MITSUBISHI
TRANSISTORIZED INVERTER
FREQROL-A100

FOR VARIABLE TORQUE LOADS

FR-A120E-0.75K(P) to 55K
FR-A140E-0.75K(P) to 55K

FREQROL

— INSTRUCTION MANUAL —

MITSUBISHI ELECTRIC

SAFETY PRECAUTIONS

When the retry function has been selected, apply these CAUTION seals to easily identifiable places.

CAUTION
RETRY FUNCTION SELECTED
⚠ Keep away from the motor and machine. They will start suddenly (after a set time) after the occurrence of an alarm.

When automatic restart after instantaneous power failure has been selected, apply these CAUTION seals to easily identifiable places.

CAUTION
AUTOMATIC RESTART AFTER INSTANTANEOUS POWER FAILURE SELECTED
⚠ Keep away from the motor and machine. They will start suddenly (after a set time) after the occurrence of an instantaneous power failure.

APPLICATION OF THE CAUTION SEALS

These seals indicate warnings for use of the Mitsubishi inverter to ensure safety. When the "retry function" and "automatic restart after instantaneous power failure" has been selected, apply the above labels according to the application spaces.

CAUTION
RETRY FUNCTION SELECTED
⚠ Keep away from the motor and machine. They will start suddenly (after a set time) after the occurrence of an alarm.

CAUTION
AUTOMATIC RESTART AFTER INSTANTANEOUS POWER FAILURE SELECTED
⚠ Keep away from the motor and machine. They will start suddenly (after a set time) after the occurrence of an instantaneous power failure.

SETTING RECORD

This seal is used to record function set values and check the data of the functions. Apply the seal to the inverter surface, operation box, etc. as required. (Note: Do not apply the seal to the rear surface of the inverter front cover.)

Setting Record (for FR-A100E series) Part 1

Function	Pr. No.	Name	Screen Display	Setting Range	Factory-Setting	Customer Set Value
Basic functions	0	Torque boost (manual)	Trq.Bst1	0 to 30%	(Note1)	
	1	Maximum frequency	Max.F1	0 to 120Hz	120Hz	
	2	Minimum frequency	Min.F1	0 to 120Hz	0Hz	
	3	Base frequency	VFbaseF1	0 to 120Hz	60Hz	
	4	Multi-speed setting (high speed)	PresetF1	0 to 120Hz	60Hz	
	5	Multi-speed setting (middle speed)	PresetF2	0 to 120Hz	30Hz	
	6	Multi-speed setting (low speed)	PresetF3	0 to 120Hz	10Hz	
	7	Acceleration time	Acc.T1	0 to 3600 seconds/ 0 to 360 seconds	(Note2)	
	8	Deceleration time	Dec.T1	0 to 3600 seconds/ 0 to 360 seconds	(Note2)	
	9	Electronic thermal O/L relay	Set THM	0 to 500A	(Note3)	
Standard operation functions	10	DC injection brake operation frequency	DC Br.F	0 to 120Hz, 9999	3Hz	
	11	DC injection brake operation time	DC Br.T	0 to 10 seconds, 8888	0.5 seconds	
	12	DC injection brake voltage	DC Br.V	0 to 30%	(Note1)	
	13	Starting frequency	Start F	0.5 to 60Hz	0.5Hz	
	14	Applied load selection	Load VF	0, 1	0	
	15	Jog frequency	JOG F	0 to 120Hz	5Hz	
	16	Jog acceleration/deceleration time	JOG T	0 to 3600 seconds/ 0 to 360 seconds	0.5 seconds	
	17	External themal O/L relay input	JOG/OH	0 to 7	0	
	19	Base frequency voltage	VFbase V	0 to 1000V, 8888, 9999	9999	
	20	Acceleration/deceleration reference frequency	Acc/DecF	1 to 120Hz	60Hz	
	21	Acceleration/deceleration time increments	Incr.T	0, 1	0	
	22	Stall prevention operation level	Stll Pv1	0 to 150%, 9999	120%	
	23	Stall prevention operation level at double speed	Stll Pv2	0 to 200%, 9999	9999	
	24	Multi-speed setting (speed 4)	PresetF4	0 to 120Hz, 9999	9999	
	25	Multi-speed setting (speed 5)	PresetF5	0 to 120Hz, 9999	9999	
	26	Multi-speed setting (speed 6)	PresetF6	0 to 120Hz, 9999	9999	
	27	Multi-speed setting (speed 7)	PresetF7	0 to 120Hz, 9999	9999	
	28	Multi-speed input compensation	Pre.Comp	0, 1	0	
	29	Acceleration/deceleration pattern	Acc/DecP	0, 1, 2, 3	0	
	30	High power factor converter connection selection	———	0, 3 to 5, 9999	0	
	31	Frequency jump 1A	Fjump 1A	0 to 120Hz, 9999	9999	
	32	Frequency jump 1B	Fjump 1B	0 to 120Hz, 9999	9999	
	33	Frequency jump 2A	Fjump 2A	0 to 120Hz, 9999	9999	
	34	Frequency jump 2B	Fjump 2B	0 to 120Hz, 9999	9999	
	35	Frequency jump 3A	Fjump 3A	0 to 120Hz, 9999	9999	
	36	Frequency jump 3B	Fjump 3B	0 to 120Hz, 9999	9999	
	37	Speed display	Dispunit	2, 4, 6, 8, 10, 11 to 9998	4	
	38	Automatic torque boost	A.TrqBst	0 to 200%	0%	
Multi-function output terminal functions	39	Automatic torque boost operation starting current	NoLoad I	0 to 500A	0A	
	40	Output terminal assignment	Selectop	0 to 9999	1234	
	41	Up-to-frequency sensitivity	SU Range	0 to 100%	10%	
	42	Output frequency detection	SetFU FW	0 to 120Hz	6Hz	
	43	Output frequency detection at reverse rotation	SetFU RV	0 to 120Hz, 9999	9999	
Second functions	44	Second acceleration/deceleration time	Ac/DecT2	0 to 3600 seconds/ 0 to 360 seconds	5 seconds	
	45	Second deceleration time	Dec.T2	0 to 3600 seconds/ 0 to 360 seconds, 9999	9999	
	46	Second torque boost	Trq.Bst2	0 to 30%, 9999	9999	
	47	Second V/F (base frequency)	VFbaseF2	0 to 120Hz, 9999	9999	
	48	Second stall prevention operation current	Stall2 I	0 to 150%	120%	
	49	Second stall prevention operation frequency	Stall2 F	0 to 120Hz	0	
Display functions	50	Second output frequency detection	SetFU 2	0 to 120Hz	30Hz	
	51	Inverter LED display data selection	Set LED	1 to 6, 8, 10 to 14, 17	1	
	52	PU main display data selection	Set Main	0, 17, 19, 20, 23, 24, 25	0	
	53	PU level display data selection	Set Lvl.	0 to 3, 5, 6, 8, 10 to 14, 17	1	

Note 1 : 6% (7.5K or down), 3%(11K or up)
2 : 5 seconds (7.5K or down), 15 seconds (11K or up)
3 : Rated inverter output current (A)

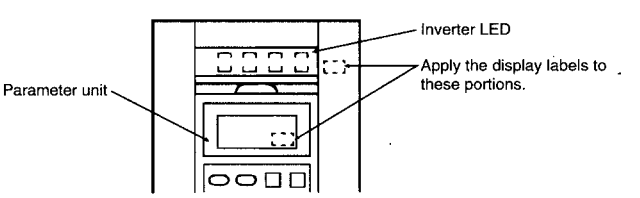
Setting Record (for FR-A100E series) Part 2

Function	Pr. No.	Name	Screen Display	Setting Range	Factory-Setting	Customer Set Value
Display functions	54	FM terminal function selection	Set FM	1 to 3, 5, 6, 8, 10 to 14, 17, 21, 101 to 103, 105, 106, 108, 110 to 114, 117, 121	1	
	55	Frequency monitoring reference	CalbFM F	0 to 120Hz	60Hz	
	56	Current monitoring reference	CalbFM I	0 to 500A	(Note 3)	
Automatic restart functions	57	Restart coasting time	RestrtT1	0.01 to 5 seconds, 9999	9999	
	58	Restart cushion time	RestrtT2	0 to 60 seconds	1.0 second	
Additional functions	59	Remote setting function selection	Rmt Set	0, 1, 2	0	
Operation selection functions	60	Intelligent mode selection	Int. Mode	0, 3, 4	0	
	61	Reference I for intelligent mode	Ref I	0 to 500A, 9999	9999	
	62	Ref. I for intelligent mode accel.	Acc I/I	0 to 150%, 9999	9999	
	63	Ref. I for intelligent mode decel.	Dcc I/I	0 to 150%, 9999	9999	
	65	Retry selection	Retry	0 to 5	0	
	66	Stall prevention operation reduction starting frequency	Stll coF	0 to 120Hz	60Hz	
	67	Number of retries at alarm occurrence	Retry No	0 to 10, 101 to 110	0	
	68	Retry waiting time	Retry t	0 to 10 seconds	1.0 second	
	69	Retry count display erasure	Retry N	0	0	
	71	Applied motor	SetMotor	0, 1, 2	0	
	72	PWM frequency selection	PWM F	0.7 to 14.5KHz	14.5KHz	
	73	0 to 5V, 0 to 10V selection	Extf/10V	0 to 5, 10 to 15	1	
	74	Response time for analog signal	IPfilter	0 to 8	1	
	75	Reset selection /PU disconnection detection/ PU stop selection	RES Mode	0, 1, 2, 3, 14 to 17	14	
	76	Alarm code output selection	Alarm OP	0, 1, 2, 3	0	
	77	Parameter write disable selection	EnableWr	0, 1, 2	0	
	78	Reverse rotation prevention selection	EnableFR	0, 1, 2	0	
	79	Operation mode selection	ContMode	0 to 5, 7, 8	0	
Commercial power supply switching functions	107	Commercial power supply switching sequence output terminal selection	———	0, 1, 2	0	
	108	MC switching interlock time	———	0 to 100.0 seconds	1.0 second	
	109	Restart waiting time	———	0 to 100.0 seconds	0.5 second	
	110	Commercial power supply switching selection at alarm occurrence	———	0.1	0	
	111	Automatic inverter-commercial power supply switching selection	———	0 to 60.0Hz, 9999	9999	
PI control functions	128	Forward-reverse action selection	PI Band	0, 1, 10, 11, 20, 21	0	
	129	PI proportional band	Intgrl T	0.1 to 1000%, 9999	100%	
	130	Integral time	PI Direc	0.1 to 3600 seconds, 9999	1.0 second	
	131	Upper limit value	PI UPlim	0 to 100%, 9999	9999	
	132	Lower limit value	PI LOlim	0 to 100%, 9999	9999	
	133	PI control set value setting for PU operation	PI Point	0 to 100%	0%	
Auxiliary functions	145	Parameter unit language switching	PU Lang	0, 1, 2, 3	0	
	152	Detection level	———	0 to 50%	5.0%	
	153	Detection time	———	0.05 to 1 seconds	0.5 second	
	154	Cumulative power monitoring clear	———	0	0	
	155	RT activated condition	RT set	0, 10	0	
	156	Stall prevent. select. at regeneration	Stll Prv	0 to 31, 100	0	
	157	OL signal waiting time	OL delay	0 to 25 seconds, 9999	0	
	158	AM terminal function selection	AM set	1 to 3, 5, 6, 8,10 to 14, 17, 21, 9999	9999	
	159	PWM f decrease at low speed	PWM3 f	0, 1, 2, 3	0	
Calibration functions	900	FM terminal calibration	FM Tune	—	—	
	901	AM terminal calibration	AM Tune	—	—	
	902	Frequency setting voltage bias	ExtVbias	0 to 10 V : 0 to 60Hz	(0V) : 0Hz	
	903	Frequency setting voltage gain	ExtVgain	0 to 10 V :1 to 120Hz	(5V) : 60Hz	
	904	Frequency setting current bias	Extlbias	0 to 20mA : 0 to 60Hz	(4mA) : 0Hz	
	905	Frequency setting current gain	Extlgain	0 to 20mA :1 to 120Hz	(20mA):60Hz	

MONITORING MODE DISPLAY LABELS

These are monitoring mode display labels for the parameter unit. To display the motor speed (rpm), line speed (m/min) or the like, apply the required labels on the left to the unit character portions "Hz", "V" according to the display unit.

rpm	rpm	r/min	r/min	V	V
A	A	Hz	Hz	kW	kW
m/min	m/min	l/min	l/min	m/min	m/min
%	%	×0.1	×0.1	×0.01	×0.01



Thank you for choosing the Mitsubishi Inverter.
This instruction manual gives handling information and precautions for use of this equipment. Incorrect handling might cause an unexpected fault. Before using the inverter, please read this manual carefully to use the equipment to its optimum.
Please forward this manual to the end user.

This section is specifically about safety matters

Do not attempt to install, operate, maintain or inspect the inverter until you have read through this instruction manual and appended documents carefully and can use the equipment correctly. Do not use the inverter until you have a full knowledge of the equipment, safety information and instructions.
In this instruction manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠ **WARNING**	Assumes that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ **CAUTION**	Assumes that incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause physical damage only.

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

SAFETY INSTRUCTIONS

1. Electric Shock Prevention

⚠ WARNING

- ⚠ While power is on or when the inverter is running, do not open the front cover. You may get an electric shock.
- ⚠ Do not run the inverter with the front cover removed. Otherwise, you may access the exposed highvoltage terminals and charging part and get an electric shock.
- ⚠ If power is off, do not remove the front cover except for wiring or periodic inspection. You may access the charged inverter circuits and get an electric shock.
- ⚠ Before starting wiring or inspection, switch power off, wait for more than 10 minutes, and check for no residual voltage with a tester or the like.
- ⚠ Use a class 3 or higher earthing method to earth the inverter.
- ⚠ Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- ⚠ Always install the inverter before wiring. Otherwise, you may get an electric shock or be injured.
- ⚠ Operate the switches with dry hands to prevent an electric shock.
- ⚠ Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise, you may get an electric shock.

2. Fire Prevention

⚠ CAUTION

- ⚠ Mount the inverter on an incombustible. Installing the inverter directly on or near a combustible could lead to a fire.
- ⚠ If the inverter has become faulty, switch power off on the inverter's power supply side. A continuous flow of a large current could cause a fire.
- ⚠ Do not connect the resistor directly to the DC terminals P, N. This could cause a fire .

3. Injury Prevention

⚠ CAUTION

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

4. Additional instructions

To prevent injury, damage or product failure, please note the following points.

(1) Transportation and mounting

⚠ CAUTION

- ⚠ Take care when carrying products, use correct lifting gear.
- ⚠ Do not stack the inverter boxes higher than the number recommended.
- ⚠ Ensure that installation position and material can withstand the weight of the inverter. Install according to the information in the Instruction Manual.
- ⚠ Do not operate if the inverter is damaged or has parts missing.
- ⚠ Do not lift the inverter with the front cover attached. It may fall off.
- ⚠ Do not stand or reset 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 impact.
- ⚠ Use the inverter under the following environmental conditions:

Environment	Conditions
Ambient temperature	–10°C to +50°C (non-freezing) (–10°C to +40°C when the dust-protection structure attachment is used)
Ambient humidity	90%RH or less (non-condensing)
Storage temperature	–20 to +65°C*
Ambience	Indoors, free from corrosive gas, flammable gas, oil mist, dust and dirt.
Altitude, vibration	Max. 1000m above sea level, 5.9m/S^2(0.6G) or less (conforming to JIS C 0911)

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

(2) Wiring

⚠ CAUTION

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

(3) Trial run

⚠ CAUTION

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

(4) Operation

⚠ CAUTION

- ⚠ While the retry function is selected, keep away from the equipment because it will start suddenly after an alarm stop.
- ⚠ The stop key is valid only when function setting has been made. Prepare an emergency stop switch separately.

⚠ CAUTION
⚠ Switch off the start signal when resetting the inverter. Failure to do so may start the motor immediately after reset. ⚠ The load used must be a three-phase induction motor. If any other electrical equipment is connected to the inverter output, the equipment may be damaged. ⚠ Do not modify the equipment.

⚠ CAUTION
⚠ The electronic motor thermal protection does not guarantee to prevent motor burn out. ⚠ Do not use a contactor on the inverter input for frequent starting/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 that electromagnetic radiation from the inverter does not damage or affect the operation of nearby electrical equipment. ⚠ Take adequate measures, e. g. install a reactor, to prevent power harmonics generated by the inverter, which may cause the power capacitor and generator to overheat or burn. ⚠ An inverter-driven 400V class motor should be insulation-enhanced. Surge voltages attributable to the wiring constant may occur at motor terminals, deteriorating the insulation of the motor. ⚠ When parameter clear or all parameter clear is performed, each parameter returns to the factory setting. Re-set the required parameters before starting operation. ⚠ The inverter can be easily set for high-speed operation. Before changing its setting, fully examine the performances of the motor and machine. ⚠ The inverter does not have a holding stop facility. For emergency stop another circuit must be used.

(5) Emergency stop

⚠ CAUTION
⚠ Provide a safety backup such as an emergency brake which will prevent the machine and equipment from hazardous conditions if the inverter fails.

(6) Maintenance, inspection and parts replacement

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

(7) Disposing of the inverter

⚠ CAUTION
⚠ Treat as industrial waste.

(8) General instructions

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

CONTENTS

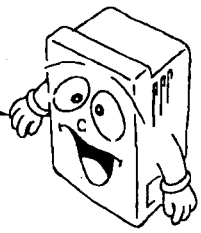
1. OUTLINE

This chapter provides details the "outline" of this product.
Always read the precautions, etc., before starting use.

1.1 PRE-OPERATION PROCEDURE

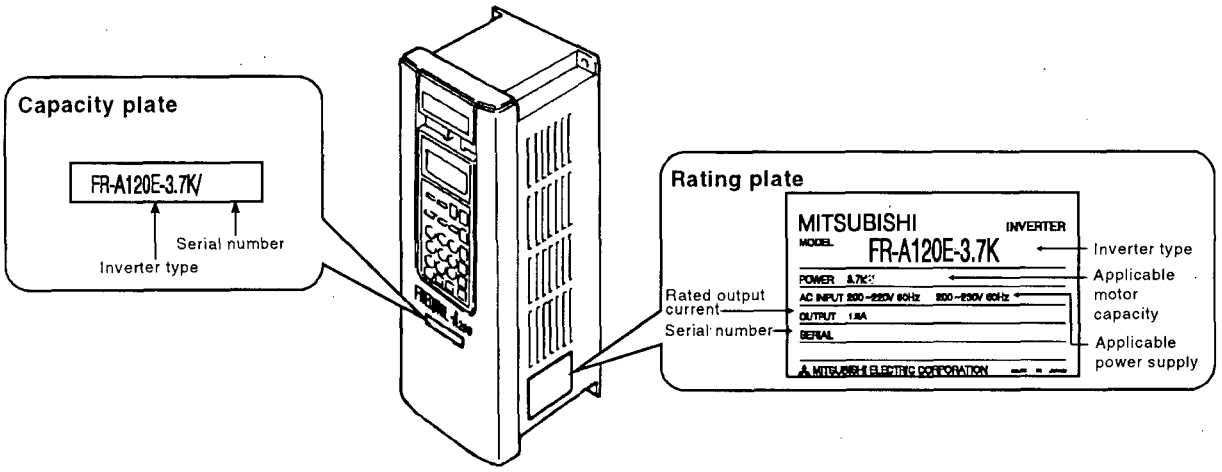
1.1.1 Pre-operations for Operation

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.



1. Unpacking and product check

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



- **Type definition**

FR- A120E - 3.7 K P

Symbol	Voltage Series
A120E	200V
A140E	400V

Symbol	Applicable Motor Capacity
0.75 to 55	Cpacity in "kW"

(Note)

Symbol	Parameter Unit
P	With parameter unit
None	None

Note: Inverters 11K and up are not equipped with the parameter unit as standard. For these models, the parameter unit is available as 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 to be prepared depend on how the inverter is operated. For required parts, etc. see Page 28 "INSTRUMENTS AND PARTS TO BE PREPARED FOR OPERATION".

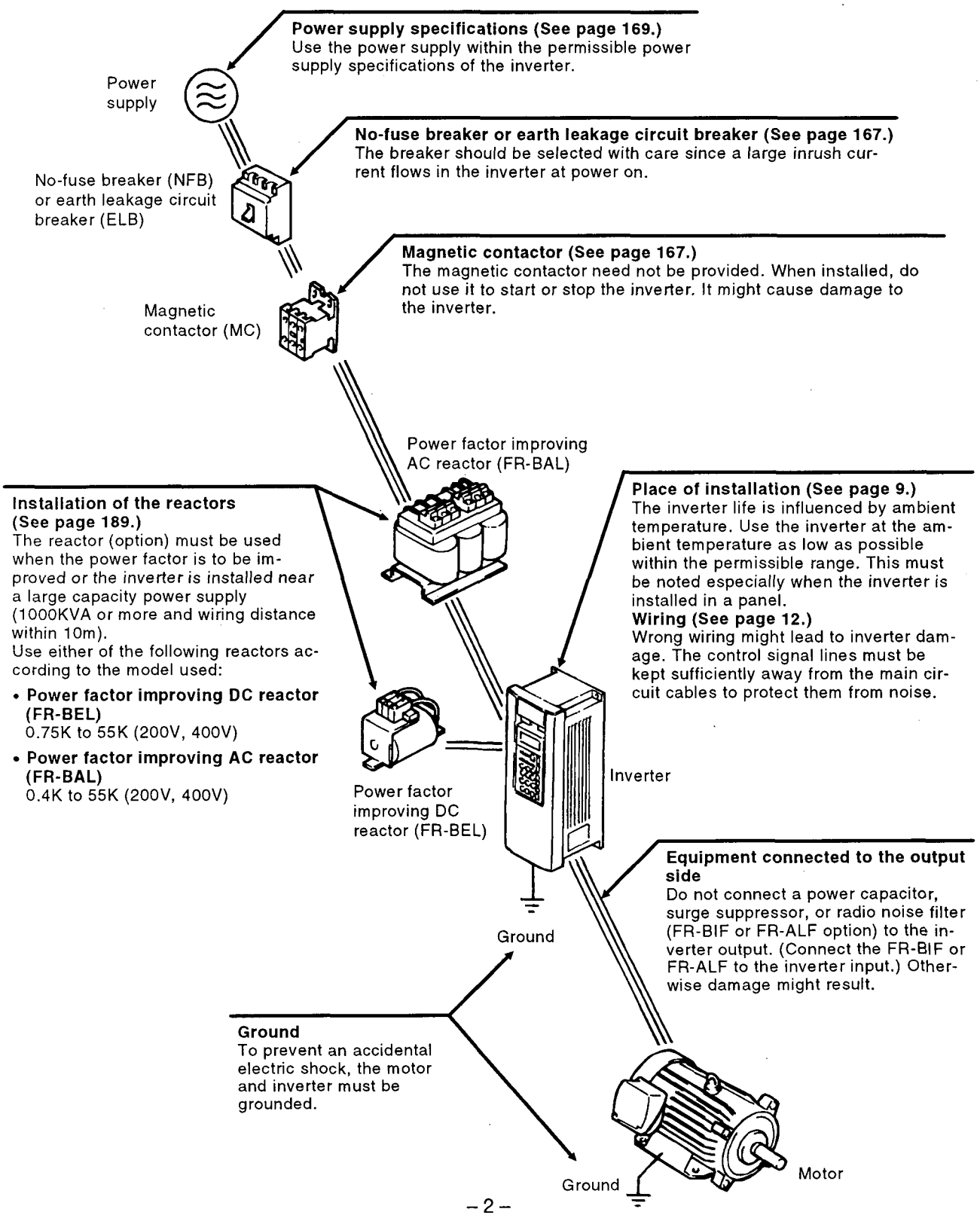
3. Installation

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

4. Wiring

Connect the power supply, motor and operation signals (control signals) to the terminal block. If they are connected improperly, the inverter itself may be damaged. (See page 12.)

1.1.2 Precautions for Handling the Inverter

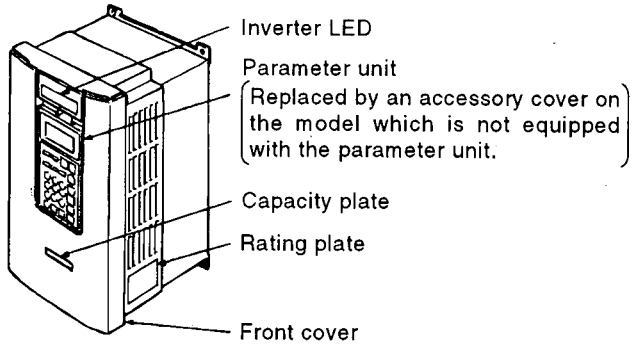


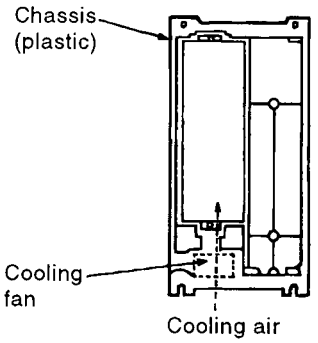
1.2 STRUCTURE

1.2.1 Structure

For the location of the charge lamp, see the terminal block layout diagram on page 175.

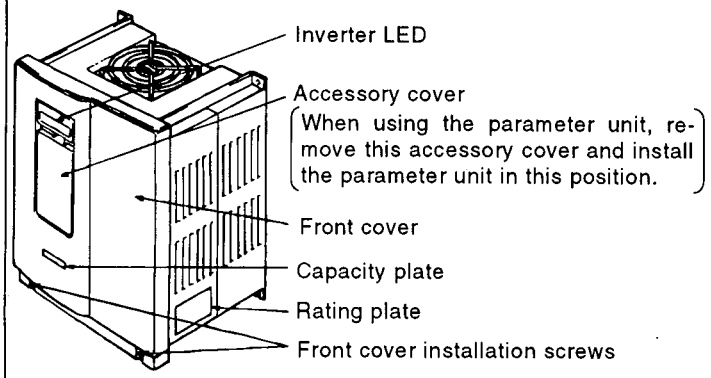
■ FR-A120E-0.75K(P) to 11K, FR-A140E-0.75K(P) to 11K
(Not equipped with the brake resistor.)

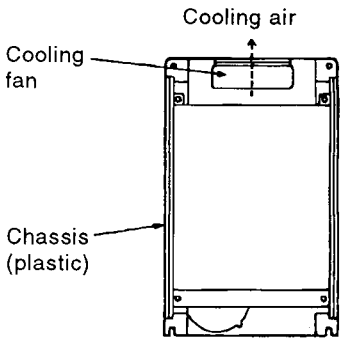




<FR-A120E-3.7K rear view>

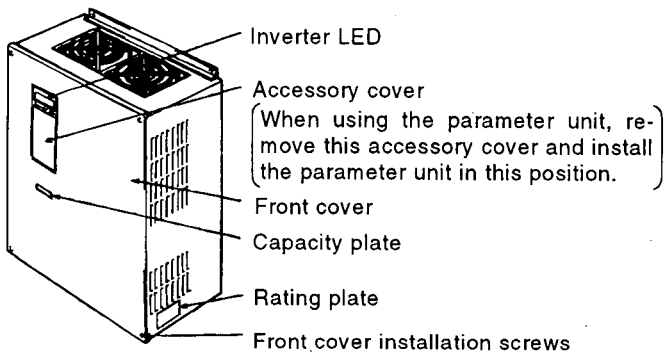
■ FR-A120E-15K to 30K, FR-A140E-15K to 22K
(Not equipped with the brake resistor.)





<FR-A120E-15K rear view>

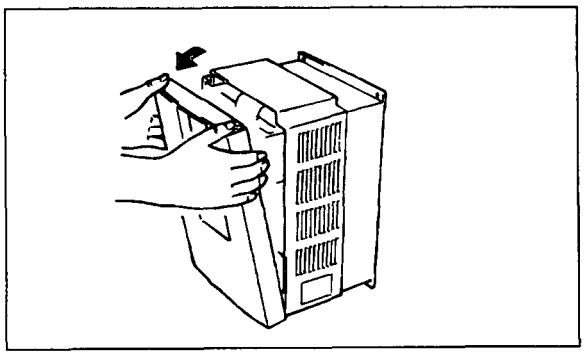
■ FR-A120E-37K to 55K, FR-A140E-30K to 55K
(The chassis and cover are made of steel. These models are not equipped with the brake resistor.)



1.2.2 Removal and Reinstallation of the Front Cover

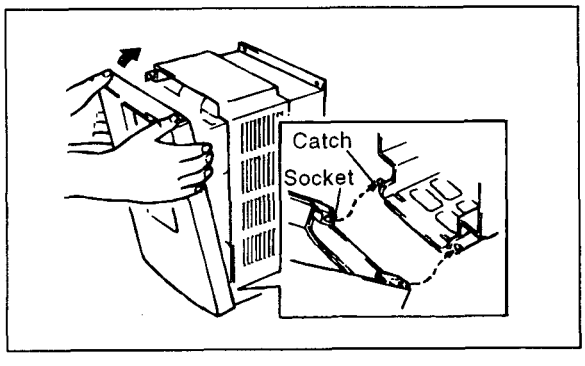
■ **FR-A120E-0.75K(P) to 11K, FR-A140E-0.75K(P) to 11K**

• 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.)

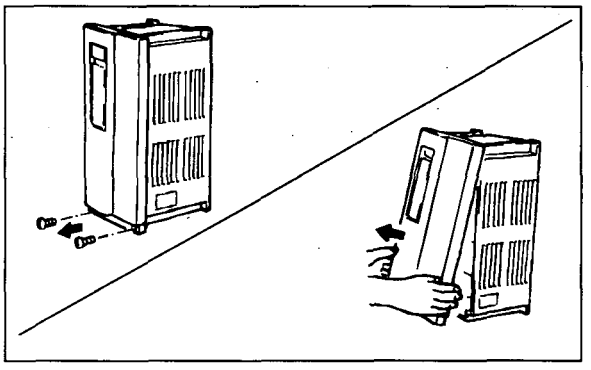
• Reinstallation



1) Fit the sockets at the cover 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.)

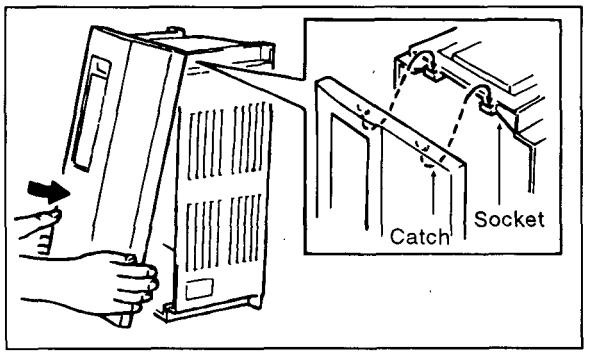
■ FR-A120E-15K to 30K, FR-A140E-15K to 22K

• Removal

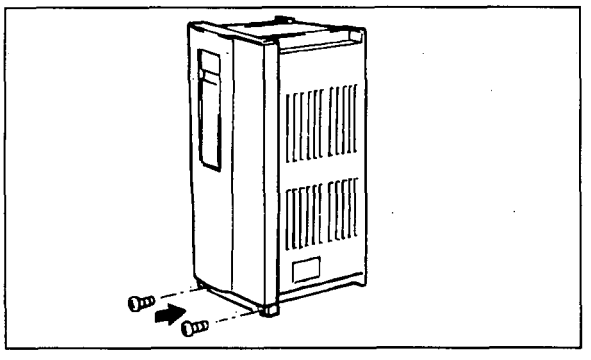


1) Remove the two installation screws at the bottom of the front cover.
2) Hold both ends of the front cover bottom and pull the cover toward you.

• Reinstallation



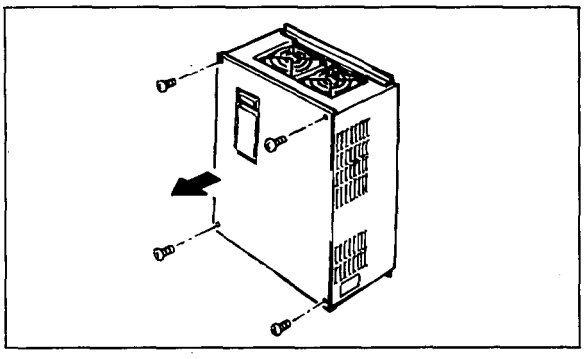
1) Fit the catches on the inside of the front cover top into the sockets of the inverter.
2) Securely press the cover against the inverter.



3) Fix the cover with the bottom installation screws.

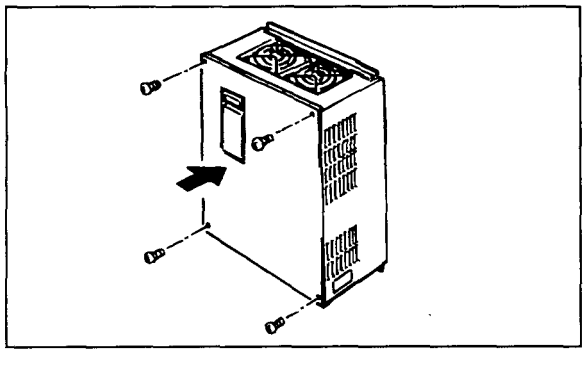
■ FR-A120E-37K to 55K, FR-A140E-30K to 55K

- **Removal**



1) Remove the front cover installation screws.

- **Reinstallation**

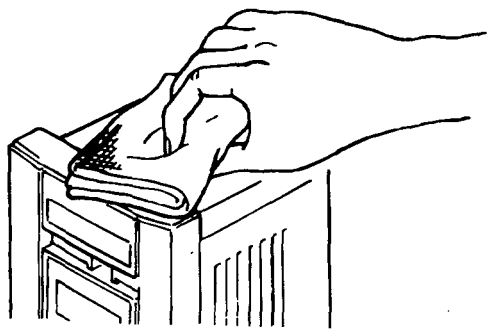


1) Fix the front cover with the installation screws.

Note: 1. Fully check that the front cover has been reinstalled securely.
2. The same serial number is printed on each of 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 the cover removed is reinstalled to the inverter from where it had been removed.

Example:
Capacity plate A46150
Rating plate A46150 001
3-digit serial number

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

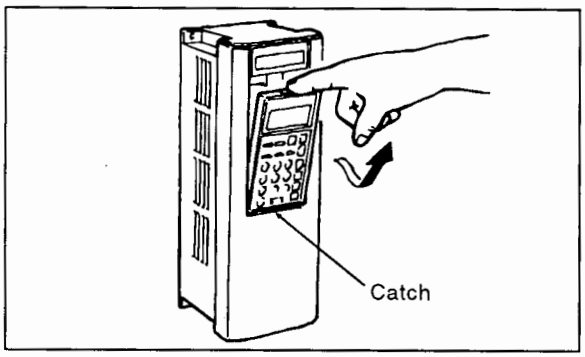


Note: 1. Do not use any solvent, such as acetone, benzene, toluene and alcohol, that will cause the inverter surface to dissolve and the paint to peel.
2. Do not clean the lens of the inverter LED with a detergent or alcohol.

1.2.3 Removal and Reinstallation of the Parameter Unit

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

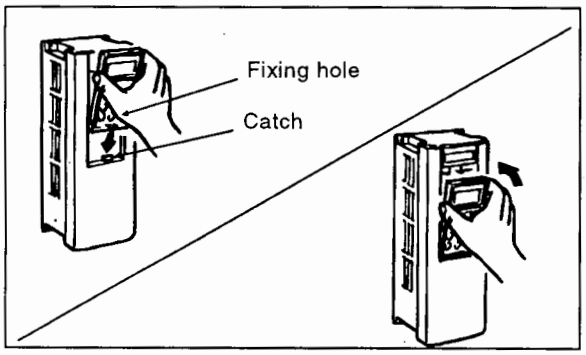
■Removal



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

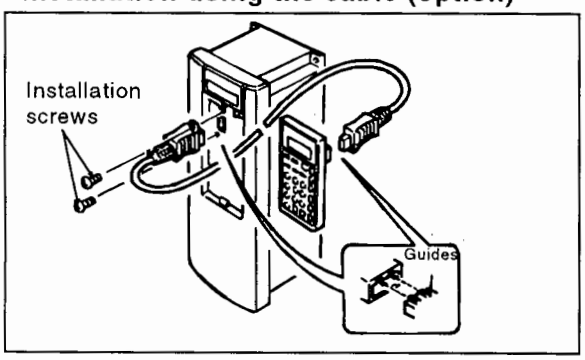
■ Reinstallation

•Direct installation onto the inverter



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

• Installation using the cable (option)



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

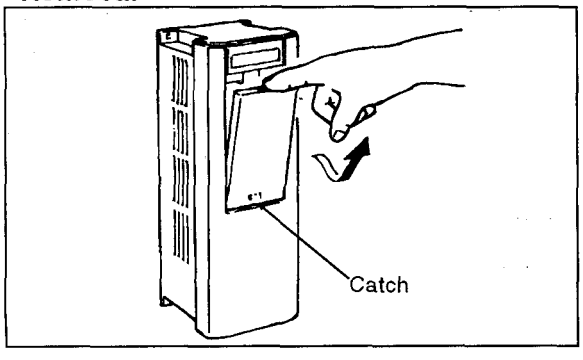
Note: 1. The parameter unit must be installed to the inverter with the front cover fitted.
2. During installation, do not apply force to the display (liquid crystal).

1.2.4 Removal and Reinstallation of the Accessory Cover

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

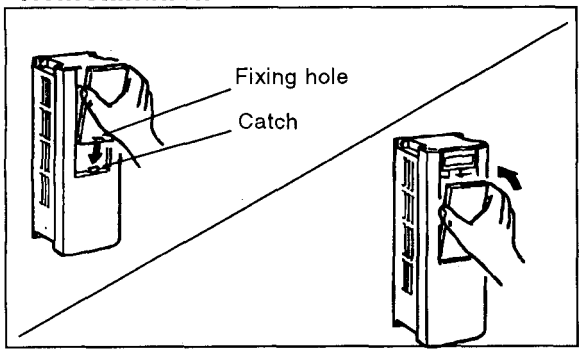
■

• **Removal**



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

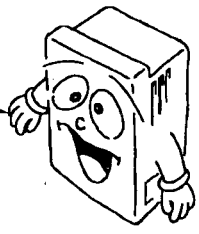
• **Reinstallation**



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

1.3 INSTALLATION AND WIRING

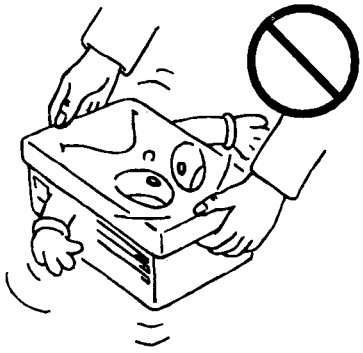
Incorrect installation or connection might cause the inverter to operate improperly, and in some cases, its life to be reduced considerably. In the worst case, the inverter will be damaged. Please handle the inverter properly in accordance with the information, precautions and instructions contained in this manual.



1.3.1 Operation Environmental Conditions

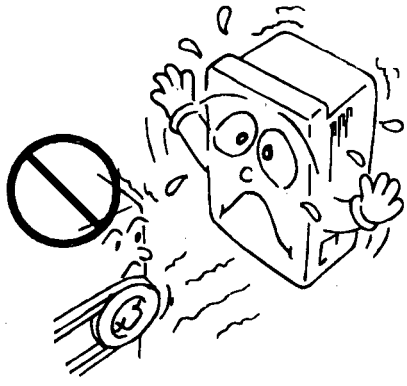
Handle the unit carefully.

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



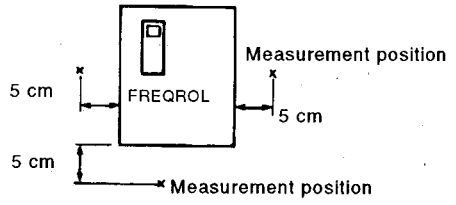
Install the inverter where it is not subjected to vibration.

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



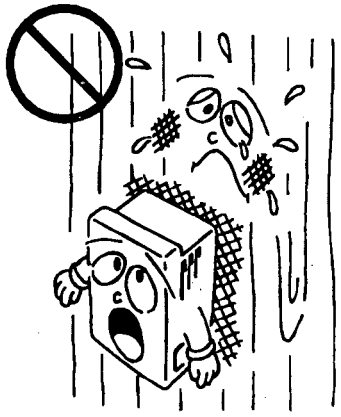
Note on ambient temperature.

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.



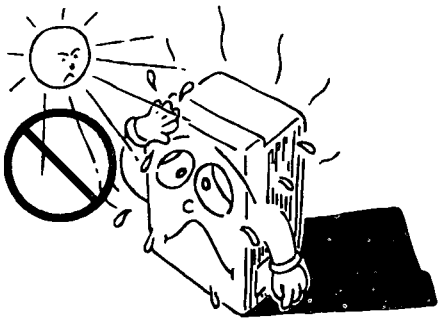
Install the inverter on a non-combustible surface.

Install the inverter on a non-combustible surface (e.g. metal).

