is set in Pr. 60 "intelligent mode selection", the inverter in the external operation mode, and magnetic flux vector control is selected.

1) When the brake sequence function is selected by setting 7 in Pr. 60 and the mechanical brake operation confirmation signal is input



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2) When the brake sequence function is selected by setting 8 in Pr. 60 and the mechanical brake operation confirmation signal is not input



4.12.3 Setting

(1) Select magnetic flux vector control. (Refer to page 14-1.)
(2) Set "7" or "8" in Pr. 60 "intelligent mode selection". (See below.)
Note that when 7 or 8 is set in Pr. 60, automatic restart after instantaneous power failure does not function. (Pr. 57 and 58 do not function.)

Pr. 60	Description
7	Brake sequence is selected and the mechanical brake operation confirmation signal is input.
8	Brake sequence is selected and the mechanical brake operation confirmation signal is not input.

Note: To ensure more positive brake sequence control, it is recommended to set 7 in Pr. 60 (mechanical brake operation confirmation signal input).

(3) Refer to the following function explanations and set the parameters:

- **Parameter setting**

Parameter Number	Description	Setting Range	Minimum Setting Increment	Factory Setting	Remarks
30	Brake sequence error display erasure	0	—	0	0: No error
60	Intelligent mode selection	0 to 8	1	0	7, 8: Brake sequence
85	Brake release frequency	0 to 30Hz	0.01Hz	3Hz	May be set only when Pr. 89 ≥ Pr. 85.
86	Brake release current	0 to 200%	0.1%	50%	Rated inverter current = 100%
87	Brake release current detection time	0 to 2 seconds	0.1 seconds	0.3 seconds	
88	Brake operation time at start	0 to 5 seconds	0.1 seconds	0.3 seconds	
89	Brake engagement frequency	0 to 30Hz	0.01Hz	6Hz	May be set only when Pr. 89 ≥ Pr. 85.
90	Brake operation time at stop	0 to 5 seconds	0.1 seconds	0.3 seconds	
91	Deceleration detection function selection	0.1	1	0	0: Not selected, 1: Selected
92	Brake release completion signal selection	0.1	1	0	0: AU, 1: STOP. Valid only when Pr. 60 = 7.
93	Overspeed detection frequency	0 to 30Hz, 9999	0.01Hz	9999	9999: Overspeed is not detected.

- Pr. 85 to 91 are accessible and valid when Pr. 60 = 7 or 8, and Pr. 92 is accessible and valid when Pr. 60 = 7. (Pr. 85 to 92 are valid in the ordinary mode.)
Pr. 93 is accessible and valid when Pr. 60 = 7 or 8, the inverter is fitted with the FR-EPA, EPB or EPC inboard option, and Pr. 105 ≠ 9999.

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Pr. 85 "brake release frequency"	Set (rated motor slip frequency) + about 1.0Hz.
Pr. 86 "brake release current"	If this setting is too low, the load is liable to gravity-drop at start. Generally, set about 50% to 90%.
Pr. 87 "brake release current detection time"	Generally, set about 0.1 to 0.3 seconds.
Pr. 88 "brake operation time at start"	• When Pr. 60 = 7 (the mechanical brake operation confirmation signal is input), set mechanical delay time until when the brake is released. • When Pr. 60 = 8 (the mechanical brake operation confirmation signal is not input), set (mechanical delay time until when the brake is released) + about 0.1 to 0.2 seconds.
Pr. 89 "brake engagement frequency"	Generally, set (Pr. 85 setting) + 3 to 4Hz.
Pr. 90 "brake operation time at stop"	• When Pr. 60 = 7 (the mechanical brake operation confirmation signal is input), set (mechanical delay time until when the brake is engaged) + 0.1 seconds. • When Pr. 60 = 8 (the mechanical brake operation confirmation signal is not input), set (mechanical delay time until when the brake is engaged) + about 0.2 to 0.3 seconds.
Pr. 91 "deceleration detection function selection"	• When deceleration is not normal during deceleration operation with 1 set in Pr. 91, the inverter results in an alarm (display: E.OPT, definition: Pr. 30 = 2), the output is shut off, and the brake release request (RUN terminal) is switched off. • When 0 is set in Pr. 91, the alarm is not output.
Pr. 92 "brake release completion signal selection"	Used to select the brake release completion signal input terminal. (For full information, refer to page 22-1.)
Pr. 93 "overspeed detection frequency"	When (detected frequency) - (output frequency) goes larger than the Pr. 93 setting during PLG feedback control, the inverter results in an alarm (display: E.OPT, definition: Pr. 30 = 1), the output is shut off, and the brake release request (RUN terminal) is switched off.

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4.12.4 Terminals Used

Terminal	In Ordinary Mode	In Brake Sequence Mode				
		Pr. 60 = 7 (with mechanical brake confirmation signal)				Pr. 60 = 8 (without mechanical brake confirmation signal)
RUN	Inverter running	Brake release request				Brake release request
AU	Current input selection	Pr. 92=0	Brake release completion signal	Pr. 92=1	Current input selection	Current input selection
STOP	Start self-holding selection		Start self-holding selection		Brake release completion signal	Start self-holding selection

* Brake release completion (AU or STOP terminal)
Set Pr. 92 "brake release completion signal selection" to make the brake release completion signal terminal selectable.

(1) When Pr. 92 = 0, the brake release completion signal is input to the AU terminal. 4 to 20mA DC current input cannot be used for operation. (Pr. 904 and Pr. 905 are invalid.)

(2) When Pr. 92 = 1, the brake release completion signal is input to the STOP terminal. The start self-holding function is deactivated.

Hence, +

Note: 1. Pr. 92 is accessible and valid when Pr. 60 = 7.

2. When 0 is set to each digit of Pr. 40 (output terminal assignment), the standard RUN signal is output from each terminal.

4.12.5 Protective Function

If any of the following faults occurs in the brake sequence mode, the inverter results in an alarm, the output is shut off, and the brake release command (RUN terminal) is switched off.
On the inverter LED and PU02 screen, "E.OPT (inboard option alarm)" is displayed.
The details of the alarm can be confirmed on the display of Pr. 30 "brake sequence error display erasure".

Pr. 30 Display	Description
1	Indicates that (detected frequency) - (output frequency) go larger than the Pr. 93 setting during PLG feedback control. (Overspeed detection frequency)
2	Indicates that deceleration is not normal in deceleration operation during PLG feedback control. (Set Pr. 91 to select whether this function is activated or not.) (Except stall prevention operation)
3	Indicates that the brake release command (RUN terminal) was switched on during a motor stop. (Gravity-drop prevention function)
4	Indicates that the brake release request signal is not switched on more than 2 seconds after the input of the operation command (forward or reverse rotation).
5	Indicates that the brake release completion signal is not switched on more than 2 seconds after the brake release request signal is switched on.
6	Indicates that the brake release completion signal was switched off midway though the inverter switched on the brake release request.
7	Indicates that the brake release completion signal is not switched off more than 2 seconds after the brake release request signal was switched off at a stop.

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MEMO

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5. PROTECTIVE FUNCTIONS

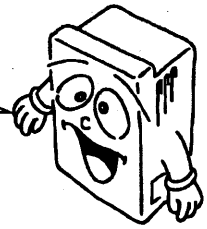
This chapter presents detailed information on the "protective functions" of the FR-A201E "inverter with built-in power return function".
Always read the precautions and instructions in this chapter before using the equipment.

5.1 ALARMS ..... 23 – 1
5.2 TROUBLESHOOTING ..... 24 – 1
5.3 MAINTENANCE AND INSPECTION ..... 25 – 1

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5.1 ALARMS

If any fault has occurred in the inverter, the corresponding protective function is activated to bring the inverter to an alarm stop and automatically give the corresponding alarm indication on the PU display and inverter LED. When the protective function is activated, reset the inverter in accordance with page 10-1.



5.1.1 Alarms

Display		Name		Description	Alarm Code	Alarm Output (Across B-C)
Parameter Unit	Inverter LED					
OC During Acc	E.OC 1	During acceleration	Overcurrent shut-off	If the inverter output current reaches or exceeds 200% of the rated current, the protective circuit is activated to stop the inverter. When any main circuit device is overheated, the protective circuit is also activated to stop the output of the inverter.	1	Provided (Open)
Stedy Spd Oc	E.OC2	During constant speed			2	
Oc During Dec	E.OC3	During deceleration During stop			3	
Ov During Acc	E.Ou 1	During acceleration	Regenerative overvoltage shut-off	If the converter output voltage is excessive due to the regenerative energy from the motor, the protective circuit is activated to stop the transistor output. This may also be activated by a surge voltage generated in the power supply system.	4	Provided (Open)
Stedy Spd Ov	E.Ou2	During constant speed				
Ov During Dec	E.Ou3	During deceleration During stop				
Motor Overload	E.THM (Motor protection)	Overload shut-off (electronic overcurrent protection)		The electronic overcurrent protection in the inverter detects inverter overload or motor overheat and activates the protective circuit to stop the inverter output. When a multi-pole motor or more than one motor is driven, for example, the motor(s) cannot be protected by the electronic overcurrent protection. Provide a thermal relay in the inverter output circuit. In this case, setting the electronic overcurrent protection value to 0A activates the inverter protection only. (Activated at a current 150% or more of the rated current.)	5	Provided (Open)
Inv. Overload	E.THT (Inverter protection)				6	
Inst. Pwr. Loss	E. IPF	Instantaneous power failure protection		If an instantaneous power failure has occurred in excess of 15msec (this applies also to inverter input power shut-off), this function is activated to stop the inverter output. (If the power failure is within 15msec, the control circuit operates without fault. If the power failure persists for more than about 100msec, the protective circuit is reset.)	7	Provided (Open)
Under Voltage	E.Uvt	Undervoltage protection		If the inverter power supply voltage has dropped, the control circuit cannot operate properly, resulting in the decrease in motor torque and/or the increase in heat generation. To prevent this, if the power supply voltage drops below about 150V (300V for the 400V series), this function stops the inverter output.	8	Provided (Open)
Br. Cct. Fault	E. bE	Power return circuit alarm detection		When the power return circuit is faulty or the regenerative electronic thermal relay or other error has occurred, this error display is output and the inverter output is stopped.	A	Provided (Open)
Ground Fault	E. GF	Output side ground fault overcurrent protection		If a ground fault current has flown due to a ground fault occurring in the output (load) side of the inverter, this function stops the inverter output. A ground fault occurring at low ground resistance may activate the overcurrent protection (OC1 to OC3).	B	Provided (Open)
OH Fault	E.OHT	External thermal relay operation		If the external thermal relay for motor overheat protection or the internally mounted temperature relay in the motor has been switched on (relay contacts open), this function stops the inverter output and keeps it stopped. This protection is only provided when "1" or "3" has been set in Pr. 17 "external thermal relay input function".	C	Provided (Open)

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Display		Name	Description	Alarm Code	Alarm Output (Across B-C)
Parameter Unit	Inverter LED				
OL is shown (during motor rotation) / Stll Prev STP (at a motor stop)	E.OLT (Indicates a stop due to the activation of the function for a long time during constant-speed operation)	Acceleration/constant-speed stall prevention current limit	If a current greater than 150% of the rated inverter current flows in the motor during acceleration, this function stops the increase in frequency until the load current reduces to prevent the inverter from resulting in overcurrent trip. If a current greater than 150% of the rated inverter current flows during constant-speed operation, this function also lowers the frequency until the load current reduces to prevent the inverter from resulting in overcurrent trip. When the load current has reduced below 150%, this function increases the frequency again and accelerates up to the set speed or continues operation.	D	(Not provided. Provided by EOLT display.) (Open)
		Deceleration stall prevention	If the brake operating amount has exceeded the specified value due to excessive regenerative energy during motor deceleration, this function stops the decrease in frequency to prevent the inverter from resulting in overvoltage trip. As soon as the regenerative energy has reduced, this function reduces the frequency again and continues deceleration.		
Option Fault	E.OPT	Inboard option connection alarm	Stops the inverter output if the dedicated option used in the inverter results in connection (connector) fault during operation.	E	Provided (Open)
Corrupt Memory	E. PE	Parameter storage device alarm	Stops the output if a fault in the EPROM which stores the function set values has occurred.	F	Provided (Open)
Retry No. Over	E.rET	Retry count exceeded	If operation cannot be resumed within the number of retry times set, this function stops the inverter output.	F	Provided (Open)
CPU Fault	E.CPU	CPU error	If the operation of the built-in CPU does not end within a predetermined period of time, the inverter self-determines it as alarm and stops the output.	F	Provided (Open)
PU Leave Out	E.PUE	Parameter unit disconnection	Stops the inverter output if the parameter unit is disconnected. This protective function is activated when "2" or "3" has been set in Pr. 75 "reset selection/PU disconnection detection".	F	Provided (Open)

Note: When Pr. 60 = 7 or 8, refer to page 22-4.

- **To know the operating status at the occurrence of alarm**
  When any alarm has occurred, the display automatically switches to the indication of the corresponding protective function (error). By pressing the [MONITOR] key at this point without resetting the inverter (see page 10-1), 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. These values are not stored in memory and are erased when the inverter is reset.

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5.1.2 Digital and Actual Characters

The alphanumeric characters and actual characters given in the display examples of this manual.

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

Actual	Digital
A	
B	
C	
E	
F	
G	
H	
I	
J	
L	

Actual	Digital
M	
N	
O	
P	
T	
U	
V	
r	
-	

5.1.3 Alarm History (History of Alarm Definitions)

Up to eight most recent alarms (alarm definitions) are stored in memory. To check these, use the help function. For more information, see "5 ALARM HISTORY" on page 7-13.

5.1.4 Erasing the Alarm History (History of Alarm Definitions)

To erase the alarm history (history of alarm definitions), use the help function. For more information. For more information, see "6 ALARM HISTORY CLEAR" on page 7-13.

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5.1.5 Alarm Code Output

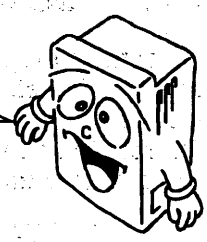
By setting Pr. 76 (alarm code output selection), an alarm definition can be output as a 4-bit digital signal. This signal is output from the open collector output terminals equipped as standard on the inverter.
Correlation between alarm definitions and alarm codes are as follows. In the table, "0" indicates that the output transistor is off and "1" on (common terminal: SE).

Alarm Definition (Protective Function)		Inverter LED Display	Output Terminal Signal On/Off				Alarm Code
			SU	IPF	OL	FU	
Normal operation		—	0	0	0	0	0
Overcurrent shut-off	During acceleration	E.OC1	0	0	0	1	1
	During constant-speed operation	E.OC2	0	0	1	0	2
	During deceleration	E.OC3	0	0	1	1	3
Regenerative overvoltage shut-off		E.OV1 to 3	0	1	0	0	4
Electronic overcurrent protector	Motor protection	E.THM	0	1	0	1	5
	Inverter protection	E.THT	0	1	1	0	6
Instantaneous power failure		E.IPF	0	1	1	1	7
Undervoltage		E.UVT	1	0	0	0	8
Power return circuit alarm		E. BE	1	0	1	0	A
Output side ground fault/overcurrent		E. GF	1	0	1	1	B
External thermal relay operation		E.OHT	1	1	0	0	C
Stall-activated stop		E.OLT	1	1	0	1	D
Inboard option alarm		E.OPT	1	1	1	0	E
Parameter storage device alarm		E. PE	1	1	1	1	F
Retry count exceeded		E.RET					
CPU error		E.CPU					
Parameter unit disconnection		E.PUE					

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5.2 TROUBLESHOOTING

If any function of the inverter is lost due to a fault, establish the cause and make adjustments in accordance with the following inspection procedure. Contact your sales representative if the corresponding fault is not found below, the inverter has failed, a part has been damaged, or any other fault has occurred.



5.2.1 Checking the Parameter Unit Display

The display of the parameter unit is switched as follows to indicate the cause of a faulty operation.

Display		Cause of Fault	Check Point	Remedy
Parameter Unit	Inverter LED			
OC During Acc	OC1 : Overcurrent during acceleration	Main circuit device overheat	Acceleration too fast? Check for output short circuit or ground fault. Check for cooling fan stop.	Increase acceleration time. Change fan. Remove obstacle to cooling fan. (Note)
Stedy Spd Oc	OC2 : Overcurrent during constant speed		Sudden load change? Check for output short circuit or ground fault. Check for cooling fan stop.	Keep load stable. Change fan. Remove obstacle to cooling fan. (Note)
OC During Dec	OC3 : Overcurrent during deceleration		Deceleration too fast? Check for output short circuit or ground fault. Check for cooling fan stop. Mechanical brake of motor operate too fast?	Increase deceleration time. Change fan. Remove obstacle to cooling fan. (Note) Check brake operation.
Ov During Acc	OV1 : Overvoltage during acceleration	Overvoltage on DC bus (terminals P-N)	Acceleration too fast?	Increase acceleration time.
Stedy Spd Ov	OV2 : Overvoltage during constant speed		Sudden load change?	Keep load stable.
Ov During Dec	OV3 : Overvoltage during deceleration		Deceleration too fast?	Increase deceleration time. (Set deceleration time which matches load GD^2.) Reduce braking duty.
Motor Overload	THM: Overload alarm	Thermal relay for motor	Motor used under overload?	Reduce load. Increase motor and inverter capacities.
Inv. Overload	THT : Overload alarm	Thermal relay for inverter		
Inst. Pwr. Loss	IPF : Instantaneous power failure	Instantaneous power failure	Check the cause of instantaneous power failure.	
Under Voltage	UVT : Undervoltage	Drop of power supply voltage	Large-capacity motor started?	Check power system equipment such as power supply capacity.
Br. Cct. Fault	BE : Power return circuit alarm	Power return circuit alarm	Braking duty too large?	Reduce load GD^2. Reduce braking duty.
Ground Fault	GF : Ground fault overcurrent	Ground fault occurred in output circuit.	Check motor and cables for ground fault.	Remedy ground fault area.
OH Fault	OHT: External thermal relay operation	External thermal relay operated.	Check motor for overheat.	Reduce load and frequency of operation.
Stll Prev STP	OLT : Stall prevention	Stall prevention or current limit function activated too long.	Motor used under overload?	Reduce load. Increase motor and inverter capacities.
Option Fault	OPT : Inboard option connection alarm☆	Option and inverter connected improperly.	Check for loose connector.	Securely connect.
Corrupt Memry	PE : Parameter storage device alarm	Storage device (EEPROM) faulty.	Number of parameter write times too many?	Change inverter.
Retry No. Over	RET : Retry count exceeded	Operation could not be resumed within the number of retry times set.	Check cause of alarm occurrence.	
CPU Fault	CPU: CPU error	CPU malfunction		Change inverter.
PU Leave Out	PUE : Parameter unit disconnection	The PU has been disconnected from the connector.	Check that the PU is connected securely.	Securely install the PU.
PU to Inverter comms. Error Inv. Reset ON	0.00 (LED display OK)	•Reset signal ON •Loose connection between PU and inverter*1 •Communication circuit fault	•Check for miswiring to reset terminal. •Check for loose connector.	•Turn the reset signal off. •Securely connect. •Change inverter.
	Err. (LED display fault) Fr-A —	CPU malfunction *2		•Switch power off, then on. •Switch reset signal on, then off. •Change inverter.

