

# **FREQROL A**

Transistorized Inverter

Instruction Manual

Art. No.: 48105 - 961113 - IB (NA) 66494-B

## **FR-A200E(EC)**

**FR-A240E - 1.5K - 55K-EC**



## FR-A240E 1.5K/2.2K/3.7K-EC

### Additional information for FR-A240E-1.5K, 2.2K, and 3.7K-EC inverters.

This information is additional to the safety and operation information in the FR-A240E 5.5-55K-EC Instruction Manual IB(NA) 66604-A (9510). Page references given are to this manual.

#### 1. Structure (page 4)

As FR-A240E-5.5 to 7.5K-EC

#### 2. Removal and reinstallation of front cover (page 5)

As FR-A240E-5.5 to 7.5K-EC

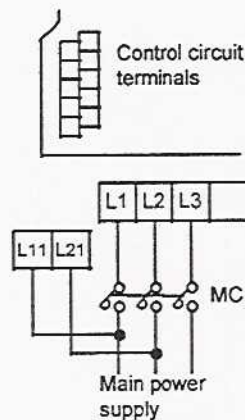
#### 3. Wiring of the main circuit (page 18)

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

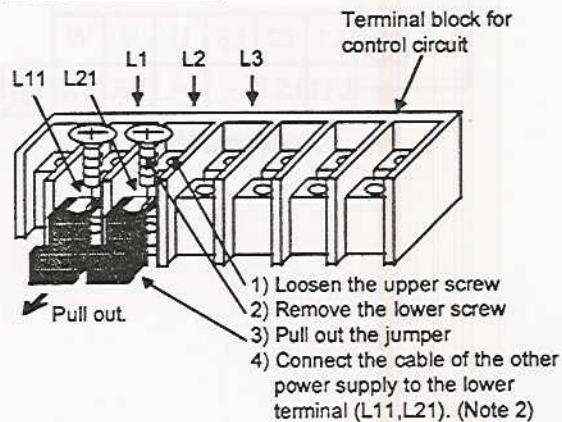
If the magnetic contactor (MC) in the inverter power supply is opened when a protective circuit is operated, the inverter control circuit power is lost and the alarm output signal cannot be kept on. To keep the alarm signal on, terminals L11 and L21 are available. In this case, connect the control circuit power supply terminals L11 and L21 to the primary (input) side of the MC.

Model FR-A240E-1.5K, 2.2K, 3.7K

Circuit diagram



Connection procedure



Note 1. When the main circuit power terminals L1, L2, L3 are on, do not switch off the control circuit power terminals L11, L21, the inverter will be damaged.

Note 2. To use a separate power supply the jumpers between L1-L11, and L2-L21 must be removed.

#### 4. Parameter setting range (page 88)

Setting range of Pr.80 changes to "0.4 to 55kW,9999"

## 5. Standard specifications (page 149)

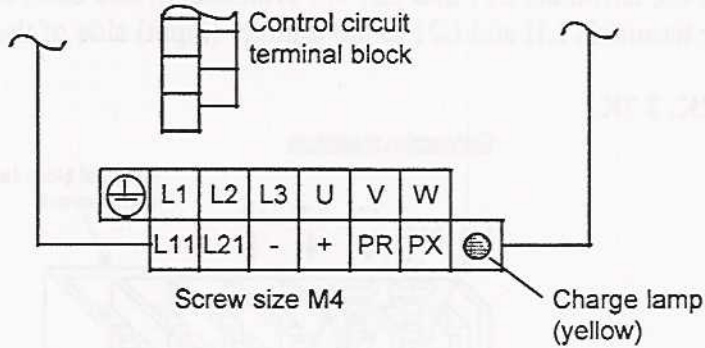
### 400V Series

Type		1.5	2.2	3.7	
Output	Applied motor capacity (kW)*1	1.5	2.2	3.7	
	Rated Capacity (kVA) *2	3	4.2	6.9	
	Constant torque	Applied motor (kW)	1.5	2.2	3.7
		Rated current (A)	4	6	9
	Variable torque	Applied motor (kW)	2.2	2.2	3.7
		Rated current (A)	4.8	6.7	9
	Overload current rating *3	Constant torque	150% 60 sec, 200% 0.5sec		
		Variable torque	120% 60 sec, 150% 0.5sec		
Voltage *4		Three phase 380 to 460V 50Hz/60Hz *10			
Regenerative braking torque	Maximum value/time	100% 5sec			
	Allowable operation factor	2% ED			
Power supply	Rated input AC voltage and frequency	Three phase 380 to 460V 50Hz/60Hz *10			
	Allowable voltage fluctuation	323 to 506V 50Hz/60Hz *10			
	Allowable frequency fluctuation	± 5%			
	Power supply capacity (kVA) *6	4.5	5.5	9	
Protective structure		IP 20			
Cooling System		Fan cooling			
Approx. weight (kg) (including PU)		4.0	4.5	4.5	

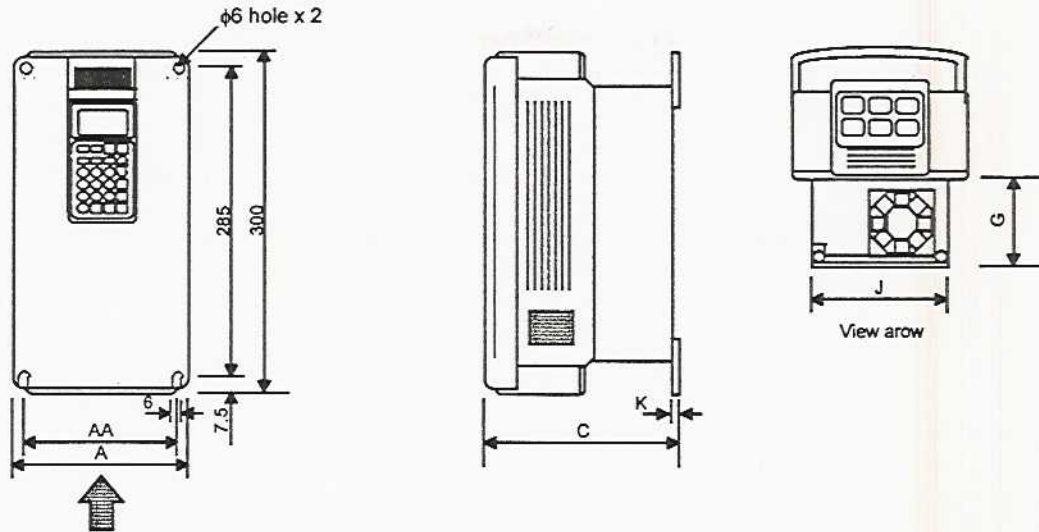
Note \*10 : For LVD compliance in EC voltage limit 380-415V, Non EC countries 380-460V

## 6. Terminal Block Arrangement (page 155)

### Terminal block for main circuit



7. Outline Drawings (Page 156)



400V series

Inverter type	A	AA	C	G	J	K
FR-A240E-1.5K-EC	150	125	170	71	142	2.3
FR-A240E-2.2K-EC	150	125	170	71	142	2.3
FR-A240E-3.7K-EC	150	125	170	71	142	2.3

8. Peripheral Device List (page 159)

400V class

Motor Output (kW)	Applicable inverter type	NFB or NV		Magnetic Contactor	Cable PVC (mm <sup>3</sup> )	
		Standard	With PFC reactor		L1, L2, L3	U, V, W
1.5	FR-A240E-1.5K-EC	Type NF30, NV30, 10A	Type NF30, NV30, 10A	S-K10	2.5	2.5
2.2	FR-A240E-2.2K-EC	Type NF30, NV30, 15A	Type NF30, NV30, 10A	S-K20	2.5	2.5
3.7	FR-A240E-3.7K-EC	Type NF30, NV30, 20A	Type NF30, NV30, 15A	S-K20	2.5	2.5

Recommended wire size for the following conditions

Ambient temperature : 40 °C maximum

Wire installation : on wall without ducts or conduits.

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



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

### This section is specifically about safety

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

 **WARNING  
HIGH VOLTAGE**

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.

 **WARNING**

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.

MITSUBISHI ELECTRIC

#### NOTE

Regarding to EMC Directive 89/336/EEC

Since AC inverter is a component that the ultimate EMC performance is dependent upon correct installation, correct installation is the responsibility of the installer. CE marking is not applicable, as an AC inverter is considered as a complex component, and only suitable for professional installers, having no intrinsic function for an end user(layman). Total EMC performance is only applicable when placed into service as part of an apparatus(e.g. machine).






Please utilize EMC Installation Guidelines  
(Document Number: BCN-A21041-202)

(1/1) BCN-A21041-801-\*

## Operator Safety




### 1. Electric shock prevention

#### WARNING HIGH VOLTAGE

-  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 and check for no residual voltage across terminals "P/+" and "- ("P" and "N") before touching wires.
-  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.





### 2. Fire Prevention

#### WARNING

-  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.
-  Do not connect a resistor directly to terminals "P" and "N".

### 3. Injury Prevention

#### WARNING





-  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

#### WARNING



-  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.

 **WARNING**

-  Do not lift the inverter with the front cover attached, it may fall off.
-  Do not stand or rest heavy objects on the inverter.
-  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.  $-10^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  (without freezing)  $-10^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$  for enclosed specification.  
Less than 90% Relative Humidity without condensation.  
Ensure the environment is  $-20^{\circ}\text{C}$  to  $65^{\circ}\text{C}$  (short time storage temperature), no corrosive or flammable gasses, altitude less than 1000m above sea level, vibration is less than  $5.9\text{m/s}^2$  {0.6G} (based on JIS C 0911).


(2) Wiring

 **WARNING**

-  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.










(3) Trial run

 **WARNING**

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



(4) Operation

 **WARNING**

-  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.




 **WARNING**

-  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

 **WARNING**

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


(6) Maintenance and inspection

 **WARNING**

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

(7) Disposing of the inverter

 **WARNING**

-  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.

## FOREWORD

Thank you for choosing the Mitsubishi "FREQROL-A200E-EC" high-function, ultra low-noise inverter.

- **Information given in this manual**

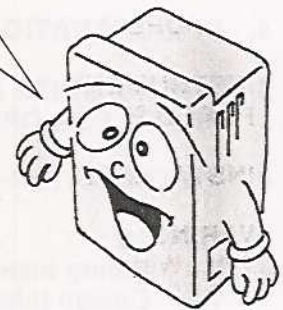
This instruction manual gives information on installation, wiring, parameter unit operation, etc. as well as maintenance and inspection procedures.

- **Before using the inverter**

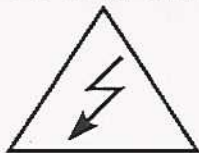
This inverter is an industrial piece of Power Electronics, which utilises the latest user friendly software to make it as easy as possible to install, maintain and run. However, it is essential to read this manual carefully to use the equipment safely, correctly, and to its full capability.

- **Attention**

Please forward this manual to the end user.



## WARNING



Hazardous voltage present when connected to the power supply. Isolate from power supply for 10 minutes before removing cover. Ensure capacitor charge lamp is off before working on drive.

## **CONTENTS**

- Foreword
  - Contents
  - Precautions for Handling the Inverter—1
- 1. PRECAUTIONS FOR OPERATION—2**
  - 2. STRUCTURE**
    - 2-1 Structure—4
  - 3. REMOVAL AND REINSTALLATION**
    - 3-1 Removal and Reinstallation of the Front Cover—5
    - 3-2 Removal and Reinstallation of the Parameter Unit—8
    - 3-3 Removal and Reinstallation of the Accessory Cover—9
  - 4. PRE-OPERATION PROCEDURE—10**
  - 5. INSTRUMENTS AND PARTS TO BE PREPARED FOR OPERATION—11**
  - 6. INSTALLATION—12**
  - 7. WIRING**
    - 7-1 Wiring Instructions—15
    - 7-2 Design Information to Be Checked—17
    - 7-3 Wiring of the Main Circuit—18
    - 7-4 Wiring of the Control Circuit—23
  - 8. PARAMETER UNIT**
    - 8-1 Structure of the Parameter Unit—25
    - 8-2 Precautions for Using the Parameter Unit—26
    - 8-3 Using of the FR-ARWER Parameter Copy Unit—28
  - 9. OVERVIEW OF THE PARAMETER UNIT FUNCTIONS—29**
  - 10. OPERATION MODE—30**
    - 10-1 Selection of the Operation Mode—31
    - 10-2 Operation Mode Indication, Operation Command Indication and Operation Status Indication—32
  - 11. PRE-OPERATION SETTINGS—33**
  - 12. OPERATION**
    - 12-1 External Operation Mode—36
    - 12-2 PU Operation Mode—38
    - 12-3 Combined Operation Mode—40
  - 13. SETTING AND CHANGING THE VALUES IN THE PARAMETERS—43**
  - 14. MONITORING FUNCTION**
    - 14-1 SHIFT Operation Sequence on the PU Main Monitor—44
    - 14-2 Selecting the Another Monitor Item in the Selective Monitoring Mode—45
  - 15. HELP FUNCTION—46**
    - 15-1 Help Function Menu—47
    - 15-2 Other Help Function—60
  - 16. CALIBRATION OF THE METER (FREQUENCY METER)**
    - 16-1 Calibration of the FM-SD Output—61
    - 16-2 Calibration of the AM-5 Output—62
  - 17. ERRORS**
    - 17-1 Errors (Alarms)—64
    - 17-2 Correspondences between Digital and Actual Characters—66
    - 17-3 Alarm History—66
    - 17-4 Erasing the Alarm History—66
    - 17-5 Alarm Code Output—67
  - 18. PU DISCONNECTION DETECTION FUNCTION—68**
  - 19. INVERTER RESET—69**
  - 20. ADJUSTMENT OF THE FREQUENCY SETTING SIGNALS "BIAS" AND "GAIN"—70**
  - 21. SELECTION OF MAGNETIC FLUX VECTOR CONTROL—76**
  - 22. AUTO COMMISSION—80**
  - 23. 5-POINT FLEXIBLE V/F CHARACTERISTIC—86**

## 24. PARAMETERS

24-1 Parameter List—87

24-2 Setting of Parameters to Improve the Corresponding Operational Functions—90

- Lifter or the like requires large starting torque [0] —90
- To keep the speed less than the set frequency of the machine [1], [18] —90
- To run the motor as soon as the start signal is switched on, without setting the frequency [2] —90
- To set the reference frequency (base frequency) at the rated torque of the motor according to the motor rating [3], [19] —91
- To set multiple speeds [4], [5], [6], [24], [25], [26], [27] —91
- To accelerate slowly or rapidly [7], [20], [21] —92
- To decelerate slowly or rapidly [8], [20], [21] —92
- Motor overheat protection [9] —93
- To adjust the stopping accuracy of positioning operation, etc. according to the load [10], [11], [12] —93
- To limit the running frequency at start [13] —94
- To select the optimum output characteristic (V/F characteristic) for application and load characteristic [14] —94
- To set the frequency and acceleration/deceleration time for jog operation [15], [16], [20], [21] —95
- To select a thermal relay outside of the inverter [17] —96
- To run at the frequency over 120Hz [18] —97
- To use the motor of 200V rating with a 230V power supply [19] —97
- To set the stall prevention (current limit) operation level [22], [23], [66] —98
- To compensate for speeds during multi-speed operation [28] —98
- To select the optimum acceleration/deceleration pattern for application [29] —100
- To make frequent starts and stops by using the optional high-duty brake resistor [30], [70] —101
- To avoid the resonant points of a machine [31], [32], [33], [34], [35], [36] —102
- To change the speed display to motor speed display (r/min) or machine speed display (m/min) [37], [51], [52], [53] —103
- To automatically control the output voltage (torque) according to the load [38], [39] —103
- To change the functions of the output terminals SU, IPF, OL, FU [40] —104
- To adjust the ON range of the up-to-frequency signal [41] —105
- To set the operation and open signals of the electromagnetic brake, etc. [42], [43] —105
- To switch between two motors different in conditions [44], [45], [46], [47] —106
- To stop a trolley etc. on contact with a stopper [48], [49] —106
- To set the second output frequency detection [50] —107
- Selection of monitor and output signals [51], [52], [53], [54], [158] —107
- To set the frequency and current referenced for the display of the level meter [55], [56] —109
- To automatically restart operation after instantaneous power failure /commercial power supply-inverter switch-over [57], [58] —110
- To perform remote setting [59] —111
- To perform intelligent mode operation [60] —112
- To perform the intelligent mode operation with higher performance [61], [62], [63], [64] —113
- To limit the errors reset for retry [65] —114
- To use the retry function [67], [68], [69] —115
- To use the Mitsubishi constant-torque motor [0], [3], [9], [71] —115
- To match the thermal characteristic of the electronic overcurrent protection with the motor used [71] —116

- To lower the PWM carrier frequency so that noise and leakage current are reduced **[72]** —116
- To set the ratio of the output voltage to the output frequency (V/F characteristic) of the inverter as appropriate **[71]**, **[100]** to **[109]** —117
- To perform main speed setting using the auxiliary frequency setting terminal 1 **[73]** —118
- Stable operation cannot be performed due to noise **[74]** —119
- To select PU disconnection detection **[75]** —119
- To output the alarm code at its occurrence **[76]** —120
- To set parameter write disable **[77]** —120
- To prevent reverse rotation **[78]** —120
- To select the operation mode **[79]** —120
- To achieve 150% torque for operation at 1Hz **[80]**, **[81]** —122
- To change the language displayed on the parameter unit **[145]** —122
- To change the condition activated by the second control function selection (terminal RT) **[155]** —122
- Selection of the stall prevention function **[156]** —123
- To output the overload alarm (OL) signal only when the signal has persisted for more than a given time **[157]** —124
- Speed fluctuation correction **[159]** —124
- To make the output calibration of terminal FM **[900]** —124
- To make the output calibration of terminal AM **[901]** —125
- To adjust the gain and bias of the frequency setting signals **[902]**, **[903]**, **[904]**, **[905]** —125

## 25. MAINTENANCE AND INSPECTION

- 25-1 Precautions for Maintenance and Inspection—126
- 25-2 Check Items—126
- 25-3 Replacement of Parts—129
- 25-4 Measurement of Main Circuit Voltages, Currents and Powers—130

## 26. TROUBLESHOOTING

- 26-1 Checking the Parameter Unit Display—132
- 26-2 Faults and Check Points—133
- 26-3 Protective Functions—134
- 26-4 Noise, RFI and EMC—136
- 26-5 Earthing—140

## 27. OPTIONS

- 27-1 Option List—142
- 27-2 Inboard Dedicated Options—143
- 27-3 External Dedicated Options—146

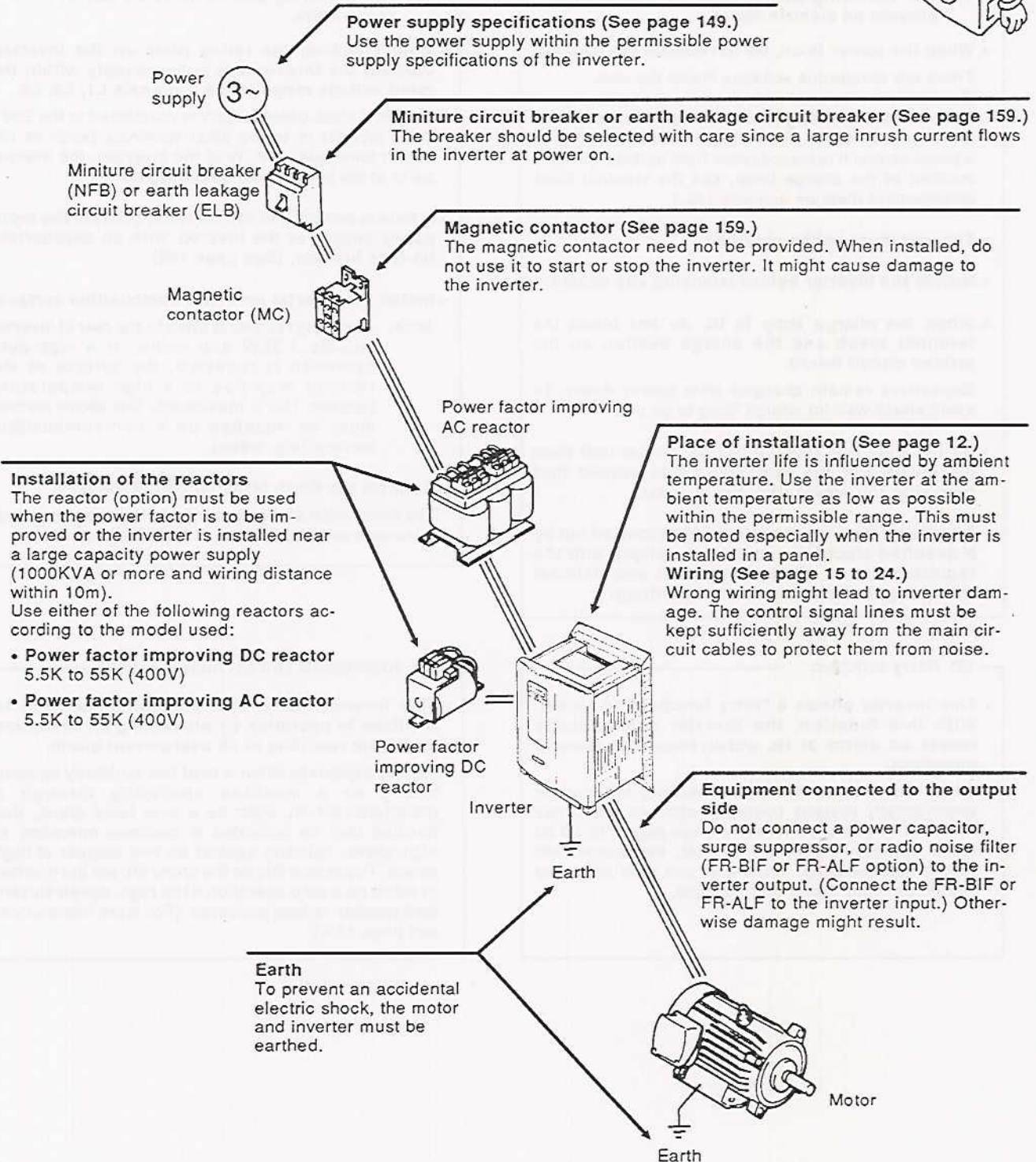
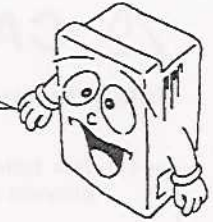
## 28. SPECIFICATIONS

- 28-1 Standard Specifications—149
- 28-2 Block Diagram—152
- 28-3 Terminals—153
- 28-4 Terminal Block Arrangement—155
- 28-5 Outline Drawings—156
- 28-6 FR-PU02(E) Parameter Unit Dimension Diagram—158
- 28-7 Peripheral Device List—159
- 28-8 Selecting the Rated Sensitivity Current for the Earth Leakage Circuit Breaker—159

## 29. USING THE FUNCTIONS—160

# PRECAUTIONS FOR HANDLING THE INVERTER

Incorrect handling might cause the inverter to operate improperly, its life to be reduced considerably, and in the worst case, the inverter to be damaged. Please handle the inverter properly in accordance with the information on each section as well as the precautions and instructions of this manual.



Note: This inverter is designed for use inside a separately earthed enclosure. It has an IP rating between IP00 and IP20, according to model, and therefore, precautions must be taken at point of installation to minimize RISK of hazard to users, and to comply with EMC directive 89/336.

# 1. PRECAUTIONS FOR OPERATION

## CAUTIONS

### Safety Instructions


(1) The following points must be observed to prevent an electric shock.

- **When the power is on, do not access the inverter.**  
There are dangerous voltages inside the unit. Especially in an application where the cover is removed, the high voltage terminals and charge section are exposed. Hence, the inverter must be installed in a panel so that it is inaccessible from outside. (For the location of the charge lamp, see the terminal block arrangement diagram on page 152.)
- **The unit must not be modified.**
- **Isolate the inverter before removing any covers.**
- **When the charge lamp is lit, do not touch the terminal block and the charge section on the printed circuit board.**  
Capacitors remain charged after power down. To avoid shock wait for charge lamp to go out.
- **Do not insert or remove the parameter unit from the inverter or the extension cable without first removing the power from the inverter.**
- **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) Retry function

- **This inverter allows a "retry function" to be set. With this function, the inverter automatically resets an alarm at its occurrence and restarts operation.**  
When this function has been selected, the inverter automatically restarts operation after an alarm has occurred. (For more information, see page 115.) If an alarm has occurred in the inverter, the inverter will restart automatically. Therefore, use care not to be caught up in the motor and machine.

(2) The following points must be observed to prevent fire.

- **After checking the rating plate on the inverter, connect the three-phase power supply within the rated voltage range to the terminals L1, L2, L3.**  
If a 400V class power supply is connected to the 200V class inverter or to the other terminals (such as the output terminals U, V, W of the inverter), the internal parts of the inverter will be damaged.
- **A fuse is not built in the inverter. Provide the input power supply of the inverter with an appropriate no-fuse breaker. (See page 159)**
- **Install the inverter on a non-combustible surface.**  
Note: A braking resistor is fitted to the rear of inverter models 7.5kW and below. If a high-duty operation is repeated, the surface of the resistor may rise to a high temperature (approx. 150°C maximum). The above models must be installed on a non-combustible surface (e.g. metal).
- **Connect the Earth terminal  of the unit.**  
The motor must also be grounded. If it is not grounded, a leakage current may cause an electric spark.

(4) High-speed current limit function

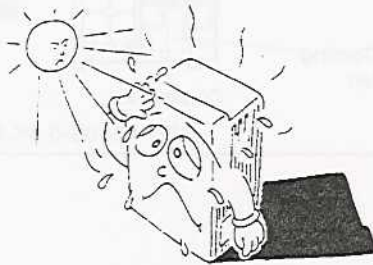
- **This inverter has a stall prevention function to continue in operation by preventing an excessive load from resulting in an overcurrent alarm.**  
Hence, especially when a load has suddenly become heavy on a machine operating through a predetermined lift, such as a over head crane, this function may be activated to continue operation at high speed, colliding against an end stopper at high speed. To prevent this on the crane lift, set the inverter or make up a stop operation if the high-speed current limit function is kept activated. (For more information, see page 123.)

# ⚠ CAUTIONS

When using the inverter, note the following points.

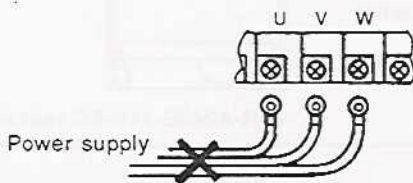
**Use the inverter within the permissible ambient temperature range.**

Since the life of the inverter is greatly influenced by ambient temperature, use the inverter at the lowest possible temperature with the permissible range. The installation direction and environment of the inverter must also be fully noted. (see page 12.)



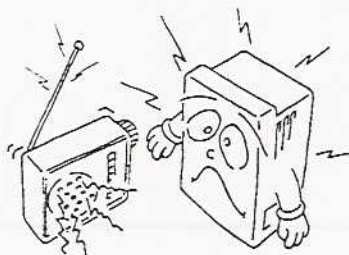
**The inverter will be damaged if the power supply is applied to the output terminals of the inverter.**

The application of the power supply voltage to the output terminals U, V, W will damage the inverter. Check that the wiring and operation sequence (such as the commercial power supply-inverter switch-over circuit) are correct.



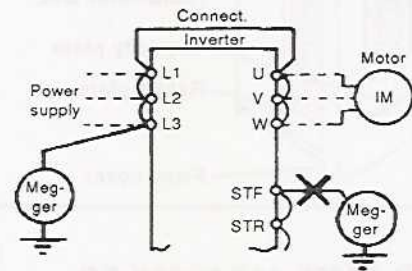
## Electric wave interference

High-frequency components included in the input/output (main circuit) of the inverter may interfere with communication equipment (such as AM radios) used near the inverter. In this case, install the optional FR-BIF radio noise filter (dedicated to the input side) or the FR-BSF01 or FR-BLF line noise filter to reduce such interference.



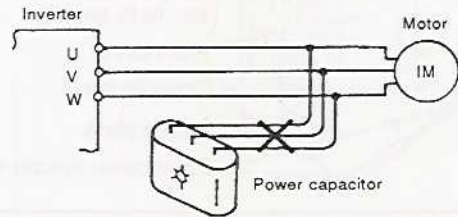
**Do not perform the insulation resistance test on the control circuits of the inverter.**

Before measuring the resistance of the power supply cable and motor using a megger, disconnect the cables to the inverter or connect the terminals as shown below.



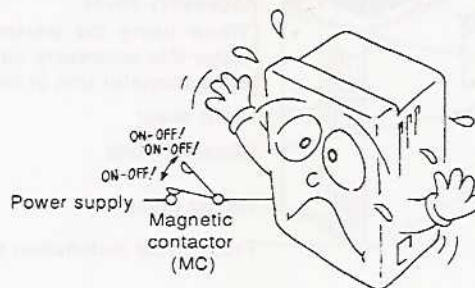
**Do not install the power capacitor, surge suppressor, and radio noise filter on the output side of the inverter.**

If any of the above components is connected, the inverter will trip and the capacitor and surge suppressor will be damaged. (Connect the FR-BIF radio noise filter to the input side.)



**Do not use the magnetic contactor on the power supply side to start and stop the motor (inverter).**

Frequent switching of the magnetic contactor will lead to an inverter fault. Where possible, use the start signal to start and stop the inverter.



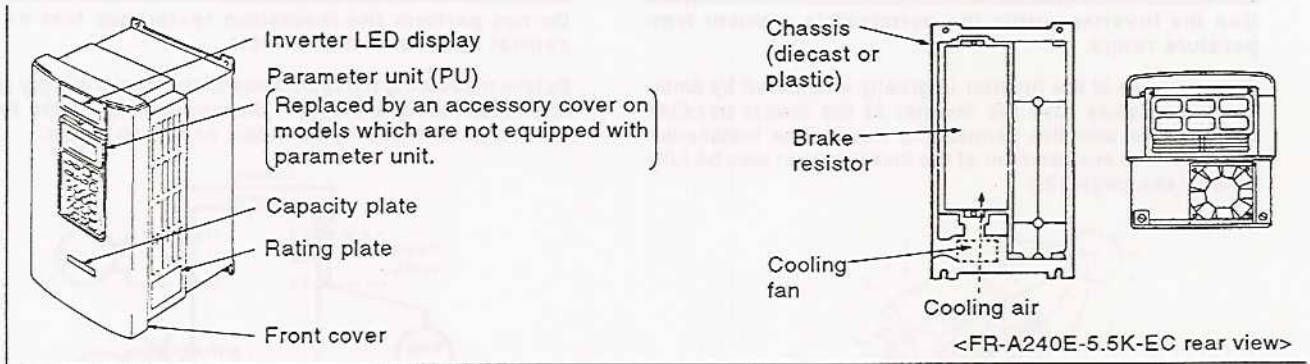


## 2. STRUCTURE

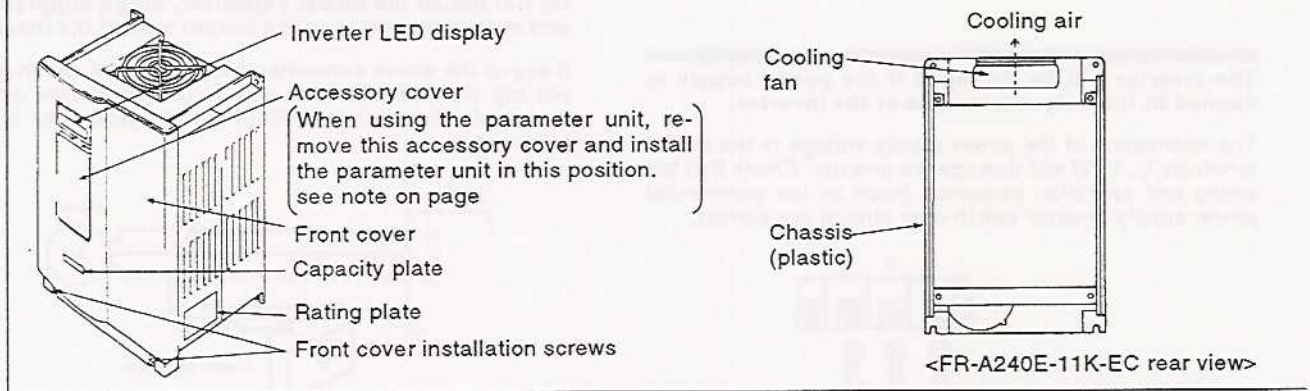
### 2-1 Structure

For the location of the charge lamp, see the terminal block layout diagram on page 155.

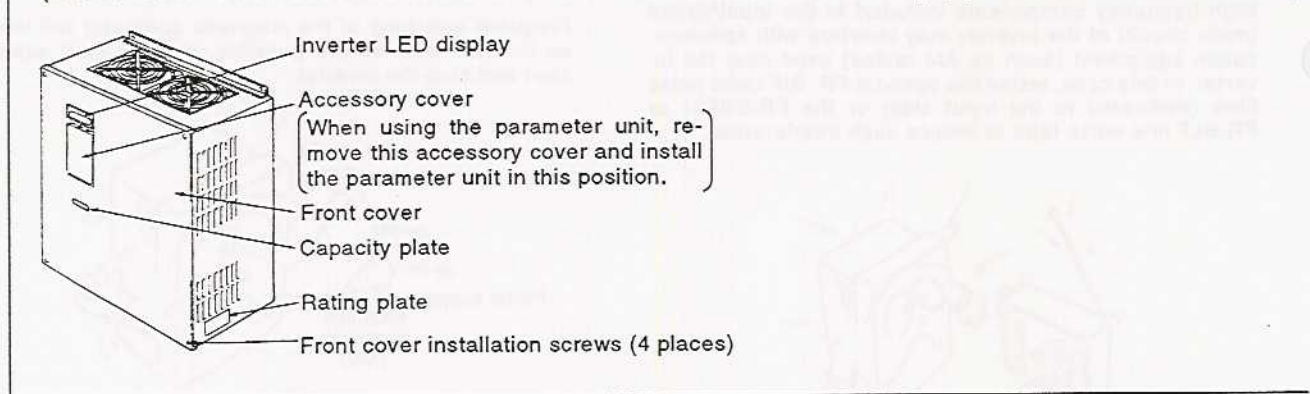
#### ■ FR-A240E-5.5K to 7.5K-EC



#### ■ FR-A240E-11K to 22K-EC (Not equipped with a brake resistor.)



#### ■ FR-A240E-30K to 55K-EC (The chassis and cover are made of steel. These models are not equipped with a brake resistor.)

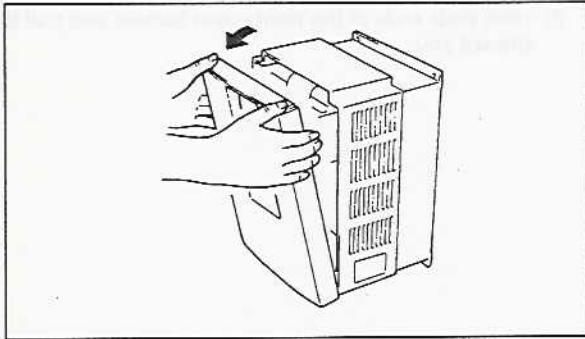


### 3. REMOVAL AND REINSTALLATION

#### 3-1 Removal and Reinstallation of the Front Cover

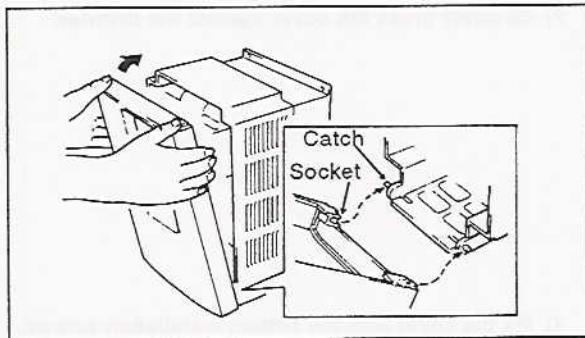
##### ■ FR-A240E-5.5K to 7.5K-EC

###### • Removal



- 1) Hold both sides of the front cover top.
- 2) Pull the cover toward you.  
(The cover may be removed with the parameter unit on.)

###### • Reinstallation



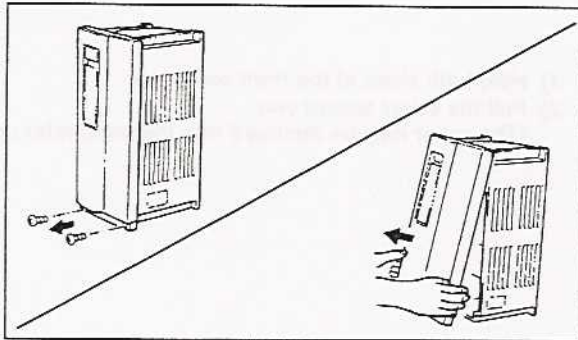
- 1) Fit the sockets at the cover bottom onto the catches of the inverter.
- 2) Using the catches as supports, securely press the cover against the inverter.  
(The cover may be reinstalled with the parameter unit on.)

#### WARNING

Do not remove PU when drive is powered.

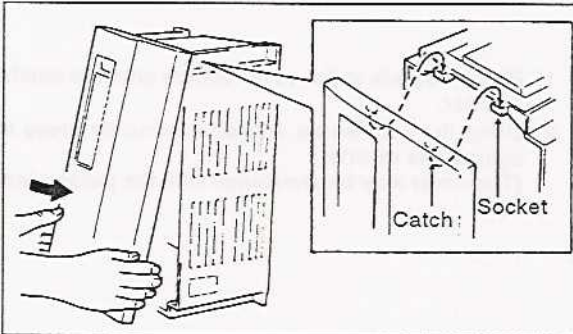
■ FR-A240E-11K to 22K-EC

• Removal

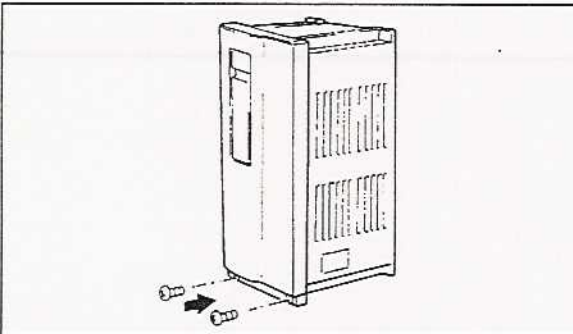


- 1) Remove the two installation screws at the bottom of the front cover.
- 2) Hold both ends of the front cover bottom and pull the cover toward you.


• Reinstallation



- 1) Fit the catches on the inside of the front cover top into the sockets of the inverter.
- 2) Securely press the cover against the inverter.



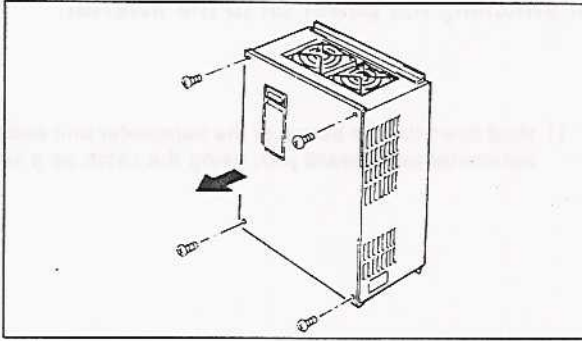
- 3) Fix the cover with the bottom installation screws.

 **WARNING**

Do not remove PU when drive is powerd.

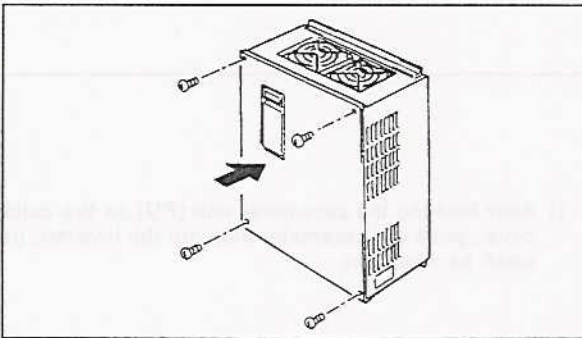
## ■ FR-A240E-30K to 55K-EC

### • 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 that the front cover has been reinstalled securely.  
2. Check that 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 number to ensure that they are the same.

Example:

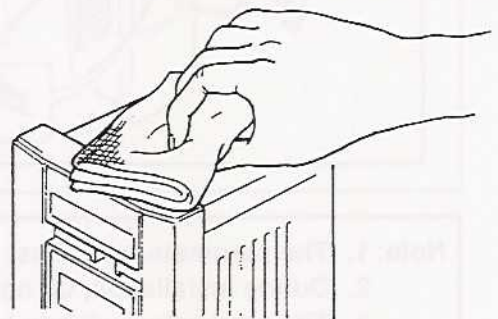
Capacity plate A4615

Rating plate A4615 0001

└── 4-digit serial number

If the inverter surface has become dirty during installation, gently clean it with a cloth soaked in a neutral detergent or ethanol.

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



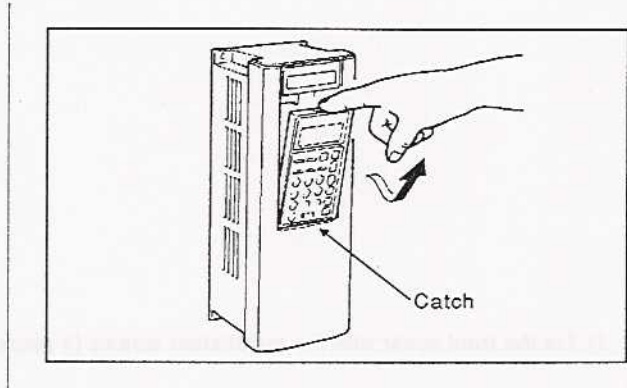
### ⚠ CAUTIONS

- 1) Removal of cover when unit is powered gives access to high voltages. Please isolate inverter from power before performing and adjustments to wiring etc.
- 2) Wait **AT LEAST** 10 minutes after isolation before top cover removal.
- 3) Do not remove PU when drive is powered.

### 3-2 Removal and Reinstallation of the Parameter Unit

Remove and reinstall the parameter unit only after switching the power off to the inverter.

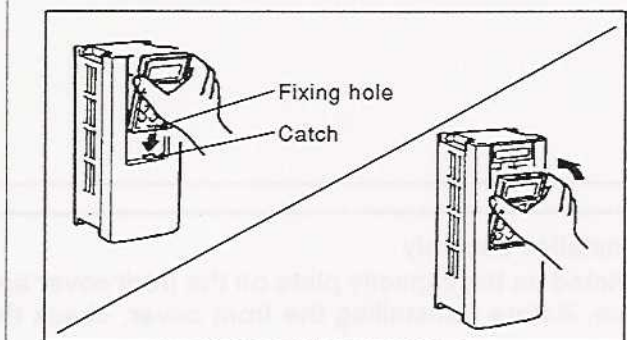
#### ■ Removal



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

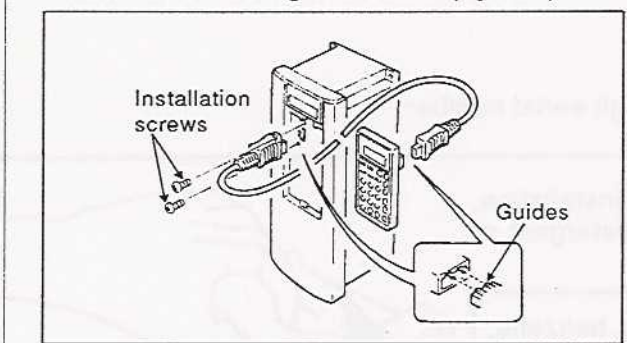
#### ■ Reinstallation

##### • Direct installation onto the inverter



- 1) After locating 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 PU socket on the inverter and the other end into the PU connector. Ensure correct alignment. (If the orientation is incorrect, the inverter may be damaged.)
- 2) After plugging the cable connector into the inverter, fix it securely with the installation screws.

- Note: 1. The parameter unit must be installed to 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 and 200 series inverters.

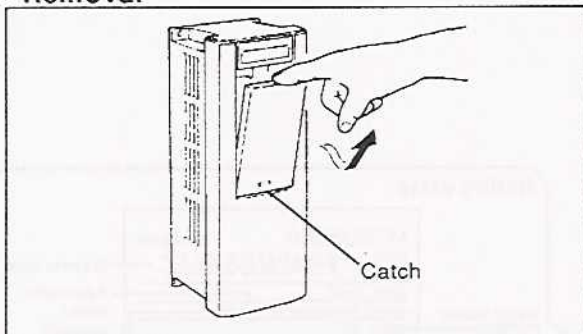
#### CAUTIONS

- 1) Never use any sharp or pointed object to depress the keys of the P.U. unit. The membrane keypad was designed ONLY for use with human fingers.
- 2) Do not insert or remove the PU from the inverter or the extension cable without first removing power from the inverter.

### 3-3 Removal and Reinstallation of the Accessory Cover

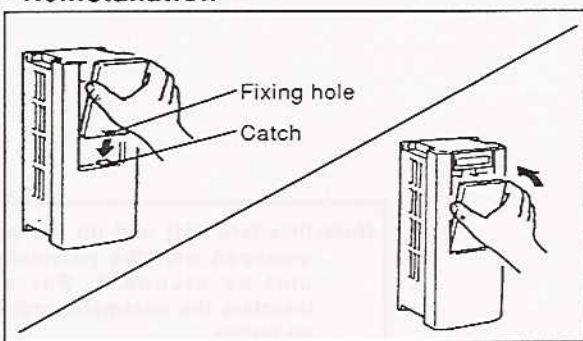
Remove and reinstall the accessory cover after switching the power off to the inverter.

#### • Removal



- 1) As with 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 locating on catch of the inverter cover, push accessory cover into the inverter.

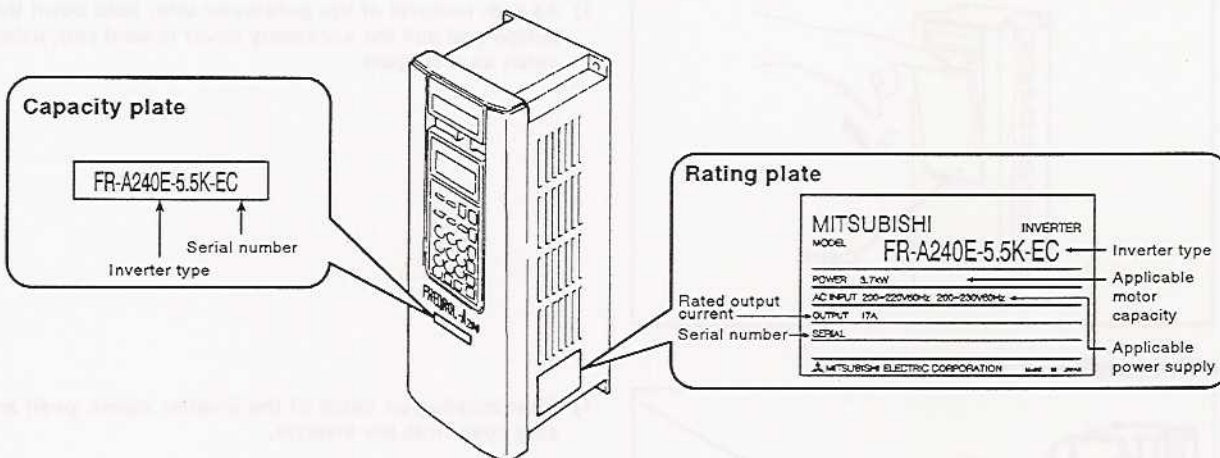
#### ⚠ CAUTION

- 1) Do not remove the accessory cover from the inverter without first removing the power from the inverter.

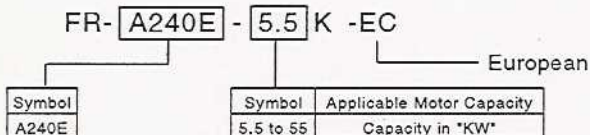
# 4. PRE-OPERATION PROCEDURE

## 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



Note: Inverters 11K and up are not equipped with the parameter unit as standard. For all inverters the parameter unit is an option.