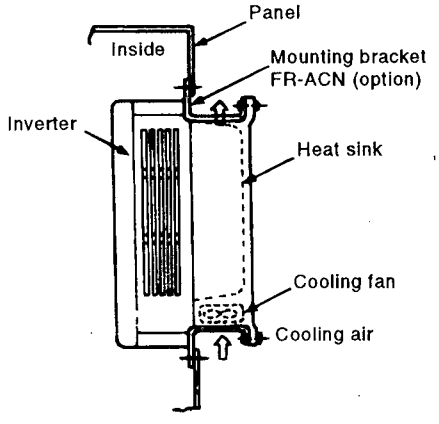


Avoid high temperature and high humidity.

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



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



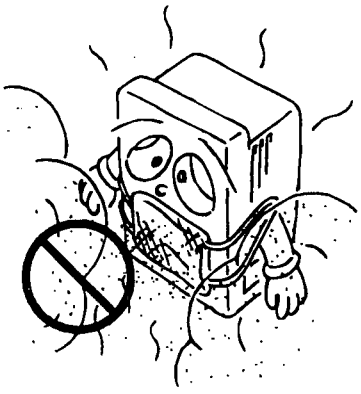
Note: 1. Use the optional mounting bracket (FR-ACN) (see page 187.). The mounting area should be machined to the panel cutting dimensions on page 179.
2. The cooling section outside the panel has the cooling fan. Do not use the inverter in environments having waterdrops, oil mist, dust, etc.

The installation holes for the FR-Z series can be used as they are.

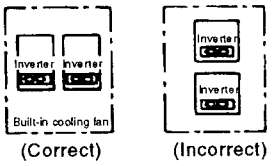
The A100E inverter can be installed as it is by using the optional mounting bracket (FR-AAT attachment) (see page 188.). The installation direction and clearances remain unchanged.

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

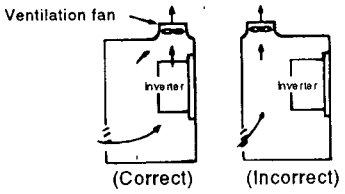
Install the inverter in a clean place or inside a totally enclosed panel which does not accept any suspended matter.



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 170).
2. When two or more inverters are installed or a ventilation fan is mounted in the panel, extreme care must be taken to keep the ambient temperature of the inverter below the permissible value. If the inverters and/or ventilation fan is installed in an improper position, the ambient temperature will rise and ventilation effect will reduce.



Installation of Two or More Inverters

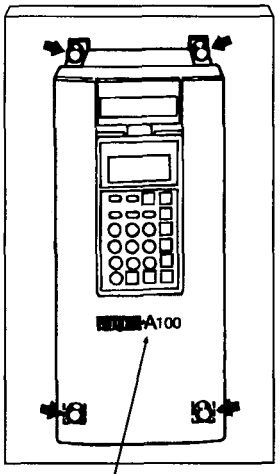


Position of Ventilation Fan

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.

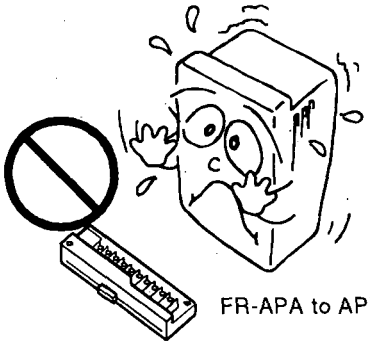
Install the inverter on an installation surface securely and vertically (so that the letters FREQROL-A100 are located at the front) with screws or bolts.



Located at front.

Never connect any of the inboard options (FR-APA, APB, APC, APD, APE) designed for exclusive use with the FR-A100/A200.

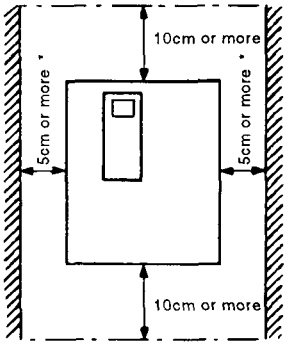
Any of the inboard options for exclusive use with the FR-A200 must not be connected to the FR-A100E. If it is connected, the inverter and option will be damaged.
The option connected must be the inboard option designed for exclusive use with the FR-A100E/A200E (FR-EPB, EPC, EPD, EPE, EPG, EPH).

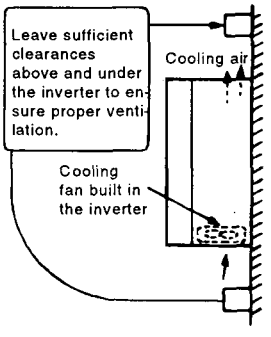


FR-APA to APE

Leave sufficient clearances around the inverter.

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

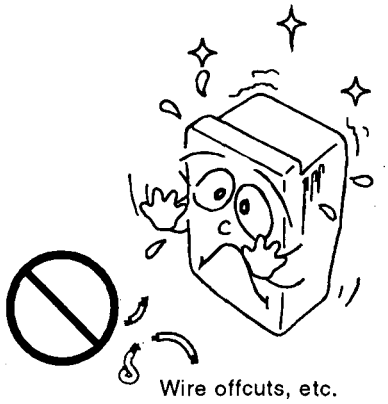




*: 1cm or more for the models 3.7K and down

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

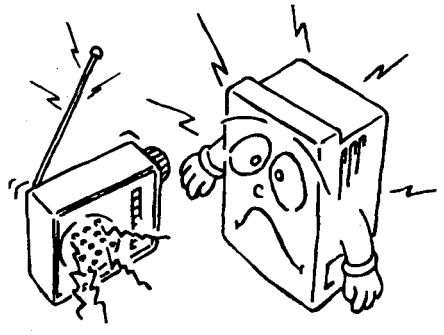
Wire offcuts will lead to a fault, failure or malfunction.
Keep the inverter clean.



Wire offcuts, etc.

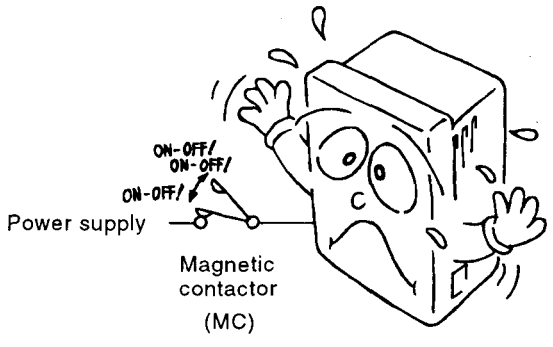
Electric wave interference

High frequency components contained 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 (for use on the input side only) or the FR-BSF01 or FR-BLF line noise filter to reduce such interference.



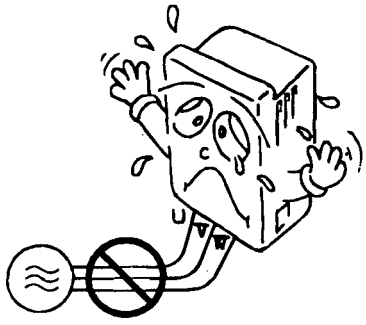
Do not use the magnetic contactor on the power supply side to make frequent starts and stops of the motor (inverter).

Frequently repeated on/off of the magnetic contactor will lead to an inverter fault. Where possible, use the start signal of the inverter.

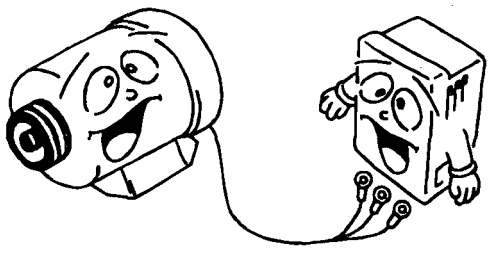


1.3.2 Wiring Instructions

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

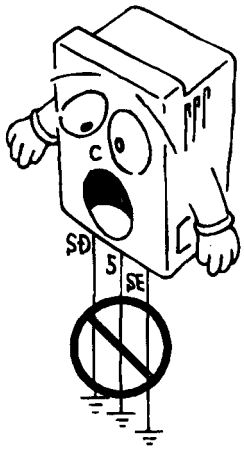


Use sleeved solderless terminals for the power supply and motor cables.



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

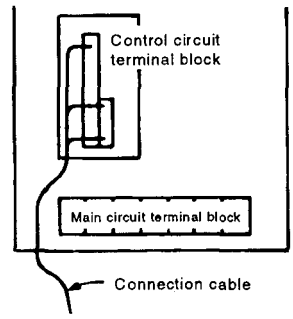
Common terminals SD, 5 and SE of the control circuit.



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

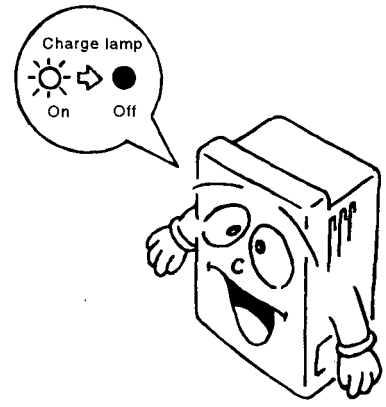
Run them away from the main and power circuits (such as 200V relay sequence circuit).

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



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

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



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

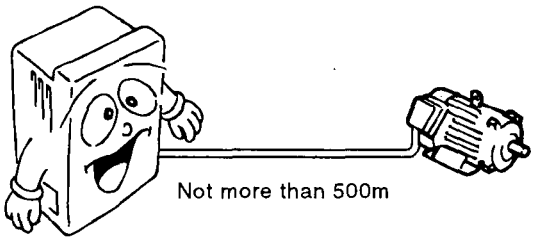
If the cable size used is 1.25mm^2 or more, the front cover may expand, resulting in a contact fault of the parameter unit. This fault is indicated by the following message displayed on the parameter unit and disables operation from the parameter unit. Run the cables so that they do not occupy much of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

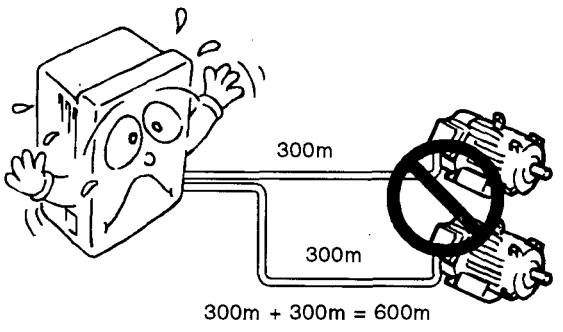
Parameter unit display

PU to Inverter comms. Error Inv. Reset ON

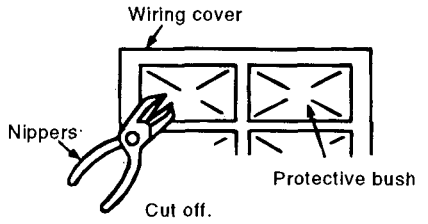
The maximum wiring length should be within 500m.

Especially for long-distance wiring, the maximum wiring length should be not more than 500m. Otherwise, the overcurrent protection may be activated accidentally as a result of a charging current generated by the stray capacitance of the wiring or the equipment connected to the secondary circuit may malfunction or become faulty. (For connection of more than one motor, the total wiring length should be within 500m.)



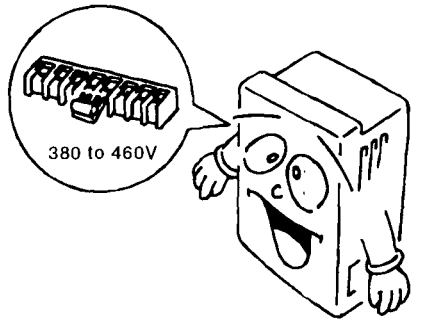


Cut off the wiring cover (protective bush) windows using nippers or a cutter when running the cables.



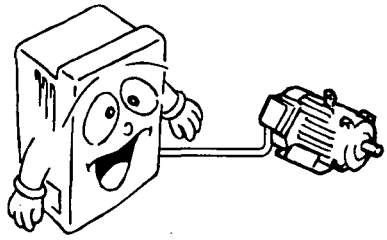
When the power supply voltage is special (342V or below, 484V or above), change the connection of the jumper in the internal transformer. (15K to 55K (400V class)) (This change is not required for 11K or less.)

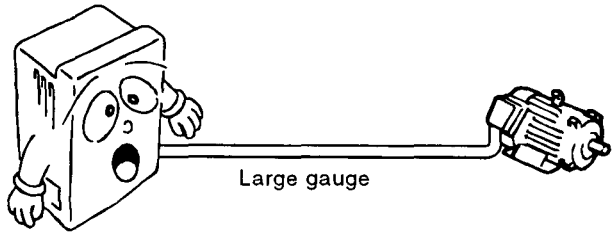
If the connection is not changed, the inverter will be damaged. (See page 20)



Use a large gauge for the main circuit cables to keep the voltage drop within 2%.

When the wiring distance between the inverter and motor is long especially at the time of low frequency output, a voltage drop over the main circuit cables will reduce the motor torque. (A selection example for the wiring distance of 20m is given on page 167.)

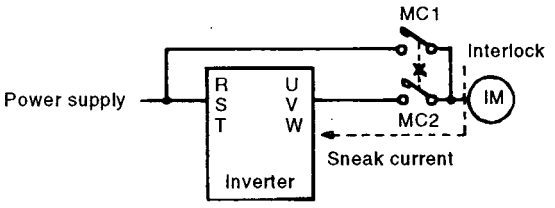




1.3.3 Design Information to be Checked

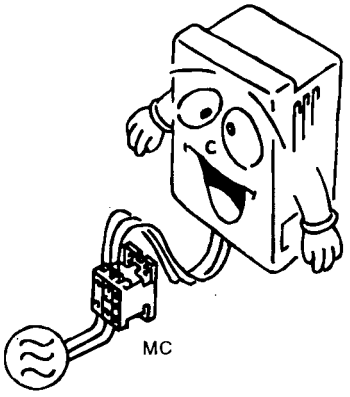
Provide electrical and mechanical interlocks for MC1 and MC2 which are used for commercial power supply-inverter switch-over.

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



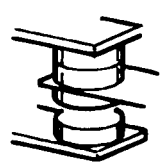
When a machine restart is to be prevented at power restoration after a power failure, provide a magnetic contactor MC in the primary circuit of the inverter and also make up a sequence which will not switch on the start signal.

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

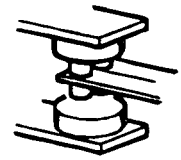


When connecting the control circuit to a power supply separately from the main circuit, make up a circuit so that when the power supply terminals R1, S1 for the control circuit are switched off, the main circuit power supply terminals R, S, T are also switched off.
Refer to page 16 for connection.

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

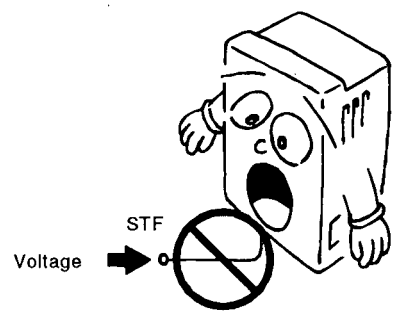


Micro signal contacts



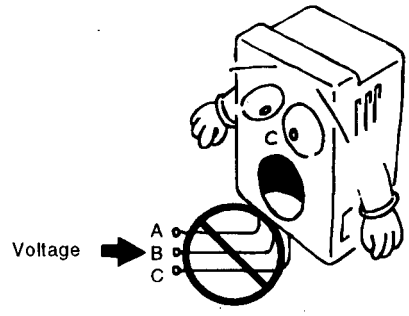
Twin contact

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



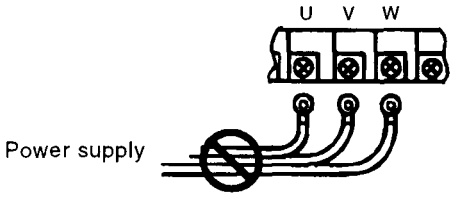
Do not apply a voltage directly to the alarm output signal terminals (A, B, C).

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



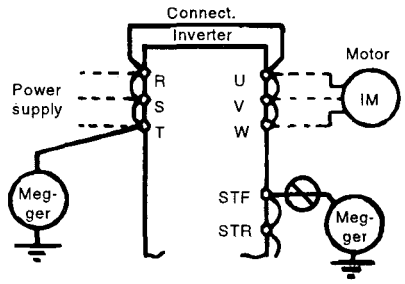
The inverter will be damaged if the power supply voltage is applied to the output side of the inverter.

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.



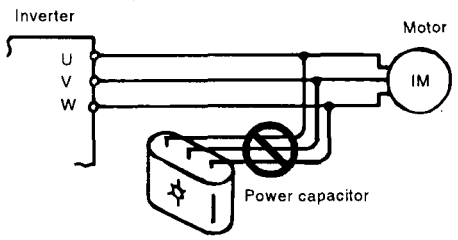
Do not perform the insulation resistance test on the control circuits of the inverter.

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.



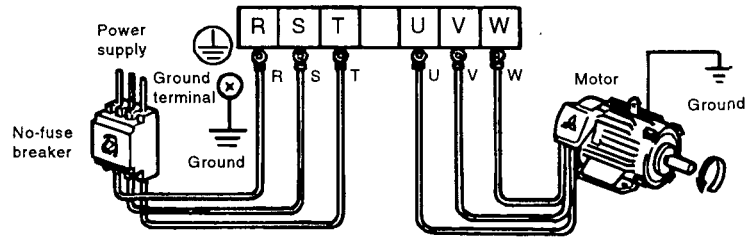
Do not install the power capacitor, surge suppressor, and radio noise filter (FR-BIF option) on the output side of the inverter.

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



1.3.4 Wiring of the Main Circuit
(For the terminal block arrangement, see pages 175, 176.)

Connection of the power supply and motor



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

(Phase sequence need not be matched.)

(For use with a single-phase power supply; the power supply cables must be connected to R and S.)

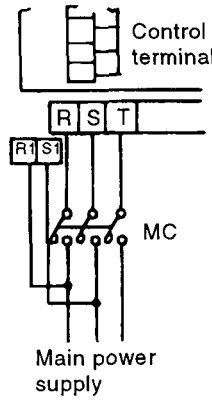
Connect the motor to U, V, W.
In the above connection, turning on the forward rotation switch (signal) rotates the motor in the counterclockwise (arrow) direction when viewed from the load shaft.

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

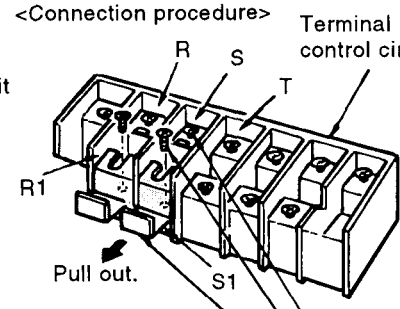
If the magnetic contactor (MC) in the inverter power supply is opened when the protective circuit is operated, the inverter control circuit power is lost and the alarm output signal cannot be kept on. To keep the alarm signal on, terminals R1 and S1 are available. In this case, connect the power supply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

• Model FR-A120(140)E-0.75K(P) to 3.7K(P)

<Circuit diagram>



<Connection procedure>

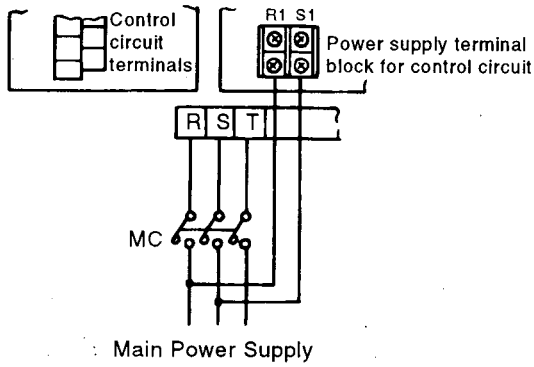


1) Loosen the upper screw.
2) Remove the lower screw.
3) Pull out the jumper.
4) Connect the cable of the other power supply to the lower terminal (R1, S1). (Note 2)

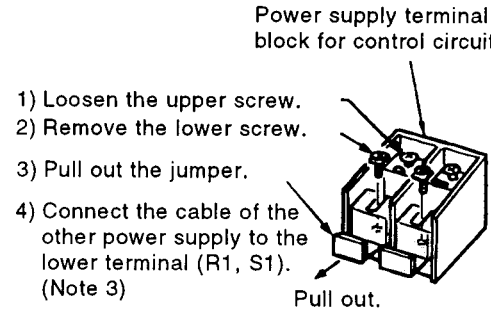
Note: 1. When the main circuit power (terminals R, S, T) is on, do not switch off the control power (terminals R1, S1), otherwise the inverter will be damaged.
2. To use a separate power supply, the jumpers between R-R1 and S-S1 must be removed.

• Model FR-A120(140)E-5.5K(P) to 55K

<Circuit diagram>



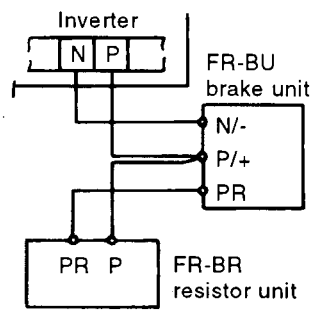
<Connection procedure>



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

Connection of the FR-BU brake unit (option)

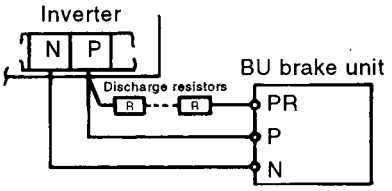
Connect the optional FR-BU brake unit as shown below to improve the braking capability during deceleration.
<Connection method>



Note: 1. Connect the inverter terminals (P, N) and FR-BU brake unit terminals so that their symbols match with each other. (Incorrect connection will damage the inverter.)
2. The wiring distance between the inverter, brake unit and resistor unit should be within 5m. If twisted wires are used, the distance should be within 10m.

Connection of the conventional BU brake unit (option)

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



Note: 1. The wiring distance between the inverter, brake unit and discharge resistors should be within 2m. If twisted wires are used, the distance should be within 5m.

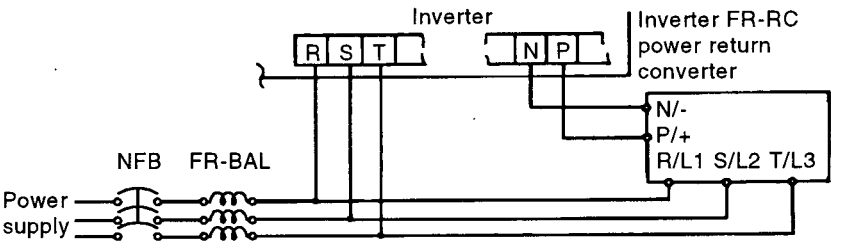
Connection of the FR-RC power return converter (option)

For power coordination, always install the power factor improving AC reactor (FR-BAL).

Connection of the FR-BAL power factor improving AC reactor (option)

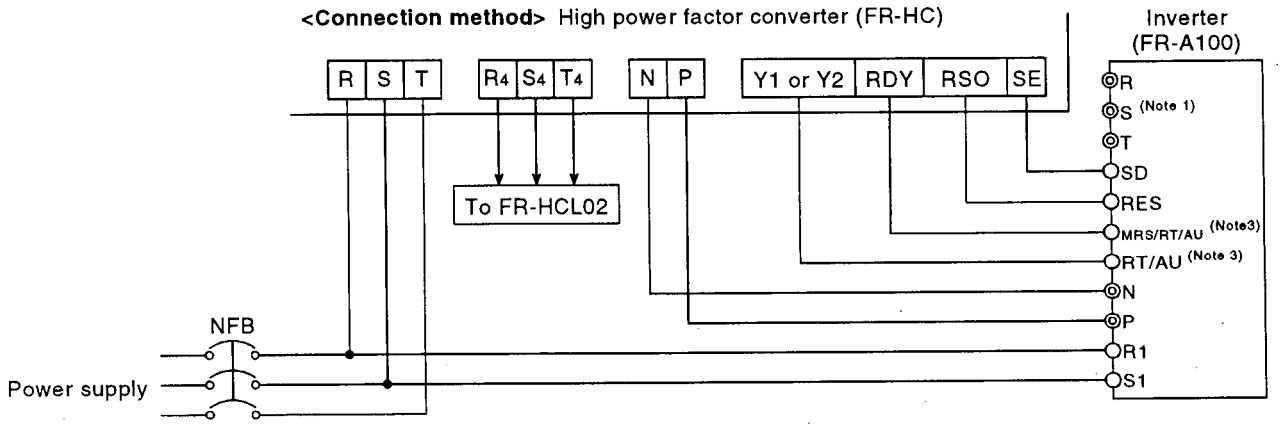
When using two or more inverters within the same system, small wiring impedance between the inverters may cause a regenerative current from the power return converter to sneak, resulting in the overcurrent alarm of the other inverters. Therefore, install the power factor improving AC reactors together on the power supply side.

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



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

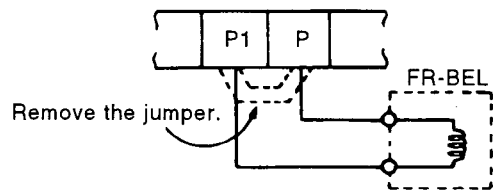
When connecting the high power factor converter (FR-HC) for power harmonic suppression, wire it securely as shown below. Incorrect wiring will cause the high power factor converter and inverter to be damaged. After connecting it securely, set "3" or "4" or "5" in Pr. 30 "high power factor converter connection selection". (Refer to page 78)



Note: 1. Always keep the inverter's power input terminals R, S, T open. Accidental connection will damage the inverter. Also, incorrect polarity of terminals N, P will damage the inverter.
2. When connecting the FR-HC converter, always match the voltage phases of terminals R, S, T and terminals R4, S4, T4.
3. Please set Pr. 30 "high power factor converter connection selection" to select the terminals connect to the high power factor converter's terminals RDY, Y1 or Y2.
4. The high power factor converter (FR-HC) has a regenerative converter capability and cannot be used with the FR-RC regenerative converter.

Connection of the power factor improving DC reactor (option)

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



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

Where the power supply is special (342V or below, 484V or above) for the 400V class 15K 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 11K and below.)

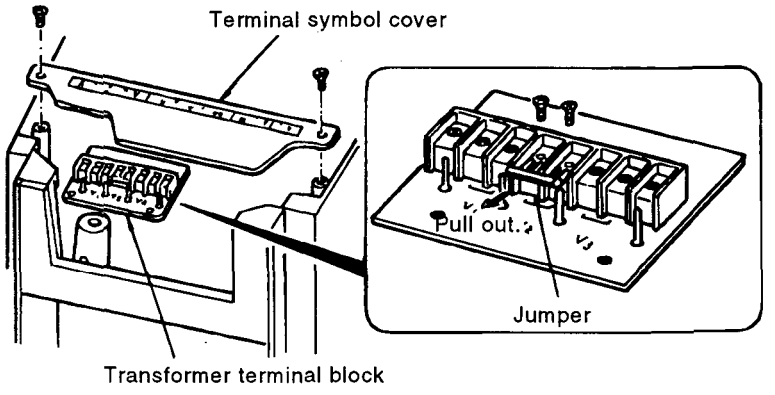
■ Voltage Range vs. Jumper Position

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

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

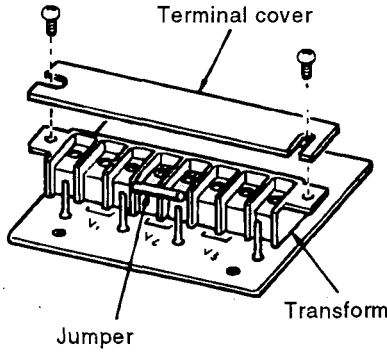
■ Changing the jumper position

• Model FR-A140E-15K to 22K



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-A140E-30K to 55K



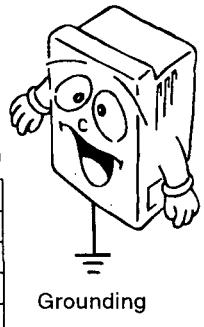
1) Remove the terminal cover of the internal transformer located under the main circuit terminal block (R, S, T).
2) After removing the screws from the jumper in the terminal block, reconnect the jumper in accordance with the operating voltage in the above table.

Notes on Grounding

- The motor and inverter must be grounded (200V class.....class 3 grounding, grounding resistance 100Ω or less, 400V class.....special class 3 grounding, grounding resistance 10Ω or less) to prevent an electric shock.
- Connect the ground cable for the inverter to the exclusively used ground terminal. (Do not use the screws of the case, chassis, etc.)
- Use a ground cable size as large as possible which is equal to or larger than that indicated in the table, right. The grounding point should be as near as possible to the inverter to minimize the ground cable length.

(Unit: mm^2)

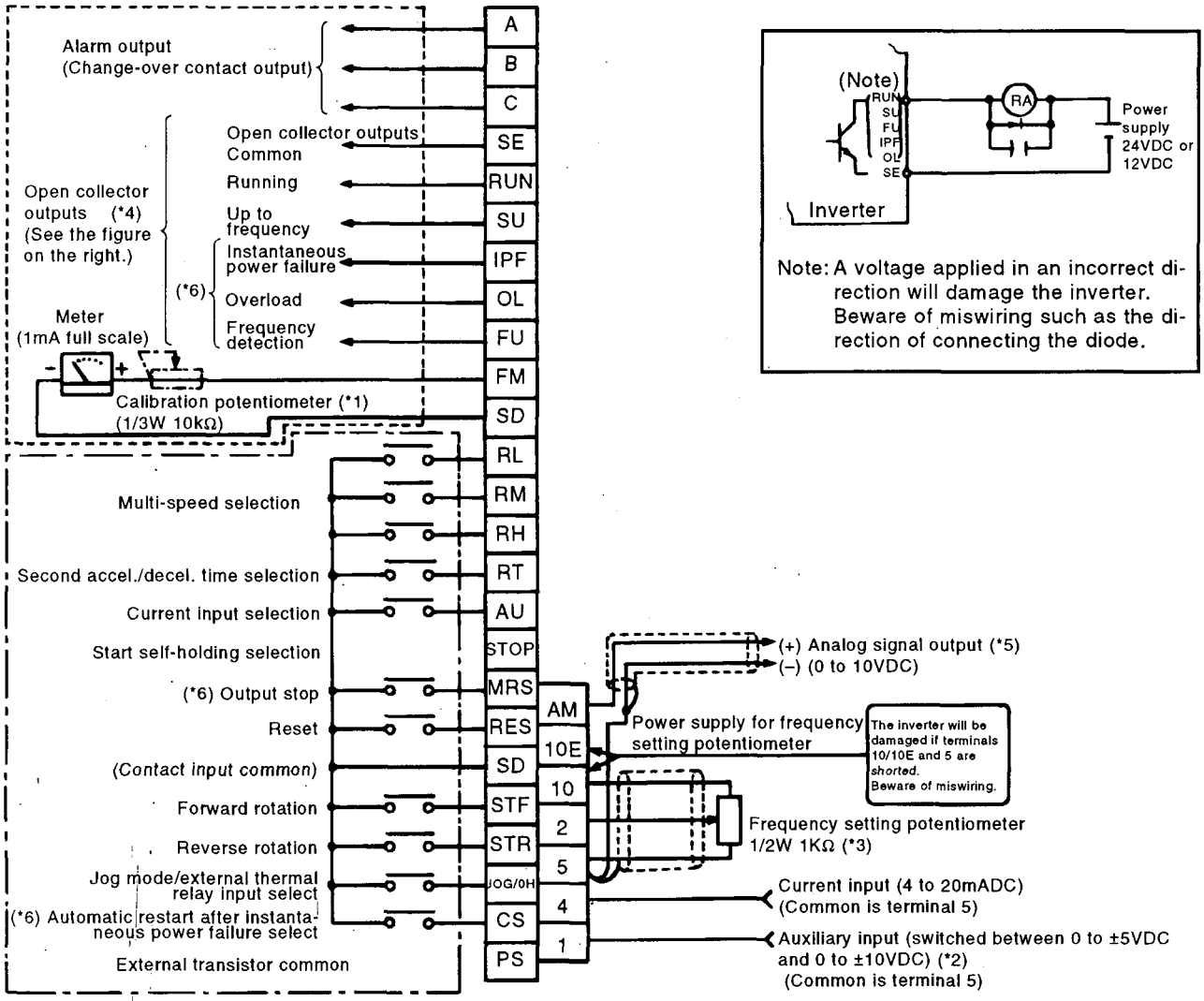
Motor Capacity	Ground Cable Size	
	200V class	400V class
3.7kW or less	3.5	2
5.5, 7.5kW	5.5	3.5
11 to 15kW	14	8
18.5 to 37kW	22	14
45, 55kW	38	22



- For connection with the ground terminal of the motor, use one wire of the four core cable grounded at the inverter end.

1.3.5 Wiring of the Control Circuit
(For the terminal block arrangement, see page 175.)

Output signals

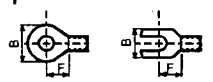


Note: A voltage applied in an incorrect direction will damage the inverter. Beware of miswiring such as the direction of connecting the diode.

Control input signals (Do not apply voltage to any terminals.)

*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 1KΩ is recommended when the frequency setting is changed frequently.
*4. The output terminals other than the running (RUN) terminal allow alarm definition to be output in alarm codes and 10 different functions to be assigned individually. (See Pr. 40 and Pr. 76.)
*5. FM-SD and AM-5 functions can be used simultaneously. (See Pr. 54 and Pr. 158.)
*6. When the commercial power supply-inverter switching function is selected, this terminal provides a function different from its ordinary function (refer to Pr. 107 to 111).

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

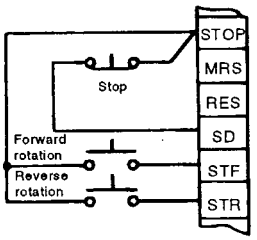


Nominal	B (mm)	F (mm)
1.25-3	6.4 or less	5.3 or more

Note: Round crimping terminal V1.25-MS3
(Japan Solderless Terminal)

Using the STOP terminal

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



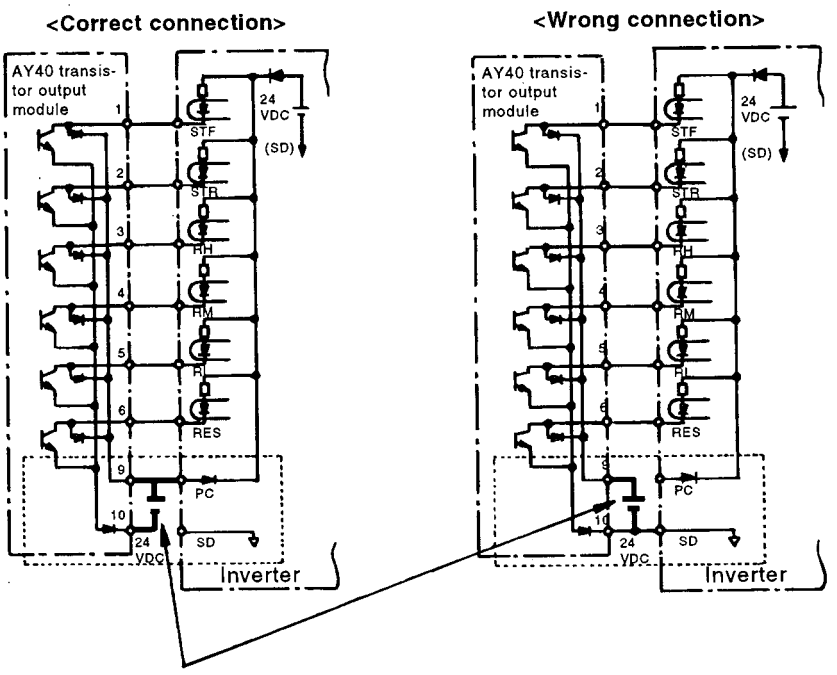
Using the CS terminal

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

(Connect)

Using the PC terminal

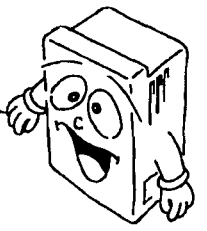
This terminal is used to connect transistor output (open collector output) such as a programmable logic controller (PLC). Connecting the external power supply common for transistor output to the PC terminal prevents a faulty operation caused by a sneak current.(The power supply voltage of the PC terminal connected should be 24VDC.)



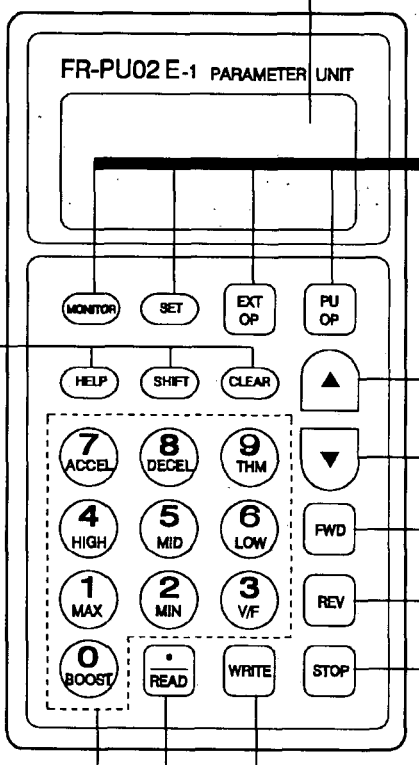
The AY40 module requires a 24VDC power supply.

1.4 PARAMETER UNIT

The FR-PU02E-1 parameter unit is installed directly to the FR-A100 series inverter or connected to it by a cable (option) and allows operation to be performed, functions to be selected (set values to be read/written), the operating status to be monitored, and alarm definition to be displayed. In addition, the FR-PU-02E-1 has a troubleshooting function, help function and parameter graphic display function. The FR-PU02E-1 parameter unit is hereinafter referred to as the PU.



1.4.1 Structure of the Parameter Unit



Help key (See page 45.)

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

Clear key

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

Shift key

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

Display

- 13 character x 4 line liquid crystal display screen for showing parameter graphic display and troubleshooting as well as monitoring 17 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.

Function and numeral keys

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

Operation command keys

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

Read key

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

Write key

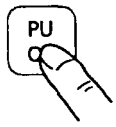
- Used to write a set value in the setting mode.
- Serves as a clear key in the all parameter clear or alarm history clear mode.
- Acts as a reset key in the inverter reset mode.

1.4.2 Precautions for Using the Parameter Unit

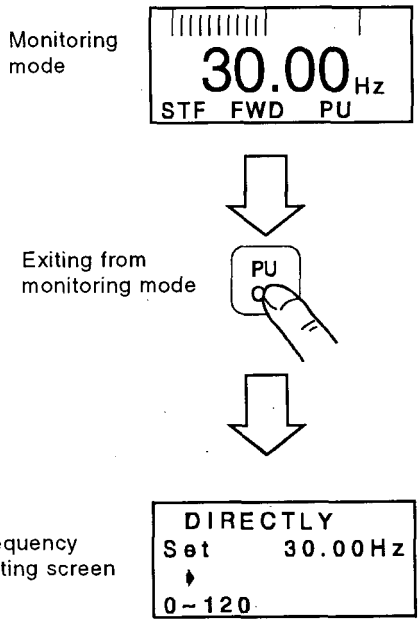
When using the PU, note the following points to make proper settings and enter correct values.

Instructions for operation performed from the PU

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



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



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

Instructions for monitoring

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

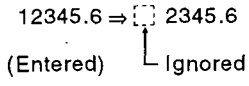
Instructions for the operation modes

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

- When "0" is in the operation mode select parameter (Pr. 79), switching the inverter power off, then on or resetting the inverter switches it to the external operation mode.

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

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



Instructions for writing set values

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

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

- In addition to the above, set values cannot be written when:
  (1) Parameter write disable (Pr. 77) has been selected;
  (2) Any parameter number that does not exist in the parameter list (see page 64) has been selected; or
  (3) The value entered is outside the setting range;
- If write is disabled and error " ⊠ " is displayed, press the [SET] (or [CLEAR]) key and restart operation from the beginning.