Note: This alarm does not occur if the cooling fan stops, but it will occur to prevent the main circuit devices from overheating by the fan failure.

*1: The parameter unit display remains unchanged but operation may be performed in the external operation mode.

*2: If the alarm is kept displayed on the parameter unit LCD and unit LED after remedy, the internal circuit may be faulty. Consult your sales representative.

☆: When Pr. 60 = 7 or 8, refer to page 22-2.

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5.2.2 Faults and Check Points

Fault	Typical Check Point
Motor does not rotate.	(1) Checking the main circuit • Check that a proper power supply voltage is applied (inverter LED display is lit). • Check that the motor is connected properly. (2) Checking the input signals • Check that the start signal is present. • Check that both the forward and reverse rotation start signals are not present simultaneously. • Check that the frequency setting signal is not zero. • Check that the signal across terminals AU-SD is on when the frequency setting signal is 4 to 20mA. • Check that the output stop signal (across terminals MRS-SD) or reset signal (across RES-SD) is not on. (3) Checking the parameter set values • Check that the reverse rotation prevention (Pr. 78) is not set. • Check that the operation mode (Pr. 79) setting is correct. • Check that the bias and gain (Pr. 902 to Pr. 905) settings are correct. • Check that the starting frequency (Pr. 13) set value is not greater than the running frequency. • Check that various operational functions (such as three-speed operation), especially the maximum frequency, are not zero. (4) Checking the load • Check that the load is not too heavy and the shaft is not locked. (5) Others • Check that alarm code (such as E.OC1) is not displayed on the inverter LED.
Motor rotates in opposite direction.	• Check that the phase sequence of the output terminals U, V and W is correct. • Check that the start signals (forward rotation, reverse rotation) are connected properly.
Speed greatly differs from the set value.	• Check that the frequency setting signal is OK. (Measure the input signal level.) • Check that the following parameter set values are OK: Maximum frequency (Pr. 1), minimum frequency (Pr. 2), bias, gain (Pr. 902 to Pr. 905), base frequency voltage (Pr. 19) • Check that the input signal lines are not affected by external noise. (Use of shielded cables)
Acceleration/deceleration is not smooth.	• Check that the acceleration/deceleration time set value is not too short. • Check that the load is not too heavy. • Check that the torque boost set value is not too large to activate the current limit function.
Motor current is large.	• Check that the load is not too heavy. • Check that the torque boost (manual) set value is not too large.
Speed does not increase.	• Check that the maximum frequency set value is OK, i.e. it is not too small. • Check that the load is not too heavy. • Check that the torque boost set value is not too large to activate the current limit function.
Speed varies during operation.	(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. (3) Others • Check that the settings of the applied motor capacity (Pr. 80) and the number of applied motor poles (Pr. 81) are correct for the inverter capacity and motor capacity in magnetic flux vector control. • Check that the wiring length is within 30m in magnetic flux vector control. • Check that the wiring length is OK in V/F control. Remedy: Change the setting of special parameter 97 (Td compensation) to 0. This parameter is displayed only when 801 is set in Pr. 77. Note: Parameters Pr. 82 to 99, which are also displayed simultaneously when 801 is set in Pr. 77, must not be set to protect the inverter from damage.
"PU to inverter comms. error" is displayed on the PU screen.	• Check that the reset signal (terminals RES-SD) is not ON. • Check that the PU is connected securely.

Note: Pr. indicates a parameter.

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5.2.3 Protective Functions

When any of the protective functions has been activated, switch the power off, then on, or reset the inverter with the reset terminal (RES). (Inverter reset can also be executed in the PU help menu.)
Note: For the definitions of the alarm codes, see page 24-1.

Function	Description		Display		Alarm Code	Alarm Output
			Parameter Unit	Inverter LED		
Acceleration /constant-speed stall prevention current limit	If a current greater than 150% of the rated inverter current flows in the motor during acceleration, this function stops the increase in frequency until the load current reduces to prevent the inverter from resulting in overcurrent trip. If a current greater than 150% of the rated inverter current flows during steady (constant-speed) operation, this function also lowers the frequency until the load current reduces to prevent the inverter from resulting in overcurrent trip. When the load current has reduced below 150%, this function increases the frequency again and accelerates up to the set speed and continues operation.		OL is shown during motor rotation. Stll Prev STP is shown at a motor stop.	E.OLr (OLT) (Indicaes a stop due to the activation of the function for a long time during constant-speed operation.	D	Not provided. Provided by EOLT display.
Deceleration stall prevention	If the brake operating amount has exceeded the specified value due to excessive regenerative energy during motor deceleration, this function stops the decrease in frequency to prevent the inverter from resulting in overvoltage trip. As soon as the regenerative energy has reduced, this function reduces the frequency again and continues deceleration.					
Overcurrent shut-off	If the inverter output current reaches or exceeds 200% of the rated current, the protective circuit is activated to stop the inverter. When any main circuit device is overheated, the protective circuit is also activated to stop the inverter.	During acceleration	OC During Acc	E.OC 1	1	Provided
		During constant speed	Stedy Spd Oc	E.OC2	2	
		During deceleration	OC During Dec	E.OC3	3	
Regenerative overvoltage shut-off	If the converter output voltage is excessive due to the regenerative energy from the motor, the protective circuit is activated to stop the transistor output. This may also be activated by a surge voltage generated in the power supply system.	During acceleration	Ov During Acc	E.Ou 1	4	Provided
		During constant speed	Stedy Spd Ov	E.Ou2		
		During deceleration	Ov During Dec	E.Ou3		
Instantaneous power failure protection	If an instantaneous power failure has occurred in excess of 15msec (this applies also to inverter input power shut-off), this function is activated to stop the inverter output in order to prevent misoperation. At this time, the alarm output contacts are open (across B-C). (If the power failure is within 15msec, the control circuit operates without fault. If the power failure persists for more than about 100msec, the protective circuit is reset.)		Inst. Pwr. Loss	E.I PF (IPF)	7	Provided
Undervoltage protection	If the inverter power supply voltage has dropped, the control circuit cannot operate properly, resulting in the decrease in motor torque and/or the increase in heat generation. To prevent this, if the power supply voltage drops below about 150V (300V for the 400V series), this function stops the inverter output.		Under Voltage	E.Uur (UVT)	8	Provided
Power return circuit alarm detection	When the power return circuit is faulty or the regenerative electronic thermal relay or other error has occurred, this error display is output and the inverter output is stopped.		Br. Cct. Fault	E. bE (BE)	A	Provided
Overload shut-off (electronic overcurrent protection)	The electronic overcurrent protection in the inverter detects inverter overload or motor overheat and activates the protective circuit to stop the inverter output. When a multi-pole motor or more than one motor is driven, for example, the motor(s) cannot be protected by the electronic overcurrent protection. Provide a thermal relay in the inverter output circuit. In this case, setting the electronic overcurrent protection value to 0A activates the inverter protection only. (Activated at a current 150% or more of the rated current.)		Motor Overload	Motor protection E.THM (THM)	5	Provided
			Inv. Overload	Inverter protection E.THT (THT)	6	
Output side ground fault overcurrent protection	If a ground fault current has flown due to a ground fault occurring in the output (load) side of the inverter, this function stops the inverter output. A ground fault occurring at low ground resistance may activate the overcurrent protec-tion (OC1 to OC3).		Ground Fault	E. GF (GF)	B	Provided

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Function	Description	Display		Alarm Code	Alarm Output
		Parameter Unit	Inverter LED		
External thermal relay operation	If the external thermal relay for motor overheat protection or the internally mounted temperature relay in the motor has been switched on (relay contacts open), this function stops the inverter output and keeps it stopped. This protection is only provided when "1" or "3" has been set in Pr. 17 "external thermal relay input" function.	OH Fault	E.OHr (OHT)	C	Provided
Inboard option connection alarm	Stops the inverter output if the dedicated option used in the inverter results in connection (connector) fault. (Note)	Option Fault	E.OPr (OPT)	E	Provided
Parameter storage device alarm	Stops the output if a fault in the EEPROM which stores the parameter set values has occurred.	Corrupt Memry	E. PE (PE)	F	Provided
Retry count exceeded	If operation cannot be resumed within the number of retry times set, this function stops the inverter output.	Retry No. Over	E.rEr (RET)	F	Provided
CPU error	If the operation of the built-in CPU does not end within a predetermined period of time, the inverter self-determines it as alarm and stops the output.	CPU Fault	E.CPU (CPU)	F	Provided
Parameter unit disconnection	Stops the inverter output if the parameter unit is disconnected. This protective function is activated only when "2" or "3" has been set in Pr. 75 "reset selection/PU disconnection detection" function.	PU Leave Out	E.PUE (PUE)	F	Provided

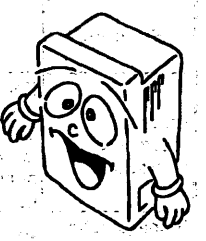
*: The stall prevention operation current can be set as needed. The factory setting is 150%.

Note: When Pr. 60 = 7 or 8, refer to page 22-2.

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5.3 MAINTENANCE AND INSPECTION

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



5.3.1 Precautions for Maintenance and Inspection

For 10 minutes after power is switched off, the smoothing capacitor remains at a high voltage. Before accessing the inverter for inspection, make sure that the charge lamp is off. (For the location of the charge lamp, see the terminal bock arrangement on page 27-8.)

5.3.2 Check Items

(1) Daily inspections

- Check the following:
  (1) Motor operation
  (2) Installation environment
  (3) Cooling system
  (4) Vibration and noise
  (5) Overheating and discoloration
- During operation, check the inverter input voltage using a tester.

(2) Periodic maintenance and inspection

- Check the areas inaccessible during operation and requiring period inspection.

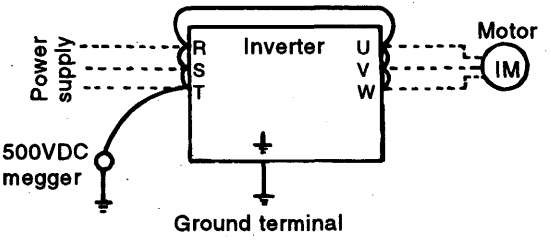
(1)	Cooling system.....	Clean the air filter, etc.
(2)	Screws and bolts.....	Check that they are securely tightened and retighten as necessary.
(3)	Conductors and insulating materials.....	Check for corrosion and damage.
(4)	Insulation resistance.....	Measure.
(5)	Cooling fan, smoothing capacitor, relay....	Check and change if necessary.

Note: Have a proper understanding of the definitions of power and alarm indications provided for the transistorized inverter. Also, have a understanding of the settings of electronic overcurrent protection, etc. and record proper set values. (Enter the values into the Customer Set Value section of the "Parameter List" on page 9-1.)

See the next page for the Inspection List.

(3) Insulation resistance test using megger

(1) Before performing the insulation resistance test using a megger on the external circuit, disconnect the cables from all terminals of the inverter so that the test voltage is not applied to the inverter.
(2) For the continuity test of the control circuit, use a tester (high resistance range) and do not use the megger or buzzer.
(3) For the inverter, conduct the insulation resistance test on the main circuit only as shown on the right and do not perform the test on the control circuit. (Use a 500VDC megger.)



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Daily and Periodic Inspection

Area of Inspection	Inspection Item	Description	Interval			Method	Criterion	Instrument
			Daily	Periodic				
				1 year	2 years			
General	Surrounding environment	Check ambient temperature, humidity, dust, dirt, etc.	O			See note on page 3-1.	Ambient temperature: −10°C to +50°C, non-freezing. Ambient humidity: 90% or less, non-condensing.	Thermometer, hygrometer, recorder
	Overall unit	Check for unusual vibration and noise.	O			Visual and auditory checks.	No fault.	
	Power supply voltage	Check that main circuit voltage is normal.	O			Measure voltage across inverter terminals R-S-T.	170 to 242V (323 to 506V) 50Hz 170 to 253V (323 to 506V) 60Hz	Tester, digital multimeter
Main circuit	General	(1) Check with megger (across main circuit terminals and ground terminal). (2) Check for loose screws and bolts. (3) Check for overheat on each part. (4) Clean.		O O O	O	(1) Disconnect all cables from inverter and measure across terminals R, S, T, U, V, W and ground terminal with megger. (2) Retighten. (3) Visual check.	(1) 5MΩ or more. (2), (3) No fault.	500VDC class megger
	Conductors, cables	(1) Check conductors for distortion. (2) Check cable sheaths for breakage.		O O		(1), (2) Visual check.	(1), (2) No fault.	
	Terminal block	Check for damage.		O		Visual check	No fault	
	Smoothing capacitor	(1) Check for liquid leakage. (2) Check for safety valve projection and bulge. (3) Measure electrostatic capacity.	O O	 O		(1), (2) Visual check. (3) Measure with capacity meter.	(1), (2) No fault. (3) 85% or more of rated capacity.	Capacity meter
	Relay	(1) Check for chatter during operation. (2) Check for rough surface on contacts.		O O		(1) Auditory check. (2) Visual check.	(1) No fault. (2) No fault.	
	Resistor	(1) Check for crack in resistor insulation. (2) Check for open cable.		O O		(1) Visual check. Cement resistor, wire-wound resistor. (2) Disconnect one end and measure with tester.	(1) No fault. (2) Error should be within ± 10% of indicated resistance value.	Tester, digital multimeter
Control circuit Protective circuit	Operation check	(1) Check balance of output voltages across phases with inverter operated independently. (2) Perform sequence protective operation test to make sure of no fault in protective and display circuits.		O O		(1) Measure voltage across inverter output terminals U-V-W. (2) Simulatively connect or disconnect inverter protective circuit output terminals.	(1) Phase-to-phase voltage balance within 4V (8V) for 200V (400V). (2) Fault must occur because of sequence.	Digital multimeter, rectifier type voltmeter
Cooling system	Cooling fan	(1) Check for unusual vibration and noise. (2) Check for loose connection.	O	 O		(1) Turn by hand with power off. (2) Retighten.	(1) Smooth rotation. (2) No fault.	
Display	Display	(1) Check for LED lamp blown. (2) Clean.	O	 O		(1) Lamps indicate indicator lamps on panel. (2) Clean with rag.	(1) Check that lamps are lit.	
	Meter	Check that reading is normal.	O			Check reading of meters on panel.	Must satisfy specified and management values.	Voltmeter, ammeter, etc.
Motor	General	(1) Check for unusual vibration and noise. (2) Check for unusual odor.	O O			(1) Auditory, sensory, visual checks. (2) Check for unusual odor due to overheat, damage, etc.	(1), (2) No fault.	
	Insulation resistance	Check with megger (across terminals and ground terminal).			O	Disconnect cables from U, V, W, including motor cables.	5MΩ or more.	500V megger

Note: The value for the 400V series is indicated in the parentheses.

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5.3.3 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 failure of the inverter. For preventive maintenance, the parts must be changed periodically.

(1) Cooling fan

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

(2) Smoothing capacitors

A large-capacity aluminum electrolytic capacitor is used for smoothing the DC in the main circuit, and an aluminum electrolytic capacitor is also used for stabilizing the control power in the control circuit. Their characteristics are adversely affected by ripple current, etc. When the inverter is operated in ordinary, air-conditioned environment, change the capacitors about every 5 years. When 5 years have elapsed, the capacitors will deteriorate more rapidly.
Check the capacitors at least every year (less than six months if the life will be expired soon).
Check the following:

1) Case (side faces and bottom face for expansion)
2) Sealing plate (for remarkable warp and extreme crack)
3) Explosion-proof valve (for excessive valve expansion and operation)
4) Appearance, external crack, discoloration, leakage. When the measured capacitance of the capacitor has reduced below 85% of the rating, change the capacitor. For capacitance measurement, it is recommended to use a handy device available on the market.

(3) Relays

To prevent a contact fault, etc., relays must be changed according to the number of accumulative switching times (switching life).
See the following table for the inverter parts replacement guide. Lamps and other short-life parts must also be changed during periodic inspection.