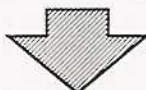
### • Accessory.....Instruction manual

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 required will depend on how the inverter is operated. For required parts, etc. see Section 5 "INSTRUMENTS AND PARTS REQUIRED FOR OPERATION".



## 3. Installation

To prolong the life of the inverter, install the inverter in a proper cabinet, with correct orientation and position. (See page 12.)

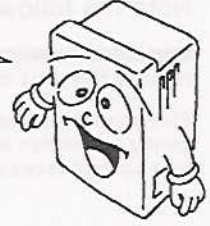


## 4. Wiring

Connect the power supply, motor and operation signals (control signals) to the terminal block. If they are connected improperly, the inverter may be damaged. (See page 15.)

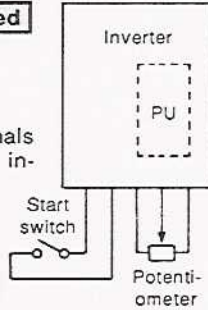
## 5. INSTRUMENTS AND PARTS TO BE PREPARED FOR OPERATION

The FR-A200E inverter can be operated in any of three modes. Select the appropriate mode for an application and running conditions and prepare required instruments and parts.



### 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



### 1. External operation mode

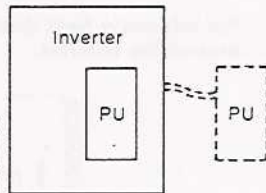
The inverter is operated under the control of external operation signals connected to the terminal block.

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

### Instruments and parts to be prepared

- **Parameter unit**  
(FR-PU02ER)
- **Cable**  
(FR-CBL) (See page 147)

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



### 2. PU operation mode

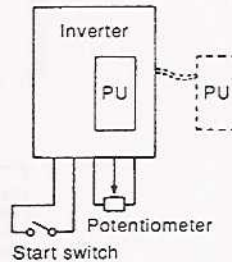
The inverter is operated from the keypad of the parameter unit.

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-PU02ER)
- **Cable**  
(FR-CBL) (See page 147)

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



### 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.



## 6. INSTALLATION

Note the following points.

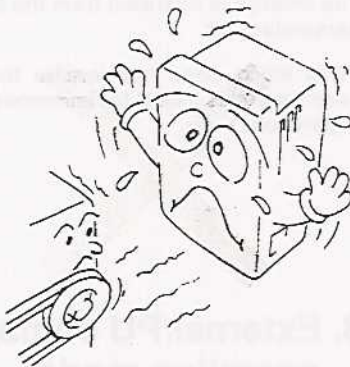
### Handle the unit carefully.

The inverter is made of plastic parts. Handle the inverter gently to protect it from damage. Also, hold the unit carefully so that excessive force is not applied to the front cover.



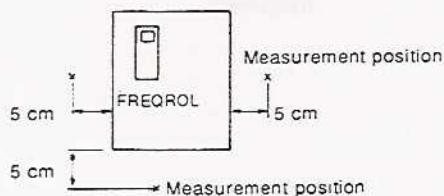
### Install the inverter where it is not subjected to vibration.

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



### 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.



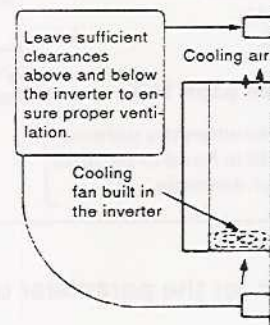
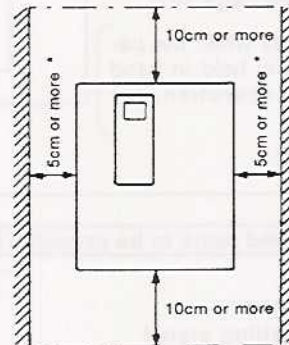
### Install the inverter on a non-combustible surface.

A Braking resistor for brake to fitted on the rear of the inverter models 7.5K and below. If high-duty operation is repeated, the surface of the resistor may rise, to a high temperature (approx. 150°C maximum). Install the above models on a non-combustible surface (e.g. metal).



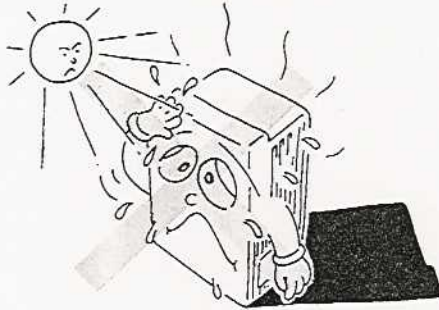
### Leave sufficient clearances around the inverter.

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



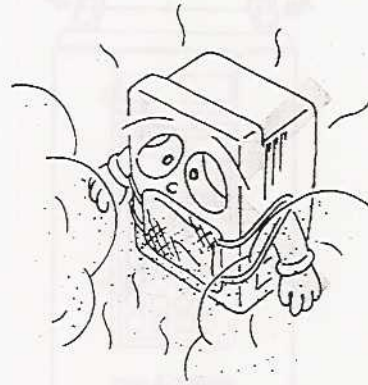
**Avoid high temperature and high humidity.**

Avoid places where the inverter is subjected to direct sunlight, high temperature and high humidity.

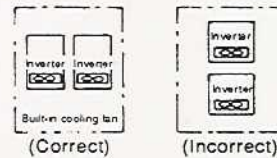


**Do not install the inverter where it is subjected to oil mist, flammable gases, fluff, dust, dirt, etc.**

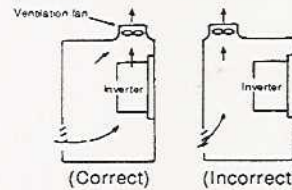
Install the inverter in a clean place or inside a totally enclosed panel.



- 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 151).
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 fans are installed incorrectly, the ambient temperature will rise and ventilation effect will be reduced.



**Installation of Two or More Inverters**

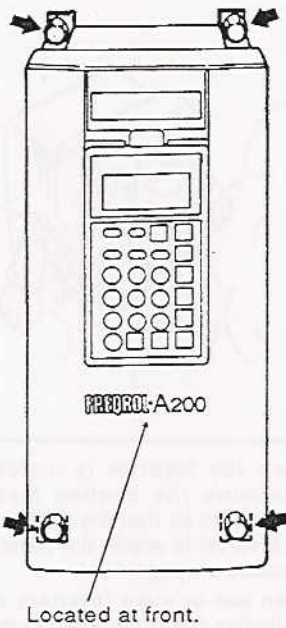


**Position of Ventilation Fan**

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

**Install the inverter securely with bolts.**

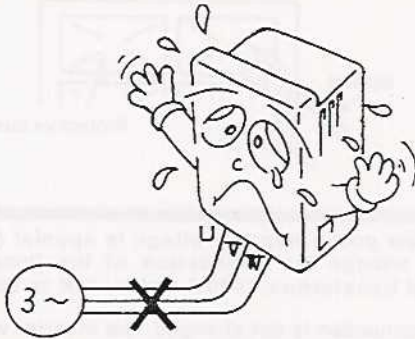
Install the inverter on a strong surface securely and vertically (so that the letters FREQROL-A200 are located at the front) with screws or bolts.



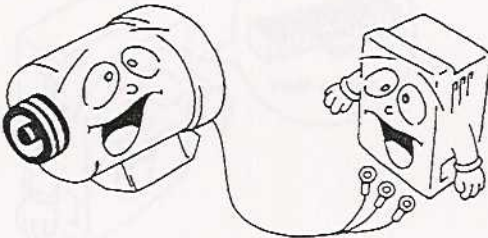
# 7. WIRING

## 7-1 Wiring Instructions

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

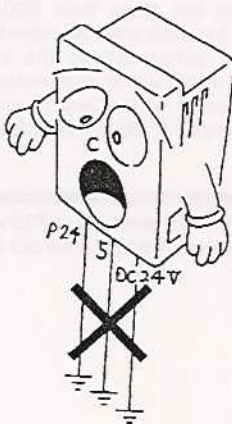


Use sleeved solderless terminals for the power supply and motor cables.



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

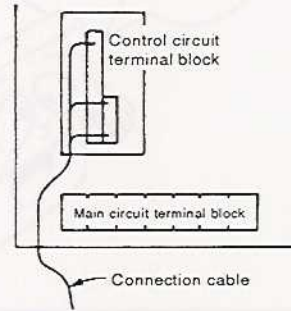
Common terminals P24, 5 and DC24 of the control circuit.



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

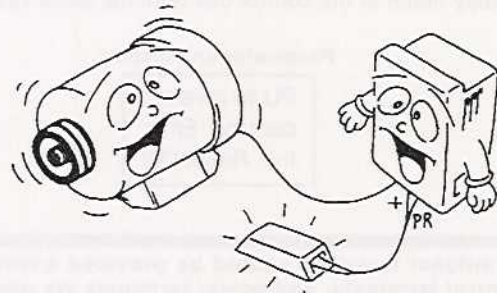
Run them away from the main and power circuits (such as 200V relay sequence circuit).

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



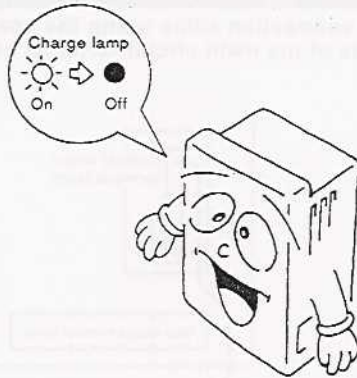
Connect only the recommended optional brake resistor between the terminals + and PR.

In addition, these terminals must not be shorted.



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 still 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  $0.75\text{mm}^2$ .

If the cable size used is  $1.25\text{mm}^2$  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 much of the control box terminal block space.

Parameter unit display

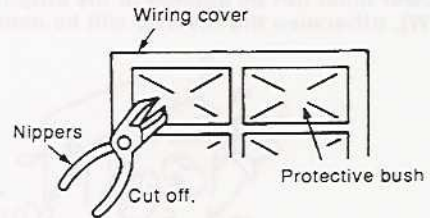
PU to Inverter comms. Error Inv. Reset ON
-------------------------------------------------

Additional isolation should be provided between any control terminals, and power terminals via use of correctly rated peripheral devices such as:

- A) Control Switches
- B) Potentiometers
- C) Meters. etc.

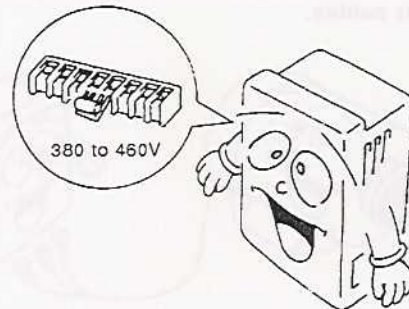
If possible, these are to be manufactured according to IEC 947 standards or equivalent.

Cut open the wiring cover (protective bush) windows using nippers or a cutter for running the cables through.



When the power supply voltage is special (not 380 to 460V), change the connection of the jumper in the internal transformer. (400V series, 11K to 55K)

If the connection is not changed, the inverter will be damaged. (For details, see pages 21, 22.)



When the wiring distance between the inverter and motor is long, and the a voltage drop over the main circuit cables will reduce the motor torque. Use a large diameter cable to keep the voltage drop within 2%.

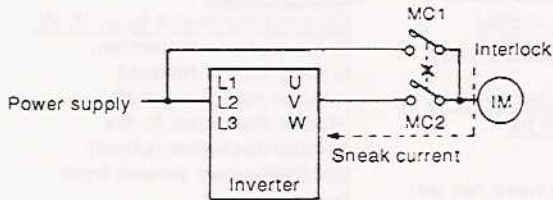
For especially long-distance wiring. (the maximum wiring length should be not more than 500m.) The overcurrent protection may be activated accidentally as a result of a charging current generated by the stray capacity of the wiring. For operation under magnetic flux vector control, the inverter-to-motor wiring length should be within 30m. (A selection example at the wiring distance of 20m is given on page 159.)

All control terminals provide 1700V, AC 1ms isolation relative to power section. Be aware of this when installing/using.

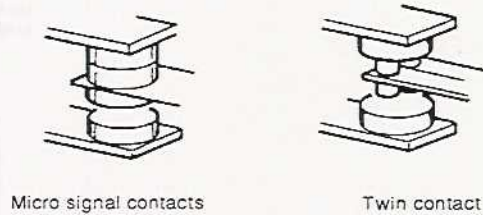
## 7-2 Design Information to Be Checked

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 incorrect wiring but also by 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.



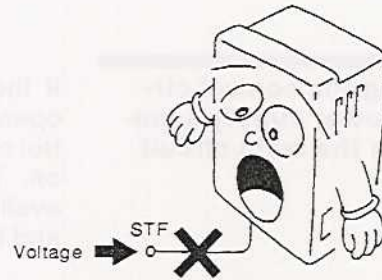
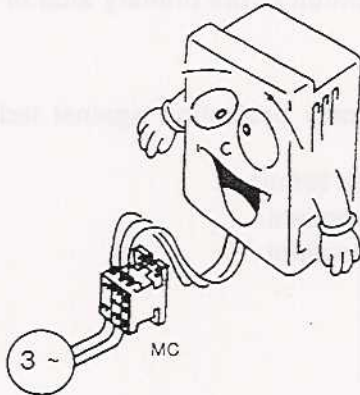
Since input signals to the control circuit are at a low level, use two parallel micro signal contacts or twin contact for contact inputs to prevent a contact fault.



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

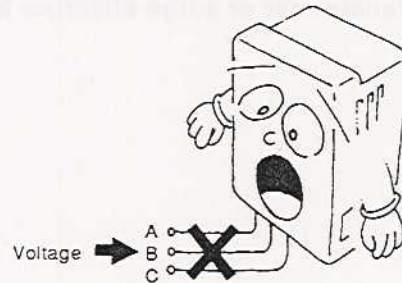
When a machine restart is to be prevented at power restoration after a power failure, provide a magnetic contactor MC in the primary circuit of the inverter and also make up a sequence which will not switch on the start signal.

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



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

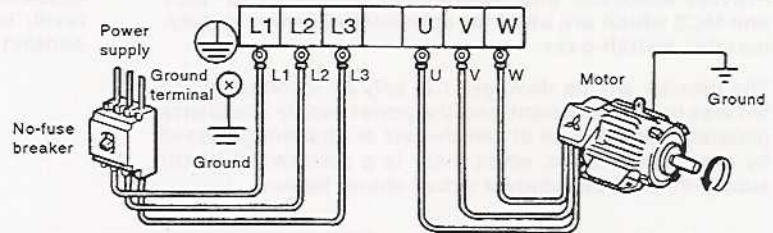
Apply a voltage via a relay coil, lamp, etc. to these terminals.



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 L11, L21 for the control circuit are switched off, the main circuit power supply terminals L1, L2, L3 are also switched off.

**7-3 Wiring of the Main Circuit**  
 (For the terminal block arrangement, see page 155.)

**Connection of the power supply and motor**



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

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.

Phase sequence need not be matched.  
 For use with a single-phase power supply, the power supply cables must be connected to L1 and L2.

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

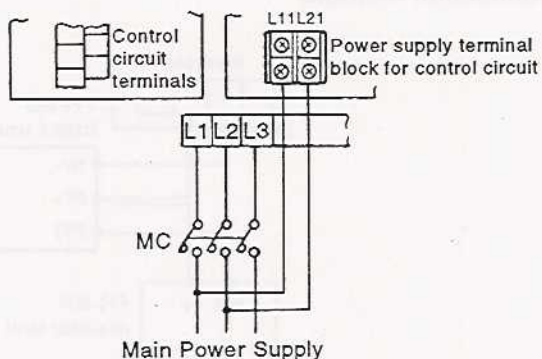
If the magnetic contactor (MC) in the inverter power supply is opened when the protective circuit is operated, the inverter control circuit power is lost and the alarm output signal cannot be kept on. To keep the alarm signal on, terminals L11 and L21 are available. In this case, connect the power supply terminals L11 and L21 of the control circuit to the primary side of the MC.

**⚠ CAUTIONS**

- 1) Do not use residual current protective device as the only protection against indirect contact. Protective earth connection essential.
- 2) Do not connect more than 2 wires on the protective earth terminal.
- 3) Use contactor and no fuse breaker EN/IEC standard compliant.
- 4) Use transformer or surge absorber EN/IEC standard compliant.

• Model FR-A240E-5.5K to 55K-EC

<Circuit diagram>

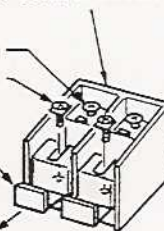


<Connection procedure>

Power supply terminal block for control circuit

- 1) Loosen the upper screw.
- 2) Remove the lower screw.
- 3) Pull out the jumper.
- 4) Connect the cable of the other power supply to the lower terminal (L11, L21). (Note 3)

Pull out.



- Note: 1. The jumpers between L1-L11 and L2-L21 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 L1-L11 and L2-L21 must be removed.

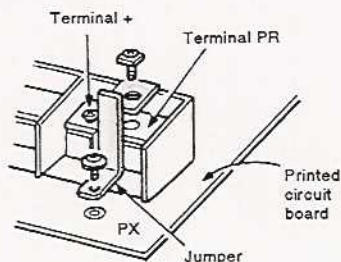
**Connection of the dedicated brake resistor (option)**

The built-in brake resistor is connected across terminals P and PR. When the built-in brake resistor cannot thermally accept operation at high duty, install the external dedicated brake resistor (option). At this time, disconnect the jumper from across terminals PR-PX and connect the dedicated brake resistor (option) across terminals P and PR.

- Note: 1. Do not connect any brake resistor other than the dedicated brake resistor.
2. Do not connect the external brake resistor with the terminals between PR-PX shorted, otherwise the inverter might be damaged.

• Model FR-A240E-5.5K, 7.5K-EC

<Connection procedure>

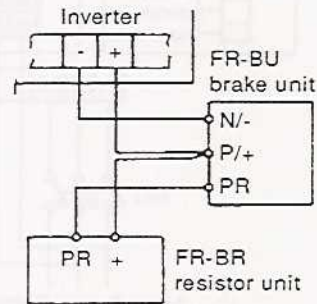


- 1) Remove the screw from terminal PR.
- 2) Remove the screw from PX on the printed circuit board and remove the jumper.
- 3) Connect the brake resistor between terminals + and PR (with the jumper removed).



**Connection of the FR-BU brake unit (option)**

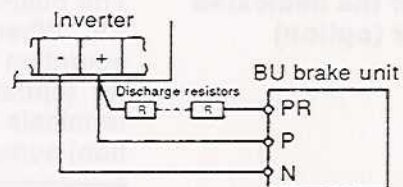
Connect the optional FR-BU brake unit as shown below to improve the braking capability during deceleration.  
<Connection method>



Note: 1. Connect the inverter terminals (+, -) and FR-BU brake unit terminals so that their symbols match with each other. (Incorrect connection will damage the inverter.) Also, the jumper across terminals PR-PX must be removed.  
2. The wiring distance between the inverter, brake unit and resistor unit should be less than 5m. If twisted wires are used, the distance should be less than 10m.

**Connection of the conventional BU brake unit (option)**

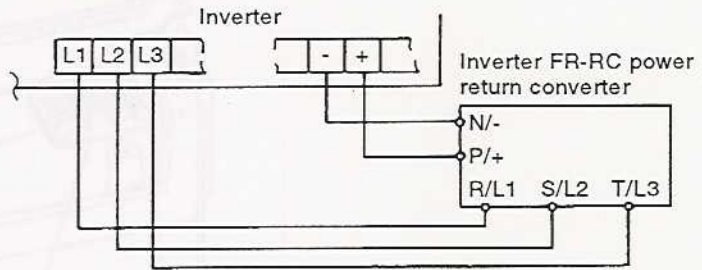
Connect the BU brake unit as shown below. Incorrect connection will damage the inverter.  
<Connection method>



Note: 1. On the models of 7.5K and below, the jumper across terminals PR-PX must be removed.  
2. The wiring distance between the inverter, brake unit and discharge resistors should be less than 2m. If twisted wires are used, the distance should be less than 5m.

**Connection of the FR-RC power return converter (option)**

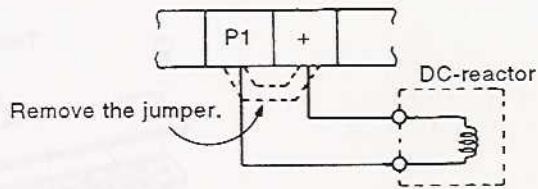
Connect the FR-RC power return converter as shown below so that the inverter terminals (+, -) and FR-RC power return converter terminals match with each other.  
<Connection method>



Note: On the models of 7.5K and below, the jumper across terminals PR-PX must be removed.

**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 +. In this case, the jumper connected across terminals P1-+ must be removed. Otherwise, the reactor will not operate.  
<Connection method>



Note: 1. The wiring distance should be less than 5m.  
2. The size of the cables used should be identical to or larger than that of the power supply cables (L1, L2, L3).

**Where the power supply is special (342V or below, 484V or above) for the 400V series 11K to 55K inverters**

Change the connection of the jumper to the internal transformer according to the operating power supply voltage. (This change is not required for inverters 7.5K and below.)

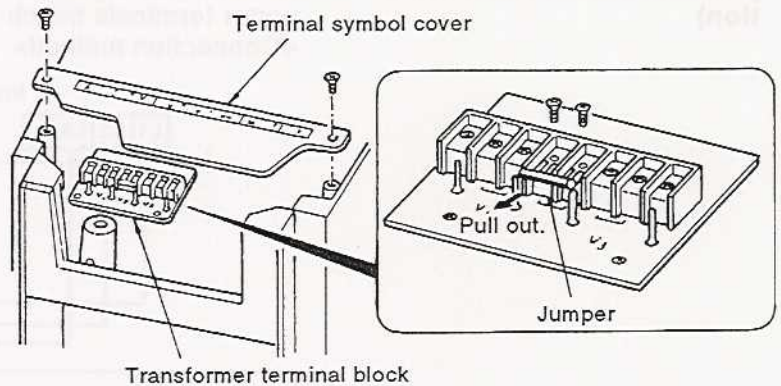
■ Voltage Range vs. Jumper Position

Jumper Position	Operating Power Supply Voltage		Note
	50Hz	60Hz	
V1	323V (380V-15%) to 456.5V (415V+10%)	As for 50Hz	
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 for 50Hz	

■ Changing the jumper position  
• Model FR-A240E-11K to 22K-EC

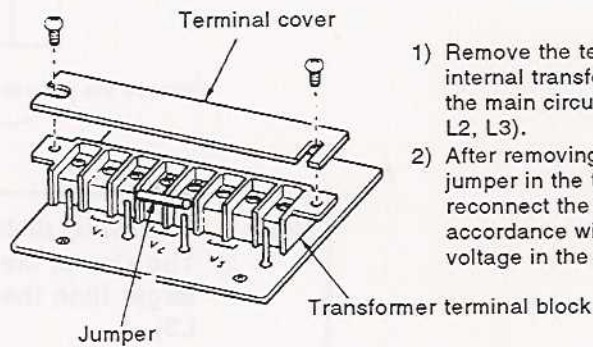
Note: Change the jumper position according to the operating power supply voltage. Otherwise the inverter will be damaged.

- 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.

• Model FR-A240E-30K to 55K-EC

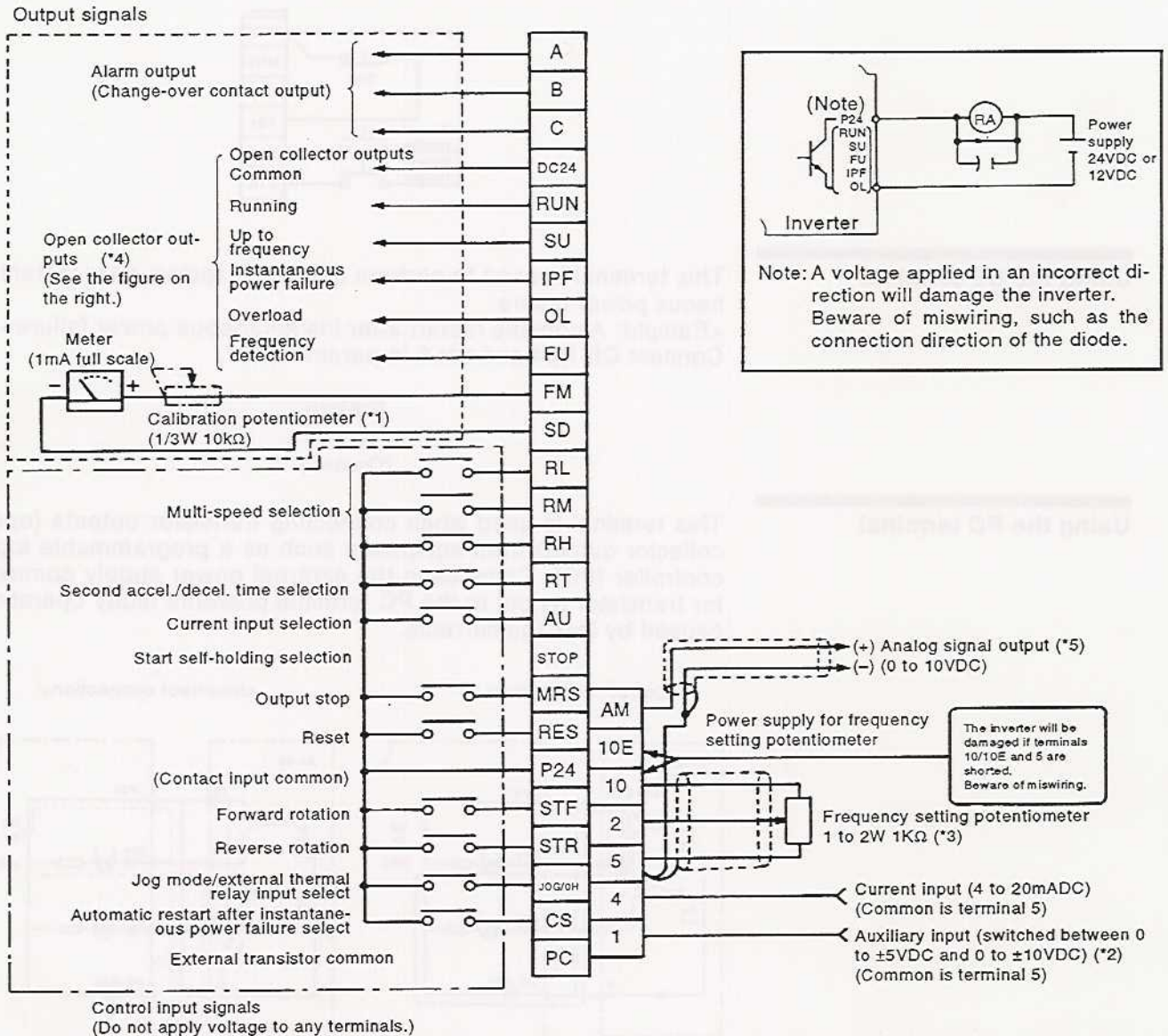


- 1) Remove the terminal cover of the internal transformer located under the main circuit terminal block (L1, L2, L3).
- 2) After removing the screws from the jumper in the terminal block, reconnect the jumper in accordance with the operating voltage in the above table.

Operating Voltage (V)	Terminal Block Position	Terminal Block Position
200V	Terminal 1-2	Terminal 1-2
220V	Terminal 1-2	Terminal 1-2
240V	Terminal 1-2	Terminal 1-2
260V	Terminal 1-2	Terminal 1-2
280V	Terminal 1-2	Terminal 1-2
300V	Terminal 1-2	Terminal 1-2
330V	Terminal 1-2	Terminal 1-2
360V	Terminal 1-2	Terminal 1-2
400V	Terminal 1-2	Terminal 1-2
440V	Terminal 1-2	Terminal 1-2
480V	Terminal 1-2	Terminal 1-2
520V	Terminal 1-2	Terminal 1-2
550V	Terminal 1-2	Terminal 1-2

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

## 7-4 Wiring of the Control Circuit (For the terminal block arrangement, see pages 156.)



- \*1. This calibration potentiometer is not required when making calibration from the parameter unit.
- \*2. Input signal switching can be done from the parameter unit.
- \*3. 2W 1K $\Omega$  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.)

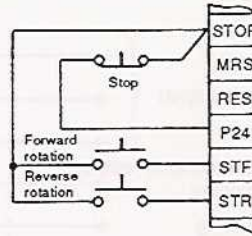
**Note:**

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

- \*5. FM-SD and AM-5 functions can be used simultaneously. (See Pr. 54 and Pr. 158.)

### 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.

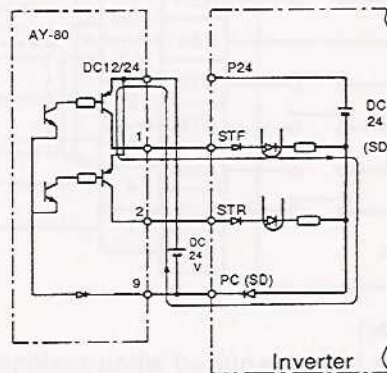
<Example: Automatic restart after instantaneous power failure>  
Connect CS-P24 and set 0 in parameter 57.



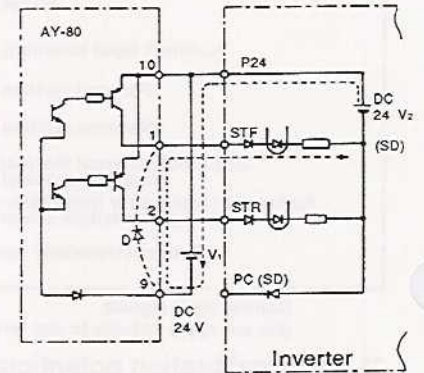
### Using the PC terminal

This terminal is used when connecting transistor outputs (open collector output) from equipment such as a programmable logic controller (PC). Connecting the external power supply common for transistor output to the PC terminal prevents faulty operation caused by leakage currents.

<Correct connection>

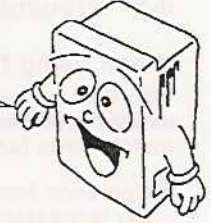


<Incorrect connection>



## 8. PARAMETER UNIT

The FR-PU02ER parameter unit can be installed directly to the FR-A series inverter or connected to it by a cable (option) and allows operations to be performed, parameters to be selected and values to be read/set. The operating status of the drive can be monitored, and alarm signals to be displayed. In addition, the FR-PU-02ER has no troubleshooting function, and parameter graphic display function. The FR-PU02ER parameter unit is generally referred to as the PU.



### 8-1 Structure of the Parameter Unit

#### Help key (See page 46.)

- 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.

#### 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.

#### Display

- 13 character × 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

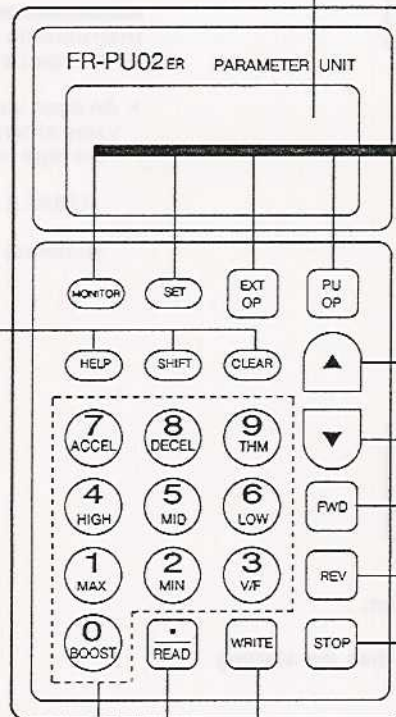
- Used to keep increasing or decreasing the running frequency. Hold down to change the frequency.
- Press either of these keys on the setting mode screen to change the parameter set value sequentially.
- On the monitoring, parameter or help menu screen, these keys are used to move the cursor. Hold down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

#### 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.



## 8-2 Precautions for Using the Parameter Unit

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

### Instructions for operation performed from the PU

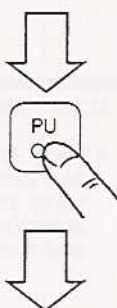
- Operation from the PU is only valid when the [PU OP] key is pressed with "0" (factory setting) set in parameter 79 or when PU operation or combined operation is selected in Pr. 79.



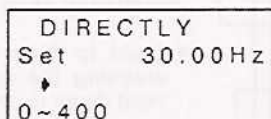
- In the monitoring mode, the running frequency cannot be set by direct setting (by entering the frequency directly from the key pad). To set the running frequency, either perform step setting sequentially by pressing the [▲]/[▼] key and press the [WRITE] key, or press the [PU OP] key and exit from the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



Exiting from monitoring mode



Frequency setting screen



- 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 operation mode cannot be switched when:
  - (1) The motor is running;
  - (2) The external operation start signal (across terminals STF or STR-P24) 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 set 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.

12345.6 ⇒ 2345.6  
 (Entered)      Ignored

### 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:
  - Parameter write disable (Pr. 77) has been selected;
  - Any parameter number that does not exist in the parameter list (see page 88) has been selected;
  - The value entered is outside the setting range; or
- If write is disabled and error "E" is displayed, press the [SET] (or [CLEAR]) key and restart operation from the beginning.

(Example: Pr. 7 "acceleration time")

```

7 Acc. T1
Setting Error
E 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 indicates that the inverter and FR-PU02E 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 132).

```

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, FR-B 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 130).



### 8-3 Using of the FR-ARWER Parameter Copy Unit

Like the FR-PU02ER, the FR-ARWER parameter copy unit can be fitted into the inverter (it can also be 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-PU02ER.)

The FR-ARWER also allows the parameters of one inverter set per application to be read in batches and easily copied to the other inverter.

#### CAUTION

When the FR-ARWER is used to copy parameters between the FR-A200 and FR- A200E series inverters, the set values of Pr. 65, 83, 84, 90 to 94 and 96 are as indicated below depending on the series of the inverters and the product version of the FR-ARWE.

Combination		1		2		3		4	
		Copy Source	Copy Destination	Copy Source	Copy Destination	Copy Source	Copy Destination	Copy Source	Copy Destination
Parameter Number/Name		A200 ⇨ A200		A200 ⇨ A200E(EC)		A200E (EC) ⇨ A200E(EC)		A200E(EC) ⇨ A200	
Pr. 65 *retry selection* Pr. 83 *rated motor voltage* Pr. 84 *rated motor frequency* Pr. 90 *motor constant R1* Pr. 91 *motor constant R2* Pr. 92 *motor constant L1* Pr. 93 *motor constant L2* Pr. 94 *motor constant δ* Pr. 96 *auto tuning setting/state*	New ARWE (Product code H02)	Set values are not copied.		Set values at the copy destination do not change.		Set values at the copy source are written to the copy destination.		Set values are not copied.	
	Old ARWE (Product code H01)	Set values are not copied.		Set values at the copy destination do not change.		Set values at the copy destination do not change.		Set values are not copied.	

#### <Reason>

The FR-A200 series do not have the functions of Pr. 65, 83, 84, 90 to 94 and 96. Hence, the old ARWE parameter copy unit (product code H01) compatible with the FR-A200 series cannot recognize Pr. 65, 83, 84, 90 to 94 and 96 and cannot copy them properly. To copy them properly, use the new ARWE parameter copy unit (product code H02) compatible with the FR-A200E(EC) series.

#### <FR-ARWE product version>

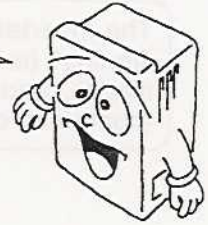
##### • Differentiation

The product code is given on the rating plate on the back of the parameter copy unit.

- Old copy unit: Product code H01
- New copy unit: Product code H02

# 9. OVERVIEW OF THE PARAMETER UNIT FUNCTIONS

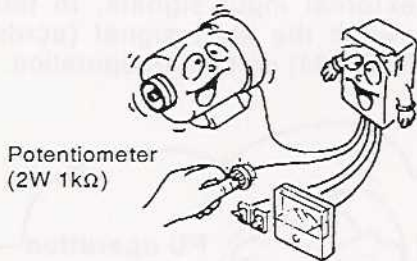
By using the PU, the following operations can be performed.



## Setting of operation mode (Page 121)

### • External operation mode (EXT. OP)

(Operation is performed from the frequency setting potentiometer (2W 1kΩ), start/stop switch similar situated outside the inverter.)



Potentiometer  
(2W 1kΩ)

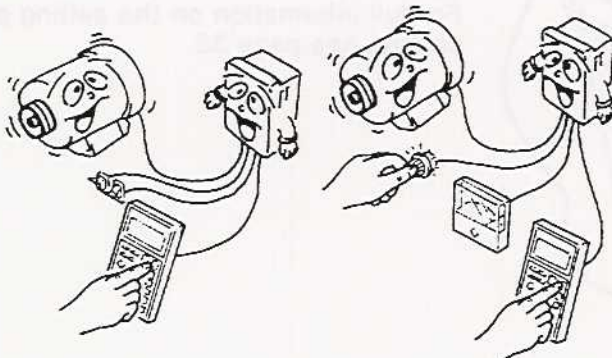
### • PU operation mode

(Operation is only performed from the key pad of the PU.)

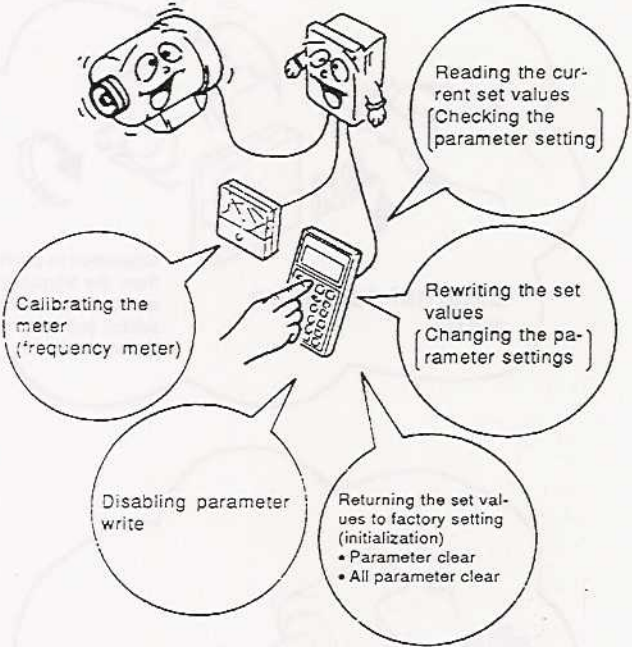


### • Combined operation mode

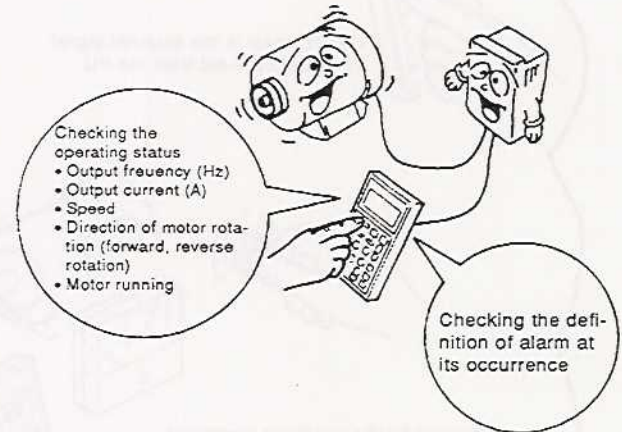
(Operation is performed with the start signal provided by an external signal and the running frequency provided from the PU (and vice versa).)



## Setting of parameters (Page 43)

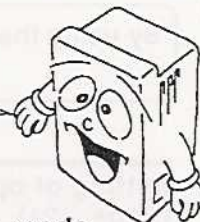


## Monitoring (Page 44)



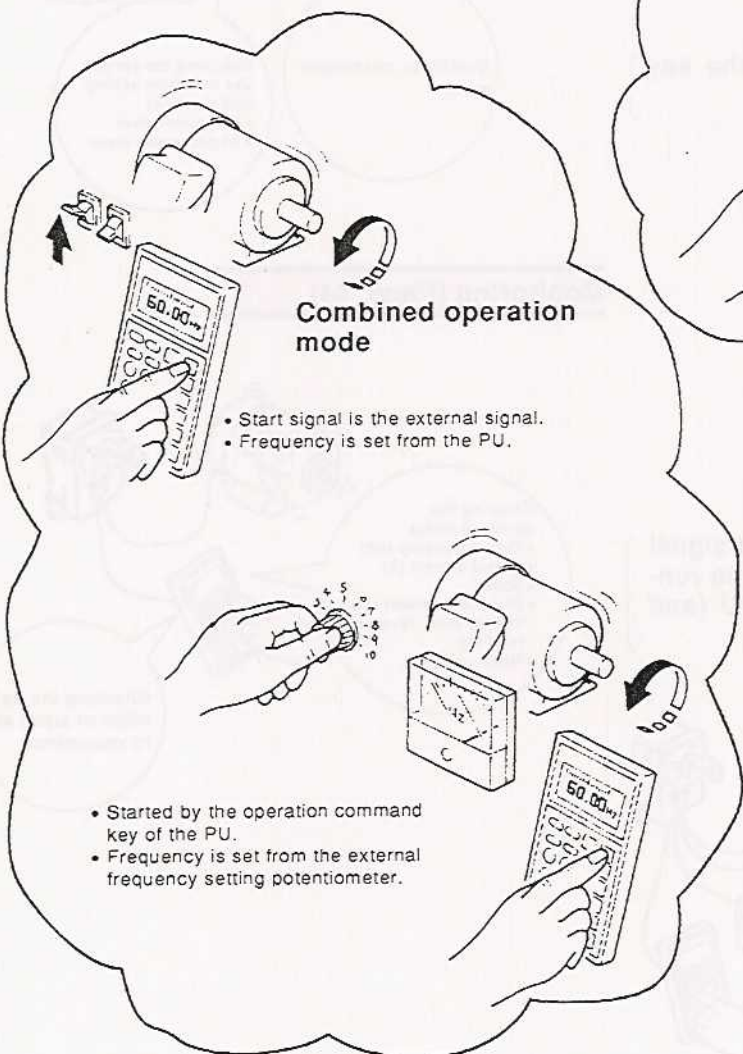
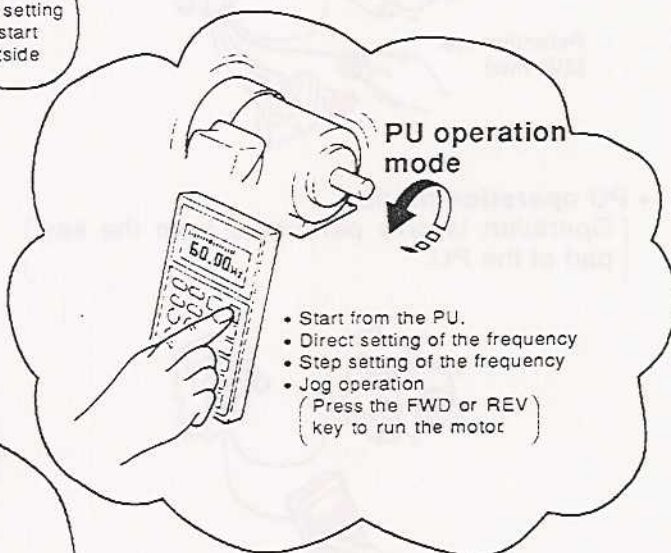
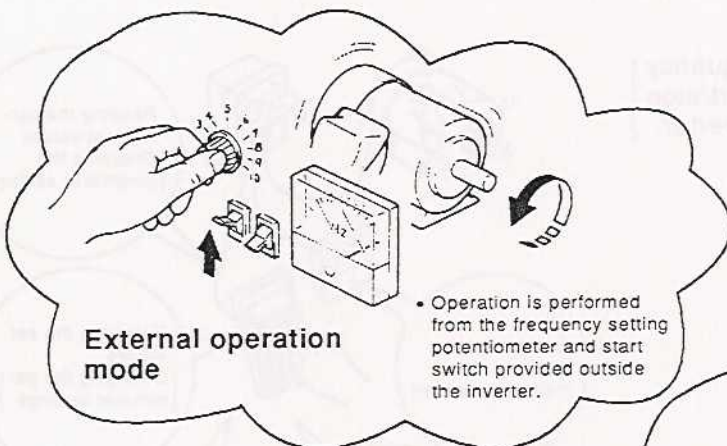
## 10. OPERATION MODE

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).



### ■ 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, switch the start signal (across STF, STR-P24) on to start operation.



### ■ Fixing the operation mode

The operation mode at power on can 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 32.

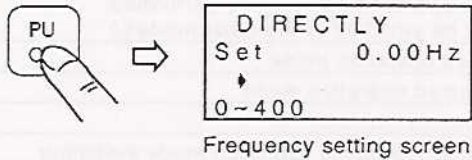
## 10-1 Selection of the Operation Mode

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 any external input signals are off (across STF or STR-P24).

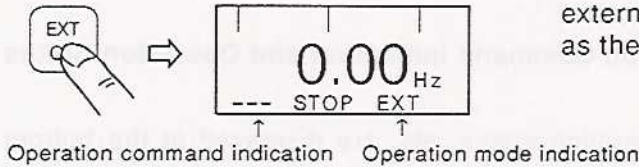
Then, press the [PU OP] key to switch to the PU operation mode, in which the frequency setting screen is displayed.



- **Switching from the PU operation mode to the external operation mode** .....

Check that any external input signals are off (across STF or STR-P24) and that the operation command indication is "---".

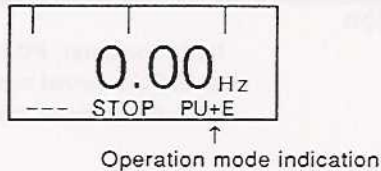
Then, press the [EXT OP] key to switch to the external operation mode, in which "EXT" is displayed as the operation mode indication.



- **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 43.)

"PU+E" is displayed as the 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

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

1. External input signal \_\_\_\_\_ Check that the signal is off. If it is on, the operation mode cannot be switched properly.  
(across STF or STR-P24)
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 modes.)
2	External operation can only be performed. (Cannot be switched to the other modes.)
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 will be 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.

## 10-2 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

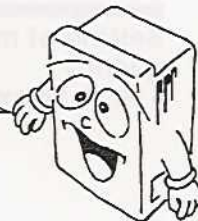
### • Operation command indication

STF: Forward rotation  
 STR: Reverse rotation

---: No command or both STF and STR "ON"

## 11. PRE-OPERATION SETTINGS

The main items to be set before operation are as follows. Set the required items according to the load and operation specifications. For simple variable-speed operations, use the inverter with the factory setting. For more information and the explanation of the other parameters, see page 87. 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 43.)

The start signal (STF or STR) must be off to switch from the external operation mode to the PU operation mode.

### Operation using the voltage input signal

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

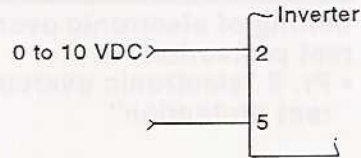
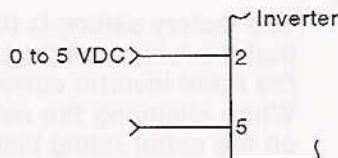
When the voltage input signal is used for operation, set the specifications of the frequency setting voltage signal entered across terminals 2-5.

- 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 AU-P24 must be linked.

### 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"	50Hz at 5V (or 10V) DC
Pr. 905 "frequency setting current gain"	0Hz at 4mADC, 50Hz 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 70.)

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 109.)

**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 when the frequency must be limited in addition to the setting of the "frequency setting voltage (current) gain" which allows the frequency to be restricted to a value 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. Applying only the start signal accelerates the motor to the set frequency if the frequency setting is 0Hz.

(At this time, the frequency output begins with the value of the starting frequency during acceleration.)

Factory setting: 0Hz

**Setting of electronic overcurrent protection**

- Pr. 9 "electronic overcurrent protection"

The factory setting is the rated current value of the inverter. Note that the factory settings of the 0.4K and 0.75K models are 85% of the rated inverter current.

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 standard squirrel-cage motors, do not apply to special motors. For a special (ie Force ventilated) motors, use a thermal relay to protect the motor. (A constant-torque or force ventilated motor characteristic can be selected by the setting of Pr. 71.)