(Example: Pr. 7 "acceleration time")

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

Instructions for setting the running frequency

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

Other instructions

- When the input power is switched on (or the inverter is reset), the following message is given on the display of the PU for about 1 second. This message indicate that the inverter and FR-PU02E-1 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" (see page 151).

```
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-A is displayed on the unit LED instantaneously at power on but it is not an alarm. If this display is kept provided, see "TROUBLESHOOTING" (see page 151).
- Use the FR-PU02E-1 (FR-ARWE-1) when any of "14 to 17" is set in Pr. 75 "reset selection/PU disconnection detection/PU stop selection" in other than the PU operation mode to stop the inverter by pressing the PU stop key.
  When the parameter unit used is not the FR-PU02E-1 (FR-ARWE-1), the inverter cannot be stopped by pressing the PU stop key in other than the PU operation mode. Also, when any of "14 to 17" is set in Pr. 75, the inverter will not start if the start signal is entered in the external or communication mode. In this case, set any of "0 to 3" in Pr. 75.

1.4.3 Handling of the FR-ARWE-1 Parameter Copy Unit

Like the FR-PU02E-1, the FR-ARWE-1 parameter copy unit can be installed to the inverter (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-PU02E-1.)
The FR-ARWE-1 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-ARWE (ARWE-1) is used to copy parameters between the FR-A100 and FR- A100E series inverters, the set values of Pr. 65 is as indicated below depending on the series of the inverters and the product version of the FR-ARWE (ARWE-1).

Parameter Number/Name	Combination	1		2		3		4	
		Copy Source	Copy Destination	Copy Source	Copy Destination	Copy Source	Copy Destination	Copy Source	Copy Destination
		A100 ⇨ A100		A100 È A100E		A100E ⇨ A100E		A100E ⇨ A100	
Pr. 65 "retry selection"	ARWE-1 and 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.	

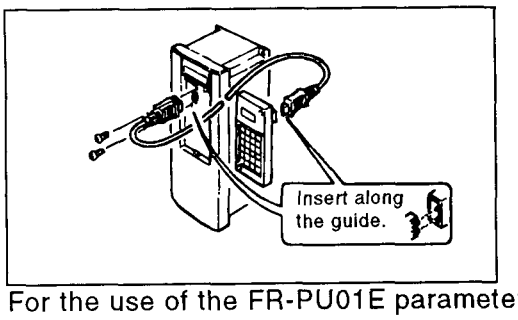
<Reason>

The FR-A100 series do not have the function of Pr. 65. Hence, the old ARWE parameter copy unit (product code H01) compatible with the FR-A100 series cannot recognize Pr. 65 and cannot copy it properly. To copy it properly, use the ARWE-1 or new ARWE parameter copy unit (product code H02) compatible with the FR-A100E series. (See page 186)

<FR-ARWE product version>

- Differentiation
  The type of the latest parameter copy unit is the FR-ARWE-1.
  Also, the other parameter copy unit FR-ARWE has two versions.
  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

1.4.4 Handling of the FR-PU01E Parameter Unit



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

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

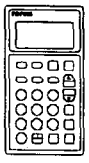
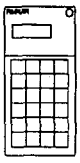
With the power on, you cannot use the the FR-PU01E and FR-PU02E-1 parameter units by changing them alternately.

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

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

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

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

Function	 FR-PU02E-1 Parameter Unit	 FR-PU01E Parameter Unit
Operation setting function	Frequency setting 0 to 120Hz Forward rotation, reverse rotation, stop	As on the left
Operation mode setting	PU operation, external operation, jog operation, PU/external combined operation	As on the left
Monitoring function	Output frequency, output current, output voltage, alarm display, frequency set value, running speed, converter output voltage, electronic overcurrent protector load factor, output current peak value, converter output voltage peak value, input power, output power, input terminal state, output terminal state, load meter, cumulative operation time, cumulative power.	Output frequency, output current, output voltage, alarm display The other items cannot be monitored.
Parameter settting function	Enabled for all of Pr.0 to Pr. 159 and Pr. 200 to Pr. 231.	Limited to Pr. 0 to Pr. 79. Disabled for the gear backlash compensation and 5-point flexible V/F characteristic parameters.
Calibration function	Pr. 900 to Pr. 905	C1 to C5 Note that C1 cannot be used when any of 101 to 121 (AM terminal) is in Pr. 54. Pr. 901 (AM terminal calibration) cannot be set.
Alarm display clear	Batch clear is performed using "ALARM HISTORY CLEAR" in the help mode.	Batch clear is performed by pressing the CLEAR key when a monitoring error is displayed.
Parameter initialization	Parameter clear (calibration function not cleared) or all parameter clear (calibration function cleared) can be set.	All parameter clear (calibration function not cleared) can only be set.
Alarm display	OV1 to OV3 → OVT PUE, RET, CPU → PE	The alarms indicated on the left are displayed in this way.

In addition, the following functions are not available for the FR-PU01E:

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

1.4.5 Handling of the FR-ZRWE Parameter Copy Unit

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

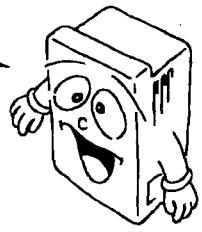
2. OPERATION

This chapter provides details the "operation" of this product.
Always read the precautions, etc., before starting use.

2.1 OPERATION

The FR-A100E 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.

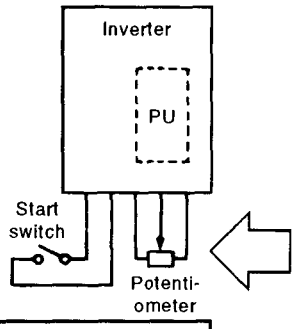
Note: This inverter is desiged for use with the FR-PU02-1 or FR-ARWE-1 parameter units. If a previous type of parameter unit is used the inverter will not start in external or communication mode as Pr. 75 is factory set to "14".
Like wise if a previous parameter unit (not FR-PU02E-1 or FR-ARWE-1) is connected during inverter operation, the inverter will be decelerated to a stop. (Refer to page 100.)



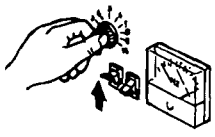
2.1.1 Instruments and Parts to be Prepared before Operation

Instruments and parts to be prepared

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



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



- Operation performed with the externally provided frequency setting potentiometer and start switch

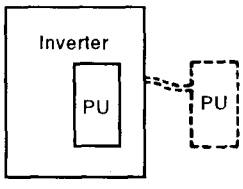
1. External operation mode

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

Instruments and parts to be prepared

- **Parameter unit (FR-PU02E-1)**
- **Cable (FR-CBL) (See page 190)**

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



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

2. PU operation mode

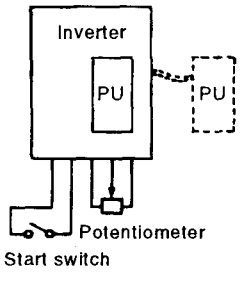
The inverter is operated from the keypad of the parameter unit.

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

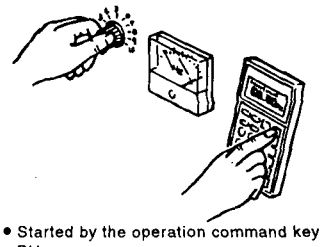
Instruments and parts to be prepared

- **Start signal**
  Switch, relay, etc.
- **Frequency setting signal**
  0 to 5V, 0 to 10V, 4 to 20mA DC signals from a potentiometer or outside the inverter
- **Parameter unit (FR-PU02E-1)**
- **Cable (FR-CBL) (See page 190)**

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



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



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

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.

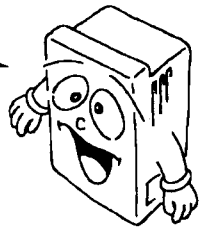
1) The external signal is used as the start signal and the PU is used to set the frequency.

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.

2.1.2 Pre-operation Settings

The main items to be set before operation are as follows. Set the required items according to the load and operational specifications. For simple variable-speed operation or the like, use the inverter with the factory setting. For more information and the explanation of the other parameters, see page 64. Note that a parameter will be referred to as "Pr.".



■ Setting method

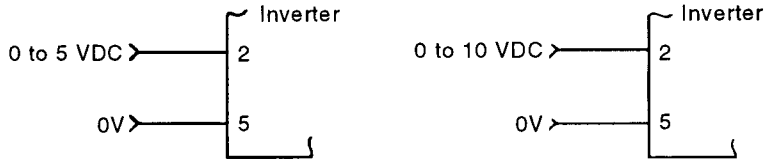
In the PU operation mode, use the parameter unit for setting. (See page 62.)
The start signal (STF or STR) must be off to switch from the external operation mode to the PU operation mode, otherwise the inverter cannot be put in the PU operation mode.

Operation using the voltage input signal

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

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

- **0 to 5VDC**
  Set "1" (factory setting) in Pr. 73.
- **0 to 10VDC**
  Set "0" in Pr. 73.



Operation using the current input signal

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

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

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

When the frequency used for operation is equal to or higher than the factory setting given below, change the setting of the corresponding parameter.

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

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 117.)

> 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 90.)

Setting of maximum frequency

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

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

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

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

Factory setting: 0Hz

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

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

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

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

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

Application	Set Value	Remarks
For constant-torque loads (e.g. conveyor, carrier)	0 (factory setting)	——
For variable-torque loads (e.g. fan, pump)	1	——

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

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		Output Terminal Signal Set to "9" in Pr. 40
	Jog Mode	OH (external thermal relay input)	N/O Input	N/C Input	
0 (factory setting)	●	—	●	—	During PU operation
1	—	●	●	—	
2	●	—	—	●	
3	—	●	—	●	
4	●	—	●	—	Open motor circuit detection
5	—	●	●	—	
6	●	—	—	●	
7	—	●	—	●	

- When any of 4 to 7 is set in Pr. 17 "external thermal relay input" and 9 is set in Pr. 40 "output terminal assignment", the open motor circuit detection signal is output as an open collector signal to the terminals selected in Pr. 40.

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

Calibration of frequency meter

To monitor the output status correctly, calibrate the frequency meter before operation.
Use the parameter unit for calibration to make adjustment with higher accuracy.
(See page 113 for the adjustment procedure.)

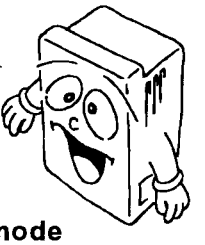
When an inverter once used is to be used again

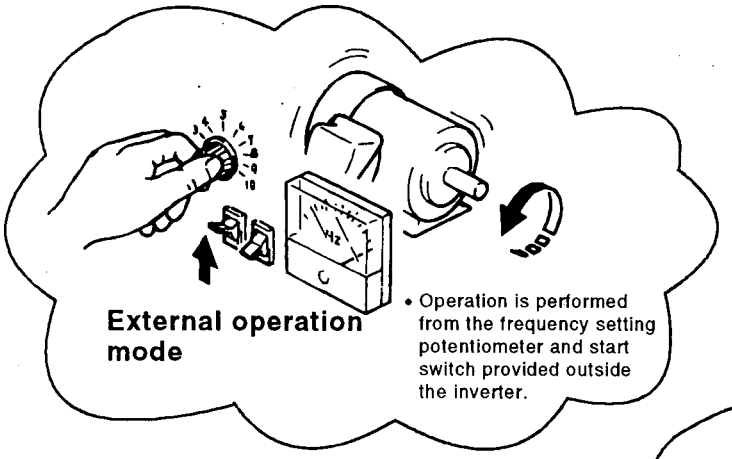
It is assumed that the set values of the parameters may have been changed according to the operational specifications. Before starting operation, initialize the parameters (return the parameter values to the factory setting). Initialization can be made by performing parameter clear operation using the parameter unit. (For the operation procedure, see page 55.) 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 all parameter 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"

2.1.3 Operation Mode

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



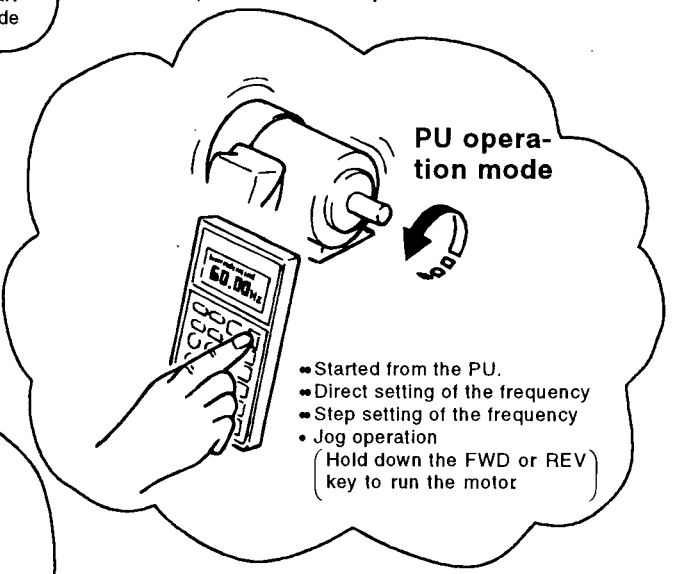


External operation mode

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

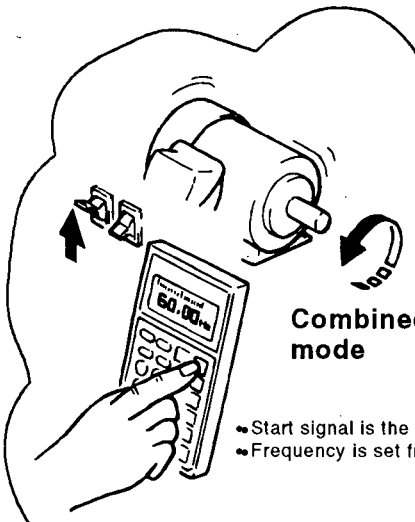
■ Factory-set operation mode

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



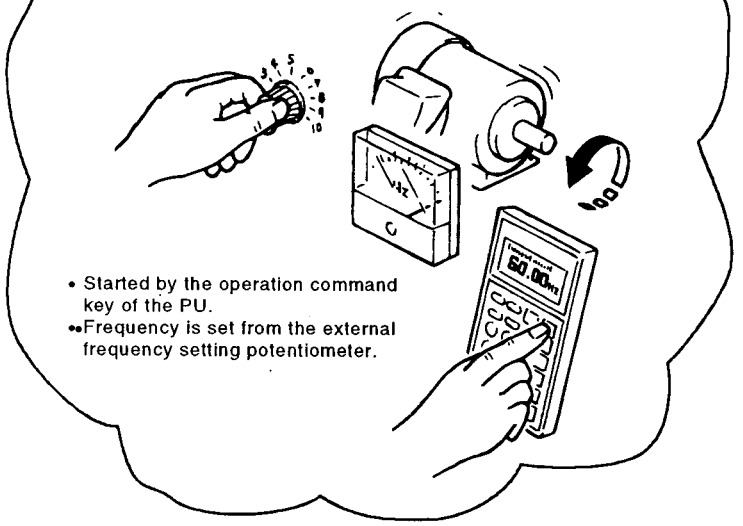
PU operation mode

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



Combined operation mode

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



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

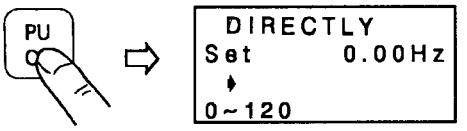
■ Fixing the operation mode

The operation mode at power on may be limited, e.g. operation from the PU is enabled at power on without switching the operation mode with the PU's mode select key.
For full information on the setting procedure, see page 34.

2.1.4 Selection of the Operation Mode

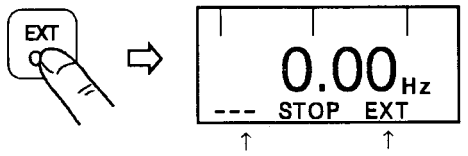
The inverter is factory-set to allow the operation mode to be switched between "external operation" and "PU operation". At power-on, the inverter is placed in the "external operation" mode. Use the PU to switch to the other operation mode.

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



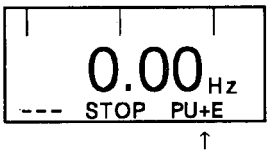
Frequency setting screen

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



Operation command indication Operation mode indication

- **Switching to the combined operation mode** ..... Change the set value of Pr. 79 "operation mode selection" as indicated below. (For more information on changing the set value, see page 62.)
  "PU+E" is displayed at the operation mode indication.



Operation mode indication

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

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

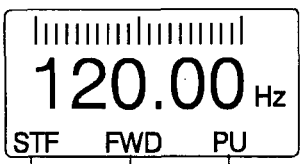
1. External input signal (across STF or STR and SD) ——— Check that the signal is off. If it is on, the operation mode cannot be switched properly. Look for STF or STR on the PU display.
2. Parameter setting ——— Check the set value of Pr. 79 "operation mode selection".

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

3. Limitation of the operation mode ——— When the set value of Pr. 79 "operation mode selection" is "0" (factory setting), the inverter is put in the external operation mode at input power-on. Press the [PU OP] key to switch to the PU operation mode. For the other set values (1 to 5, 7, 8), the operation mode is limited accordingly. See page 103.

2.1.5 Operation Mode, Command and 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

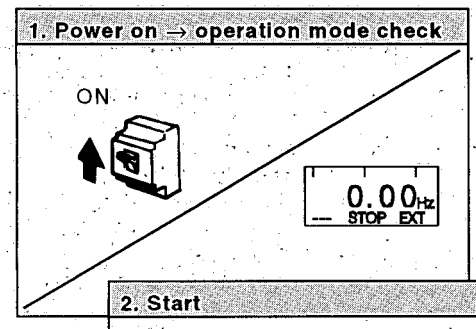
•Operation command indication

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

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

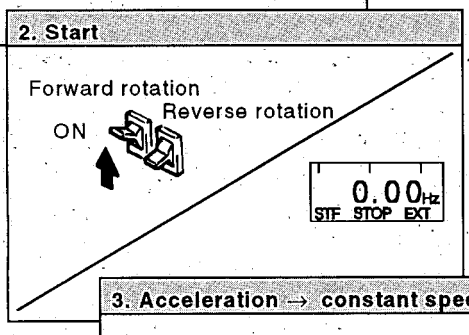
(1) Ordinary operation

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

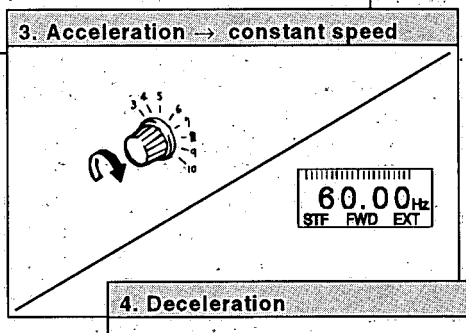


Switch the power on and make sure that "EXT" is shown at the operation mode indication.
If it is not shown, switch to the external operation mode in accordance with page 34.

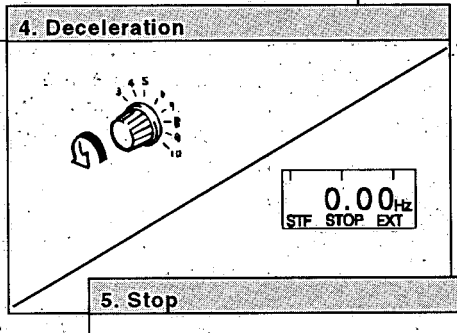
Note 1: If the forward and reverse rotation switches are turned on together, the inverter will not start. Also, if these switches are turned on together during operation, the motor is decelerated to a stop.



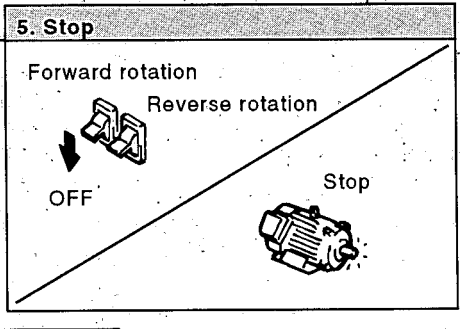
Turn on the start switch (connect terminals STF or STR and SD). (Note 1)
The operation command indication changes to "STF" or "STR".



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



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



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

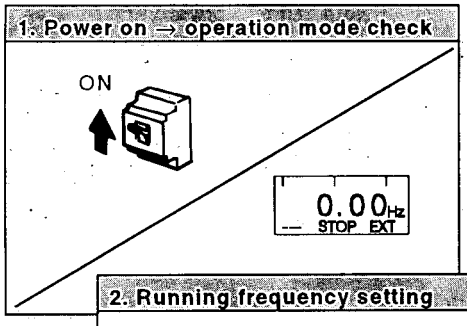
Note 2: If the start switch is turned off with the potentiometer in the full clockwise position, the motor is decelerated to a stop. The DC dynamic brake operated at this time generates high-frequency noise immediately before the stop, but it is not a fault.

Note 3: Do not switch power on when the run command (STF, STR terminal) is on. Switch on the run command (STF, STR terminal) more than 1 second after switching power on.

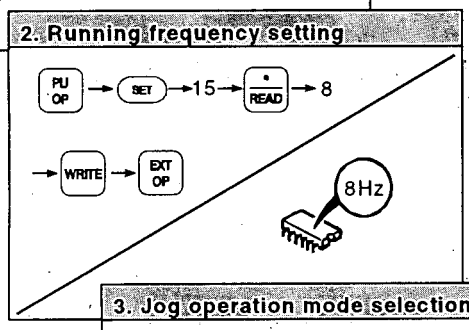
(2) External jog operation

Keep the start switch on (connect terminals STF or STR and SD) to perform operation, and switch it off to stop. For details of changing the parameter setting, see page 63.

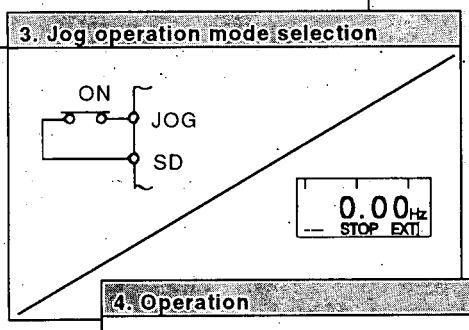
- **Operation procedure (Operation at 8Hz)**



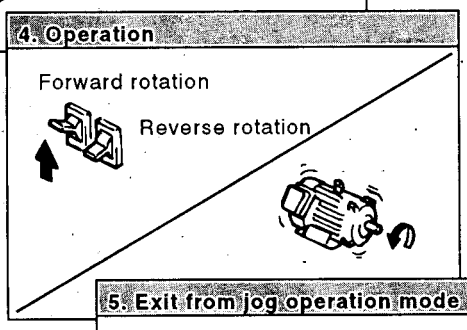
Switch the power on and make sure that "EXT" is shown at the operation mode indication.
If it is not shown, switch to the external operation mode in accordance with page 34.



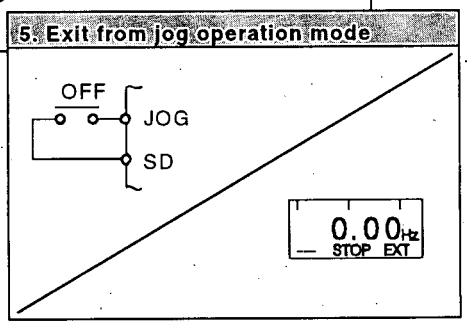
Press the [PU OP] key to switch to the PU operation mode and use Pr. 15 "jog frequency" to set. (Note 1)
After the setting is complete, press the [EXT OP] key to switch to the external operation mode.



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



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



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

Note 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

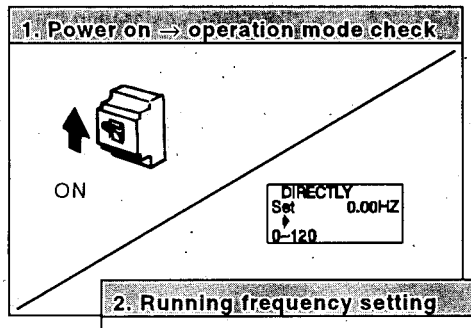
Note 2: If the motor does not run, check Pr. 13 "starting frequency". If the set value is less than the starting frequency, the motor does not start.

2.1.7 PU Operation Mode (Operation using the PU)

(1) Ordinary operation

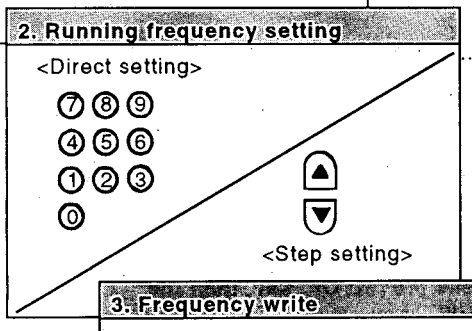
By repeating the above steps 2 and 3 during motor operation, speed can be changed.

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

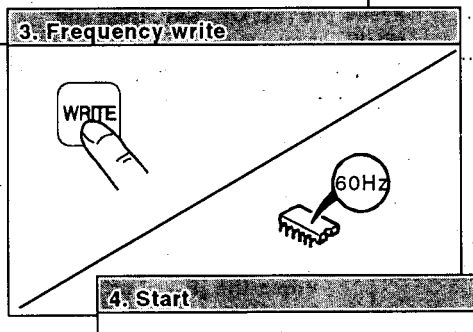


Switch the power on, press the [PU OP] key, and make sure that the frequency setting screen is shown on the display.
If it is not shown, switch to the PU operation mode in accordance with page 34.

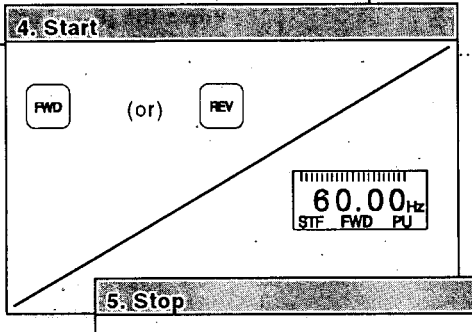
Note 1: After pressing the [PU OP] key, enter the frequency directly with the numeral keys. This setting is not available in the monitoring mode. Press the [PU OP] key to leave the monitoring mode before setting.



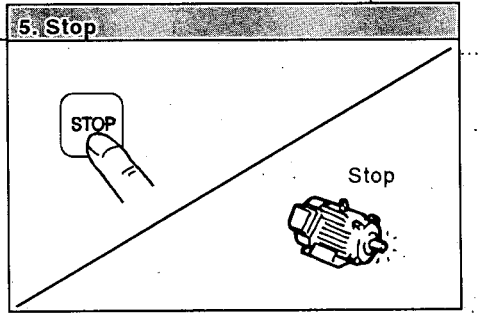
Set the running frequency to 60Hz.
- Direct setting (Note 1)
- Step setting (Note 2) (Note 3)



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



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



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

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

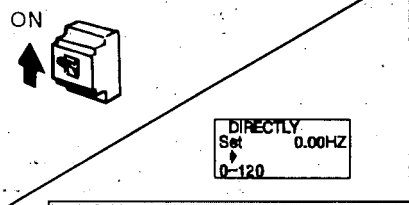
Note 3: Step setting can also be made during inverter operation. However, if the [▲] (or [▼]) key is pressed in the monitoring mode, the frequency does not stop changing when the key is released and rises (or falls) further. (Since the [▲] (or [▼]) key changes the set frequency, switch operation does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

(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 62.

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

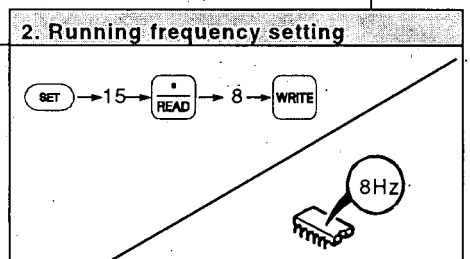
1. Power on → operation mode check



Switch the power on, press the [PU OP] key, and make sure that the frequency setting screen is shown on the display.
If it is not shown, switch to the PU operation mode in accordance with page 34.

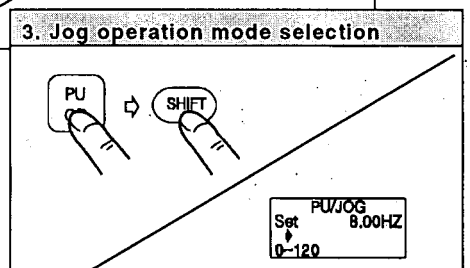
Note 1: The frequency and acceleration/deceleration time for jog operation can be set in the following parameters.
<Factory setting>
- Pr. 15 "jog frequency" ... 5Hz
- Pr. 16 "jog acceleration/deceleration" ... 0.5 seconds

2. Running frequency setting



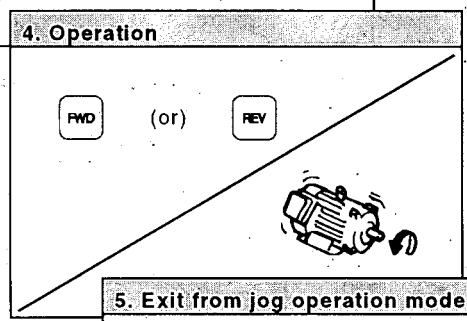
Use Pr. 15 "jog frequency" to set.
(Note 1).

3. Jog operation mode selection



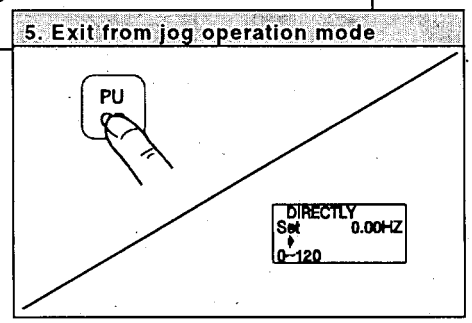
Press the [PU OP] key, then the [SHIFT] key.
The jog operation mode is selected and the PU JOG frequency setting screen is shown on the display.
To change the frequency, enter the numerical value and press the [WRITE] key.

4. Operation



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

5. Exit from jog operation mode



Press the [PU OP] key.
The inverter exits from the jog operation mode and returns to the 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.

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

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

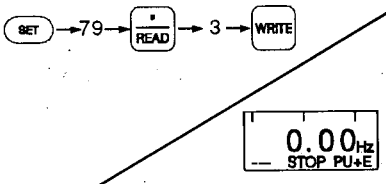
The external frequency setting signals and the PU's FWD, REV and STOP keys are not accepted.
For details of changing the parameter setting, see page 62.

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

1. Power on

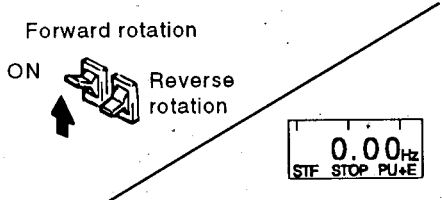
..... **Switch the power on.**

2. Operation mode selection



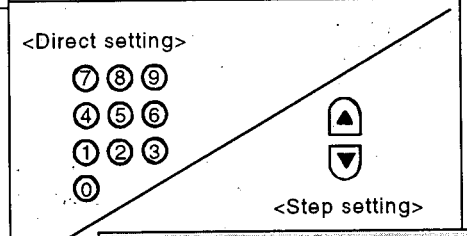
..... **Set "3" in Pr. 79 "operation mode selection".**
The combined operation mode is selected and the operation mode indication on the display changes to "PU+E".

3. Start



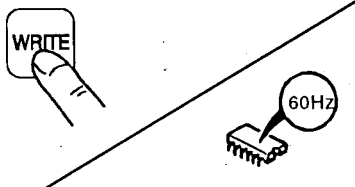
..... **Turn on the start switch (connect terminals STF or STR and SD).**
(Note 1)

4. Running frequency setting



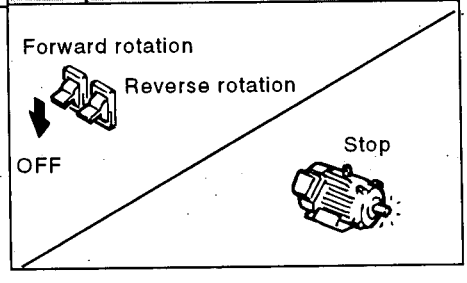
..... **Using the PU, set the running frequency to 60Hz.**
The operation command indication changes to "STF" or "STR" and the operation status indication changes to output indication (FWD or REV).
- Direct setting (Note 2)
- Press the [PU OP] key to call the frequency setting screen, and perform step setting. (Note 3)

5. Frequency write



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

6. Stop



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

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

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

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

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

For details of changing the parameter setting, see page 62.

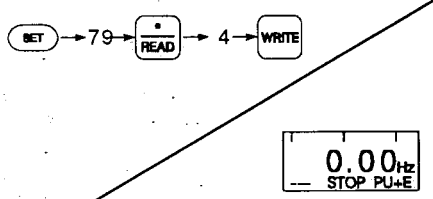
• **Operation procedure**

1. Power on

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

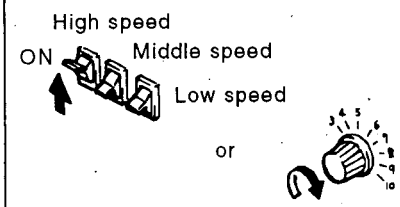
Note 1: The starting terminals (STF, STR) of the inverter are invalid.
The inverter cannot be started if the [FWD] or [REV] key is pressed and the level of the frequency setting signal is then raised.

2. Operation mode selection



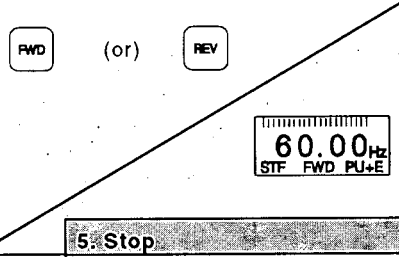
..... **Set "4" in Pr. 79 "operation mode selection".**
The combined operation mode is selected and the operation mode indication on the display changes to "PU+E".

3. Running frequency setting



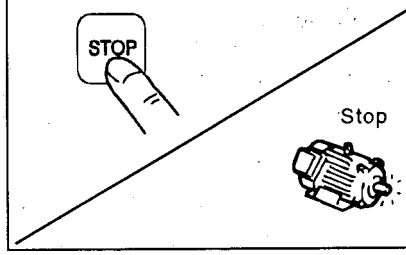
..... **Enter the running frequency signal (select the multi-speed signal or turn the frequency setting potentiometer).**

4. Start



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

5. Stop



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

(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".

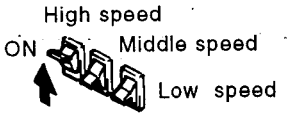
For details of changing the parameter setting, see page 62.

••Operation procedure

1. Power on

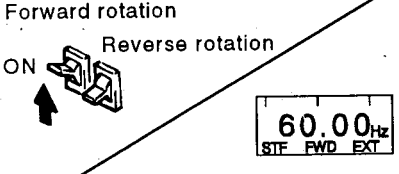
..... **Switch the power on.**

2. Operation mode selection



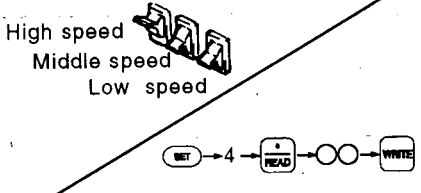
..... **Select the multi-speed signal required for operation (connect terminals RH/RM/RL and SD).**

3. Start



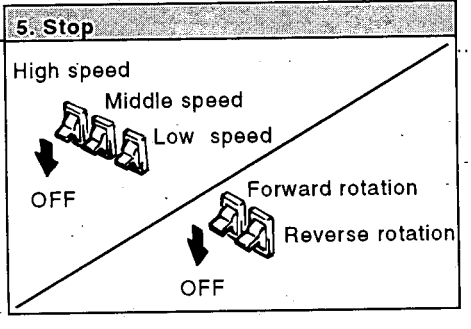
..... **Turn on the start switch (connect terminals STF or STR and SD).**
(Note 1)
The operation command indication changes to "STF" or "STR" the operation status indication changes to output indication (FWD or REV), and the motor starts rotating.

4. Multi-speed frequency setting



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

5. Stop



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

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

Note 2: The set values of the multiple speeds not being used can also be changed during operation. (See page 68.)

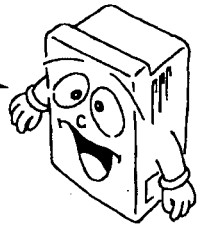
MEMO

3. PARAMETERS

This chapter provides details the "parameters" of this product.
Always read the precautions, etc., before starting use.

3.1 MONITORING FUNCTION

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



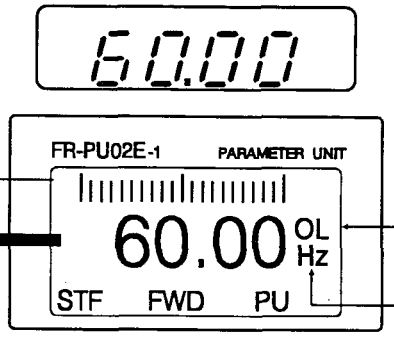
PU level meter

Setting Pr. 53 on the PU allows selection from 13 types of data. (See page 88.)

• 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 88.)

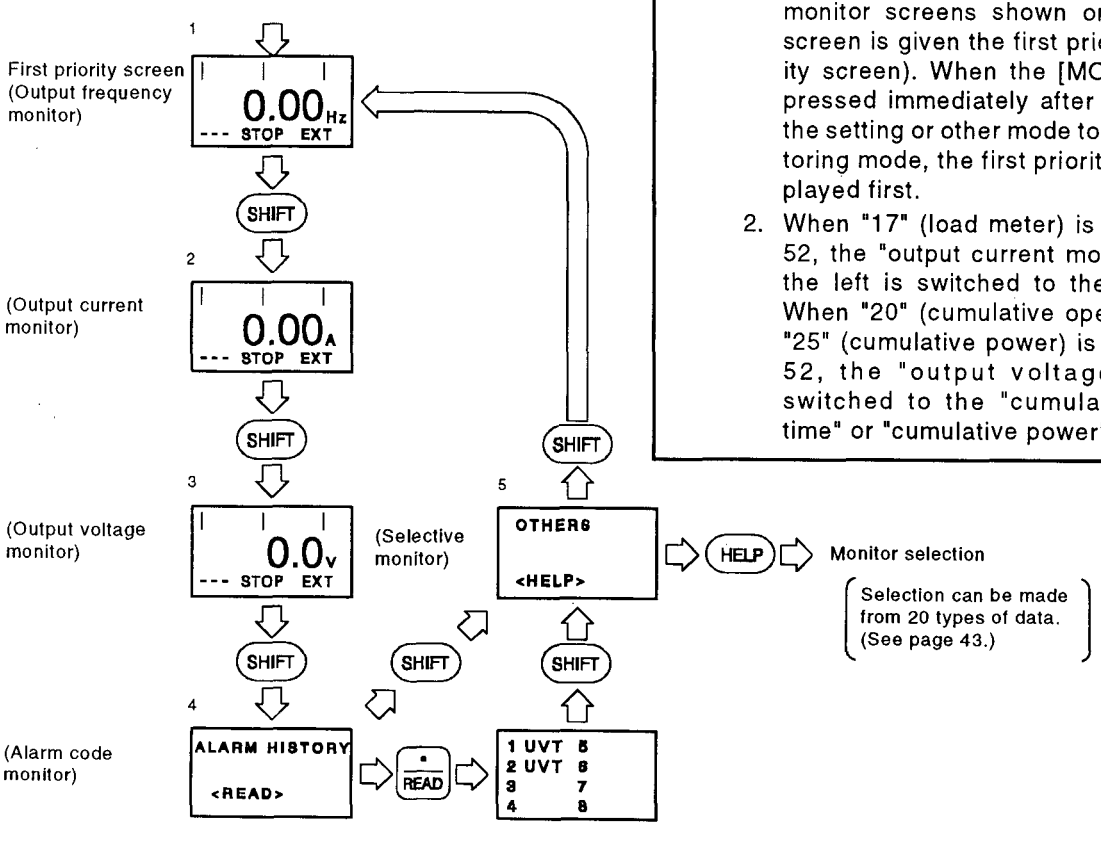
• Factory setting .... Pr. 51 = "1" Output frequency indication

Indicates that the stall prevention function is activated.

Display unit

3.1.1 SHIFT Operation Sequence on the PU Main Monitor

When "0" (factory setting) is set in Pr. 52 "PU main display data selection", merely pressing the [SHIFT] key calls five types of data in sequence. 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.



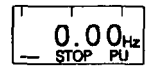
Note: 1. By pressing the [WRITE] key on any of the monitor screens shown on the left, that screen is given the first priority (first priority screen). When the [MONITOR] key is pressed immediately after power-on or in the setting or other mode to enter the monitoring mode, the first priority screen is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

2. When "17" (load meter) is selected in Pr. 52, the "output current monitor shown on the left is switched to the "load meter". When "20" (cumulative operation time) or "25" (cumulative power) is selected in Pr. 52, the "output voltage monitor" is switched to the "cumulative operation time" or "cumulative power".

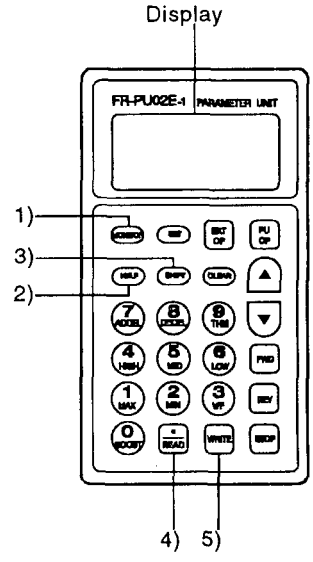
3.1.2 Selecting the Another Monitor Item in the Selective Monitoring Mode

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

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



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



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

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

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

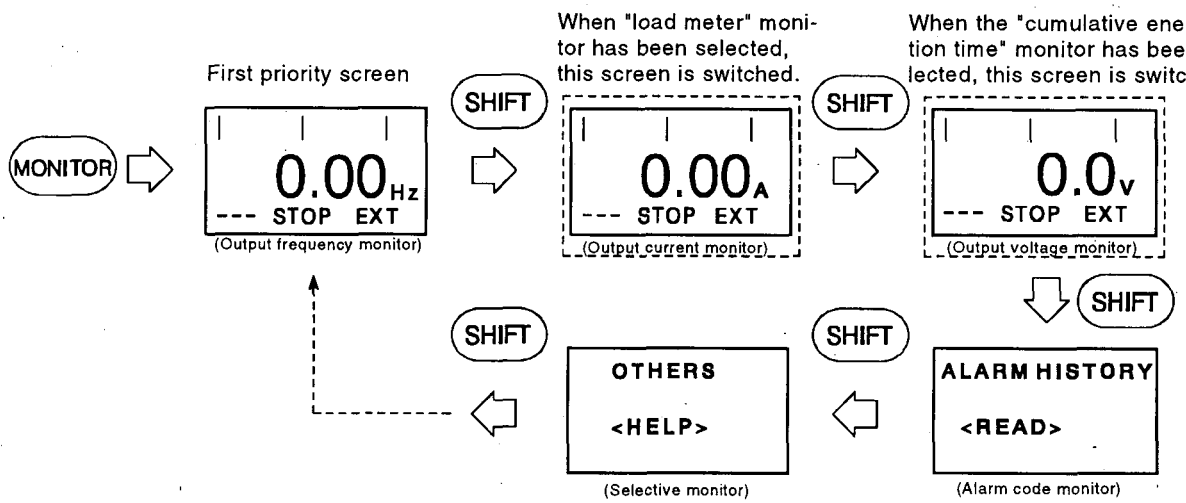
5) Press the [WRITE] key. (Note 2) ...The screen in step 5) is set as the first priority screen.

..... Subsequently press the [SHIFT] key to call the other monitor screen. (For monitor types, refer to Pr. 52.)

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 5) 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.

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

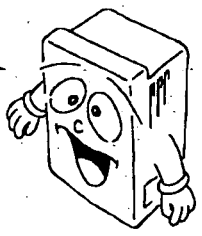


• **Selecting "current monitoring" or "power monitoring"**
Note that a current not more than 5% of the rated current of the inverter cannot be detected and displayed.
Also note that the electronic thermal relay does not operate at that current. For motor protection, examine the use of an external temperature detector or the like.

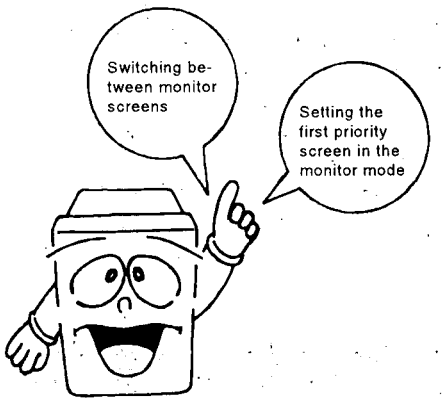
Example: When a small motor (0.4kW motor) is run by a large-capacity inverter (55kW), power monitoring is inactive.

3.2 HELP FUNCTION

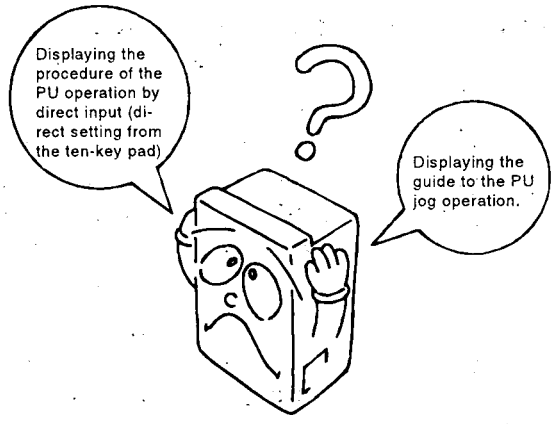
The FR-A100E inverter has a help function to assist you in performing the following.



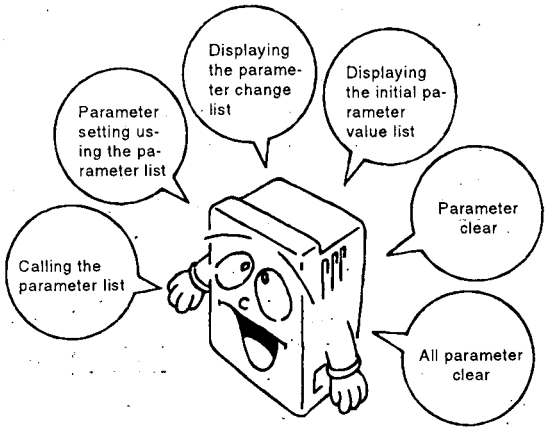
Monitor list display



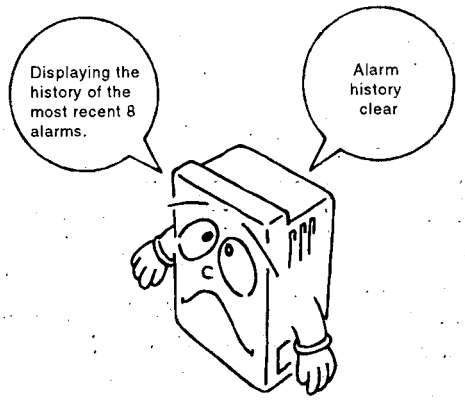
PU operation guide display



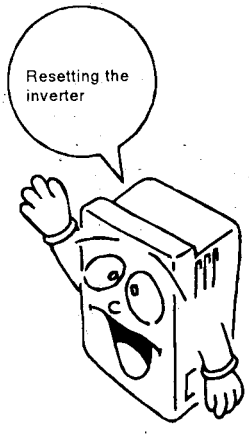
Various parameter settings



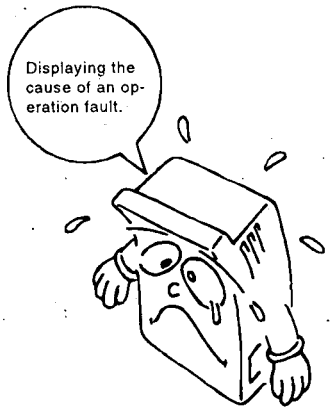
Alarm history



Inverter reset

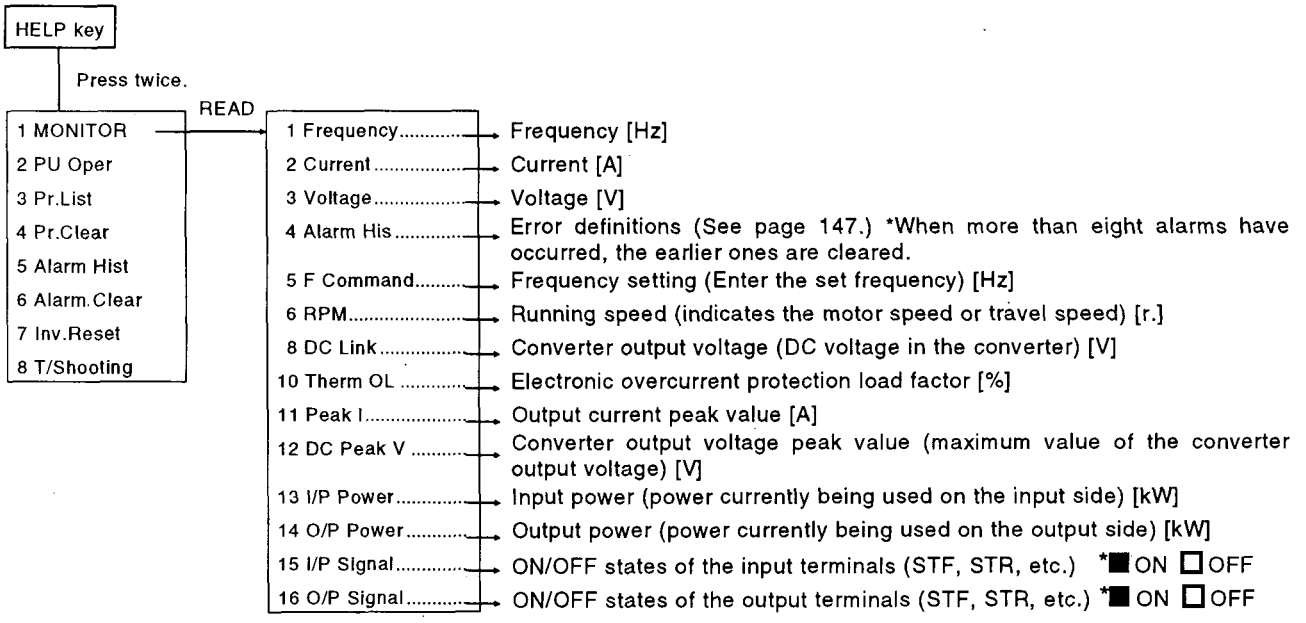


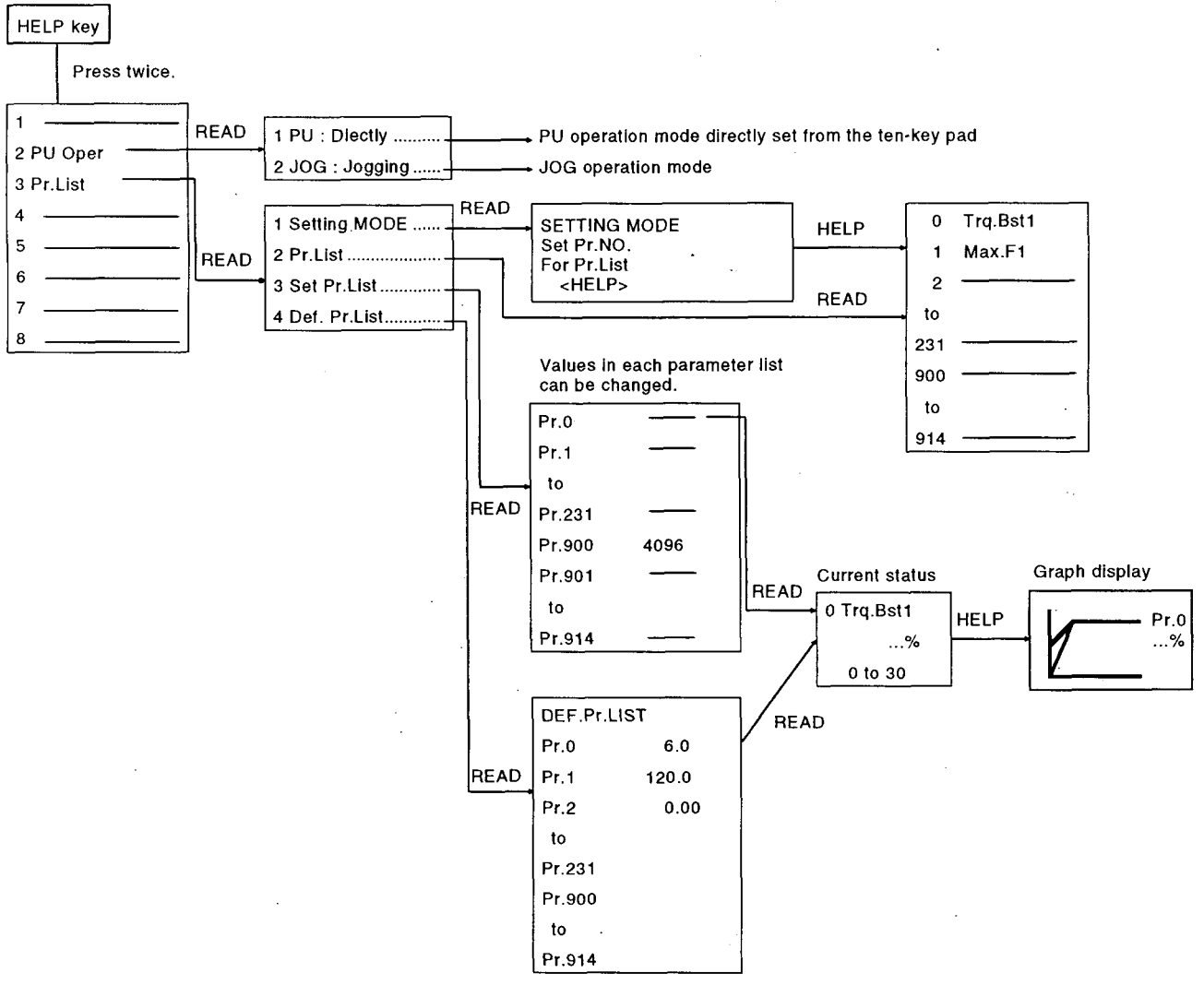
Troubleshooting

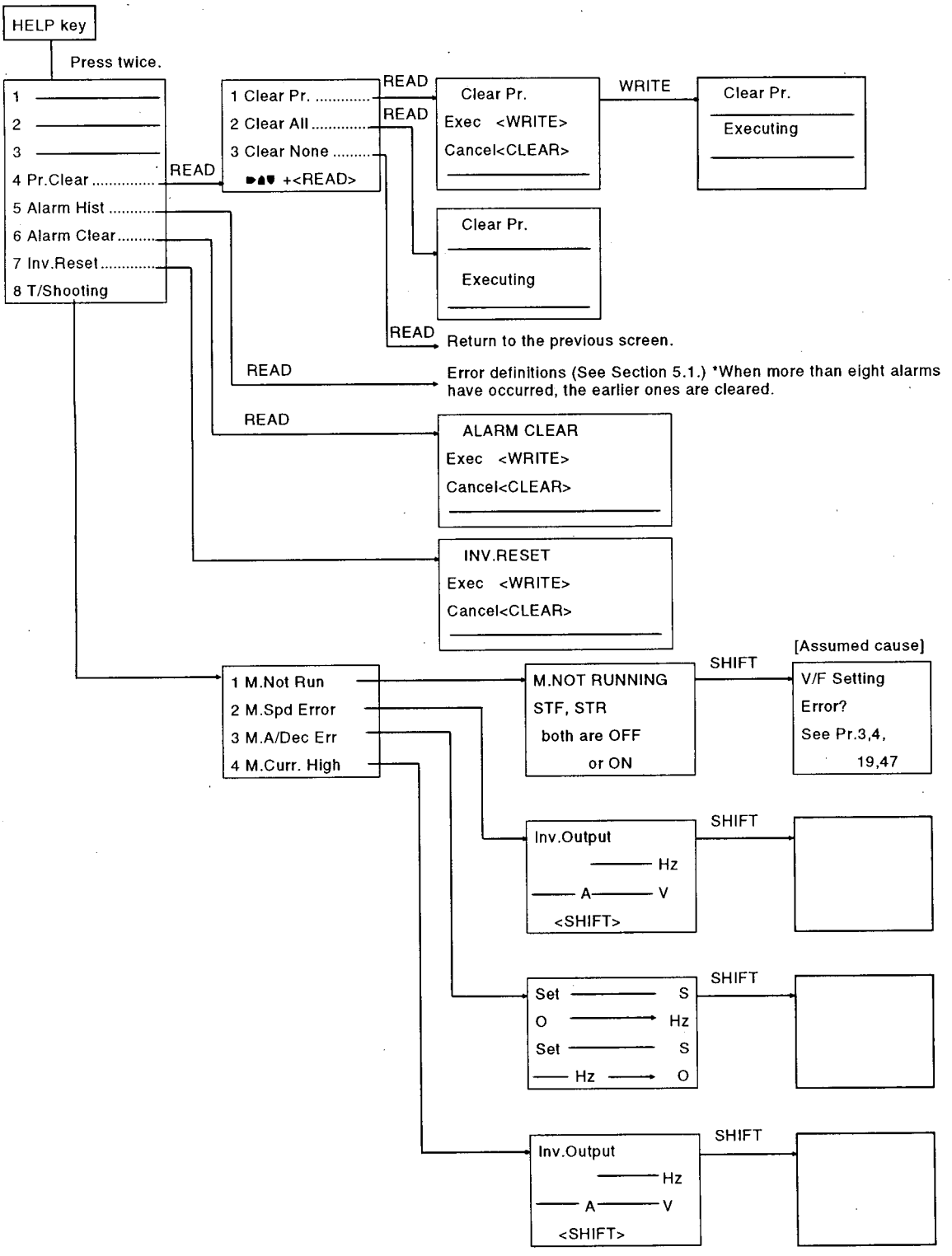


In addition, press the [HELP] key in any of the PU operation modes to call a guide to the operation procedure. Press the [HELP] key when you do not know how to operate or what to do.

3.2.1 Definitions of the Help Function Displays






HELP key
Press twice.
1
2
3
4 Pr.Clear
5 Alarm Hist
6 Alarm Clear
7 Inv.Reset
8 T/Shooting
READ
1 Clear Pr.
2 Clear All
3 Clear None
▶▲▼ +<READ>
READ
READ
READ
Clear Pr.
Exec <WRITE>
Cancel<CLEAR>