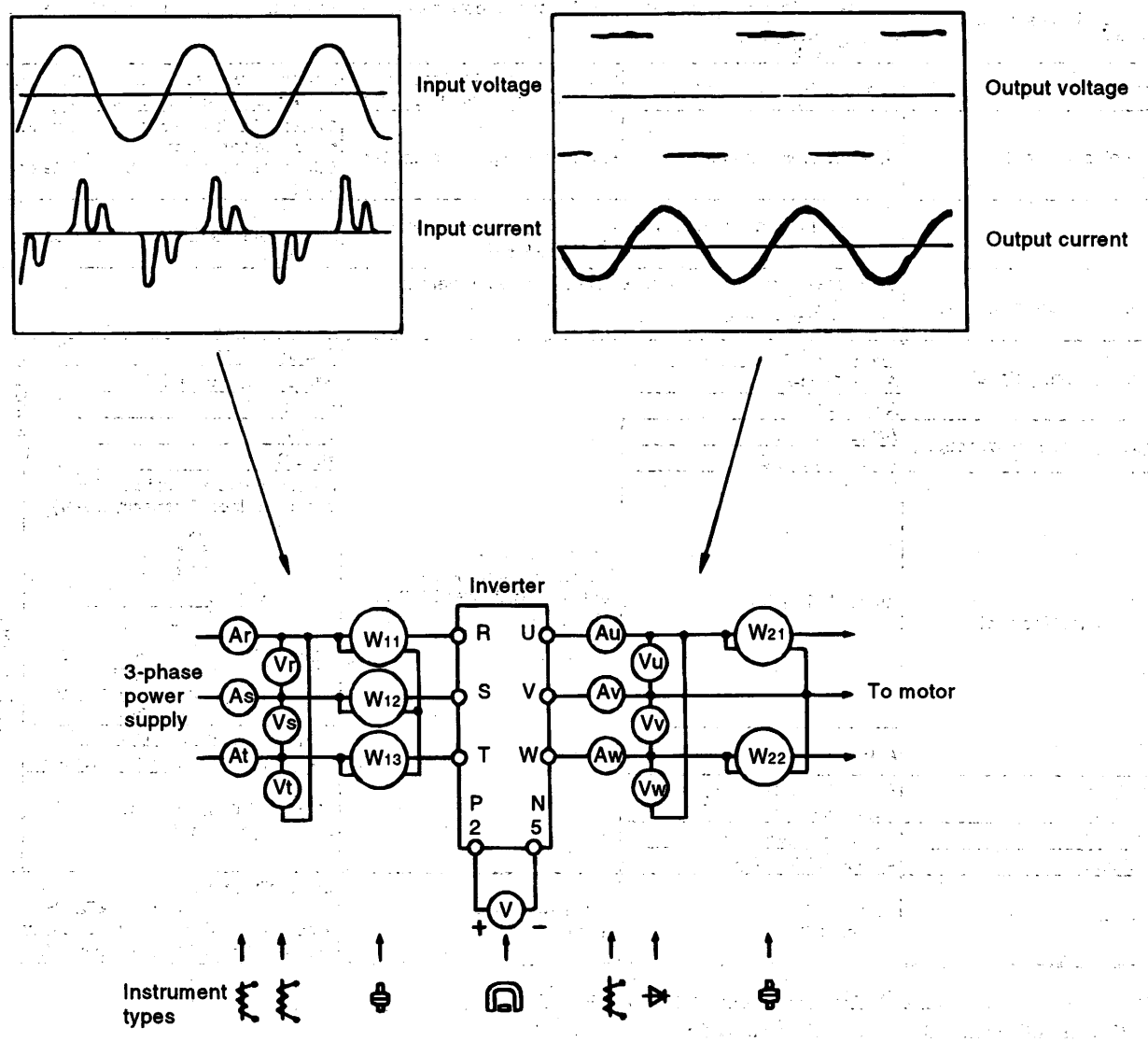
Replacement Parts of the Inverter

Part Name	Standard Replacement Interval	Description
Cooling fan	2 to 3 years	Change (as required)
Smoothing capacitor in main circuit	5 years	Change (as required)
Smoothing capacitor on control board	5 years	Change the board (as required).
Relays	—	Change as required.

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5.3.4 Measurement of Main Circuit Voltages, Currents and Powers

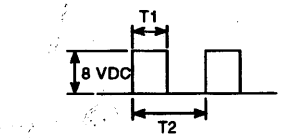
- **Measurement of voltages and currents**
  Since the voltages and currents on the inverter power supply and output sides include harmonics, accurate measurement depends on the instruments used and circuits measured.
  When instruments for commercial frequency are used for measurement, measure the following circuits using the instruments given on the next page.



Typical Measuring Points and Instruments

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Measuring Points and Instruments

Item	Measuring Point	Measuring Instrument	Remarks (Reference Measured Value) *
Power supply voltage V_1	Across R-S, S-T and T-R	Moving-iron type AC voltmeter	Commercial power supply 170 to 242V (342 to 506V) 50Hz 170 to 253V (342 to 506V) 60Hz
Power supply side current I_1	R, S and T line currents	Moving-iron type AC ammeter	
Power supply side power P_1	At R, S and T, and across R-S, S-T and T-R	Electrodynamic type single-phase wattmeter	$P_1=W_{11}+W_{12}+W_{13}$ (3-wattmeter method)
Power supply side power factor Pf_1	Calculate after measuring power supply voltage, power supply side current and power supply side power. $Pf_1=\frac{P_1}{\sqrt{3}V_1 \cdot I_1}\times 100\%$		
Output side voltage V_2	Across U-V, V-W and W-U	Rectifier type AC voltmeter (Note 1) (Not moving-iron type)	Difference between phases is within ± 1% of maximum output voltage.
Output side current I_2	U, V and W line currents	Moving-iron type AC ammeter	Current should be equal to or less than rated inverter current. Difference between phases is 10% or lower.
Output side power P_2	At U, V and W, and across U-V and V-W	Electrodynamic type single-phase wattmeter	$P_2 = W_{21} + W_{22}$ 2-wattmeter method (or 3-wattmeter method)
Output side power factor Pf_2	Calculate in similar manner to power supply side power factor. $Pf_2=\frac{P_2}{\sqrt{3}V_2 \cdot I_2}\times 100\%$		
Frequency setting signal	Across 2(+)-5	Moving-coil type (Tester, etc. may be used) (Internal resistance: 50kΩ or larger)	0 to 5V/0 to 10VDC
	Across 1(+)-5		0 to ± 5V/0 to ± 10VDC
	Across 4(+)-5		4 to 20mADC
Frequency setting power supply	Across 10(+)-5		5VDC
	Across 10E(+)-5		10VDC
			"5" is common.
Frequency meter signal	Across FM(+)-SD		Approx. 5VDC at maximum frequency (without frequency meter)  Pulse width T1: Adjusted by Pr.900 Pulse cycle T2: Set by Pr.55 (Valid for frequency monitoring only)
	Across AM(+)-5		Approx. 10VDC at maximum frequency (without frequency meter)
			SD is common.
Start signal Select signal	Across STF, STR, RH, RM, RL, JOG/OH, RT, AU-SD		20 to 30VDC when open. ON voltage: 1V or less
Reset	Across RES(+)-SD		
Output stop	Across MRS(+)-SD		
Alarm signal	Across A-C Across B-C	Moving-coil type (such as tester)	Continuity check <Normal> <Fault> Across A-C: Discontinuity Continuity Across B-C: Continuity Discontinuity

Note 1: Accurate data will not be obtained by a tester.
* Values in parentheses indicate those for 400V series.

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6. SELECTION INSTRUCTIONS

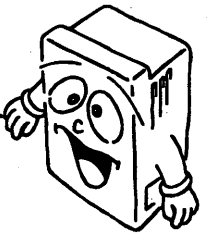
This chapter provides detailed information about "peripheral selection instructions" for the FR-A201E "inverter with built-in power return function".
Always read the precautions and instructions in this chapter before using the equipment.

6.1 INSTRUCTIONS FOR SELECTING PERIPHERALS.....26 – 1

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6.1 INSTRUCTIONS FOR SELECTING THE PERIPHERALS

With the spread of electronic equipment, problems due to noises and leakage tend to increase. Because of its operation principle, the inverter generates noises and may affect adjacent devices. The following noise reduction measures can be taken according to the place of installation, select peripheral devices as required.



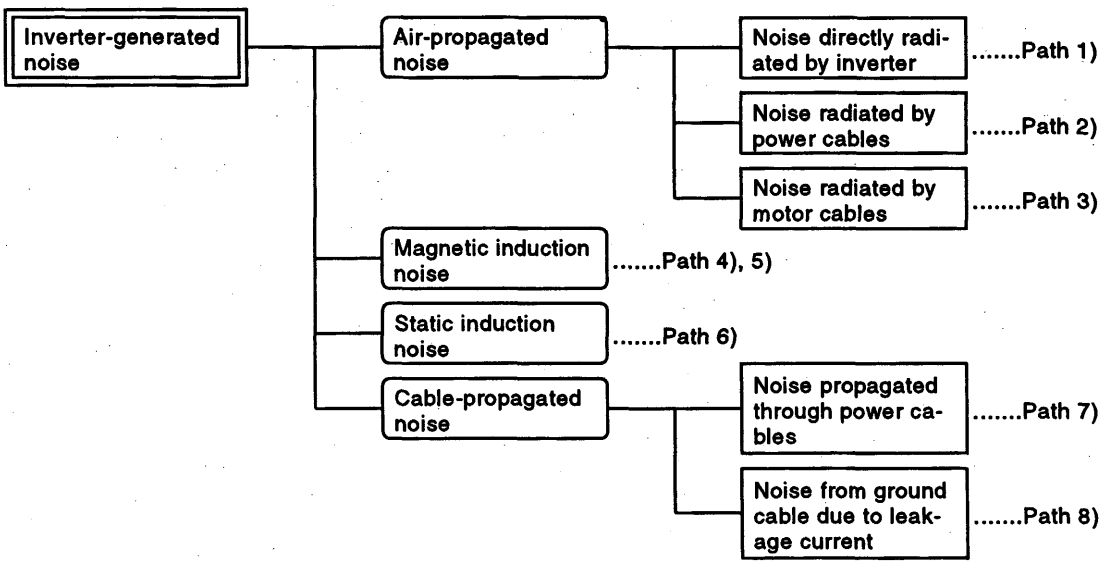
6.1.1 Electrical Noise

There are two types of electrical noise, external noise which cause malfunctioning of the inverter and those radiated from the inverter to cause malfunctioning of a peripheral device. Although the inverters are designed not to be influenced by noise the following general measures must be taken since the inverter is an electronic device which handles weak signals. In addition, since the inverter chops the output at high frequency, the inverter itself is a source of noise. If peripheral equipment is affected by the noise generated by the inverter, noise suppressing measures must also be taken. The noise suppressing measures differ depending on noise propagation route.

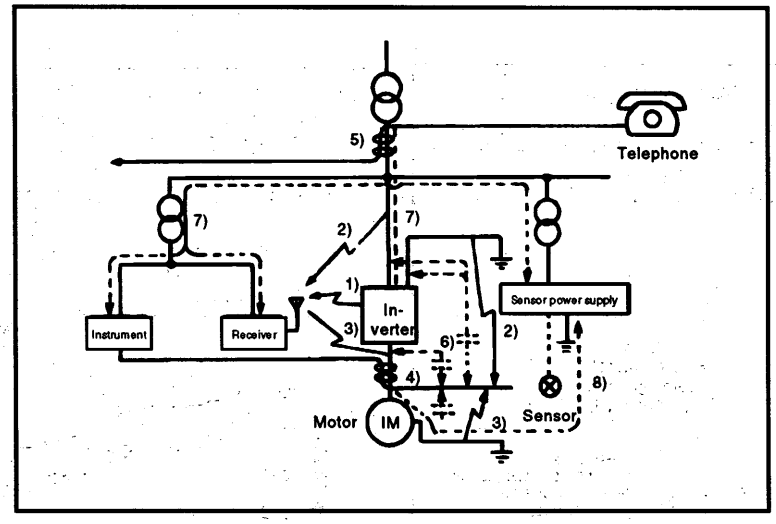
1) **Basic measures**
   - Do not run the power cables (I/O cables) and signal cables of the inverter in parallel with each other, do not bundle them.
   - Use twisted shield cables for control signal cables and connect the sheathes of the shield cables to terminal SD.
   - Ground the inverter, motor, etc. at one point (single point earth).

2) **Measures against external noise**
   When devices which generate noise (magnetic contactors, magnetic brakes, relays, for example) are installed near the inverter, the inverter may malfunction, the following measures must be taken:
   - Provide surge suppressors for devices that generate noise.
   - Fit line filters to signal cables.
   - Ground the shields of the control signal cables with a metal cable clamp.

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



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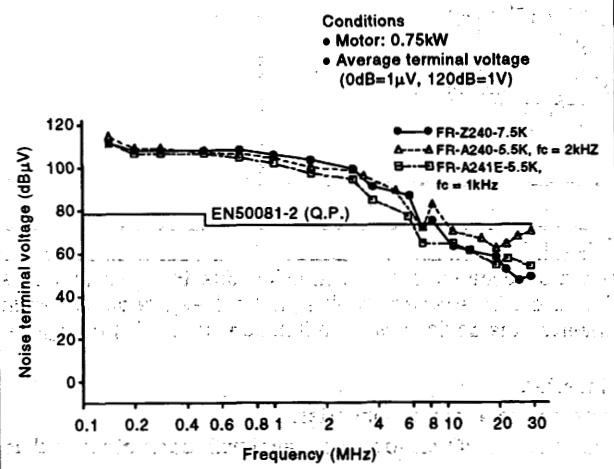


Noise Path	Measures
1), 2), 3)	When devices which handle low-level signals and are susceptible to malfunction due to noise (such as instruments, receivers and sensors) are installed near the inverter and their signal cables are contained in the same panel as the inverter or are run near the inverter,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

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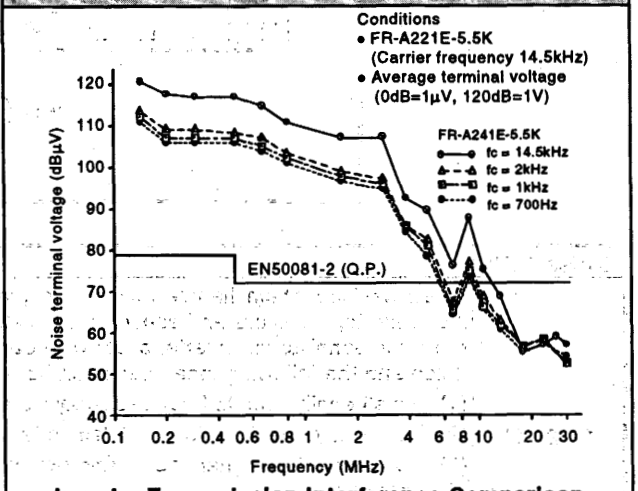
• Data example

By decreasing the carrier frequency, the noise terminal voltage* can be reduced.
When motor noise does not pose a problem, set the carrier frequency to a low value (1kHz) using Pr. 72.
When motor noise poses a problem, see the figure on the right.



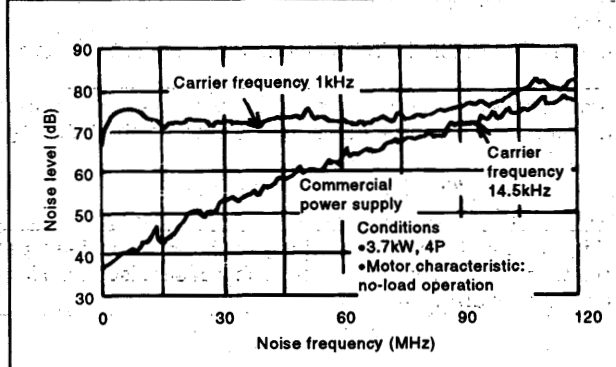
Inverter Transmission Interference Comparison (Quasi-peak values)

In the frequency band of AM radio broadcasting, fitting the FR-BIF on the input side provides a large effect.
The FR-BSF01 and FR-BLF reduce a noise terminal voltage in a wide frequency band, having effects on measures against the misoperation of sensors and the like.
As the measures against the malfunctioning of sensors and the like, also take the following measures against induction noises.



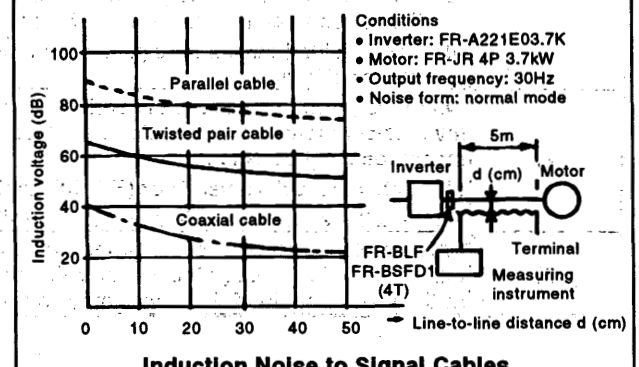
Inverter Transmission Interference Comparison (Quasi-peak values)

By increasing the carrier frequency of the inverter, motor noise reduces.
Since the motor-generated sound reduces at low speed, the motor can be run more silently by the inverter than by commercial power supply.



Relation between Carrier Frequency and Motor Noise

By using shield cables for signal cables, induction noise can be reduced greatly (1/10 - 1/100).
Induction noise can also be reduced by separating the signal cables from the inverter output cables. (Separation of 30cm reduces noise by 1/2-1/3.)
By fitting the FR-BSF01 or BLF on the inverter output side, induction noise to the signal cables can be reduced.

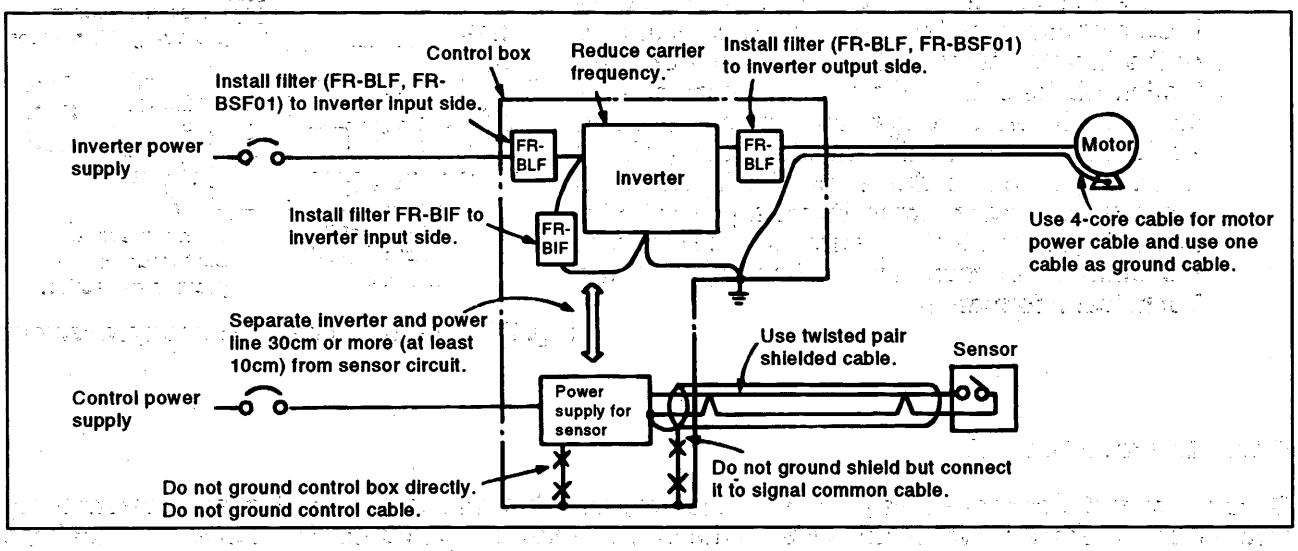


Induction Noise to Signal Cables by Inverter Output Cables

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

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- **Example of measures against noises**



6.1.2 Power Harmonics

The inverter may generate power harmonics from its converter circuit, affecting generators, power capacitors, etc. Power harmonics differ from noise and leakage currents in generation source, frequency band and transmission method. Take appropriate measures according to the following description:

- Differences between harmonics and noises are listed below:

Item	Harmonics	Noises
Frequency	Normally degrees 40 to 50, 3kHz or less	High frequency (several 10kHz to MHz order)
Environment	To line, power impedance	To space, distance, wiring path
Quantitative grasp	Theoretical calculation possible.	Random occurrence, quantitative grasp difficult.
Generated amount	Almost proportional to load capacity.	According to current fluctuation value (larger as switching speed increases)
Immunity of equipment affected	Specified in the standard of each device	Different according to manufacturer's equipment specifications.
Measure example	Install reactor (L).	Increase distance (l).