**Selection of applied load**

- 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.
	5	• Terminal RT ON (Note) As in constant-torque loads. • Terminal RT OFF As in no boost at forward rotation for lift.

Note: When terminal RT is ON, the second control functions (second acceleration/deceleration time, second torque boost and second base frequency) are selected. This can be done while the motor is running!

### 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 to make acceleration/deceleration, change the values of these parameters.

Parameter	Factory Setting
Pr. 7 "acceleration time"	7.5K and below.....5 seconds, 11K and above.....15 seconds
Pr. 8 "deceleration time"	7.5K and below.....5 seconds, 11K and above.....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 61 for the adjustment procedure.)

### When the inverter once used is to be used again on a different application

It is assumed that the set values of the parameters may have been changed according to the operation specification. Before starting operation, re-set previous 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 54.) 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 a 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"

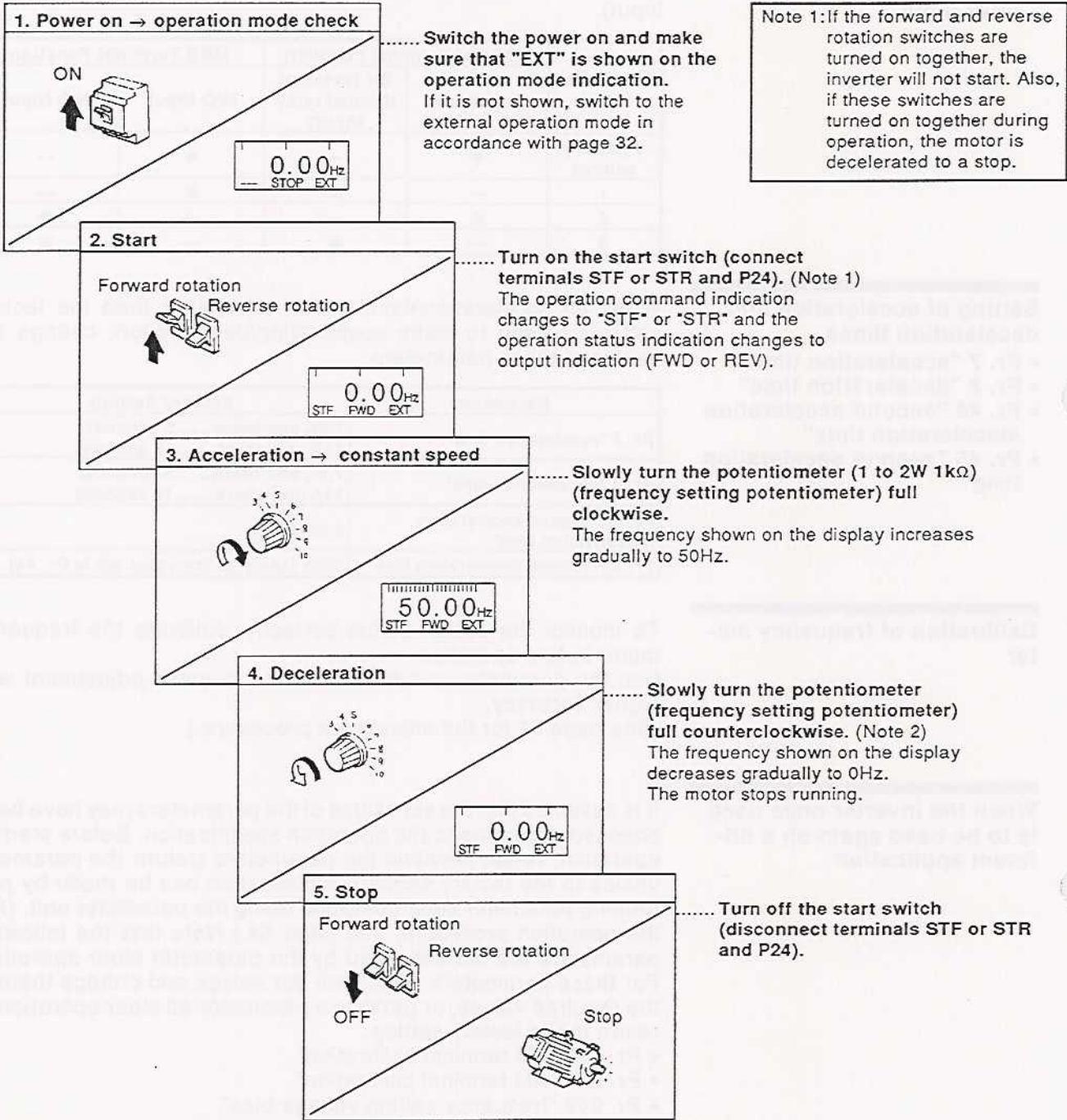


# 12. OPERATION

## 12-1 External Operation Mode (Operation using the external input signals)

### (1) Ordinary operation

#### • Operation procedure (Operation at 50Hz)

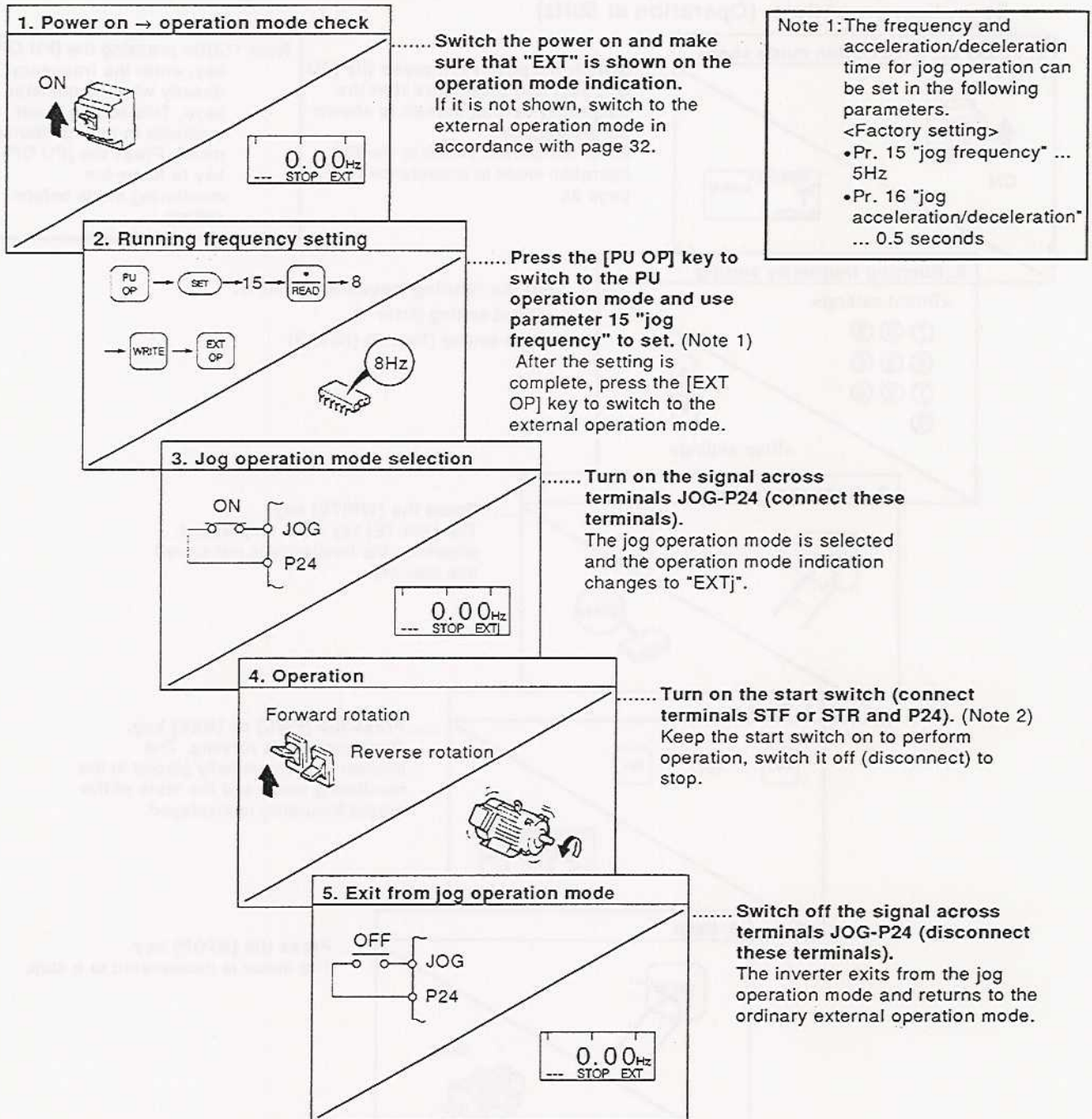


Note 2: If the start switch is turned off with the potentiometer in the full clockwise position, the motor is decelerated to a stop. The DC injection brake operated at this time generates high-frequency noise immediately before the stop. This is not a fault.

## (2) External jog operation

Keep the start switch on (connect terminals STF or STR-P24) to perform operation, and switch it off to stop. For details of changing the parameter setting, see page 43.

### • Operation procedure (Operation at 8Hz)



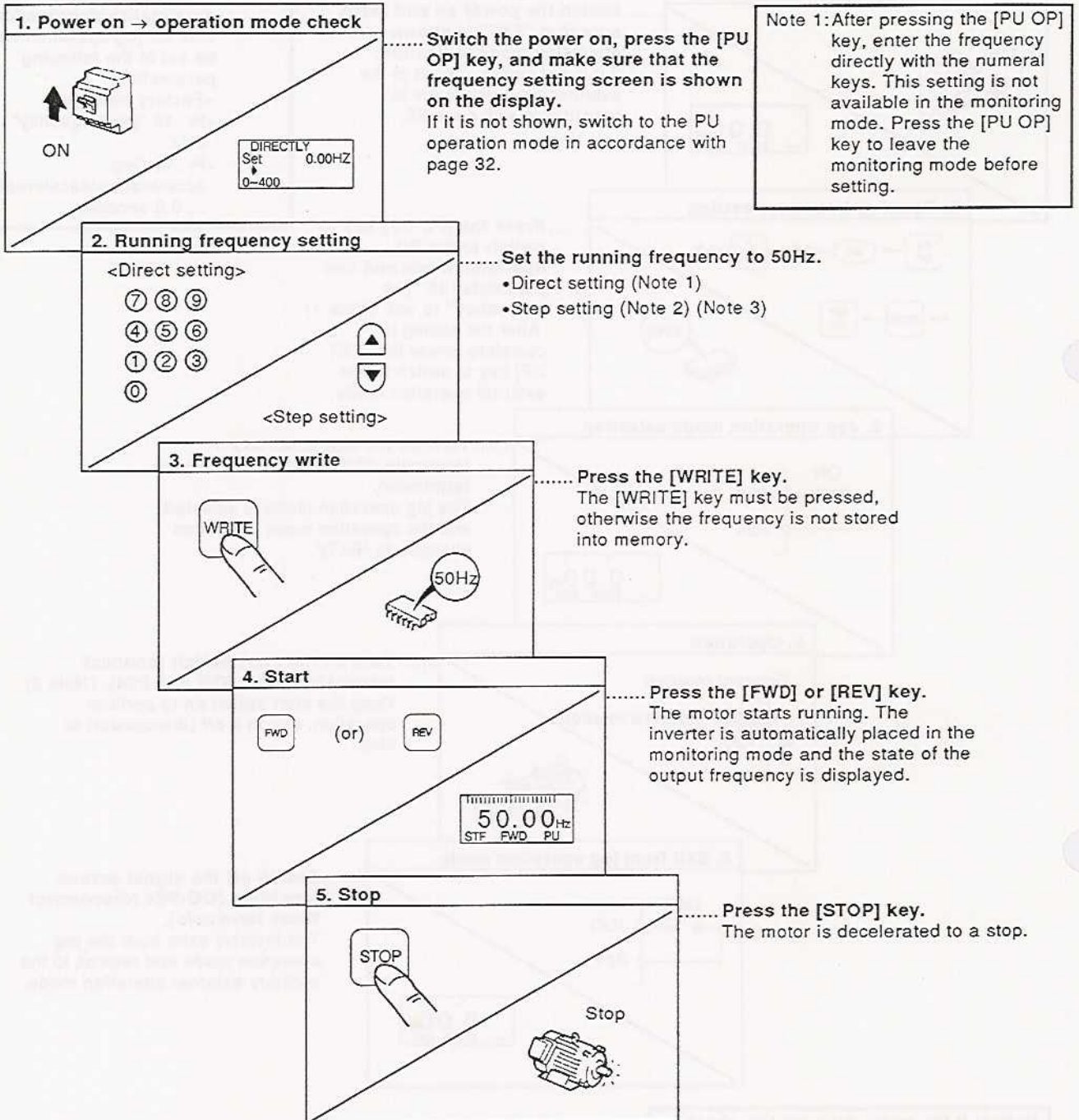
Note 2: If the motor does not run, check Pr. 13 "starting frequency". If the set value is less than the starting frequency, the motor will not start.

## 12-2 PU Operation Mode (Operation using the PU)

### (1) Ordinary operation

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

#### • Operation procedure (Operation at 50Hz)



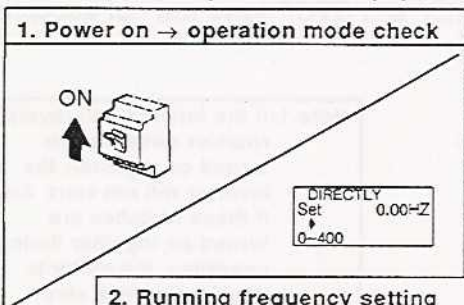
Note 2: Press the [▲]/[▼] key to keep the frequency changing. Hold down the [▲] (or [▼]) key to change the frequency. At first, the frequency changes slowly and this may be used for fine adjustment.

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.)

## (2) PU jog operation

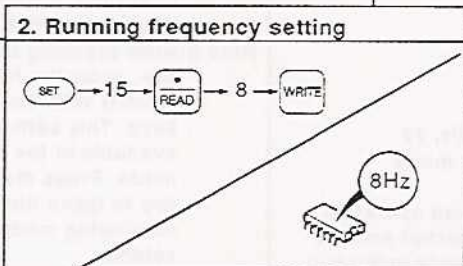
Hold down the [FWD] or [REV] key to perform operation, and release it to stop. For details of changing the parameter setting, see page 43.

### • Operation procedure (Operation at 8Hz)

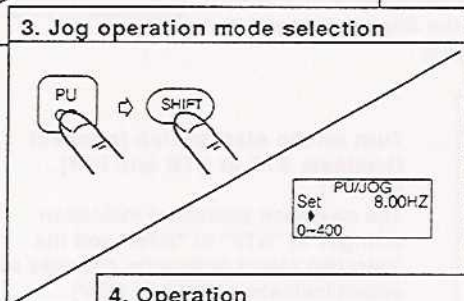


Switch the power on, press the [PU OP] key, and make sure that the frequency setting screen is shown on the display. If it is not shown, switch to the PU operation mode in accordance with page 32.

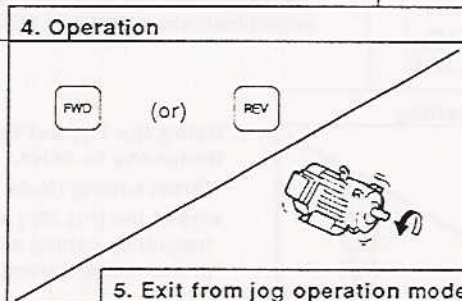
**Note 1:** The frequency and acceleration/deceleration time for jog operation can be set in the following parameters.  
 <Factory setting>  
 • Pr. 15 "jog frequency" ... 5Hz  
 • Pr. 16 "jog acceleration/deceleration" ... 0.5 seconds



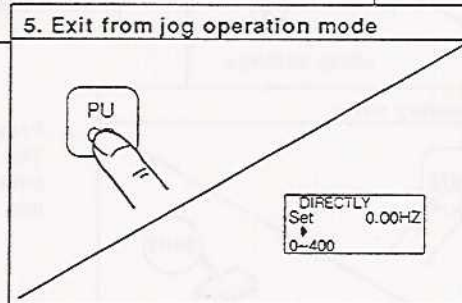
Use parameter 15 "jog frequency" to set. (Note 1).



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.



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)



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

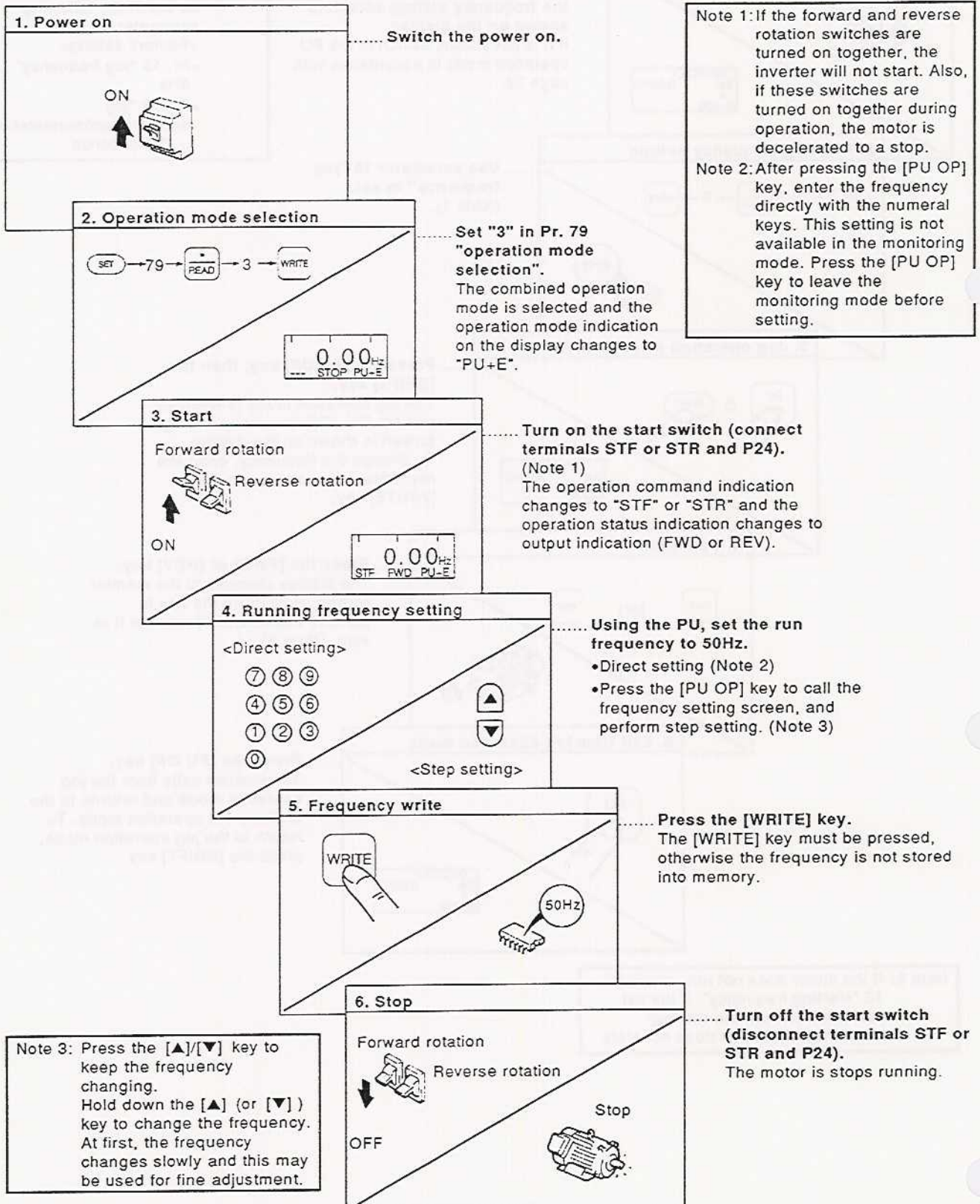
**Note 2:** If the motor does not run, check Pr. 13 "starting frequency". If the set value is less than the starting frequency, the motor does not start.

## 12-3 Combined Operation Mode (Operation using the external input signals and PU)

### (1) Entering the start signal from the terminals 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 43.

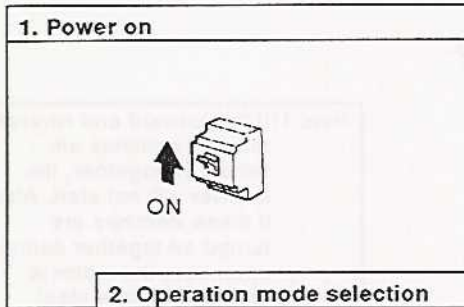
#### • Operation procedure (Operation at 50Hz)



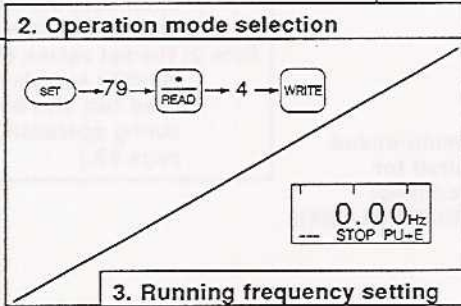
(2) Entering the run frequency from the terminals and the start and stop signal from the PU (Pr.79=4)  
 For details of changing the parameter setting, see page 43.

• Operation procedure

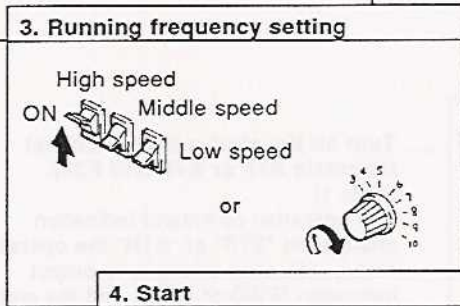
Note 1: The start terminals (STF, STR) of the inverter are invalid.  
 The inverter cannot be started if the [FWD] or [REV] key is pressed and the level of the frequency setting signal is then raised.



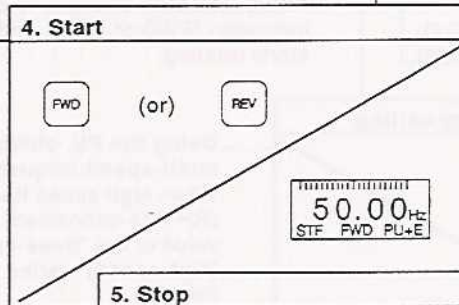
..... Switch the power on.



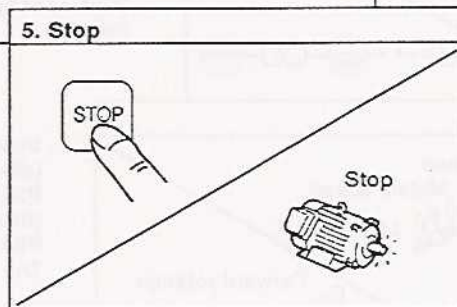
..... Set "4" in Pr. 79 "operation mode selection".  
 The combined operation mode is selected and the operation mode indication on the display changes to "PU+E".



..... Enter the run frequency signal (select the multi-speed signal or turn the frequency setting potentiometer (1 to 2W, 1kΩ)).



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



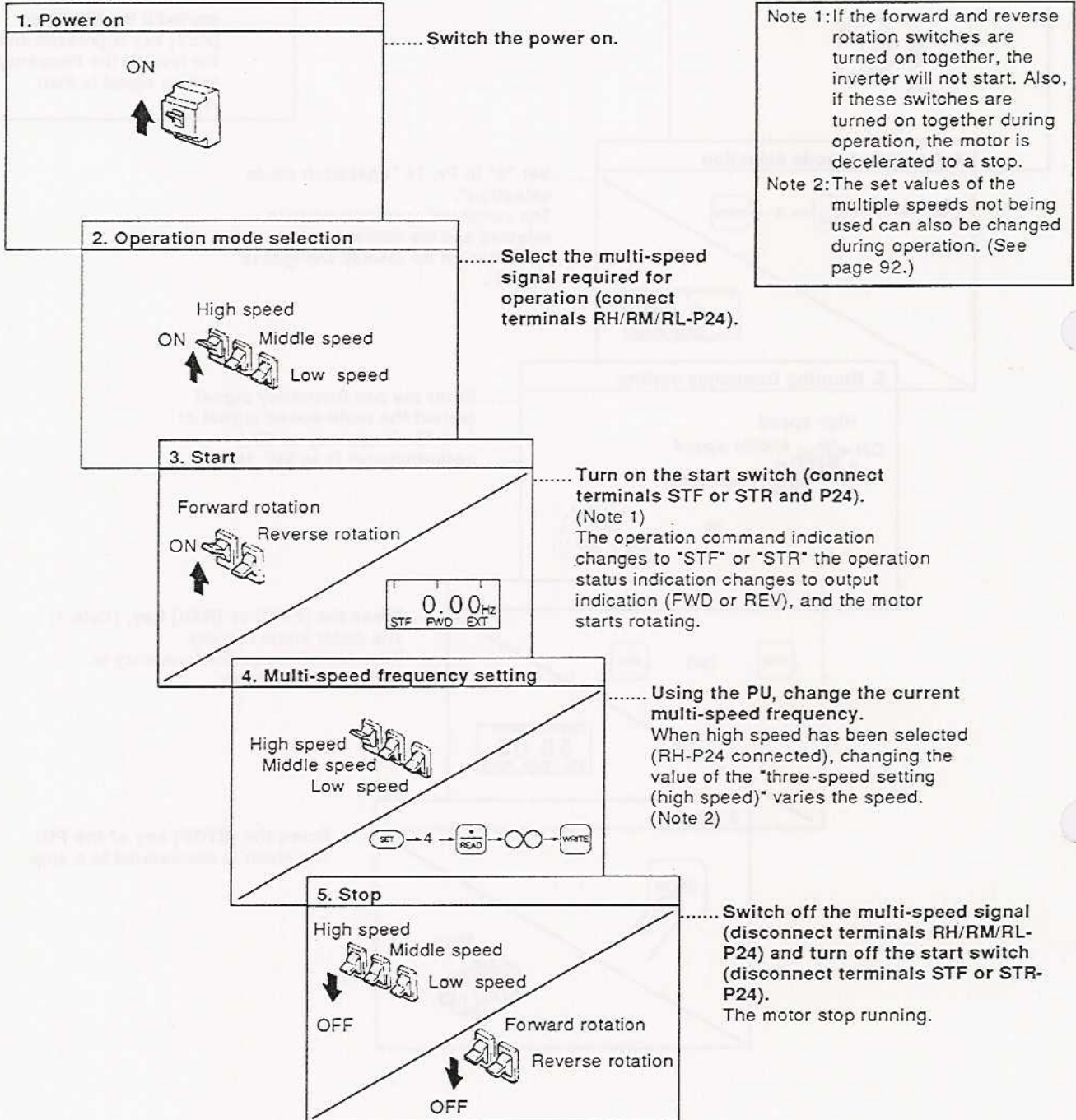
..... Press the [STOP] key of the PU.  
 The motor is decelerated to a stop.

**(3) Entering the start signal and multi-speed signal from the outside 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 43.

• **Operation procedure**

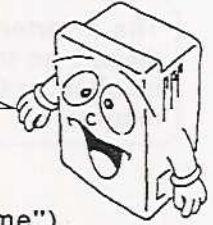


Note 1: If the forward and reverse rotation switches are turned on together, the inverter will not start. Also, if these switches are turned on together during operation, the motor is decelerated to a stop.

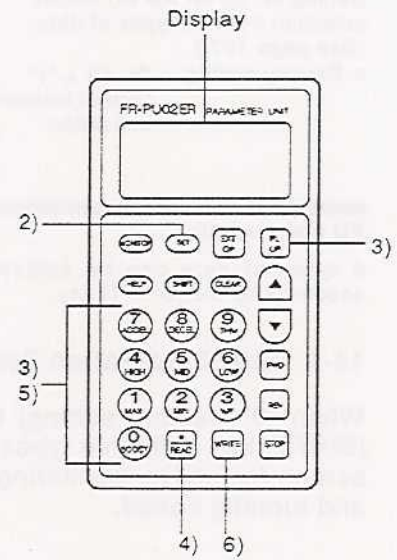
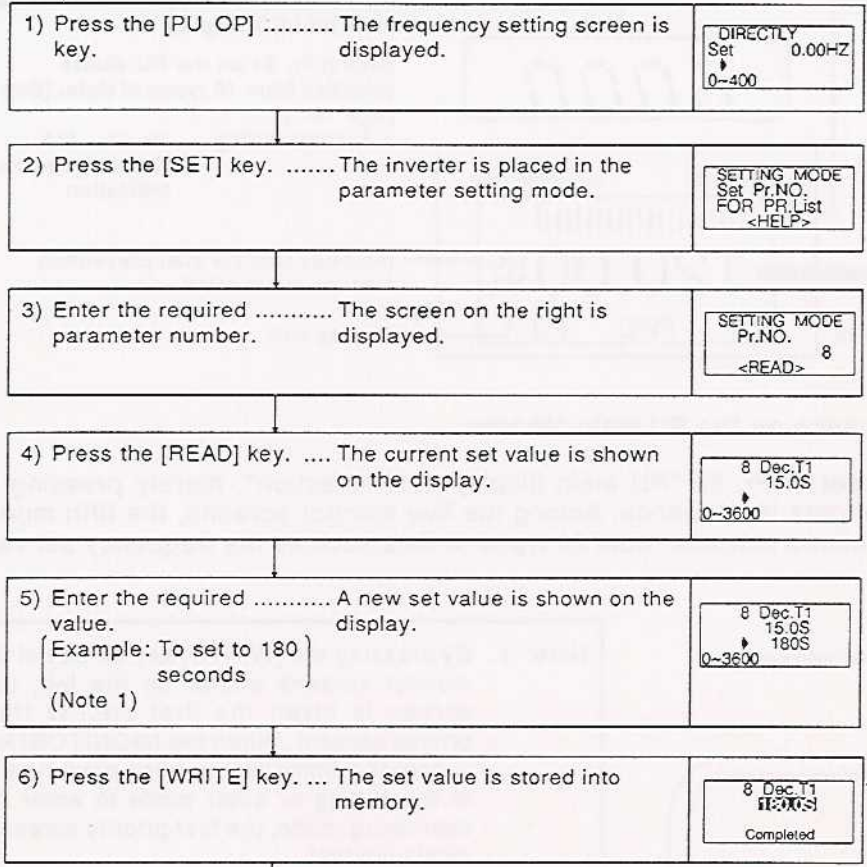
Note 2: The set values of the multiple speeds not being used can also be changed during operation. (See page 92.)

# 13. 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 87). Set "1" in Pr. 77 "parameter write disable" to disable write. (See page 120.)



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



..... If an error is displayed by pressing the [WRITE] key, see page 27.

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 being shown, switch to the PU operation mode in accordance with page 31. Note that the values of the following parameters may be set and/or changed in the external operation and combined operation modes:

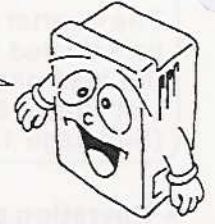
- 3-speed setting .....Pr. 4 to 6
- Multi-speed setting .....Pr. 24 to 27
- Display function .....Pr. 51 to 56
- Calibration function .....Pr. 900 to 905

In addition to the above procedure, the help function may be used to call the parameter list for setting. For more information, see page 51.



# 14. 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:



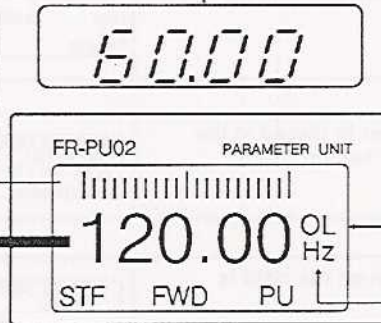
## PU level meter

Setting Pr. 53 on the PU allows selection from 15 types of data. (See page 107.)

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

## PU main monitor

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



## Inverter LED display

Setting Pr. 51 on the PU allows selection from 16 types of data. (See page 107.)

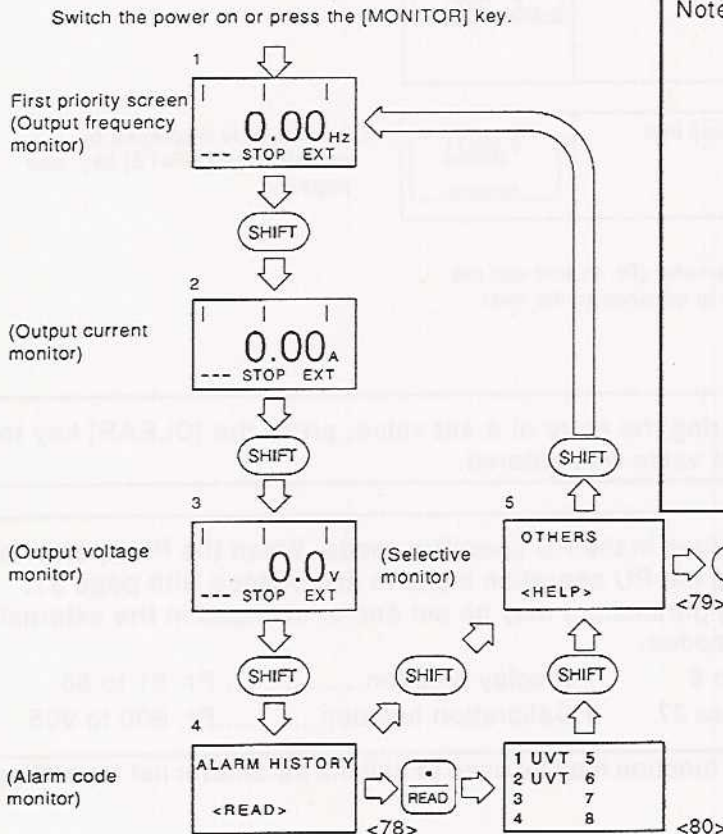
- Factory setting .... Pr. 51 = "1" Output frequency indication

indicates that the stall prevention function is activated.

Display unit

## 14-1 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. Among 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.

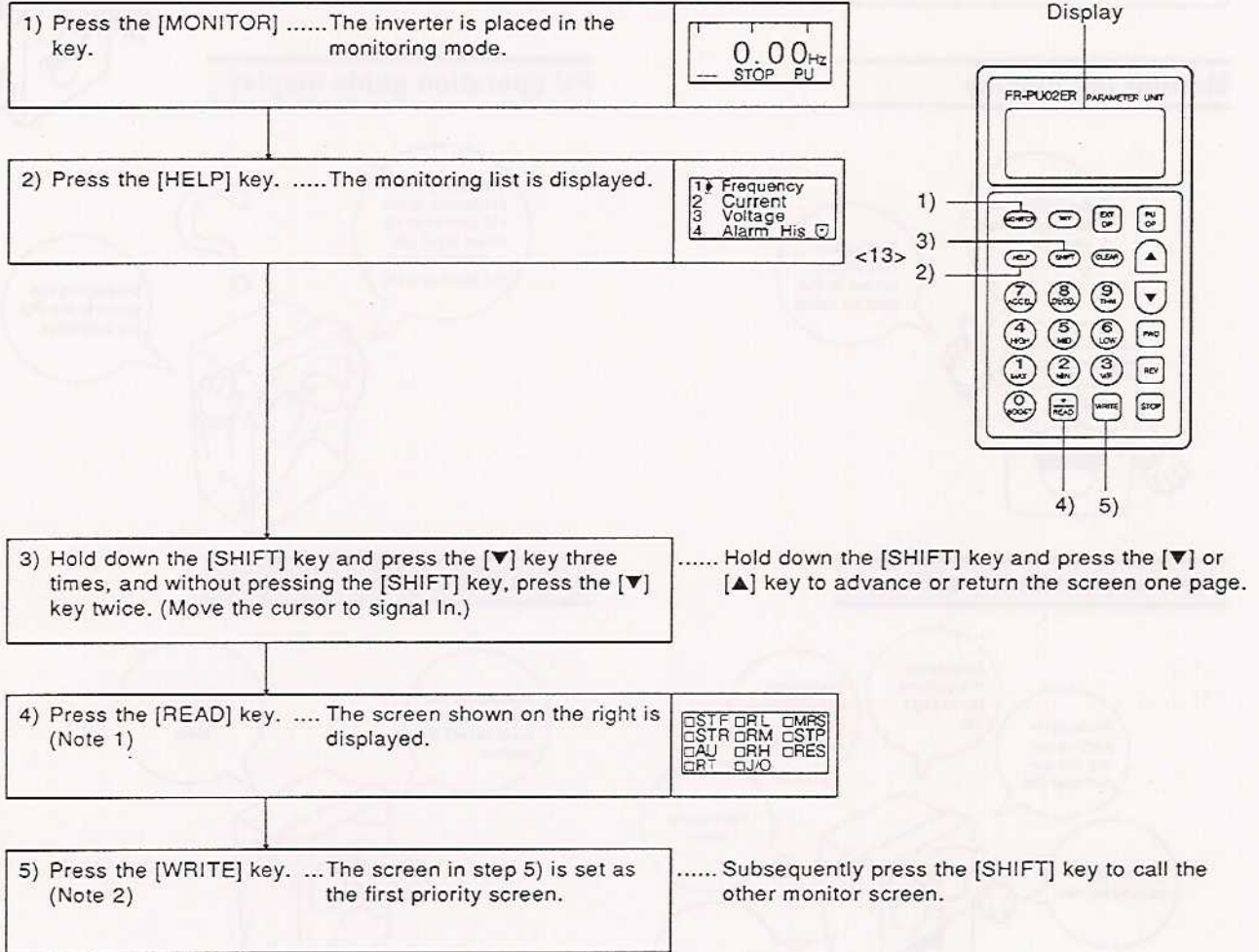


- Note: 1. By pressing the [WRITE] key on any of the monitor screens shown on the left, that screen is given the first priority (first priority screen). When the [MONITOR] key is pressed immediately after power-on or in the setting or other mode to enter the monitoring mode, the first priority screen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

Selection can be made from 20 types of data. (See page 45.)

## 14-2 Selecting the Another Monitor Item in the Selective Monitoring Mode

### • Selection procedure (Example: Select the input terminal state monitor screen)

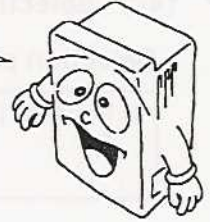


Note: 1. Since the selective monitor screen is not the first priority screen in the above step 5) where the [READ] key has been pressed, the selected data is erased from the memory as soon as the power is shut off or the other operation mode (such as external operation) is selected.  
In this case, the 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.

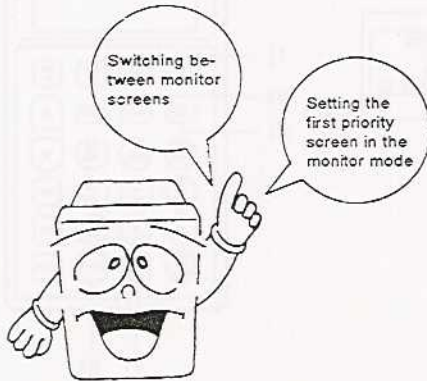
2. In step 6) where the [WRITE] key has been pressed in the above setting example, the "I/O terminal states" selected here are first displayed with priority when the other operation mode is switched to the monitoring mode. To give first priority to other data, press the [WRITE] key with the monitor screen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

# 15. HELP FUNCTION

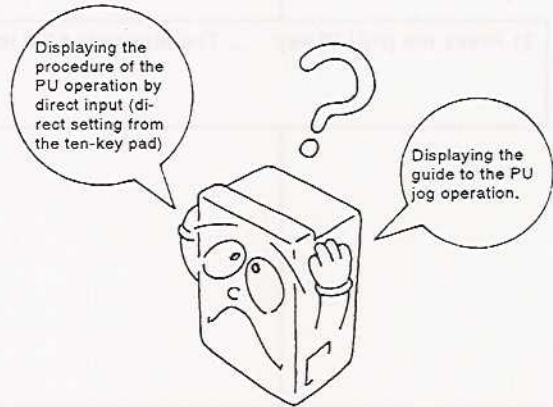
The FR-A200EC inverter has a help function to assist you in performing the following.



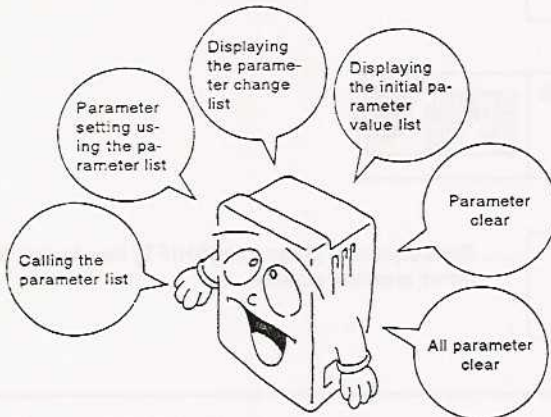
## Monitor list display



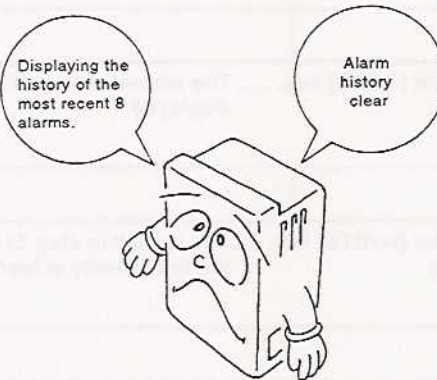
## PU operation guide display



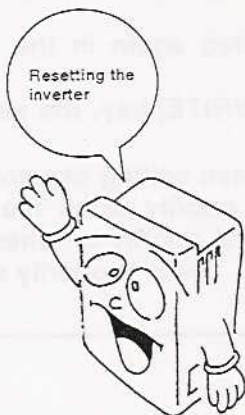
## Various parameter settings



## 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 when you do not know how to operate or what to do.

\* This function can be used when the parameter unit used is the PU02E.

## 15-1 Help Function Menu

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

### • Menu screen page 1

1	MONITOR	
2	PU Oper	
3	Pr. List	
4	Pr. Clear	<6>

#### 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 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

#### 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

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

### • Menu screen page 2

5	Alarm Hist	<12>
6	AlarmClear	
7	Inv. Reset	
8	T/Shooting	

#### 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.

#### 8 TROUBLESHOOTING

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

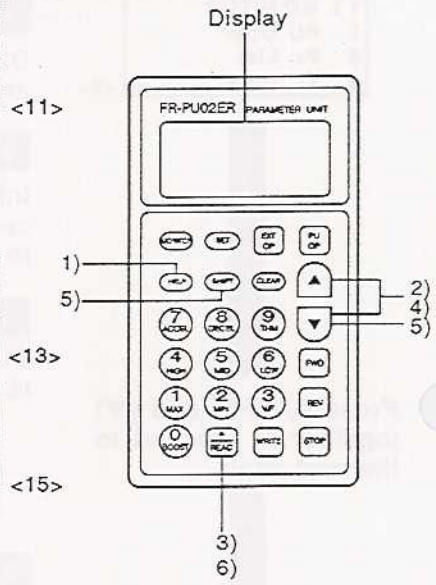
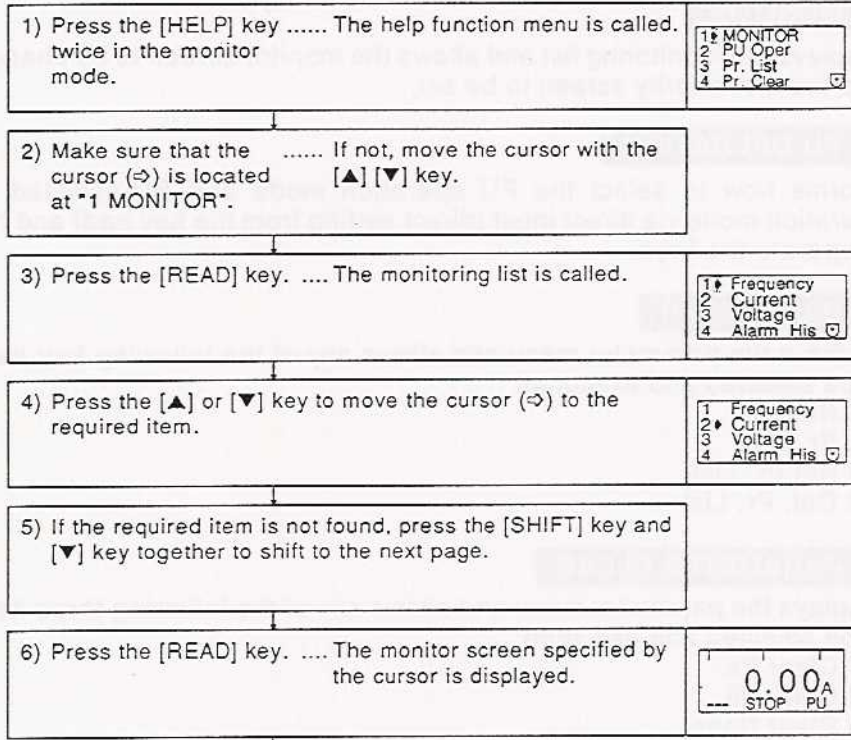
Press any of [MONITOR], [SET], [EXT OP] and [PU OP] to switch to the corresponding mode.

\* This function can be used when the parameter unit used is the PU02E.

# 1 MONITOR

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

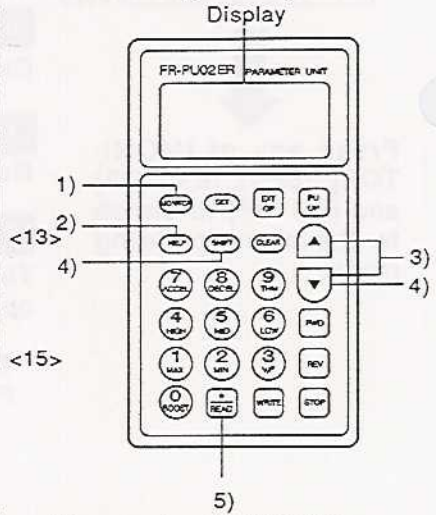
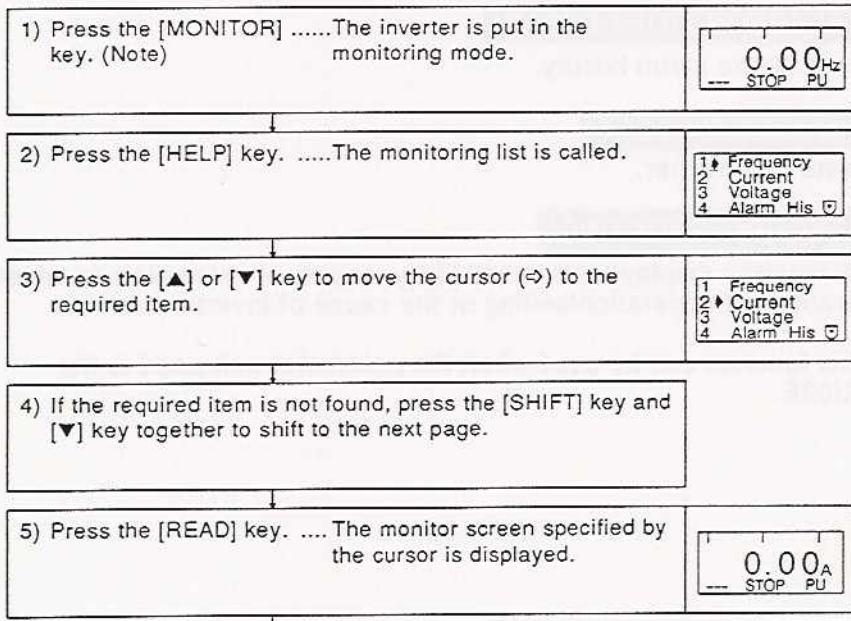
## • Operation procedure 1 (To call the monitoring list from the help function menu)



..... 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.

## • Operation procedure 2 (To call the monitoring list directly in the monitoring mode)



..... 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.