WRITE
Clear Pr.
Executing
Clear Pr.
Executing
Return to the previous screen.
READ
Error definitions (See Section 5.1.) *When more than eight alarms have occurred, the earlier ones are cleared.
READ
ALARM CLEAR
Exec <WRITE>
Cancel<CLEAR>
INV.RESET
Exec <WRITE>
Cancel<CLEAR>
1 M.Not Run
2 M.Spd Error
3 M.A/Dec Err
4 M.Curr. High
M.NOT RUNNING
STF, STR
both are OFF
or ON
SHIFT
[Assumed cause]
V/F Setting
Error?
See Pr.3,4,
19,47
Inv.Output
Hz
A
V
<SHIFT>
SHIFT
Set
S
O
Hz
Set
S
Hz
O
SHIFT
Inv.Output
Hz
A
V
<SHIFT>
SHIFT

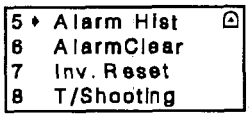
3.2.2 Help Function Menu

Press the [HELP] key twice in any operation mode to call the help menu, with which various functions can be executed. (See page 46)

- **Menu screen page 1**

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

- **Menu screen page 2**



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

..... **1 MONITOR**

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

2 PU OPERATION

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

3 PARAMETER

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

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

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

..... **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.

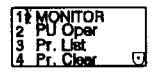
3.2.3 Help Function Operation Procedure

1 MONITOR

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

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

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



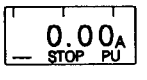
2) Make sure that the cursor (⇨) is located at "1 MONITOR". ..... If not, move the cursor with the [▲] [▼] key.

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

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

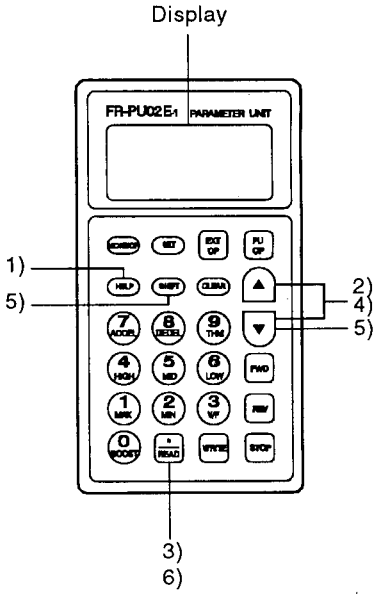
5) If the required item is not found, press the [SHIFT] key and [▼] key together to shift to the next page.

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



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

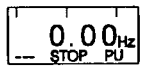
Display



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

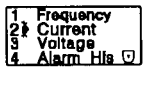
• Operation procedure 2 (To call the monitoring list directly in the monitoring mode)

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



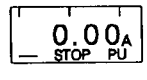
2) Press the [HELP] key. .... The monitoring list is called.

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



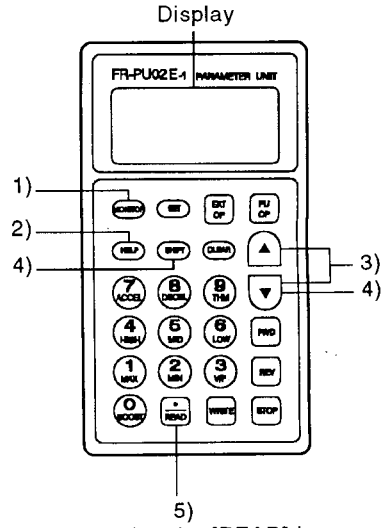
4) If the required item is not found, press the [SHIFT] key and [▼] key together to shift to the next page.

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



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

Display



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

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

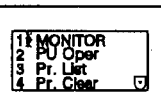
2 PU OPERATION

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.

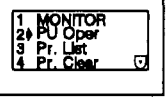
■ Selection of the PU operation mode (direct input)

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

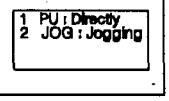
1) Press the [HELP] key ..... The help function menu is called. twice in the monitor mode.



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

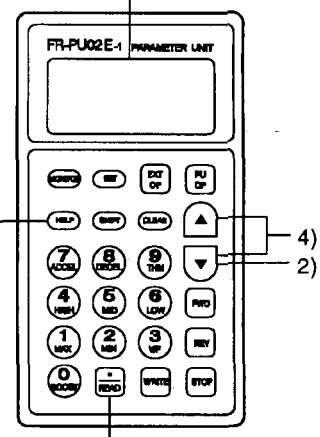


3) Press the [READ] key. ....The menu on the right is displayed.



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

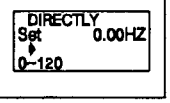
Display



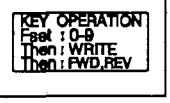
1) 6) — 4) 2) — 3) 5)

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

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



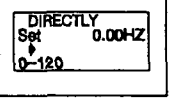
6) Press the [HELP] key. .... The key operation guide is displayed.



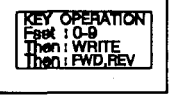
Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

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

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

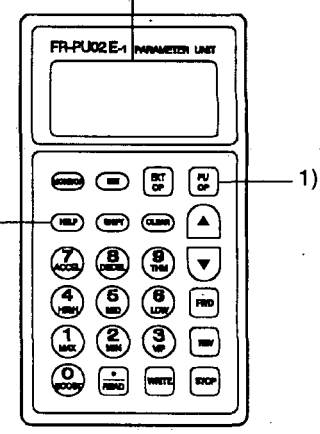


2) Press the [HELP] key. .... The key operation guide is displayed.



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

Display

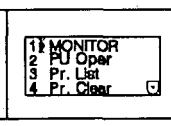


2) — 1)

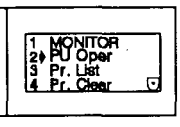
■ Selection of the PU jog operation mode

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

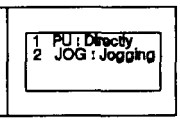
1) Press the [HELP] key twice in the monitor mode. ..... The help function menu is called.



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



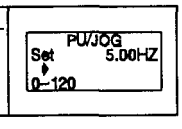
3) Press the [READ] key. .... The menu on the right is displayed.



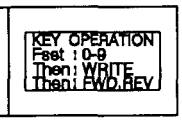
Press the [HELP] key to return to the help function menu.

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

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

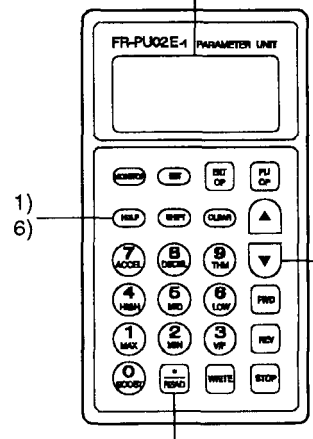


6) Press the [HELP] key. .... The key operation guide is displayed.



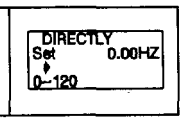
Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.

Display

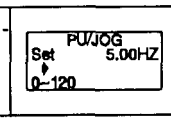


• Operation procedure 2 (To call the key operation guide directly)

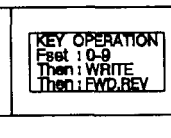
1) Press the [PU OP] key. ...The frequency setting screen is displayed.



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

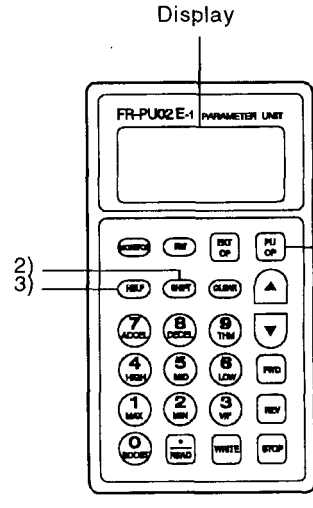


3) Press the [HELP] key. .... The key operation guide is displayed.



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

Display



3 PARAMETER

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

1 Setting..... Switches to the parameter setting mode.

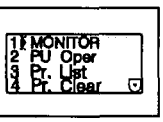
2 Pr. List..... Displays the parameter list in numerical order and allows the values of individual parameters to be read and written.

3 Set Pr. List..... Displays a list of Pr. numbers and set values of only the parameters that have been changed from the factory setting. (For the parameters that have not been changed, their Pr. numbers are only displayed.)

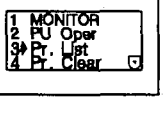
4 Def. Pr. List..... Displays a list of the initial values (default factory setting) of parameters.

• Display of the parameter menu

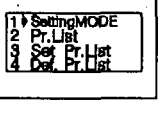
1) Press the [HELP] key twice in the operation mode. ..... The help function menu is called.



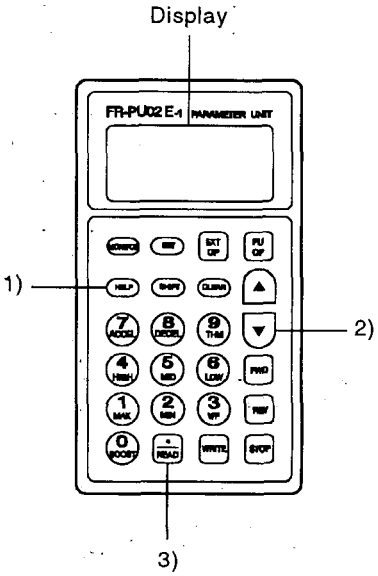
2) Using the [▼] key, move the cursor (⇨) to "3 PARAMETER".



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



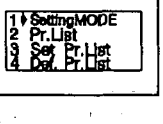
Press any of the [MONITOR], [SET], [EXT OP] and [PU OP] keys to switch to the corresponding mode.



■ Selection and execution of "1 Setting"

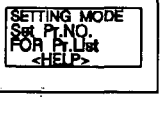
• Operation procedure

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

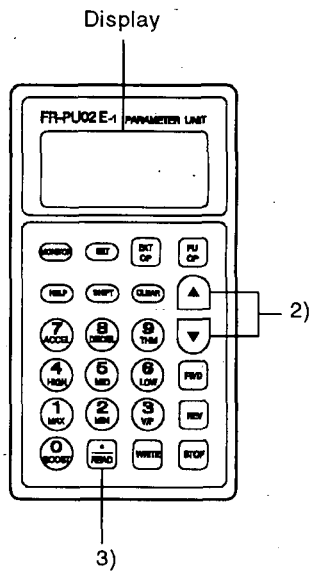


2) Make sure that the cursor (⇨) is located at "1 Setting". ..... If not, move the cursor with the [▲] [▼] key.

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



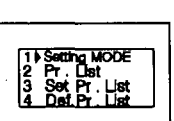
Press any of the [MONITOR], [EXT OP] and [PU OP] keys to switch to the corresponding mode.



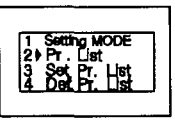
■Selection and execution of "2 Pr. List"

• Operation procedure

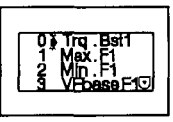
1) Call the parameter menu in accordance with page 52.



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



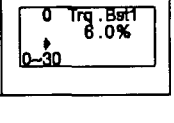
3) Press the [READ] key. .... The parameter list is displayed.



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

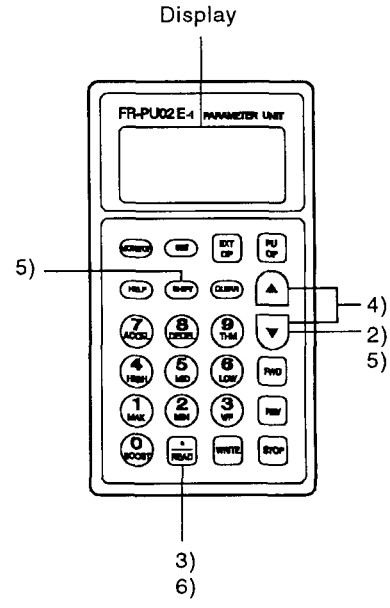
5) If the required item is not found, press the [SHIFT] key and [▼] key together to shift to the next page.

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



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

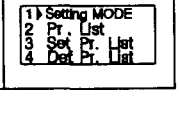
Press any of the [MONITOR], [EXT OP] and [PU OP] keys to switch to the corresponding mode.



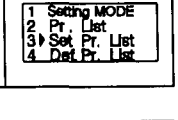
■ Display of "3 Set Pr. List"

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

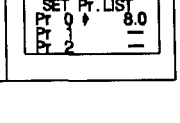
1) Call the parameter menu in accordance with page 52.



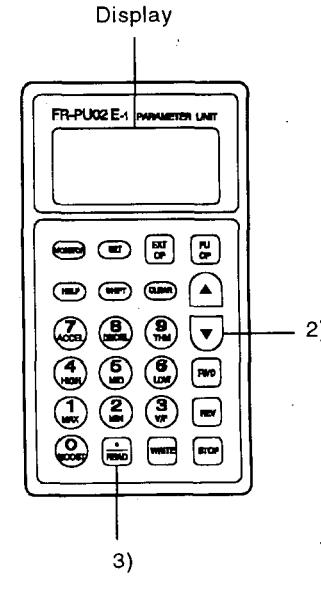
2) Using the [▼] key, move the cursor (⇨) to "3 Set Pr. List".



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



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



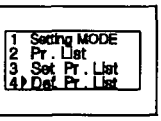
Note: Press the [SHIFT] key and [▼] key together to move to the next page.

■ Display of "4 Def. Pr. List"

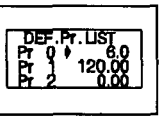
• Operation procedure

1) Call the parameter menu in accordance with page 52.

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

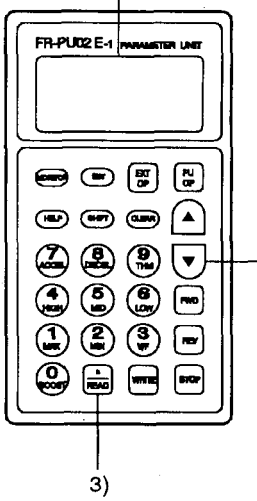


3) Press the [READ] key. .... The initial value list is displayed. (Note)



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

Display



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

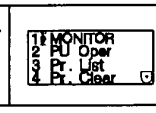
4 PARAMETER CLEAR (To be performed in the PU operation mode)

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

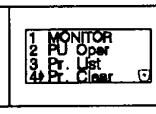
1 Clear Pr. ..... Returns (initializes) the parameter values to the factory setting with the exception of the calibration values in Pr. 900 to 905.
2 Clear All ..... Initializes all parameters.
3 Clear None ..... Does not initialize.

• Display of the parameter clear menu

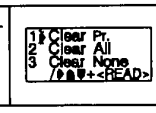
1) Press the [HELP] key ..... The help function menu is called. twice in the operation mode.



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

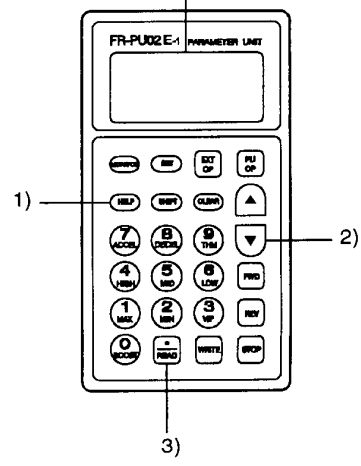


3) Press the [READ] key. .... The parameter clear menu is displayed.



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

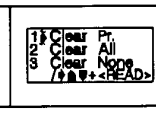
Display



■ Selection and execution of "1 Clear Pr."

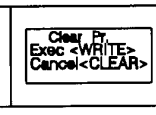
• Operation procedure

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

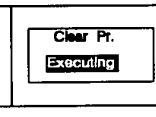


2) Make sure that the cursor (⇨) is located at "1 Setting". ..... If not, move the cursor with the [▲] [▼] key.

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

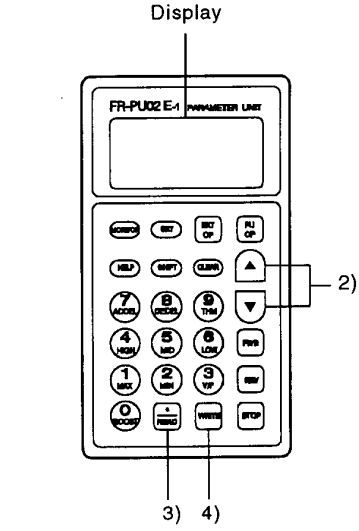


4) Press the [WRITE] key. (Note) ...The data on the right is displayed and the parameters are initialized.



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

Display



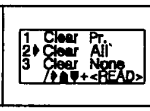
Note: Press the [CLEAR] key to disable parameter clear.

■ Selection and execution of "2 Clear All"

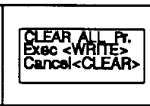
• Operating procedure

1) Call the parameter clear menu in accordance with page 55.

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

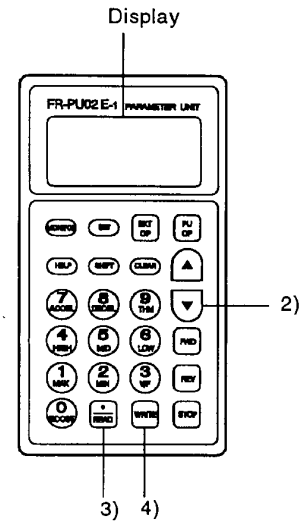


3) Press the [READ] key. .... The data on the right is displayed.



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

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



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

■ "3 Clear None"

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

5 ALARM HISTORY

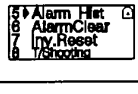
Displays the history of eight past alarms.

- **Operation procedure**

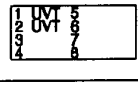
1) Press the [HELP] key twice in the operation mode. ..... The help function menu is called.

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

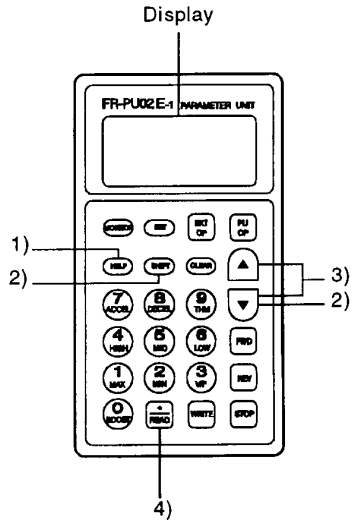
3) Make sure that the cursor (⇨) is located at "5 Alarm Hist". .....If not, move the cursor with the [▲] [▼] key.



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



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



6 ALARM HISTORY CLEAR

Clears all the alarm history.

- **Operation procedure**

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

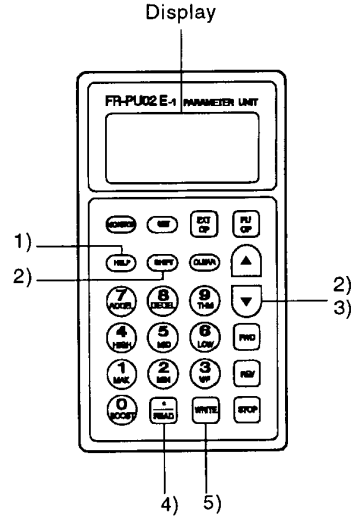
2) Press the [SHIFT] key and [▼] key together..... The screen moves to the next page.

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

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

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

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



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

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 and SD.

- **Operation procedure**

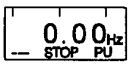
1) Press the [HELP] key twice in the operation mode. ..... The help function menu is called.

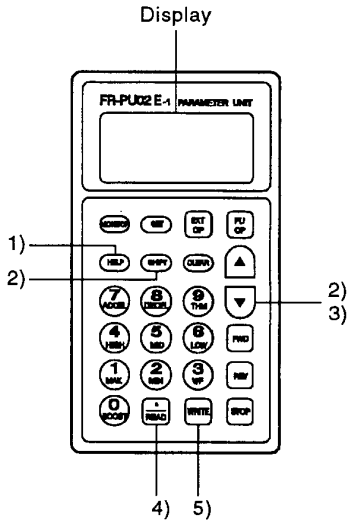
2) Press the [SHIFT] key and [▼] key together. .... The screen moves to the next page.

3) Using the [▼] key, move the cursor (⇨) to "7 Inv. Reset".

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

5) Press the [WRITE] key. ...The inverter is reset and switches to the monitoring mode. (Note)





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**

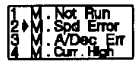
1) Press the [HELP] key twice in the operation mode. ..... The help function menu is called.

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

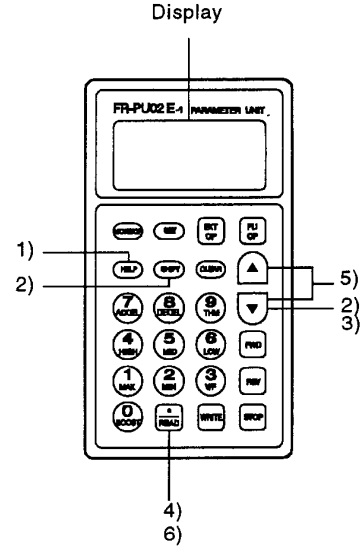
3) Using the [▼] key, move the cursor (⇨) to "8 T/Shooting".

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

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



6) Press the [READ] key. .... The cause of fault is displayed. (See page 60.)



• Faults

1 M.NOT RUNNING (Motor does not rotate)

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

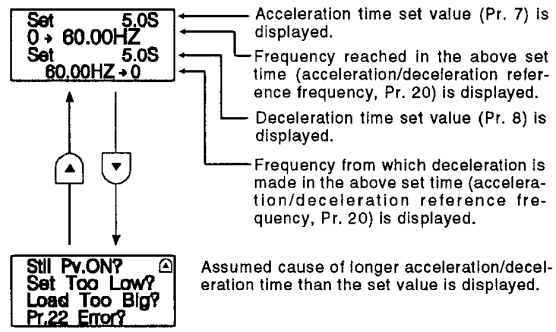
2 M.SPEED ERROR

(Speed does not match the running frequency set value)

M.SPEED ERROR SetF>MaxF1/F2 60.00 Pr1/18 Hz	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 (Pr. 23), the running frequency has jumped.
M.SPEED ERROR Current Limit Activated <SHIFT>	The current limit function has been activated and forced the running frequency to reduce. Press the [SHIFT] key to display the cause of activating the current limit function.
M.SPEED ERROR Under PI Control	The operation of PI control has caused the running frequency to be offset from the set value.

3 M.A/Dec Err

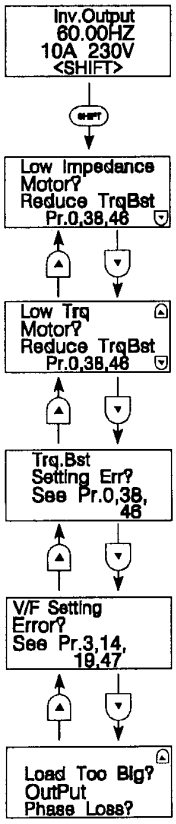
(Acceleration/deceleration time is longer than the value set in Pr. 7/Pr. 8)



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

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

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



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.

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

Is the motor a constant-torque motor (motor for inverter)? If so, reduce the torque boost set value.
Related parameters: Pr. 0, 38, 46

Since the torque boost set value may be inappropriate, check the following relevant parameters:
Related parameters: Pr. 0, 38, 46

Since the V/F pattern setting may be inappropriate, check the following relevant parameters: Related parameters: Pr. 3, 14, 19, 47

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.

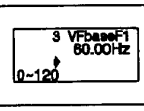
Press the [SHIFT] key to display the relevant assumed cause.

3.2.4 Other Help Function

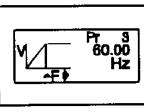
■ Graphic function
Press the [HELP] key on the parameter setting screen to display the data of the corresponding parameter graphically.

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

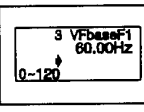
1) Read the required parameter in accordance with page 51 or page 62.

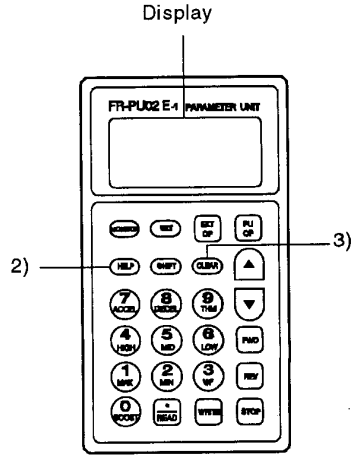


2) Press the [HELP] key. .....The data of the parameter is displayed graphically.



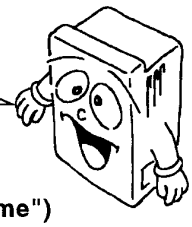
3) Press the [CLEAR] key. .... The display returns to the previous screen.





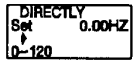
3.3 SETTING AND CHANGING THE VALUES IN THE PARAMETERS

The inverter has many parameters. Using the PU, the required parameters can be selected and their values set and/or changed as appropriate according to the load and running conditions. For more information, see the "Parameter List" (page 64). Set "1" in Pr. 77 "parameter write disable" to disable write. (See page 102.)



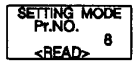
- **Operation procedure (Reading and writing the value of Pr. 8 "deceleration time")**

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

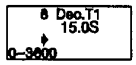


2) Press the [SET] key. ..... The inverter is placed in the parameter setting mode.

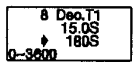
3) Enter the required parameter number. ..... The screen on the right is displayed.



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



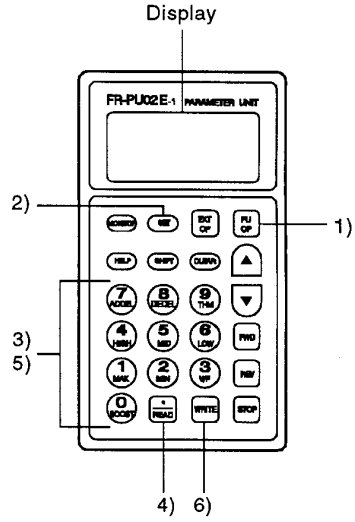
5) Enter the required value. (Example: To set to 180 seconds) (Note 1) ..... A new set value is shown on the display.



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

..... If an error is displayed by pressing the [WRITE] key, see page 23.

Display



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.

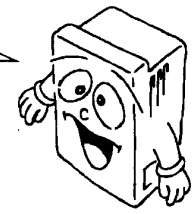
Note: Set and/or change the parameter values in the PU operation mode. When the PU operation display is not being provided, switch to the PU operation mode in accordance with page 33. Note that the values of the following parameters may be set and/or changed in the external operation and combined operation 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 52.

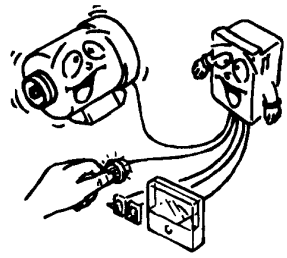
3.3.1 Overview of the Parameter Unit Functions

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

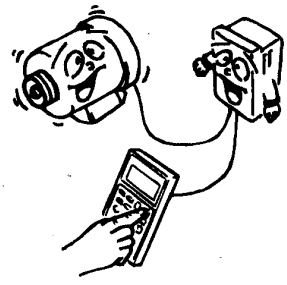


Setting of operation mode (Page 103)

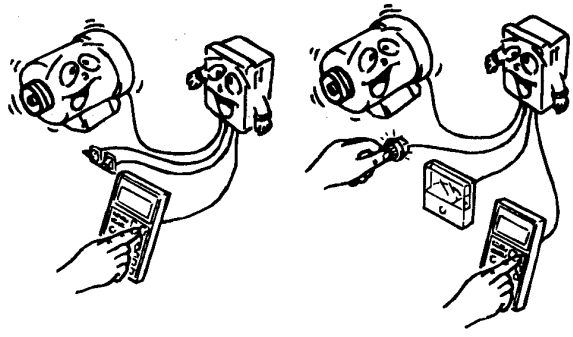
- **External operation mode**
  (Operation is performed from the frequency setting potentiometer, start switch or the like provided outside the inverter.)



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

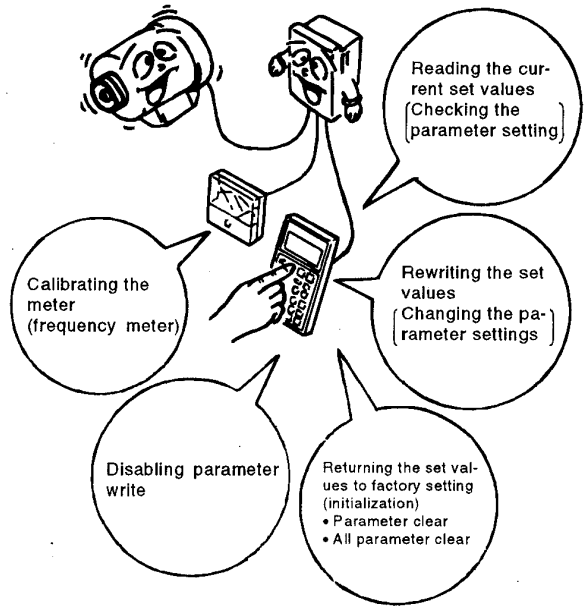


- **Combined operation mode**
  (Operation is performed with the start signal provided by an external signal and the running frequency provided from the PU (and vice versa).)

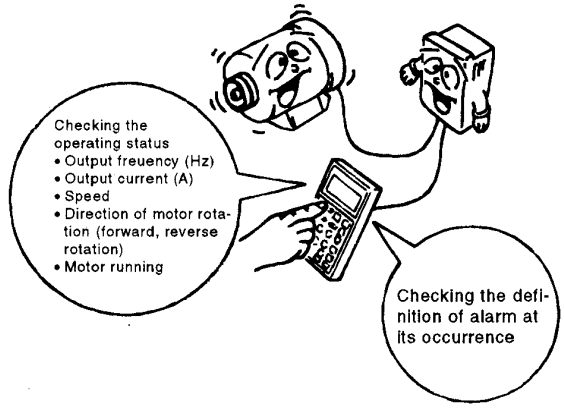


Potentiometer rating 1 or 2W, 1kΩ

Setting of parameters (Page 62)



Monitoring (Page 42)



3.4 PARAMETERS

3.4.1 Parameter List

Function	Parameter Number	Name	Screen Display	Setting Range	Minimum Setting Increment	Factory Setting	Customer Set Value	Refer To:
Basic functions	0	Torque boost(manual)	Trq.Bst1	0 to 30%	0.1%	6%/3% (Note 1)		67
	1	Maximum frequency	Max.F1	0 to 120Hz	0.01Hz	120Hz		
	2	Minimum frequency	Min.F1	0 to 120Hz	0.01Hz	0Hz		
	3	Base frequency	VFbaseF1	0 to 120Hz	0.01Hz	60Hz		68
	4	Multi-speed setting (high speed)	PresetF1	0 to 120Hz	0.01Hz	60Hz		
	5	Multi-speed setting (middle speed)	PresetF2	0 to 120Hz	0.01Hz	30Hz		
	6	Multi-speed setting (low speed)	PresetF3	0 to 120Hz	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)		69
	8	Deceleration time	Dec.T1	0 to 3600 seconds/0 to 360 seconds	0.1 seconds/ 0.01 seconds	5 seconds/15 seconds (Note 1)		
	9	Electronic thermal O/L relay	Set THM	0 to 500A	0.01A	Rated output current		70
Standard operation functions	10	DC injection brake operation frequency	DC Br.F	0 to 120Hz, 9999	0.01Hz	3Hz		
	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	0.5 to 60Hz	0.01Hz	0.5Hz		71
	14	Applied load selection	Load VF	0, 1	1	0		72
	15	Jog frequency	JOG F	0 to 120Hz	0.01Hz	5Hz		
	16	Jog acceleration/deceleration time	JOG T	0 to 3600 seconds/0 to 360 seconds	0.1 seconds/ 0.01 seconds	0.5 seconds		
	17	External thermal O/L relay input	JOG/OH	0 to 7	1	0		74
	19	Base frequency voltage	VFbase V	0 to 1000V, 8888, 9999	0.1V	9999		75
	20	Acceleration/deceleration reference frequency	Acc/DecF	1 to 120Hz	0.01Hz	60Hz		
	21	Acceleration/deceleration time increments	Incr.T	0, 1	1	0		
	22	Stall prevention operation level	Stll Pv1	0 to 150%, 9999	0.1%	120%		
	23	Stall prevention operation level at double speed	Stll Pv2	0 to 200%, 9999	0.1%	9999		
	24	Multi-speed setting (speed 4)	PresetF4	0 to 120Hz, 9999	0.01Hz	9999		77
	25	Multi-speed setting (speed 5)	PresetF5	0 to 120Hz, 9999	0.01Hz	9999		
	26	Multi-speed setting (speed 6)	PresetF6	0 to 120Hz, 9999	0.01Hz	9999		
	27	Multi-speed setting (speed 7)	PresetF7	0 to 120Hz, 9999	0.01Hz	9999		
	28	Multi-speed input compensation	Pre.Comp	0, 1	1	0		
	29	Acceleration/deceleration pattern	Acc/DecP	0, 1, 2, 3	1	0		
	30	High power factor converter connection selection	———	0, 3 to 5, 9999	1	0		78
	31	Frequency jump 1A	Fjump 1A	0 to 120Hz, 9999	0.01Hz	9999		81
	32	Frequency jump 1B	Fjump 1B	0 to 120Hz, 9999	0.01Hz	9999		
	33	Frequency jump 2A	Fjump 2A	0 to 120Hz, 9999	0.01Hz	9999		
	34	Frequency jump 2B	Fjump 2B	0 to 120Hz, 9999	0.01Hz	9999		
	35	Frequency jump 3A	Fjump 3A	0 to 120Hz, 9999	0.01Hz	9999		
	36	Frequency jump 3B	Fjump 3B	0 to 120Hz, 9999	0.01Hz	9999		
	37	Speed display	Dispunit	2, 4, 6, 8, 10, 11 to 9998	1	4		82
	38	Automatic torque boost	A.TrqBst	0 to 200%	0.1%	0%		83
	39	Automatic torque boost operation starting current	NoLoad I	0 to 500A	0.01A	0A		
Multi-function output terminal functions	40	Output terminal assignment	Selectop	0 to 9999	1	1234		
	41	Up-to-frequency sensitivity	SU Range	0 to 100%	0.1%	10%		84
	42	Output frequency detection	SetFU FW	0 to 120Hz	0.01Hz	6Hz		85
	43	Output frequency detection at reverse rotation	SetFU RV	0 to 120Hz, 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		86
	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 to 30%, 9999	0.1%	9999		
	47	Second V/F (base frequency)	VFbaseF2	0 to 120Hz, 9999	0.01Hz	9999		
	48	Second stall prevention operation current	Stall2 I	0 to 150%	0.1%	120%		
	49	Second stall prevention operation frequency	Stall2 F	0 to 120Hz, 9999	0.01Hz	0		
	50	Second output frequency detection	SetFU 2	0 to 120Hz	0.01Hz	30Hz		87

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.

Function	Parameter Number	Name	Screen Display	Setting Range	Minimum Setting Increment	Factory Setting	Customer Set Value	Refer To:
Display functions	51	Inverter LED display data selection	Set LED	1 to 6, 8, 10 to 14, 17	1	1		88
	52	PU main display data selection	Set Main	0, 17,19, 20, 23, 24, 25	1	0		
	53	PU level display data selection	Set Lvl.	0 to 3, 5, 6, 8, 10 to 14, 17	1	1		
	54	FM terminal function selection	Set FM	1 to 3, 5, 6, 8, 10 to 14, 17, 21, 101 to 103, 105, 106, 108, 110 to 114, 117, 121	1	1		
	55	Frequency monitoring reference	CalbFM F	0 to 120Hz	0.01Hz	60Hz		90
	56	Current monitoring reference	CalbFM I	0 to 500A	0.01A	Rated output current		
Automatic restart functions	57	Restart coasting time	RestrtT1	0, 0.1 to 5 seconds, 9999	0.1 seconds	9999		91
	58	Restart cushion time	RestrtT2	0 to 60 seconds	0.1 seconds	1.0 second		
Additional function	59	Remote setting function selection	Rmt Set	0, 1, 2	1	0		93
Operation selection functions	60	Intelligent mode selection	Int.Mode	0, 3, 4	1	0		94
	61	Reference I for intelligent mode	Ref I	0 to 500A, 9999	0.01A	9999		95
	62	Ref. I for intelligent mode accel.	Acc t/I	0 to 150%, 9999	0.1%	9999		
	63	Ref. I for intelligent mode decel.	Dcc t/I	0 to 150%, 9999	0.1%	9999		
	65	Retry selection	Retry	0 to 5	1	0		96
	66	Stall prevention operation reduction starting frequency	Stll coF	0 to 120Hz	0.01Hz	60Hz		
	67	Number of retries at alarm occurrence	Retry No	0 to 10, 101 to 110	1	0		97
	68	Retry waiting time	Retry t	0 to 10 seconds	0.1 seconds	1.0 second		
	69	Retry count display erasure	Retry N	0	—	0		
	71	Applied motor	SetMotor	0, 1, 2	1	0		98
	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		99
	74	Response time for analog signal	IPfilter	0 to 8	1	1		100
	75	Reset selection/PU disconnection detection/PU stop selection	RES Mode	0, 1, 2, 3, 14 to 17	1	14		
	76	Alarm code output selection	Alarm OP	0, 1, 2, 3	1	0		102
	77	Parameter write disable selection	EnableWr	0, 1, 2	1	0		
	78	Reverse rotation prevention selection	EnableFR	0, 1, 2	1	0		
	79	Operation mode selection	ContMode	0 to 5, 7, 8	1	0		103
Commercial power supply switching functions	* 107	Commercial power supply switching sequence output terminal selection	——	0, 1, 2	1	0		104
	* 108	MC switching interlock time	——	0 to 100.0 seconds	0.1 second	1.0 second		
	* 109	Restart waiting time	——	0 to 100.0 seconds	0.1 second	0.5 second		
	* 110	Commercial power supply switching selection at alarm occurrence	——	0.1	1	0		
	* 111	Automatic inverter-commercial power supply switching selection	——	0 to 60.0Hz, 9999	0.01Hz	9999		
PI control functions	* 128	Forward-reverse action selection	PI Band	0, 1, 10, 11, 20, 21	1	0		105
	* 129	PI proportional band	Intgrl T	0.1 to 1000%, 9999	0.1%	100%		
	* 130	Integral time	PI Direc	0.1 to 3600 seconds, 9999	0.1 second	1 second		
	* 131	Upper limit value	PI UPlim	0 to 100%, 9999	0.1%	9999		
	* 132	Lower limit value	PI LOlim	0 to 100%, 9999	0.1%	9999		
	* 133	PI control set value setting for PU operation	PI Point	0 to 100%	0.01%	0%		
Auxiliary functions	* 145	Parameter unit language switching	PU Lang	0, 1, 2, 3	1	0		106
	* 152	Open motor circuit detection level	——	0 to 50%	0.1%	5.0%		
	* 153	Open motor circuit detection time	——	0.05 to 1 seconds	0.1 second	0.5 second		
	* 154	Cumulative power monitoring clear	——	0	——	0		107
	* 155	RT activated condition	RT set	0, 10	1	0		
	* 156	Stall prevent. select. at regeneration	Stll Prv	0 to 31, 100	1	0		108
	* 157	OL signal waiting time	OL delay	0 to 25 seconds, 9999	0.1 seconds	0		109
	* 158	AM terminal function selection	AM set	1 to 3, 5, 6, 8, 10 to 14, 17, 21, 9999	1	9999		
	* 159	PWM f decrease at low speed	PWM3 f	0, 1, 2, 3	1	0		110
	* 160 to * 199	Parameters for inboard options.						—
	* 200 to * 231	Parameters set for programmed operation.						

Function	Parameter Number	Name	Screen Display	Setting Range		Minimum Setting Increment	Factory Setting		Customer Set Value	Refer To:
Calibration functions	900	FM terminal calibration	FM Tune	—		—	—	(Note 4)		110
	901	AM terminal calibration	AM Tune	—		—	—	(Note 4)		111
	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 120Hz	0.01Hz	(5V)	60Hz		
	904	Frequency setting current bias	ExtIbias	0 to 20mA	0 to 60Hz	0.01Hz	(4mA)	0Hz		
	905	Frequency setting current gain	ExtIgain	0 to 20mA	1 to 120Hz	0.01Hz	(20mA)	60Hz		

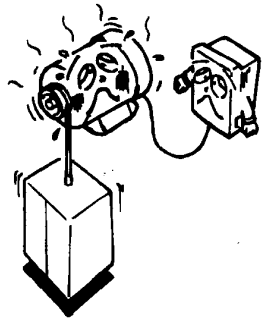
Note *: When the FR-PU01E is used, read and write of these parameters cannot be performed. (IF performed, Err is displayed.) (Set the calibration function numbers 900 to 905 using C-1 to C-6). For more information, see page .

3: 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 selection).

4: 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).

3.4.2 Setting of Parameters to Improve the Corresponding Operational Functions

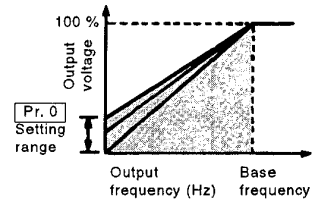
Hoist or the like requires large starting torque



⇨ Pr. 0 "torque boost (manual)"

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

Model	Factory Setting	Setting Range
7.5K and down	6 %	0 to 30 %
11K and up	3 %	



Note: 1. When the inverter-dedicated motor (constant-torque motor) is used, change the setting of this parameter as follows:
7.5 K and down...4 %
11 K and up...2 %

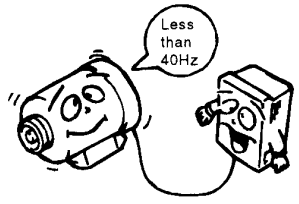