- **Reduction technique**

Harmonic currents generated on the power supply side by the inverter differ according to such conditions as the control mode (PWM, PAM), the presence/absence of the power factor improving reactor, and the output frequency and output current of the load.

The appropriate output frequency and output current would be found under the rated load at the maximum operating frequency. The following table lists harmonic current contents generated by the inverter under a 100% load:

Harmonic Current Contents (%)

Inverter Capacity	5.5K or More		
Harmonic Degree	Without ACL	With Power Factor Improving ACL	With Power Factor Improving DCL
Fundamental	86.5	96	95.5
5	44.5	24	26
7	21	9.5	10.5
11	6.5	3.7	7.1
13	5.2	3.5	5.2

Note: The square root value of each harmonic current is 100%.

Inverter Input Capacity (kVA)

Corresponding Mode / Output kW	FR-A201		
	Without ACL	With Power Factor Improving ACL	With Power Factor Improving DCL
5.5	12	9.0	8.5
7.5	17	12	11
11	20	17	16
15	28	22	20
18.5	34.5	27.5	25.5
22	41	33	31
30	52	44	41
37	66	54	51
45	80	66	62
55	100	80	75

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Note: The power factor improving capacitor and surge suppressor on the inverter output side may be heated or damaged by the harmonic components of the inverter output. Also, as overcurrent protection will be activated due to overcurrent flowing in the inverter, do not install a capacitor and surge suppressor in the inverter output circuit when the motor is driven by the inverter. To improve the power factor, insert a power factor improving reactor in the inverter primary circuit or DC circuit. For more information, refer to the Technical Information.

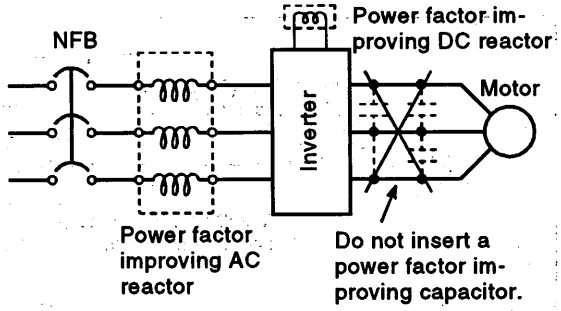


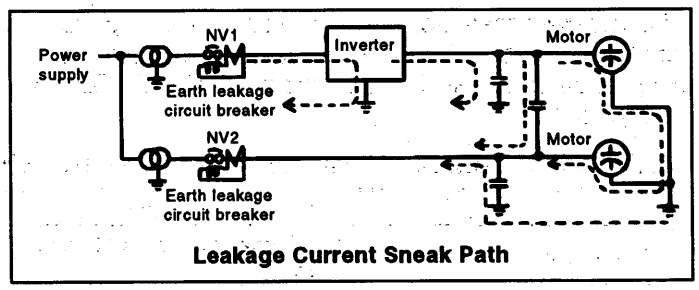
Fig. 5.2 Inverter Power Factor Improvement

6.1.3 Leakage Current

Because of static capacitances existing in the inverter I/O wiring and motor, leakage current flows through them. Since its value depends on the static capacitances, carrier frequency, etc., leakage current increases when the low-noise type inverter is used. In this case, take the following measures.

1) To-ground leakage current

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



Leakage Current Sneak Path

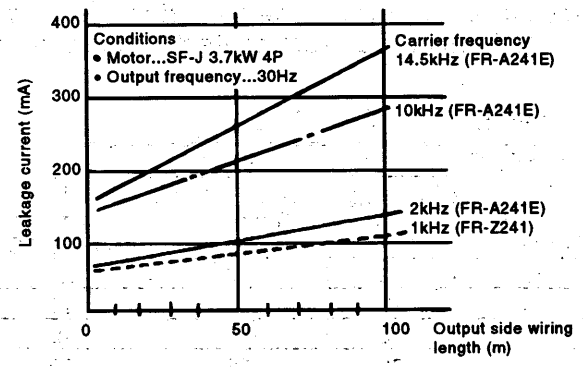
- **Measures**
  - Decrease the carrier frequency (Pr. 72) of the inverter. Note that motor noise increases.
  - By using earth leakage circuit breakers compatible with harmonics and surges (e.g. Mitsubishi's New Super NV series) in the inverter's own line and other line, operation can be performed with low noise (with the carrier frequency kept high).

    * For the selection of the earth leakage circuit breaker, refer to page 26-7.

*: For information on selecting the earth leakage circuit breaker, see page 176.

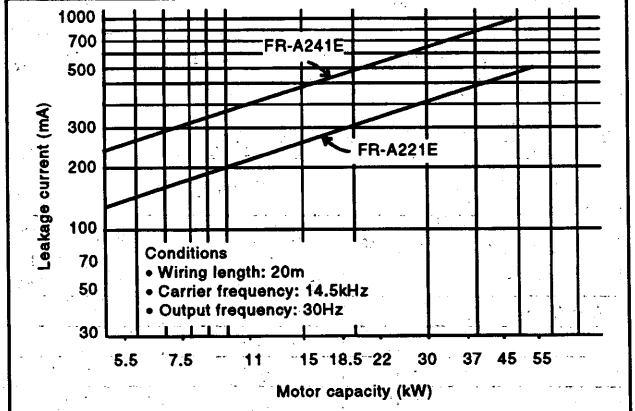
- **To-ground leakage current data example**

Note that long wiring length will increase leakage current. Decrease the carrier frequency of the inverter to reduce leakage current.



To-Ground Leakage Current versus Carrier Frequency and Wiring Length

Higher motor capacity leads to larger leakage current. Larger leakage current occurs in 400V class than in 200V class.

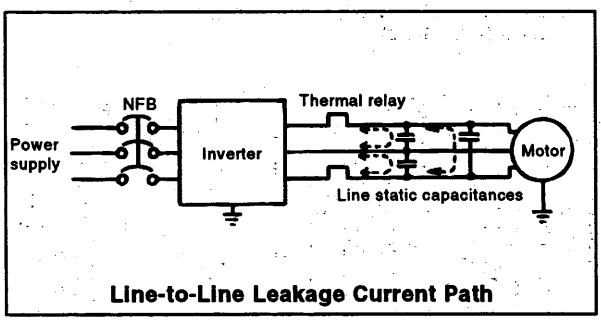


To-Ground Leakage Current versus Motor Capacity

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2) Line-to-line leakage current

Harmonics of the leakage current flowing in the static capacities between the inverter output cables may operate the external thermal relay unnecessarily. When the wiring length of a 400V class small-capacity model (especially 7.5kW or down) is long (50m or more), the external thermal relay is likely to operate unnecessarily because the ratio of the leakage current to the rated current of the motor increases.



Line-to-Line Leakage Current Path

• **Line-to-line leakage current data example (200V class)**

Motor Capacity (kW)	Rated Motor Current (A)	Leakage Current (mA)	
		Wiring Length 50m	Wiring Length 100m
5.5	19.4	490	680
7.5	25.6	535	725

• Motor SF-J 4P
• Carrier frequency: 14.5Hz
• Cable used: 2mm², 4-core cabtyre cable

• The leakage current of the 400V class is twice larger.

- **Measures**
  - Use the electronic overcurrent protection of the inverter.
  - Install a reactor (FR-BOL) in the output side.
  - Decrease the carrier frequency. Note that motor noise increases.

To protect the motor from the line-to-line leakage current, it is recommended to use a temperature sensor to directly detect the temperature of the motor.

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6.1.4 Selecting the Rated Sensitivity Current for the Earth Leakage Circuit Breaker

When using the earth leakage circuit breaker with the inverter circuit, select its rated sensitivity current as follows:

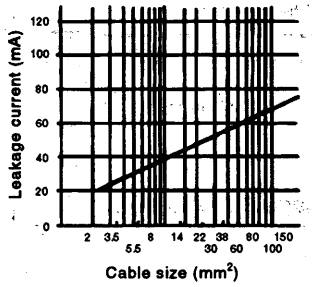
- New Super NV series (Type SF, CF)
  Rated sensitivity current: $I\Delta n \geq 10 \times (Ig_1 + Ig_2 + Igm)$
- Conventional NV series (Type CA, CS, SS)
  Rated sensitivity current: $I\Delta n \geq 10 \times \{Ig_1 + Ign + 3 \times (Ig_2 + Igm)\}$

Ig_1, Ig_2 : leakage currents of cable path during commercial power supply operation

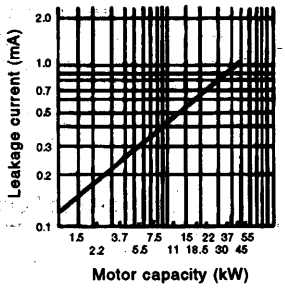
Ign^* : leakage current of noise filter on inverter input side

Igm : leakage current of motor during commercial power supply operation

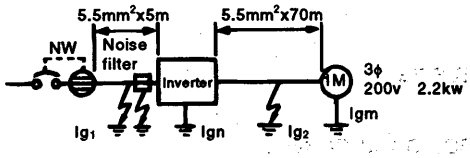
Leakage Current Example of Cable Path during Commercial Power Supply Operation When the CV Cable Is Routed in Metal Conduit (200V 60Hz)



Leakage Current Example of 3-Phase Induction Motor during Commercial Power Supply Operation (200V 60Hz)



<Example>



Note: 1. The NV should be installed to the power supply side of the inverter.

2. Ground fault in the output side of the inverter can be detected at the running frequency of 120Hz or lower.

3. In a Y connection neutral point grounded system, the sensitivity current is higher against ground fault in the inverter output side. Hence, the protective ground resistance of the load equipment should be 10Ω or less.

4. When the breaker is grounded on the output side of the inverter, it may be unnecessarily operated by harmonics if the effective value is less than the rating. In this case, note that the eddy current and hysteresis loss increase and temperature rises.

Selection Example
(for the diagram shown on the left) (mA)

	New Super NV	Conventional NV
Leakage current Ig1	$33 \times \frac{5m}{1000m} = 0.17$	
Leakage current Ign	0 (without noise filter)	
Leakage current Ig2	$33 \times \frac{70m}{1000m} = 2.31$	
Motor leakage current Igm	0.18	
Total leakage current	2.66	7.64
Rated sensitivity current (≥Igx10)	30	100

- For the leakage current value of the noise filter installed on the inverter input side, contact the corresponding filter manufacturer. (For Mitsubishi's dedicated filters, see pages 28-7 and 28-9.)

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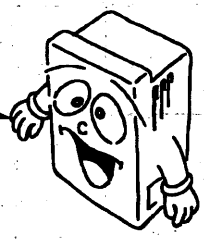
6.1.5 Peripheral Device List

Voltage	Motor Output (kW)	Applicable Inverter Type	No-Fuse Breaker (NFB) or Earth Leakage Circuit Breaker (NV)		Magnetic Contactor (MC)	Cables (mm^2)	
			Standard	With power Factor Improving Reactor		R,S,T	U,V,W
200V class	5.5	FR-A221E-5.5k	Type NF50, NV50 50A	Type NF50, NV50 40A	S-K25	5.5	5.5
	7.5	FR-A221E-7.5k	Type NF100, NV100 60A	Type NF50, NV50 50A	S-K35	14	8
	11	FR-A221E-11k	Type NF100, NV100 75A	Type NF100, NV100 75A	S-K50	14	14
	15	FR-A221E-15k	Type NF225, NV225 125A	Type NF100, NV100 100A	S-K65	22	22
	18.5	FR-A221E-18.5k	Type NF225, NV225 150A	Type NF225, NV225 125A	S-K80	30	30
	22	FR-A221E-22k	Type NF225, NV225 175A	Type NF225, NV225 150A	S-K95	38	30
	30	FR-A221E-30k	Type NF225, NV225 225A	Type NF225, NV225 175A	S-K125	60	50
	37	FR-A221E-37k	Type NF400, NV400 250A	Type NF225, NV225 225A	S-K150	80	80
	45	FR-A221E-45k	Type NF400, NV400 300A	Type NF400, NV400 300A	S-K180	100	80
	55	FR-A221E-55k	Type NF400, NV400 400A	Type NF400, NV400 350A	S-K220	150	125
400V class	5.5	FR-A241E-5.5k	Type NF30, NV30 30A	Type NF30, NV30 20A	S-K20	3.5	2
	7.5	FR-A241E-7.5k	Type NF30, NV30 30A	Type NF30, NV30 30A	S-K20	3.5	3.5
	11	FR-A241E-11k	Type NF50, NV50 50A	Type NF50, NV50 40A	S-K20	5.5	5.5
	15	FR-A241E-15k	Type NF100, NV100 60A	Type NF50, NV50 50A	S-K25	14	8
	18.5	FR-A241E-18.5k	Type NF100, NV100 75A	Type NF100, NV100 60A	S-K35	14	8
	22	FR-A241E-22k	Type NF100, NV100 100A	Type NF100, NV100 75A	S-K50	22	14
	30	FR-A241E-30k	Type NF225, NV225 125A	Type NF100, NV100 100A	S-K65	22	22
	37	FR-A241E-37k	Type NF225, NV225 150A	Type NF225, NV225 125A	S-K80	30	22
	45	FR-A241E-45k	Type NF225, NV225 175A	Type NF225, NV225 150A	S-K80	38	30
	55	FR-A241E-55k	Type NF225, NV225 200A	Type NF225, NV225 175A	S-K100	50	50

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6.1.6 Driving the 400V Class Motor by the Inverter

In a PWM type inverter, a micro surge voltage attributable to a wiring constant is generated at the motor terminals.
Especially for a 400V class motor, the micro surge voltage may deteriorate the motor insulation.
When a 400V class motor is driven by the inverter, consider the following measures:



- **Reduction technique**

It is recommended to take either of the following measures:

(1) Rectifying the motor insulation

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

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

(2) Suppressing the micro surge voltage from the inverter side

On the output side of the inverter, connect a filter which suppresses the micro surge voltage to make the terminal voltage of the motor 850V or less.
When the motor is to be driven by Mitsubishi inverter, connect the optional surge voltage suppressing filter (see page 28-10) on the output side of the inverter.

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7. SPECIFICATIONS

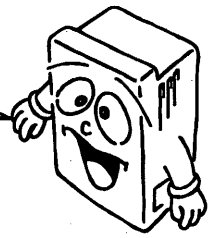
This chapter provides detailed information on the "specifications" of the FR-A201E "inverter with built-in power return function".
Always read the precautions and instructions in this chapter before using the equipment.