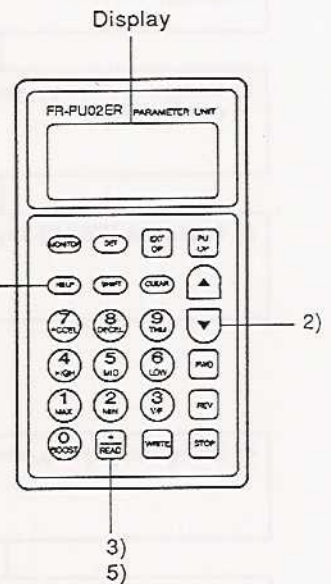
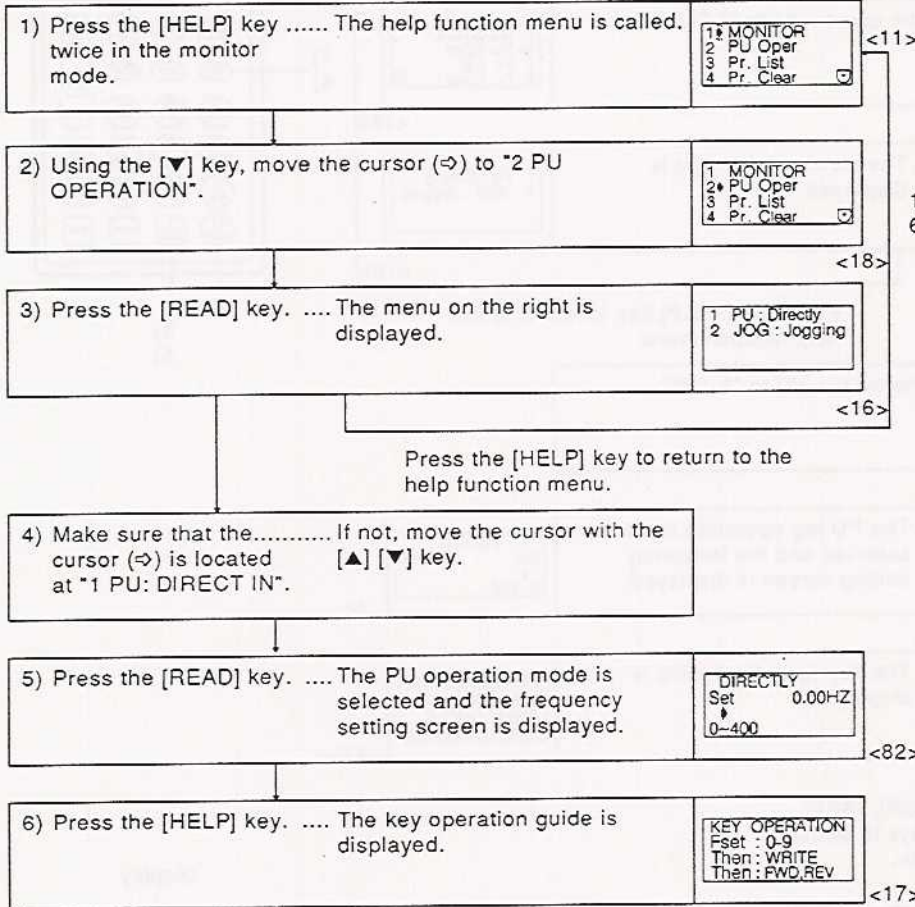
Note: This key need not be pressed if the inverter is already in the monitoring mode.

## 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.

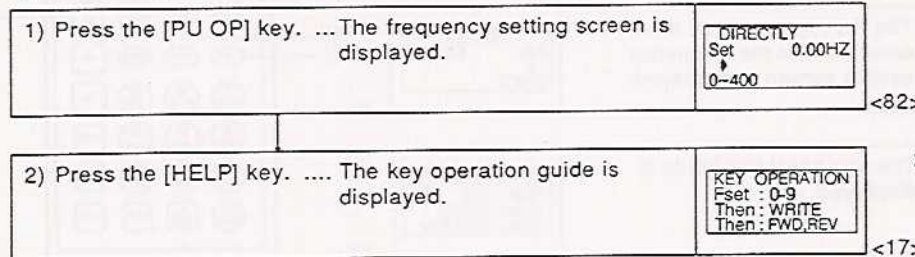
### ■ Selection of the PU operation mode (direct input)

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

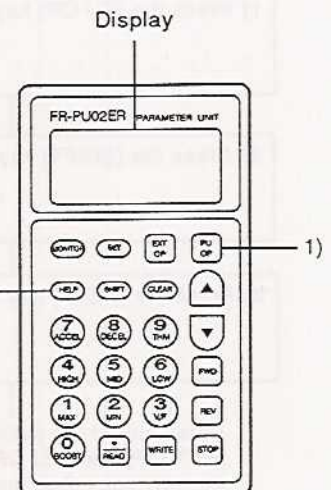


Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

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

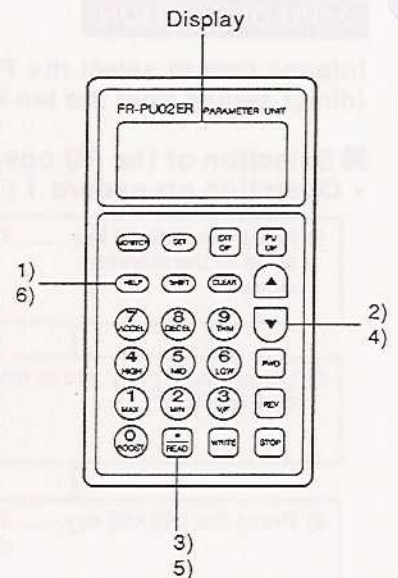
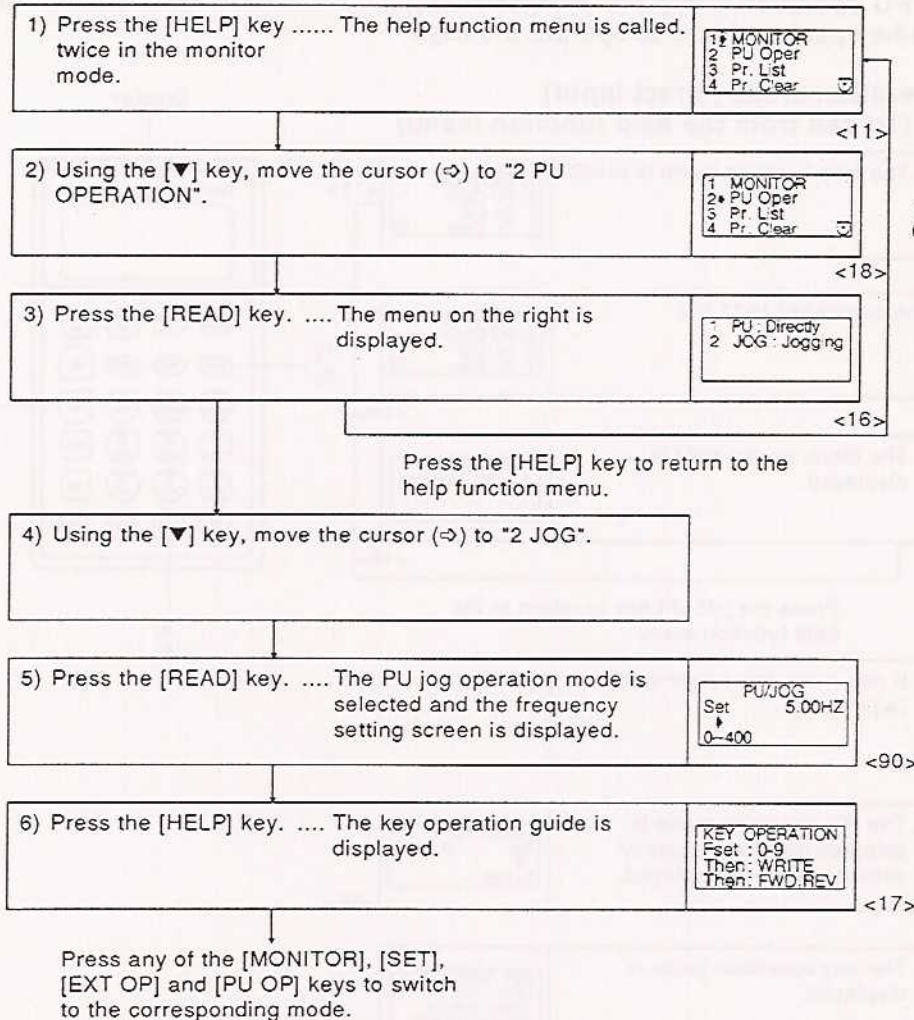


Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

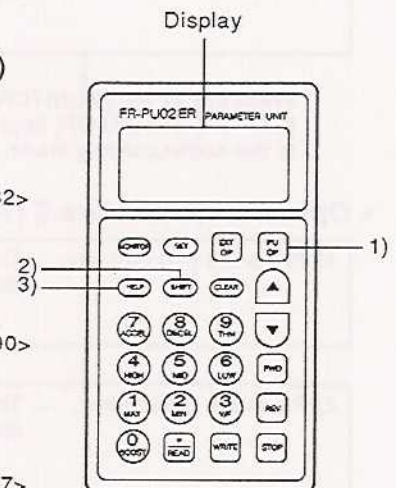
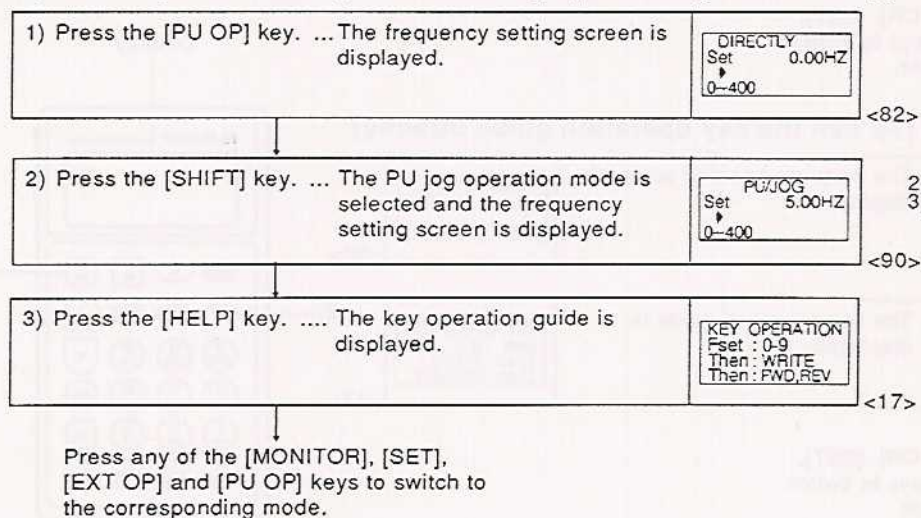


## ■ Selection of the PU jog operation mode

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



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

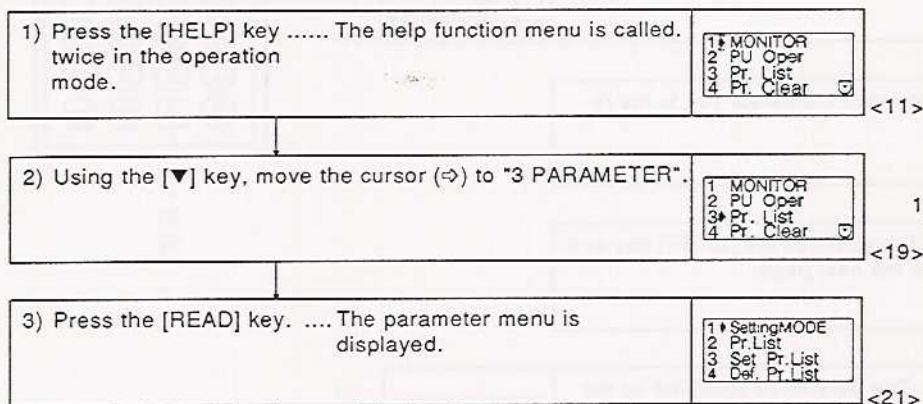


### 3 PARAMETER

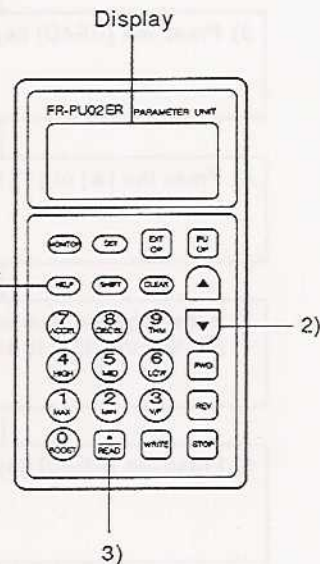
Displays the parameter menu and allows any of the following four items to be selected and executed:

- 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

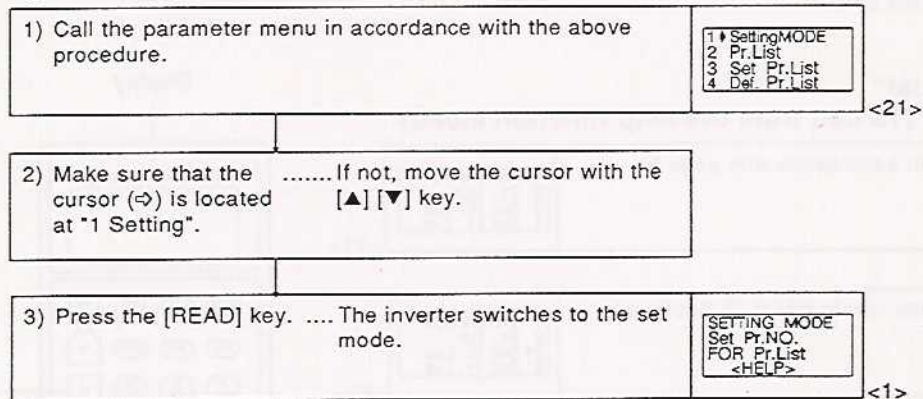


Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

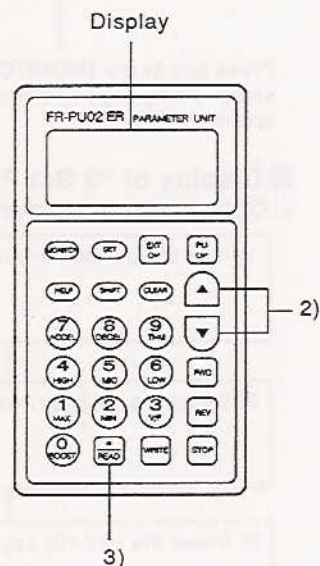


#### ■ Selection and execution of "1 Setting"

##### • Operation procedure



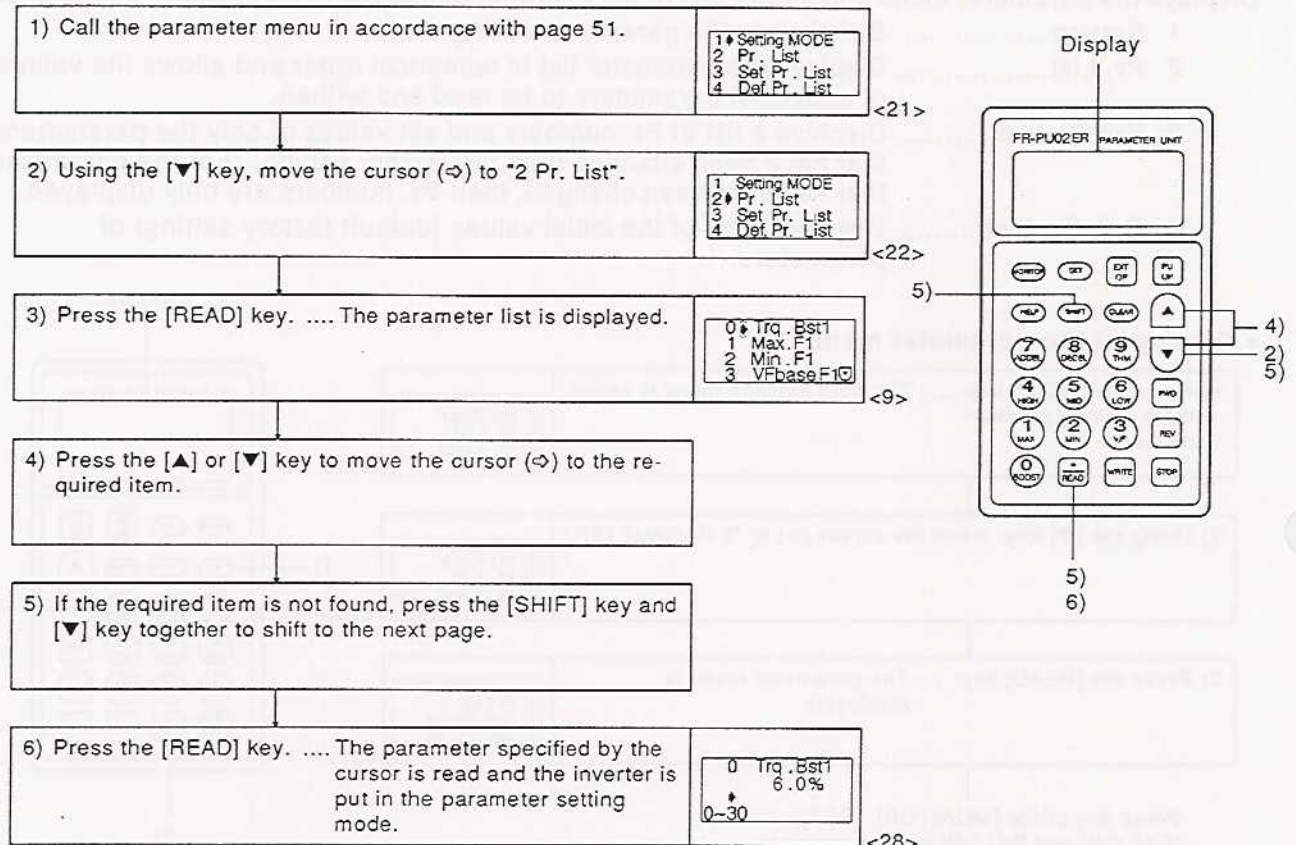
Press any of the [MONITOR], [EXT OP] and [PU OP] keys to switch to the corresponding mode.





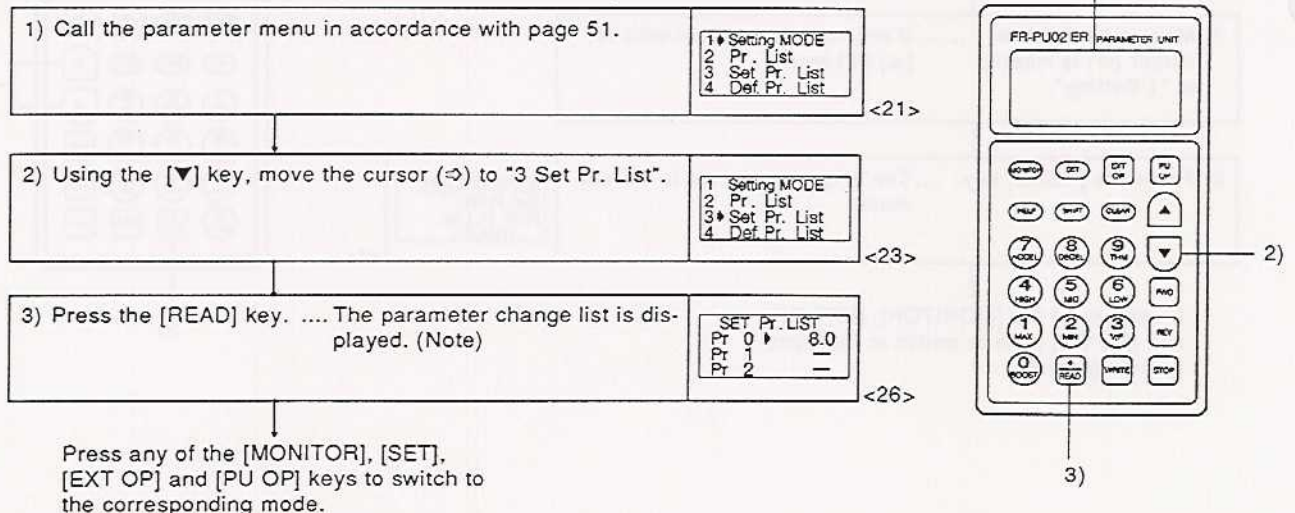
## ■ Selection and execution of "2 Pr. List"

### • Operation procedure



## ■ Display of "3 Set Pr. List"

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



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

## ■ Display of "4 Def. Pr. List"

### • Operation procedure

1) Call the parameter menu in accordance with page 51.

```

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

<21>

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

```

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

<24>

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

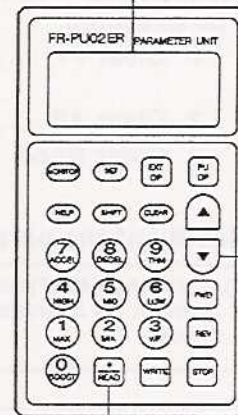
```

DEF. Pr. LIST
Pr 0 6.0
Pr 1 120.00
Pr 2 0.00
    
```

<27>

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

Display



2)

3)

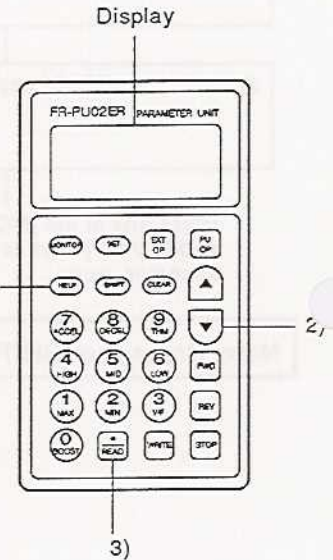
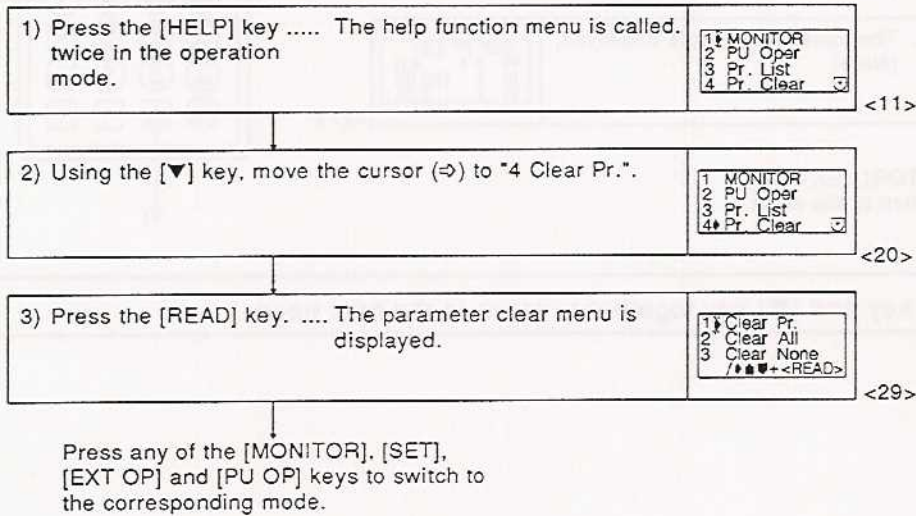
Note: Press the [SHIFT] key and [▼] key together to move to the next page.

## 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.

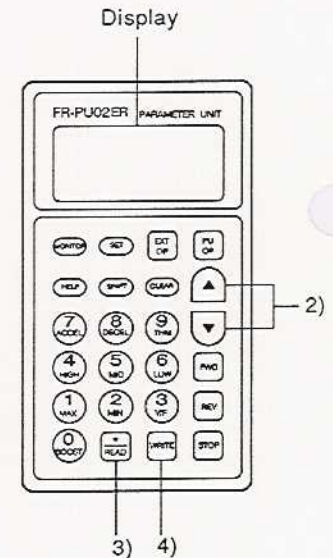
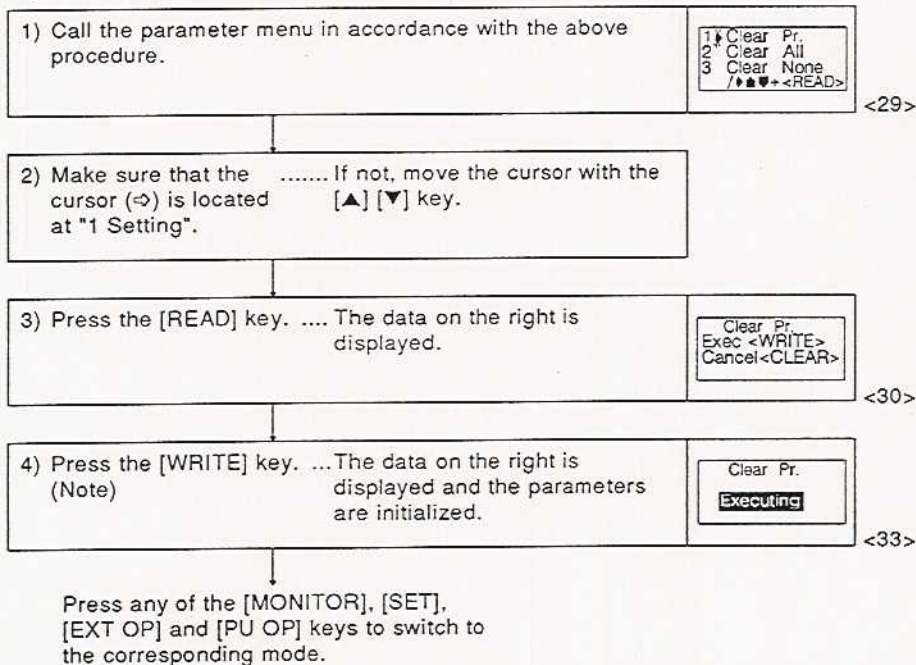
- 1 Clear Pr. .... Returns (initializes) the parameter values to the factory setting with the exception of the calibration values in Pr. 900 to 905.
- 2 Clear All ..... Initializes all parameters.
- 3 Clear None ..... Does not initialize.

### • Display of the parameter clear menu



### ■ Selection and execution of "1 clear Pr."

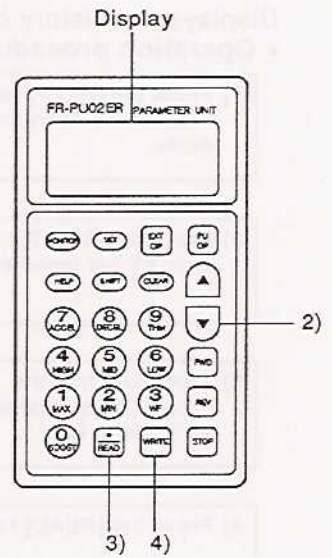
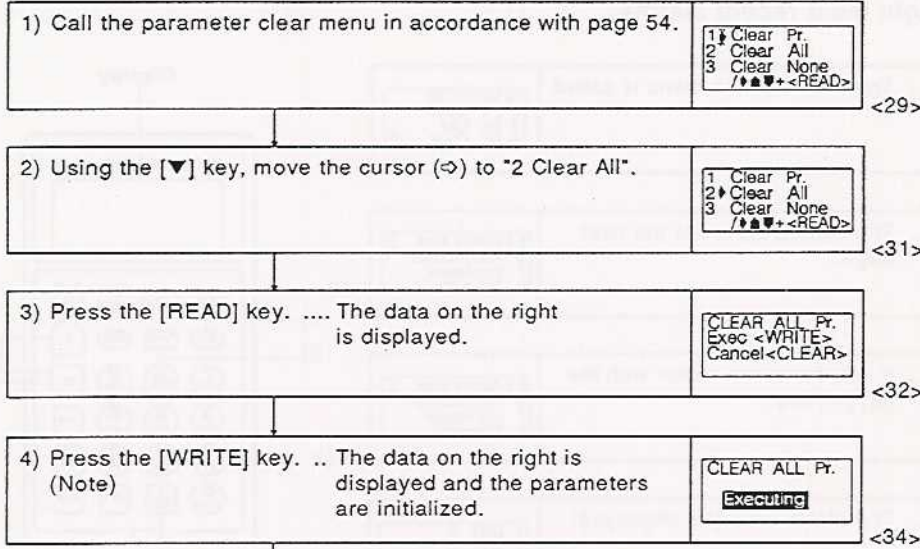
#### • Operation procedure



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

## ■ Selection and execution of "2 Clear All"

### • Operating procedure



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.

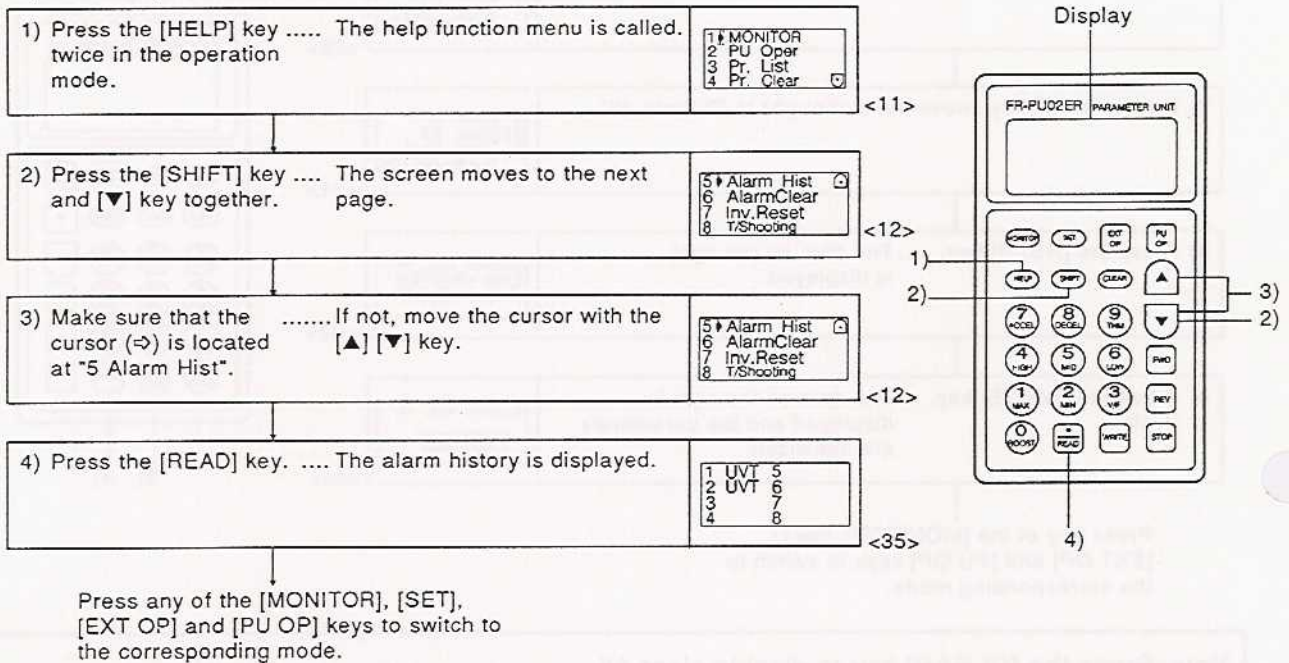
## ■ "Clear None"

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

## 5 ALARM HISTORY

Displays the history of eight most recent alarms.

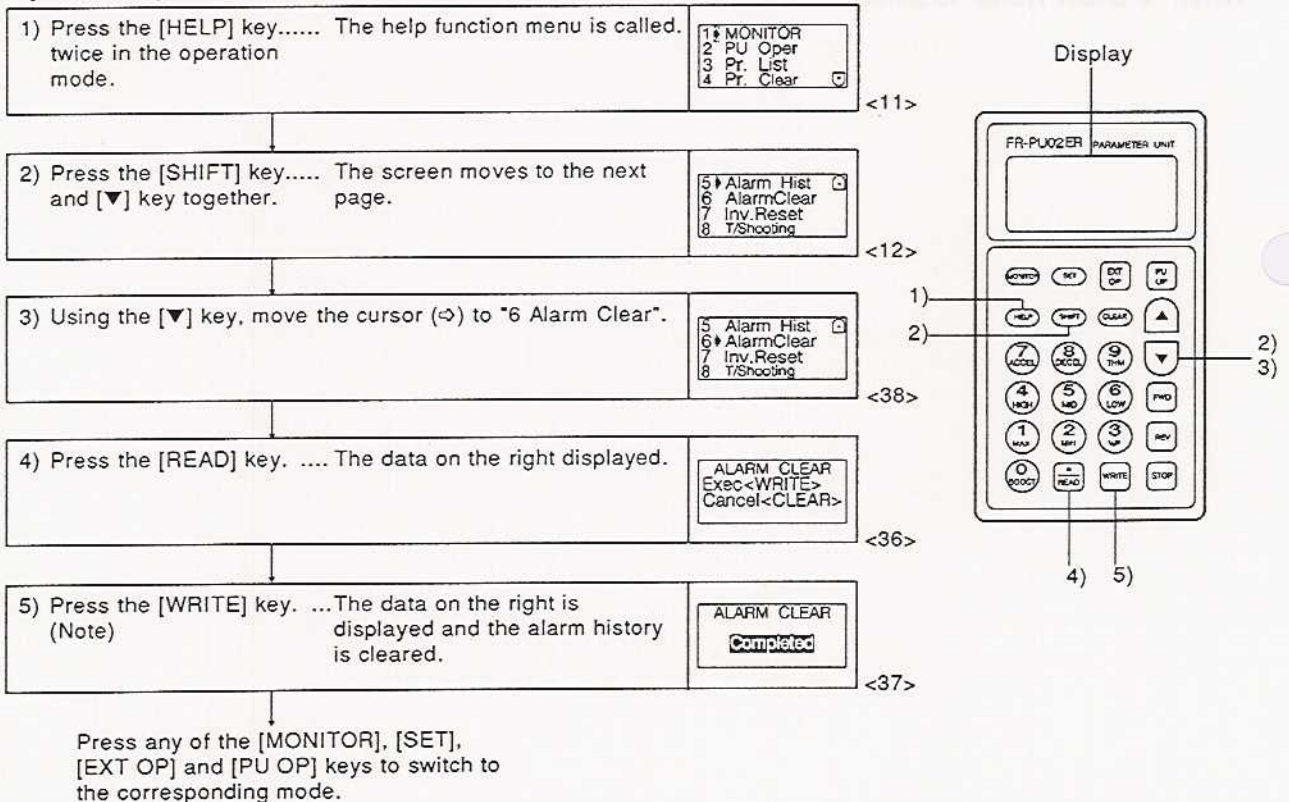
### • Operation procedure



## 6 ALARM HISTORY CLEAR

Clears all the alarm history.

### • Operation procedure

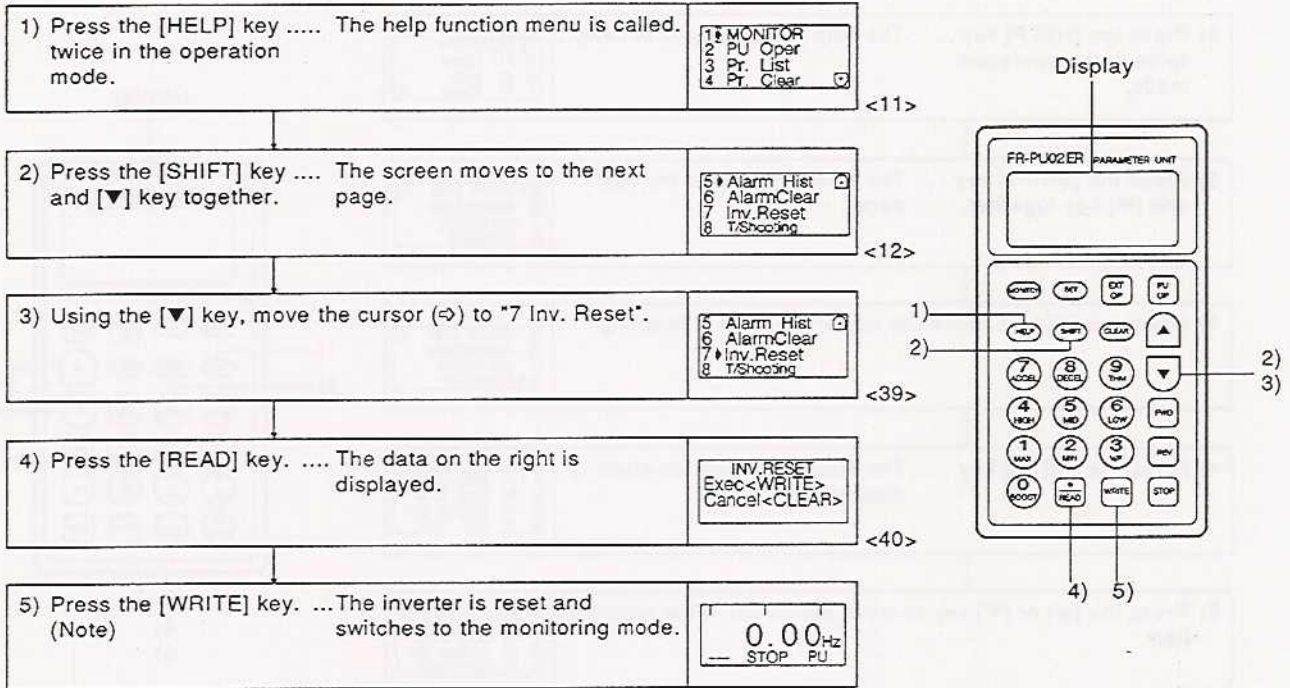


Note: Press the [CLEAR] key to disable Alarm History Clear.

## 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-P24.

### • Operation procedure

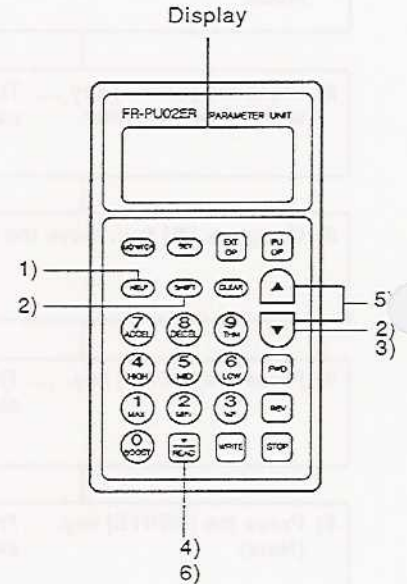
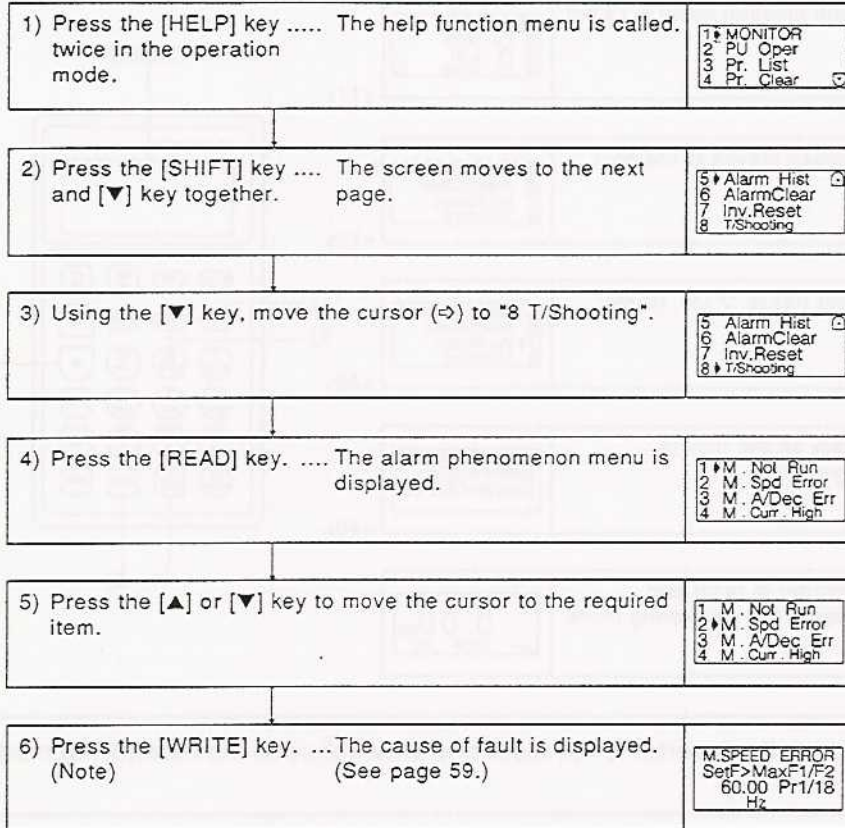


Note: By pressing the [CLEAR] key, the inverter is not reset and is switched to the monitoring mode.

## 8 TROUBLESHOOTING

If the inverter appears to operate improperly, 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



Note: This function can be used when the parameter unit used is the PU02E.

## • 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 Pr.1/18  
Hz

Since 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

Since 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

Since the running frequency set value is within the frequency jump setting range, 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)

Set 5.0S  
0 → 60.00Hz  
Set 5.0S  
60.00Hz → 0

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.

Still Pv.ON?  
Set Too Low?  
Load Too Big?  
Pr.22 Error?

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



#### 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>

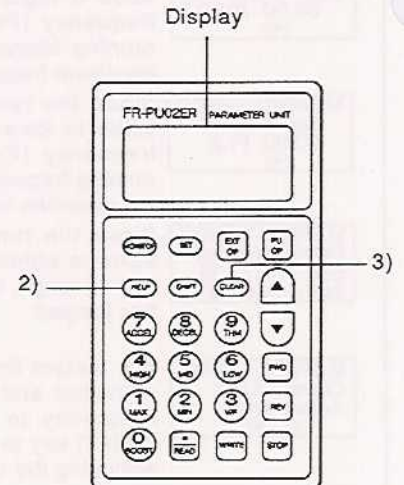
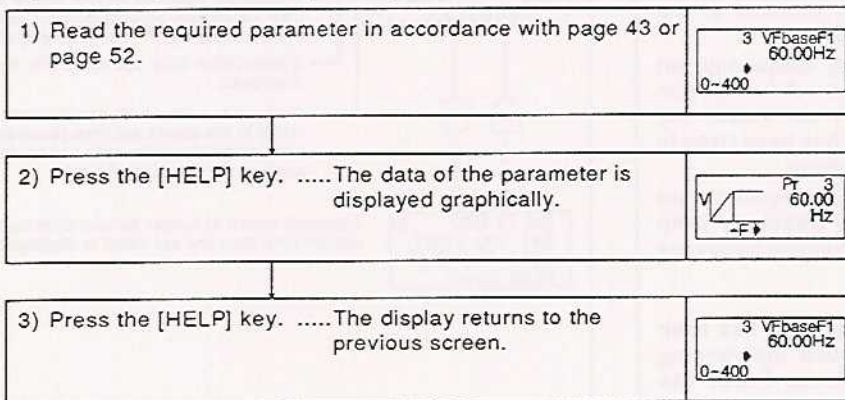
Press the [SHIFT] key to display the relevant assumed cause.

## 15-2 Other Help Function

### Graphic function

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

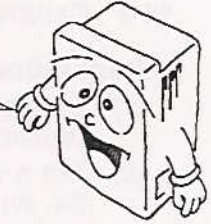
#### Operation procedure (Example: Pr. 3 "starting frequency")



Note: This function can be used when the parameter unit used is the PU02E.

## 16. CALIBRATION OF THE METER (FREQUENCY METER)

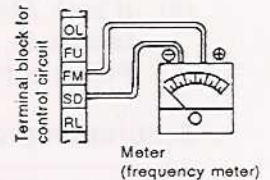
The PU allows the calibration (adjustment) of a meter connected across the meter connection terminal FM-SD or AM-5 of the inverter. When a digital meter is used, the PU allows the frequency of the pulse train output signal to be adjusted. The motor need not be connected.



### 16-1 Calibration of the FM-SD Output

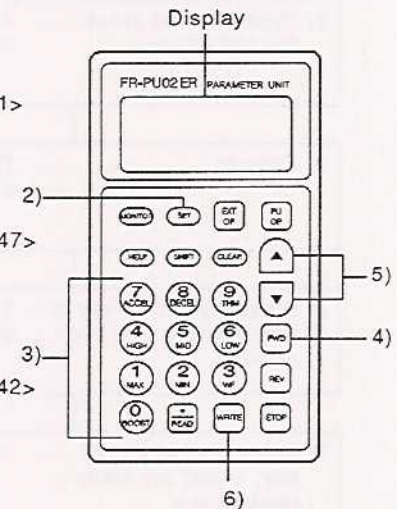
#### • Preparation

- (1) Connect a meter (frequency meter) across inverter terminals FM-SD. (Note the polarity. FM is the positive terminal.)
- (2) When a calibration resistor has already been connected, adjust the resistance 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, set in Pr. 55 or Pr. 56 the running frequency or current value at which the output signal is 1440Hz. This 1440Hz normally makes the meter full-scale deflect.



#### • Calibration procedure (Example: To calibrate the meter to the running frequency of 60Hz)

1) Press the [SET] key in .... The inverter is placed in the the PU operation mode. parameter setting mode.	SETTING MODE Set Pr.NO. FOR PR.List <HELP>	<1>
2) Type 900 and press ..... The current PU set frequency is the [READ] key.	900 FM Tune Run Inverter Set 0.00Hz PU	<47>
3) Type 60. .... The value shown on the right is displayed.	900 FM Tune Run Inverter Set 60.00Hz PU	<42>
4) Press the [FWD] key to ... The motor need not be start forward operation connected. at 60Hz.	900 FM Tune Run Inverter MintrF 60.00Hz MOC<WRITE>PU	<43>
5) Using the [▲] or [▼] ..... The meter reading moves. key, adjust the meter reading to a predetermined position.		
6) Press the [WRITE] key. ... Calibration is complete.	900 FM Tune Completed <MONITOR>	<44>



#### 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.

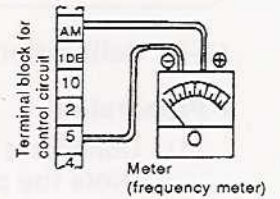
Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

Note : When the frequency meter is connected across terminals FM-SD to motor 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 109.)