2. When either of the following values is set in Pr. 0, changing the setting of Pr. 71 "applied motor" will change the set value of this parameter automatically:

(1) Pr. 0 = 6%/3%* (factory setting)
When the set value of Pr. 71 is changed from the general-purpose motor selection value "0 or 2" to the constant-torque motor selection value "1", the Pr. 0 setting is automatically changed to 4%/2%*.

(2) Pr. 0 = 4%/2%*
When the set value of Pr. 71 is changed from the constant-torque motor selection value "1" to the general-purpose motor selection value "0 or 2", the Pr. 0 setting is automatically changed to 6%/3%* (factory setting).

*: The set value changes with the inverter capacity (7.5K or less)/(11K or more).

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

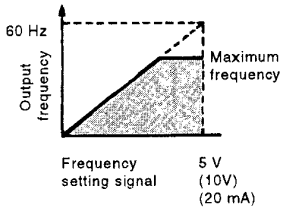


⇨ Pr. 1 "maximum frequency"

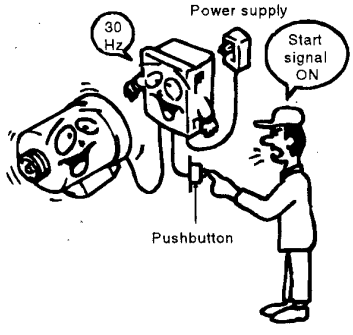
Allows the upper limit of the outputfrequency to be clamped.

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

Factory Setting	Setting Range
120 Hz	0 to 120 Hz



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

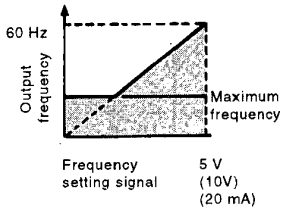


⇨ Pr. 2 "minimum frequency"

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.

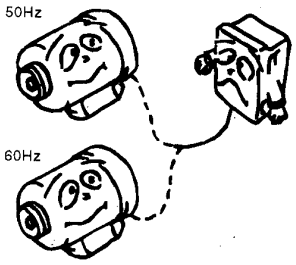
Factory Setting	Setting Range
0 Hz	0 to 120 Hz



⚠ CAUTION

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

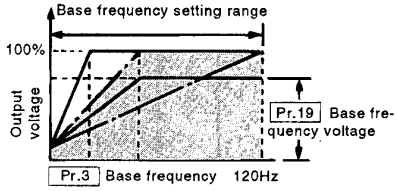
To set the reference frequency (base frequency) at the rated torque of the motor according to the motor rating



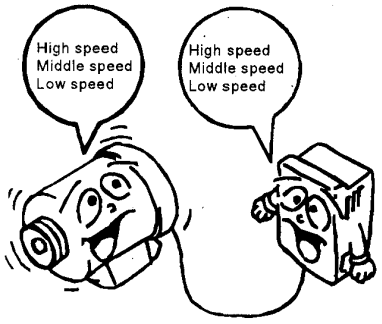
⇨ **Pr. 3 "base frequency", Pr. 19 "base frequency voltage"**

- Allows the base frequency (reference frequency at the rated motor torque) to be set as appropriate between 0 and 120Hz according to the motor rating.

Note: 1. Set the base frequency to 60Hz for use of an inverter-dedicated motor (constant-torque motor).
2. 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.

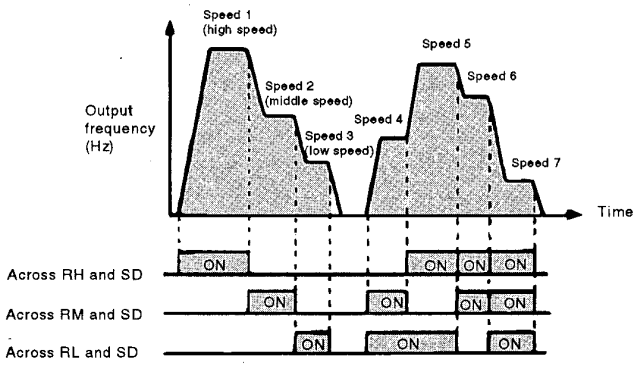


To set multiple speeds



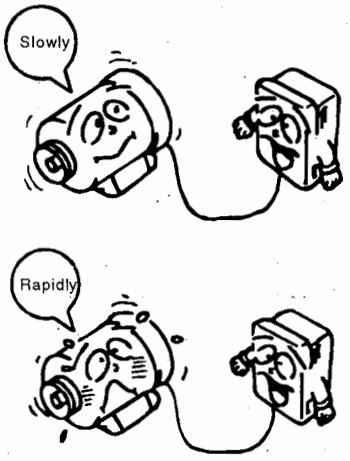
⇨ **Pr. 4 "3-speed setting (high speed)", Pr. 5 "3-speed setting (middle speed)", Pr. 6 "3-speed setting (low speed)", Pr. 24 "multi-speed setting (speed 4)", Pr. 25 "multi-speed setting (speed 5)", Pr. 26 "multi-speed setting (speed 6)", Pr. 27 "multi-speed setting (speed 7)"**

- Allows any speed to be selected by switching the external contact signal (across terminals RH/RM/RL and SD).
- Each speed (frequency) may be specified as appropriate between 0 to 120Hz 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"**

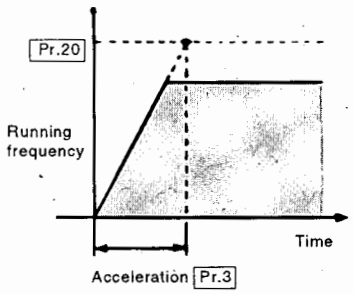
(1) Confirmation of acceleration time setting range and minimum setting increments

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

(2) Setting of acceleration time

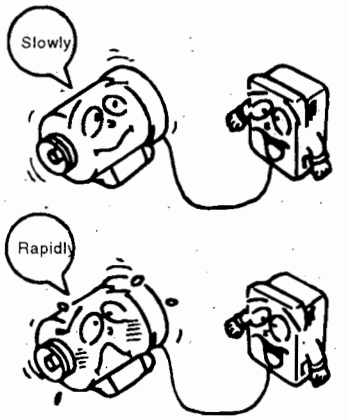
In acceleration time (Pr. 7), set a period of time required to reach the acceleration/deceleration reference frequency (Pr. 20) from 0Hz. Set a longer time to accelerate more slowly, and a shorter time to accelerate more rapidly. (Note)



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

Note: 1. In only S-pattern acceleration/deceleration A (see page 77), the set time is a period of time required to reach the base frequency (Pr. 3).
2. If Pr. 20 (acceleration/deceleration reference frequency) setting is changed, the set values of calibration Pr. 903 and Pr. 905 (frequency setting signal gain) remain unchanged. To adjust the gains, adjust calibration Pr. 903 and Pr. 905.
3. When the set value of Pr. 7 is "0", the acceleration time is set to 0.04 seconds.

To decelerate slowly or rapidly



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

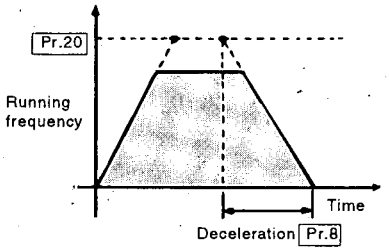
(1) Confirmation of deceleration time setting range and minimum setting increments

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

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

(2) Setting of deceleration time

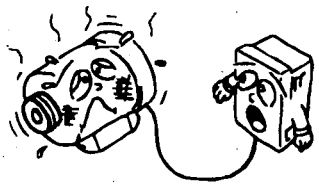
In deceleration time (Pr. 8), set a period of time required to reach 0Hz from the acceleration/deceleration reference frequency (Pr. 20). Set a longer time to decelerate more slowly, and a shorter time to decelerate more rapidly. (Note)



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

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

Motor overheat protection



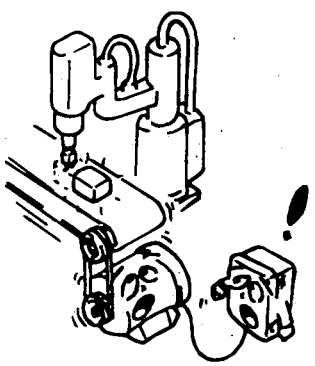
⇨ Pr. 9 "electronic overcurrent protection"

- The set value for motor overheat protection may be set as a current value (A). Normally set the rated current value of the motor at 50Hz. This function provides an optimum protective characteristic including a reduction in motor cooling capability in low-speed operation.
- Setting of "0" makes the motor protective function invalid. (The inverter output transistor protective function is valid.)
- When Mitsubishi's constant-torque motor is used, set "1" 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".

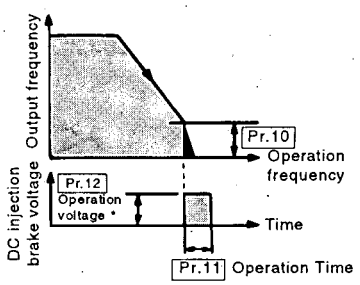
Factory setting of Pr. 9 ..... [rated output current of the inverter]

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



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

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

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

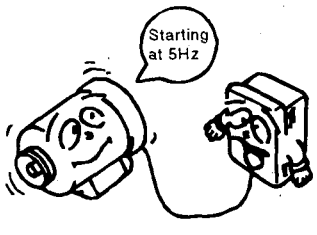
Parameter	Factory Setting	Setting Range
Pr.10	3Hz	0 to 120Hz, 9999 (Note 1)
Pr.11	0.5 seconds	0 to 10 seconds, 8888 (Note 2)
Pr.12	7.5K and down...6%, 11K and up...3%	0 to 30%

Note: 1. Setting 9999 in Pr. 10 allows the DC injection brake to start at the frequency set in Pr. 13 (starting frequency).
2. When 8888 is set in Pr. 11, connection of terminal MRS and SD starts the DC injection brake. At this time, the essential function (output stop) of terminal MRS is invalid.
3. The Pr. 11 setting of 8888 and commercial power supply-inverter switch-over function (refer to page 134) cannot be used together since terminal MRS is shared between them.
4. When the inverter-dedicated motor (constant-torque motor) is used, change the setting of Pr. 12 "DC dynamic brake operation frequency" as described below:
   7.5K or down.....4%, 11K and up.....2%
5. When either of the following values is set in Pr. 0, changing the setting of Pr. 71 "applied motor" will change the set value of this parameter automatically:
   (1) Pr. 0 = 6%/3%* (factory setting)
   When the set value of Pr. 71 is changed from the general-purpose motor selection value "0 or 2" to the constant-torque motor selection value "1", the Pr. 0 setting is automatically changed to 4%/2%*.
   (2) Pr. 0 = 4%/2%*
   When the set value of Pr. 71 is changed from the constant-torque motor selection value "1" to the general-purpose motor selection value "0 or 2", the Pr. 0 setting is automatically changed to 6%/3%* (factory setting).
   *: The set value changes with the inverter capacity (7.5K or less)/(11K or more).

⚠ CAUTION

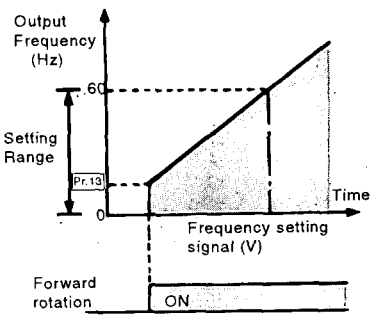
⚠ Install a mechanical brake. There is no stopping torque.

To limit the running frequency at start

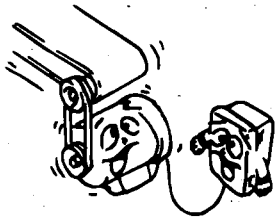


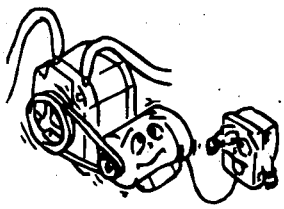
⇨ Pr. 13 "starting frequency"

- Allows the starting frequency to be set between 0.5 to 60Hz.
For example, when the starting frequency setting is 5Hz, the motor starts running as soon as the frequency setting signal reaches 5Hz.



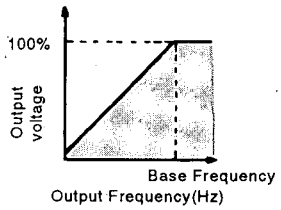
To select the optimum output characteristic (V/F characteristic) for application and load characteristic



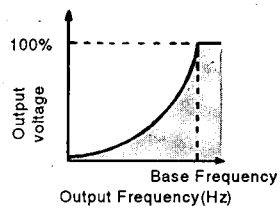


⇨ **Pr. 14 "applied load selection"**

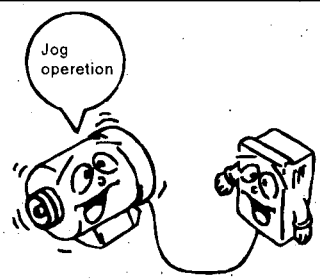
- **Conveyor, carrier, etc. (for constant-torque loads)**
  Set "0" (factory setting).



- **Fan and pump (for variable-torque loads)**
  Set "1".
  Since an overvoltage is more likely to occur in this load characteristic than in the constant-torque load characteristic, set a longer deceleration time.



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



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

- Allows jog operation to be started and stopped by selecting the jog mode (connecting terminals JOG and SD) and turning on/off the start signal (terminals STF,STR). Jog operation may also be performed by using the parameter unit. For full information on the operation procedure, see page 38.

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

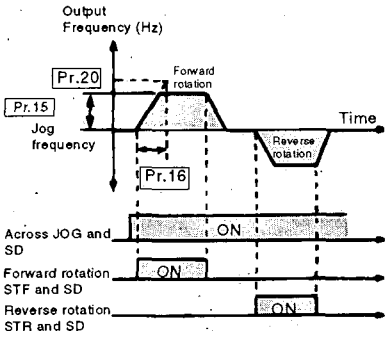
  (1) Confirmation of acceleration/deceleration time setting range and minimum setting increments
  Use Pr. 21 "acceleration/deceleration time increments" to set the acceleration/deceleration time setting range and minimum setting increments. Before setting the acceleration/deceleration time, the set value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

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

(2) Setting of acceleration/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

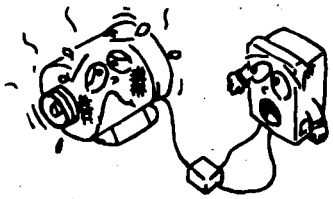
Note: 1. In only S-pattern acceleration/deceleration A (see page 77), the set time is a period of time required to reach the base frequency (Pr. 3).
2. If Pr. 20 (acceleration/deceleration reference frequency) setting is changed, the set values of calibration Pr. 903 and Pr. 905 (frequency setting signal gain) remain unchanged. To adjust the gains, adjust calibration Pr. 903 and Pr. 905.

(3) Setting of frequency

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

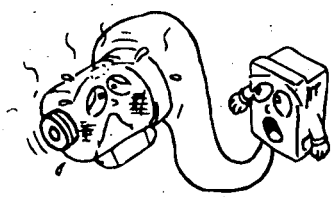
Factory Setting	Setting Range
5Hz	0 to 120Hz

To select a thermal relay in the outside of the inverter



External thermal relay

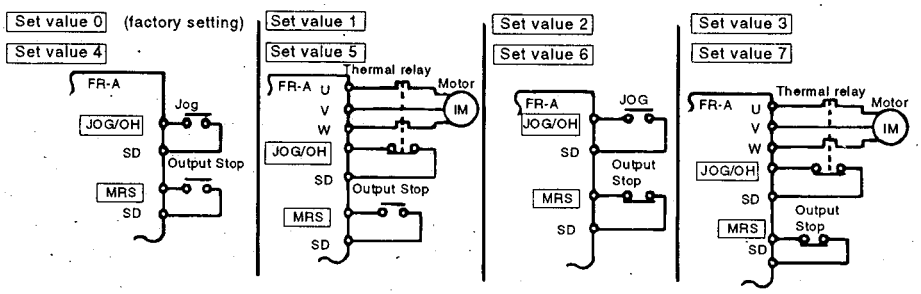
Temperature sensor



⇨ 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). Also, when any of 4 to 7 is set, the output terminal to which "9" was set in Pr. 40 (output terminal assignment) acts as the zero current detection signal terminal.

Pr. 17 Set Value	JOG/OH Terminal Function		MRS Terminal Function		Output Terminal Signal Set to "9" in Pr. 40
	Jog mode	OH(external thermal relay input)	N/O input	N/C input	
0 (factory setting)	●	—	●	—	During PU operation
1	—	●	●	—	
2	●	—	—	●	
3	—	●	—	●	
4	●	—	●	—	Open motor circuit detection (For details, refer to page 106.)
5	—	●	●	—	
6	●	—	—	●	
7	—	●	—	●	

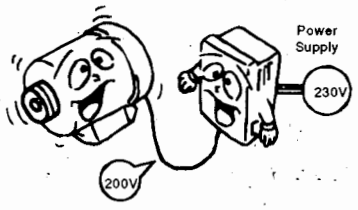


Note: When the commercial power supply switching sequence is selected, the function of the JOG/OH input terminal is fixed to the external thermal relay input.

⚠ CAUTION

⚠ With the external thermal relay connected, do not switch to jog operation. Otherwise, the motor will be started by the start signal only.

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



⇨ **Pr. 19 "base frequency voltage"**

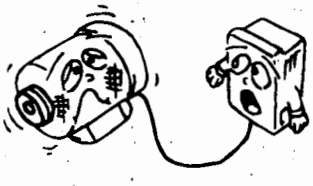
- By setting 200V in Pr. 19 "base frequency voltage", the motor of rated voltage lower than the power supply voltage of the inverter can be used most a ppropriately.

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

Note: 1. Setting "9999" (factory setting) in Pr. 19 makes the maximum output voltage identical to the power supply voltage.
2. 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.)

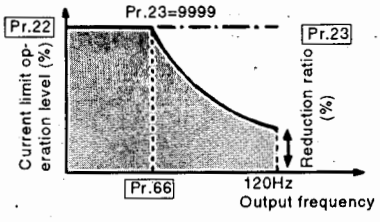
■ **<Pr. 20, Pr. 21 ⇨ See the section of Pr. 7>**

To set the stall prevention (current limit) operation level



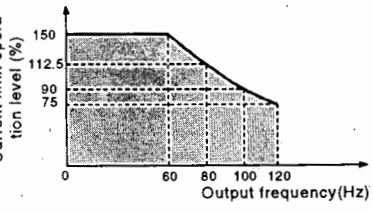
⇨ **Pr. 22 "stall prevention operation level"**
Pr. 23 "stall prevention operation level at double speed"
Pr. 66 "stall prevention operation level reduction starting frequency"

- In Pr. 22 "stall prevention operation level", set the stall prevention (current limit) operation level. Normally set to 120% (factory setting).



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

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



Pr. 66 is for the reduction starting frequency, and Pr. 23 for 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 120Hz.

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

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

where, $A = \left(\frac{Pr.66(Hz) \times Pr.22(\%)}{\text{output frequency (Hz)}}\right)$, $B = \left(\frac{Pr.66(Hz) \times Pr22(\%)}{120(Hz)}\right)$

- When "0" is set in Pr. 22, the stall prevention operation is not performed.
- When "9999" is set in Pr. 22, the stall prevention level can be changed by terminal No. 1. A specific method is given below. (The fast-response current limit level remains unchanged.)

⚠ CAUTION

⚠ Do not set the stall prevention operation level too small. If set so,torque generated will reduce.

⚠ Test run must be performed.
During acceleration, the stall prevention may be activated to increase acceleration time.
During constant speed, the stall prevention may be activated to vary speed suddenly.
During deceleration, the stall prevention may be activated to increase deceleration time, increasing deceleration distance.

Setting method

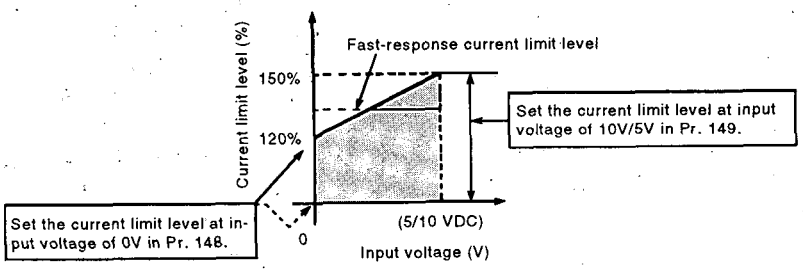
Set "9999" in Pr. 22 "stall prevention operation level".

Stall prevention operation level signal

Enter 0-5V (or 0-10V) 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

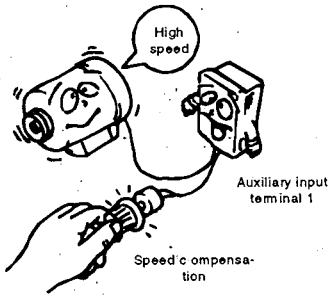
Pr. No.	Description	Setting Range	Minimum Increment	Factory Setting	Remarks
22	Stall prevention level	0 to 150%, 9999	0.1%	120%	9999: Analog input
22 (Note)	First response current limit level	0, 1	1	1	0: None 1: 135%
148 (Note)	Current limit level at the input voltage of 0V	0 to 150%	0.1%	120%	(Bias)
149 (Note)	Current limit level at the input voltage of 10V/5V	0 to 150%	0.1%	150%	(Gain)



Note: 1. Set 701 in Pr. 77 to enable read and write. (When Pr. 77 = 701, Pr. 22 acts as a parameter for fast response current limit level.)
2. Use Pr. 73 to switch the terminal 1 input voltage between 0 to 5V and 0 to 10V.
3. When 9999 is set in Pr. 22, the terminal 1 input is dedicated to stall prevention level setting. Therefore, the auxiliary input and override functions of terminal 1 are made invalid.
4. The fast response current limit level is factory-set to 135%.

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

To compensate for speeds during multi-speed operation



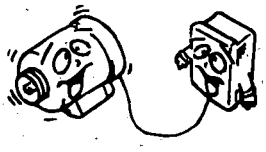
⇨ **Pr. 28 "multi-speed input compensation"**

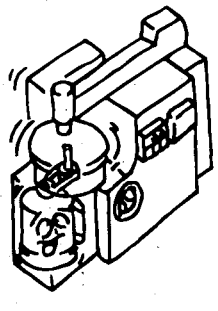
- By entering a compensation signal into the auxiliary input terminal 1 (Note), the speeds (frequencies) of multi-speed settings selected by the RH, RM and RL terminals can be compensated for.

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

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

To select the optimum acceleration/deceleration pattern for application

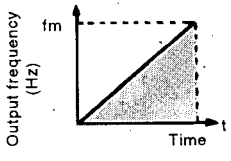




⇨ **Pr. 29 "acceleration/deceleration pattern"**

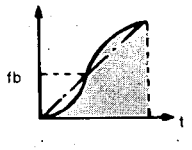
- **General application**
  Set "0" (factory setting). A general acceleration/deceleration pattern (linear acceleration/deceleration) is achieved.
  Generally this setting is used for operation.

Set value 0
[Linear acceleration/deceleration]

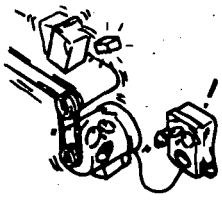


- **For machine tool spindles**
  Set "1". This setting is used when it is necessary to make acceleration/deceleration in a short time up to the 60Hz or higher speed range (S-pattern acceleration/deceleration A). In this acceleration/deceleration pattern, fb (base frequency) is always the inflection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

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

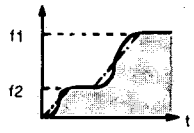


Note: For the acceleration/deceleration time, set the time required to reach the base frequency (Pr. 3), not the acceleration/deceleration reference frequency (Pr. 20).



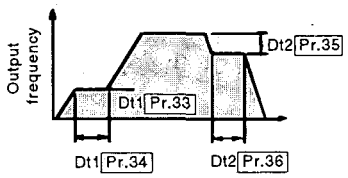
- **Prevention of cargo collapse on conveyor, etc.**
  Set "2" to provide an S-pattern acceleration/deceleration from f2 (current frequency) to f1 (target frequency), easing an acceleration/deceleration shock. This pattern has an effect on the prevention of cargo collapse, etc.

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



- **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 the setting.

Set value 3
[Backlash compensation function]



Pr. Number	Function Name	Setting Range	Factory Setting
33	Backlash acceleration stopping frequency	0 to 120Hz	1Hz
34	Backlash acceleration stopping time	0 to 360 seconds	0.5 seconds
35	Backlash deceleration stopping frequency	0 to 120Hz	1Hz
36	Backlash deceleration stopping time	0 to 360 seconds	0.5 seconds

Note: When Pr. 29 = 3, Pr. 33 to 36 act as parameters for backlash compensation function. Frequency jump function, if used, for Pr. 33 to 36 will still function but parameter values are not shown. To read these parameters set Pr. 29 = 0, 1 or 2.

To use the high power factor converter (FR-HC)

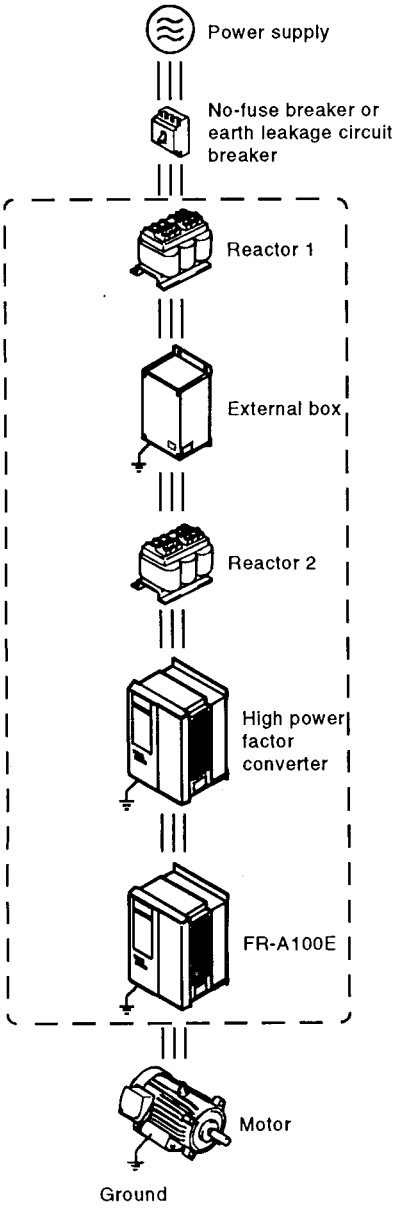
⇨ **Pr. 30 "high power factor converter connection selection"**

- ***When the high power factor converter (FR-HC) is connected and used with the inverter, the inverter must be protection-coordinated with the high power factor converter. When connecting the high power factor converter, always set any of 3, 4 and 5 in Pr. 30. Also, connect cables between the inverter, power supply and high power factor converter correctly in accordance with the high power factor converter instruction manual.***

(1) Inverter operation enable signal input terminal
The inverter operation enable (RDY) signal of the high power factor converter is entered into this terminal. Allocate the used terminals to the MRS/AU/RT terminal by parameter setting and connect it to the RDY terminal of the high power factor converter (refer to Table 1). The conventional functions of the used terminals are deleted (refer to Table 2).

- Operation logic
  Inverter operation enable signal input terminal and SD are connected.....Output shut-off
  Inverter operation enable signal input terminal and SD are disconnected.....Shut-off canceled

The operation logic is fixed. Unlike the mechanical reset (MRS) signal, it cannot be changed by parameter setting.



(2) Undervoltage, instantaneous power failure protection
Undervoltage and instantaneous power failure are detected by the high power factor converter. When the protective function of the high power factor converter is activated, the inverter output is shut off by the inverter operation enable signal. The undervoltage/instantaneous power failure protection function of the inverter itself is made invalid.

(3) Automatic restart after instantaneous power failure
When automatic restart after instantaneous power failure is required, select automatic restart after instantaneous power failure (Pr. 57 ≠ "9999", terminals CS and SD connected) in the inverter and also set the corresponding parameter in the high power factor converter to activate automatic restart after instantaneous power failure. The inverter will restart in accordance with the automatic restart after instantaneous power failure of the high power factor converter.

(4) Regeneration
The high power factor converter has the power return function. In the regenerative mode, power is returned from the high power factor converter.

(5) Instantaneous power failure detection signal input terminal
The instantaneous power failure detection signal of the high power factor converter is entered into this terminal. Use this terminal when automatic restart after instantaneous power failure for computer link or programmable controller link has been selected (Pr. 125 = "2", Pr. 57 ≠ "9999") by using the computer link or programmable controller link function of the inboard option. Assign either of AU and RT by parameter setting and connect the terminal to the instantaneous power failure detection signal terminal of the high power factor converter (refer to Table 1). The inverter will preserve the operating status at the time when the instantaneous power failure detection signal input terminal and SD are connected, and will restart in that status when power is restored. This signal is not used for instantaneous power failure protection.

Table 1 Pr. 30 Setting and Used Terminals

<table>
<tr><th>Pr. 30 Setting / Terminal</th><th>0</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>MRS</td><td rowspan="3">Provides the corresponding function given in Table 2.</td><td>Inverter operation enable signal</td><td colspan="2">Provides the corresponding function given in Table 2.</td></tr>
<tr><td>RT</td><td>Provides the corresponding function given in Table 2.</td><td>Inverter operation enable signal</td><td>Instantaneous power failure detection signal</td></tr>
<tr><td>AU</td><td colspan="2">Instantaneous power failure detection signal</td><td>Inverter operation enable signal</td></tr>
</table>

Table 2 Pr. 30 Setting and Deleted Functions (×: Deleted function)

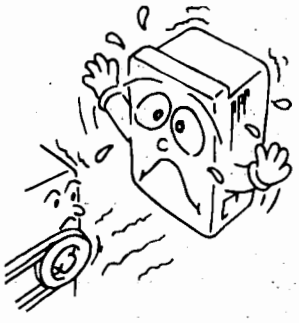
Corresponding Function \ Pr. 30 Setting		0, 1	3	4	5
External DC injection brake operation (Pr. 11 = 8888)	Refer to page 70	●	×	●	●
PU operation interlock (Pr. 79 = 7)	Refer to page 131	●	×	●	●
Commercial power supply-inverter switch-over sequence (Pr. 107 ≠ 0)	Refer to page 104	●	×	●	●
Second acceleration/deceleration time selection terminal (RT terminal)	Refer to page 173	●	●	×	●*1
RT terminal activated condition (Pr. 155)	Refer to page 107	●	●	×	●*1
RT terminal-based PI control (Pr. 128 ≠ 0)	Refer to page 105	●	●	×	●*1
Current input selection (AU selection)	Refer to page 173	●	●	●	×
Output shut-off function (MRS terminal)	Refer to page 173	●	● (Logic fixed)	●	●

*1: When the following conditions are all satisfied, the instantaneous power failure detection signal is input to the corresponding terminal and its conventional function cannot be used:

- Pr. 30 (high power factor converter connection selection) = "3", "4", "5" (high power factor converter connected)
- Pr. 57 (coasting time for automatic restart after instantaneous power failure/commercial power supply--inverter switch-over) ≠ "9999" (restart possible)
- Pr. 125 (link starting mode) = "2" (restart in link mode)

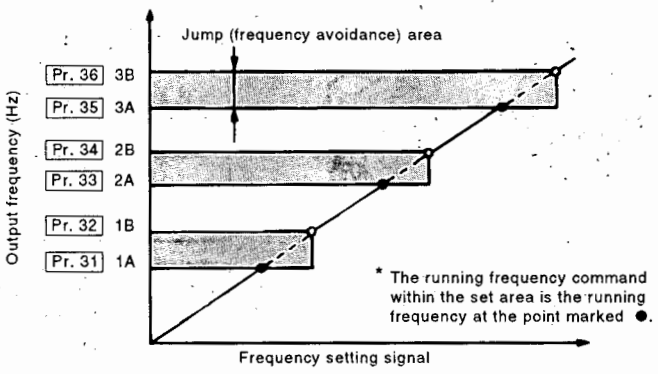
Note: 1. When the FR-HC is connected to the inverter, do not connect the power supply to the R, S and T terminals of the inverter. When Pr. 30 = 3, 4 or 5 and power is input to the R, S and T terminals, the inverter will shut off the output and display the option alarm (E.OPT).
2. When 3, 4 or 5 is set in Pr. 30, the parameter unit is reset and therefore the initial screen is displayed.

To avoid the resonant points of a machine



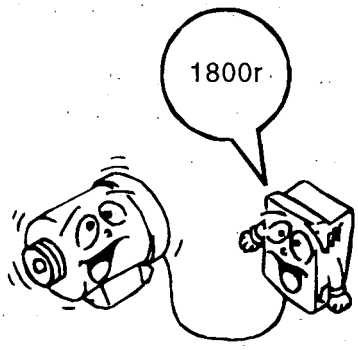
⇨ **Pr. 31 "frequency jump 1A", Pr. 32 "frequency jump 1B"**
Pr. 33 "frequency jump 2A", Pr. 34 "frequency jump 2B"
Pr. 35 "frequency jump 3A", Pr. 36 "frequency jump 3B"

- 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 to 36 into the backlash compensation setting functions. But Pr. 33 to 36 setting ranges are not displayed on the PU screen. And the set values of the frequency jump parameters are displayed in the parameter change list and initial value list, that is, when Pr. 29 is set to 3, the set values of Pr. 33 to 36 are not displayed in the lists.
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, 4, 6, 8, 10	• The set value is the number of motor poles. • The displayed value is the motor speed. Example: When the set value is "2", 3600 (r/min) is displayed at the output of 60Hz.
11 to 9998	• Set the machine speed at 60Hz operation. Example: When the set value is 150 (m/min), 150 (without display unit) is displayed at the output of 60Hz.

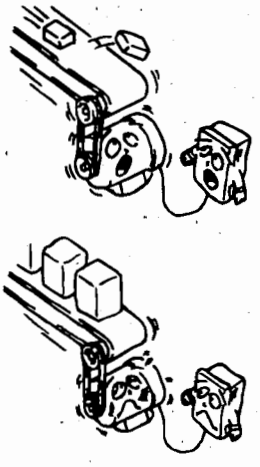
Note: 1. Only the display unit is set in this parameter. For the other frequency-related parameters (such as Pr. 1), set a frequency unit.
2. In the V/F control mode, the motor speed is converted into the output frequency and does not match the actual speed.
3. The factory setting is "4" (poles) (1800 r/min is displayed at the output of 60Hz).

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

⚠ CAUTION

⚠ Set the number of motor poles correctly.
Otherwise, the motor may result in overspeed, damaging the machine.

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

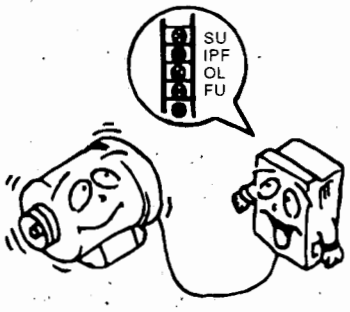


⇨ Pr. 38 "automatic torque boost"
Pr. 39 "automatic torque boost starting current"

- 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).

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.

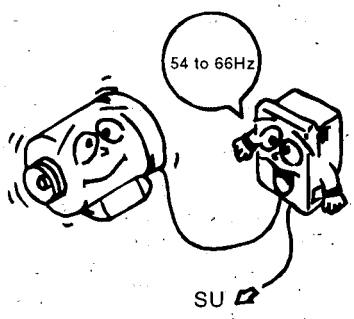
Pr. 40 : 1st digit | 2nd digit | 3rd digit | 4th digit
↑ SU ↑ IPF ↑ OL ↑ FU

- **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 ±10% of the set frequency. (Note 4) (Note 5)	Pr. 41
2	IPF/UVT	Instantaneous power failure or undervoltage	Output when instantaneous power failure protection or undervoltage protection occurs.	—
3	OL	Overload alarm	Output while the current limit function is operating.	Pr. 22, 23
4	FU1	Frequency detection	Output when the output frequency reaches or exceeds the specified detection frequency. (Note 4)	Pr. 42, 43
5	FU2	Second frequency detection	Output when the output frequency reaches or exceeds the specified detection frequency. (Note 4)	Pr. 50
7	THP	Electronic overcurrent protection alarm	Output when the electronic overcurrent protection cumulative value reaches 85% of the set level.	Pr. 9
8	PRG	Program mode	Output in the program mode. (Note 6)	Pr. 79
9	PU	PU operation mode	Output when the PU operation mode is selected.	Pr. 17 = 0 to 3
		Open motor circuit detection	—	Pr. 17 = 4 to 7

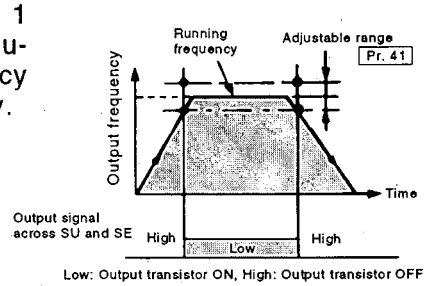
Note: 1. "0" set in the first digit of the four digits is not displayed. However, "0" set only in one digit is displayed.
2. The function of terminal RUN (output during inverter running) is fixed. This function cannot be changed by using Pr. 40.
3. "Output" indicates that the built-in transistor for open collector output is turned on (conducts).
4. In the PLG feedback control mode, the operations of up-to-frequency (SU) and frequency detection (FU1, FU2) are as described below:
   SU, FU1 : Output when the actual speed (frequency) under the control of the PLG feedback signal reaches or exceeds the specified detection frequency.
   FU2 : Output when the inverter output frequency reaches or exceeds the specified detection frequency.
5. Note that when the frequency setting is changed by the analog signal or the [▲]/[▼] key of the PU, the output of the SU (up to frequency) signal may alternate between ON and OFF depending on the speed of that change and the timing of the changing speed determined by the setting of the acceleration/deceleration time. (Such alternation does not take place when the acceleration/deceleration time setting is "0 seconds".)
6. Output when the inverter is switched to the external operation mode (enters the program mode) with "5" set in Pr. 79 (operation mode selection).
7. 6 cannot be set.
8. When "9" is set with any of 4 to 7 set in Pr. 17 (external thermal relay input), the output terminals function as open motor circuit detection signal terminals. (See page 106.)