7.1 SPECIFICATIONS ..... 27 – 1
7.2 OPTIONS ..... 28 – 1

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7.1 SPECIFICATIONS

This section introduces specifications applied to the FR-A201E series.
The inverter must be used in accordance with the following specifications:



7.1.1 Standard Specifications

■ 200V Series

Type FR-A221E-[ ]		5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Applicable motor output (kW) *1		5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated capacity (kVA) *2	9.2	12.6	17.6	23.3	29	34	44	55	67	82
	Rated current (A)	24	33	46	61	76	90	115	145	175	215
	Overload current rating *3	150% 60 seconds, 200% 0.5 seconds (inverse-time characteristics)									
	Voltage *4	Three phase, 200 to 220V 50Hz, 200 to 230V 60Hz									
	Regenerative braking torque	100% continuous, 150% 60 seconds									
Power supply	Rated input AC voltage, frequency	Three phase, 200 to 220V 50Hz, 200 to 230V 60Hz									
	Permissible AC voltage fluctuation	170 to 242V 50Hz, 170 to 253V 60Hz									
	Permissible frequency fluctuation	±5%									
	Instantaneous voltage drop immunity	Operation is continued at more than 165V. At less than 165V, operation is continued for 15msec.									
	Power supply capacity (kVA) *5	12	17	20	28	34	41	52	66	80	100
Protective structure (JEM 1030)		Open type (IP00)									
Cooling system		Forced air cooling									
Approx. weight (kg)		23	23	34	37	52	52	63	85	87	120

■ 400V Series

Type FR-A241E-[ ]		5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Applicable motor output (kW) *1		5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated capacity (kVA) *2	9.1	13	17.5	23.6	29	32.8	43.4	54	65	84
	Rated current (A)	12	17	23	31	38	43	57	71	86	110
	Overload current rating *3	150% 60 seconds, 200% 0.5 seconds (inverse-time characteristics)									
	Voltage *4	Three phase, 380 to 460V 50Hz/60Hz									
	Regenerative braking torque	100% continuous, 150% 60 seconds									
Power supply	Rated input AC voltage, frequency	Three phase, 380 to 460V 50Hz/60Hz									
	Permissible AC voltage fluctuation	323 to 506V 50/60Hz *9									
	Permissible frequency fluctuation	±5%									
	Instantaneous voltage drop immunity	Operation is continued at more than 320V. At less than 320V, operation is continued for 15msec.									
	Power supply capacity (kVA) *5	12	17	20	28	34	41	52	66	80	100
Protective structure (JEM 1030)		Open type (IP00)									
Cooling system		Forced air cooling									
Approx. weight (kg)		24	24	37	37	48	48	63	85	85	120

Short Circuit Ratings
The drive is suitable for use on a Circuit Capable of delivering not more than ___*___ RMS Symmetrical Amperes, 500 volts Maximum.

kW (HP) rating	•
5.5 to 37 (7.5 to 50)	5.000
45, 55 (60, 75)	10.000

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Common Specifications

Control specification	Control system		Control specifications High carrier frequency sine-wave PWM control (V/F control or magnetic flux vector control can be selected)
	Output frequency range		0.2 to 400Hz
	Frequency setting resolution	Analog input	0.015Hz/60Hz (terminal 2 input: 12 bits/0 to 10V, 11bits/0 to 5V, terminal 1 input: 12 bits/–10 to +10V, 11 bits/–5 to +5V)
		Digital input	0.002Hz/60Hz (0.01Hz when PU is used)
	Frequency accuracy		Within ±0.2% of maximum output frequency (25°C±10°C)/analog input, within 0.01% of set output frequency/digital input
	Voltage/frequency characteristic		Base frequency set as required between 0 and 400Hz. Constant torque or variable torque pattern can be selected.
	Starting torque		150%/1Hz (for magnetic flux vector control)
	Torque boost		Manual and automatic torque boost
	Acceleration/deceleration time setting		0 to 3600 seconds (acceleration and deceleration can be set individually), linear or S-pattern acceleration/deceleration mode can be selected.
	DC dynamic brake		Operation frequency (0 to 120Hz), operation time (0 to 10 seconds), voltage (0 to 30%) variable
	Stall prevention operation level		Current limit can be set (0 to 200% variable), presence or absence can be selected.
Operational specifications	Frequency setting signal	Analog input	0 to 5VDC, 0 to 10VDC, 0 to ± 5VDC, 0 to ±10VDC, 4 to 20mA
		Digital input	BCD 3-digit or 12-bit binary using parameter unit (when the FR-EPA or FR-EPE option is used)
	Input signal	Start signal	Forward and reverse rotations individual, start signal self-holding input (3-wire input) can be selected.
		Multi-speed selection	Up to 7 speeds can be selected. (Each speed can be set between 0 and 400Hz, running speed can be changed during operation from the parameter unit.)
		Second acceleration/deceleration time selection	0 to 3600 seconds (acceleration and deceleration can be set individually.)
		Jogging operation selection	Provided with jogging (JOG) mode select terminal *7
		Current input selection	Input of frequency setting signal 4 to 20mADC (terminal 4) is selected.
		Output stop	Shut-off of inverter output (frequency, voltage)
		Alarm reset	Alarm retained at the activation of protective function is reset.
	Output signals	Operation functions	Maximum/minimum frequency setting, frequency jump operation, external thermal relay input selection, polarity reversible operation, automatic restart operation after instantaneous power failure, commercial power supply-inverter switch-over operation, forward/reverse rotation prevention, slip compensation, operation mode selection, auto tuning function.
		Operating status	4 types can be selected from inverter running, up to frequency, instantaneous power failure (undervoltage), frequency detection, second frequency detection, during program mode operation, during PU operation, overload alarm, regenerative brake pre-alarm, and electronic overcurrent protector pre-alarm. Open collector output.
		Alarm (inverter trip)	Contact output...change-over contact (230VAC 0.3A, 30VDC 0.3A) Open collector...alarm code (4 bit) output
		For meter	1 type can be selected from output frequency, motor current (steady or peak value), output voltage, frequency set value, running speed, motor torque, converter output voltage (steady or peak value), regenerative brake duty, electronic overcurrent protector load factor, input power, output power, load meter, and motor exciting current. Pulse train output (1440Hz/full scale) or analog output (0 to 10VDC).
Display	Display on parameter unit or inverter LED	Operating status	Selection can be made from output frequency, motor current (steady or peak value), output voltage, frequency set value, running speed, motor torque, overload, converter output voltage (steady or peak value), electronic overcurrent protector load factor, input power, output power, load meter, motor exciting current, cumulative operation time, regenerative brake duty.
		Alarm definition	Alarm definition is displayed when protective function is activated. 8 alarm definitions are stored.
	Additional display to parameter unit only	Operating status	State of input terminal signal, state of output terminal signal
		Alarm definition	Output voltage/current/frequency/input terminal state immediately before protective function is activated
		Interactive guidance	Operation guide, troubleshooting and graphic display by help function
Protective/alarm functions			Overcurrent shut-off (during acceleration, deceleration, constant speed), regenerative overvoltage shut-off, undervoltage, instantaneous power failure, overload shut-off (electronic overcurrent protection), power return circuit alarm *8, ground fault current *9, output short circuit, main circuit device overheat, stall prevention, overload alarm.
Environment	Ambient temperature		–10°C to +50°C (non-freezing).
	Ambient humidity		90%RH or less (non-condensing)
	Storage temperature *10		–20°C to +65°C
	Ambience		Indoors. No corrosive gases, flammable gas, oil mist, dust and dirt.
	Altitude, vibration		Below 1000m, 5.9m/s^2 (0.6G) or less (conforms to JIS C 0911)

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Note: *1 The applicable motor capacity indicated is the maximum applicable capacity when the Mitsubishi 4-pole standard motor is used.

*2 The rated capacity indicated assumes that the output voltage is 220V for the 200V series and 440V for the 400V series.

*3 The % value of the overload current rating indicates a ratio to the rated output current of the inverter. For repeated use, it is necessary to wait until the inverter and motor return to temperature below the value at 100% load.

*4 The maximum output voltage does not exceed the power supply voltage. Below the power supply voltage, the maximum output voltage can be set as required.

*5 Where a power supply is 342V and below or 484V and above for the 400V class inverters, change the position of the jumper to the internal transformer, according to page 3-7.

*6 The power supply capacity depends on the value of impedance on the power supply side (including the input reactor and cables).

*7 Jogging operation can also be performed from the parameter unit.

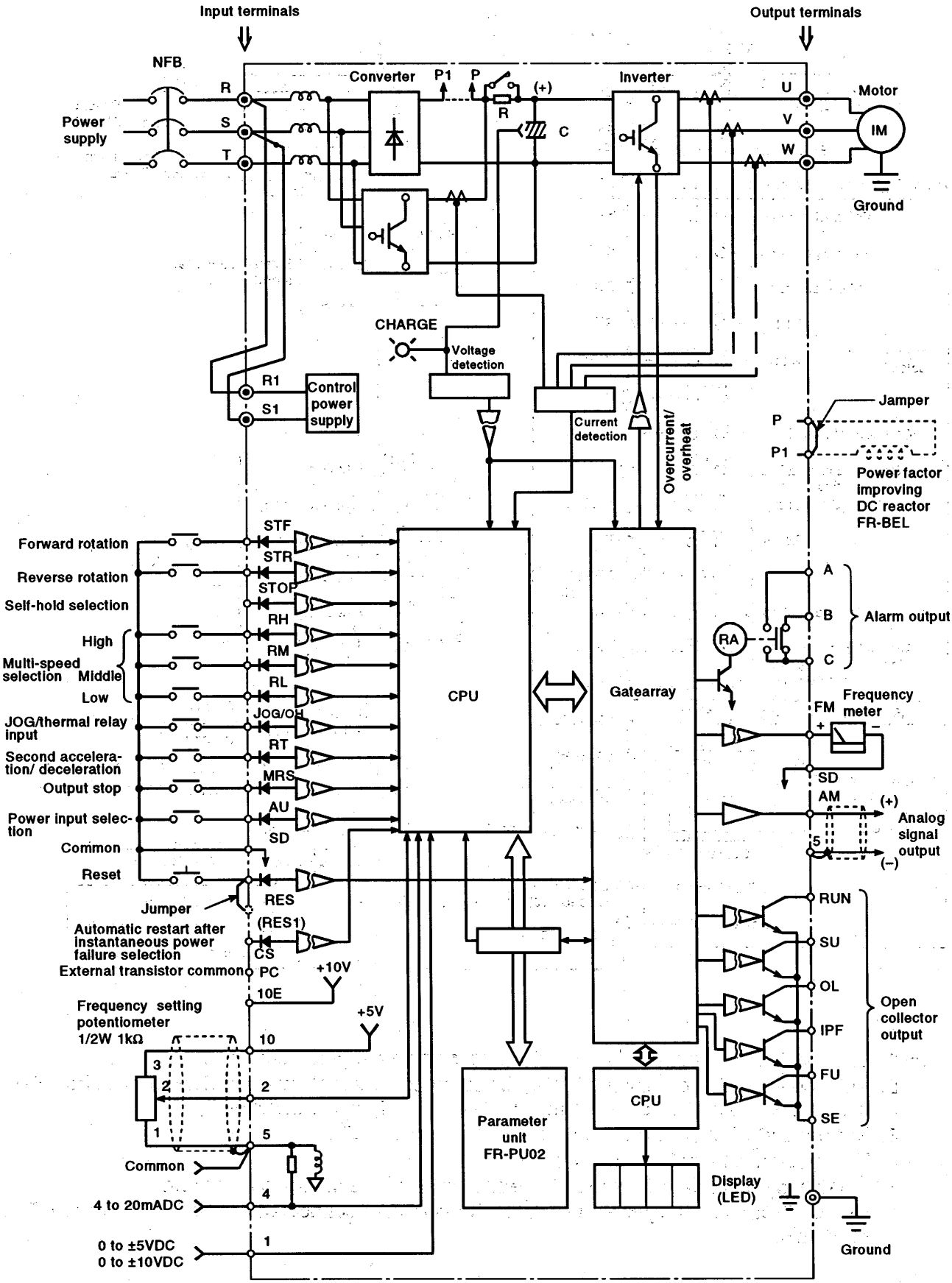
*8 When the power return circuit alarm or regenerative electronic thermal relay error occurs, the brake transistor alarm (BE error) is displayed.

*9 May not be protected depending on the ground fault mode.

*10 Temperature applicable for a short period in transit, etc.

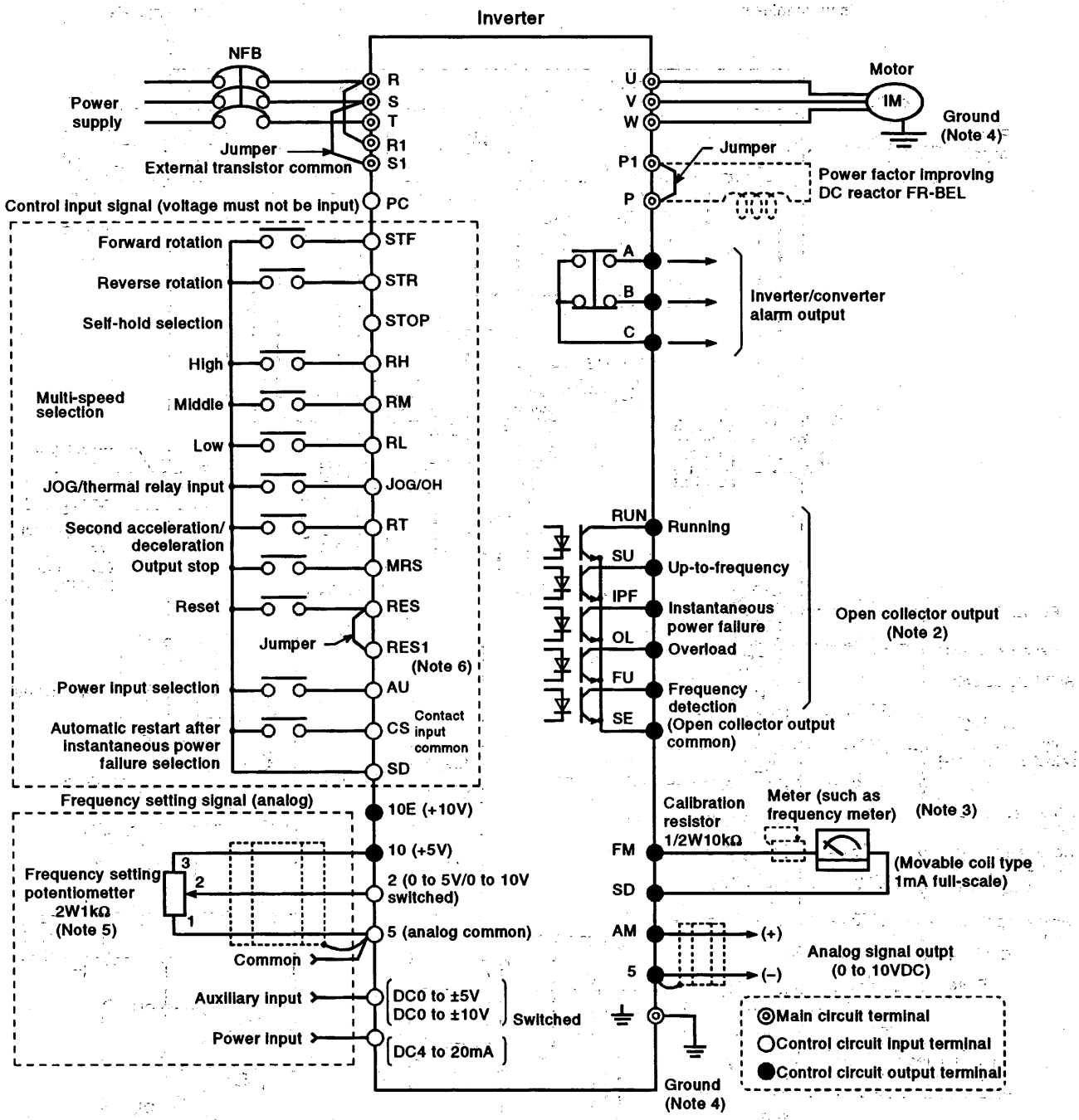
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7.1.2 Block Diagram



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7.1.3 Terminal Connection Diagram



Note: 1. The input signal can be switched to the other from the parameter unit.
2. With the exception of running (RUN), the output terminals allow alarm definitions to be output in alarm codes and 10 different functions to be assigned to individually.
3. Not needed when calibration is made from the parameter unit.
4. The inverter and motor must be grounded.
5. 2W1kΩ is recommended when the frequency setting is changed frequently.
6. Do not disconnect the jumper which has been factory-connected across the RES and RES1 terminals.

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7.1.4 Terminals

Type	Symbol	Terminal Name	Description	
Main circuit	R, S, T	AC power input	Connect to the commercial power supply.	
	U, V, W	Inverter output	Connect a three-phase squirrel-cage motor.	
	R1, S1	Power supply for control circuit	Connected to the AC power supply terminals R and S. To retain the alarm display and alarm output, remove the jumper from the terminal block and apply external power to these terminals.	
	P, P1	Power factor improving DC reactor connection	Disconnect the jumper from terminals P and P1 and connect the optional power factor improving reactor (FR-BEL).	
	⏚	Ground	For grounding the inverter chassis. Must be earthed.	
Control circuit (input signals) / Contact (start, function selection, etc.)	STF	Forward rotation start	Turn on the signal across STF and SD for forward rotation and turn off to stop. Acts as a programmed operation start signal in the programmed operation mode. (Turn on to start and turn off to stop.)	When the signals across terminals STF and SD, STR and SD are turned on simultaneously, the stop command is given.
	STR	Reverse rotation start	Turn on the signal across STR and SD for reverse rotation and turn off to stop.	
	STOP	Start self-holding selection	Turn on the signal across terminals STOP and SD to select the self-holding of the start signal.	
	RH, RM, RL	Multi-speed selection	Turn on the signal across RH/RM/RL and SD as appropriate to select up to 7 speeds. Act as group 1, 2 and 3 select signals in the programmed operation mode.	
	JOG/OH	JOG mode selection or external thermal relay input	Turn on the signal across terminals JOG and SD to select jog operation (factory setting). Jog operation can be performed with the start signal (STF or STR). Can also be used as the thermal relay contact input terminal to stop the inverter by the operation of the external thermal relay.	
	RT	Second acceleration/ deceleration time selection	Turn on the signal across terminals RT and SD to select the second acceleration/deceleration time. When the second torque boost and second V/F (base frequency) functions have been set, these functions can also be selected by turning on the signal across terminals RT and SD. Turn on the signal across terminals RT and SD to switch between the two control modes, magnetic flux vector control and V/F control.	
	MRS	Output stop	Turn on the signal across terminals MRS and SD (20ms or longer) to stop the inverter output. Used to shut off the inverter output to bring the motor to a stop by the magnetic brake. Can also be used as the DC dynamic brake operation start signal or PU operation interlock signal.	
	RES	Reset	Used to reset the protective circuit activated. Turn on the signal across terminals RES and SD for more than 0.1 sec, then turn it off. (Do not disconnect the jumper connected across this terminal and the internal printed board.)	
	AU	Current input selection	When the signal across terminals AU and SD is turned on, the inverter can be operated with the 4-20mADC frequency setting signal.	
	CS	Automatic restart after instantaneous power failure selection	When the signal across terminals CS and SD has been turned on, restart can be made automatically when the power is restored after an instantaneous power failure. Note that this operation requires restart parameters to be set. When the inverter is shipped from the factory, it is set to disallow restart.	
	SD	Contact input common	Common to the contact input terminals and terminal FM. Isolated from the common terminal of the control circuit.	
	PC	External transistor common	When transistor output (open collector output), such as a programmable controller (PC), is connected, connect the external power supply common for transistor output to this terminal to prevent a fault caused by sneak current.	