## 16-2 Calibration of the AM-5 Output

### • Preparation

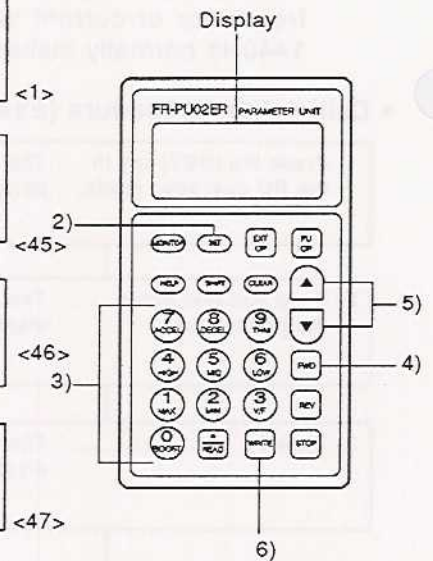
- (1) Connect a meter (frequency meter) of 0-10VDC across inverter terminals AM-5. (Note the polarity. AM is the positive terminal.)
- (2) Set a value of 101 to 103, 105, 106, 108, 110 to 114, 117 or 121 in Pr. 54. When the running frequency has been selected as the output signal, set in Pr. 55 the running frequency at which the output signal is 10V. If output current has been selected set in Pr. 56 the current value for a 10V output.
- (3) If both AM and FM terminal functions are required, Pr. 54 will set FM terminals, and Pr. 158 will set AM terminal (Refer to page 104)  
Pr. 55 sets Full scale for FM, Pr. 56 sets full scale for AM



### • Calibration procedure 1 (Example: To calibrate the meter to the running frequency of 60Hz)

1) Press the [SET] key in ..... The inverter is placed in the the PU operation mode. parameter setting mode.	SETTING MODE Set Pr.NO. FOR PR.List <HELP>	<1>
2) Type 901 and press ..... The current PU set frequency is the [READ] key.	901 AM Tune Run Inverter Set 0.00Hz PU	<45>
3) Type 60. .... The value shown on the right is displayed.	901 AM Tune Run Inverter Set 60.00Hz PU	<46>
4) Press the [FWD] key to .. The motor need not be start forward operation connected. at 60Hz.	901 AM Tune MntF 60.00Hz MON<WRITE>PU	<47>
5) Using the [▲] or [▼] ..... The meter reading moves. key, adjust the meter reading to a predetermined position.		<45>
6) Press the [WRITE] key. ... Calibration is complete.	901 AM Tune Completed <MONITOR>	<48>

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

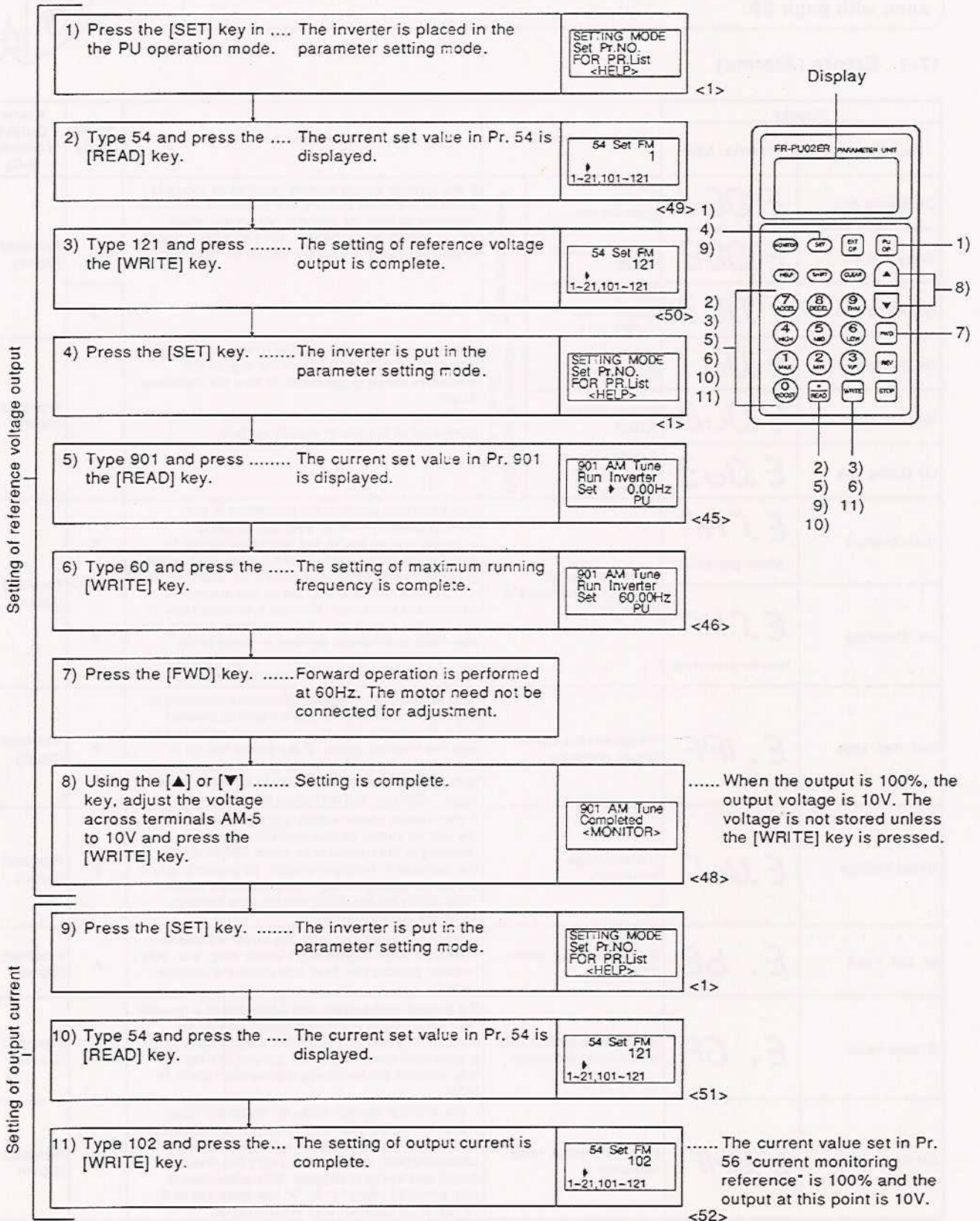


#### Note

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.

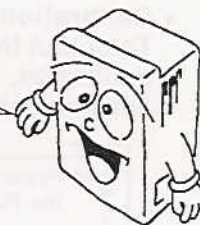
**• Calibration procedure 2 (Example: Output current)**

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-AM terminal function selection" is "121"), then select any of the choices displayed.



## 17. ERRORS

If any fault has occurred in the inverter, the corresponding protective function is activated to bring the inverter to an alarm stop and automatically give the corresponding error (alarm) indication on the PU display and inverter LED. When the protective function is activated, the inverter can be reset in accordance with page 69.



### 17-1 Errors (Alarms)

Display		Name	Description	Alarm Code	Alarm Output (Across B-C)
Parameter Unit	Inverter LED				
OC During Acc	E.OC1	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			
Oc During Dec	E.OC3	During deceleration During stop			
Ov During Acc	E.Ov1	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.Ov2	During constant speed			
Ov During Dec	E.Ov3	During deceleration During stop			
Motor Overload	E.FH7 (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.FH7 (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.UVF	Undervoltage protection	If the inverter power supply voltage has reduced, 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 reduces below about 150V (300V for the 400V series), this function stops the inverter output.	8	Provided (Open)
Br. Cct. Fault	E.bE	Brake transistor alarm detection	If the brake transistor fault has occurred due to extremely large regenerative brake duty, etc., this function detects that fault and stops the inverter output.	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.OHI	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)

Display		Name	Description	Alarm Code	Alarm Output (Across B-C)
Parameter Unit	Inverter LED				
OL is shown (during motor rotation)	<b>E.OLT</b> (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 not less 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 not less 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)
Still Prev STP (at a motor stop)		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	<b>E.OPF</b>	Inboard option connection alarm	Stops the inverter output if the dedicated option used in the inverter results in setting error or connection (connector) fault.	E	Provided (Open)
Corrupt Memory	<b>E.PE</b>	Parameter storage device alarm	Stops the output if the fault of EPROM which stores the function set values has occurred.	F	Provided (Open)
Retry No. Over	<b>E.REP</b>	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	<b>E.CPU</b>	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	<b>E.PUE</b>	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)
(Not displayed)	(Not displayed)	Brake resistor overheat protection	If the regenerative brake duty from the motor has exceeded the specified value, the brake operation is stopped to protect the brake resistor from overheat. When the brake resistor has cooled, the brake operation is resumed.	—	Not Provided (Close)

• **To know the operating status when the alarm happened.**

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 69), 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.

## 17-2 Correspondences between Digital and Actual Characters

There are the following correspondences between 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	
-	

## 17-3 Alarm History (History of Alarm Signals)

Up to eight most recent alarms (alarm signals) are stored in memory. To check these, use the help function. For more information, see "5 ALARM HISTORY" on page 56.

## 17-4 Erasing the Alarm History (History of Alarm Signals)

To erase the alarm history (history of alarm signals), use the help function. For more information, see "6 ALARM HISTORY CLEAR" on page 56.

## 17-5 Alarm Code Output

By setting Pr. 76 (alarm code output selection), an alarm signal can be output as a 4-bit digital signal. This signal is output from the open collector output terminals equipped as standard for the inverter.

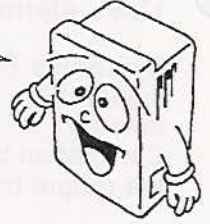
Correlation between alarm definitions and alarm codes are as follows. In the table, "0" indicates that the output transistor is off and "1" on (common terminal: DC24).

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
Brake transistor 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					



## 18. 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, this function detects that the PU has been disconnected from the inverter, switches the PU display 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.	○
3	Reset input enabled only when the protective function is activated.	○

Note: When the inverter comes to an alarm stop, the error messages displayed are as follows:

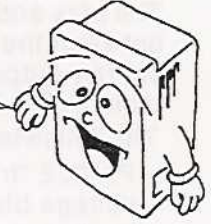
- PU display..... PU DISCONNECTED Inverter
- LED..... E.PUE

### • 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 69) after checking that the PU is connected securely.

## 19. 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, re-set the inverter. For details, see "7 INVERTER RESET" on page 57.

### Operation 2

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

### Operation 3

Connect the reset terminal RES-P24 for more than 0.1 seconds, then disconnect.

### Operation 4

When an alarm has occurred while the edit enable signal function is being used, press the STOP key in the PU operation mode.



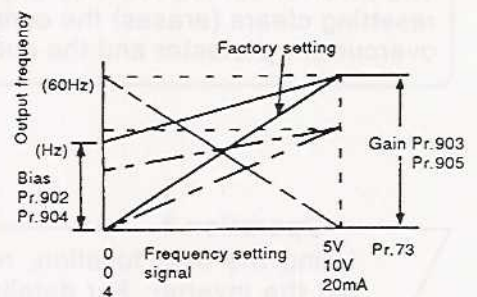
Resetting the inverter erases the heat build up calculation value for both motor and inverter. Consecutive resets or regular powering up and down can cause damage to the output transistors, or cause motor burn-out due to cumulative heat build up. Avoid resetting the inverter as part of its operation cycle.

## 20. 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 from outside the inverter to set the output frequency, e.g. 0 to 5VDC, 0 to 10VDC selectable by Pr. 73 or 4 to 20mADC, and the output frequency.

The following parameters are used for this adjustment:

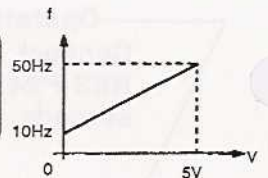
- Pr. 902 "frequency setting voltage bias"
- Pr. 903 "frequency setting voltage gain"
- Pr. 904 "frequency setting current bias"
- Pr. 905 "frequency setting current gain"



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

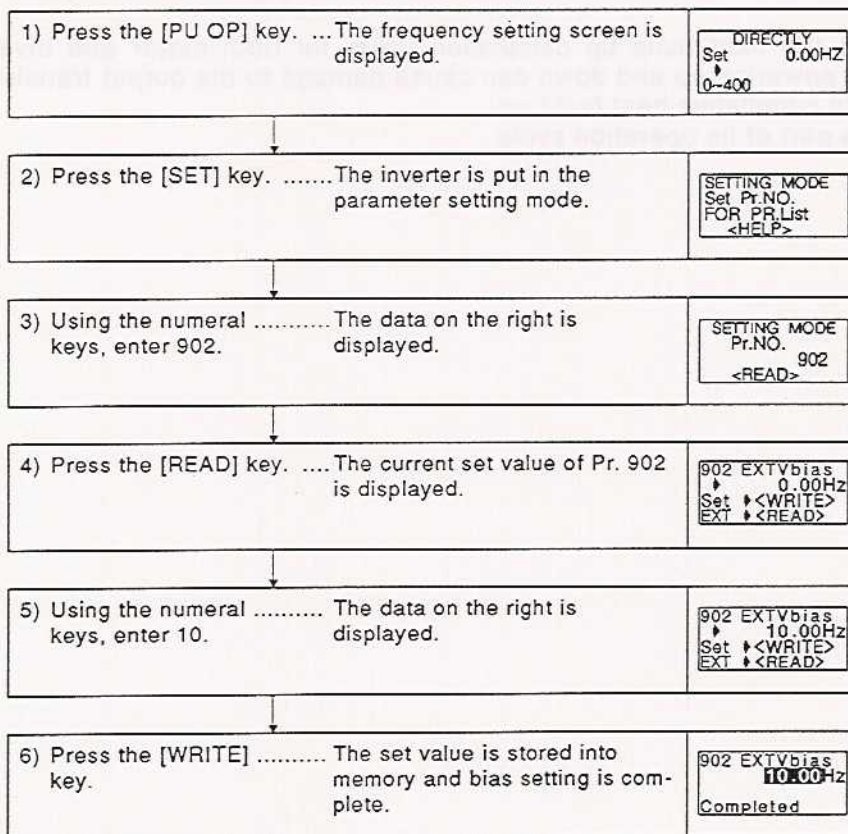
- (Example: Pr. 902 "frequency setting..... Set the output frequency to 10Hz voltage bias" at the set voltage of 0V.  
Pr. 903 "frequency setting..... Set the output frequency to 50Hz voltage gain" at the set voltage of 5V.)



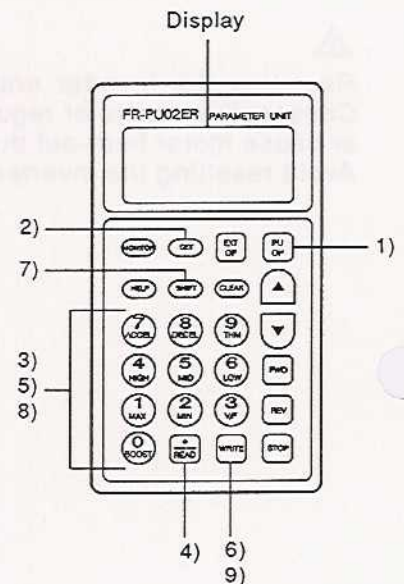
Before making adjustment, make sure that the set value of Pr. 73 "0 to 5V, 0 to 10V selection" is "0" (factory setting: 0 to 5V).

### • Adjustment procedure 1 (without a voltage applied across terminals 2-5)

#### (1) Setting of the frequency setting voltage bias

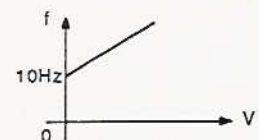


(To the next page)



..... The voltage need not be applied across terminals 2-5.

..... The bias setting is 10Hz.



If the voltage is being applied across terminals 2-5 at this time, the bias setting as shown above.

(From the preceding page)

## (2) Setting of the frequency setting voltage gain

7) Press the [SHIFT] key. .... The current set value of Pr. 903 is displayed.

```
903 EXTVgain
  ↓ 60.00Hz
SET ↓ <WRITE>
EXT ↓ <READ>
```

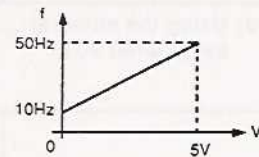
8) Using the numeral..... The data on the right is displayed.

```
903 EXTVgain
  ↓ 50.00Hz
Set ↓ <WRITE>
EXT ↓ <READ>
```

..... The voltage need not be applied across terminals 2-5. At this time, the 5V (10V) in the inverter is used as the set voltage.

9) Press the [WRITE] ..... The set value is stored into memory and gain setting is complete.

```
903 EXTVgain
  ↓ 50.00Hz
Completed
```

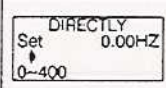


The adjustment of the frequency setting voltage bias and gain is complete.

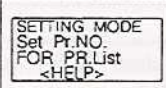
- Note: 1. The current input (Pr. 904, Pr. 905) can also be set in a similar manner.  
2. Pr. 903 remains unchanged if the value set in Pr. 20 "acc./dec. reference f) is changed.  
3. The FR-PU01E may also be used to adjust the frequency setting voltage bias and gain and current bias and gain (C-2 to C-5). Make these adjustments in accordance with "Adjustment procedure 2".

• Adjustment procedure 2 (any point is adjusted with a voltage applied across terminals 2-5)  
 (1) Setting of the frequency setting voltage bias

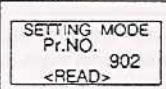
1) Press the [PU OP] key. ... The frequency setting screen is displayed.



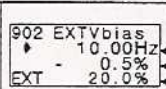
2) Press the [SET] key. .... The inverter is put in the parameter setting mode.



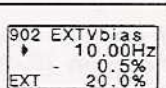
3) Using the numeral ..... The data on the right is displayed, enter 902.



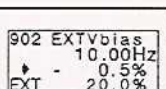
4) Press the [READ] key ..... The current set value of Pr. 902 is displayed.



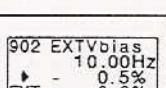
5) Using the numeral ..... The data on the right is displayed, enter 10.



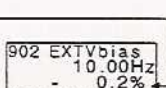
6) Press the [WRITE] key. .... The cursor (⇨) moves to the set voltage.



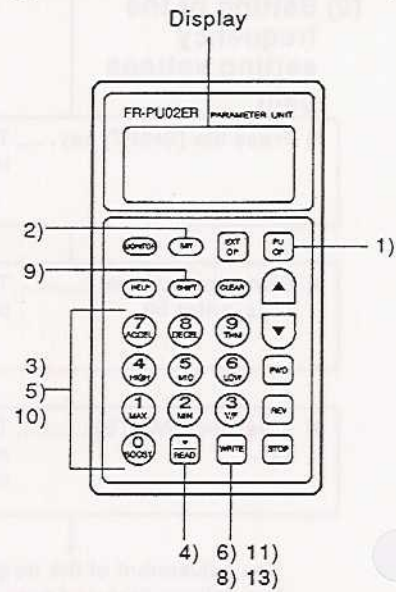
7) Apply the voltage of 0V.



8) Press the [WRITE] key. .... The set value is stored into memory and bias setting is complete.

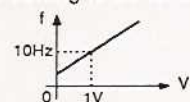


(To the next page)



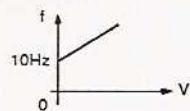
The preceding set value is displayed.  
 The current set voltage across terminals 2-5 is displayed in %.  
 The displayed value is changed according as the set voltage.  
 (In this example, the voltage of 1V is applied.)  
 (The value "0" selected in Pr. 73 (5V in this example) is 100%.)

Adjust the set voltage. When the voltage set is 1V, the bias setting is as follows:



Since 10Hz is set against 0V in this example, 0V is applied. (The % value for EXT changes.)

0.0% may not be displayed. The bias setting is complete as shown below:

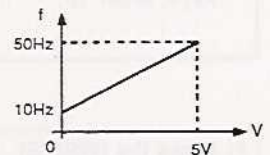


(From the preceding page)

## (2) Setting of the frequency setting voltage gain

<p>9) Press the [SHIFT] key, ... The current set value of Pr. 903 is displayed. then the [READ] key.</p>	<pre>903 EXT Vgain   ▸ 60.00Hz     97.1% EXT 99.0%</pre>	<p>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.</p>
<p>10) Using the numeral ..... The data on the right is displayed. keys, enter 50.</p>	<pre>903 EXT Vgain   ▸ 50.00Hz     97.1% EXT 99.0%</pre>	<p>[ The value selected in Pr. 73 (5V in this example) is 100%. ]</p>
<p>11) Press the [WRITE] key. .. The cursor (⇒) moves to the set voltage.</p>	<pre>903 EXT Vgain   ▸ 50.00Hz     97.1% EXT 99.0%</pre>	<p>Set the voltage across terminals 2-5 until 100% is achieved.</p>
<p>12) Apply the voltage of 5 V.</p>	<pre>903 EXT Vgain   ▸ 50.00Hz     97.1% EXT 99.0%</pre>	<p>..... Since 50Hz is set against 5V in this example, 5V is applied.</p>
<p>13) Press the [WRITE] key. .. The set value is stored into memory and gain setting is complete.</p>	<pre>903 EXT Vgain   Completed     99.6%</pre>	<p>100.0% may not be displayed. The setting is complete as shown below:</p>

The adjustment of the frequency setting voltage bias and gain is complete.

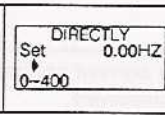


Note: 1. The current input (Pr. 904, Pr. 905) can also be set in a similar manner.  
2. Pr. 903 remains unchanged if the value set in Pr. 20 "acc./dec. reference f) is changed.

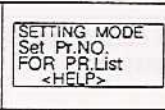
• Adjustment procedure 3 (any point is adjusted without a voltage applied across terminals 2-5)

(1) Setting of the frequency setting voltage bias

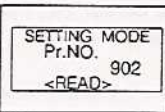
1) Press the [PU OP] key. ... The frequency setting screen is displayed.



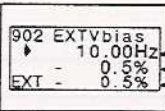
2) Press the [SET] key. .... The inverter is put in the parameter setting mode.



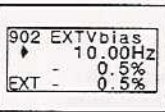
3) Using the numeral keys, enter 902. .... The data on the right is displayed.



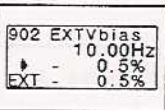
4) Press the [READ] key ..... The current set value of Pr. 902 is displayed.



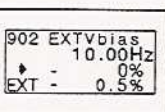
5) Using the numeral keys, enter 10. .... The data on the right is displayed.



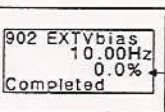
6) Press the [WRITE] key. .... The cursor (⇨) moves to the set voltage.



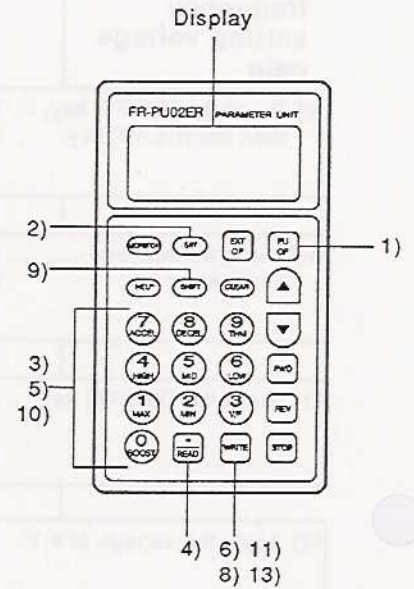
7) Using the numeral key, enter 0. .... Since 10Hz is set against 0V (0%, in this example, 0% is entered.



8) Press the [WRITE] key. .... The set value is stored into memory and bias setting is complete.



(To the next page)

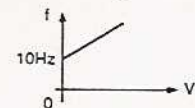


The preceding set value is displayed.  
The current set voltage across terminals 2-5 is displayed in %.  
The displayed value is changed according as the set voltage.  
(The value selected in Pr. 73 (5V in this example) is 100%.)

..... The voltage need not be applied across terminals 2-5.

..... Since 10Hz is set against 0V (0%, in this example, 0% is entered.

The bias setting is as follows:

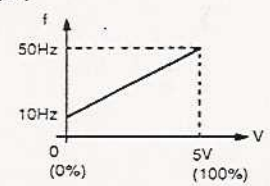


(From the preceding page)

**(2) Setting of the frequency setting voltage gain**

<p>9) Press the [SHIFT] key, ... The current set value of Pr. 903 then the [READ] key. is displayed.</p>	<pre> 903 EXTvgen   60.00Hz   97.1% EXT 99.0%</pre>	<p>The preceding set value is displayed.</p> <p>The current set voltage across terminals 2-5 is displayed in %.</p> <p>The displayed value is changed according as the set voltage</p>
<p>10) Using the numeral ..... The data on the right is keys, enter 50. displayed.</p>	<pre> 903 EXTvgen   50.00Hz   97.1% EXT 99.0%</pre>	<p>( The value selected in Pr. 73 (5V in this example) is 100%.</p>
<p>11) Press the [WRITE] key. .. The cursor (⇒) moves to the set voltage.</p>	<pre> 903 EXTvgen   50.00Hz   97.1% EXT 99.0%</pre>	<p>..... The voltage need not be applied across terminals 2-5.</p>
<p>12) Using the numeral keys, enter 100.</p>	<pre> 902 EXTvbias   50.00Hz   100% EXT 99.0%</pre>	<p>..... Since 50Hz is set against 5V (100%) in this example, 100% is entered.</p>
<p>13) Press the [WRITE] key. .. The set value is stored into memory and gain setting is complete.</p>	<pre> 903 EXTvgen   50.00Hz   100% Completed</pre>	<p>..... The setting is complete as shown below:</p>

The adjustment of the frequency setting voltage bias and gain is complete.

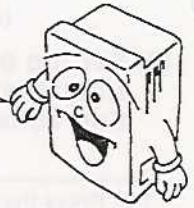


Note: 1. The current input (Pr. 904, Pr. 905) can also be set in a similar manner.  
 2. Pr. 903 remains unchanged if the value set in Pr. 20 "acc./dec. reference f) is changed.



## 21. 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 used when high starting torque is required, low-speed torque is required or when load varies considerably.



### Conditions for selecting magnetic flux vector control

When the following conditions are met, can magnetic flux vector control 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 either a squirrel cage or Force ventilated squirrel cage induction motor.
- The number of motor poles is 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 within 30m.

### Magnetic flux vector control selection method

Set any value other values than 9999 in Pr. 80 "motor capacity" and Pr. 81 (number of poles) to select the magnetic flux vector control. (When 9999 has been set in either Pr. 80 or Pr. 81, V/F control is selected.)

When the Mitsubishi constant-torque motor or Force vent. motor is used, set "1" in Pr. 71 "applied motor".

When the old Mitsubishi constant-torque motor (SF-JRC) is used, special parameters must be set in addition to the above parameters.

By switching the signal across terminals RT-P24 during a stop, operation can be switched between V/F control and magnetic flux vector control. Switch the signal off to select magnetic flux vector control.

Note: Precautions for magnetic flux vector control

1. The degree of speed fluctuation correction is slightly lower than in the 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 high starting torque
- Machines which require torque at low speed
- Machines where 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. )

## Parameters related to magnetic flux vector control

Parameter Number	Parameter Name	Setting Range	Set Value	Description	Factory Setting		
80	Motor capacity	9999, 0.4 to 55kW	9999	V/F control is selected.	0		
			0.4 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.	0		
			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	0	Standard motor (more than 1.5kW)	0		
			1	Constant-torque motor =	—		
			2	Standard motor (5-point flexible V/F characteristic)			
			20	Standard motor (1.5kW or less)			
			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.

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.

\* Constant torque or Force vent. motor

**MEMO**

Item No.	Description	Unit	Quantity	Unit Price	Total Price
1	...	...	...	...	...
2	...	...	...	...	...
3	...	...	...	...	...
4	...	...	...	...	...
5	...	...	...	...	...
6	...	...	...	...	...
7	...	...	...	...	...
8	...	...	...	...	...
9	...	...	...	...	...
10	...	...	...	...	...
11	...	...	...	...	...
12	...	...	...	...	...
13	...	...	...	...	...
14	...	...	...	...	...
15	...	...	...	...	...
16	...	...	...	...	...
17	...	...	...	...	...
18	...	...	...	...	...
19	...	...	...	...	...
20	...	...	...	...	...
21	...	...	...	...	...
22	...	...	...	...	...
23	...	...	...	...	...
24	...	...	...	...	...
25	...	...	...	...	...
26	...	...	...	...	...
27	...	...	...	...	...
28	...	...	...	...	...
29	...	...	...	...	...
30	...	...	...	...	...
31	...	...	...	...	...
32	...	...	...	...	...
33	...	...	...	...	...
34	...	...	...	...	...
35	...	...	...	...	...
36	...	...	...	...	...
37	...	...	...	...	...
38	...	...	...	...	...
39	...	...	...	...	...
40	...	...	...	...	...
41	...	...	...	...	...
42	...	...	...	...	...
43	...	...	...	...	...
44	...	...	...	...	...
45	...	...	...	...	...
46	...	...	...	...	...
47	...	...	...	...	...
48	...	...	...	...	...
49	...	...	...	...	...
50	...	...	...	...	...

Partners' interest to ...  
 into the vector ...

The ... of ... is ...

...

...

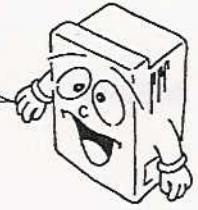


## 22. AUTO COMMISSION

If the motor used is not Mitsubishi's standard motor (0.4kW or more) or Mitsubishi's constant-torque motor (4-pole, 0.4kW to 55kW), the auto tuning function allows the motor to be run with optimum operation characteristics under magnetic flux vector control.

Also, commission data (motor constants) can be copied to the other inverter by 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 commission, check the following:

- (1) The motor is connected. However, 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 the smaller, the load the higher the commission accuracy. Also note that if inertia is high, commission accuracy remains unchanged.
- (3) When "101" (auto commission is performed with the motor rotated) has been set in Pr. 96 (auto tuning setting/state), ensure the following:
  - 1) Enough torque is provided during commission.  
    ( There should be no problem if the motor is run at about the rated motor frequency (set value of Pr. 84). )
  - 2) The brake is released.
  - 3) No external 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, make tuning after fixing the motor securely with a mechanical brake or ensuring that motor rotation will not compromise safety.  
    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 it before starting auto tuning.

#### 2. Selection of magnetic flux vector control

Select the magnetic flux vector control in accordance with page 76.

#### 3. Setting of parameters

Set the following parameters.

- (1) Pr. 96 "auto tuning setting/state" ..... Set "1" or "101".
  - Set value "1" ..... Commissioned without the motor rotating.
  - Set value "101" ..... Commissioned with the motor rotating.
- (2) Pr. 83 "rated motor voltage" ..... Set the rated motor voltage (V).
- (3) Pr. 84 "rated motor frequency" ... 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 or Force vent motor..... Set "13".

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)	—		
			1	Constant-torque *			
			2	Standard motor (5-point flexible V/F characteristic)			
			20	Standard motor (1.5kW or less)			
			3	Standard motor		*Auto tuning setting* is selected	
			13	Constant-torque *			
			4	Standard motor		Auto tuning data read/change setting is enabled	
			14	Constant-torque *			
			5	Standard motor		Star connection	Direct input of motor constants is enabled
			15	Constant-torque *			
6	Standard motor	Delta connection					
16	Constant-torque *						
83	Rated motor voltage	0 to 1000V	0 to 1000V	*No auto commission* is selected. Rated motor voltage (V) is set.	400		
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 0 to 10.000Ω	Tuning data *2	0 — 0 — 0 — 0		
91	Motor constant R2	9999, 0 to 10.000Ω	9999 0 to 10.000Ω				
92	Motor constant L1	9999, 0 to 1000.0mH	9999 0 to 1000.0mH				
93	Motor constant L2	9999, 0 to 1000.0mH	9999 0 to 1000.0mH				
94	Motor constant X	9999, 0 to 1000%	9999 0 to 1000%				
96	Auto tuning setting/state	0, 1, 101 *3	0		*No auto commission* is selected.	0	
			1		Auto commission is performed without the motor rotated.	—	
			101*3	Auto commission 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.

\* : or Force vent motor

#### 4. Switching the auto commission command ON

In external PU operation mode, press the [FWD] or [REV] key. In external external operation mode, turn on the start switch (connect terminals across STF or STR-P24).

#### ⚠ SAFETY

- Note: 1. When "101" is set in Pr. 96, be careful to avoid hazard because the motor rotates.  
2. During auto commission, the input terminals are made valid/invalid as indicated below:

Valid Terminals	Invalid Terminals
STOP OH MRS RT, JOG, CS RES STF/STR	RH/RM/RL 2, 1, 4 AU

- When it is necessary to stop the motor during tuning Terminate commission using the MRS terminal, RES terminal or [STOP] key.

#### 5. Commission state monitoring

During commissioning, the value of Pr. 96 is displayed on the main monitor and level meter of the PU as indicated below. On the PU, 1, 2, 3, 8, 9, 102 or 103 is shown, on the inverter LED. (When Pr. 51 = "1" (factory setting))

##### •PU main monitor

	1. Setting	2. Tuning in Progress	3. Completion	Error-activated End
Display	1 --- STOP PU	TUNE 2 STF FWD PU	TUNE 3 COMPLETION STF STOP PU	TUNE 9 ERROR STF STOP PU
	101 --- STOP PU	TUNE 102 STF FWD PU	TUNE 103 COMPLETION STF STOP PU	

##### •PU level meter

Indicates tuning progress with 0% (start) to full-scale 100% (end).

##### •Inverter LED

	1. Setting	2. Tuning in Progress	3. Completion	Error-activated End
Displayed value	0	2	3	9
	101	102	103	

#### 6. Auto commission end

Check the value of Pr. 96.

- Normal end..... "3" or "103" is displayed.
- Forced end ..... "8" is displayed.
- Error-activated end..... "9" is displayed.

When commission comes to a normal end in PU operation mode, press the [STOP] key. When in the external operation mode, turn off the start switch (disconnect terminals STF or STR-P24). This operation resets auto commission and returns the PU monitor to an ordinary display.

Note that if this operation is not performed, next operation cannot be started.

When tuning resulted in an error-activated end (Pr. 96 value = 9) or a forced end (Pr. 96 value = 8), reset the inverter (see page 69) and restart from operation step 1.

## [Optional Setting of Motor Constants]

The motor constants (Pr. 90 to 94) may either be set as appropriate by reading and changing the data measured by auto commission, or without using the auto commission data:

### ■ Setting the motor constants by reading and changing the auto commission 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", can 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 not be adjusted:doing so many damage the drive.

2. Set Pr. 71 "applied motor" as indicated below:  
Standard motor: Set "4". Constant-torque or Force ventilated 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 $\delta$	0 to****, 9999	1	9999

4. 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), can Pr. 90 to 94 be read.  
2. Set "9999" in 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 commission 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.  $2516 \times 1.05 = 2641.8$ ) 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 commission data

The motor constants of Pr. 92 and 93 may either be entered in [ $\Omega$ ] or [mH]. Check the unit of the motor constants before starting the setting operation.

### • Entering the motor constants of Pr. 92 and 93 in [ $\Omega$ ]

#### <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 not be adjusted.
2. Set Pr. 71 "applied motor" as indicated below:

		Star Connection Motor	Delta Connection Motor
Set value	Standard motor	5	6
	Constant-torque *	15	16

\* or Force vent. motor

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 10 $\Omega$ , 9999	0.001 $\Omega$	9999
Pr. 91	Motor constant r2	0 to 10 $\Omega$ , 9999	0.001 $\Omega$	9999
Pr. 92	Motor constant x1	0 to 10 $\Omega$ , 9999	0.001 $\Omega$	9999
Pr. 93	Motor constant x2	0 to 10 $\Omega$ , 9999	0.001 $\Omega$	9999
Pr. 94	Motor constant xm	0 to 500 $\Omega$ , 9999	0.01 $\Omega$	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), can Pr. 90 to 94 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 achieved.

• **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 not be adjusted.
2. Set Pr. 71 "applied motor" as indicated below:  
 Standard motor  $\left\{ \begin{array}{l} \text{Greater than 1.5kW: Set "0".} \\ \text{Constant-torque or Force vent. motor: Set "1".} \end{array} \right.$
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 10 $\Omega$ , 9999	0.001 $\Omega$	9999
Pr. 91	Motor constant R2	0 to 10 $\Omega$ , 9999	0.001 $\Omega$	9999
Pr. 92	Motor constant L1	0 to 1000mH, 9999	0.1mH	9999
Pr. 93	Motor constant L2	0 to 1000mH, 9999	0.1mH	9999
Pr. 94	Motor constant $\gamma$	0 to 100%, 9999	0.1%	9999

4. Set Pr. 84 "rated motor frequency" with reference to the following table:

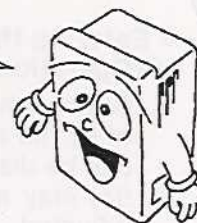
Pr.No.	Name	Range	Increment	Factory Setting
Pr. 84	Rated motor frequency	50 to 120Hz, 9999	0.01Hz	9999

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.

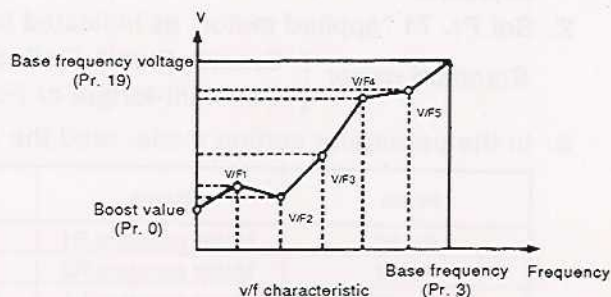
## 23. 5-POINT FLEXIBLE V/F CHARACTERISTIC

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) 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:  $F1 \neq F2 \neq F3 \neq F4 \neq F5 \neq \text{base frequency}$ .  
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 above 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 No.	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 values of Pr. 100 to Pr. 109 set when Pr. 71 = 0 or 1 are stored internally and remain unchanged if the set values are written with Pr. 71 = 2. When the inboard option is added with "2" set in Pr. 71, the parameters set when Pr. 71 = 0 or 1 are made valid and the option operates with these parameters.

# 24. PARAMETERS

## 24-1 Parameter List

Function	Parameter Number	Name	Screen Display	Note 4	Setting Range	Minimum Setting Increment	Factory Setting	Customer Set Value	Refer To:		
Basic functions	0	Torque boost(manual)	Trq_Bst1	0	0 to 30%	0.1%	6%/3% (Note 1)		90		
	1	Maximum frequency	Max.F1		0 to 120Hz	0.01Hz	120Hz				
	2	Minimum frequency	Min.F1		0 to 120Hz	0.01Hz	0Hz				
	Basic functions	3	Base frequency	VFbaseF1		0 to 400Hz	0.01Hz	50Hz		91	
		4	Multi-speed setting (high speed)	PresetF1		0 to 400Hz	0.01Hz	60Hz			
		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)			92
		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)			92, 93
Standard operation functions	9	Electronic thermal O/L relay	Set THM		0 to 500A	0.01A	Rated output current		93		
	10	DC injection brake operation frequency	DC Br.F		0 to 120Hz, 9999	0.01Hz	3Hz		93, 94		
	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		94		
	14	Applied load selection	Load VF	0	0, 1, 2, 3, 4, 5	1	0		94, 95		
	15	Jog frequency	JOG F		0 to 400Hz	0.01Hz	5Hz		95, 96		
	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, 1, 2, 3	1	0			96, 97	
	18	High-speed maximum frequency	Max.F2		120 to 400Hz	0.01Hz	120Hz		97		
	19	Base frequency voltage	VFbase V		0 to 1000V, 8888, 9999	0.1V	8888				
	20	Acceleration/deceleration reference frequency	Acc/DecF		1 to 400Hz	0.01Hz	50Hz			92, 93	
	21	Acceleration/deceleration time increments	Incr.T		0, 1	1	0		98		
	22	Stall prevention operation level	Still Pv1		0 to 200%, 9999 **	0.1%	150%				
	23	Stall prevention operation level at double speed	Still Pv2		0 to 200%, 9999	0.1%	9999				
	Standard operation functions	24	Multi-speed setting (speed 4)	PresetF4		0 to 400Hz, 9999	0.01Hz	9999		91	
		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		98, 99	
		29	Acceleration/deceleration pattern	Acc/DecP		0, 1, 2, 3	1	0		100	
		30	External brake resistor selection	Br.Set		0, 1	1	0		101	
		31	Frequency jump 1A	Fjump 1A		0 to 400Hz, 9999	0.01Hz	9999		102	
		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		103	
	38	Automatic torque boost	A.TrqBst	0	0 to 200%	0.1%	0				
39	Automatic torque boost operation starting current	NoLoad I	0	0 to 500A	0.01A	0					
Multi-function output terminal functions	40	Output terminal assignment	Selectop		0 to 9999	1	1234		104		
	41	Up-to-frequency sensitivity	SU Range		0 to 100%	0.1%	10%		105		
	42	Output frequency detection	SetFU FW		0 to 400Hz	0.01Hz	6Hz				
	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		106		
	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	0	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			107	

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 a voltage, I a current, and t time.

\*: For external start input for the DC injection brake.

\*\* : For analog external input for the setting after stall prevention level using terminal 1.

Function	Parameter Number	Name	Screen Display	Note 4	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		107,108	
	52	PU main display data selection	Set Main		0, 17 to 20, 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 114, 117, 118, 121	1	1			
	55	Frequency monitoring reference	CalbFM F		0 to 400Hz	0.01Hz	50Hz		109	
	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		110	
	58	Restart cushion time	RestrtT2		0 to 5 seconds	0.1 seconds	1.0 second			
Additional function	59	Remote setting function selection	Rmt Set		0, 1, 2	1	0		111	
Operation selection functions	60	Intelligent mode selection	Int.Mode		0 to 6	1	0		112, 113	
	61	Reference I for intelligent mode	—		0 to 500A, 9999	0.01A	9999			
	62	Ref. I for intelligent mode accel. *	—		0 to 200%, 9999	0.1%	9999		113, 114	
	63	Ref. I for intelligent mode decel. *	—		0 to 200%, 9999	0.1%	9999			
	64	Starting I for elevator mode *	—		0 to 10Hz, 9999	0.01Hz	9999		114	
	65	Retry selection	Retry		0 to 5	1	0			
	66	Stall prevention operation reduction starting frequency	Still coF		0 to 400Hz	0.01Hz	60Hz		98	
	67	Number of retries at alarm occurrence	Retry No		0 to 10	1	0		115	
	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		101	
	70	Special regenerative brake duty	Br.Duty		0 to 30%/0% (Note 3)	0.1%	0%			
	71	Applied motor ***	SetMotor		0 to 6, 13 to 16, 20	1	0		116	
	72	PWM frequency selection	PWM F		0.7 to 14.5KHz	0.1KHz	14.5KHz			
	73	0 to 5V, 0 to 10V selection	Extf/10V		0 to 5, 10 to 15	1	1		118	
	74	Response time for analog signal	IPfilter		0 to 8	1	1		119	
	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		120	
	77	Parameter write disable selection	EnableWr		0, 1, 2	1	0			
	78	Reverse rotation prevention selection	EnableFR		0, 1, 2	1	0		121, 122	
	79	Operation mode selection	ContMode		0 to 4	1	0			
	* 80	Motor capacity	Motor KW		3.7 to 55kW, 9999	0.01kW	9999		122	
	* 81	Number of motor poles	Mpole No		2, 4, 6, 12, 14, 16, 9999	1	9999			
	* 82	Parameter set by manufacturer. Do not set.								
	* 83	Rated motor voltage	Motor V		0 to 1000V, 9999	0.1V	400		80	
	* 84	Rated motor frequency	Motor f		50 to 120.00Hz, 9999	0.01Hz	60			
	* 85 to * 95	Parameters set by manufacturer. Do not set.								
* 96	Auto tuning setting/state	AutoTune		0, 1, 101	1	0		80		
* 97 to * 99	Parameters set by manufacturer. Do not set.									
145	Parameter unit language switching	PU Lang		0,1,2,3	1	0		122		
* 100 to * 154	Parameters for inboard options. For details, see the option manual. Pr. 100 to 109 for V/F 5-points setting.									
* 155	RT activated condition	RT set		0, 10	1	0		122		
* 156	Stall prevent. select. at regeneration	Still Prv		0 to 31, 100	1	0		123		
* 157	OL signal waiting time	OL delay		0 to 25 seconds, 9999	0.1 seconds	0		124		
* 158	AM terminal function selection	AM set		1 to 3, 5 to 14, 17, 18, 21, 9999	1	9999		107, 108		
* 159	PWM f decrease at low speed	PWM3 f		0, 1, 2, 3	1	0		124		
* 160 to * 199	Parameters for inboard options.									

\*: These parameters appear on the screen only when a value either 1 to 6 is set in Pr.60.

\*\* : Pr.52=23 run hour monitor could be available.

\*\*\*: Pr.71=3 auto commission mode is setting.

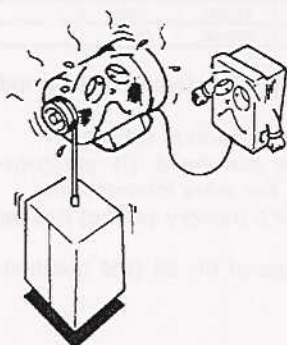
Function	Parameter Number	Name	Screen Display	Note 4	Setting Range	Minimum Setting Increment	Factory Setting	Customer Set Value	Refer To:
Calibration functions	900	FM terminal calibration	FM Tune		—	—	— (Note 6)		124, 125
	901	AM terminal calibration	AM Tune		—	—	— (Note 6)		125
	902	Frequency setting voltage bias	ExtVbias		0 to 10V : 0 to 60Hz	0.01Hz	(0V) : 0Hz		
	903	Frequency setting voltage gain	ExtVgain		0 to 10V : 1 to 400Hz	0.01Hz	(5V) : 50Hz		
	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) : 50Hz		

Note: 3. The setting range depends on the inverter capacity: (5.5K to 7.5K)/(11K and up). The factory setting indicated is %ED of the built-in brake transistor operation.

4. 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). For more information.
5. 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).
6. 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).

24-2 Setting of Parameters to Improve the Corresponding Operational Functions

**Lifter or the like requires large starting torque**



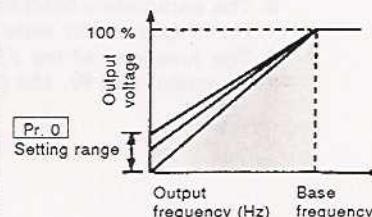
⇒ Pr. 0 "torque boost (manual)"

- Used to adjust the motor torque in the low-frequency range, there by increasing the motor torque at the time of start.

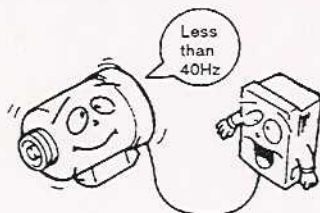
Model	Factory Setting	Setting Range
7.5K and below	6 %	0 to 30 %
11K and above	3 %	

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 below...4 %  
11 K and above.....2 %



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



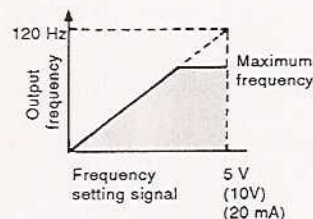
⇒ Pr. 1 "maximum frequency" or Pr. 18 "high-speed maximum frequency"

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

- The maximum setting up to 120 Hz.

Use parameter Pr. 1 "maximum frequency" to set the upper limit of the output frequency.

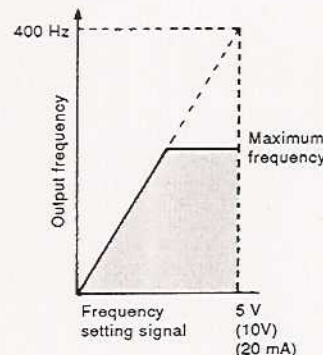
Factory Setting	Setting Range
120 Hz	0 to 120 Hz



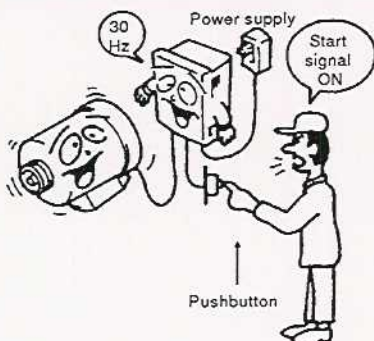
- The maximum setting is higher than 120 Hz.

Use parameter Pr. 18 "high-speed 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



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

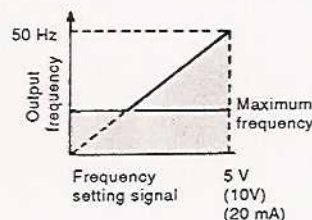


⇒ Pr. 2 "minimum frequency"

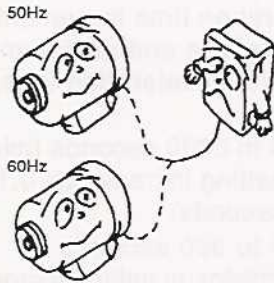
Allows the lower limit of the output frequency to be clamped.

- 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



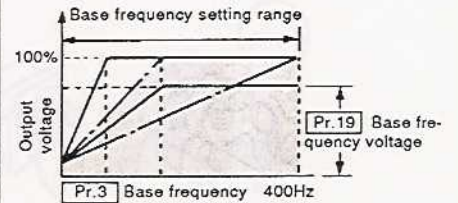
**To set the reference frequency (base frequency) at the rated torque of the motor according to the motor rating**



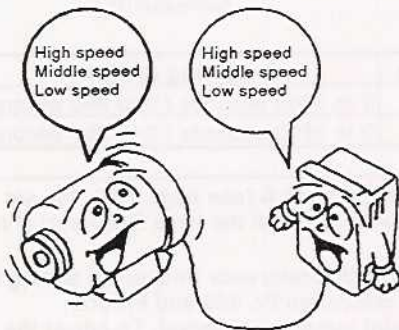
⇒ Pr. 3 "base frequency", Pr. 19 "base frequency voltage"

- 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.