9. When PI control is selected for the inverter, some of the terminal functions change. (See page 139.)
10. When 2 (commercial power supply switching) is set in Pr. 107, the output terminals act as commercial power supply switching function terminals. (See page 134.)

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



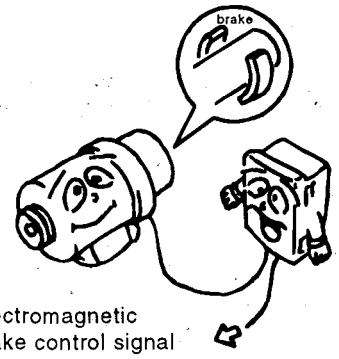
⇨ Pr. 41 "up-to-frequency sensitivity"

- Allows the output signal ON range to be adjusted between 1 and ± 100% of the running frequency when the output frequency reaches the running frequency.



Low: Output transistor ON, High: Output transistor OFF

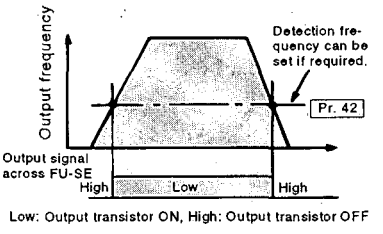
To set the operation and open signals of the electromagnetic brake, etc.



Electromagnetic brake control signal

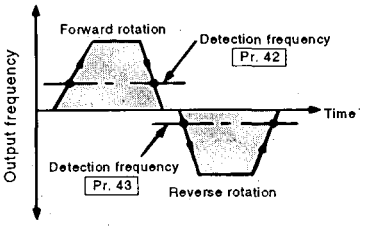
⇨ Pr. 42 "output frequency detection", Pr. 43 "output frequency detection at reverse rotation"

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



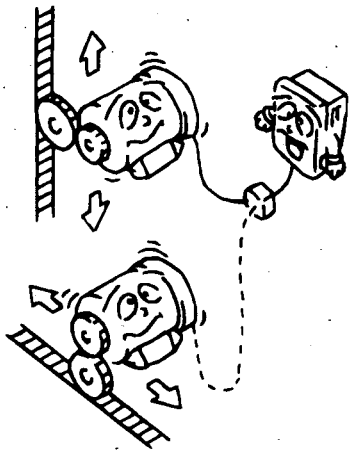
Low: Output transistor ON, High: Output transistor OFF

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



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

To switch between two motors different in conditions



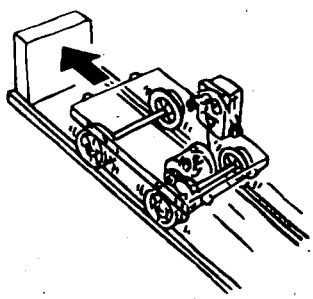
⇨ **Pr. 44 "second acceleration/deceleration time", Pr. 45 "second deceleration time"**
Pr. 46 "second torque boost", Pr. 47 "second V/F (base frequency)"

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

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

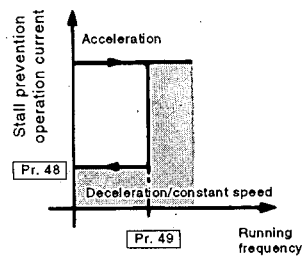
Note: 1. Setting "9999" (factory setting) in Pr. 45 causes both the second acceleration time and deceleration time to be the value set in Pr. 44.
2. The second acceleration/deceleration time is the time taken for acceleration to the frequency set in Pr. 20 "acceleration/deceleration reference frequency", as in Pr. 7 "acceleration time" and Pr. 8 "deceleration time".
3. The terminal RT activated condition can be selected using Pr. 155 "RT terminal activated condition".

To stop a trolley or the like 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 from 0Hz to the frequency set in Pr. 49. The setting of a low value is effective for a stop on contact, which requires low torque at low speed.
- This function is not valid during acceleration and is only valid during deceleration or at constant speed.
- This function is invalid when "0" is set in Pr. 49 (factory setting).



- By setting "9999" in Pr. 49, the external contact signal (across terminals RT and SD) can be used to change the stall prevention operation level (current) together with the other second functions (second acceleration/deceleration time, second torque boost, etc.).

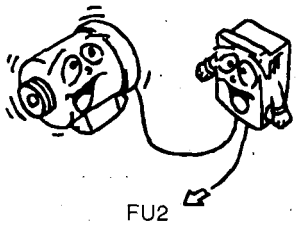
Set Function	Parameter number	Signal Across Terminals RT-SD OFF	ON
Stall prevention operation level (current)	Pr. 22	●	
	Pr. 48		●

Note: 1. The set value (%) indicates the ratio to the rated inverter output current.
2. If the stall prevention operation level signal input function has been selected (Pr. 22 = "9999"), setting "9999" in Pr. 49 will also change the stall prevention operation level from the value of the stall prevention operation level signal (terminal 1 input) to the set value of Pr. 48 when terminals RT and SD are connected.
3. If Pr. 49 = "9999", setting "0" in Pr. 48 will deactivate the stall prevention function when terminals RT and SD are connected.
If Pr. 49 ≠ "9999" and Pr. 48 = "0", the stall prevention operation level is 0% at or below the frequency set in Pr. 49.

⚠ CAUTION

⚠ Do not set the second stall prevention operation current too small.
If set so, torque generated will reduce.

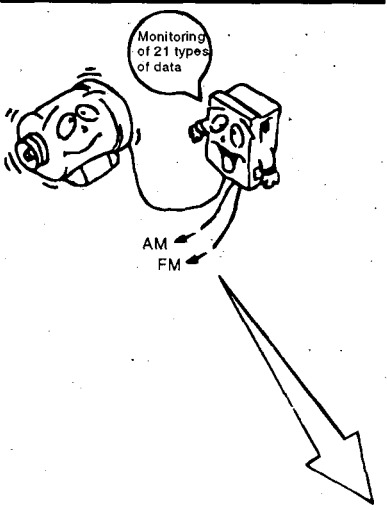
To set the second output frequency detection



⇨ Pr. 50 "second output frequency detection"

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

Selection of monitor and output signals



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

- By setting any of the numbers in the following table, the required signal can be selected from among the 19 signals for the monitor and output signals.
- There are two types of signal outputs: FM pulse train output terminal and AM analog output terminal. Different signals can be output at the same time. Select the signals using Pr. 54 and Pr. 158.

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

	Signal Type	Display Unit	Parameter Set Value						Full-Scale Value of FM, AM, Level Meter
			Pr. 51	Pr. 52	Pr. 53	Pr. 54		Pr. 158	
			Inverter LED	PU main monitor	PU level meter	FM terminal	AM terminal	AM terminal	
	No display	—	×	×	0	×	×	×	—
	Output frequency	Hz	1	0	1	1	101	1	Pr. 55
	Output current	A	2	0	2	2	102	2	Pr. 56
	Output voltage	V	3	0	3	3	103	3	400V or 800V
	Alarm display	—	4	0	×	×	×	×	—
☆	Frequency set value	Hz	5	*	5	5	105	5	Pr. 55
☆	Running speed	(r/min)	6	*	6	6	106	6	Value converted from Pr. 55 by Pr. 37 value
☆	Motor torque**	%	×	*	×	×	×	×	—
☆	Converter output voltage	V	8	*	8	8	108	8	400V or 800V
☆	Regenerative brake duty**	%	×	*	×	×	×	×	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
☆	Inverter input power	kW	13	*	13	13	113	13	Rated power of applied motor x2
☆	Inverter output power	kW	14	*	14	14	114	14	Rated power of applied motor x2
	Input terminal status	—	×	*	×	×	×	×	—
	Output terminal status	—	×	*	×	×	×	×	—
☆	Load meter	%	17	17	17	17	117	17	Pr. 56
☆	Motor exciting current**	A	×	×	×	×	×	×	Pr. 56
	Position pulse	—	×	19	×	×	×	×	—
	Cumulative energization time	hr	×	20	×	×	×	×	—
☆	Reference voltage output	—	×	×	×	21	121	21	1440Hz is output to FM terminal. Full-scale voltage is output to AM terminal.
	Actual operation time	hr	×	23	×	×	×	×	—
	Motor load factor	%	×	24	×	×	×	×	Rated load of applied motor x2
	Cumulative power***	kw	×	25	×	×	×	×	—

Note: 1. Monitor cannot be selected for items marked ×.
2. Setting "0" in Pr. 52 "PU main monitor" allows the monitoring of "output frequency to alarm display" to be selected in sequence by the SHIFT key. (Factory setting)
3. The load meter is displayed in %, with the current set in Pr. 56 regarded as 100%.
4. * "Frequency set value to output terminal status" on the PU main monitor are selected by "other monitor selection" of PU operation.
5. ** This signal may be selected on the PU main monitor, but the value displayed remains 0 and no operation is performed.
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 or 17" in Pr. 53 or Pr. 54 allows the full-scale value to be set in Pr. 55 or Pr. 56.
8. The cumulative energization time is calculated from 0 to 65535 hr, is then cleared, and is recalculated from 0.
9. By setting "0" in Pr. 53, the level meter display of the PU can be switched off.
10. For the actual operation time, the length of time when the inverter is running is calculated. (The time when the inverter is at a stop is not calculated.)
11. When the fast-response current limit function is activated, the outputs of terminals FM and AM are zeroed. (To prevent this, make the fast-response current limit function invalid or use the extension analog output of the EPE option.)
12. Cumulative power and actual operation time are added every hour. Note that these values are not added when the inverter operation time is less than one hour.
13. *** The cumulative power monitor value may be about 25% greater than the power meter reading.

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

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

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

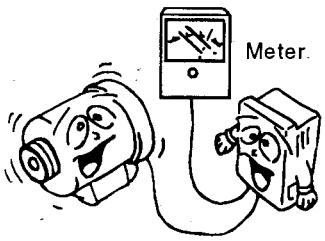
<Setting example>

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

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

For adjustment, see page 113.

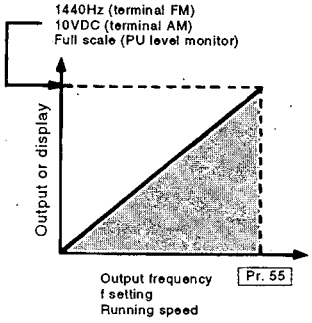
To set the frequency and current referenced for the display of the level meter

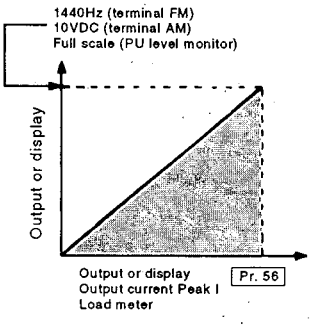


⇨ **Pr. 55 "frequency monitoring reference"**
Pr. 56 "current monitoring reference"

- 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.

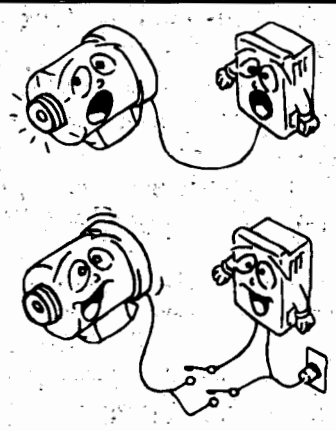
Monitoring Reference Setting Pr.	Monitor Screen Selection (Setting unit)	Pr. 53 Setting	FM, AM Terminal Function Selection Pr. 54 Setting	
f monitoring reference Pr. 55	Output f (Hz)	1	1	101
	f setting (Hz)	5	5	105
	Running speed (Pr. 37)	6	6	106
I monitoring reference Pr. 56	Output I (A)	2	2	102
	Peak I (A)	11	11	111
	Load meter (%)	17	17	117
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"**

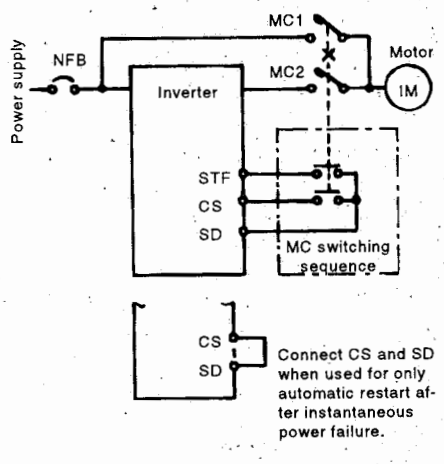
Set Value	Automatic Restart Operation Enable/Disable
9999 (factory setting)	Disable
0, 0.1 to 5 seconds*	Enable

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^2) and torque.

0.75K, 1.5K ..... 0.5 seconds
2.2K to 7.5K ..... 1.0 second
11K and up .....3.0 seconds

- **Pr. 58 setting of "rise time for automatic 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 and 60 seconds according to the magnitude of load specifications (inertia, torque).



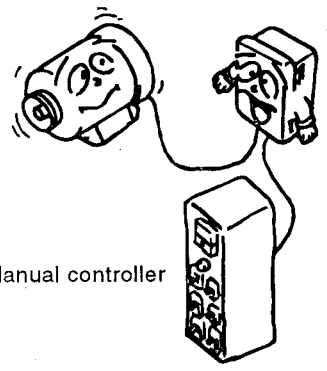
Note: 1. When the inverter capacity is two or more ranks higher than the motor capacity, the overcurrent (OCT) alarm may occur and the motor may not be started.
2. This function is not performed properly when two or more motors are connected to one inverter. (The motors cannot be started properly.)
3. When any value other than 9999 is set in Pr. 57, disconnection of terminals CS and SD will make the inverter inoperative.
4. As DC brake is applied instantaneously when speed is detected at restart, speed may reduce if GD^2 is small.

⚠ CAUTION

⚠ Provide mechanical interlocks for MC1 and MC2.
If power is input to the inverter output circuit, the inverter will be damaged.

⚠ When an instantaneous stop occurs, the motor will start suddenly (after reset time has elapsed).
When the automatic restart after instantaneous power failure function has been selected, keep away from the motor and machine.
When the automatic restart after instantaneous power failure function has been selected, apply the accessory CAUTION seal in an easily identifiable place.

To perform remote setting



Manual controller

⇨ Pr. 59 "remote setting function selection"

- By setting "1" or "2" in Pr. 59, the functions of the RH, RM and RL terminals can be changed to the remote setting input functions.
- Merely setting this parameter provides the acceleration, deceleration and setting clear setting functions of the FR series FR-FK motorized speed setter (option).
- RH (acceleration) and RM (deceleration) allow the frequency to be varied between 0 and the maximum frequency (set value in Pr. 1).
- When the remote function is used, the frequency output by the inverter can be corrected as described below:

  External operation: (Frequency set by RH/RM operation) + (frequency set to terminal 1)

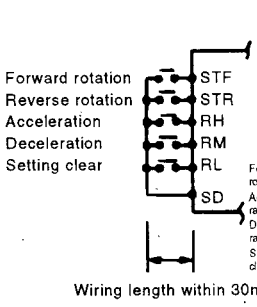
  PU operation: (Frequency set by RH/RM operation) + (PU running frequency)

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

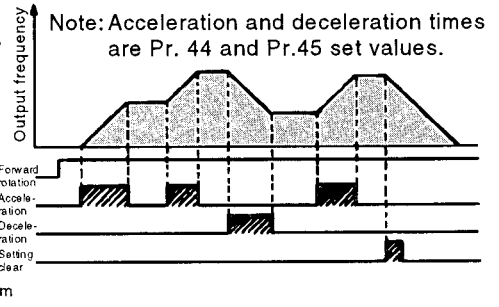
×:no, O:yes

* After RH-SD and RM-SD are kept open for more than about one minute, or STF (or STR) is switched off, 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



Operation example



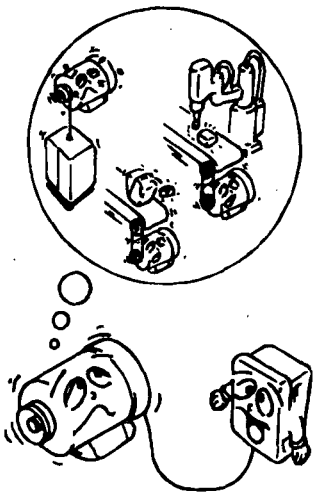
Note: The frequency set value up/down times are set in Pr. 44 and Pr. 45, but the output f acceleration/deceleration times set in Pr. 7 and Pr. 8. Therefore, the actual acceleration/deceleration times become the longer set values respectively.

⚠ CAUTION

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

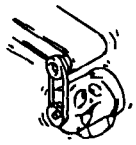
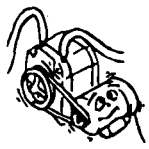
⚠ If you write frequencies often by using the frequency storage function, the life of the storage element may decrease.

To perform intelligent mode operation



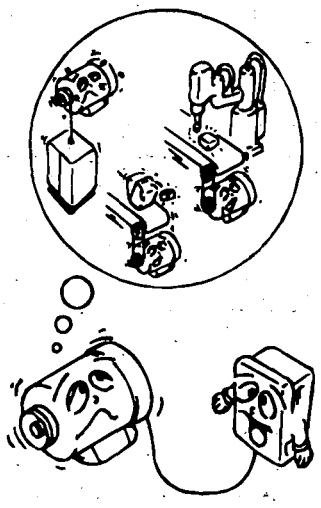
⇨ Pr. 60 "intelligent mode selection"

- 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	—	—
	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 6)	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. (Note 2) Appropriate for energy-saving applications such as fan and pump.	Output voltage

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. If an overvoltage (OV3) trip has occurred during operation in the optimum acceleration/deceleration mode, reset Pr. 8 "deceleration time" to a slightly larger value and restart operation in this mode.
4. When either of "3 or 4" has been set in Pr. 60, the parameters dedicated to intelligent mode Pr. 61 to 63 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 63.
5. When the motor is decelerated to a stop in the energy-saving mode, the deceleration time may become longer than the setting.
   Also, since an overvoltage is more likely to occur in this mode than in the constant-torque load characteristic, set a longer deceleration time.
6. The optimum acceleration/deceleration mode is only valid for the frequency setting of 30.01Hz or higher.

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"

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

Note: These parameters are valid only when any of "3, 4" 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 (%)

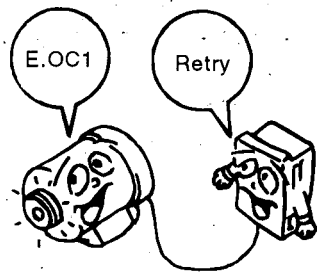
The reference value setting can be changed.

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

Pr. 63 Reference current for deceleration (%)

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

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. GF	Ground Fault	●				●	
E. OLT	Stll Prev STP	●				●	
E. OPT	Option Fault	●				●	
E. PE	Corrupt Memry	●				●	
E. THM	Motor Overload	●					
E. THT	Inv. Overload	●					
E. OHT	OH Fault	●					
E. RET	Retry No. Over	●					
E. CPU	CPU Fault	●					
E. PUE	PU Leave Out	●				●	

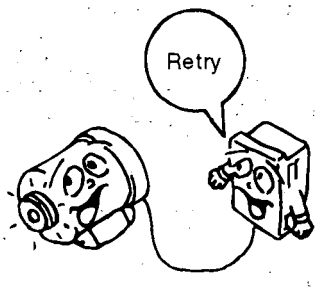
Note: indicates the errors selected for retry.

⚠ CAUTION

⚠ When the retry function has been selected, keep away from the motor and machine unless required. They will start suddenly (after a predetermined time has passed) at occurrence of an alarm.
When the retry function has been selected, apply the accessory CAUTION seal to a place where it is easily identifiable.

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

To use the retry function



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

••Retry is a function which causes the inverter to automatically reset a trip at its occurrence, make a restart, and continue operation.

••In Pr. 67, set the number of retries at trip occurrence.

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

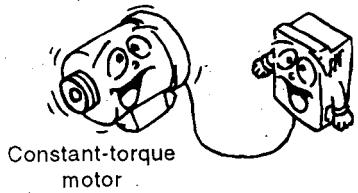
Note: The setting range of 0 to 10, 9999 is displayed on the setting display screen of the PU. 101 to 110 is not displayed.

••A waiting time between inverter alarm occurrence and restart can be set in Pr. 68 in the range 0 to 10 seconds.

••By reading the value of Pr. 69, the cumulative number of restart times made by retry is provided. The set value of "0" erases the cumulative number of times.

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

To use the Mitsubishi constant-torque motor



Constant-torque motor

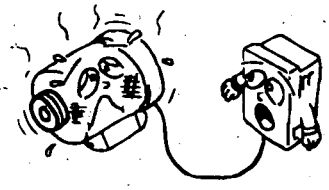
Pr. 0 "torque boost (manual), Pr. 3 "base frequency"
⇨ **Pr. 9 "electronic overcurrent protection"**
Pr. 71 "applied motor"

•Mitsubishi's old constant-torque motor (SF-JRC) can be run continuously at 100% torque down to low speed. 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).
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 down-4%, 11K and up-2%
Pr. 3 "base frequency".....60Hz (factory setting)
Pr. 9 "electronic overcurrent protection"
.....rated current of motor
Pr. 71 "applied motor".....set value "1"

Note: 1. Select the inverter capacity carefully as the constant-torque motor output current is larger than that of the standard motor.
2. When two or more constant-torque motors are run synchronously, they are liable to cause torque imbalance because of their smaller slip than the standard motors.

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

Note: 1. For the adjustment of the 5-point flexible v/f characteristic, refer to page 130.

2. When "9999" has been set in Pr. 19, "2" cannot be set in Pr. 71. When "2" is selected in Pr. 71, set the appropriate value (other than "9999") in Pr. 19.
3. When "2" has been set in Pr. 71, the setting ranges of Pr. 100 to Pr. 109 are not displayed on the PU screen. At this time, if the set value of any of Pr. 100 to Pr. 109 is changed, the new set value is not dis-played in the "INITIAL VALUE LIST" and "CHANGE LIST".
4. To set "1" (constant torque motor) in Pr. 71, refer to page 97 and change the settings of Pr. 0, Pr. 3 and Pr. 9 at the same time.
5. When either of the following values is set in Pr. 0, changing the setting of Pr. 71 "applied motor" will change the set value of this parameter automatically:
   (1) Pr. 0 = 6%/3%* (factory setting)
   When the set value of Pr. 71 is changed from the general-purpose motor selection value "0 or 2" to the constant-torque motor selection value "1", the Pr. 0 setting is automatically changed to 4%/2%*.
   (2) Pr. 0 = 4%/2%*
   When the set value of Pr. 71 is changed from the constant-torque motor selection value "1" to the general-purpose motor selection value "0 or 2", the Pr. 0 setting is automatically changed to 6%/ 3%* (factory setting).
   *: The set value changes with the inverter capacity (7.5K or less)/(11K or more).

⚠ CAUTION

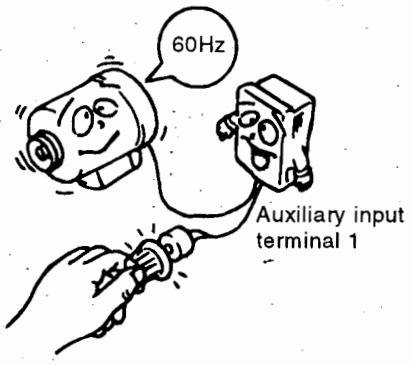
⚠ Set this parameter correctly according to the motor used. Incorrect setting may cause the motor to burn due to overheat.

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

⇨ Pr. 72 "PWM frequency selection"

- The FR-A100 series PWM carrier frequency of 14.5kHz can be changed by using Pr. 72 when this frequency must be changed due to the effect of motor/mechanical system resonance. Lowering the PWM carrier frequency will increase motor noise but reduce inverter-generated noise and leakage current.
- During operation, the frequency in either of the following two ranges may only be changed or written.
  (1) 0.7 kHz to 2.0 kHz
  (2) 2.1 kHz to 14.5 kHz
  Changing the frequency to any value outside the ranges (1) and (2) is not allowed during operation and should be made during a stop.

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



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

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

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

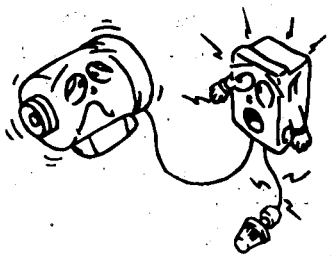
*1: The value of terminal 1 (auxiliary frequency setting input) is added to the main speed setting signal of terminal 2 or 4.

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

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

Note: 1. × indicates that a signal is not accepted.
2. To change the maximum output frequency when the maximum frequency command voltage (current) has been input, use the frequency setting voltage (current) gain, Pr. 903 (Pr. 905).
At this time, the command voltage (current) need not be input.
Also, the acceleration/deceleration time, 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 the stall prevention level setting.

Stable operation cannot be performed due to noise

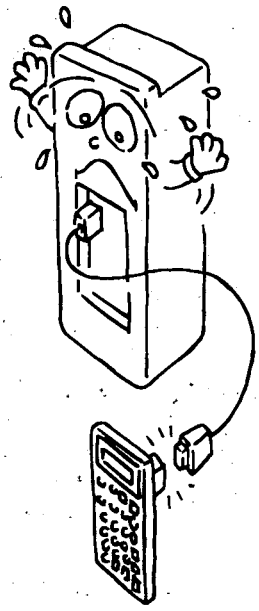


Potentiometer

⇨ Pr. 74 "input filter time constant"

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

To select PU disconnection detection



⇨ Pr. 75 "reset selection/PU disconnection detection/PU stop selection

- Detecting that the connector of 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. Further, setting any of 14 to 17 in Pr. 75 allows selection of the function which causes the motor to be decelerated to a stop by pressing the PU's STOP key in any of the PU, external and communication operation modes. (PU disconnection detection: Refer to page 116, PU stop selection: Refer to page 146.)
- Operation (PU disconnection detection)
  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	Reset Selection	PU Disconnection Detection (Note 1 to 5)	PU Stop Selection (Note 6 to 8)
0	Reset input normally enabled. *	Operation will be continued with the PU disconnected.	Only in the PU operation mode, the motor is decelerated to a stop by pressing the PU's STOP key.
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.	
3	Reset input enabled only when the protective function is activated.		
14 ** (factory setting)	Reset input normally enabled.	Operation will be continued with the PU disconnected.	In any operation mode such as PU, external, communication, etc., the motor is stopped by pressing the PU's STOP key. (To restart, the following operation is required.
15 **	Reset input enabled only when the protective function is activated.		
16 **	Reset input normally enabled.	When the PU is disconnected, an error is displayed and the inverter output is shut off.	
17 **	Reset input enabled only when the protective function is activated.		

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

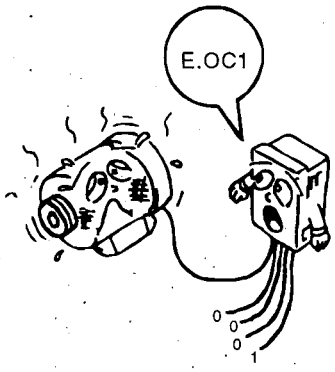
** Only to be set with FR-PU02E(ER)-1 and FR-ARWE-(ER)-1 parameter units. If set with other parameter units the inverter will not start, return the setting to 0 to 3 to allow the inverter to start.

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.
6. When the motor has been stopped by pressing the PU's STOP key, restart the motor in the following procedure:
   1) After completion of deceleration to a stop, switch off the start command. (Disconnect STF or STR from SD.)
   2) Press the EXT OP key on the parameter unit.
   3) Switch on the start command again.
7. When any of 14 to 17 is set in Pr. 75 and stop the motor by pressing the PU's STOP key in any operation mode, the FR-PU02E(ER)-1 (FR-ARWE(ER)-1) must be used.
   When the parameter unit used is other than FR-PU02E(ER)-1 and any of 14 to 17 set in Pr. 95, the motor is not started if the operator command is input.
8. Pr. 75 may be set any time. If parameter (all) clear is executed, the setting of Pr. 75 does not return to the initial value.

⚠ CAUTION

⚠ With the start signal input, do not reset the inverter. After reset, the inverter will start instantaneously, creating a hazardous condition.

To output the alarm code at its occurrence



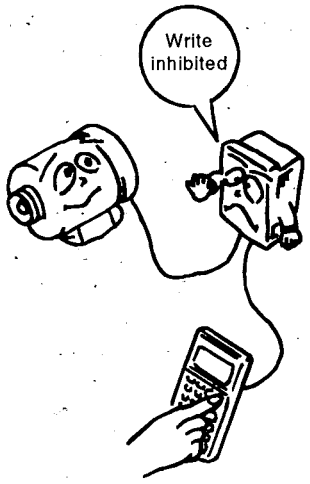
⇨ Pr. 76 "alarm code output selection"

- 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 147.

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 and Pr. 75 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.

⚠ CAUTION

⚠ Do not change any setting unnecessarily during operation.
The inverter may result in an alarm, causing the motor to coast.

To prevent reverse rotation

⇨ Pr. 78 "reverse rotation selection"

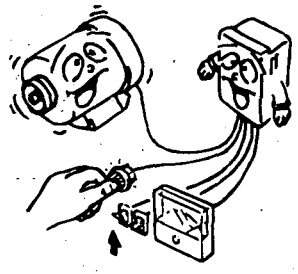
••Set Pr. 78 to prevent any reverse rotation fault resulting from the mis-input of the start signal.

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

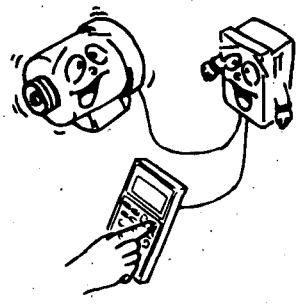
Note: This function is valid for both the parameter unit and external operations.

To select the operation mode

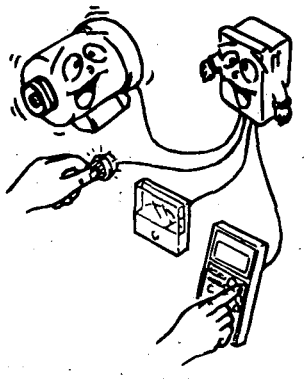
External operation mode

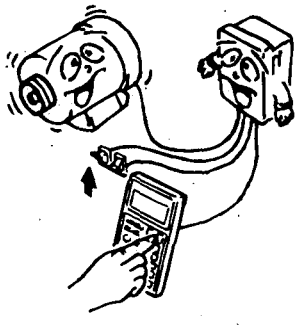


PU operation mode



Combined operation mode





⇨ Pr. 79 "operation mode selection"

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

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

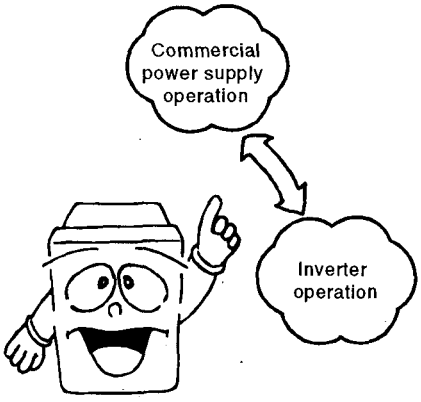
Note: 1. In the parameter unit/external signal combined operation mode, the following signals are made valid:

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

2. For the adjustment of the programmed operation function, see page 123.
3. This function number can also be rewritten in the external operation mode.
   The settings of the other parameters cannot be changed. To change any of the other settings, set "0" or "1" in Pr. 79 to switch to the PU operation mode.
4. For full information on the PU operation interlock function available with the set value of "7" and the external signal-based operation mode switching function available with the set value of "8", see page 131.

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

To switch between commercial power supply operation and inverter operation



Pr. 107 "Commercial power supply switching sequence output terminal selection"
Pr. 108 "MC switching interlock time"
Pr. 109 "Restart waiting time (MC3 ON time)"
Pr. 110 "Commercial power supply switching selection at alarm occurrence"
Pr.111 "Automatic inverter operation-commercial power supply operation switching frequency"

- Alows the inverter to execute the magnetic contactor operation sequence for switching between commercial power supply operation and inverter operation. (For the adjustment procedure, see page 134.)

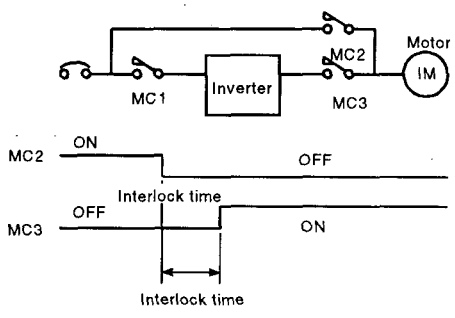
Pr. 107 "Commercial power supply switching sequence output terminal selection"

Allows the output terminals of the signals which control the magnetic contactors (MC1, MC2, MC3).

Set Value	Sequence Output	Output Terminals MC1 Signal	MC2 Signal	MC3 signal
0	Sequence is not output.	—	—	—
1	sequence is output to the FR-APE (option) terminals.	1A	2A	3A
2	Sequence is output to the inverter terminals.	IPF	OL	FU

Pr. 108 "MC switching interlock time"

Sets the MC2 and MC3 operation interlock time. Setting range: 0 to 100 seconds



Pr. 109 Restart waiting time (MC3 ON time)

When automatic restart after instantaneous power failure has been selected, coasting speed must be detected after MC3 is turned on. (Also set parameters Pr. 57 and 58.)

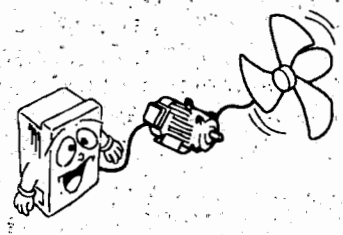
Pr. 110 Commercial power supply switching selection at alarm occurrence

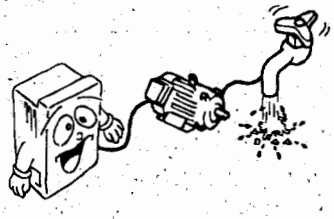
Set Value	Operation
0	Inverter stops at inverter alarm (both MC2 and MC3 are turned off).
1	Inverter operation is automatically switched to commercial power supply operation at inverter alarm(MC2: On, MC3: OFF).

Pr. 111 Automatic inverter operation-commercial power supply operation switching frequency

Set Value	Operation
9999	Not switched automatically.
0 to 60Hz	Switched to commercial power supply operation when the output frequency exceeds the set value.

To set automatic process control





⇨ **Pr. 128 "forward-reverse action selection", Pr. 129 "PI proportional band" Pr. 130 "integral time", Pr. 131 "upper limit"**
Pr. 132 "lower limit", Pr. 133 "PI control set value for PU operation"

•Automatic process control can be exercised for flow rate, air volume, pressure or the like by the inverter.
PI control action is a combination of proportional (P) control action and integral (I) control action designed to provide a manipulated value according to an error or a change with time.

Parameter Number	Name	Setting Range	Factory Setting
128	Forward-reverse action selection	0, 1, 10, 11, 20, 21	0
129	PI proportional band	0.1 to 1000%, 9999	100%
130	Integral time	0.1 to 3600 second, 9999	1 second
131	Upper limit	0 to 100%, 9999	9999
132	Lower limit	0 to 100%, 9999	9999
133	PI control set value for PU operation	0 to 100%	0%

•For setting or adjustment, the following must be done:
(1) Pr. 128 to Pr. 133 PI control parameter settings
(2) I/O and PI control terminal settings