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Type		Symbol	Terminal Name	Description	
Control circuit (input signals)	Analog frequency setting	10E	Frequency setting power supply	10VDC, permissible load current 10mA	When the frequency setting potentiometer is connected in the factory-set state, connect it to terminal 10. When it is connected to terminal 10E, change the input specifications of terminal 2.
		10		5VDC, permissible load current 10mA	
		2	Frequency setting (voltage)	By entering 0 to 5VDC (0 to 10VDC), the maximum output frequency is reached at 5V (or 10V) and I/O are proportional. Switch between input 0 to 5VDC (factory setting) and 0 to 10VDC from the parameter unit. Input resistance 10kΩ. Max. permissible voltage 20VDC.	
		4	Frequency setting (current)	By entering 4 to 20mADC, the maximum output frequency is reached at 20mA and I/O are proportional. This input signal is valid only when the signal across terminals AU and SD is on. Input resistance 250Ω. Max. permissible current 30mA.	
		1	Auxiliary frequency setting	By entering 0 to ±5VDC 0 to ±10VDC, this signal is added to the frequency setting signal of terminal 2 or 4. Switch between input 0 to ±5VDC (factory setting) and 0 to ±10VDC (factory setting) from the parameter unit. Input resistance 10kΩ. Max. permissible voltage ±20VDC.	
		5	Frequency setting input common	Common to the frequency setting signals (terminals 2, 1 or 4) and analog output terminal AM. 0V line of the common circuit of the control circuit. Do not ground.	
Control circuit (output signals)	Contact	A, B, C	Alarm output	Change-over contact output indicating that the output has been stopped by the inverter protective function activated. 200VAC 0.3A, 30VDC 0.3A. Alarm: discontinuity across B-C (continuity across A-C), normal: continuity across B-C (discontinuity across A-C).	
	Open collector (Note)	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 dynamic brake operation (*). Permissible load 24VDC 0.1A.	
		SU	Up to frequency **	Switched low when the output frequency has reached within ±10% of the set frequency (factory setting, variable). Switched high during acceleration, deceleration or stop (*). Permissible load 24VDC 0.1A.	
		OL	Overload alarm **	Switched low when the current limit function has caused stall prevention to be activated. Switched high when stall prevention is reset (*). Permissible load 24VDC 0.1A.	
		IPF	Instantaneous power failure **	Switched low when instantaneous power failure or undervoltage protection is activated (*). Permissible load 24VDC 0.1A.	
		FU	Frequency detection **	Switched low when the output frequency has reached or exceeded the detection frequency set optionally. Switched high when below the detection frequency (*). Permissible load 24VDC 0.1A	
		SE	Open collector output common	Common to the RUN, SU, OL, IPF and FU terminals. Isolated from the common circuit of the control circuit.	
	Pulse	FM	For meter	One selected from 16 monitoring items, such as output frequency, is output. The output signal is proportional to the magnitude of each monitoring item. Terminals FM and AM can be used at the same time.	Factory-set output item: frequency Permissible load current 1mA 1440Hz at 60Hz. (Max. frequency 2400Hz)
	Analog	AM	Analog signal output		Factory-set output item: frequency Output signal 0 to 10VDC Permissible load current 1mA (Max. output voltage 10VDC)

* Low indicates that the open collector transistor is on (conducts). High indicates that the transistor is off (does not conduct).

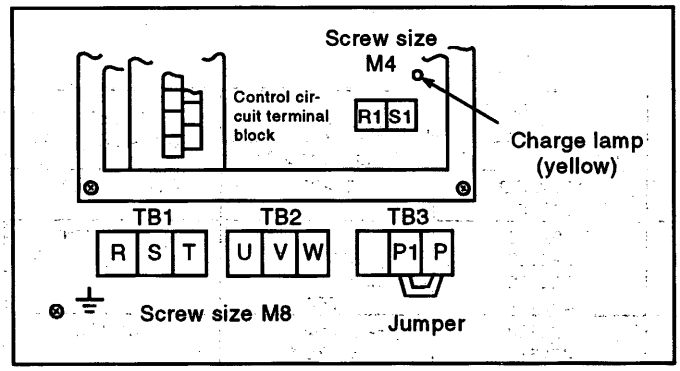
** The output of these terminals can be reassigned by the output terminal assignment function (see page 9-19).

Note: Application of the voltage in the wrong direction will damage the inverter. Use care when wiring.

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7.1.5 Terminal Block Arrangement

Terminal Block for Main Circuit <200V, 400V, Series>



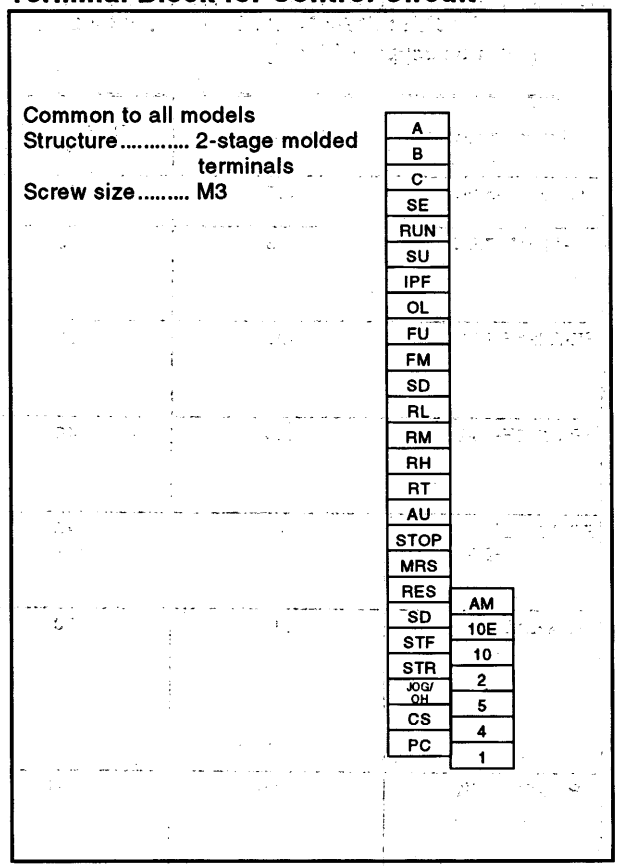
<200V Series>

Inverter Type	TB1	TB2	TB3	GND
FR-A221E-5.5/7.5/11K	M5	M5	M5	M5
FR-A221E-15K	M6	M6	M6	M6
FR-A221E-18.5/22/30K	M8	M8	M8	M6
FR-A221E-37/45K	M10	M10	M10	M8
FR-A221E-55K	M12	M12	M12	M8

<400V Series>

Inverter Type	TB1	TB2	TB3	GND
FR-A241E-5.5/7.5K	M4	M4	M4	M4
FR-A241E-11/15K	M5	M5	M5	M5
FR-A241E-18.5/22/30K	M6	M6	M6	M6
FR-A241E-37/45/55K	M8	M8	M8	M8

Terminal Block for Control Circuit



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7.1.6 Field Wiring Reference Table

Field wiring reference table for input (R, S, T) and output (U, V, W)

Note (*1) Manufacturer : AMP INCORPORATED, HARRISBURG, PA 17105
PHONE : 717-564-0100 TWX : 510-657-4110
(*2) Use copper wire only

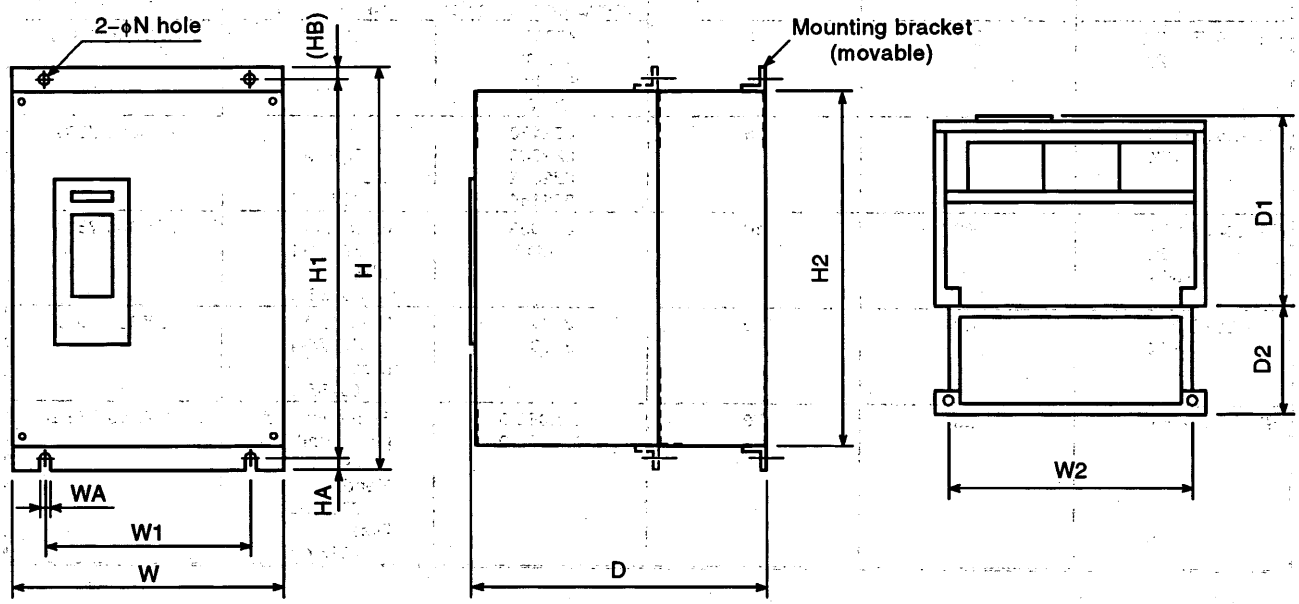
Inverter model	Screw size	Screw torque (Pound inch)	Crimping terminals Type and tool type (*1)		Wire size /temp-rating (*2)
			Crimping terminals	Crimping tools	
FR-A221E-5.5K	M5	23	170785-2 171519-2	59239	AWG10 / 75°C
FR-A221E-7.5K	M5	23	322128 322048 322002 322154	Hand tool 59974-1 Dies 48752-1	AWG8 / 75°C
FR-A221E-11K	M5	23	322153 321671	Hand tool 59974-1 Dies 48753-1	AWG6 / 75°C
FR-A221E-15K	M6	40	322053 31811	Hand tool 59974-1 Dies 48754-1	AWG4 / 75°C
FR-A221E-18.5K -22K	M8	70	322074 326896	Hand tool 59974-1 Dies 48755-1	AWG2 / 75°C
FR-A221E-30K	M8	70	322086	Foot operated power unit 69325-3 Head 69066 Dies 48756-1	AWG1/0 / 75°C
FR-A221E-37K	M10	131	322095	Foot operated power unit 69325-3 Head 69066 Dies 48758-1	AWG3/0 / 75°C
FR-A221E-45K	M10	131	170740-1	Foot operated power unit 69040 Head 300430 48131 Dies 69065	AWG4/0 / 75°C
FR-A221E-55K	M12	219	324105	Foot operated power unit 69040 Head 48816 Dies 69060	300MCM / 75°C

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Inverter model	Screw size	Screw torque (Pound inch)	Crimping terminals Type and tool type (*1)		Wire size /temp-rating (*2)
			Crimping terminals	Crimping tools	
FR-A241E-5.5K -7.2K	M4	13	35787-0 34169 32543-0 32968	59239	AWG10 / 75°C
FR-A241E-11K -15K	M5	23	322128 322048 322002 322154	Hand tool 59974-1 Dies 48752-1	AWG8 / 75°C
FR-A241E-18.5K -22K -30K	M6	40	322053 31811	Hand tool 59974-1 Dies 48753-1	AWG4 / 75°C
FR-A241E-37K -45K	M8	70	322074 326896	Hand tool 59974-1 Dies 48755-1	AWG2 / 75°C
FR-A241E-55K	M8	70	322056-0 324083-0	Foot operated power unit 69325-3 Head 69066-0 Dies 48757-1	AWG2/0 / 75°C

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7.1.7 Outline Drawings



• 200V Class

(Unit: mm)

Inverter Type	W	W1	W2	WA	H	H1	H2	HA	HB	D	D1	D2	DA	N
FR-A221E-5.5/7.5K	250	190	234	10	470	454	425	8	8	270	170	100	2.3	10
FR-A221E-11/15K	300	220	284	10	600	575	540	10	15	294	169	125	3.2	10
FR-A221E-18.5/22K	390	290	370	12	600	575	535	10	15	320	190	130	3.2	12
FR-A221E-30K	450	350	430	12	700	675	635	10	15	340	195	145	3.2	12
FR-A221E-37/45K	470	370	450	14	700	670	630	15	15	368	205	163	3.2	14
FR-A221E-55K	600	480	580	14	900	870	830	15	15	405	215	190	3.2	14

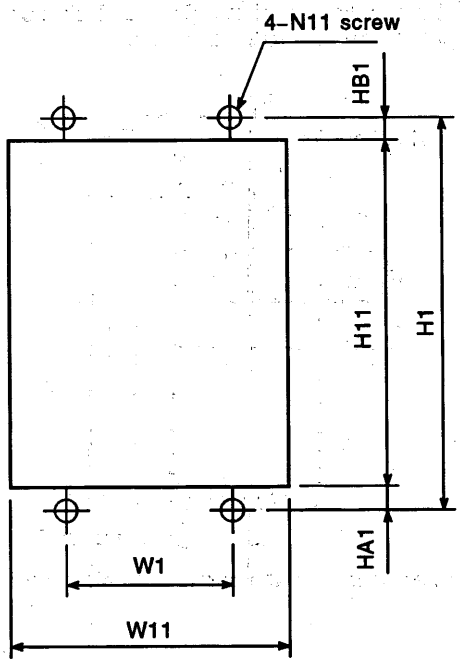
• 400V Class

(Unit: mm)

Inverter Type	W	W1	W2	WA	H	H1	H2	HA	HB	D	D1	D2	DA	N
FR-A241E-5.5/7.5K	250	190	234	10	470	454	425	8	8	270	170	100	2.3	10
FR-A241E-11/15K	300	220	284	10	600	575	540	10	15	294	169	125	3.2	10
FR-A241E-18.5/22K	360	290	340	12	600	575	535	10	15	320	190	130	3.2	12
FR-A241E-30K	450	350	430	12	700	675	635	10	15	340	195	145	3.2	12
FR-A241E-37/45K	470	370	450	14	700	670	630	15	15	368	205	163	3.2	14
FR-A241E-55K	600	480	580	14	900	870	830	15	15	405	215	190	3.2	14

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7.1.8 Panel Cutting Dimensions (for mounting the heatsink outside the panel)



• 200V Series

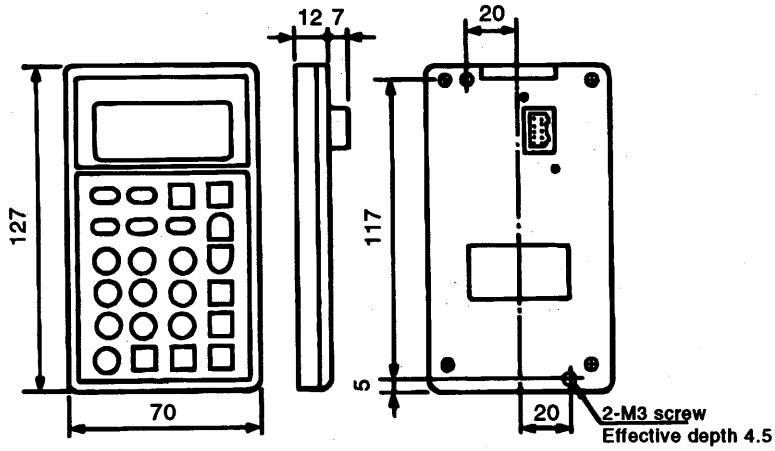
Inverter Type	W1	W11	H1	H11	HA1	HB1	N11
FR-A221E-5.5/7.5K	190	240	454	434	12	8	M8
FR-A221E-11/15K	220	290	575	548	17	10	M8
FR-A221E-18.5/22K	290	376	575	546	17	12	M10
FR-A221E-30K	350	436	675	646	17	12	M10
FR-A221E-37/45K	370	456	670	641	17	12	M12
FR-A221E-55K	480	586	870	841	17	12	M12

• 400V Series

Inverter Type	W1	W11	H1	H11	HA1	HB1	N11
FR-A241E-5.5/7.5K	190	240	454	434	12	8	M8
FR-A241E-11/15K	220	290	575	548	17	10	M8
FR-A241E-18.5/22K	260	346	575	546	17	12	M10
FR-A241E-30K	350	436	675	646	17	12	M10
FR-A241E-37/45K	370	456	670	641	17	12	M12
FR-A241E-55K	480	586	870	841	17	12	M12

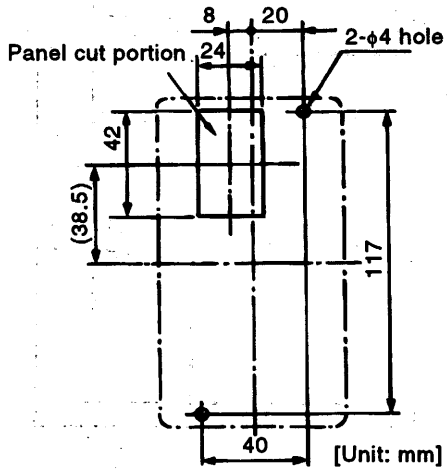
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7.1.9 FR-PU02E Parameter Unit Dimension Diagram



Note: The length of the installation screw should be selected so that it does not exceed the effective installation screw depth of the parameter unit.

Panel cutting dimensions for installation of the parameter unit to a panel, etc.



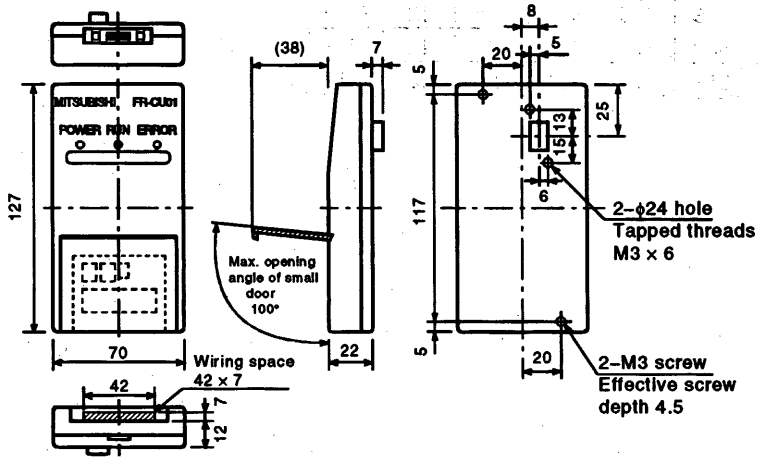
(View as seen from the parameter unit front)

■ FR-PU02E Specifications

Item	Specifications	
Ambient temperature	Operating	−10 to +50°C (Note 1)
	Storage	−20 to −65°C
Ambient humidity	90%RH	Non-condensing
Operating ambience	No oil mist and corrosive gases. Minimal dust and dirt.	
Connected object	FR-A series inverter or dedicated cable (FR-CBL)	
Power supply	Power is supplied from the inverter.	
Connection	Loaded to the inverter directly or connected by the cable.	
Display	LCD (liquid crystal display, 13 characters x 4 lines)	
Keyboard	24 keys (covered with polyurethane film)	
Size	127 x (H) x 70 (W) x 12 (D)	

Note: 1. When the temperature is less than about 0°C, the liquid crystal display (LCD) may be slower in operation. And high temperature may reduce the LCD life.
2. Do not expose the liquid crystal display directly to the sun.