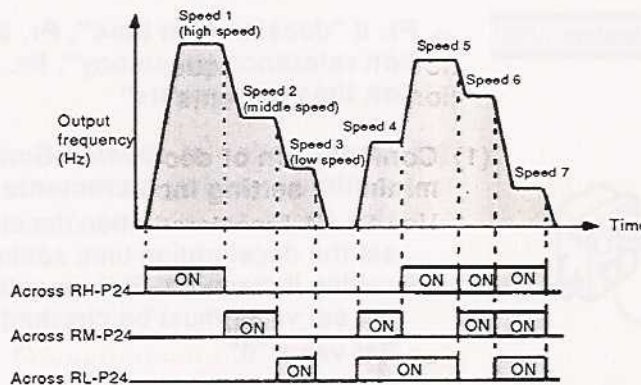


**To set multiple speeds**



⇒ 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)"

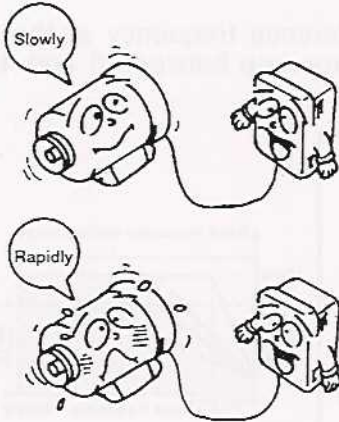
- Allows any speed to be selected by switching the external contact signal (across terminals RH/RM/RL and P24).
- Each speed (frequency) may be specified as appropriate between 0 and 400Hz during inverter operation. The speed may also be set using the [▲] and [▼] keys. (On releasing the [▲] and [▼] keys, 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- 5, 4-5).  
 3. This setting may also 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.



**To accelerate slowly or rapidly**



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

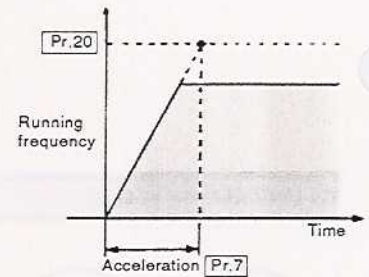
**(1) Confirmation of acceleration time setting range and minimum setting increments**

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"..... 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. (See below Note)



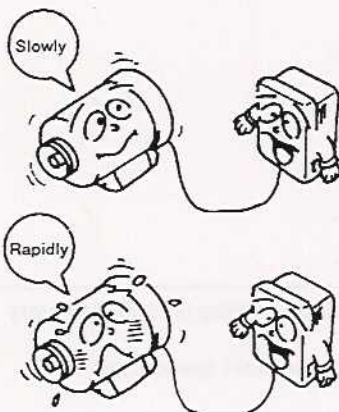
Model	Factory Setting	Setting Range
7.5K and below	5 seconds	0 to 3600 seconds / 0 to 360 seconds
11K and above	15 seconds	0 to 3600 seconds / 0 to 360 seconds

Note: 1. In S-pattern acceleration/deceleration A (see page 100), 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, recalibrate Pr. 903 and Pr. 905.

3. When the set value of Pr. 7 is "0", the acceleration time is set to 0.04 seconds.

**To decelerate slowly or rapidly**



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

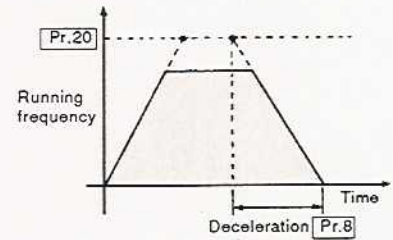
**(1) Confirmation of deceleration time setting range and minimum setting increments**

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" ..... 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**



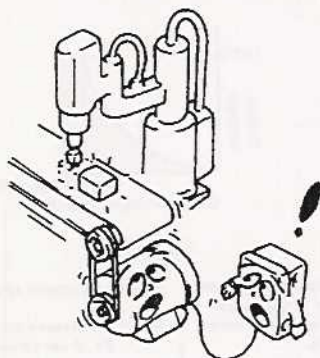
⇒ **Pr. 9 "electronic overcurrent protection"**

- The value for motor overheat protection is 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 in the low speed range, and set the rated motor current in Pr. 9 "electronic overcurrent protection".

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

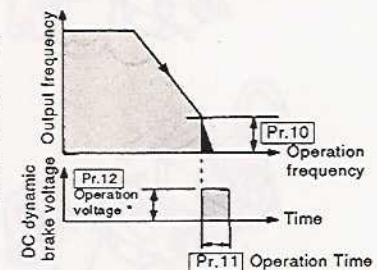
Note: When two or more motors are run simultaneously, provide a thermal relay for each motor.

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



⇒ **Pr. 10 "DC injection braking operation frequency", Pr. 11 "DC injection braking operation time", Pr. 12 "DC injection braking voltage"**

- Setting the stopping DC injection braking 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 injection braking operation time". Set a large value in Pr. 12 "DC injection braking voltage".

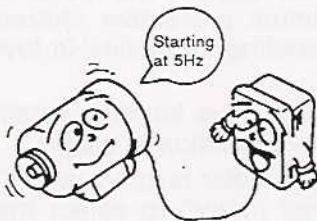
**<When load is small>**

Set a long time in Pr. 11 "DC injection braking operation time". Set a small value in Pr. 12 "DC injection braking 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%, 11 and above...3%	0 to 30%

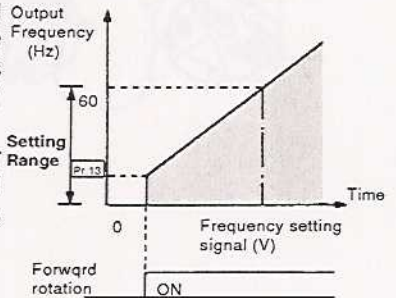
Note: 1. Setting 9999 in Pr. 10 allows the DC injection braking to start at the frequency set in Pr. 13 (starting frequency).  
 2. When 8888 is set in Pr. 11, connection of terminal MRS-SD starts the DC injection braking. At this time, the essential function (output stop) of terminal MRS is invalid.  
 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%

**To limit the running frequency at start**

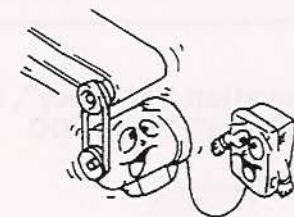


⇒ **Pr. 13 "starting frequency"**

- 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.

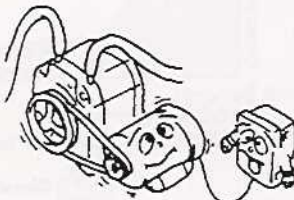
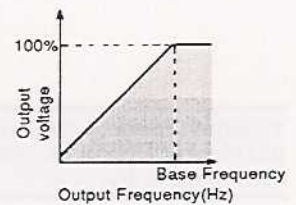


**To select the optimum output characteristic (V/F characteristic) for application and load characteristic**

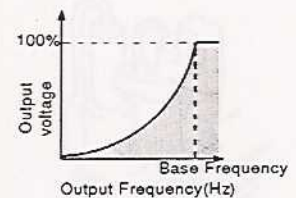


⇒ **Pr. 14 "applied load selection"**

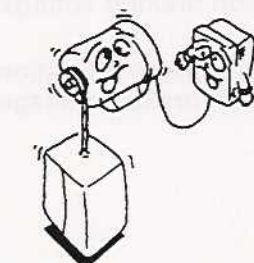
- Conveyor, carrier, etc. (for constant-torque loads)**  
Set "0" (factory setting).



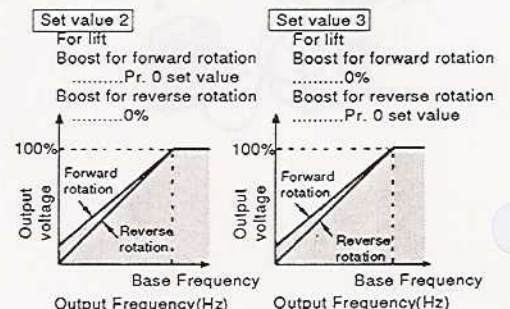
- Fan and pump (for variable-torque loads)**  
Set "1".



- The inverter accelerates slowly until the motor starts running to prevent the inverter from being stopped by the overcurrent protection function.



- 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.

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-P24) 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 39.

• **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)

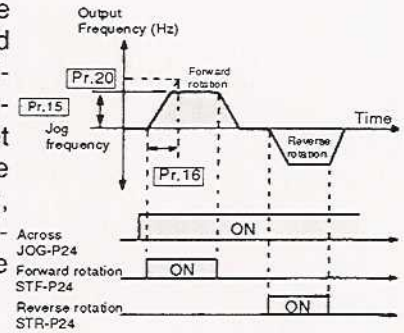
Set value "1"..... 0 to 360 seconds  
(minimum setting increments: 0.01 seconds)

(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

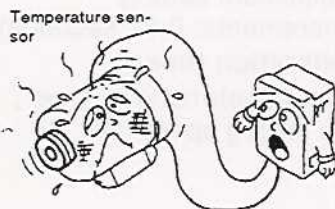
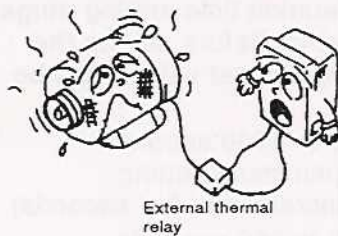
- Note: 1. In S-pattern acceleration/deceleration A (see page 100), the set time is a period of time required to reach the base frequency (Pr. 3).
2. If Pr. 20 (acceleration/deceleration reference frequency) setting is changed, the set values of calibration Pr. 903 and Pr. 905 (frequency setting signal gain) remain unchanged. To adjust the gains, recalibrate 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

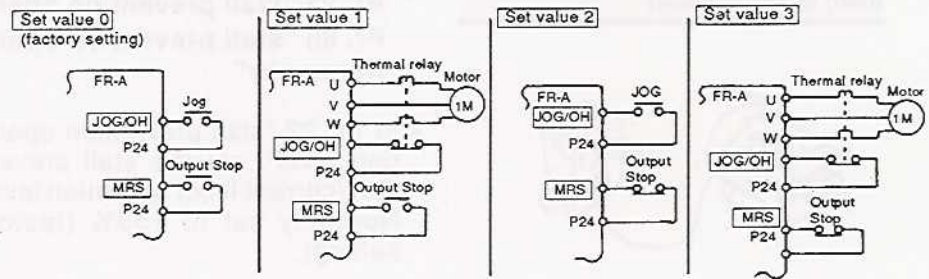
To select a thermal relay outside of the inverter



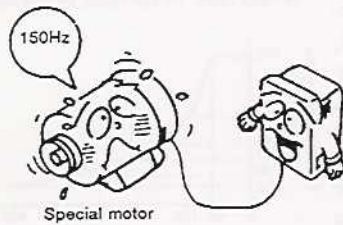
⇒ Pr. 17 "external thermal relay input"

- 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 in the inverter outside 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).

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	—	●	—	●



### To run at the frequency over 120Hz

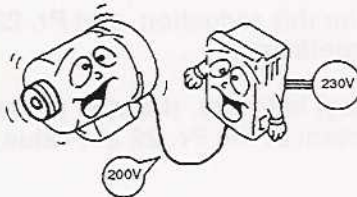


### ⇒ Pr. 18 "high-speed maximum frequency"

- This inverter is factory-set to the maximum running frequency of 120Hz. To run at the frequency over 120Hz, set a value of more 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 400V rating with a 460V power supply



### ⇒ Pr. 19 "base frequency voltage"

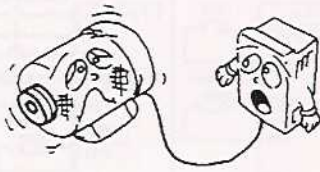
- By setting 400V in Pr. 19 "base frequency voltage", the motor of rated voltage lower than the power supply voltage of the inverter can be used most appropriately.

Factory Setting	Setting Range
8888	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 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>

**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).

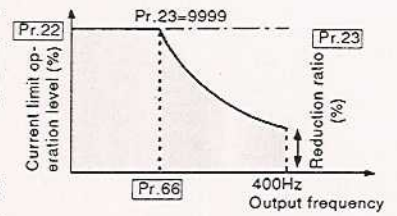
- When operation is performed at high speed at or over 50Hz, acceleration may occur because motor current does not increase.

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).

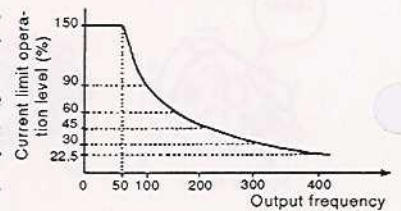
To improve this and activate the alarm, the stall prevention (current limit) level is reduced.

Pr. 66 sets the start frequency for this reduction, and Pr. 23 sets 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.



Setting example  
(Pr.22=150%, Pr.23=100%, Pr.66=50Hz)



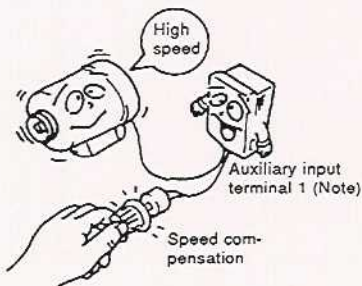
- **Calculation expression for current limit operation level**

$$\text{Current limit operation level (\%)} = A + B \times \left( \frac{\text{Pr.22} - A}{\text{Pr.22} - B} \right) \times \left( \frac{\text{Pr.23} - 100}{100} \right)$$

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

- When "9999" is set in Pr. 22, the stall prevention level can be changed by terminal No. 1. A specific method is given below.

**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.

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

- 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

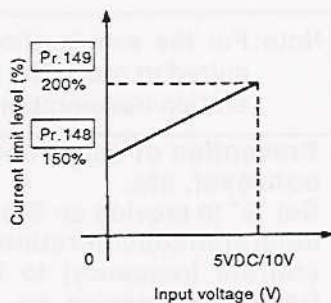
Set "9999" in Pr. 22 "stall prevention operation level".

### 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

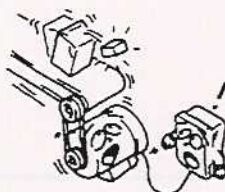
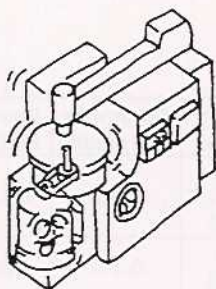
Pr. No.	Description	Setting Range	Minimum Increment	Factory Setting	Remarks
22	Stall prevention level	0 to 200%, 9999	0.1%	150%	9999: analog input
148 (Note)	Current limit level at the input voltage of 0V	0 to 200%	0.1%	150%	
149 (Note)	Current limit level at the input voltage of 10V/5V	0 to 200%	0.1%	200%	



- Note: 1. Set 701 in Pr. 77 to enable read and write.  
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.



**To select the optimum acceleration/deceleration pattern for application**

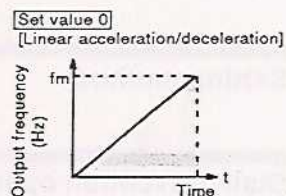


⇒ Pr. 29 "acceleration/deceleration pattern"

• **General application**

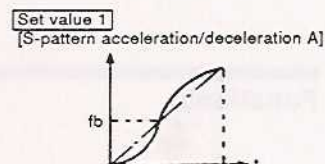
Set "0" (factory setting). A general acceleration/deceleration pattern (linear acceleration/deceleration) is achieved.

Generally this setting is used for operation.



• **For machine tool spindles**

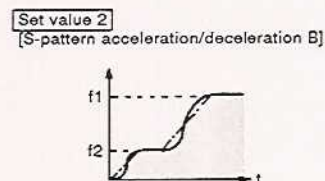
Set "1". This setting is used when it is necessary to make acceleration/deceleration in a short time up to the 50Hz or higher speed range (S-pattern acceleration/deceleration A). In this acceleration/deceleration pattern, fb (base frequency) is always the inflection point of an S shape, allowing acceleration/deceleration time to be set according to the reduction in motor torque in the 50Hz or higher constant-output operation range (Pr. 7, Pr. 8).



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).

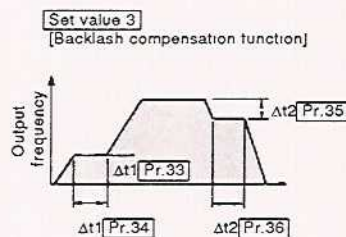
• **Prevention of cargo collapse on conveyor, etc.**

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



• **Backlash compensation for reduction gear, etc.**

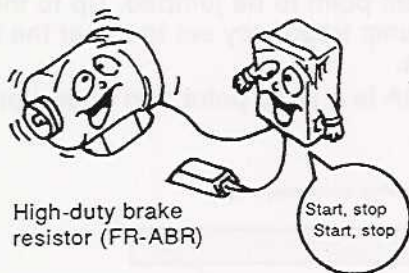
Set "3". This function stops the output frequency change temporarily during acceleration/deceleration, reducing a shock (backlash) generated when a reduction gear backlash is eliminated suddenly. Use Pr. 33 to 36 for further setting.



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 are implemented as frequency jump functions.

To make frequent starts and stops by using the optional high-duty brake resistor



⇒ Pr. 30 "regenerative brake duty change selection"  
Pr. 70 "special regenerative brake duty"

- Set these parameters when it is necessary to increase the regenerative brake duty for frequent start/stop operations. In this case, as a higher brake resistor capacity is required, use an optional FR-ABR high-duty brake resistor.

<Setting method>

After setting "1" in Pr. 30 "regenerative brake duty change selection", set the duty in Pr. 70 "special regenerative brake duty".

<Regenerative brake duty when Pr. 30 = 0>

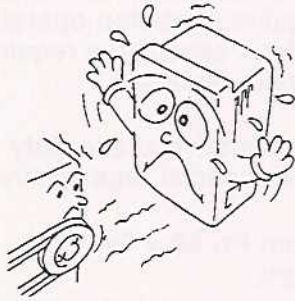
FR-A240E-5.5K to 7.5K..... 2%

<Pr. 70 "special regenerative brake duty" setting range when Pr. 30 = 1>

Model	Factory Setting	Setting Range
5.5K to 7.5K	0%	0 to 30%
11K and above	0%	0%

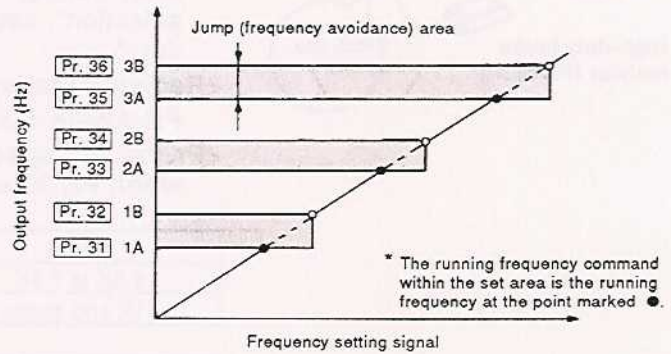
- Note: 1. When the Pr. 70 setting is increased from the factory setting, the set value must be matched to the permissible brake duty of the external brake resistor (FR-ABR).
2. Setting is invalid for models 11K and above.
3. The brake duty indicates %ED of the built-in brake transistor operation.
4. When Pr. 30 is "0", Pr. 70 is not displayed.

To avoid the resonant points of a machine



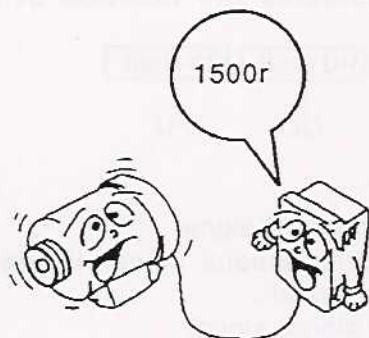
Pr. 31 "frequency jump 1A", Pr. 32 "frequency jump 1B"  
 ⇨ Pr. 33 "frequency jump 2A", Pr. 34 "frequency jump 2B"  
 Pr. 35 "frequency jump 3A", Pr. 36 "frequency jump 3B"

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



- Note: 1. Frequency jump is not made when the set value is "9999" (factory setting).
2. Setting "3" in Pr. 29 switches Pr. 33-36 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.
3. During acceleration/deceleration, the running frequency within the set area is valid.

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	<ul style="list-style-type: none"> <li>• The set value is the number of motor poles.</li> <li>• The displayed value is the motor speed.</li> </ul> Example: When the set value is "2", 3000 (r/min) is displayed at the output of 50Hz.
11 to 9998	<ul style="list-style-type: none"> <li>• Set the machine speed at 60Hz operation.</li> </ul> Example: When the set value is 150 (m/min), 150 (without display unit) is displayed at the output of 50Hz.

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 slippage).  
 3. The factory setting is "4" (poles) (1500 r/min is displayed at the output of 50Hz).

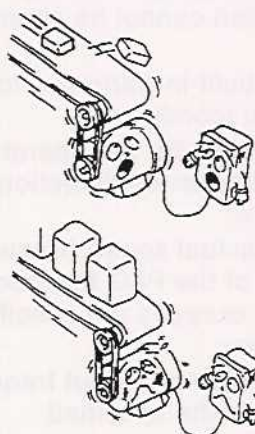
#### • To change the PU level meter (PU level display)

- (1) Set "6" (running speed) in Pr. 53 "PU level display data selection".
- (2) Set Pr. 37 "speed display" in accordance with 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.

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



### Pr. 38 "automatic torque boost"

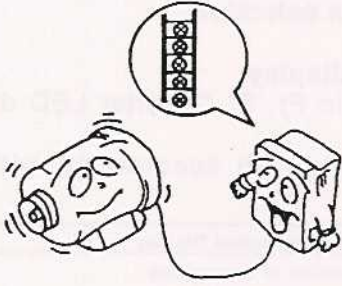
### Pr. 39 "automatic torque boost starting current"

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

Parameter	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 10 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 within $\pm 10\%$ of the set frequency.	Pr. 41
2	IPF/UVT	Instantaneous power failure or undervoltage	Output when instantaneous power failure or undervoltage occurs. (Note 4)	—
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
6	RBP	Regenerative brake pre-alarm	Pre-alarm is output on reaching 85% of the regenerative brake duty set in Pr. 70.	Pr. 70
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 operation	Output during operation in the program mode.	Pr. 79
9	PU	PU operation mode	Output when the PU operation mode is selected.	—

Note: 1. "0" set in the first digit of the four digits is not displayed. However, "0" set in any other digit is displayed.

2. The function of terminal RUN (output during inverter running) is fixed. This function cannot be changed by using Pr. 40.

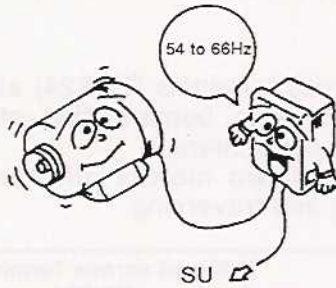
3. "Output" indicates that the built-in transistor for open collector output is turned on (conducts).

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.

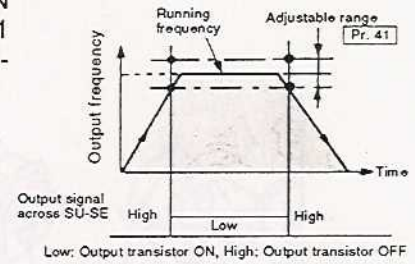
FU2 : Output when the inverter output frequency reaches or exceeds the specified detection frequency.

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

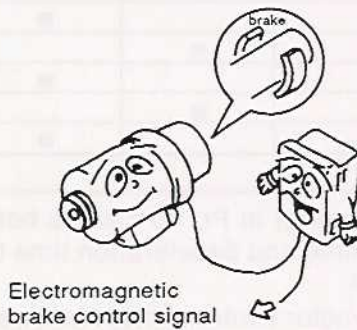


⇒ Pr. 41 "up-to-frequency sensitivity"

- Allows the output signal ON range to be adjusted between 1 and  $\pm 100\%$  of the running frequency.

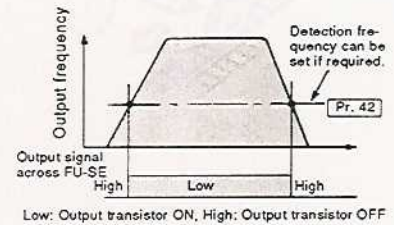


**To set the operation and open signals of the electromagnetic brake, etc.**

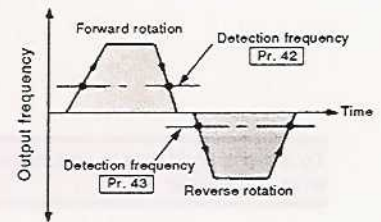


⇒ Pr. 42 "output frequency detection", Pr. 43 "output frequency detection at reverse rotation"

- The signal across terminals FU-SE is switched to 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.

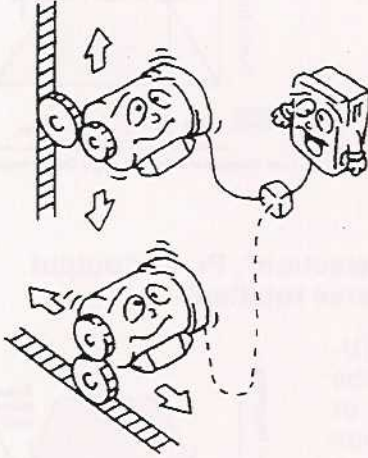


- Setting a value in Pr. 43 "output frequency detection, reverse rotation" allows the frequency to be detected exclusively during reverse rotation. (In this case, the set value in Pr. 42 is for the forward rotation only.) This function is effective for switching the timing of electromagnetic brake operation between forward rotation (rise) and reverse rotation (fall) during lifting operations. 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 for PLG feedback control, use the RUN (running) signal. (If the FU (output frequency detection) signal is used, the brake may not be released.)

To switch between two motors different in conditions



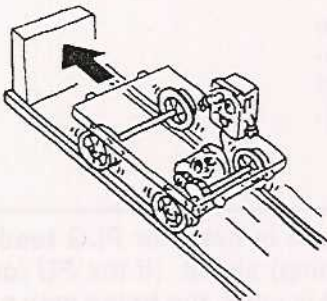
- Pr. 44 "second acceleration/deceleration time", Pr. 45 "second deceleration time"
- Pr. 46 "second torque boost", Pr. 47 "second V/F (base frequency)"

- The external contact signal (across terminals RT-P24) allows the acceleration and deceleration times, boost setting, etc. to be changed between two sets of parameters. Effective for switching between two motors different in parameter setting, e.g. elevating and traversing.

Set Function	Parameter number	Signal across Terminals RT-P24	
		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		●

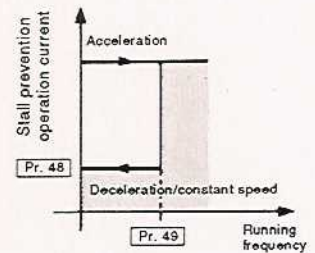
Note: 1. Setting "9999" (factory setting) in Pr. 45 causes both the second acceleration time and deceleration time to be the value set in Pr. 44.  
 2. When the magnetic flux vector control mode has been selected in Pr. 80 and Pr. 81, the setting of Pr. 46 is ignored.  
 3. The second acceleration/deceleration 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 etc. on contact with a stopper



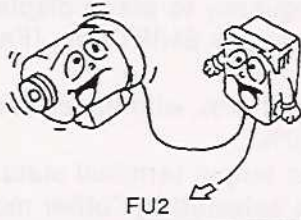
- Pr. 48 "second stall prevention operation current"
- Pr. 49 "second stall prevention operation frequency"

- Allows the stall prevention (current limit) operation level to be changed within the range of 0Hz and 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).

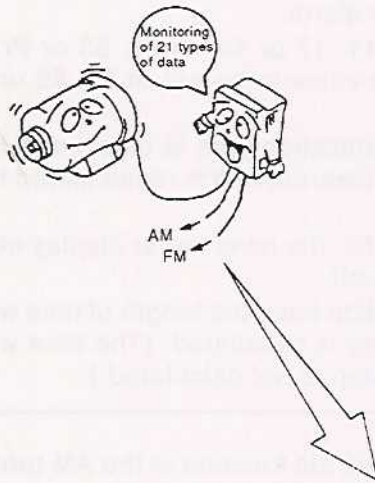


Note: The set value (%) indicates the ratio to the rated inverter output current.

**To set the second output frequency detection**



**Selection of monitor and output signals**



⇒ **Pr. 50 "second output frequency detection"**

- In addition to the detected output frequencies set in Pr. 42 and Pr. 43, the 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.)

⇒ **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 Inverter LED	Pr. 52 PU main monitor	Pr. 53 PU level meter	Pr. 54		Pr. 158	
					FM terminal	AM terminal	AM terminal	
No display	—	x	x	0	x	x	x	—
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	x	x	x	x	—
☆ 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
☆ Load percentage **	%	7	*	7	7	107	7	Rated torque of applied motor x2
☆ Converter output voltage	V	8	*	8	8	108	8	400V or 800V
☆ Regenerative brake duty	%	9	*	9	9	109	9	Pr. 70
☆ Electronic overcurrent protection load factor	%	10	*	10	10	110	10	Protector 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
Input terminal status	—	x	*	x	x	x	x	—
Output terminal status	—	x	*	x	x	x	x	—
Position pulse	—	x	19	x	x	x	x	—
Cumulative energization time	hr	x	20	x	x	x	x	—
☆ Reference voltage output	—	x	x	x	21	121	21	1440Hz is output to FM terminal. Full-scale voltage is output to AM terminal.
Actual operation time	hr	x	23	x	x	x	x	—
Motor load factor	%	x	24	0	x	x	x	Rated load of applied motor 0.2



- Note:
1. Monitor cannot be selected for items marked x.
  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 6535 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.)

- 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.	Both the calibration Pr. 900 and Pr. 901 values can be read and written.
	101 to 121*	The AM terminal outputs the signal set in Pr. 158.	

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

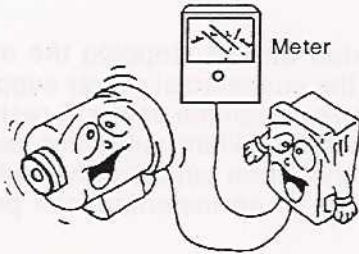
#### <Setting example>

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 61 to 63.

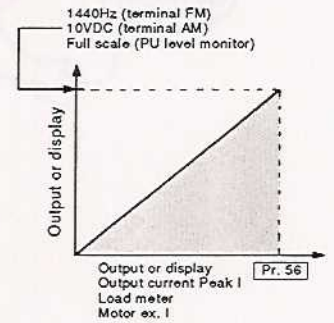
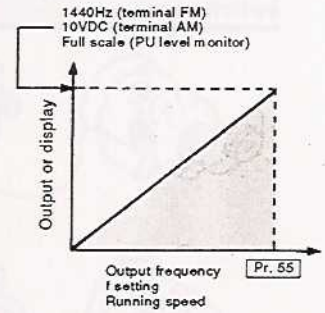
To set the frequency and current referenced for the display of the level meter



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

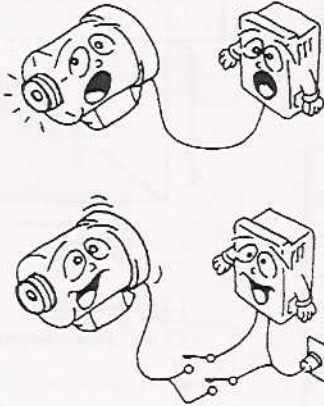
- Set the frequency or current which is referenced for display when the frequency or current is selected for the FM and AM terminals and PU level meter display.

Monitoring Reference Setting Pr.	Monitor Screen Selection (Setting unit)	Pr. 53 Setting	FM, AM Terminal Function Selection Pr. 54 Setting	
			FM	AM
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 is full-scale.	Terminal FM output is 1440Hz.	Terminal AM output is 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.

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 to be enabled, 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, 0.1 to 5 seconds	Enable

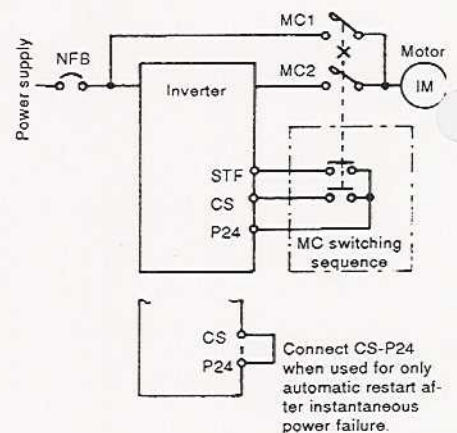
Coasting time indicates a waiting time for automatic restart after power restoration.

\* 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 also be adjusted between 0.1 and 5 seconds according to the magnitude of load inertia (GD) and torque.

- 5.5K to 7.5K ..... 1.0 second
- 11K and up ..... 3.0 seconds

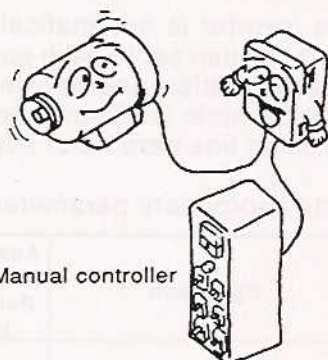
- **Pr. 58 setting of "rise time for auto matic restart after instantaneous power failure/commercial power supply-inverter switch-over"**

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-SD will make the inverter inoperative.

To perform remote setting



⇒ 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).

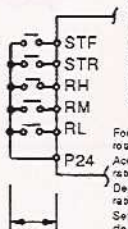
Pr. 59 Set Value	Operation	
	Remote setting function	Frequency set value storage function (*)
0	×	—
1	○	○
2	○	×

x:no, O:yes

\*: After RH-P24 and RM-P24 are kept open for more than about one minute, the running frequency set value is stored into the memory. When the power is switched off, then on, operation is resumed at this set value.

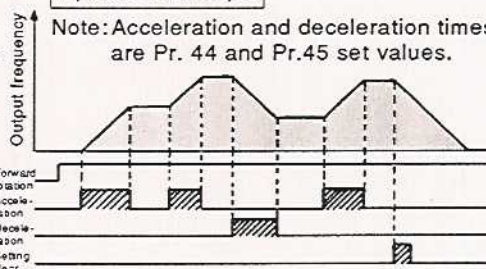
Connection

Forward rotation  
Reverse rotation  
Acceleration  
Deceleration  
Setting clear



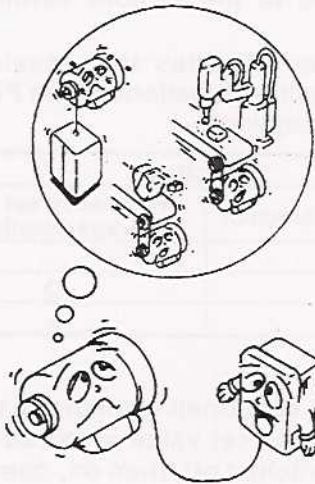
Wiring length  
less than 30m

Operation example



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.

To perform intelligent mode operation



⇒ Pr. 60 "intelligent mode selection"

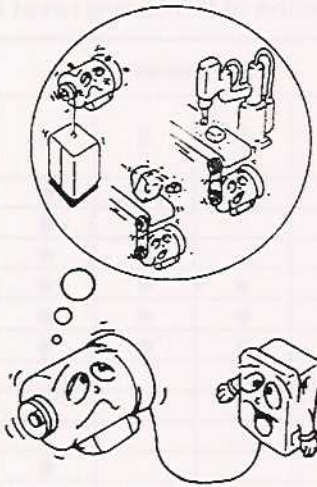
- By selecting this parameter, the inverter is automatically adjusted as if the appropriate value had been set in each parameter, without needing to set the acceleration and deceleration times and V/F pattern. This operation mode is useful to perform operation immediately without making fine parameter 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
	4	Energy-saving mode	Tunes the inverter output voltage online so that the inverter output voltage is minimized during constant-speed operation. Appropriate for energy-saving applications such as fans and pumps.	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 counter-balanced elevator. • Set value "5": current limit value 150% • Set value "6": current limit value 180%	Pr. 0 Pr. 13 (2Hz) Pr. 19

- 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, re-set Pr. 8 "deceleration time" to a slightly larger value and restart operation in this mode.
5. When any of "1 to 6" 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.

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

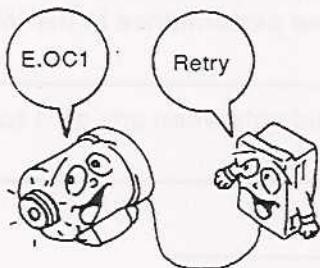
**Pr. 63** Reference current for deceleration (%)

(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
	150% (180%) 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.

**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	Still 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: 1. ● indicates the errors selected for retry.

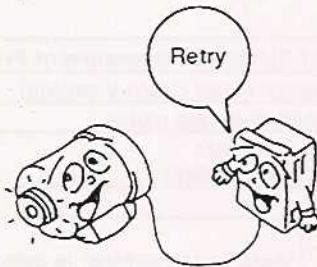
2. When the factory setting of "0" is in Pr. 65, retry is made at occurrence of any alarm but is not made when the inverter becomes faulty.

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

---

**To use the retry function**


---


**⚠ WARNING**

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

- Retry is a function which allows 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
0 (factory setting)	Retry is not made.
1 to 10	1 to 10 times

- 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 times longer than the time set in Pr. 68 "retry waiting time".

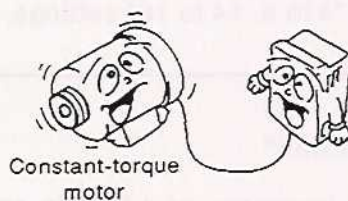
3. When the inverter trip is reset at the restart time, the data of the electronic overcurrent protection, regenerative brake duty, etc. is not reset. (Different from the power-on reset.)

**■ < Pr. 70 ⇒ See the section of Pr. 30 >**


---

**To use the Mitsubishi 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 old 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) within the range of a 1: 10 speed ratio (6 to 60Hz). The settings for magnetic flux vector control are given on page 76. When Mitsubishi's old 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 up-2%
- Pr. 3 "base frequency" .....50Hz (factory setting)
- Pr. 9 "electronic overcurrent protection" .....rated current of motor
- Pr. 71 "applied motor" .....set value "1"

Note: For full information on the setting method, see page 76.



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



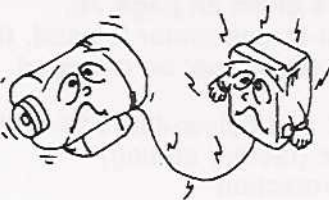
### ⇒ Pr. 71 "applied motor"

- In accordance with the following table, set this parameter according to 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	For a general-purpose motor 5-point flexible v/f characteristic		
20	Standard motor		
3	Standard motor		
13	Constant-torque motor	"Auto tuning setting" is selected	
4	Standard motor		
14	Constant-torque motor	Auto tuning data read/change setting is enabled	
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		

- Note: 1. For the adjustment of the 5-point flexible v/f characteristic, refer to page 93.
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 displayed 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 83.

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



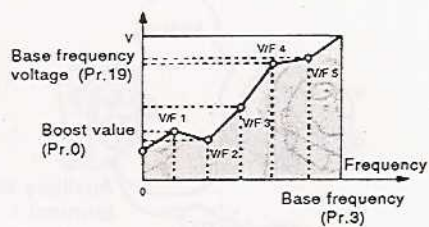
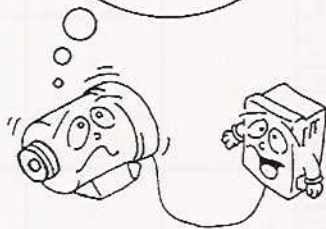
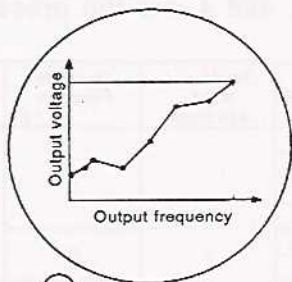
### ⇒ Pr. 72 "PWM frequency selection"

- 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 RFI noise and leakage current.

To set the ratio of the output voltage to the output frequency (V/F characteristic) of the inverter as appropriate

⇒ Pr. 71 "applied motor", Pr. 100 to Pr. 109

- The ratio of the output voltage to the output frequency (V/F characteristic) can be changed by linear interpolation made between five points set from V/F1 to V/F5. For the setting method, see page 86.



v/f characteristic

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	x	x	*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	x				0 to ∞ 10V	* 0	x	*3
1							0 to ± 10V			
2							0 to ± 5V			
3	0 to ± 5V									
4	0 to 10V		x							
5	0 to 5V									
10	x		0 to ∞ 10V							
11			0 to ± 10V							
12			0 to ± 5V							
13			0 to ± 5V							
14			0 to 10V	x						
15	0 to 5V		x							

\*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 terminal 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. x 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, which is an inclination up to the acceleration/deceleration reference frequency, 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.

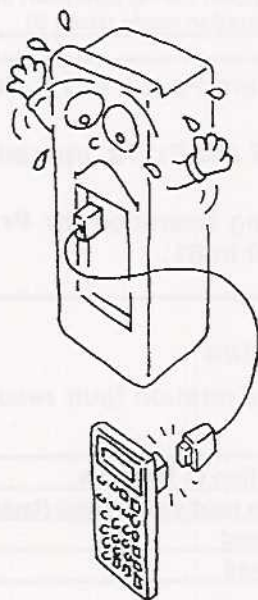
4. When the set value of Pr. 22 is "9999", the value of terminal 1 is for stall prevention level setting.

Stable operation cannot be performed due to noise



Potentiometer

To select PU disconnection detection



#### ⇒ Pr. 74 "input filter time constant"

- Allows the setting of a built-in filter time constant in the external voltage or current frequency setting signal. For eliminating noise in the frequency setting circuit.
- Increase the filter time constant if stable operation cannot be performed due to noise. A larger set value results in slower response.

#### ⇒ Pr. 75 "reset selection/PU disconnection detection"

- Detects that the connector or 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, this function detects that the PU has been disconnected from the inverter and brings the inverter 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-P24 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.

**To output the alarm code at its occurrence**



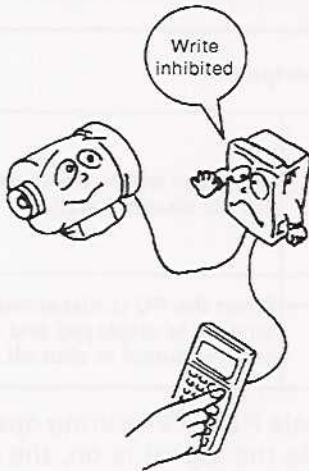
⇒ **Pr. 76 "alarm code output selection"**

- 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 67.

**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.

**To prevent reverse rotation**



⇒ **Pr. 78 "reverse rotation selection"**

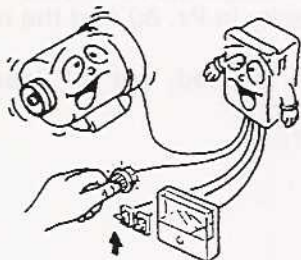
- Set Pr. 78 to prevent any reverse rotation fault resulting from the mis-input of the start signal.

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.

### To select the operation mode

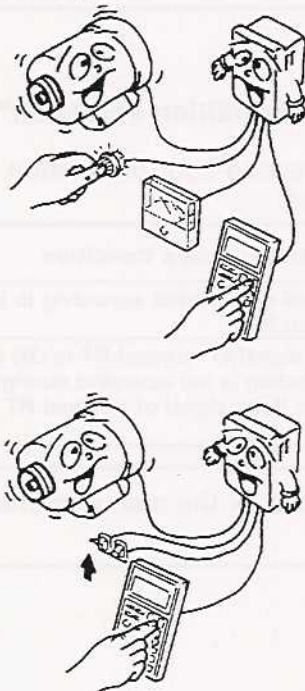
External operation mode



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

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 • Across 1-5 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

- For the adjustment of the programmed operation function.
- 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.
- 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".

To achieve 150% torque for operation at 1Hz



To change the language displayed on the parameter unit

⇒ 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 the constant-torque motor is used, set "1" (constant-torque motor) in Pr. 71 "applied motor". For more information, see page 76.

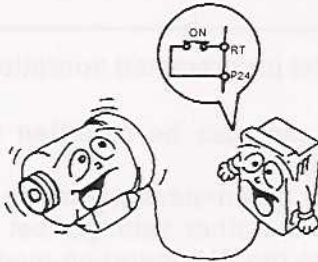
⇒ Pr. 145 "parameter unit language switching"

- 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 invalid when the FR-PU02, FR-PU02E or FR-ARW parameter (copy) unit is used.

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



⇒ Pr. 155 "terminal RT activated condition selection"

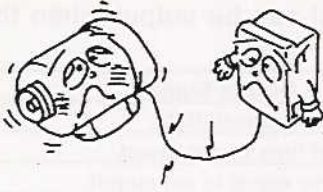
- The condition activated by the second control function selection (terminal RT) can be selected.

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.

■ <Pr. 83, Pr. 84, Pr. 96 ⇒ For the setting method, see page 80>

### Selection of the stall prevention function



### ⇒ Pr. 156 "stall prevention operation selection"

- By setting Pr. 156, stall prevention (overcurrent stall prevention) can be disabled and the OL signal output delayed.

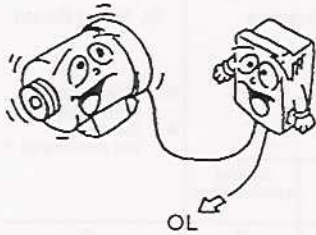
Pr. 156 Set Value	Fast-Response Current Limit Function Selection ○..... Activated ●..... Not activated	Stall Prevention Selection			OL Signal Output ○..... Operation continued ●..... Operation not continued *	Factory Setting
		○..... Activated ●..... Not activated		During deceleration		
		During acceleration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

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 is not reduced while stall prevention is being activated.



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>

Speed fluctuation correction



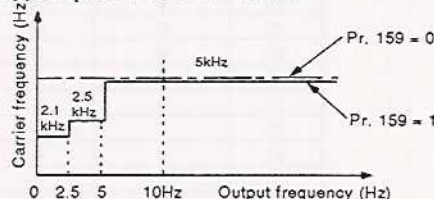
⇒ Pr. 159 "PWM frequency decrease at low speed"

- Speed in the low range (10Hz or less) can be smoothed to correct speed fluctuation. (To be set only when reduced torque ripple is required.)

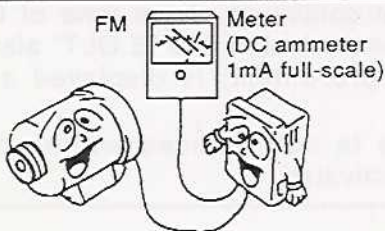
Pr. 159 Set Value	Description	
	Improvement of low speed fluctuation	Correction at high speed
0 (factory setting)	No	No
1	Yes	No
2	No	Yes
3	Yes	Yes

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

<Example: Pr. 72 = 5Hz>

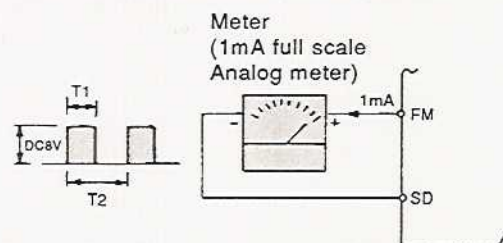


To make the output calibration of terminal FM



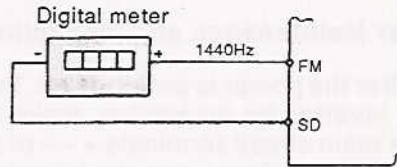
⇒ Pr. 900 "FM terminal calibration"

- 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 61.)



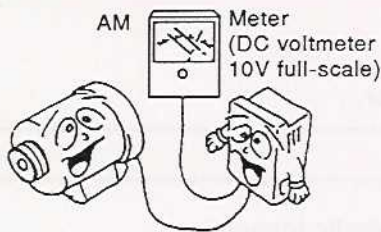
Pulse width T1 : Adjusted with Pr. 900  
 Pulse period T2 : Set in Pr. 55 (valid for frequency monitoring only)

- **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 50Hz, the parameter is factory-set to 1mA full-scale and 1440Hz FM output frequency.  
The maximum output frequency of FM is 2400Hz.