(3) Connection of terminals RT and SD
(4) Operation
For more information, refer to "PI Control Function" on page 139.

To change the language displayed on the parameter unit

⇨ Pr. 145 "parameter unit language switching"

- Allows selection of the language displayed on the FR-PU02ER-1/ FR-ARWER-1 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-PU02-1, FR-PU02E-1 or FR-ARW-1 parameter (copy) unit is used.

To output a signal when the output current value is "0"

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

- When the motor circuit becomes open (ie. a wire is cut), motor torque is not generated and a drop may occur in vertical motion applications or the like.
  To prevent this, the open motor circuit signal can be output from the inverter to apply the mechanical brake when the output current becomes "zero".
- If the value of the output current detected during motor operation remains lower than the setting of Pr. 152 "open motor circuit detection level" for longer than the period set in Pr. 153 "open motor circuit detection time", the open motor circuit detection signal is output from the output terminal PU (Pr. 40 "output terminal assignment" = 9) of the inverter as an open collector signal.

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

(1) Setting of the open motor circuit detection level

In Pr. 152 "open motor circuit detection level", set the percentage of the output current to the rated current from 0 [A], at which the open motor circuit is detected.

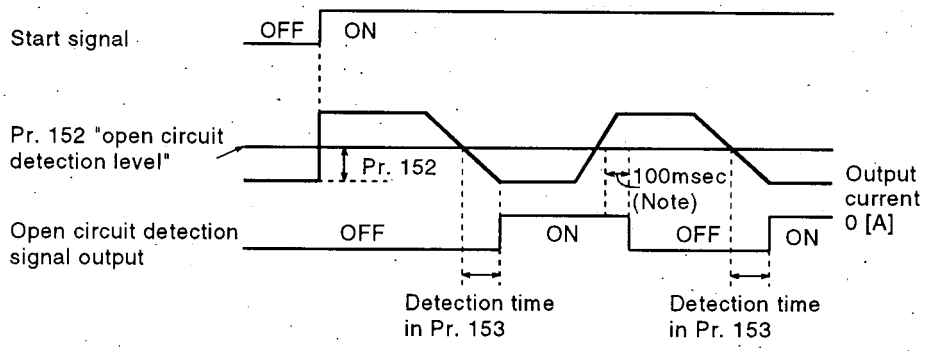
(2) Setting of the open motor circuit detection time

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

Pr. 17 Setting	JOG/OH		MRS Terminal		Pr. 40 = 9	
	JOG	OH	Normally Open Input	Normally Closed Input	PU Signal	Open Motor Circuit Detection
0	●	—	●	—	●	—
1	—	●	●	—		
2	●	—	—	●		
3	—	●	—	●		
4	●	—	●	—	—	●
5	—	●	●	—		
6	●	—	—	●		
7	—	●	—	●		

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

• **Timing chart**



Note: If the output current exceeds the preset detection level and the condition not established, the open circuit detection signal is held for about 100ms.

⚠ CAUTION

⚠ Do not set the open circuit detection level too large and the open circuit detection time too long. If set so, the detection signal may not be output when the output current is small and torque is not generated.

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

To clear the cumulative power monitor value

⇨ **Pr. 154 "cumulative power monitor clear"**

• Use this parameter to clear the power added up (accumulated) during the actual operation period of the inverter.

(1) Display

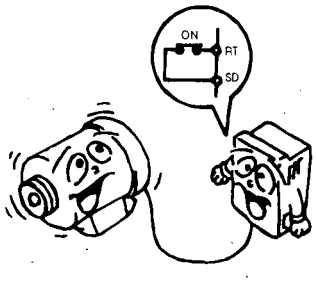
Set 25 in Pr. 52 "PU main display data selection" to display the monitor value. This value is added per hour. Note that no power is added if inverter run is less than one hour.

For the accuracy of this monitor, its error will be maximum at 70% of the rated load.

(2) Clearing method

Set 0 in Pr. 154 "cumulative power monitor clear".

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.

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

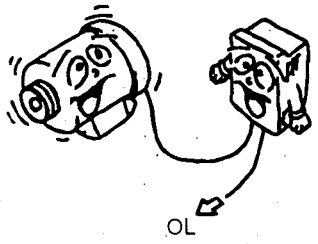
D: Driving R: Regenerative

Note: 1. When "Operation not continued at the time of OL signal output" has been selected, the "E.OLT" alarm code (stop by stall prevention) is displayed and operation stopped.
2. The output voltage reduces during stall prevention operation. When high torque is required (e.g. for an elevator), set the parameter in the following procedure:
1. Record the Pr. 77 value in advance.
2. Set "701" in Pr. 77.
3. Set "1" in Pr. 156.
4. Return Pr. 77 to the previous value.
This completes the setting.
3. For a heavy load, predetermined lift or short acceleration/deceleration time, the stall prevention (current limit) may be activated and the motor may not stop in the preset acceleration/deceleration time. Hence, set the optimum values in Pr. 22 and Pr. 156.

⚠ CAUTION

⚠ Test run must be performed.
During acceleration, the stall prevention may be activated to increase acceleration time.
During constant speed, the stall prevention may be activated to vary speed suddenly.
During deceleration, the stall prevention may be activated to increase deceleration time, increasing a deceleration distance.

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



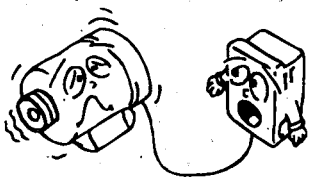
⇨ Pr. 157 "OL signal output waiting time"

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

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

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

You care about speed fluctuation



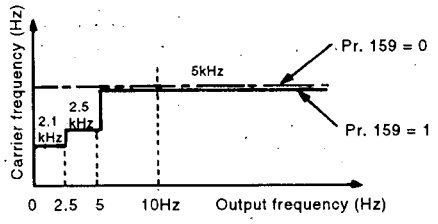
⇨ Pr. 159 "PWM frequency decrease at low speed"

- Speed in the low range (10Hz or less) can be smoothed to correct speed fluctuation. (To be set only when you care about speed fluctuation.)

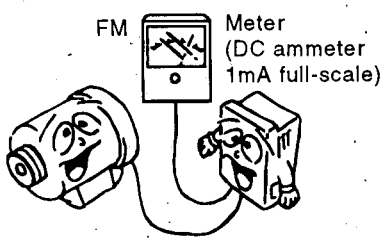
Pr. 159 Set Value	Description
	Improvement of speed fluctuation
0 (factory setting)	No
1	Yes

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

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

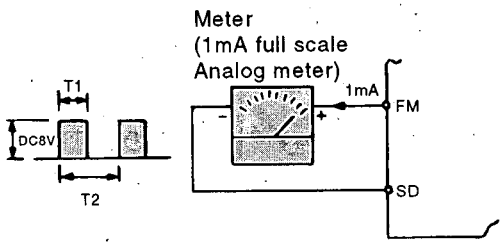


To make the output calibration of terminal FM



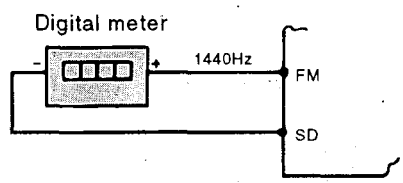
⇨ Pr. 900 "FM terminal calibration"

- 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 113.)



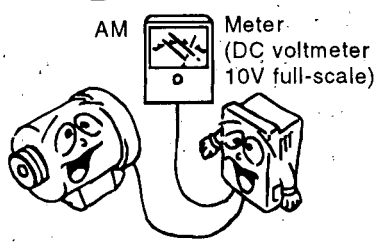
Pulse width T1 : Adjusted with Pr. 900
Pulse period T2 : Set in Pr. 55 (valid for frequency monitoring only)

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



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

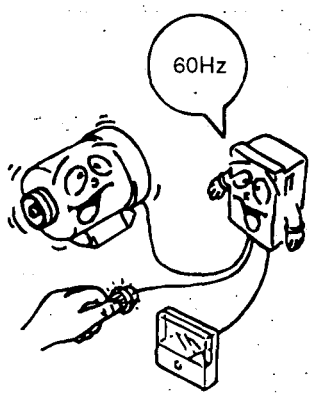
To make the output calibration of terminal AM



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

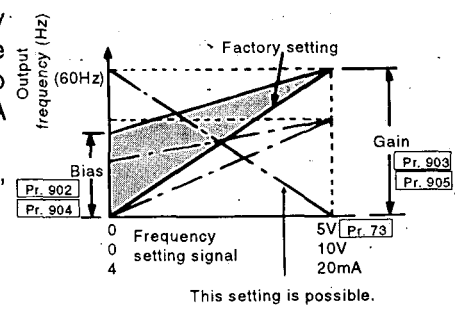
• Used when any of "101 to 118" has been set in Pr. 54 to select analog output to terminal AM and when any of "1 to 21" has been set in Pr. 158 to use the outputs of terminals FM and AM separately.
As explained in the section of Pr. 54, the analog output is factory-set to 10VDC in the full-scale of each monitored data. This parameter allows the output voltage ratio (gain) to be adjusted according to the meter reading. Note that the maximum output voltage is 10VDC.
(For details of the adjustment, see page 114.)

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 117.)



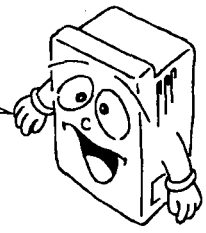
Note: If the gain adjustment (Pr. 903, Pr. 905) is changed, the acceleration/deceleration reference frequency (Pr. 20) does not change. The signal to the terminal 1 (aux. input) is added to the frequency setting signal.

⚠ CAUTION

⚠ Take care when setting Pr. 902 or Pr. 904 to any value other than "0". In this case, without the speed command, the motor starts at the preset frequency by merely switching the start signal on.

3.5 INVERTER RESET

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



Operation 1

Using the help function, reset the inverter. For details, see "7 INVERTER RESET" on page 58.

Operation 2

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

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

Operation 3

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

Operation 4

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

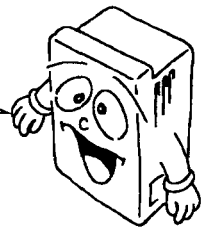
Warning: Repeated resetting can cause damage to motor and inverter due to thermal build-up. The internal heat value, and electronic overcurrent protection devices will not be calculated correctly.

4. FUNCTIONS

This chapter provides details the "function" of this product.
Always read the precautions, etc., before starting use.

4.1 CALIBRATION OF THE METER (FREQUENCY METER)

The PU allows the calibration (adjustment) of a meter connected across the meter connection terminal FM and SD or AM and 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.



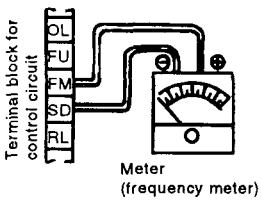
4.1.1 Calibration of the FM-SD Output

• Preparation

(1) Connect a meter (frequency meter) across inverter terminals FM and SD. (Note the polarity. FM is the positive terminal.)

(2) When a calibration resistor has already been connected, adjust the resistance value to zero or remove the resistor.

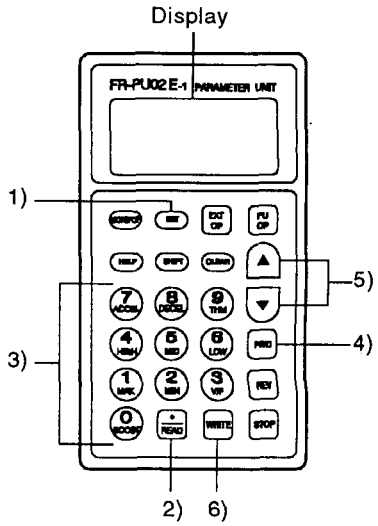
(3) Set any of 1 to 3, 5, 6, 8, 10 to 14, 17 and 21 in Pr. 54 (FM terminal function selection". When the running frequency or inverter output current has been selected as the output signal, preset in Pr. 55 or Pr. 56 the running frequency or current value at which the output signal is 1440Hz. This 1440Hz normally makes the meter full-scale. (See page 90.)



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

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

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



Note:
This calibration (Pr. 900) is only valid when any of 1 to 3, 5, 6, 8, 10 to 14,17 and 21 has been set in Pr. 54 to output a signal to terminal FM.
When any other value has been set (signal output to terminal AM has been selected in Pr. 54), the absence of Pr. 900 is displayed on the screen as soon as this parameter is selected by the above operation.

Note : When the frequency meter is connected across terminals FM and SD to monitor the running frequency, the output of terminal FM is saturated if the maximum output frequency reaches or exceeds 100Hz, with the factory-set value unchanged.
Hence, the setting of Pr.55 "frequency monitoring reference" must be changed to the maximum output frequency. (See page 90.)

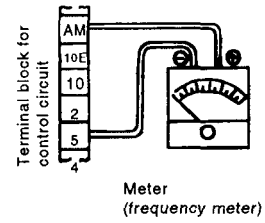
4.1.2 Calibration of the AM-5 Output

- **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 any of 101 to 103, 105, 106, 108, 110 to 114, 117 and 121 in Pr. 54. When the running frequency or inverter output current has been selected as the output signal, preset in Pr. 55 or Pr. 56 the running frequency or current value at which the output signal is 10V.

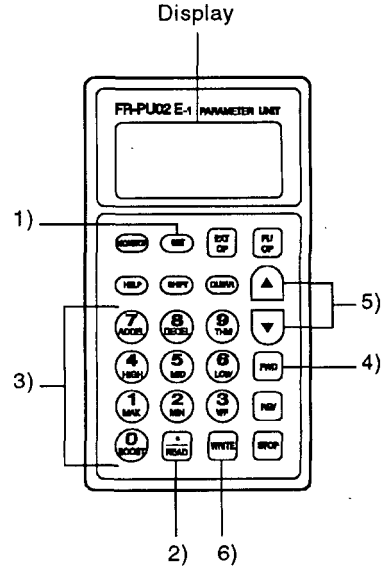
(3) As in the setting of Pr. 54, set any of 1 to 3, 5, 6, 8, 10 to 14, 17 and 21 in Pr. 158 (AM terminal function selection) to use both of the FM-SD output and AM-5 output simultaneously.



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

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

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



Note:
This calibration (Pr. 901) is only valid when any of 101 to 103, 105, 106, 108, 110 to 114, 117 and 121 has been set in Pr. 54 or the required value set in Pr. 158 to output a signal to terminal AM. When any other value has been set (signal output to terminal FM has been selected in Pr. 54), the absence of Pr. 901 is displayed on the screen as soon as this parameter is selected by the above operation.

- **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.

Setting of reference voltage output

1) Press the [SET] key in the PU operation mode. .... The inverter is placed in the parameter setting mode.
   Display: SETTING MODE / Set Pr.NO. / FOR PR.List / <HELP>

2) Type 54 and press the [READ] key. .... The current set value in Pr. 54 is displayed.
   Display: 54 Set FM / 1 / 1-21,101-121

3) Type 121 and press the [WRITE] key. ..... The setting of reference voltage output is complete.
   Display: 54 Set FM / 121 / 1-21,101-121

4) Press the [SET] key. .....The inverter is put in the parameter setting mode.
   Display: SETTING MODE / Set Pr.NO. / FOR PR.List / <HELP>

5) Type 901 and press the [READ] key. ..... The current set value in Pr. 901 is displayed.
   Display: 901 AM Tune / Run Inverter / Set 0.00Hz / PU

6) Type 60 and press the [WRITE] key. .....The setting of maximum running frequency is complete.
   Display: 901 AM Tune / Run Inverter / Set 60.00Hz / PU

7) Press the [FWD] key. .....Forward operation is performed at 60Hz. The motor need not be connected for adjustment.

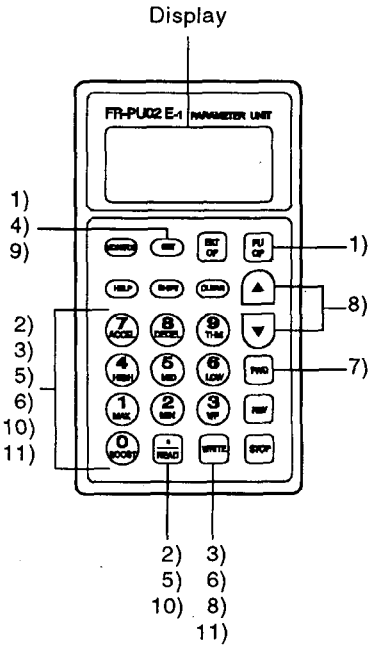
8) Using the [▲] or [▼] key, adjust the voltage across terminals AM-5 to 10V and press the [WRITE] key. ..... Setting is complete.
   Display: 901 AM Tune / Completed / <MONITOR>
   ..... When the output is 100%, the output voltage is 10V. The voltage is not stored unless the [WRITE] key is pressed.

Setting of output current

9) Press the [SET] key. .....The inverter is put in the parameter setting mode.
   Display: SETTING MODE / Set Pr.NO. / FOR PR.List / <HELP>

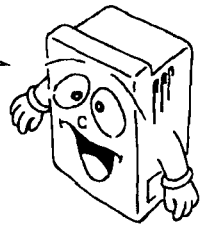
10) Type 54 and press the [READ] key. .... The current set value in Pr. 54 is displayed.
    Display: 54 Set FM / 121 / 1-21,101-121

11) Type 102 and press the... [WRITE] key. The setting of output current is complete.
    Display: 54 Set FM / 102 / 1-21,101-121
    ..... The current value set in Pr. 56 "current monitoring reference" is 100% and the output at this point is 10V.



4.2 PU DISCONNECTION DETECTION FUNCTION

This function detects that the parameter unit (PU) has been disconnected from the inverter and brings the inverter to an alarm stop.



- **Operation**

When Pr. 75 "reset selection/PU disconnection detection/PU stop selection" has been set to detect the disconnection of the PU, this function detects that the PU has been disconnected from the inverter, switches the PU display and inverter LED to the indication of the corresponding error, and brings the inverter to an alarm stop.

Pr.75 Set Value	Reset Selection	PU Disconnection Detection	PU Stop Selection
0	Reset input normally enabled.	Operation will be continued with the PU disconnected.	Only in the PU operation mode, the motor is decelerated to a stop by pressing the PU's STOP key.
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.	
3	Reset input enabled only when the protective function is activated.		
14 (Factory setting)	Reset input normally enabled.	Operation will be continued with the PU disconnected.	In any mode, the motor is decelerated to a stop by pressing the PU's STOP key.
15	Reset input enabled only when the protective function is activated.		
16	Reset input normally enabled.	When the PU is disconnected, an error is displayed and the inverter output is shut off.	
17	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**

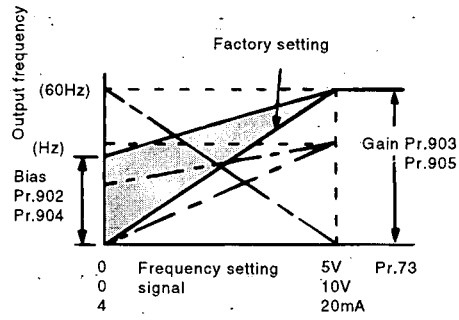
(1) If the PU had been disconnected from initial start, this is not defined as an alarm.
(2) This disconnection detection judges that the PU is disconnected when the PU is removed for more than 1 second.
(3) When the FR-PU01E is used, this function can also be used but its alarm display is "E.PE".
(4) To resume operation, reset the inverter (see page 112) after checking that the PU is connected securely.

4.3 ADJUSTMENT OF THE FREQUENCY SETTING SIGNALS "BIAS" AND "GAIN"

The bias and gain functions are used to adjust the relationship between the input signal entered from outside the inverter to set the output frequency, e.g. 0 to 5VDC, 0 to 10VDC or 4 to 20mADC, and the output frequency.

The following parameters are used for this adjustment:

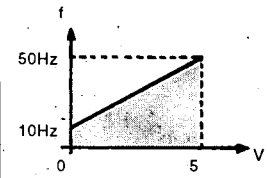
- Pr. 902 "frequency setting voltage bias"
- Pr. 903 "frequency setting voltage gain"
- Pr. 904 "frequency setting current bias"
- Pr. 905 "frequency setting current gain"



Any of three procedures may be used for the adjustment: adjustment is made without a voltage applied across terminals 2 and 5 (adjustment procedure 1); any point is adjusted with a voltage applied (adjustment procedure 2); or any point is adjusted without a voltage applied (adjustment procedure 3).

■ Adjustment example

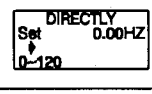
Example: Pr. 902 "frequency setting voltage bias"..... Set the output frequency to 10Hz at the set voltage of 0V.
Pr. 903 "frequency setting voltage gain"..... Set the output frequency to 50Hz at the set voltage of 5V.

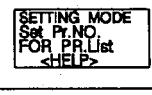


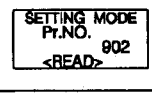
Before making adjustment, make sure that the set value of Pr. 73 "0 to 5V, 0 to 10V selection" is "1" (factory setting: 0 to 5V).

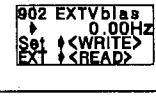
• Adjustment procedure 1 (without a voltage applied across terminals 2 and 5)

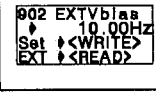
(1) Setting of the frequency setting voltage bias

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


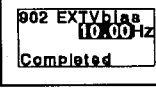
2) Press the [SET] key. .....The inverter is put in the parameter setting mode.


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


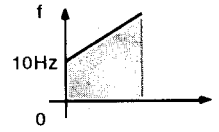
4) Press the [READ] key. ....The current set value of Pr. 902 is displayed.


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


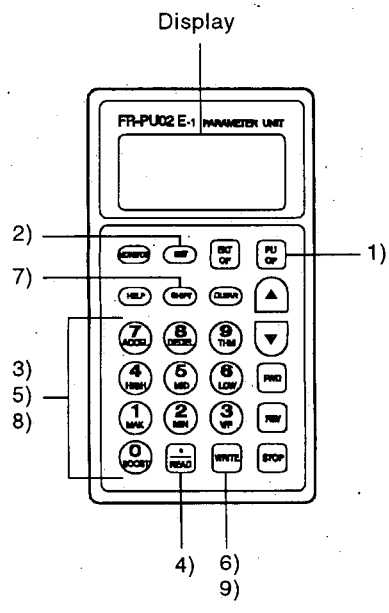
.....The voltage need not be applied across terminals 2 and 5.

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


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



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

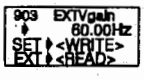


(To the next page)

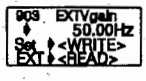
(From the preceding page)

(2) Setting of the frequency setting voltage gain

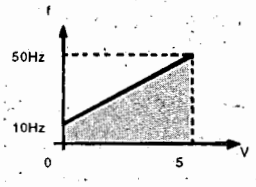
7) Press the [SHIFT] key. .... The current set value of Pr. 903 is displayed.



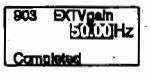
8) Using the numeral keys, enter 50. ..... The data on the right is displayed.



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



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



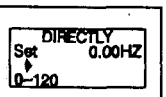
The adjustment of the frequency setting voltage bias and gain is complete.

Note: 1. The current input (Pr. 904, Pr. 905) can also be set in a similar manner.
2. Pr. 903 remains unchanged if the value set in Pr. 20 "acc./dec. reference frequency" is changed.
3. The FR-PU01E may also be used to adjust the frequency setting voltage bias and gain and current bias and gain (C-2 to C-5). For full information, see the FR-Z series instruction manual.

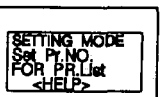
- **Adjustment procedure 2 (any point is adjusted with a voltage applied across terminals 2 and 5)**

(1) Setting of the frequency setting voltage bias

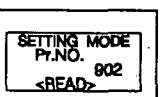
1) Press the [PU OP] key. ... The frequency setting screen is displayed.



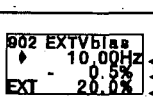
2) Press the [SET] key. ..... The inverter is put in the parameter setting mode.



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



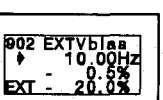
4) Press the [READ] key twice. ..... The current set value of Pr. 902 is displayed.



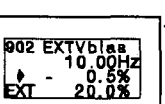
The preceding set value is displayed.

The current set voltage across terminals 2 and 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 selected in Pr. 73 (5V in this example) is 100%.]

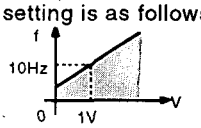
5) Using the numeral keys, enter 10. ..... The data on the right is displayed.



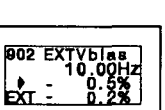
6) Press the [WRITE] key. ..... The cursor (⇨) moves to the set voltage.



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

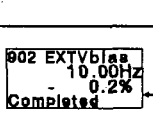


7) Apply the voltage of 0V.

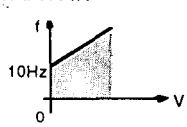


..... Since 10Hz is set against 0V in this example, 0V is applied.
(The % value for EXT changes.)

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

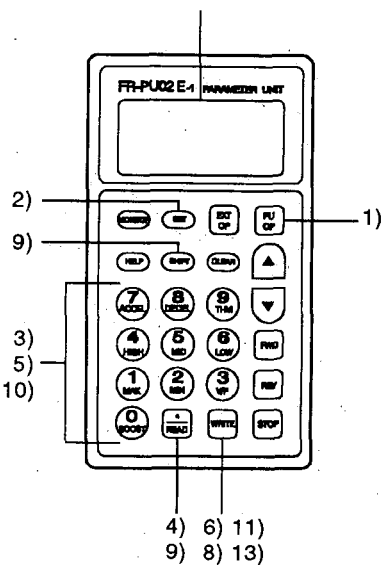


The bias setting is complete as shown below:



(To the next page)

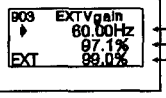
Display



(From the preceding page)

(2) Setting of the frequency setting voltage gain

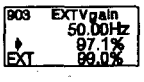
9) Press the [SHIFT] key, then the [READ] key. ... The current set value of Pr. 903 is displayed.



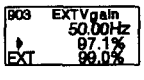
The preceding set value is displayed.

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

10) Using the numeral keys, enter 50. ..... The data on the right is displayed.

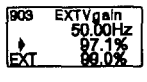


11) Press the [WRITE] key. .. The cursor (⇨) moves to the set voltage.



Set the voltage across terminals 2 and 5 until 100% is achieved.

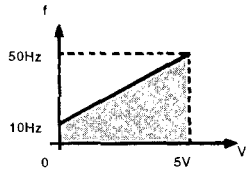
12) Apply the voltage of 5 V.



..... Since 50Hz is set against 5V in this example, 5V is applied.

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

100.0% may not be displayed. The setting is complete as shown below:



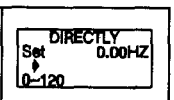
The adjustment of the frequency setting voltage bias and gain is complete.

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

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

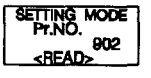
(1) Setting of the frequency setting voltage bias

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

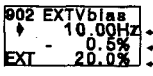


2) Press the [SET] key. ..... The inverter is put in the parameter setting mode.

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



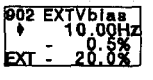
4) Press the [READ] key ..... The current set value of Pr. 902 is displayed.
twice.



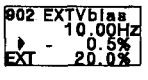
The preceding set value is displayed.

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

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

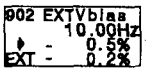


6) Press the [WRITE] ..... The cursor (⇨) moves to the set voltage.
key.



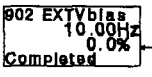
..... The voltage need not be applied across terminals 2 and 5.

7) Using the numeral key, enter 0.

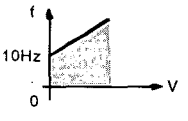


..... Since 10Hz is set against 0V (0%) in this example, 0% is entered.

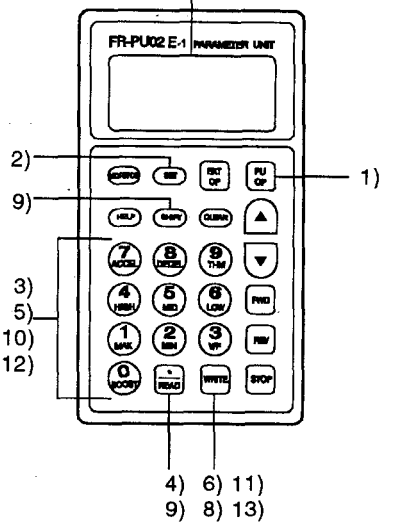
8) Press the [WRITE] ..... The set value is stored into memory and bias setting is complete.
key.



The bias setting is as follows:



Display

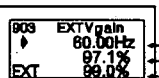


(To the next page)

(From the preceding page)

(2) Setting of the frequency setting voltage gain

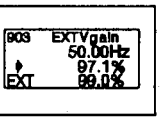
9) Press the [SHIFT] key, then the [READ] key. ... The current set value of Pr. 903 is displayed.



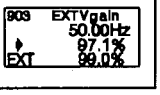
The preceding set value is displayed.

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

10) Using the numeral keys, enter 50. ..... The data on the right is displayed.

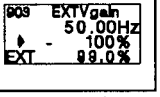


11) Press the [WRITE] key. .. The cursor (⇨) moves to the set voltage.



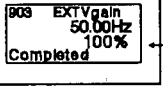
..... The voltage need not be applied across terminals 2 and 5.

12) Using the numeral keys, enter 100.

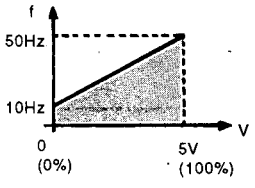


..... Since 50Hz is set against 5V (100%) in this example, 100% is entered.

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



The setting is complete as shown below:

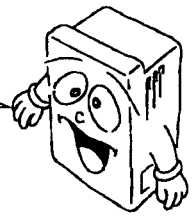


The adjustment of the frequency setting voltage bias and gain is complete.

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

4.4 PROGRAMMED OPERATION FUNCTION

In programmed operation, automatic operation is performed under the control of the internal timer in accordance with the desired time of day, running frequency and direction of rotation set in advance.

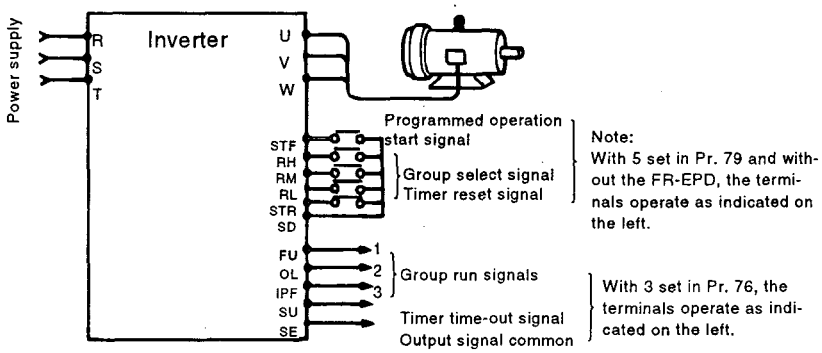


4.4.1 Preparation

Setting of operation mode and output terminals (Pr. 79, Pr. 76)

To perform programmed operation, set "5" (programmed operation) in Pr. 79 "operation mode selection" and "3" (programmed operation output) in Pr. 76 "alarm code output selection".

Wiring



When "5" (programmed operation) is set in Pr. 79, the following terminals are made valid and invalid and are used for programmed operation:

Valid Terminals	Invalid Terminals	Terminals Used
RES	AU	STF
MRS	STOP	STR
RT	No. 2	RH
OH	No. 4	RM
	No. 1	RL
	JOG	

Note: When the battery pack for programmed operation (FR-EPD) is fitted, note that the terminals used for programmed operation are not as indicated on the left. (For details, see the option instruction manual.)

During programmed operation, the inverter cannot be operated in any other operation mode. When the programmed operation start signal (STF) and timer reset signal (STR) are ON, the operation mode cannot be switched between PU operation and external operation. When "5" is set in Pr. 79, the following functions are unavailable if the corresponding inboard option is fitted:

(1)12-bit digital input
(2) PI control

Programmed operation time unit selection (Pr. 200)

Set the time unit for programmed operation. Select either of "minute/second" and "o'clock/minute" in Pr. 200.

Set Value	Description
0 (factory setting)	Minute/second unit (voltage monitor)
1	O'clock/minute unit (voltage monitor)
2	Minute/second unit (reference time of day monitor)
3	O'clock/minute unit (reference time of day monitor)

Note: When 2 or 3 is set in Pr. 200, the reference time-of-day monitor screen is displayed instead of the voltage monitor screen.

Setting of reference time of day (Pr. 231)

The inverter has an internal timer (RAM). When the reference time of day is set in Pr. 231, programmed operation is started at this time of day.

(1) Setting range

The time unit depends on the set value of Pr. 200.

Pr. 200 Set Value	Pr. 231 Setting Range	Pr. 200 Set Value	Pr. 231 Setting Range
0 (factory setting)	Max. 99 minutes 59 seconds	2	Max. 99 minutes 59 seconds
1	Max. 99 o'clock 59 minutes	3	Max. 99 o'clock 59 minutes

Note: The reference time-of-day timer starts the timing of the reference time of day when both the start signal and group select signal are entered. Set the reference time of day in Pr. 231 when both signals are on.

(2) Resetting the reference time of day

The reference time of day is cleared (returns to "0") by switching on the timer reset signal (STR) or resetting the inverter (see page 112). Note that the reference time-of-day value set in Pr. 231 is also reset to "0".

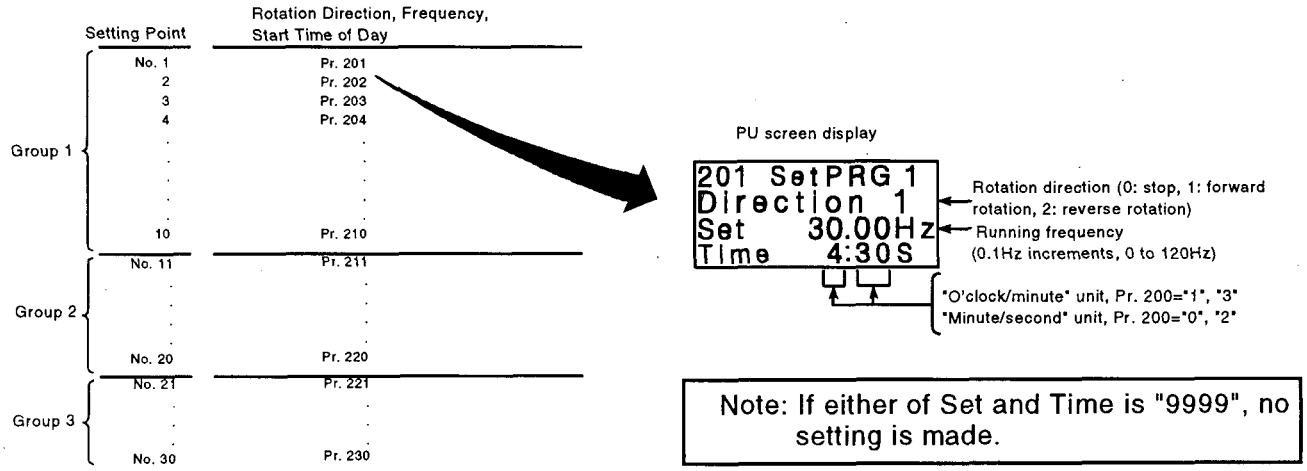
(3) Timer accuracy

- Instantaneous error: ±0.16s
- Cumulative error: ±50ppm (according to the accuracy of the crystal oscillator)

The inverter independent error: Max. 4.5s per day
(24Hr×60×60×50ppm=4.32s)

4.4.2 Program Setting (Pr. 201 to 230)

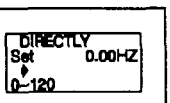
The rotation direction, running frequency and start time of day are defined as one point and every 10 points are grouped into three. Pr. 201 to Pr. 231 are used for this setting. Note that when the setting of Pr. 200 has been changed independently, the units of Pr. 201 to 230 change (the numerals do not change).



Note: If either of Set and Time is "9999", no setting is made.

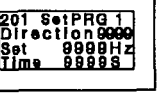
■ Setting procedure (Example: Setting point No. 1, forward rotation, 30Hz, 4 o'clock 30 minutes)

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



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

3) Type 201 and press the [READ] key. The current set value is shown on the display.



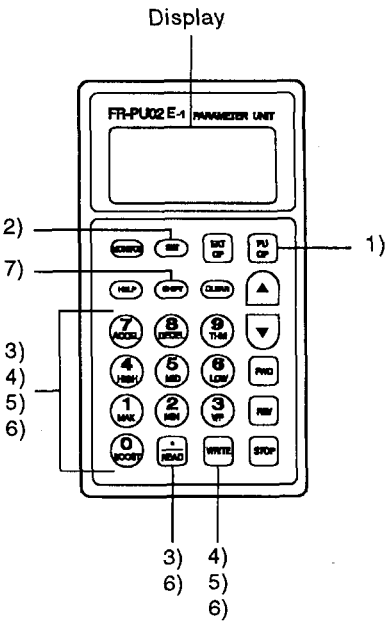
4) Type 1 (forward rotation) and press the [WRITE] key. (Note 1) ..... "1" is displayed at Direction and stored into memory.

5) Type 30 (30Hz) and press the [WRITE] key. (Note 1) ..... "30.00Hz" is displayed at Set and stored into memory.