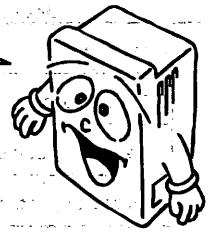
7.1.10 FR-CU01 Serial Communication Unit Outline Drawing



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7.2 OPTIONS

Use of the following options with this FR-A201E series improves its functions. Select the appropriate options.



7.2.1 Option List

	Option Name	Type	Application, Specifications, Etc.	Applicable Inverter
Inboard type (dedicated to FR-A)	Industrial equipment compatible function	FR-EPA	• 12-bit digital input • PLG feedback control • Extension analog output • Orientation control (machine tool spindle fixed-position stop control)	Common to all models
	Computer link function	FR-EPB	• RS-422, RS-485 interface for computer link (serial communication) • PLG feedback control	
	Programmable controller link function	FR-EPC	• MELSECNET/MINI-S3 (optical cable) interface • PLG feedback control	
	Automatic control compatible function	FR-EPD	• PI control • Battery backup for programmed operation (programmed operation function is standard.)	
	I/O function	FR-EPE	• 12-bit digital input • Relay output (3 points) • Extension analog output	
	Computer link + extension output function	FR-EPG	• RS422/RS485 interface for computer link (serial communication) • Selective relay output • Analog current output	
	Pulse train input function	FR-EPH	• Pulse train input • Selective relay output • Analog current output • PI control	
External option (dedicated to FR-A)	Parameter unit (Japanese)	FR-PU02	Interactive parameter unit using LCD display	
	Parameter unit (English)	FR-PU02E	The LCD display and ten-key pad of the FR-PU02 are indicated in English.	
	Parameter unit (4 languages)	FR-PU02ER	For use in English, German, French and Spanish.	
	Parameter copy unit (Japanese)	FR-ARW	Allows parameter settings to be read in batch and copied to the other inverter.	
	Parameter copy unit (English)	FR-ARWE	The LCD display and ten-key pad of the FR-ARW are indicated in English.	
	Parameter copy unit (4 languages)	FR-ARWER	For use in English, German, French and Spanish.	
	Accessory cover	———	Blind cover fitted after the parameter unit is removed from the inverter.	
	Serial communication unit	FR-CU01	RS485 interface for computer link (serial communication)	
	VDE Standard compatible noise filer	FR-ALF-(H)*	Noise filer which allows the inverter to conform to the VDE Standard (0871 Class A noise terminal voltage).	5.5K to 55K According to capacity
External option	Power factor improving DC reactor	FR-BEL-(H)*	Used to improve the inverter input power factor (overall power factor about 95%) and cooperate with the power supply.	5.5K to 55K According to capacity
	Radio noise filter	FR-BIF-(H)*	For radio noise reduction	Common to all models
	Line noise filter	FR-BSF01	For line noise reduction (applies to small capacities)	
		FR-BLF	For line noise reduction	
	Parameter unit cable	FR-CBL☐	Cable for connection with the parameter unit or parameter copy unit. Straight or L shape type available.	
	Digital operation panel	FR-DU01	For operation from the control box surface.	
	Surge voltage suppressing filter	FR-ASF-H	Absorbs surge voltage on the inverter output side.	400V series 5.5 to 55K According to capacity

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	Option Name	Type	Application, Specifications, Etc.	Applicable Inverter
FR series controllers and setters	Manual controller	FR-AX	For independent operation.With frequency meter, frequency setting potentiometer and start switch.	Common to all models
	DC tach. follower	FR-AL	For joint operation using external signals. (0 to 5VDC, 0 to 10VDC) (1VA)**	
	Three speed selector	FR-AT	For three-speed (high, middle, low) switching operation. (1.5VA)	
	Motorized speed setter	FR-FK	For remote operation. Allows operation to be controlled from several places. (5VA)	
	Ratio setter	FR-FH	For ratio control. Allows ratios to be set to five inverters. (3VA)	
	PG follower	FR-FP	For follow-up operation using the signal of a pilot generator (PG). (2VA)	
	Master controller	FR-FG	For parallel operation of several (up to 35) inverters. (5VA)	
	Soft starter	FR-FC	For soft start and stop. Allows parallel operation and acceleration/deceleration. (3VA)	
	Deviation detector	FR-FD	For synchronous operation. Used with a deviation sensor and synchro. (5VA)	
	Preamplifier	FR-FA	Can be used as A/V conversion or operational amplifier. (3VA)	
Others	Pilot generator	QVAH-10	For follow-up operation. 70/35VAC 500Hz (at 2500rpm)	
	Deviation sensor	YVGC-500W-NS	For synchronous operation (mechanical deviation detection). Output 90VAC/90°	
	Frequency setting potentiometer	WA2W1KΩ	For frequency setting. Wire-wound type. 2W1KΩ B characteristic.	
	Frequency meter	YM206RI 1mA	Dedicated frequency meter (up to 120Hz scale). Moving-coil DC ammeter.	
	Calibration resistor	RV24YN 10KΩ	For calibration of the frequency meter. Carbon-film type. B characteristic.	

* Type for 400VAC class has H.

** Rated power consumption.

Power supply specifications of the FR series controllers and setters: 200VAC 50Hz, 200/220VAC 60Hz 115VAC 60Hz

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7.2.2 Inboard Dedicated Options

Option / Function	FR-EPA (Industrial equipment compatible function)	FR-EPB (Computer link function)	FR-EPC (Programmable controller link function)	FR-EPD (Automatic control compatible function)	FR-EPE (I/O function)	FR-EPG (Computer link + extension output function)	FR-EPH (Pulse train input function)
PLG feedback control	●	●	●	●			
Orientation control	●						
12-bit digital input	●				●		
Relay output					●	●(Note 1)	●(Note 1)
Extension analog output	●				●		
Computer link		●				●	
MELSECNET/MINI-S3			●				
PI control				●			●
Programmed operation				●			
Analog current output						●(Note 2)	●(Note 2)
Pulse train input							●

Out of the above option units, only one can be installed in the inverter.
Each option unit has several function as listed above.

	Function, Application, Etc.	Rating, Etc.
PLG feedback control	• The motor speed is detected by the pulse encoder, this detection signal is fed back to the inverter, and its speed variation is automatically compensated for. Hence, the motor speed can be kept constant if load variation occurs. • The actual motor speed can be monitored on the inverter LED display and parameter unit. [Application example] extruder, winder, conveyor, etc.	• Speed variation ratio: within ±0.2% at the load variation of 0 to 100% (*) (at 1800r/min) • Applicable motor: standard motor of 2 to 8 poles • Encoder specifications: 3 phase, differential output, 1024P/rev. • 5VDC power supply Example: Tamagawa Seiki's TS 1508 N 207, etc. (*) Load of 100% indicates the continuous operation torque of the motor at each running frequency.
Orientation control	• Used with a pulse encoder installed to a machine tool spindle to allow the spindle to be stopped at a predetermined position (orientation function). • The current position can be monitored on the inverter LED display an parameter unit. [Application example] fixed-position stop and indexing of a machine tool spindle	• Positioning accuracy±1.5° • Encoder specifications: same as those for the above PLG feedback function
12-bit digital input	• Input interface used to set the inverter frequency accurately using external BCD or binary digital signals. • Either 12-bit binary or BCD 3-digit signal can be selected. • Gain and offset can also be adjusted.	• Input voltage, current: 24VDC, 5mA (per circuit) • Input signal format: contact signal input or transistor open collector (sink type) input Example: MELSEC AY40, AY40A, etc.
Relay output (3 points)	• Any three signals can be selected and output as relay contacts (change-over contacts) from among the 10 standard output signals (RUN, SU, IPF/UVT, OL, FU1, FU2, RBP, THP, PRG, PU) of the inverter.	• Signal types: change-over contact (three output relays installed) • Contact capacity: 230VAC 0.3A 30VDC 0.3A
Extension analog output Analog current output (Note 2)	• 16 signals, which can be monitored on the FM and AM terminals, such as output frequency, output voltage, output current and motor torque, are expanded and output. • A 1mA DC or 5V (10V) DC meter can be connected. (FR-EPA, EPE) • A 20mADC or 5V(10V)DC meter can be connected. (FR-EPG, EPH) • Gain and offset can also be adjusted.	• Output voltage (across LM0-LM2): 0 to 10VDC, max. 1mA • Output current (across LM1-LM2): 0 to 1mADC (20mA) Output resolution: 3mV for voltage output Output resolution: 1μA for current output (20μA) • Output accuracy ±10%
Computer link function (serial communication)	• Allows inverter operation/monitoring and parameter read/write to be performed using user program from a computer, e.g. personal computer or FA controller, which is connected by communication cables. • Noiseless communication system using twisted pair cables.	• Conforming standard: EIA Standard, for RS-422 and RS-485 • Transmission format: multidrop link system • Communication speed: max. 19200 baud rates • Max. number of inverters connected: RS-422 - 10 inverters RS-485 - 32 inverters • Overall extension: 500m

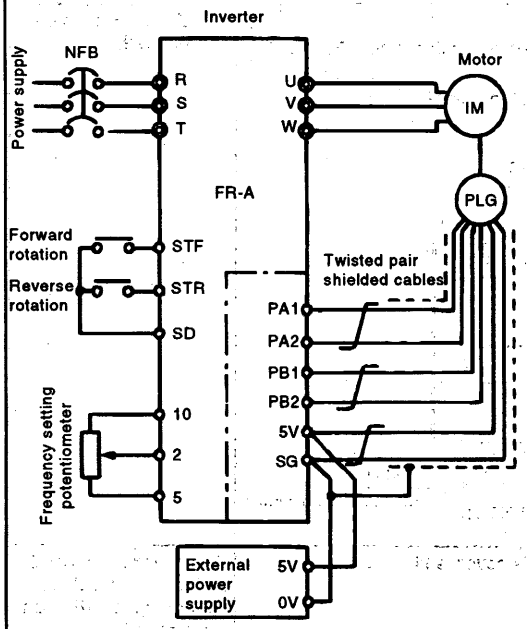
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	Function, Application, Etc.	Rating, Etc.
MELSECNET/MINI-S3 interface	• Allows inverter operation/monitoring and parameter read/write to be performed using user program from the master station in the Mitsubishi programmable controller data link system MELSECNET/MINI-S3 (AJ71PT32-S3) which is connected by optical fiber. • Communication is made via optical link system without noise.	• Max. number of inverters connected: 16 inverters (up to 64 inverters when used with remote I/O stations) • Interstation transmission distance: 50m max. 1m min
PI control	• PI control function is required when process control, e.g. flow rate, air volume or pressure, is carried out by the inverter. • The set value can be set from any of terminal 2, 1 or parameter unit. The measured value (feedback signal) is input to terminal 4 by a 4-20mA current signal.	• PI control range: proportional band 1 to 1000% integral time 0.1 to 3600 seconds • Output signal: high limit, low limit, during forward rotation, during reverse rotation
Battery backup for programmed operation	• Allows the timer to be battery backed for programmed operation. If a power failure occurs, automatic operation can be continued after the power is restored. (Programmed operation is standard in the inverter. See Pr. 87.) Group selection and time-out output signal for the programmed operation are incorporated.	• Battery life: 10 years (lithium battery) • Permissible power failure time: max. 18 hours when Pr. 200=0 (seconds selected) Max. 30 days when Pr. 200=1 (minutes selected)
Pulse train input	• Allows a pulse train signal to be used as a speed command input to the inverter.	• Max. permissible number of pulses: 100KPPS or less • Input interface: Open collector system • Input voltage/current: 24VDC, 10mA

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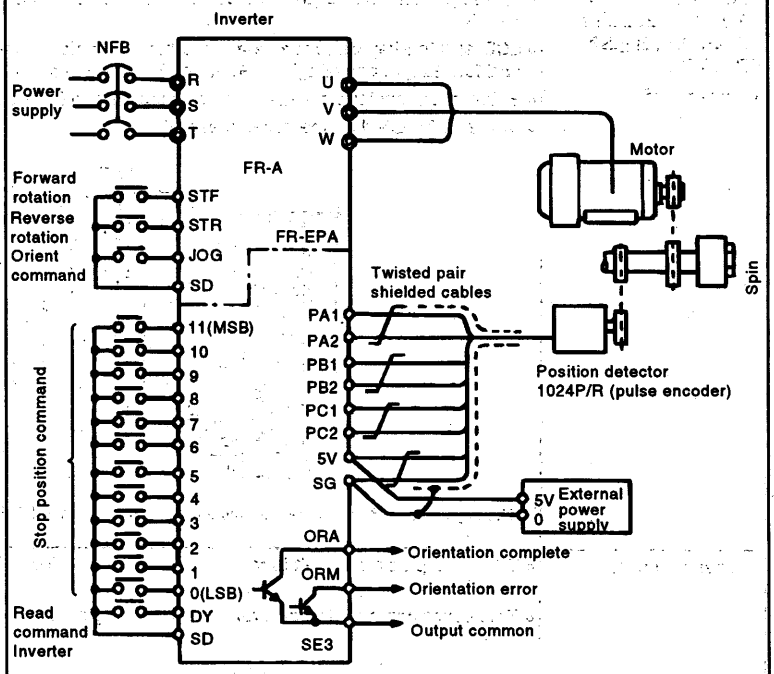
<Connection examples>

• PLG feedback contorol

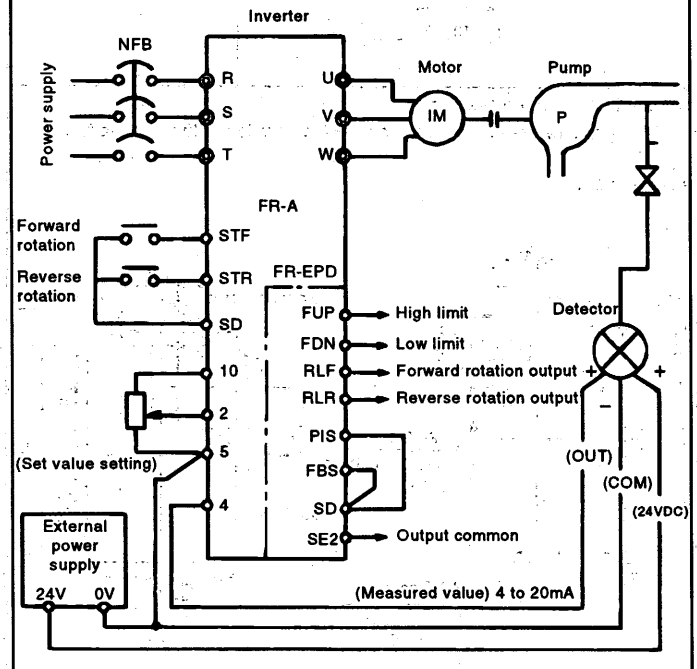


When a motor with brake is used, note the release timing of the brake. For more information, see the instruction manual of the option.