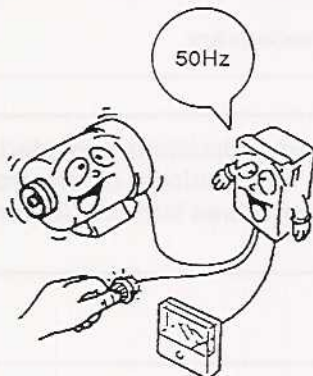
**To make the output calibration of terminal AM**



⇒ **Pr. 901 "AM terminal calibration"**

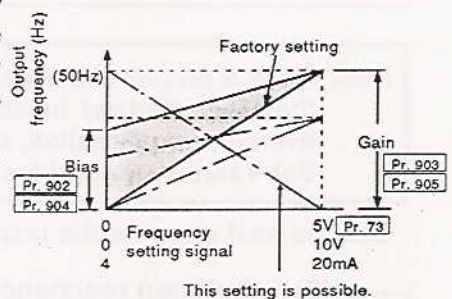
- Used when any of "101 to 118" has been set in Pr. 54 to select analog output to terminal AM and when any of "1 to 21" has been set in Pr. 158 to use the outputs of terminals FM and AM separately.  
As explained in the section of Pr. 54, the analog output is factory-set to 10VDC in the full-scale of 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 63.)

**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 70.)

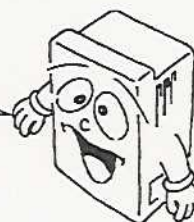


Note: If the gain adjustment (Pr. 903, Pr. 905) is changed, the acceleration/deceleration reference frequency (Pr. 20) does not change. The signal to the terminal 1 (aux. input) is added to the frequency setting signal.

## 25. MAINTENANCE AND INSPECTION

⚠ All maintenance should be carried out by a suitably skilled or trained person.

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 environment, such as temperature, humidity, dust, dirt and vibration. This will improve reliability, service life, and other factors.



### 25-1 Precautions for Maintenance and Inspection

For some short time after the 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 and check that the voltage across the main circuit terminals + - of the inverter is 30VDC or less using a tester, etc. (For the location of the charge lamp, see the terminal block arrangement on page 155.)

### 25-2 Check Items

#### (1) Daily inspections

- Check the following:
  - (1) Motor operation
  - (2) Installation environment
  - (3) Cooling system
  - (4) Unusual vibration and noise
  - (5) Unusual overheat and discoloration
- During operation, check the inverter input voltages using a tester.

#### (2) Periodic maintenance and inspection

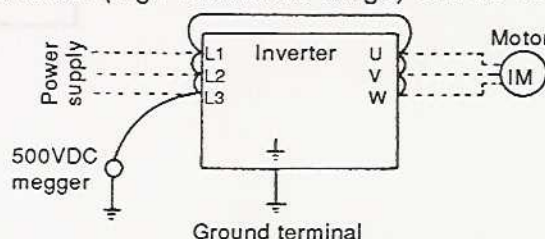
- Check the areas inaccessible during operation and requiring periodic inspection.
  - (1) Cooling system..... Clean the air filter, etc.
  - (2) Screws and bolts..... Check that they are securely tightened and retighten as necessary.
  - (3) Conductors and insulating materials..... Check for corrosion 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 the 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 87.)

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.)



## 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.	○			See note on page 13.	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.	○			Visual and auditory checks.	No fault.	
	Power supply voltage	Check that main circuit voltage is normal.	○			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.		○	○	(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.		○		(1), (2) Visual check.	(1), (2) No fault.	
	Terminal block	Check for damage.		○		Visual check	No fault	
	Inverter module Converter module	Check resistance across terminals.			○	Disconnect cables from inverter and measure across terminals R, S, T↔P, N, and across U, V, W↔P, N with tester × 1Ω range.	(See the next page.)	Analog tester
	Smoothing capacitor	(1) Check for liquid leakage. (2) Check for safety valve projection and bulge. (3) Measure electrostatic capacity.	○ ○		○	(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.		○	○	(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.		○	○	(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.		○	○	(1) Measure voltage across inverter output terminals U-V-W. (2) Simultaneously 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.	○	○		(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.	○		○	(1) Lamps indicate indicator lamps on panel. (2) Clean with rag.	(1) Check that lamps are lit.	
	Meter	Check that reading is normal.	○			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.	○ ○			(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).			○	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.

• **Checking the inverter and converter modules**

**<Preparation>**

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

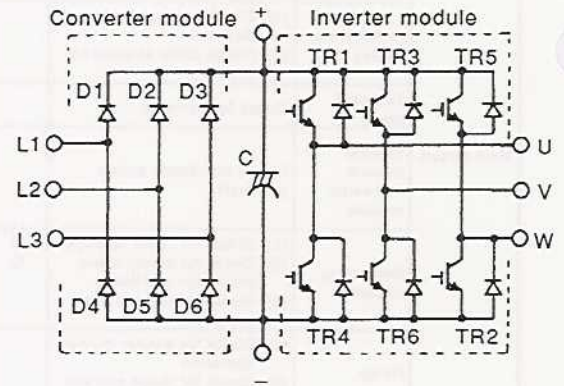
**<Checking method>**

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

Note: 1. Before measurement, check that the smoothing capacitor is discharged.  
 2. At the time of continuity, the measured value is several ohms depending on the module type, circuit tester type, etc. If all measured values are almost the same, the modules are without fault.

**<Module device numbers and terminals to be checked>**

	Tester Polarity		Measured Value		Tester Polarity		Measured Value	
	⊕	⊖			⊕	⊖		
Converter module	D1	R	P	Discontinuity	D4	R	N	Continuity
		P	R	Continuity		N	R	Discontinuity
	D2	S	P	Discontinuity	D5	S	N	Continuity
		P	S	Continuity		N	S	Discontinuity
	D3	T	P	Discontinuity	D6	T	N	Continuity
		P	T	Continuity		N	T	Discontinuity
Inverter module	TR1	U	P	Discontinuity	TR4	U	N	Continuity
		P	U	Continuity		N	U	Discontinuity
	TR3	V	P	Discontinuity	TR6	V	N	Continuity
		P	V	Continuity		N	V	Discontinuity
	TR5	W	P	Discontinuity	TR2	W	N	Continuity
		P	W	Continuity		N	W	Discontinuity



### 25-3 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. After 5 years have elapsed, the capacitors will deteriorate more rapidly.

Check the capacitors at least every year (less than six months if the life is nearly 5 years).

Check the following:

- 1) Case (side faces and bottom face for expansion)
- 2) Sealing plate (for warp and cracking)
- 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.

(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**

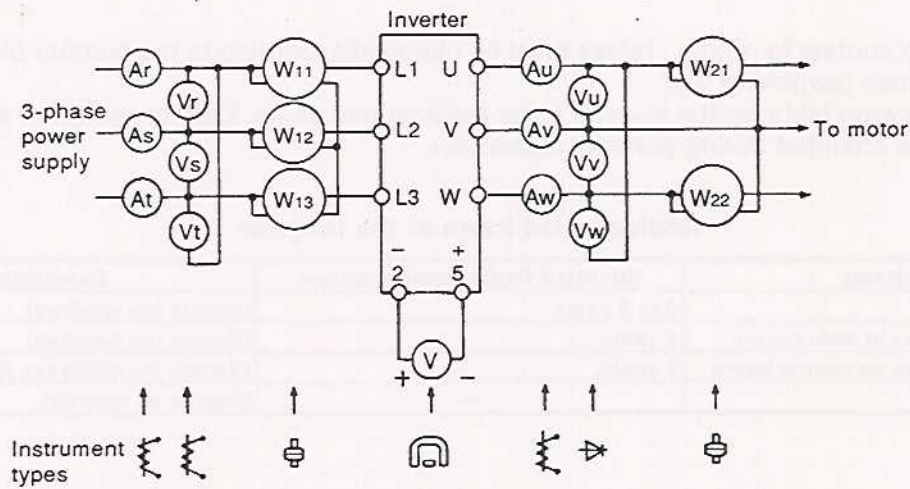
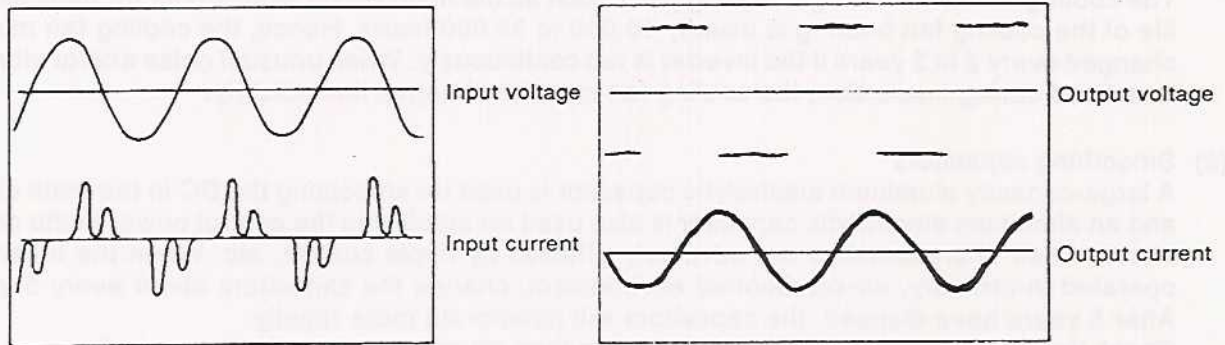
Part Name	Standard Replacement Interval	Description
Cooling fan	2 to 3 years	Change (as required)
Smoothing capacitor in main circuit	5 years	Change (as required)
Smoothing capacitor on control board	5 years	Change the board (as required).
Relays	—	Change as required.

## 25-4 Measurement of Main Circuit Voltages, Currents and Powers

### • Measurement of voltages and currents

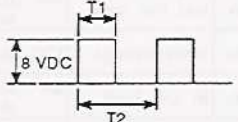
Since the voltages and currents on the inverter power supply and output sides include harmonics, accurate measurement depends on the instruments used and circuits measured.

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

## Measuring Points and Instruments

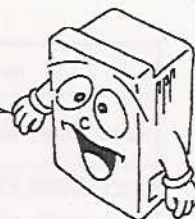
Item	Measuring Point	Measuring Instrument	Remarks (Reference Measured Value) *
Power supply voltage V <sub>1</sub>	Across L1-L2, L2-L3 and L3-L1	Moving-iron type AC voltmeter	Commercial power supply 170 to 242V (342 to 506V) 50Hz 170 to 253V (342 to 506V) 60Hz
Power supply side current I <sub>1</sub>	L1, L2 and L3 line currents	Moving-iron type AC ammeter	
Power supply side power P <sub>1</sub>	At L1, L2 and L3, and across L1-L2, L2-L3 and L3-L1	Electrodynamic type single-phase wattmeter	P <sub>1</sub> =W <sub>11</sub> +W <sub>12</sub> +W <sub>13</sub> (3-wattmeter method)
Power supply side power factor Pf <sub>1</sub>	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 <sub>2</sub>	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 <sub>2</sub>	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 <sub>2</sub>	At U, V and W, and across U-V and V-W	Electrodynamic type single-phase wattmeter	P <sub>2</sub> = W <sub>21</sub> + W <sub>22</sub> 2-wattmeter method (or 3-wattmeter method)
Output side power factor Pf <sub>2</sub>	Calculate in similar manner to power supply side power factor. $Pf_2 = \frac{P_2}{\sqrt{3}V_2 \cdot I_2} \times 100\%$		
Converter output	Across P-N	Moving-coil type (such as tester)	Inverter LED display is lit. 1.35 × V <sub>1</sub> Max. 380V (760V) during regenerative operation
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
Frequency setting power supply	Across 1(+)-5		0 to ± 5V/0 to ± 10VDC
	Across 4(+)-5		4 to 20mADC
	Across 10(+)-5		5VDC
	Across 10E(+)-5		10VDC
Frequency meter signal	Across FM(+)-SD	Approx. 5VDC at maximum frequency (without frequency meter)	SD is common.  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)	
Start signal	Across STF, STR, RH, RM, RL, JOG/OH, RT, AU-P24	20 to 30VDC when open.	
Select signal		ON voltage: 1V or less	
Reset	Across RES(+)-P24		
Output stop	Across MRS(+)-P24		
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.



## 26. TROUBLESHOOTING

If any function of the inverter is lost due to the occurrence of a fault, establish the cause and make a correction in accordance with the following inspection procedure. Contact your sales representative if the corresponding fault is not found below, or the inverter has failed, or a part has been damaged, or any other fault has occurred.



### 26-1 Checking the Parameter Unit Display

The display of the parameter unit is switched as follows to indicate the cause of a faulty operation.

No	Display		Cause of Fault	Check Point	Remedy
	Parameter Unit	Inverter LED			
<1>	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)
<2>	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)
<3>	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.
<4>	Ov During Acc	OV1 : Overvoltage during acceleration	Overvoltage on DC bus (terminals P-N)	Acceleration too fast?	Increase acceleration time.
<5>	Stedy Spd Ov	OV2 : Overvoltage during constant speed		Sudden load change?	Keep load stable.
<6>	Ov During Dec	OV3 : Overvoltage during deceleration		Deceleration too fast?	Increase deceleration time. (Set deceleration time which matches load $GD^2$ .) Reduce braking duty.
<7>	Motor Overload	THM : Overload alarm	Thermal relay for motor		
<8>	Inv. Overload	THT : Overload alarm	Thermal relay for inverter	Motor used under overload?	Reduce load. Increase motor and inverter capacities.
<9>	Inst. Pwr. Loss	IPF : Instantaneous power failure	Instantaneous power failure	Check the cause of instantaneous power failure.	
<10>	Under Voltage	UVT : Undervoltage	Drop of power supply voltage	Large-capacity motor started?	Check power system equipment such as power supply capacity.
<11>	Br. Cct. Fault	BE : Brake transistor alarm	Brake transistor fault	Braking duty proper?	Reduce load $GD^2$ . Reduce braking duty.
<12>	Ground Fault	GF : Ground fault overcurrent	Ground fault occurred in output circuit.	Check motor and cables for ground fault.	Remedy ground fault area.
<13>	OH Fault	OHT : External thermal relay operation	External thermal relay operated.	Check motor for overheat.	Reduce load and frequency of operation.
<14>	Still 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.
<15>	Option Fault	OPT : Inboard option connection alarm	Option and inverter connected improperly.	Check for loose connector.	Securely connect.
<16>	Corrupt Memry	PE : Parameter storage device alarm	Storage device (EEPROM) faulty.	Number of parameter write times too many?	Change inverter.
<17>	Retry No. Over	RET : Retry count exceeded	Operation could not be resumed within the number of retry times set.	Check cause of alarm occurrence.	
<18>	CPU Fault	CPU : CPU error	CPU malfunction		Change inverter.
<19>	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 proper)	•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 improper) Fr-A	CPU malfunction *2		•Switch power off, then on. •Switch reset signal on, then off. •Change inverter.

Note: This alarm does not occur due to the cooling fan stop, but it will occur to prevent the main circuit devices from overheating because of 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 still displayed on the parameter unit and unit LED after remedy, the internal circuit may be faulty. Consult your sales representative.

## 26-2 Faults and Check Points

Fault	Typical Check Point
Motor does not rotate.	(1) Checking the main circuit <ul style="list-style-type: none"> <li>• Check that a proper power supply voltage is applied (inverter LED display is lit).</li> <li>• Check that the motor is connected properly.</li> </ul> (2) Checking the input signals <ul style="list-style-type: none"> <li>• Check that the start signal is present.</li> <li>• Check that both the forward and reverse rotation start signals are not present simultaneously.</li> <li>• Check that the frequency setting signal is not zero.</li> <li>• Check that the signal across terminals AU-P24 is on when the frequency setting signal is 4 to 20mA.</li> <li>• Check that the output stop signal (across terminals MRS-P24) or reset signal (across RES-P24) is not on.</li> </ul> (3) Checking the parameter set values <ul style="list-style-type: none"> <li>• Check that the reverse rotation prevention (Pr. 78) is not set.</li> <li>• Check that the operation mode (Pr. 79) setting is correct.</li> <li>• Check that the bias and gain (Pr. 902 to Pr. 905) settings are correct.</li> <li>• Check that the starting frequency (Pr. 13) set value is not greater than the running frequency.</li> <li>• Check that various operational functions (such as three-speed operation), especially the maximum frequency, are not zero.</li> </ul> (4) Checking the load <ul style="list-style-type: none"> <li>• Check that the load is not too heavy and the shaft is not locked.</li> </ul> (5) Others <ul style="list-style-type: none"> <li>• Check that alarm code (such as E.OC1) is not displayed on the inverter LED.</li> </ul>
Motor rotates in opposite direction.	<ul style="list-style-type: none"> <li>• Check that the phase sequence of the output terminals U, V and W is correct.</li> <li>• Check that the start signals (forward rotation, reverse rotation) are connected properly.</li> </ul>
Speed greatly differs from the set value.	<ul style="list-style-type: none"> <li>• Check that the frequency setting signal is proper. (Measure the input signal level.)</li> <li>• Check that the following parameter set values are proper: Maximum frequency (Pr. 1), minimum frequency (Pr. 2), bias, gain (Pr. 902 to Pr. 905), base frequency voltage (Pr. 19)</li> <li>• Check that the input signal lines are not affected by external noise. (Use of shielded cables)</li> </ul>
Acceleration is not smooth.	<ul style="list-style-type: none"> <li>• Check that the acceleration/deceleration time set value is not too short.</li> <li>• Check that the load is not too heavy.</li> <li>• Check that the torque boost set value is not too large to activate the current limit function.</li> </ul>
Motor current is large.	<ul style="list-style-type: none"> <li>• Check that the load is not too heavy.</li> <li>• Check that the torque boost (manual) set value is not too large.</li> </ul>
Speed does not increase.	<ul style="list-style-type: none"> <li>• Check that the maximum frequency set value is proper, i.e. it is not too small.</li> <li>• Check that the load is not too heavy.</li> <li>• Check that the torque boost set value is not too large to activate the current limit function.</li> </ul>
Speed varies during operation.	(1) Inspection of load <ul style="list-style-type: none"> <li>• Check that the load is not varying.</li> </ul> (2) Inspection of input signal <ul style="list-style-type: none"> <li>• Check that the frequency setting signal is not varying.</li> </ul> (3) Others <ul style="list-style-type: none"> <li>• 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.</li> <li>• Check that the wiring length is within 30m in magnetic flux vector control.</li> <li>• Check that the wiring length is proper in V/F control.</li> </ul> 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.	<ul style="list-style-type: none"> <li>• Check that the reset signal (terminals RES-P24) is not ON.</li> <li>• Check that the PU is connected securely.</li> </ul>

Note: Pr. indicates a parameter.

## 26-3 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 67.

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 is supplied to 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 is present 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.  Still Prev STP is shown at a motor stop.	<b>E.O.L.T</b> (OLT) (Indicates 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 current exceeds the specified value due to excessive regenerative energy during motor deceleration, this function stops the decrease in frequency to prevent the inverter from 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	<b>E.O.C 1</b>	1	Provided
		During constant speed Stedy Spd Oc	<b>E.O.C 2</b>	2	
		During deceleration OC During Dec	<b>E.O.C 3</b>	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	<b>E.O.v 1</b>	4	Provided
		During constant speed Stedy Spd Ov	<b>E.O.v 2</b>		
		During deceleration Ov During Dec	<b>E.O.v 3</b>		
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	<b>E.I.P.F</b> (IPF)	7	Provided
Undervoltage protection	If the inverter power supply voltage has reduced, 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 reduces below about 150V (300V for the 400V series), this function stops the inverter output.	Under Voltage	<b>E.U.v T</b> (UVT)	8	Provided
Brake transistor alarm detection	If a brake transistor fault has occurred due to extremely large regenerative brake duty, etc., this function detects that fault and stops the inverter output.	Br. Cct. Fault	<b>E. bE</b> (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 <b>E.T.H.T</b> (THM)	5	Provided
		Inv. Overload	Inverter protection <b>E.T.H.T</b> (THT)	6	
Brake resistor overheat protection	If the regenerative brake duty from the motor has exceeded the specified value, the brake operation is stopped temporarily to protect the brake resistor from overheat. When the brake resistor has cooled, the brake operation is resumed.	(Not displayed)	(Not displayed)	—	Not provided

Function	Description	Display		Alarm Code	Alarm Output
		Parameter Unit	Inverter LED		
Output side ground fault overcurrent protection	If a ground fault current has occurred 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).	Ground Fault	<i>E. GF</i> (GF)	B	Provided
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	<i>E.OHT</i> (OHT)	C	Provided
Inboard option connection alarm	Stops the inverter output if the dedicated option used in the inverter results in connection (connector) fault.	Option Fault	<i>E.OPT</i> (OPT)	E	Provided
Parameter storage device alarm	Stops the output if the fault of EEPROM which stores the parameter set values has occurred.	Corrupt Memry	<i>E. PE</i> (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	<i>E. RET</i> (RET)	F	Provided
CPU error	If the operation of the built-in CPU does not end within a pre-determined period of time, the inverter self-determines it as alarm and stops the output.	CPU Fault	<i>E.CPU</i> (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	<i>E.PUE</i> (PUE)	F	Provided

\*: The stall prevention operation current can be set as appropriate. The factory setting is 150%.

## 26-4 Noise, RFI and EMC

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

### 1) Basic measures

- Do not run the power cables (I/O cables) and signal cables of the inverter in parallel with each other and do not bundle them.
- Use twisted shield cables for the detector connecting and control signal cables and connect the sheathes of the shield cables to terminal P24.
- Ground the inverter, motor, etc. at one point.

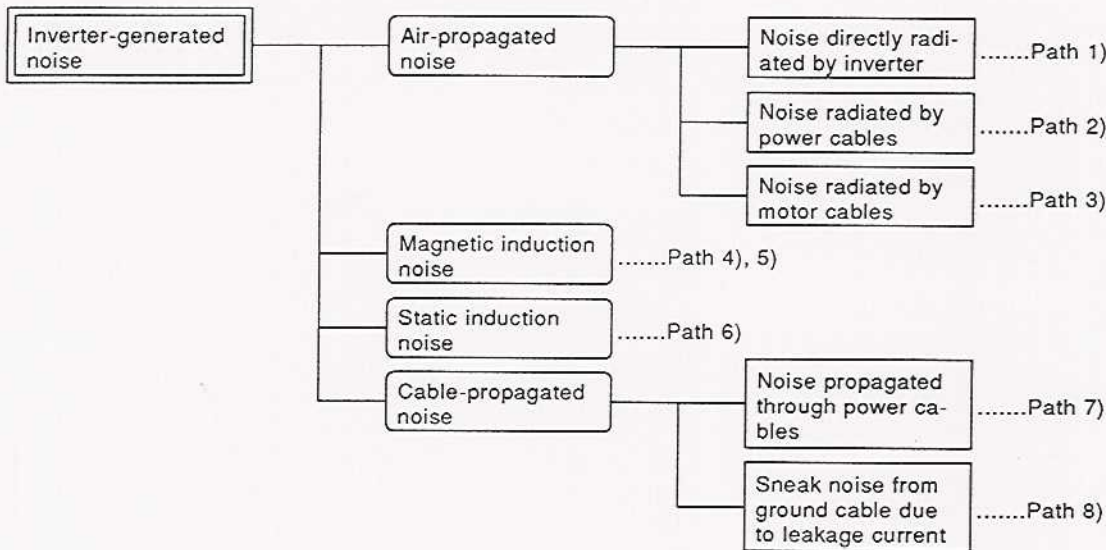
### 2) Measures against noises which enter and misoperate the inverter

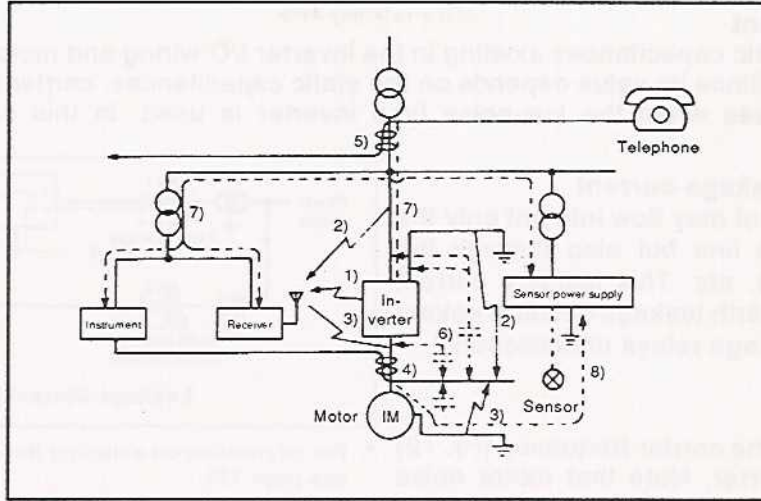
When devices which generate many noises (which use magnetic contactors, magnetic brakes, many relays, for example) are installed near the inverter and the inverter may be misoperated by noises, the following measures must be taken:

- Provide surge suppressors for devices that generate many noises to suppress noises.
- Fit data line filters to signal cables.
- Ground the shields of the detector connection and control signal cables with cable clamp metal.

### 3) Measures against noises which are radiated by the inverter to misoperate peripheral devices

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





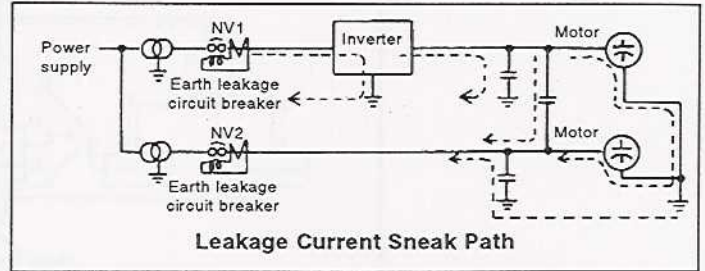
Noise Path	Measures
1), 2), 3)	<p>When devices which handle low-level signals and are susceptible to misoperation due to noises (such as instruments, receivers and sensors) are installed near the inverter and their signal cables are contained in the same panel as the inverter or are run near the inverter, the devices may be misoperated by air-propagated noises and the following measures must be taken:</p> <ol style="list-style-type: none"> <li>(1) Install easily affected devices as away as possible from the inverter.</li> <li>(2) Run easily affected signal cables as away as possible from the inverter.</li> <li>(3) Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them.</li> <li>(4) Insert line noise filters into I/O and radio noise filters into input to suppress cable-radiated noises.</li> <li>(5) Use shield cables for signal cables and power cables and run them in individual metal conduits to produce further effects.</li> </ol>
4), 5), 6)	<p>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 to misoperate the devices and the following measures must be taken:</p> <ol style="list-style-type: none"> <li>(1) Install easily affected devices as away as possible from the inverter.</li> <li>(2) Run easily affected signal cables as away as possible from the inverter.</li> <li>(3) Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them.</li> <li>(4) Use shield cables for signal cables and power cables and run them in individual metal conduits to produce further effects.</li> </ol>
7)	<p>When the power supplies of the peripheral devices are connected to the power supply of the inverter in the same line, inverter-generated noises may flow back through the power supply cables to misoperate the devices and the following measures must be taken:</p> <ol style="list-style-type: none"> <li>(1) Install the radio noise filter (FR-BIF) to the power cables (I/O cables) of the inverter.</li> <li>(2) Install the line noise filter (FR-BLF, FR-BSF01) to the power cables of the inverter.</li> </ol>
8)	<p>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 to misoperate the device. In such a case, disconnection of the ground cable of the device may cause the device to operate properly.</p>

## ■ 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 through the ground cables, etc. This leakage current may operate earth leakage circuit breakers and earth leakage relays unnecessarily.



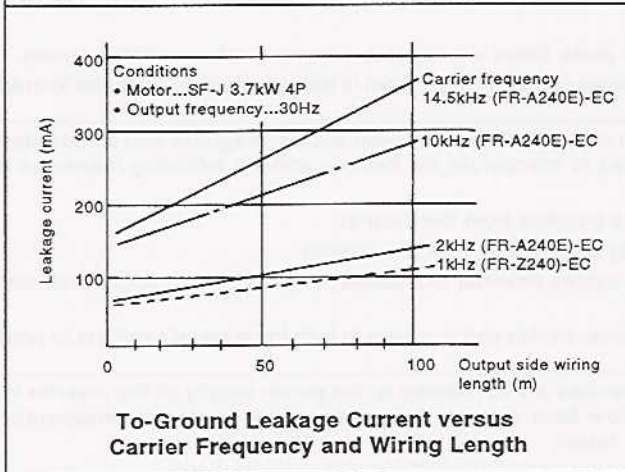
#### • Measures

- 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).

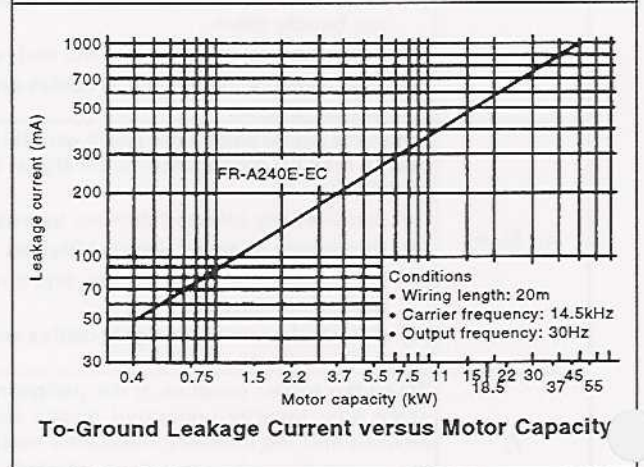
\*: For information on selecting the earth leakage circuit breaker, see page 171.

#### • 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.

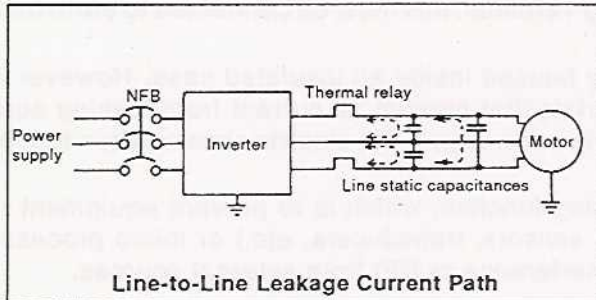


Higher motor capacity leads to larger leakage current. Larger leakage current occurs in 400V series than in 200V series.



## 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 series small-capacity model (especially 7.5kW or below) 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 data example (200V series)

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: 2mm<sup>2</sup>, 4-core cable

\* The leakage current of the 400V series is twice larger.

### • Measures

- Use the electronic overcurrent protection of the inverter.
- Install the reactor (FR-BOL) in the output side.
- Decrease the carrier frequency. Note that motor noise increases.

To protect the motor securely from the line-to-line leakage current, it is recommended to use a temperature sensor to directly detect the temperature of the motor.

### ■ Power supply harmonics

Power supply harmonics may be generated from the converter section of the inverter, affecting the generator, power capacitor, etc. Power supply harmonics are different in generation source, frequency band and transmission path from noises and leakage currents. For details, see the technical information.

### ■ Surge filter

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

Especially for a 400V class motor, the micro surge voltage spike may deteriorate the insulation.

When the 400V class motor is driven by the inverter, consider the following measures:

### • Measures

It is recommended to take either of the following measures:

#### (1) Improve the motor insulation

For the 400V class motor, use a high class insulation motor. Specifically,

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

#### (2) Suppressing the micro surge voltage on the inverter side

On the output side of the inverter, connect a filter which suppresses micro surge voltage spike to make the terminal voltage to the motor 850V or less.

When the motor is to be driven by Mitsubishi inverter, connect the optional surge voltage suppressing filter (see page 150) on the secondary side to the inverter.



---

## 26-5 Earthing

### (1) Earthing and Earth Leakage Current

#### (a) Purpose of Earthing

Electrical equipment usually has an Earthing Terminal, this must be connected to earth before using equipment.

For protection electric circuits are normally housed inside an insulated case. However it is impossible to manufacture insulating materials that prevent all current from leaking across them, therefore it is the function of the safety earth to prevent electric shocks when touching the case.

There is however, another important earthing function, which is to prevent equipment that uses very weak signals (Audio equipment, sensors, transducers, etc.) or micro processors from being affected by Radio Frequency Interference, or RFI from external sources.

#### (b) Points to remember when Earthing

As detailed above there are two entirely different types of earthing and to attempt to use the same earth for both will lead to problems. It is necessary to separate the "safety" earthing, a yellow/green wire to prevent electric shocks; from the "RFI" earthing, a braided wire strap to counter radio noise.

The inverter output voltage does not take the form of a sine wave but of a modulated pulse wave form causing "noisy" leakage currents due to the capacitance of the insulation.

The same type of leakage current will occur in the motor due to the charging and discharging of the insulation from the high frequency wave form. This trend becomes more pronounced with higher carrier frequencies.

To solve this problem it is necessary to use separate "dirty" earthing for inverter and motor installations and "clean" earthing for equipment such as sensors, computers and audio equipment.

## (2) Earthing methods

Two main types of earth

- 1-To prevent electrical shocks  
Yellow green cable
- 2-To prevent RFI induced malfunction  
Braided strap

It is important to make a clear distinction between these two, and to keep them separate by following the measures below.

- a) When possible earth the inverter independently of other equipment.

If independent earthing (Fig 4.2a) is not possible, use a common earthing point (Fig 4.2b). Avoid connecting earthing wires together (Fig 4.2c) particularly on high power equipment such as motors and inverters.

Independent earthing should always be used between sensitive equipment and inverters.

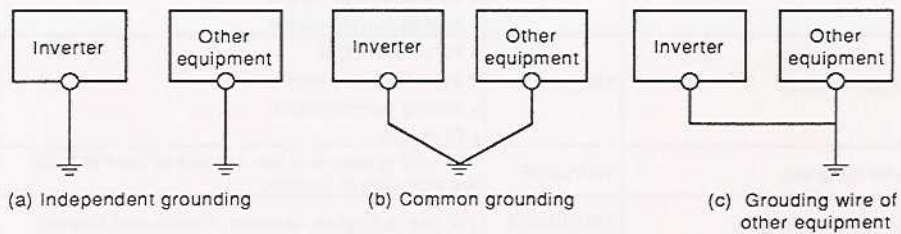


FIG. 4.2 Grounding Methods

- b) Safety earths should be...
  - For 400 V duty - Class 3, 10 ohm or less
  - For 200 V duty - Class 3, 100 ohm or less
- c) The Safety earth should be as thick as possible, minimum thickness as stated in below table.
- d) The earthing point should be as close to the inverter as possible, and the wire as short as possible.
- e) The RFI earth should be a braided strap with a 10 mm<sup>2</sup> minimum cross sectional area, and as short as possible.
- f) The earths should be as far away from input and output cables (particularly to equipment sensitive to RFI) as possible, and any distance where they are parallel kept to a minimum.
- g) Design in RFI prevention before installation.

(Unit: mm<sup>2</sup>)

Motor Size	Earth Wire Size
	400V class
5.5, 7.5kW	3.5
11 to 15kW	8
18.5 to 37kW	14
45, 55kW	22

## 27. OPTIONS

### 27-1 Option List

	Option Name	Type	Application, Specifications, Etc.	Applicable Inverter
Inboard type (dedicated to FR-A)	Industrial equipment compatible function	FR-EPA	<ul style="list-style-type: none"> <li>12-bit digital input</li> <li>PLG feedback control</li> <li>Extension analog output</li> <li>Orientation control (machine tool spindle fixed-position stop control)</li> </ul>	Common to all models
	Computer link function	FR-EPB	<ul style="list-style-type: none"> <li>RS-422, RS-485 interface for computer link (serial communication)</li> <li>PLG feedback control</li> </ul>	
	Programmable controller link function	FR-EPC	<ul style="list-style-type: none"> <li>MELSECNET/MINI-S3 (optical cable) interface</li> <li>PLG feedback control</li> </ul>	
	Automatic control compatible function	FR-EPD	<ul style="list-style-type: none"> <li>PI control</li> <li>Battery backup for programmed operation (programmed operation function is standard.)</li> </ul>	
	I/O function	FR-EPE	<ul style="list-style-type: none"> <li>12-bit digital input</li> <li>Relay output (3 points)</li> <li>Extension analog output</li> </ul>	
	Computerlink + Extension output function	FR-EPG	<ul style="list-style-type: none"> <li>RS-422, RS-485 interface for computer link (serial communication)</li> <li>Selective relay output</li> <li>Analog current output</li> </ul>	
	Pulse train input function	FR-EPH	<ul style="list-style-type: none"> <li>Pulse train input</li> <li>Selective relay output</li> <li>Analog current output</li> <li>PI control</li> </ul>	
External option (dedicated to FR-A)	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 (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)	
External option	Surge voltage suppressing filter	FR-ASF-H	Absorbs surge voltage on the inverter output side.	400V series 5.5 to 55K According to capacity
	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.	
Brake unit	FR-BU-H15K to H55K	Used to improve the braking capability of the inverter (for high-inertia load or negative load).	According to capacity	

## 27-2 Inboard Dedicated Options

One option card be mounted inside the FR-A240EC, Each card has multiple functions as shown below.

Function	EPA	EPB	EPC	EPD	EPE	EPG	EPH
PLG feedback control	●	●	●				
Orient control	●						
12-bit digital input	●				●		
Relay output					●		
Extended analog output	●				●		
Serial link communication		●				●	
MELSECNET/MINI-S3			●				
PI control				●			●
Program operation				●			
Selectable relay output						●	●
Analog current output						●	●
Pulse train input							●
Internal voltage source						●	●

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	<ul style="list-style-type: none"> <li>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.</li> <li>The actual motor speed can be monitored on the inverter LED display and parameter unit. [Application example] extruder, winder, conveyor, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Speed variation ratio: within <math>\pm 0.2\%</math> at the load variation of 0 to 100% (*) (at 1800r/min)</li> <li>Applicable motor: standard motor of 2 to 8 poles</li> <li>Encoder specifications: 3 phase, differential output, 1024P/rev.</li> <li>5VDC power supply</li> <li>(*) Load of 100% indicates the continuous operation torque of the motor at each running frequency.</li> </ul>
Orientation control	<ul style="list-style-type: none"> <li>Used with a pulse encoder installed to a machine tool spindle to allow the spindle to be stopped at a predetermined position (orientation function).</li> <li>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</li> </ul>	<ul style="list-style-type: none"> <li>Positioning accuracy <math>\pm 1.5^\circ</math></li> <li>Encoder specifications: same as those for the above PLG feedback function</li> </ul>
12-bit digital input	<ul style="list-style-type: none"> <li>Input interface used to set the inverter frequency accurately using external BCD or binary digital signals.</li> <li>Either 12-bit binary or BCD 3-digit signal can be selected.</li> <li>Gain and offset can also be adjusted.</li> </ul>	<ul style="list-style-type: none"> <li>Input voltage, current: 24VDC, 5mA (per circuit)</li> <li>Input signal format: contact signal input or transistor open collector (sink type) input</li> <li>Example: MELSEC AY40, AY40A, etc.</li> </ul>
Relay output (3 points)	<ul style="list-style-type: none"> <li>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.</li> </ul>	<ul style="list-style-type: none"> <li>Signal types: change-over contact (three output relays installed)</li> <li>Contact capacity: 230VAC 0.3A 30VDC 0.3A</li> </ul>
Extension analog output Analog current output (Note 2)	<ul style="list-style-type: none"> <li>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.</li> <li>A 1mA DC or 5V (10V) DC meter can be connected. (FR-EPA, EPE)</li> <li>A 20mADC or 5V(10V)DC meter can be connected. (FR-EPG, EPH)</li> <li>Gain and offset can also be adjusted.</li> </ul>	<ul style="list-style-type: none"> <li>Output voltage (across LM0-LM2): 0 to 10VDC, max. 1mA</li> <li>Output current (across LM1-LM2): 0 to 1mADC (20mA)</li> <li>Output resolution: 3mV for voltage output 1<math>\mu</math>A for current output (20<math>\mu</math>A)</li> <li>Output accuracy <math>\pm 10\%</math></li> </ul>
Computer link function (serial communication)	<ul style="list-style-type: none"> <li>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.</li> <li>Noiseless communication system using twisted pair cables.</li> </ul>	<ul style="list-style-type: none"> <li>Conforming standard: EIA Standard, for RS-422 and RS-485</li> <li>Transmission format: multidrop link system</li> <li>Communication speed: max. 19200 baud rates</li> <li>Max. number of inverters : RS-422 - 10 inverters connected RS-485 - 32 inverters</li> <li>Overall extension: 500m</li> </ul>

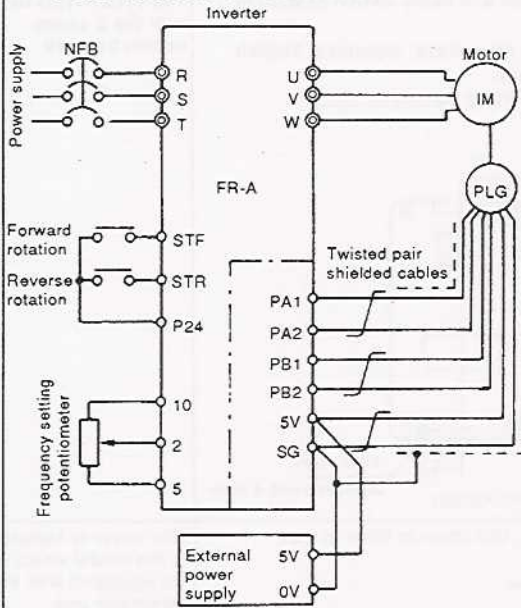
	Function, Application, Etc.	Rating, Etc.
MELSECNET/MINI-S3 interface	<ul style="list-style-type: none"> <li>Allows inverter operation/monitoring and parameter read/write to be performed using user program from the master station in the Mitsubishi programmable controller data link system MELSECNET/MINI-S3 (AJ71PT32-S3) which is connected by optical fiber.</li> <li>Communication is made via optical link system without noise.</li> </ul>	<ul style="list-style-type: none"> <li>Max. number of inverters connected: 16 inverters (up to 64 inverters when used with remote I/O stations)</li> <li>Interstation transmission distance: 50m max. 1m min</li> <li>Response time: approx. 40 to 120msec</li> </ul>
PI control	<ul style="list-style-type: none"> <li>PI control function is required when process control, e.g. flow rate, air volume or pressure, is carried out by the inverter.</li> <li>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.</li> </ul>	<ul style="list-style-type: none"> <li>PI control range: proportional band 1 to 1000% integral time 0.1 to 3600 seconds</li> <li>Output signal: high limit, low limit, during forward rotation, during reverse rotation</li> </ul>
Battery backup for programmed operation	<ul style="list-style-type: none"> <li>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.</li> </ul>	<ul style="list-style-type: none"> <li>Battery life: 10 years (lithium battery)</li> <li>Permissible power failure time: max. 18 hours when Pr. 200=0 (seconds selected) Max. 30 days when Pr. 200=1 (minutes selected)</li> </ul>
Pulse train input	<ul style="list-style-type: none"> <li>Allows a pulse train signal to be used as a speed command input to the inverter.</li> </ul>	<ul style="list-style-type: none"> <li>Max. permissible number of pulses: 100KPPS or less</li> <li>Input interface: Open collector system</li> <li>Input voltage/current: 24V, 10mA DC</li> </ul>

Function	Description/Rating
Selectable relay output (One output)	<ul style="list-style-type: none"> <li>One fully selectable true relay output (1C contact); changer</li> <li>Any of 5 functions (RUN, SU, IPF/UVT, OL,FU1,FU2) can be assigned to relay output</li> <li>Contact capacity: 230VAC, 0.3A 30VDC, 0.3A</li> <li>Calibration is made by FM terminal calibration Pr.900</li> </ul>
Analog current output	<ul style="list-style-type: none"> <li>AM output terminal output 4-20mA. (Application range Process control)</li> </ul>
Pulse train input	<ul style="list-style-type: none"> <li>Digital speed reference input for master/slave control.</li> <li>Input pulse train: 0f to 120f changer</li> <li>Response time:16.6ms</li> <li>Frequency setting resolution : 0.012Hz/50Hz</li> </ul>
Internal voltage	<ul style="list-style-type: none"> <li>An internal voltage source for the supply of external auxiliary devices.</li> <li>Specifications; +24V, 0.1A, short circuit proof.</li> </ul>

OPTION TERMINAL	Symbol	Terminal name	Description
	1A, 1B, 1C	Selectable relay output	AC230V 0.3A, 30VDC 0.3A
	AM0,AM1,AMC	Analog output current	AM0(0 to 10VDC), AM1(0 to 20mA DC), AMC(analog common)
	PIN,P24	Pulse train input	Open collector type(10mA), input pulse 0f to 120f, permissive max. pulse 100kpps
	P24, SD	Internal voltage source	24VDC, 0.1A

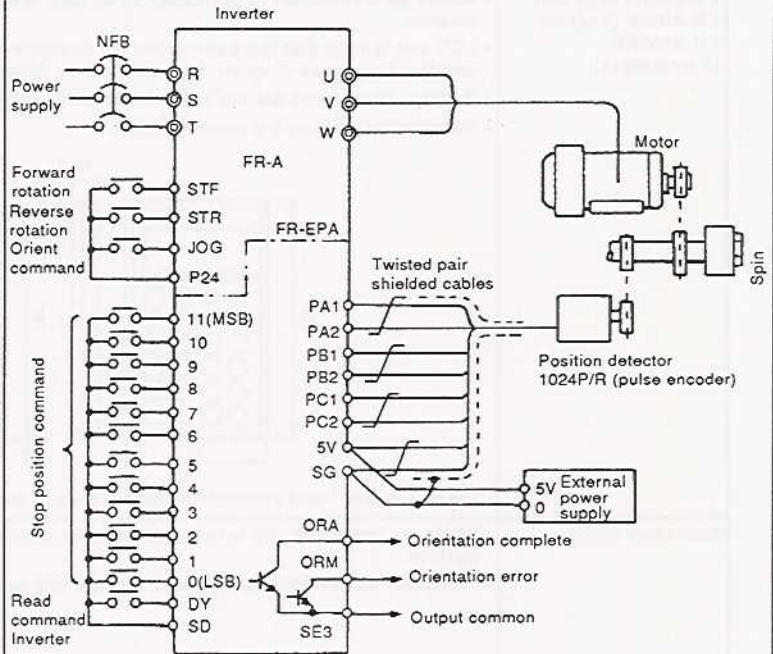
<Connection examples>

• PLG feedback control

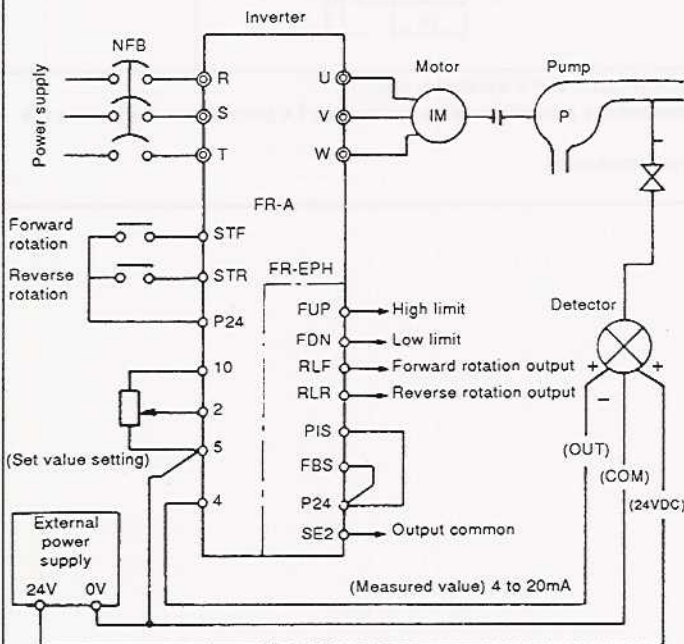


When a motor with brake is used, note the release timing of the brake. For more information, see the instruction manual of the option.

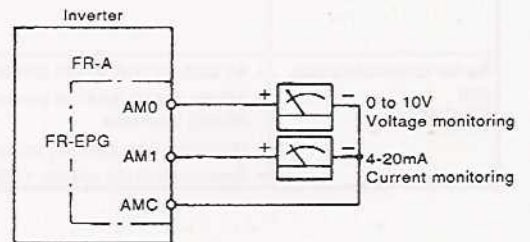
• Orientation control



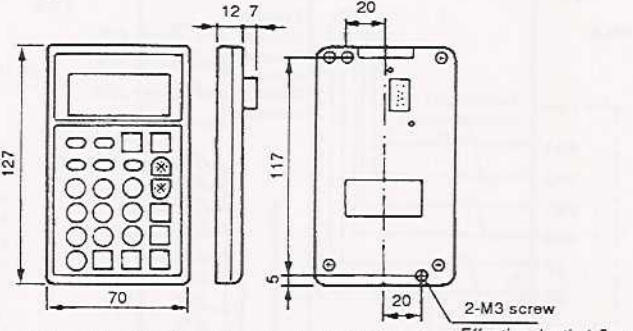
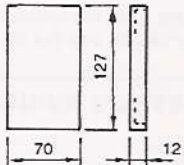
• PI control (for pressure control)



• Extension analog output



## 27-3 External Dedicated Options

Option (Type)	Specifications, Structure, Etc.	Remarks
Parameter copy unit FR-ARWE (English) FR-ARWER (4 languages)	<ul style="list-style-type: none"> <li>Allows parameters set to application to be read in batch and easily written to another inverter.</li> <li>LCD and ten-key pad representations are available in three ways: Japanese, English and four languages (English, German, French, Spanish).</li> <li>External dimensions are the same as those of the FR-PU02 parameter unit.</li> <li>Can also be used as the parameter unit.</li> </ul>  <p>The keys marked * have different functions from those for the FR-PU02(E).</p>	The FR-ZRW(E) used with the Z series cannot be used.
Accessory cover	<ul style="list-style-type: none"> <li>When the parameter unit is removed from the inverter, this cover is fitted to that position.</li> <li>This cover can be fitted and removed by a single action.</li> </ul> 	This cover is supplied to the model which is not equipped with the parameter unit.
Serial communication unit FR-CU01	<ul style="list-style-type: none"> <li>An add-on unit which can be fitted after removal of the parameter unit.</li> <li>Allows the inverter to be run/monitored and the parameters to be set from an FA controller or the like via the RS485 interface.</li> <li>Multidrop link system, up to 31 inverters connected.</li> <li>Communication speed: 1200 baud</li> </ul>	

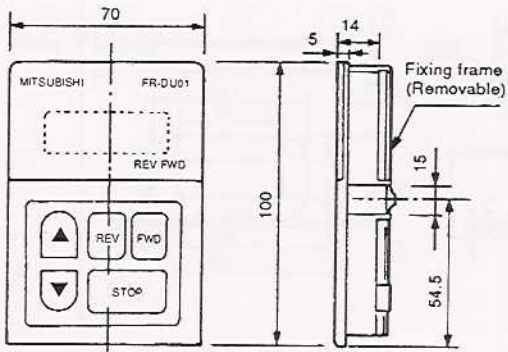
Option (Type)	Specifications, Structure, Etc.	Remarks														
Line noise filter FR-BSF01 (applies to small capacities) FR-BLF	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>FR-BSF01</b></p> </div> <div style="text-align: center;"> <p><b>FR-BLF</b></p> </div> </div>	<div style="text-align: center;"> </div> <p>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.)</p> <p>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.</p> <p>3. This filter can also be used on the output side as on the input side. The winding on the output side should be less than 3 turns.</p>														
Parameter unit cable FR-CBL □	<div style="display: flex; flex-direction: column;"> <div style="margin-bottom: 20px;"> <p><b>Straight type</b></p> </div> <div> <p><b>L shape type</b></p> </div> </div> <table border="1" style="margin-top: 20px; width: 100%;"> <thead> <tr> <th colspan="2">Type</th> <th rowspan="2">Length l (m)</th> </tr> <tr> <th>Straight Type</th> <th>L</th> </tr> </thead> <tbody> <tr> <td>FR-CBL01</td> <td>FR-CBL-L1</td> <td>1</td> </tr> <tr> <td>FR-CBL03</td> <td>FR-CBL-L3</td> <td>3</td> </tr> <tr> <td>FR-CBL05</td> <td>FR-CBL-L5</td> <td>5</td> </tr> </tbody> </table>	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	<p>The PU side connector of this L type can be fixed with the accessory screws.</p>
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														



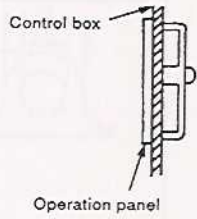
**Option (Type)** Specifications, Structure, Etc.

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.



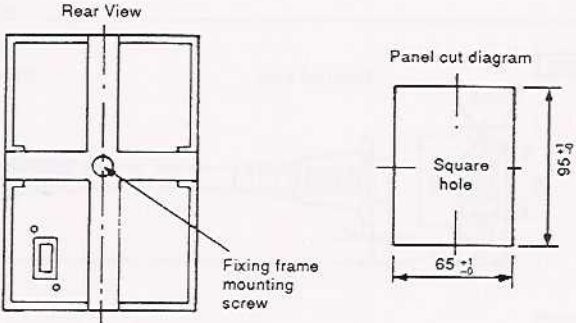
2. Installation method



- 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

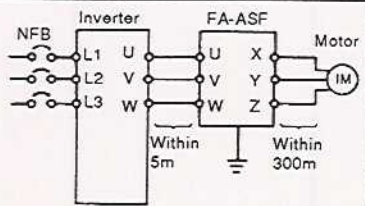
4. Parameters cannot be read or written.



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.

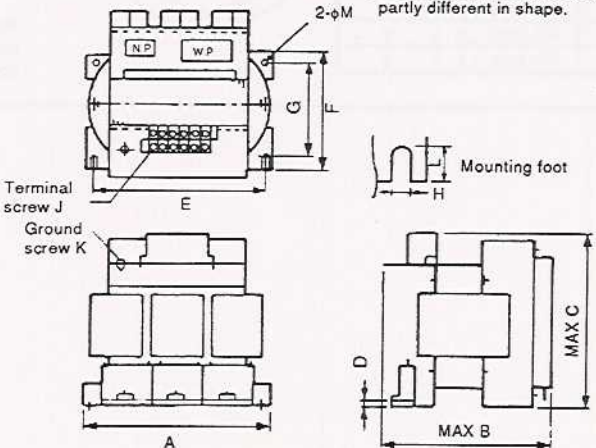
Voltage	Filter Type	Applicable inverter	Dimensions (mm)										Approx. Mass (Kg)		
			A	B	C	D	E	F	G	H x L	M	Terminal Screw J		Ground Screw K	Mounting Screw
400V	FR-ASF-H7.5K	FR-A240-5.5K/7.5K	280	215	250	3.2	255	191	125	8 x 24	8	M6	M4	M6	20.0
	FR-ASF-H15K *	FR-A200E-11K/15K	335	285	260	6	310	235	200	φ10		M6	M6	M8	28
	FR-ASF-H22K *	FR-A200E-18.5K/22K	335	349	340	6	310	281	240	φ10		M8	M6	M8	38
	FR-ASF-H37K *	FR-A240E-30K/37K	375	388	445	6	350	388	330	φ10		M8	M8	M8	55
	FR-ASF-H55K *	FR-A240E-45K/55K	395	568	445	6	370	553	490	φ10		M10	M8	M8	73



- 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.

- The wiring length from the inverter output terminals to the filter input terminals should be within 5m.
- The wiring length from the filter terminals to the motor terminals should be within 300m.
- The terminals used for wiring should be sleeved solderless terminals.

\*: The filters of H15K and up are partly different in shape.



## 28. SPECIFICATIONS

### 28-1 Standard Specifications

#### ■ 400V Series

TYPE		5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K	
Output	Applied motor capacity (kw) *1	5.5	7.5	11	15	18.5	22	30	37	45	55	
	Rated capacity (KVA) *2	9.1	13	17.5	23.6	29	32.8	43.4	54	65	84	
	Constant torque	Applied Motor (hp)	7.5	10	15	20	25	30	40	50	60	75
		Rated current (A)	12	17	23	31	38	43	57	71	86	110
	Variable torque	Applied Motor (hp)	10	15	20	25	30	40	50	60	75	100
		Rated current (A)	14	21	27	34	40	52	65	77	96	124
	Overload current rating *3	Constant torque	150% 60sec, 200% 0.5sec									
		Variable torque	120% 60sec, 150% 0.5sec									
	Voltage *4		Three-phase 380 to 415V 50Hz/60Hz									
	Regenerative braking torque	Maximum value/time	100%/5sec					20% *5				
Allowable operaiton factor		2%ED					Continuous *5					
Power supply	Rated input AC voltage and frequency		Three-phase 380 to 415V 50Hz/60Hz *10									
	Allowable voltage fluctuation		323 to 457V 50Hz/60Hz									
	Allowable frequency fluctuation		±5%									
	Power supply capacity (KVA) *6		12	17	20	28	34	41	52	66	80	100
Protective structure		IP20		IP00 (open type)								
Cooling system		Fan cooling										
Approx. weight(kg) (with PU) **		8.2	8.2	16	16	20	20	35	54	54	72	

\*\* : The value for the 5.5K/7.5K is approximate weight including that of PU.

Note :Regarding to 'Output voltage' and 'Rated input AC voltage and frequency'  
 For LVD compliance in EC voltage limit 380-415V(Fluctuation:323-457V),  
 Non EC countries 380-460V(Fluctuation:323-506V)

## Common Specifications

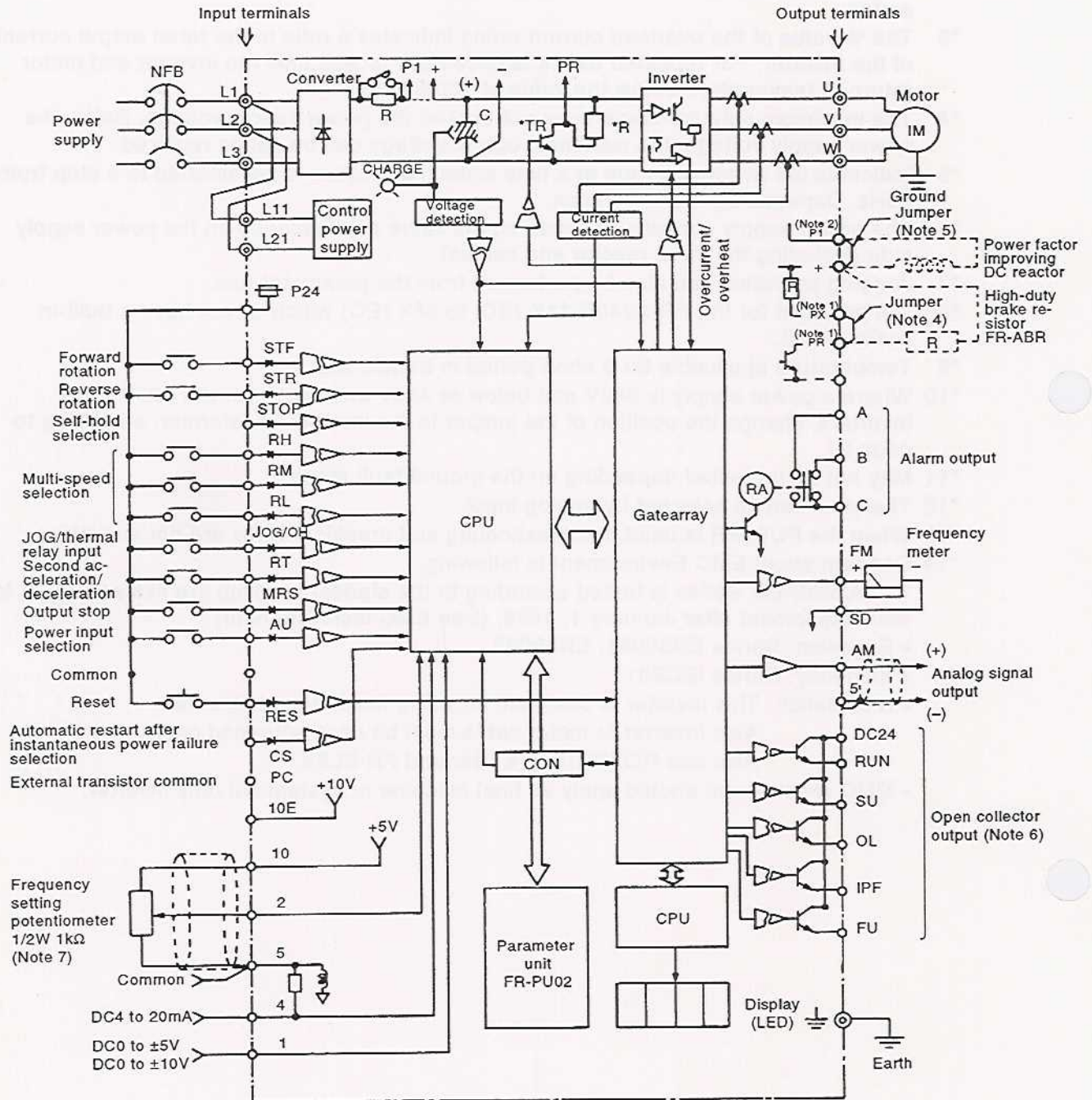
Control specification	Control system		Control specifications High carrier frequency sine-wave PWM control (V/F control or magnetic flux vector control can be selected)	
	Output frequency range		0.2 to 400Hz	
	Frequency setting resolution	Analog input	0.012Hz/50Hz (terminal 2 input: 12 bits/0 to 10V, 11bits/0 to 5V, terminal 1 input: 12 bits/-10 to +10V, 11 bits/-5 to +5V)	
		Digital input	0.01Hz/50Hz (also pulse train input)	
	Frequency accuracy		Within $\pm 0.2\%$ of maximum output frequency ( $25^{\circ}\text{C}\pm 10^{\circ}\text{C}$ )/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 injection 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 $\pm 5$ VDC, 0 to $\pm 10$ VDC, 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, autotuning 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 (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, overload, converter output voltage (steady or peak value), electronic overcurrent protector load factor, cumulative operation time, regenerative brake duty, load percentage.	
		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 *13	
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), brake transistor alarm *8, ground fault current *11, output short circuit, main circuit device overheat, stall prevention, overload alarm, brake resistor overheat protection	
Environment	Ambient temperature		-10°C to +50°C (non-freezing), -10 °C to +40°C when the dust-protection structure attachment (FR-ACV) is used. Also, variable torque rating limited temperature rise to 40°C.	
	Ambient humidity		90%RH or less (non-condensing)	
	Storage temperature *9		-20°C to +65°C	
	Ambience		Indoors. No corrosive gases, oil mist, dust and dirt.	
	Altitude, vibration		Below 1000m, 5.9m/s <sup>2</sup> (0.6G) or less (conforms to JIS C 0911)	
EMC Protection			Installed in an earth metal box.	

- 
- Note: \*1 The applicable motor capacity indicated is the maximum applicable capacity when a 4-pole standard motor is used.
- \*2 The rated capacity indicated assumes that the output voltage is 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 Indicates the average torque at a time when the inverter is decelerated to a stop from 50Hz. Depends on the motor loss.
- \*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 Not provided for the FR-A240E-11K (EC) to 55K (EC) which do not have a built-in brake circuit.
- \*9 Temperature applicable for a short period in transit, etc.
- \*10 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 21.
- \*11 May not be protected depending on the ground fault mode.
- \*12 The level can be selected by analog input.
- \*13 When the PU02ER is used, troubleshooting and graphic display are not available.
- \*14 Concern about EMC Environment is following.

The A240E-EC Series is tested according to the standards which are likely to apply to drive equipment after January 1, 1996; (See EMC technical note)


- Emission: Series EN50081, EN50082
- Immunity: Series IEC801
- Installation: This inverter is designed for using inside the enclosure.  
Also inverter to motor cable must be used screened cable.  
Also use ROXBURGH's filter and FR-BLFs.
- EMC requirement should apply as final machine or system not only inverter.

## 28-2 Block Diagram



- Note: 1. Terminals PR and PX are provided for the FR-A240E-5.5K-EC to 7.5K-EC.  
 2. Terminal P1 is provided for the FR-A240E-5.5K-EC to 55K-EC.  
 3. The models of 11K and up are not provided with the built-in brake resistor and brake transistor.  
 4. When the FR-ABR or FR-BU brake unit or FR-RC power return unit is used, disconnect this jumper.  
 5. When the DC reactor is used, disconnect this jumper.  
 6. The output terminals other than running (RUN) allow alarm definitions to be output in alarm code and 10 different functions to be assigned individually.  
 7. When the frequency setting is changed frequently, it is recommended to use 2W1K. Also, for normal use, it is recommended to use 1/2W 1K $\Omega$ .

## 28-3 Terminals

Type	Symbol	Terminal Name	Description	
Main circuit	L1, L2, L3	AC power input	Connect to the commercial power supply.	
	U, V, W	Inverter output	Connect a three-phase squirrel-cage motor.	
	L11, L21	Power supply for control circuit	Connected to the AC power supply terminals L1 and L2. To retain the alarm display and alarm output, remove the jumper from the terminal block and apply external power to these terminals.	
	P, PR	Brake resistor connection	Disconnect the jumper from terminals PR-PX and connect the optional brake resistor across terminals P-PR.	
	+, -	Brake unit connection	Connect the optional FR-BU brake unit or power return converter (FR-RC).	
	P, P1	Power factor improving DC reactor connection	Disconnect the jumper from terminals +-P1 and connect the optional power factor improving reactor.	
	PR, PX *	Built-in brake circuit connection	When the jumper is connected across terminals PX-PR (factory setting), the built-in brake resistor is used.	
		Ground	For earthing the inverter chassis. Must be earthed.	
Control circuit (input signals) Contact (start, function selection, etc.)	STF	Forward rotation start	Turn on a signal across STF-P24 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-P24 and STR-P24 are turned on simultaneously, the stop command is given.
	STR	Reverse rotation start	Turn on a signal across STR-P24 for reverse rotation and turn off to stop.	
	STOP	Start self-holding selection	Turn on a signal across terminals STOP-P24 to select the self-holding of the start signal.	
	RH, RM, RL	Multi-speed selection	Turn on a signal across RH/RM/RL-P24 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 a signal across terminals JOG-P24 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 a signal across terminals RT-P24 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-P24. Turn on the signal across terminals RT-SD to switch between the two control modes, magnetic flux vector control and V/F control.	
	MRS	Output stop	Turn on a signal across terminals MRS-P24 (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-P24 for more than 0.1 sec, then turn it off.	
	AU	Current input selection	Only when the a link across terminals AU-P24 is present can the inverter be operated with the 4-20mADC frequency setting signal.	
	CS	Automatic restart after instantaneous power failure selection	When the a link across terminals CS-P24 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.	
	P24	Contact input common	Common to the contact input terminals. 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.	
SD	FM common	Common to the terminal FM. Isolated from the common terminal of the control circuit.		

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-P24 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. 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	
		DC24	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 output selected from 16 monitoring items, such as output frequency. 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 50Hz. (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)	

\*Terminals PR and PX are provided for the FR-A240E-5.5K-EC to 7.5K-EC.

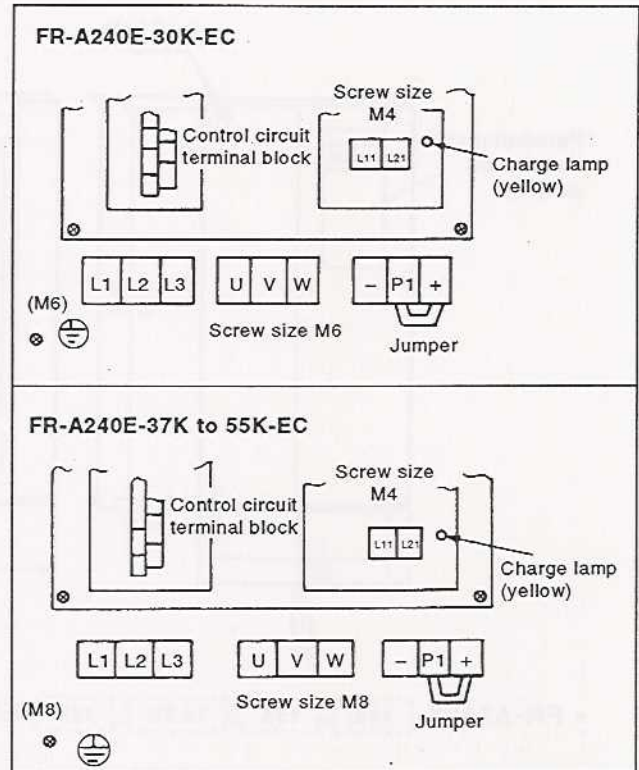
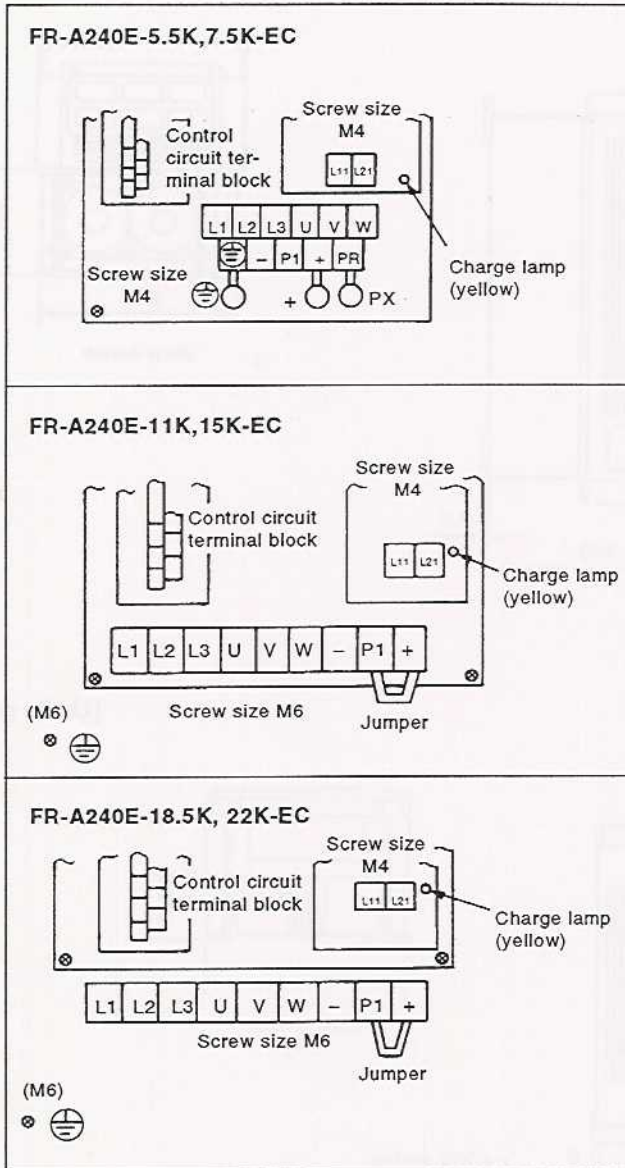
\*\*Low indicates that the open collector outputting transistor is on (conducts). High indicates that the transistor is off (does not conduct).

\*\*\*The output of these terminals can be reassigned by the output terminal assignment function (see page 104).

Note: Application of the voltage in the wrong direction will damage the inverter. Use care when wiring.

## 28-4 Terminal Block Arrangement

### Terminal Block for Main Circuit



### Terminal Block for Control Circuit

Common to all models  
 Structure.....2-stage molded terminals  
 Screw size..... M3

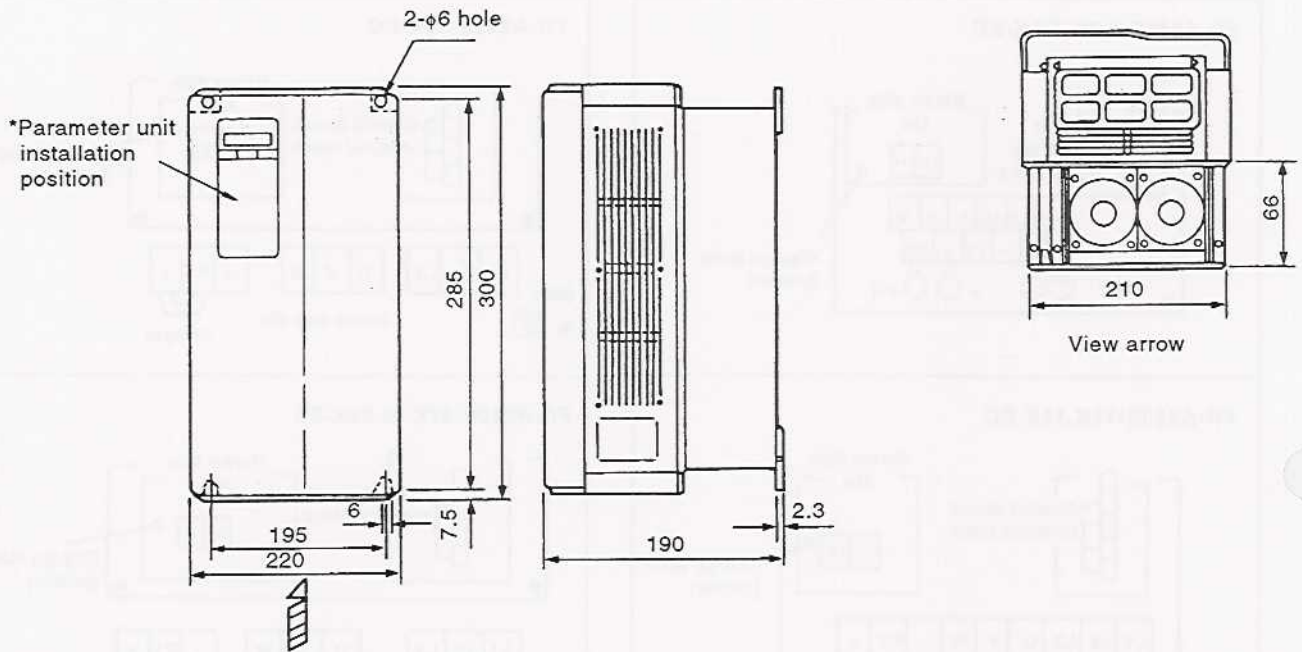
A	
B	
C	
DC24V	
RUN	
SU	
IPF	
OL	
FU	
FM	
SD	
RL	
RM	
RH	
RT	
AU	
STOP	
MRS	
RES	
P24	AM
STF	10E
STR	10
JOG/OH	2
CS	5
PC	4
	1



28-5 Outline Drawings

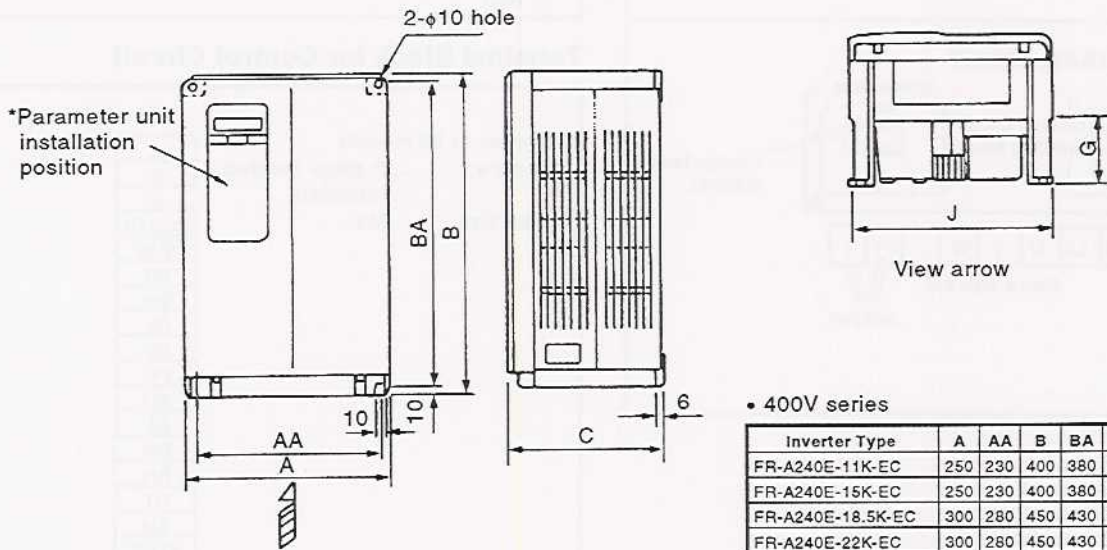
• FR-A240E-5.5K, 7.5K-EC

[Unit: mm]



• FR-A240E-11K, 15K, 18.5K, 22K-EC

[Unit: mm]

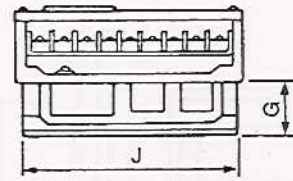
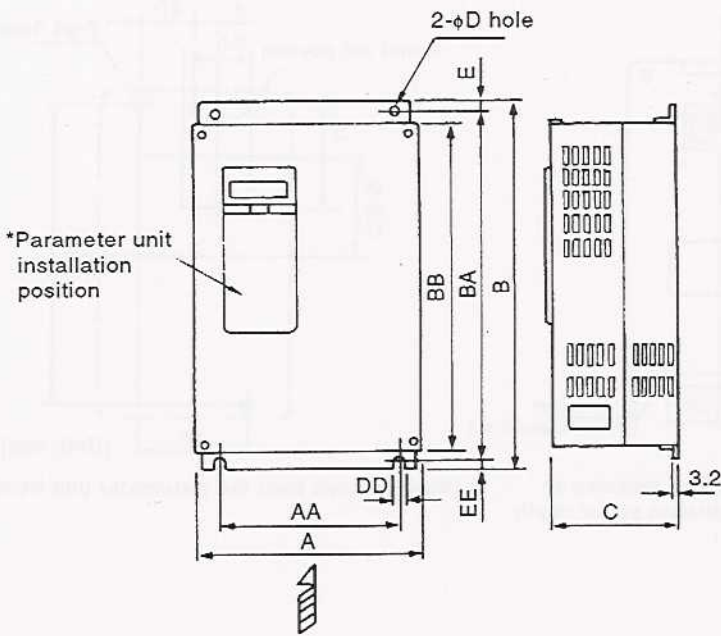


• 400V series

Inverter Type	A	AA	B	BA	C	G	J
FR-A240E-11K-EC	250	230	400	380	190	80	242
FR-A240E-15K-EC	250	230	400	380	190	80	242
FR-A240E-18.5K-EC	300	280	450	430	195	80	292
FR-A240E-22K-EC	300	280	450	430	195	80	292

• FR-A240E-30K, 37K, 45K, 55K-EC

[Unit: mm]

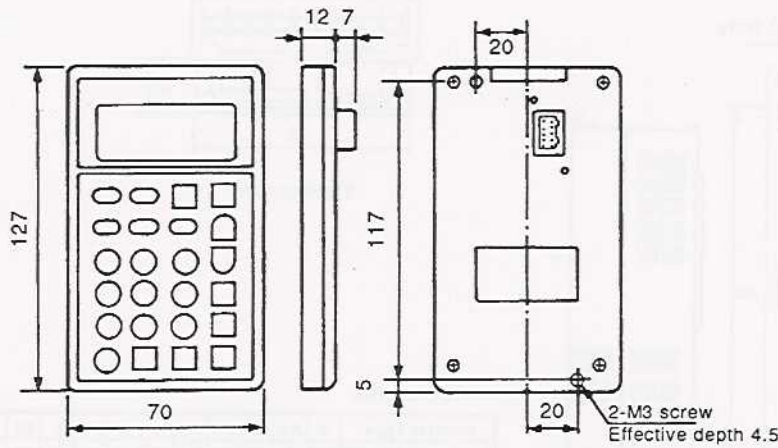


View arrow

• 400V series

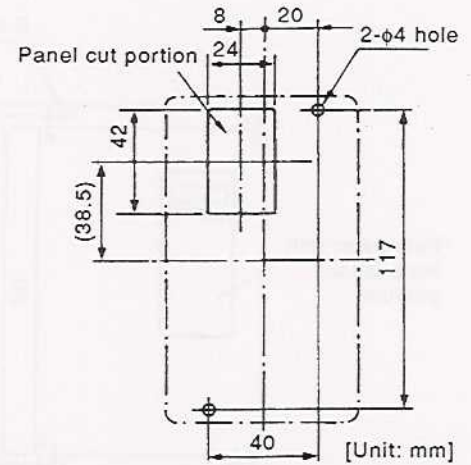
Inverter Type	A	AA	B	BA	BB	C	D	DD	E	EE	G	J
FR-A240E-30K-EC	340	270	550	530	510	195	10	10	10	10	78	324
FR-A240E-37K-EC	450	380	550	525	495	250	12	12	15	10	130	434
FR-A240E-45K-EC	450	380	550	525	495	250	12	12	15	10	130	434
FR-A240E-55K-EC	480	410	700	675	645	250	12	12	15	10	130	464

## 28-6 FR-PU02(E), (ER) 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-PU02(E), (ER) Specifications

Item	Specifications	
	Ambient temperature	Operating
	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.

## 28-7 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 <sup>2</sup> ) PVC	
			Standard	With power factor improving reactor		L1, L2, L3	U, V, W
400V class	5.5	FR-240E-5.5k-EC	Type NF30, NV30 30A	Type NF30, NV30 20A	S-K20	4	2.5
	7.5	FR-240E-7.5k-EC	Type NF30, NV30 30A	Type NF30, NV30 30A	S-K20	4	4
	11	FR-240E-11k-EC	Type NF50, NV50 50A	Type NF50, NV50 40A	S-K20	6	6
	15	FR-240E-15k-EC	Type NF100, NV100 60A	Type NF50, NV50 50A	S-K25	16	10
	18.5	FR-240E-18.5k-EC	Type NF100, NV100 75A	Type NF100, NV100 60A	S-K35	16	10
	22	FR-240E-22k-EC	Type NF100, NV100 100A	Type NF100, NV100 75A	S-K50	25	16
	30	FR-240E-30k-EC	Type NF225, NV225 125A	Type NF100, NV100 100A	S-K65	25	25
	37	FR-240E-37k-EC	Type NF225, NV225 150A	Type NF225, NV225 125A	S-K80	35	25
	45	FR-240E-45k-EC	Type NF225, NV225 175A	Type NF225, NV225 150A	S-K80	50	35
	55	FR-240E-55k-EC	Type NF225, NV225 200A	Type NF225, NV225 175A	S-K100	70	50

\* Recommended wire size for following conditions.

- Ambient Temp. : 40°C maximum
- Wire Installation: On wall without ducts or conduits

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

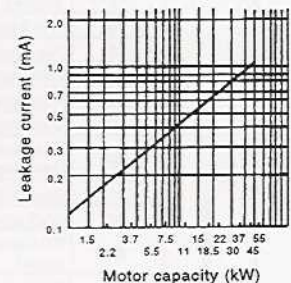
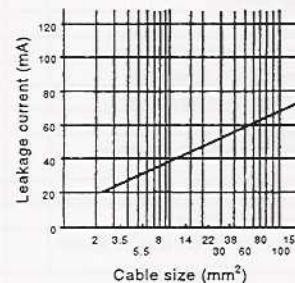
## 28-8 Selecting the Rated Sensitivity Current for the Earth Leakage Circuit Breaker

When using the earth leakage circuit breaker with the inverter circuit, select its rated sensitivity current as follows:

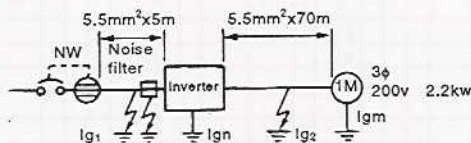
- New Super NV series (Type SF, CF)  
Rated sensitivity current:  $\Delta n \geq 10 \times (I_{g1} + I_{g2} + I_{gm})$
  - Conventional NV series (Type CA, CS, SS)  
Rated sensitivity current:  $\Delta n \geq 10 \times \{I_{g1} + I_{gn} + 3 \times (I_{g2} + I_{gm})\}$
- $I_{g1}, I_{g2}$  : leakage currents of cable path during commercial power supply operation
- $I_{gn}^*$  : leakage current of noise filter on inverter input side
- $I_{gm}$  : 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 primary (power supply) side of the inverter.

2. Ground fault in the secondary side of the inverter can be detected at the running frequency of 120Hz or lower.

3. In the Y connection neutral point grounded system, the sensitivity current is purified against ground fault in the inverter secondary side. Hence, the protective ground resistance of the load equipment should be 10Ω or less.

4. When the breaker is grounded on the secondary side of the inverter, it may be unnecessarily operated by harmonics if the effective value is less than the rating. In this case, note that the eddy current and hysteresis loss increase and temperature rises.

- \* For the leakage current value of the noise filter installed on the inverter input side, contact the corresponding filter manufacturer. (For Mitsubishi's dedicated filters, see page 147.)

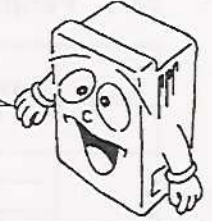
### Selection Example

(for the diagram shown on the left) (mA)

	New Super NV	Conventional NV
Leakage current $I_{g1}$	$33 \times \frac{5m}{1000m} = 0.17$	
Leakage current $I_{gn}$	0 (without noise filter)	
Leakage current $I_{g2}$	$33 \times \frac{70m}{1000m} = 2.31$	
Motor leakage current $I_{gm}$	0.18	
Total leakage current	2.66	7.64
Rated sensitivity current ( $\geq I_{gx}10$ )	30	100

# 29. USING THE FUNCTIONS

Set the functions according to the load specifications and operating conditions. The following list indicates purposes of use and applied functions. The parameter numbers indicated are those of the FR-A200E series inverters.



- : Indicates that the parameter must be set.
- : Indicates that the parameter may be set as required.

Function	Parameter Number	Name	Purpose of Use																									
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Basic functions	0	Torque boost (manual)								●																		
	1	Maximum frequency				●	○			○																		
	2	Minimum frequency				●				○																		
	3	Base frequency			●																							●
	4	Multi-speed setting (high speed)									●																	
	5	Multi-speed setting (middle speed)									●																	
	6	Multi-speed setting (low speed)									●																	
	7	Acceleration time	●																				○	○				●
	8	Deceleration time	●																				○	○				●
Standard operation functions	9	Electronic thermal O/L relay		●																								
	10	DC injection brake operation frequency														●												
	11	DC injection brake operation time														●												
	12	DC injection brake voltage														●												
	13	Starting frequency								○																	○	
	14	Applied load selection			○																						○	
	15	Jog frequency								○	●																○	
	16	Jog acceleration/deceleration time	○								●																	
	17	External thermal O/L relay input																●										
	18	High-speed maximum frequency				●																					○	
	19	Base frequency voltage			○																						○	
	20	Acceleration/deceleration reference frequency	●																				○	○				
	21	Acceleration/deceleration time increments	●																				○	○				
	22	Stall prevention operation level								○													○	○				
	23	Stall prevention operation level at double speed								○													○					
	24	Multi-speed setting (speed 4)									●																	
	25	Multi-speed setting (speed 5)									●																	
	26	Multi-speed setting (speed 6)									●																	
	27	Multi-speed setting (speed 7)									●																	
	28	Multi-speed input compensation									○					●												
	29	Acceleration/deceleration pattern	○																									
	30	External brake resistor selection															○											
	31	Frequency jump 1A										●																
	32	Frequency jump 1B										●																
	33	Frequency jump 2A										●																
	34	Frequency jump 2B										●																
	35	Frequency jump 3A										●																
	36	Frequency jump 3B										●																
	37	Speed display																										
	38	Automatic torque boost								○																		
39	Automatic torque boost operation starting current Multi-function output terminal functions								○																			

Function	Parameter Number	Name	Purpose of Use																									
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Multi-function output terminal functions	40	Output terminal assignment																										
	41	Up-to-frequency sensitivity																										
	42	Output frequency detection																										
	43	Output frequency detection at reverse rotation																										
Second functions	44	Second acceleration/deceleration time	○																									●
	45	Second deceleration time	○																									●
	46	Second torque boost																										●
	47	Second V/F (base frequency)			○																							●
	48	Second stall prevention operation current																										●
	49	Second stall prevention operation frequency																										●
Display functions	50	Second output frequency detection																○										
	51	Inverter LED display data selection																				●						
	52	PU main display data selection																				●						
	53	PU level display data selection																				●						
	54	FM terminal function selection									●	●																
	55	Frequency monitoring reference									●	●																
Automatic restart functions	56	Current monitoring reference								●	●																	
	57	Restart coasting time																●										
Additional function	58	Restart cushion time															●											
	59	Remote setting function selection																										
Operation selection functions	60	Intelligent mode selection																						●	●	○		
	61	Reference I for intelligent mode																						○				
	62	Ref. I for intelligent mode accel.																						○				
	63	Ref. I for intelligent mode decel.																						○				
	64	Starting f for elevator mode																								○		
	65	Retry selection																									○	●
	66	Stall prevention operation reduction starting frequency																								○		
	67	Number of retries at alarm occurrence																										●
	68	Retry waiting time																										●
	69	Retry count display erasure																										●
	70	Special regenerative brake duty																										●
	71	Applied motor		○																								
	72	PWM frequency selection																										
	73	0 to 5V, 0 to 10V selection																										
	74	Response time for analog signal																										
	75	Reset selection/PU disconnection detection																										
	76	Alarm code output selection																										
	77	Parameter write disable selection																										
	78	Reverse rotation prevention selection																										
	79	Operation mode selection																										
Auxiliary functions	80	Motor capacity		○																								●
	81	Number of motor poles		○																								●
	145	Parameter unit language switching																										
	155	RT activated condition																										
	156	Stall prevent. select. at regeneration																										
	157	OL signal waiting time																										
Calibration functions	158	AM terminal function selection																										
	159	PWM f decrease at low speed																										
	900	FM terminal calibration				○					●	●																
	901	AM terminal calibration				○					○																	
	902	Frequency setting voltage bias				○					●	●																
	903	Frequency setting voltage gain				○					●	●																
904	Frequency setting current bias				○					●	●																	
905	Frequency setting current gain				○					●	●																	

# REVISIONS

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

Print Date	*Manual Number	Revision
Oct. 1995	IB-66604-A	First edition

**FA Center**
**JAPAN**

MITSUBISHI ELECTRIC CORPORATION  
Marunouchi  
Tokyo 100  
JAPAN  
Phone: (03) 3218-3176  
Fax: (03) 3218-2422

**EUROPE**

MITSUBISHI ELECTRIC EUROPE  
Gothaer Str. 8  
D-40880 Ratingen  
GERMANY  
Phone: (0 21 02) 486 - 0  
Fax: (0 21 02) 486 - 112

**UK**

MITSUBISHI ELECTRIC EUROPE  
Travellers Lane  
GB-Hatfield Herts. AL10 8 XB  
UK  
Phone: (07 07) 27 61 00  
Fax: (07 07) 27 86 95

**USA**

MITSUBISHI ELECTRONICS AMERICA, INC.  
800 Biermann Court  
Mt. Prospect, IL 60056  
USA  
Phone: (708) 298-9223  
Fax: (708) 298-1834

**HONG KONG**

Ryoden (Holdings) Ltd.  
10th Fl., Manulife T., 169 Electric Rd., N. Point  
Hong Kong  
HONG KONG  
Phone: 2887-8870  
Fax: 2578-2461

**INDONESIA**

P.T. SAHABAT INDONESIA  
Blok A/Utara No. 1 Kav. No. 11  
Jakarta 11050  
INDONESIA  
Phone: 6610651  
Fax: 6603700

**TAIWAN**

SETSUYO ENTERPRISE Co., Ltd.  
3rd Fl., No.122, Wu Kung 2nd Road  
Wu-Ku Hsiang Taipei Hsien  
TAIWAN  
Phone: (02) 298 - 17 95  
Fax: (02) 298 - 18 25

**SINGAPORE**

MITSUBISHI ELECTRIC SALES SINGAPORE Pte.Ltd.  
No. 6, Commonwealth Lane #01 - 01  
149547 Singapore  
SINGAPORE  
Phone: 476 - 72 35  
Fax: 476 - 74 39

**European Representatives**
**AUSTRIA**

GEVA  
Wiener Straße 89  
A-2500 Baden  
Phone: (0 22 52) 8 55 52-0  
Fax: (0 22 52) 4 88 60

**BELGIUM**

GETRONICS NV/SA  
Pontbeeklaan 43  
B-1731 Zellik  
Phone: (02) 4 67 17 49  
Fax: (02) 4 67 17 45

**CROATIA**

INEA CR d.o.o.  
Drvinje bb  
HR-10000 Zagreb  
Phone: (0) 1 300 175  
Fax: (0) 1 300 175

**CZECHIA**

AutoCont Control Systems s.r.o.  
28. října 125  
CZ-70100 Ostrava 1  
Phone: (0 69) 5 16 00  
Fax: (0 69) 5 25 26

**DENMARK**

ELPEFA A/S  
Geminivej 32  
DK-2670 Greve  
Phone: (0 43) 95 95 95  
Fax: (0 43) 95 95 90

**FINLAND**

URHO TUOMINEN OY  
PL 59  
SF-28101 Porri  
Phone: (0 39) 55 08 00  
Fax: (0 39) 55 08 41

**FRANCE**

Delta Résistances S.A.  
208, Avenue du 8 Mai 1945  
F-69165 Rillieux la Pape Cedex  
Phone: (04) 72 01 46 00  
Fax: (04) 78 88 20 21

**FRANCE**

STROMAG S.A.  
Z.I. Rue Denis Papin  
F-57204 Sarreguemines Cedex  
Phone: (03) 87 95 25 43  
Fax: (03) 87 95 45 43

**GERMANY**

MITSUBISHI ELECTRIC EUROPE  
Gothaer Str. 8  
D-40880 Ratingen  
Phone: (0 21 02) 486 - 0  
Fax: (0 21 02) 486 - 112

**GREECE**

IMATECH Ltd.  
34 Vassilisis Olgas Avenue  
GR-54641 Thessaloniki  
Phone: (0 31) 84 33 45  
Fax: (0 31) 81 51 59

**HUNGARY**

GEVA Kft.  
Tamási Áron u. 34  
H-1124 Budapest  
Phone: (01) 175 0688  
Fax: (01) 175 0688

**ITALY**

SCS  
Via Piave, 84  
I-22050 Verderio Inf. (Como)  
Phone: (0 39) 9 51 51 88  
Fax: (0 39) 9 51 51 83

**NETHERLANDS**

Geveke Electronics bv  
Donauweg 10  
NL-1043 AJ-Amsterdam  
Phone: (0 20) 5 86 15 92  
Fax: (0 20) 5 86 19 27

**NETHERLANDS**

R + H Systems B.V.  
Sluisjesdijk 155  
NL-3087 AB Rotterdam  
Phone: (0 10) 4 87 19 11  
Fax: (0 10) 4 87 17 02

**NORWAY**

SCANELEC AS  
Leirvikasen 43B  
N-5074 Godvik-Bergen  
Phone: (0 55) 50 60 00  
Fax: (0 55) 50 60 99

**POLAND**

MPL Technology Sp. Z.o.o.  
ul. Wroclawska 53  
PL-30011 Kraków  
Phone: (0 12) 32 28 85  
Fax: (0 12) 32 47 82

**PORTUGAL**

F. Fonseca Lda.  
Estrada de Taboeira 87/89, Esgueira  
P-3800 Aveiro  
Phone: (0 34) 31 58 00  
Fax: (0 34) 31 58 04

**SLOVENIA**

INEA  
Ljubljanska 80  
SLO-61230 Domžale  
Phone: (0 61) 71 25 63  
Fax: (0 61) 72 16 72

**SPAIN**

Medición y Control, S. A.  
Gran Via de les Corts Catalanes 133, 4  
E-08014 Barcelona  
Phone: (03) 4 22 77 00  
Fax: (03) 4 32 28 47 / 2 96 63 32

**SWEDEN**

Beijer Electronics AB  
Box 325  
S-20123 Malmö  
Phone: (0 40) 35 86 00  
Fax: (0 40) 93 23 01

**SWITZERLAND**

ECONOTEC AG  
Postfach 282  
CH-8309 Nürensdorf  
Phone: (01) 838 48 11  
Fax: (01) 838 48 12

**TURKEY**

GTS  
Fahri Gizden Sokak, Hacaloglu Apt. No. 22/6  
TR-80280 Gayrettepe/Istanbul  
Phone: (212) 267 40 11  
Fax: (212) 266 14 50

**UK**

MITSUBISHI ELECTRIC EUROPE  
Travellers Lane  
GB-Hatfield Herts. AL10 8 XB  
Phone: (07 07) 27 61 00  
Fax: (07 07) 27 86 95