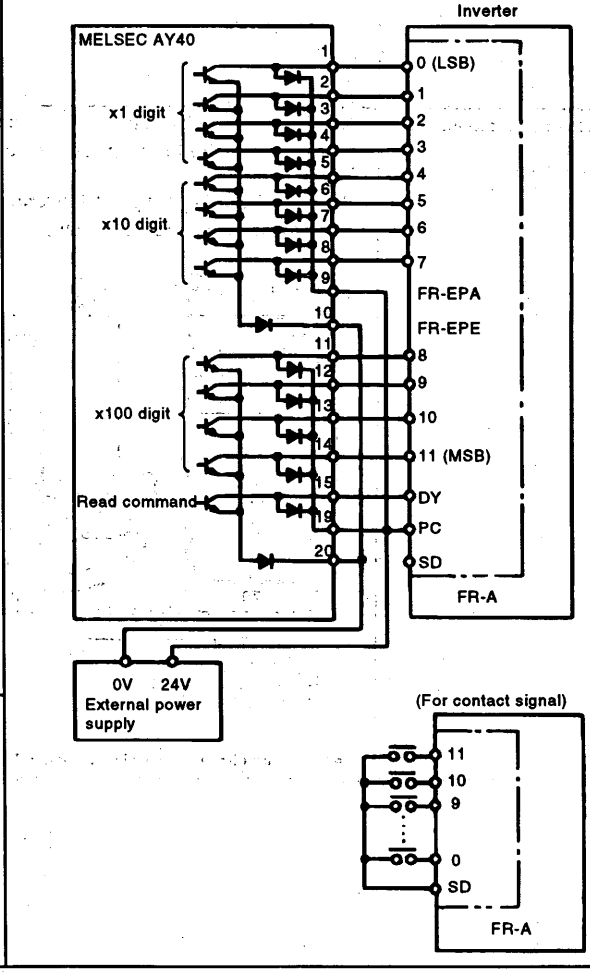
• Orientation control



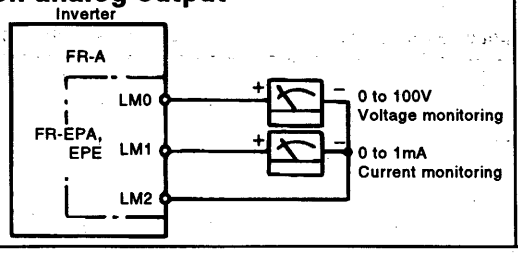
• PI control (for pressure control)



• 12-bit digital input (for BCD code)

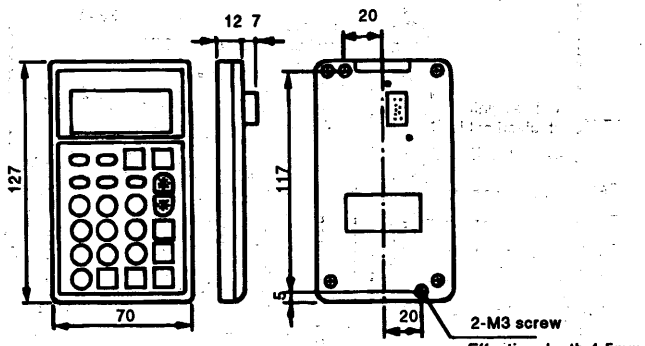
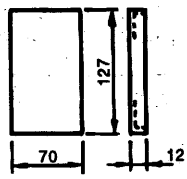
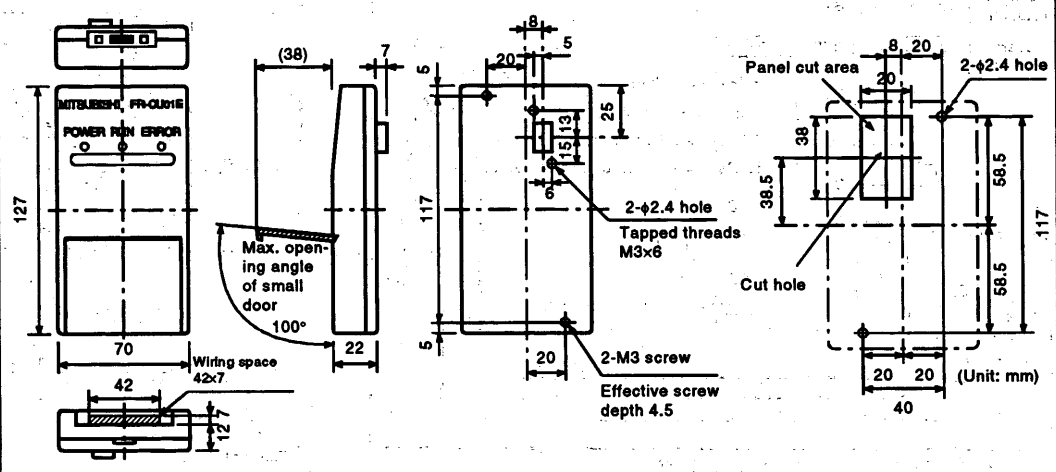


• Extension analog output



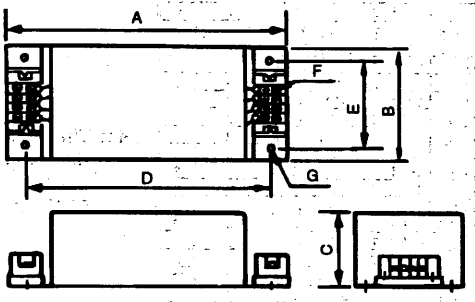
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7.2.3 External Dedicated Options

Option (Type)	Specifications, Structure, Etc.	Remarks
Parameter copy unit FR-ARW (Japanese) FR-ARWE (English) FR-ARWER (4 languages)	• Allows parameters set to application to be read in batch and easily written to another inverter. • LCD and ten-key pad representations are available in three ways: Japanese, English and four languages (English, German, French, Spanish). • External dimensions are the same as those of the FR-PU02 parameter unit. • Can also be used as the parameter unit.  The keys marked * have different functions from those for the FR-PU02(E).	The FR-ZRW(E) used with the Z series cannot be used.
Accessory cover	• When the parameter unit is removed from the inverter, this cover is fitted to that position. • This cover can be fitted and removed by a single action. 	This cover is supplied on the model which is not equipped with a parameter unit.
Serial communication unit FR-CU01	• An add-on unit which can be fitted after removal of the parameter unit. • Allows the inverter to be run/monitored and the parameters to be set from an FA controller or the like via the RS485 interface. • Multidrop link system, up to 31 inverters connected. • Communication speed: 1200 baud  Panel cutting dimensions for installation of FR-CU01 to a panel, etc. Diagram viewed from the FR-CU01 front	

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Option (Type)	Specifications, Structure, Etc.
VDE standard (German) compatible noise filter FR-ALF-(H)☐☐K* (NOT EN STANDARD APPROVED)	•Conforms to VDE 0871 Class A (noise terminal voltage). Maker: Fuji Denki Kagaku (FDK) •External dimension diagram

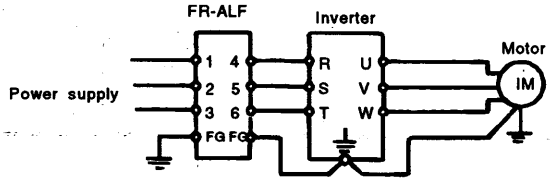


(Unit: mm)

	Filter Type	Applicable inverter	A	B	C	D	E	F	G	Mass (kg)	Leakage Current (mA)
200V	FR-ALF-7.5K	FR-A221E-5.5K/7.5K	490	185	115	435	150	M5	ϕ6.5	12	1

*For the filters used with the inverters of 200V 11K and up (filters 18.5K, 30K, 55K) and 400V 5.5K and up (filters 11K, 15K, 30K, 55K), contact Mitsubishi.

•Connection diagram



A different grounding connection from the above diagram may reduce the filter effect.

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Option (Type)	External Dimensions (Unit: mm)	Wiring, Etc.

Power factor improving DC reactor (for power coordination) FR-BEL-(H)□□K*

	Type	A	B	C	D	E	F	G	H	Mass (kg)	Fig.
* 200V	3.7K	150	75	102	2	135	6	M4	40	1.7	1
	5.5K	150	75	126	2	135	6	M5	40	2.2	1
	7.5K	150	75	126	2	135	6	M5	40	2.3	1
	11K	170	93	132	2.3	155	6	M5	50	3.1	1
	15K	170	93	170	2.3	155	6	M8	56	3.8	2
	18.5K	185	94	184	2.6	165	7	M8	56	5.1	2
	22K	185	119	182	2.6	165	7	M8	70	5.4	2
	30K	185	119	201	2.6	165	7	M8	70	6.7	2
	37K	195	136	215	2.6	175	7	M10	70	7.4	2
	45K	195	136	215	2.6	175	7	M10	70	8.0	2
	55K	195	136	246	3.2	175	9	M12	80	9.8	2
* 400V	H3.7K	150	75	102	2	135	6	M4	40	1.7	1
	H5.5K	150	75	124	2	135	6	M4	40	2.2	1
	H7.5K	150	75	124	2	135	6	M4	40	2.3	1
	H11K	170	93	132	2.3	155	6	M5	50	3.1	1
	H15K	170	93	160	2.3	155	6	M6	56	3.7	2
	H18.5K	185	94	173	2.6	165	7	M6	56	4.8	2
	H22K	185	119	171	2.6	165	7	M6	70	5.0	2
	H30K	185	119	189	2.6	165	7	M6	70	6.7	2
	H37K	195	136	199	2.6	175	7	M8	70	7.0	2
	H45K	195	138	219	3.2	175	9	M8	80	8.6	2
	H55K	195	138	219	3.2	175	9	M8	80	9.0	2

Note: The numeral in the type indicates a motor capacity (kW).

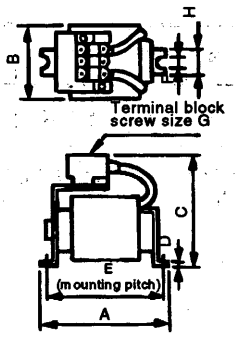


Fig. 1

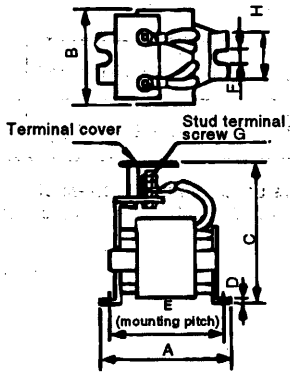
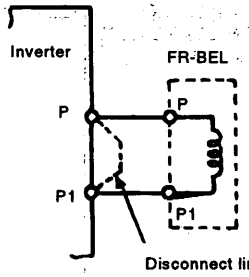


Fig. 2

•Input power factor: about 95%



Note:1. The input power factor is improved to about 95 %.

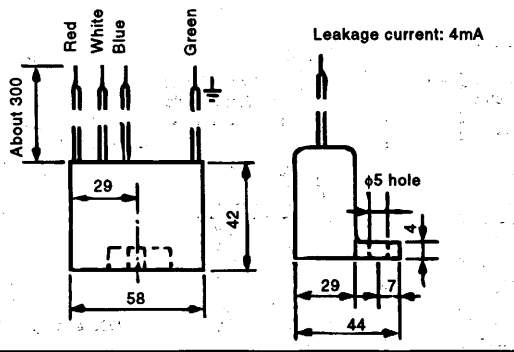
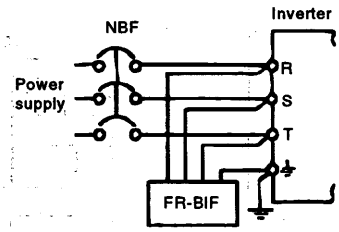
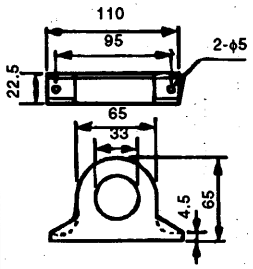
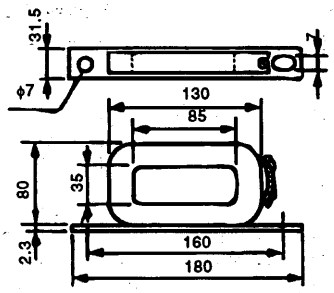
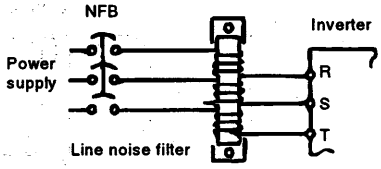
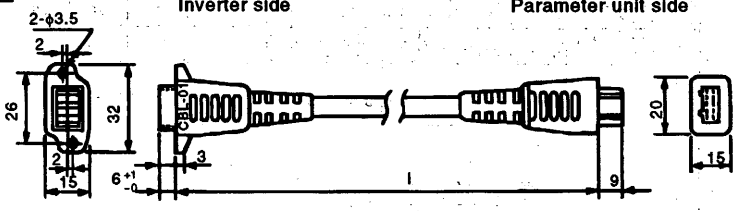
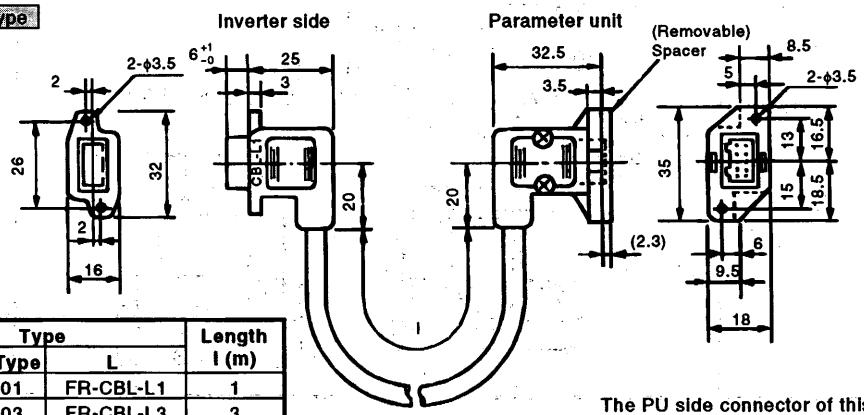
2 The link across inverter terminals P-P1 must be disconnected. (If it is not disconnected, there is no power factor improvement.)

3. The wiring distance from the inverter should be less than 5m.

4. The size of the cable used should be identical to or larger than that of the power supply cable (R, S, T). (See page 26-8.)

5. Select the reactor according to the motor capacity. (If the inverter capacity is greater than the motor capacity, select the reactor according to the motor capacity.)
*To be used when a 3.7kW motor is used with a 5.5K inverter.

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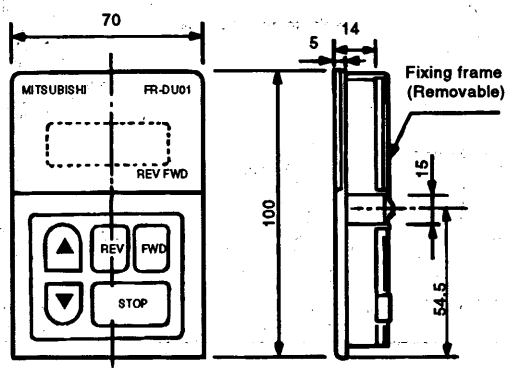
Option (Type)	Specifications, Structure, Etc.	Remarks
Radio noise filter FR-BIF.....200V series FR-BIF-H...400V series		 Note:1. This filter must not be connected to the output circuit of the inverter. 2. The cables should be as short as possible and connected to the terminal block of the inverter.
Line noise filter FR-BSF01 (applies to small capacities) FR-BLF	FR-BSF01  FR-BLF 	 Note:1. Wind the cable 4 or more times in the same direction in each phase. (A greater effect is produced as the winding times increase.) 2. If the cable size is too large to wind, use four or more filters in series and wind the cable in the same direction in each phase. 3 This filter can also be used on the output side as on the input side. The winding on the output side should be within 3 turns. 4. Use the FR-BSF01 for capacities of 3.7kW and down. A cable of large size (38mm^2 or more) cannot be used. If the cable size is large, use the FR-BLF.
Parameter unit cable FR-CBL□	Straight type  L shape type 	

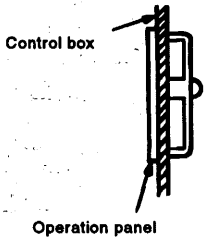
Type		Length l (m)
Straight Type	L	
FR-CBL01	FR-CBL-L1	1
FR-CBL03	FR-CBL-L3	3
FR-CBL05	FR-CBL-L5	5

The PU side connector of this L type can be fixed with the accessory screws.

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Option (Type)	Specifications, Structure, Etc.
Digital operation panel (for installation on panel surface) FR-DU01	



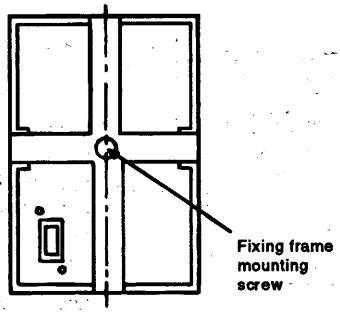


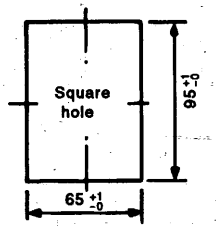
Note:1. This panel cannot be installed on the inverter. Use this panel with the parameter unit cable.

2. Installation method

- Cut a square hole in the control box for installation of this panel.
- Fit the operation panel onto the front and the fixing frame onto the rear of the control box and secure them with screws.

3. Acceptable plate thickness 0.6 to 3.2mm
4. Parameters cannot be read or written.



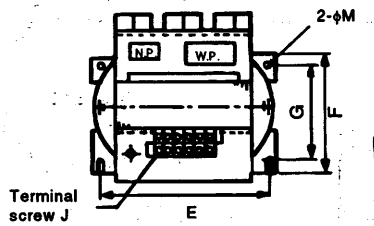


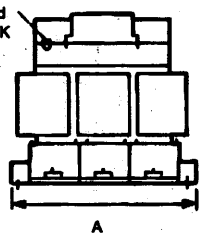
Surge voltage suppressing filter FR-ASF-H☐☐K

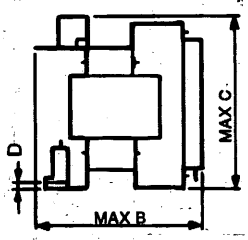
- This filter suppresses a surge voltage generated in the motor terminal voltage when a 400V class motor is driven by the inverter.

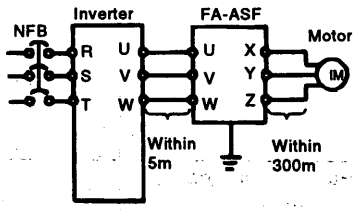
Voltage	Filter Type	Applicable Inverter	Dimensions (mm) A	B	C	D	E	F	G	H x L	M	Terminal Screw J	Ground Screw K	Mounting Screw	Approx. Mass (kg)
400V	FR-ASF-H7.5K	FR-A241E-5.5K/7.5K	280	215	250	3.2	255	191	125	8 x 24	8	M6	M4	M6	20.0
	FR-ASF-H15K *	FR-A241E-11K/15K	335	285	260	6	310	235	200	ϕ10		M6	M6	M8	28
	FR-ASF-H22K *	FR-A241E-18.5K/22K	335	349	340	6	310	281	240	ϕ10		M8	M6	M8	38
	FR-ASF-H37K *	FR-A241E-30K/37K	375	388	445	6	350	388	330	ϕ10		M8	M8	M8	55
	FR-ASF-H55K *	FR-A241E-45K/55K	395	568	445	6	370	553	490	ϕ10		M10	M8	M8	73

* The filters of H15K and up are slightly different in shape.









Note: 1. Connect the cables from the output terminals (U, V, W) of the inverter to the input terminals (U, V, W) of the filter and the cables from the motor terminals to the output terminals (X, Y, Z) of the filter. Run the cables with extreme care. Incorrect wiring may overheat and damage the resistor.

2. The wiring length from the inverter output terminals to the filter input terminals should be within 5m.
3. The wiring length from the filter terminals to the motor terminals should be less than 300m.
4. The terminals used for wiring should be sleeved solderless terminals.

* (H) in the type code indicates that H is attached to the code for 400V.

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3. Delivery condition

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- This product is not designed or manufactured for use with any equipment or system which will be operated under conditions hazardous to life.
- If you are planning to use this product in any specific application such as passenger mobile, medical, aerospace, atomic, power or submarine junction equipment or system, please refer to our business department.
- This product is manufactured under rigorous quality control. However, safety devices should be installed if this product is applied to any facility that may result in a serious accident or loss due to a failure of this product.
- This product should only be used with a load of three-phase induction motor.

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REVISIONS

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

Print Date	*Manual Number	Revision
June, 1996	IB (NA) 66637-A	First edition

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MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100

IB (NA) 66637-A (9606) MEE Printed in Japan

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