6) Using the numeral keys and [READ] key, enter 4.30 and press the [WRITE] key. (Note 2) ..... "4.30" is displayed at Time, the set value is stored into memory, and setting is complete.

..... Max. setting: 99:59
Press [READ] to enter ":" at Time.

Display



7) Press the [SHIFT] key to move to the next parameter (Pr. 202), and press the [READ] key to display the current set value. Then, press the [SHIFT] key to advance to the next parameter.

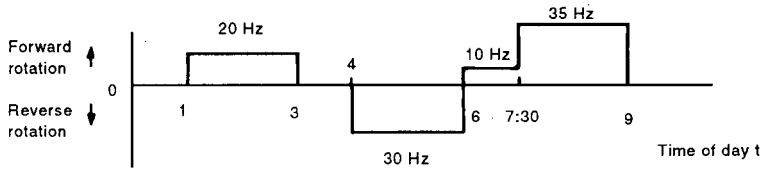
Note : 1. To make a stop, write "0" in the rotation direction and frequency. Set "9999" for no setting.
2. An error will result if 4.80 is entered (in excess of 59 minutes or 59 seconds).

Operation pattern

Assuming that operation has been programmed as indicated in the following table, the operation pattern is as shown in the figure below:

No.	Operation	Parameter Setting
1	Forward rotation, 20Hz, 1 o'clock 0 minutes	Pr. 201=1, 20, 1:00
2	Stop, 3 o'clock 0 minutes	Pr. 202=0, 0, 3:00
3	Reverse rotation, 30Hz, 4 o'clock 0 minutes	Pr. 203=2, 30, 4:00
4	Forward rotation, 10Hz, 6 o'clock 0 minutes	Pr. 204=1, 10, 6:00
5	Forward rotation, 35Hz, 7 o'clock 30 minutes	Pr. 205=1, 35, 7:30
6	Stop, 9 o'clock 0 minutes	Pr. 206=0, 0, 9:00

<Operation pattern>



4.4.3 Details of the Functions

Parameters used

Pr. No.	Name	Range	Increments/ Unit	Factory Setting	Remarks
200	Programmed operation minute/second selection	0 to 3	1	0	0-minute/second unit/ voltage monitor 1-o'clock/minute unit/ voltage monitor 2-minute/second unit/ reference time of day monitor 3-o'clock/minute unit/ reference time of day monitor
201 to 230	Programmed operation program setting	0 to 2	1	9999	Rotation direction setting 0-stop, 1-forward rotation, 2-reverse rotation
		0 to 120Hz	0.1Hz		Frequency setting
		0 to 99:59	Minutes or seconds		Time of day setting
231	Timer setting	0 to 99:59	—	0	Reference time-of-day timer (RAM) (Note1)

Note: 1. When both the start signal and group select signal are entered, the set value of Pr. 231 "timer setting" returns to "0". Set the optional time of day with both signals on. Note that if the start signal and group select signals are entered after setting the optional time of day, the Pr. 231 set value returns to "0" again.
2. Note that when the setting of Pr. 200 has been changed independently, the unitsof Pr. 231 and Pr. 201 to 230 change.
3. When "2" or "3" is set in Pr. 200, the reference time-of-day monitor screen is displayed instead of the voltage monitor screen.

Input signals

Name	Description	Signal Level	Remarks
Group select signal (RH (group 1) RM (group 2) RL (group 3))	Used to select the group for programmed operation.	Photocoupler isolated	May also be driven by transistor. When ic=10mA, Vec<0.5V should be satisfied.
Terminal reset signal (STR)	Input to zero the reference time of day.	Photocoupler isolated	
Programmed operation start signal (STF)	Input to start programmed operation.	Photocoupler isolated	

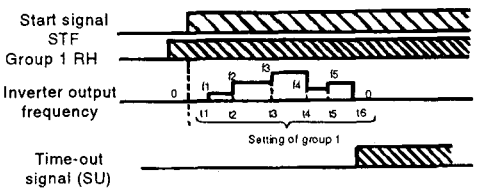
Output signals

Name	Description	Signal Level	Remarks	
Time-out signal Inverter terminal (SU)	Output on completion of the operation of the selected group and cleared on timer reset.	Open collector output (isolated)	Permissible load 24VDC, 0.1A	Only when Pr. 76=3
Group select signal Inverter terminal (FU, OL, IPF)	Output during operation of corresponding group's program and cleared on timer reset.	Open collector output (isolated)	Permissible load 24VDC, 0.1A	

4.4.4 Operation

Ordinary operation

After completion of all preparations and settings, turn on the desired group select signal (any of RH (group 1), RM (group 2) and RL (group 3)), then turn on the start signal (STF). This causes the internal timer (reference time of day) to be reset automatically and the operation of that group to be performed in sequence in accordance with the settings. When the operation of the group ends, a signal is output from the time-out output terminal. (The open collector signal of SU is turned on.)

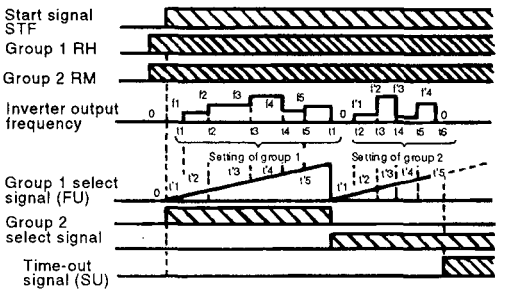


Note that the operation is not started if the timer reset (STR) is on.

Note: Use the programmed operation function with "5" set in Pr. 79. Programmed operation will not be performed if any of the group select signals is switched on during PU operation or data link operation.

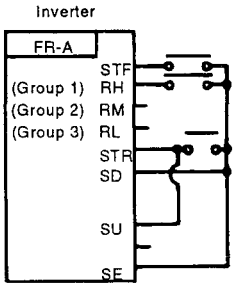
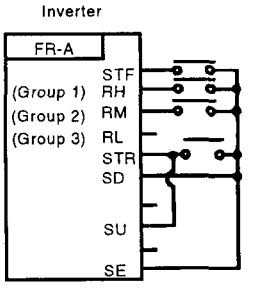
Multi-group select operation

When two or more groups are selected at the same time, the operations of the selected groups are executed in sequence of group 1, group 2 and group 3.
For example, if group 1 and group 2 have been selected, the operation of group 1 is first carried out, and after that operation ends, the reference time of day is reset, the operation of group 2 is started, and the time-out signal (SU) is output after the operation of group 2 ends.



Repeated operation

To repeat the operation of the same group, reset the timer using the time-out signal as shown below.

1) To repeat the operation of only group 1	2) To repeat the operation of groups 1and 2
	

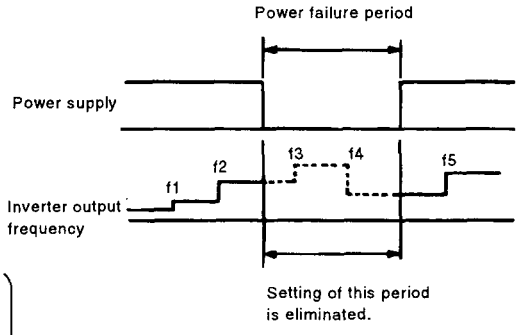
Note: If the inverter is powered down, then up (including a power failure or an instantaneous power failure) during the execution of the programmed operation, the internal timer is reset and the inverter does not restart if the power is restored. To resume the operation, turn the programmed operation start signal (terminal STF) off, then on again. (At this time, the reference time of day is zeroed. When it is required to set the reference time of day, switch the start signal on before setting.)

4.4.5 Programmed Operation Battery Backup (FR-EPD option)

To continue programmed operation at the occurrence of an instantaneous power failure, install this unit (FR-EPD) and start programmed operation.

Operation at occurrence of instantaneous power failure

(1) When a power failure has occurred, operation is continued as shown on the right with the operation during the power failure period eliminated.
(The internal timer for programmed operation continues timing.)



(2) If the group selected has been changed during the power failure, the operation of the group selected is started from the beginning after the power is restored.

(3) The battery is guaranteed for 10 years. If the BAT.E lamp is lit, change the FR-EPD option unit. Replacement of only the battery cannot be made.

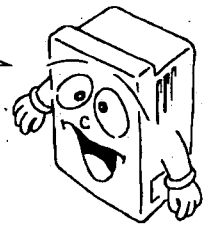
(4) The operation is not performed if the power is restored when or after the time-out signal is output.

(5) If the power is restored after a long power failure period, programmed operation is not resumed. Perform group selection and time setting again.

- Max. permissible power failure period..... 18 hours when Pr. 200 = "0" or "2" (minute/second selection).
  30 days when Pr. 200 = "1" or "3" (o'clock/minute selection)

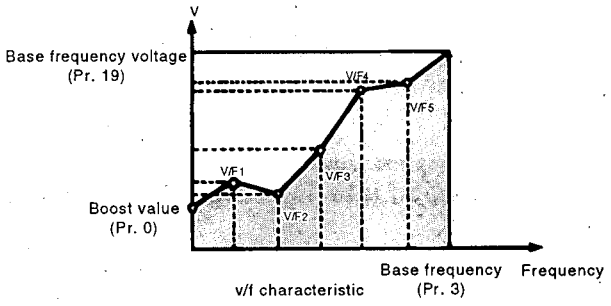
4.5 5-POINT FLEXIBLE V/F CHARACTERISTIC

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.



v/f characteristic

• Setting

(1) Set "2" in Pr. 71 "applied motor" after set Pr.19 "base frequency voltage".

(2) Set the desired frequencies and voltages in Pr. 100 to Pr. 109.
The setting must satisfy the following relationship: F1≠F2≠F3≠F4≠F5≠base frequency.
If the set frequencies are the same, a write error occurs.
If "9999" is set in any frequency, it is ignored.

Note: 1. The V/F 5-point flexible characteristic functions for V/F control only.
2. The V/F 5-point flexible characteristic only function when Pr. 60 (intelligent mode selection) is selected to 0.
3. The frequency voltage may be set optionally between 0 and 1000V, but output voltage is clamped at the base frequency voltage if output frequency is beyond the base frequency.
4. Pr. 19 (base frequency voltage) must be set. (When Pr. 19 = 9999, Pr. 71 cannot be set to 2 (5-point flexible V/F characteristic).)
5. If "2" is set in Pr. 71, Pr. 47 (second V/F (base frequency)) does not function.
6. When "2" is set in Pr. 71, the electronic overcurrent protection is calculated for a general-purpose motor.

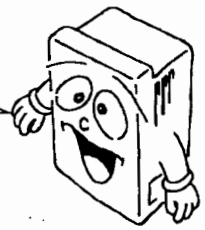
• V/F1 to 5 setting range

Parameter 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 120Hz	V/F1 (first frequency)	0 to 120Hz, 9999	0.01	9999
Pr. 101	BCD input (gain)	0 to 120Hz, 9999	V/F1 (first frequency voltage)	0 to 1000V	0.1	0
Pr. 102	Binary input (offset)	0 to 120Hz	V/F2 (second frequency)	0 to 120Hz, 9999	0.01	9999
Pr. 103	Binary input (gain)	0 to 120Hz, 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 120Hz, 9999	0.01	9999
Pr. 105	Speed feedback range	0 to 120Hz, 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 120Hz, 9999	0.01	9999
Pr. 107	Commercial power supply switching sequence output terminal selection	0 to 2	V/F4 (fourth frequency voltage)	0 to 1000V	0.1	0
Pr. 108	MC switching interlock time	0 to 100 second	V/F5 (fifth frequency)	0 to 120Hz, 9999	0.01	9999
Pr. 109	Reset waiting time(MC3 ON time)	0 to 100 second	V/F5 (fifth frequency voltage)	0 to 1000V	0.1	0

Note: The set values of Pr. 100 to Pr. 109 set when Pr. 71 is other than "2" are stored internally and remain unchanged if the set values are written with "2" set in Pr. 71. When the inboard option is added with "2" set in Pr. 71, the parameters set when Pr. 71 is other than "2" are made valid and the option operates with these parameters.

4.6 PU OPERATION INTERLOCK FUNCTION AND EXTERNAL SIGNAL-BASED OPERATION MODE SWITCHING FUNCTION

The PU operation interlock function allows PU operation to be interlocked depending on the ON-OFF of the terminal MRS signal.
The external signal-based operation mode switching function allows the operation mode to be fixed depending on the ON-OFF of the terminal RH signal.
These functions prevent the inverter from not starting operation under external command if the operation mode is left unswitched from the PU operation mode.



4.6.1 PU Operation Interlock Function

Setting method

Set "7" in Pr. 79 "operation mode selection".

PU operation interlock signal

The input signal MRS is assigned as the PU operation interlock signal. (When "7" is set in Pr. 79, MRS automatically operates as the PU operation interlock signal.)

Functions

- In the PU operation interlock mode, the following functions are made valid:

Set Value	Terminals MRS-SD	Function, Operation
7	Connected	• Output stopped during external operation. • Switchable to the PU mode. • Parameter setting can be changed in the PU mode. • PU operation allowed.
	Disconnected	• Forces the operation mode to be switched to the external operation mode. • External operation allowed. • Switching to the PU operation mode disabled.

The following table lists the functions and operations performed by switching on (connecting)/off (disconnecting) the external signal (across terminals MRS):

Operation Mode	Operation Status	Terminals MRS-SD	Mode Switching	Status	Parameter Write	Remarks
PU	Stop	Connected ↓ Disconnected	Forcibly switched to the external operation mode. (Note 1)	Remains stopped.	Enable ↓ Disable	• Unswitchable to the PU operation mode. Note 1: Switched independently of the external start signal.
	Running	Connected ↓ Disconnected	Forcibly switched to the external operation mode. (Note 1)	If the frequency setting and start signals of external operation are on, operation is performed accordingly.	Enable ↓ Disable (Note 2)	• Unswitchable to the PU operation mode. Note 2: Limited to parameters that may be rewritten during operation.
External	Stop	Disconnected ↓ Connected	Remains in the external operation mode. (Note 3)	Remains stopped.	Disable ↓ Disable	• Switchable to the PU operation mode. Note 3: Output stopped.
		Connected ↓ Disconnected	Remains in the external operation mode.	Remains stopped.	Disable ↓ Disable	• Unswitchable to the PU operation mode.
	Running	Disconnected ↓ Connected	Remains in the external operation mode. (Note 3)	Running ↓ Output stop	Disable ↓ Disable	• Unswitchable to the PU operation mode.
		Connected ↓ Disconnected	Remains in the external operation mode.	Output stop ↓ Run (Note 4)	Disable ↓ Disable	• switchable to the PU operation mode. Note 4: If the frequency setting signal is on, operation is performed accordingly.

Note: 1. When the signal across terminals MRS and SD is switched on and the value of Pr. 79 is then changed to other than 7 in the PU operation mode, that signal functions as the ordinary signal (output stop), not as the edit enable signal. Also, as soon as the value of Pr. 79 is changed, the ordinary mode switching is carried out.

2. When Pr. 79 = 7, the link operation (computer link, PC link) function cannot be used. Also, the inverter is put in the external operation mode if Pr. 125 = 1 (link mode at power on).

3. If the signal across STF or STR and SD is on, the external operation mode cannot be switched to the PU operation mode when the signal across MRS and SD is on.

4. When 7 is set in Pr. 79 and the signal across terminals MRS and SD is switched on and is then switched off during PU operation, the inverter is switched to the external operation mode independently of the external terminal (STF, STR) signal state. Therefore, when the signal across terminals MRS and SD is switched off with either of the STF and STR signals on, the motor is run in the external operation mode.

5. The ordinary MRS function is invalid for the PU operation mode.

6. The above description all applies to a case where Pr. 17 = 0 or 1 (MRS terminal normally disconnected). When Pr. 17 = 2 or 3, ON changes to OFF and OFF changes to ON in the above table and description.

7. When the PU operation mode is forcibly switched to the external operation mode, the PU is internally reset once to secure the monitor screen.

8. The above function is not available for the FR-PU01E and "7" cannot be written to Pr. 79.

9. At the occurrence of any alarm, press the STOP key in the PU operation mode to reset the inverter. The inverter cannot be reset in the external operation mode and must be reset in the PU operation mode.

10. This function is not activated when the commercial power supply-inverter switching sequence is selected.

4.6.2 External Signal-Based Operation Mode Switching Function

Setting method

Set "8" in Pr. 79 "operation mode selection".

External signal-based operation mode switching signal

The input signal RH is assigned as the external signal-based operation mode switching signal. (When "8" is set in Pr. 79, RH automatically operates as the external signal-based operation mode switching signal.)

Functions

- In the external signal-based operation mode switching mode, the following functions are made valid:

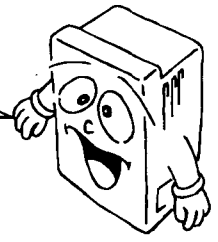
Set Value	Terminals RH and SD	Fixed Mode	Remarks
8	Connected	External operation mode	Cannot be switched to the PU operation mode.
	Disconnected	PU operation mode	Cannot be switched to the external operation mode.

Connection of RH and SD in the PU operation mode forces the inverter to switch to the external operation mode. Disconnection of RH and SD switches the inverter to the PU operation mode. Note that this switching can be done only during an inverter stop and cannot be done during operation.

Note: 1. Setting "8" in Pr. 79 changes the function of terminal RH (three-speed setting (high speed)) to the operation mode switching function. At this time, the function of terminal RH (three-speed setting (high speed)) is invalid.
2. This function is not available for the FR-PU01E parameter unit.

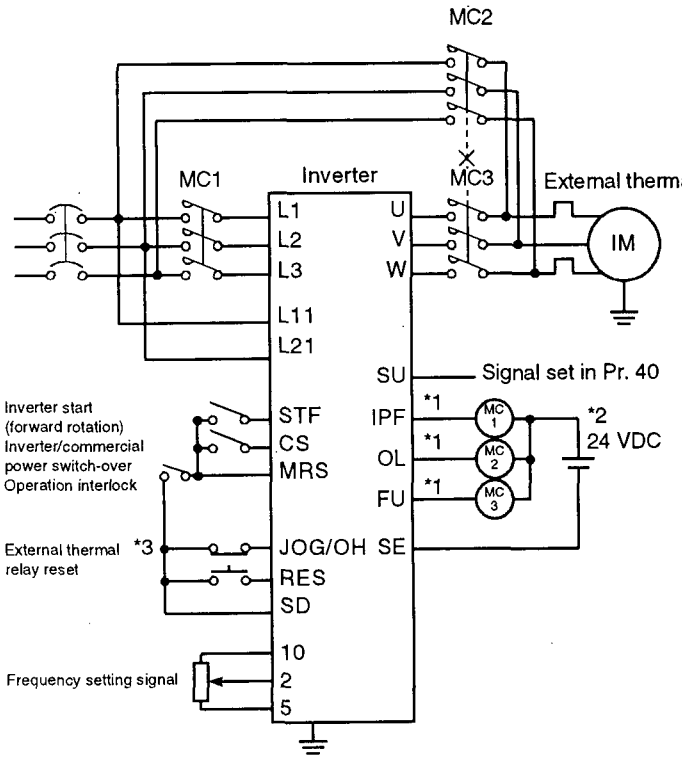
4.7 COMMERCIAL POWER SUPPLY-INVERTER OPERATION SWITCH-OVER FUNCTION

The inverter contains a complicated sequence circuit for commercial power supply-inverter operation switch-over. Hence, by merely entering the start/stop and automatic switch-over select signals, the interlock operation of the switching magnetic contactors can be performed.
Also, note that this function is not activated in the PU operation mode. (When the PU operation mode is selected, MC1 and MC3 are switched on automatically.)

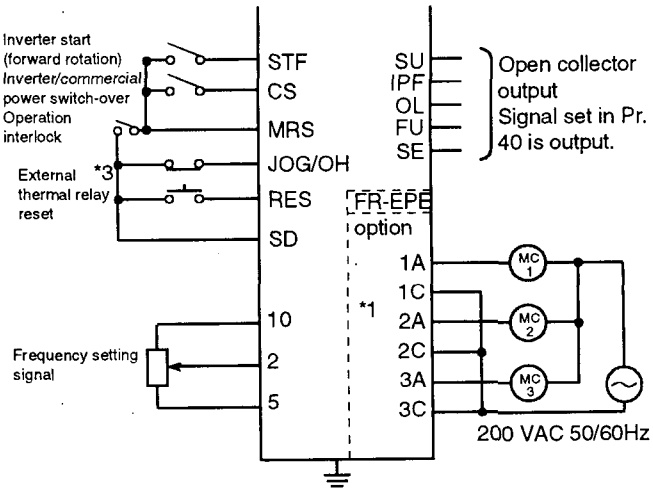


• Connection example

** •Use this switch-over function in the external operation mode. Also, this function is not performed unless the terminals R1 and S1 of the wiring use a seperate power supply (power supply not passing MC1), so these terminals must be connected to a different power supply.
•Always provide mechanical interlocks for MC2 and MC3.



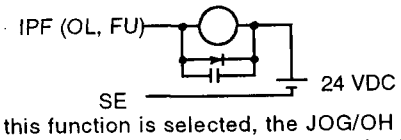
For Use of Inverter Open Collector
(Pr. 107 = 2)



For Use of the FR-EPE (Option)
(Pr. 107 = 1)

*1. Note the capacity of the sequence output terminals. (See the table on the right.)

*2. When the AC power supply is connected, fit the FR-EPE option and use the relay contact output. (See the above figure.)
When the DC power supply is connected, provide the following protective diode.



*3. When this function is selected, the JOG/OH terminal acts as the OH terminal (external thermal relay). When this terminal is open, therefore, the inverter results in alarm (external thermal relay operated) and cannot be operated. 3-wire type operation cannot be performed, either.

Output Terminal Capacity	Permissible Output Terminal Load
Inverter open collector output (IPF, OL, FU)	24 VDC 0.1A
FR-EPE (option output) (1A, 2A, 3A)	230 VAC 0.3A *3 30 VDC 0.3A

• **Roles of the Magnetic Contactors (MC1, MC2, MC3)**

Magnetic Contactor	Place of Installation	Role
MC1	Across power supply-inverter input	Normally connected with the exception of the following: Disconnected only at inverter alarm (re-connected at reset operation)
MC2	Across power supply-motor	Connected at commercial power supply operation, disconnected at inverter operation. Connected at inverter alarm (selected by setting in Pr. 110 except when the external thermal relay is operated)
MC3	Across inverter output-motor	Connected at inverter operation, disconnected at commercial power supply operation. Status held at inverter alarm

4.7.1 Explanation of the Terminals

When this function is used (Pr. 107 = 1, 2), the input terminals operate as follows:

Terminal Symbol	Role	Operation	MC Operation (O: ON, X: OFF)		
			MC1	MC2	MC3
MRS	Operation enable/disable select terminal*	Commercial power supply-inverter operation enable .....ON	O	—	—
		Commercial power supply-inverter operation disable.....OFF	O	X	Unchanged
CS	Inverter-commercial power supply switch-over select terminal	Inverter operation.....ON	O	X	O
		Commercial power supply operation .....OFF	O	O	X
STF (STR)	Inverter operation command terminal (Invalid for commercial power supply) (Note)	Forward (reverse) rotation.....ON	O	X	O
		Stop.....OFF	O	X	O
JOG/OH	Terminal dedicated to external thermal relay input	Motor normal .....ON	O	—	—
		Motor alarm .....OFF	X	X	X
RES	Operation status initialization terminal	Initialization.....ON	Unchanged	X	Unchanged
		Regular operation.....OFF	O	—	—

Note: • In the MC Operation section, [-] indicates MC2 OFF and MC3 ON for inverter operation, and MC2 ON and MC3 OFF for commercial power supply operation. [Unchanged] indicates that a state at the time of switch change-over is held.

- The function of CS is performed only when MRS is ON.
- The function of STF (STR) is implemented only when MRS and CS are ON.
- At inverter alarm, MC1 is switched off.
- If the MRS terminal signal is not switched on, neither of commercial power supply nor inverter operations can be performed.

When the FR-EPE (option) is used (Pr. 107 = 1), the output terminals operate as follows:

Terminal Symbol	Role
1A	Outputs MC1 operation signal.
2A	Outputs MC2 operation signal.
3A	Outputs MC3 operation signal.

* The SU, IPF, OL and FU terminals of the inverter output the signals set in Pr. 40. Also, the Pr. 107 setting of 1 is valid only when the FR-EPE is installed. (Without the FR-EPE, "1" cannot be set in Pr. 107.)

When the open collector outputs of the inverter are used (Pr. 107 = 2) without the FR-EPE (option) being used, the output terminals operate as follows:

Terminal Symbol	Role
SU	Outputs signal set in Pr. 40.
IPF	Outputs MC1 operation signal.
OL	Outputs MC2 operation signal.
FU	Outputs MC3 operation signal.

* Because Pr. 107 = 2, the relay outputs (terminals 1A, 2A, 3A) provide signals set in Pr. 134 (output signal selection) if the FR-EPE (option) is fitted.

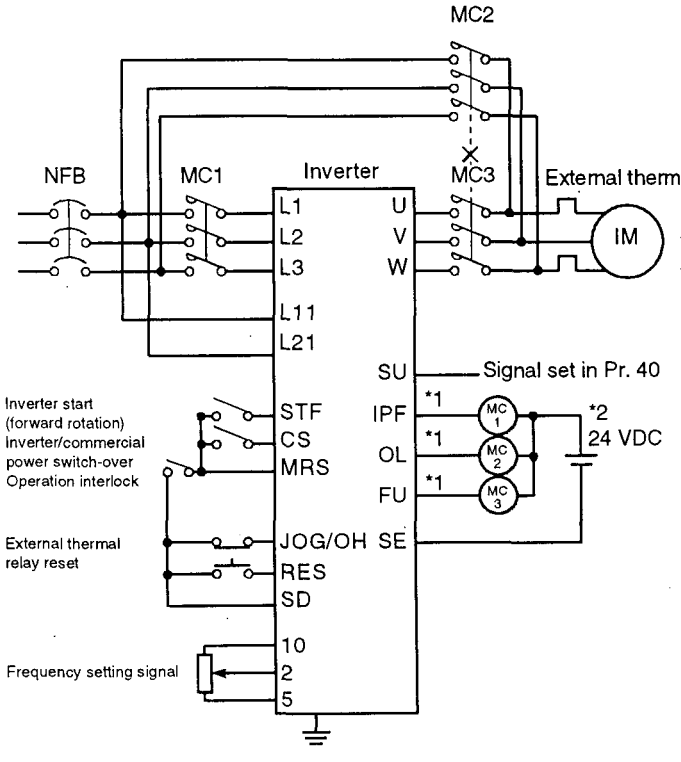
4.7.2 Adjustment

Function Number	Description	Setting Range	Factory Setting	Remarks
107	Commercial power supply-inverter switching sequence output terminal selection 0...Sequence output is not provided (this function is not performed) 1...Relay output terminals of the FR-EPE are used. 2...Open collector output terminals of the inverter are used.	0 to 2	0	
108	MC switching interlock timer time Set waiting time to prevent MC2 and MC3 from being turned on simultaneously at the time of MC switching.	0 to 100 seconds	1.0 second	Setting 0 seconds results in 0.05 seconds setting.
109	Waiting time for automatic restart after instantaneous power failure (MC3 ON waiting time) Set a period equal to or longer than the time from when MC3 ON signal is entered to when MC3 is actually turned on.	0 to 100 seconds	0.5 seconds	Setting 0 seconds results in 0.05 seconds setting.
110	Commercial power supply operation switch-over selection at inverter alarm At inverter alarm (except external thermal relay), switch-over to commercial power supply operation is carried out: 0...No 1...Yes	0, 1	0	
111	Automatic inverter operation-commercial power supply operation switch-over frequency When automatic switch-over is executed, inverter operation is automatically switched to commercial power supply operation at or above the set frequency when the inverter has reached the set frequency.	0 to 60Hz, 9999	9999	9999: Not automatically switched.

Note: • Pr. 111 is valid when Pr. 107 = 1 or 2.

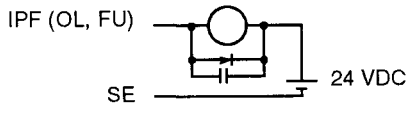
• After the motor started by the inverter has been switched to commercial power supply operation when the inverter had reached the automatic switching frequency, the motor is not automatically switched to inverter operation if the running frequency of the inverter is reduced to below the switching frequency.
To switch the motor to inverter operation again, switch the inverter running command terminal (STF or STR) signal from on to off, then to on.

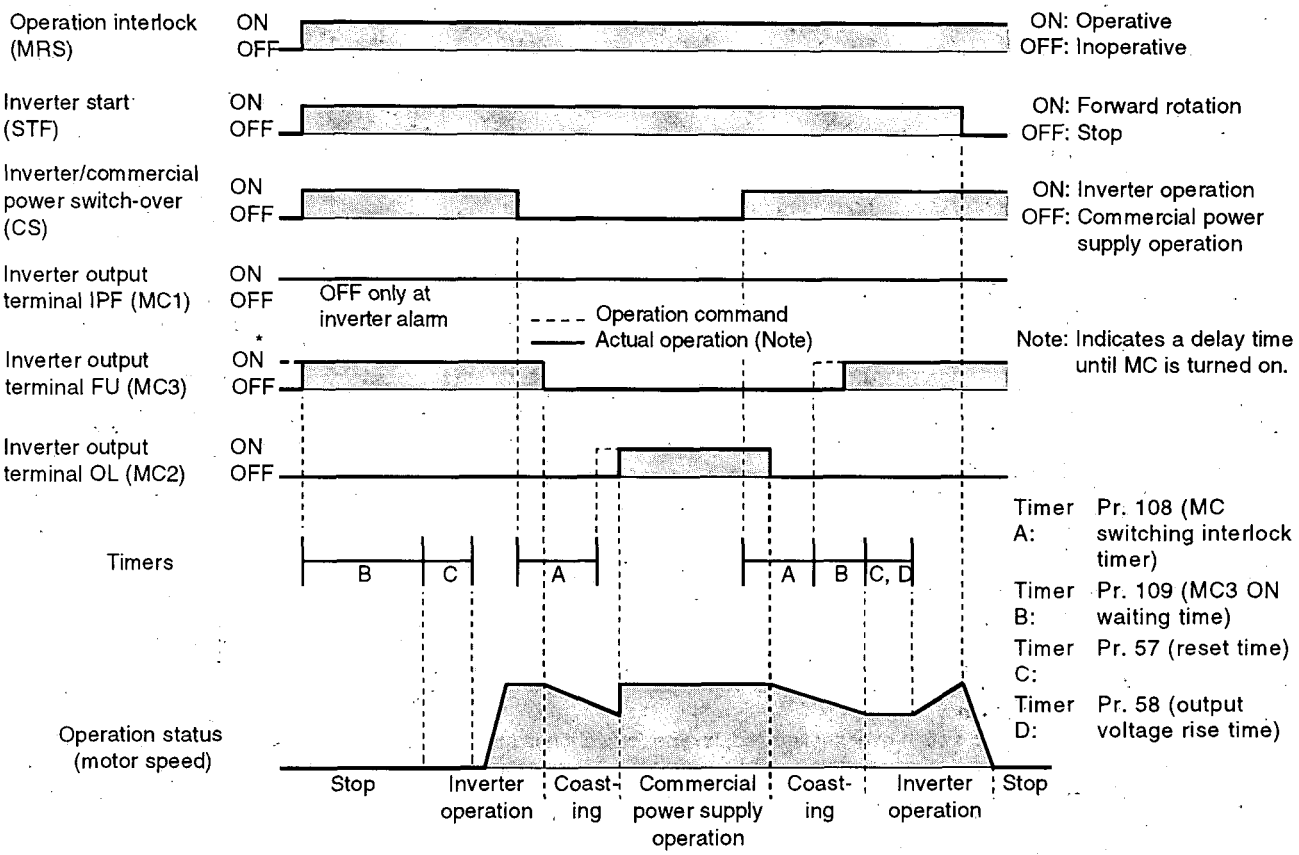
4.7.3 Operation Sequence Example



*1. Note the capacity of the sequence output terminals.

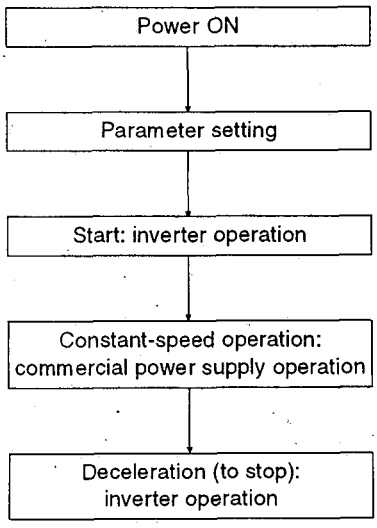
*2. When the AC power supply is connected, fit the FR-EPE option and use the relay contact output. When a DC power supply is connected, provide the following protective diode.





*MC3 may be ON depending on the operation method.

4.7.4 Operation Pattern



Operation Procedure (The following set values are given for reference.)

1) Set parameters for operation.

- Pr. 107 (switching sequence output terminal selection) = 2 (open collector output terminals of the inverter)
- Pr. 108 (MC switching interlock timer) = 2.0 seconds
- Pr. 109 (waiting time for start of automatic restart after instantaneous power failure) = 1.0 second
  Set a period equal to or longer than the time until when MC3 is actually switched on to connect between the inverter and motor. If the time set is short, restart may not function properly.
- Pr. 57 (restart coasting time) = 0.5 seconds
- Pr. 58 (output voltage rise time) = 0.5 seconds
  (Must always be set when commercial power supply operation is switched to inverter operation.)

2) Terminal operation after parameter setting

	MRS	CS	STF	MC1	MC2	MC3	Remarks
Power on	OFF (OFF)	OFF (OFF)	OFF (OFF)	OFF → ON (OFF → ON)	OFF (OFF)	OFF → ON (OFF → ON)	External operation mode (PU operation mode)
At start (inverter)	OFF → ON	OFF → ON	OFF → ON	ON	OFF	ON	
At constant speed (commercial)	ON	ON → OFF	ON	ON	OFF → ON	ON → OFF	MC2 is turned ON after MC3 is turned OFF. (The motor coasts during this period) Waiting time 2 seconds
Switched to inverter for deceleration (inverter)	ON	OFF → ON	ON	ON	ON → OFF	OFF → ON	MC3 is turned on after MC2 is turned off. (The motor coasts during this period) Waiting time 4 seconds
Stop	ON	ON	ON → OFF	ON	OFF	ON	

4.7.5 Notes

(1) This function is not implemented unless R1 and S1 use a different power supply (power supply not passing via MC1).

(2) When the value set in Pr. 107 is other than 0, this function is only valid for external operation or PU (speed command) + external (operation command) operation. When the value set in Pr. 107 is other than 0, MC1 and MC3 are turned on in the other operation mode.

(3) When MRS and CS are ON and STF is OFF, MC is ON. However, when the motor was coasted to a stop during commercial power supply operation, inverter starts operation after the time set in Pr. 109 has elapsed.

(4) When the frequency is set in Pr. 111 for automatic switch-over operation, connect CS and SD and set the automatic restart after instantaneous power failure (Pr. 57, 58). Start/stop is made by the STF switch during inverter operation. (When the setting of automatic restart after instantaneous power failure has not been made, the motor is coasted to a stop.)

(5) When the value set in Pr. 111 is equal to or less than the starting frequency, commercial power supply operation is performed as soon as inverter operation is commanded (STF is turned on). Note that operation is not performed if the set frequency of the inverter is less than the starting frequency.

(6) If MC2 or MC3 is turned on when both MC2 and MC3 are off, the waiting time set in Pr. 108 exists.

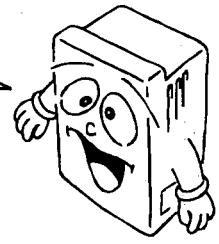
(7) If the value set in Pr. 107 is other than 0, Pr. 108 and 109 settings are ignored in the PU operation mode.
Also, the input terminals (STF, CS, MRS, JOG/OH) of the inverter return to their regular functions.

(8) When the commercial power supply-inverter switching sequence is selected, the PU operation interlock function is not activated if it has been selected (Pr. 79 = 7).

(9) When 8888 has been set in Pr. 11 "DC injection brake operation time", the commercial power supply-inverter switching sequence cannot be selected, set a value for Pr. 11.

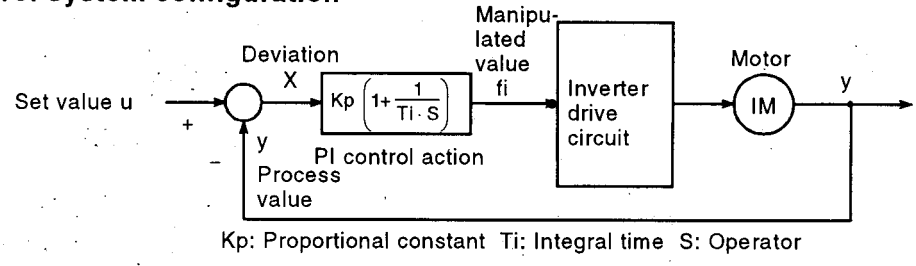
4.8 PI CONTOROL FUNCTION

Process control can be exercised for flow rate, air volume, pressure, etc. by the inverter.



4.8.1 Operation

(1) PI control system configuration



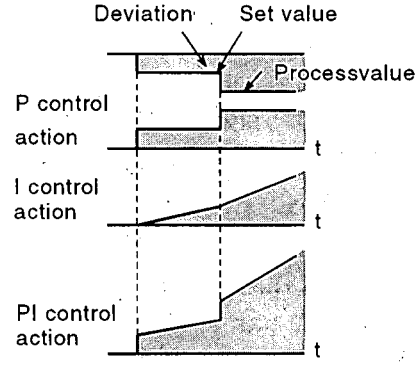
Kp: Proportional constant Ti: Integral time S: Operator

(2) Overview of PI control action

1) PI control action

PI control action is a combination of proportional (P) control action and integral (I) control action designed to provide a manipulated value according to an error and a change with time.

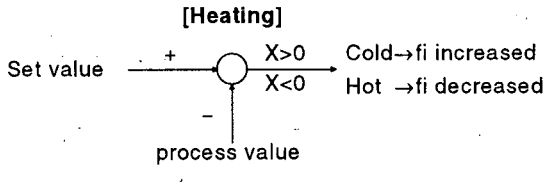
[Example of operation performed when process value varies step by step]

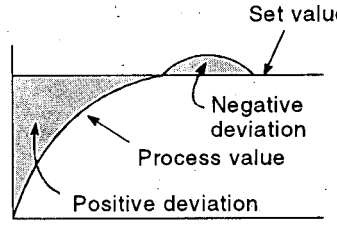


Note: PI control action is combined P and I control

2) Reverse action

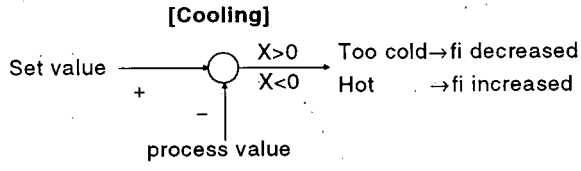
The manipulated value (output frequency) is increased when deviation X (set value - process value) is positive, and is decreased when the deviation is negative.

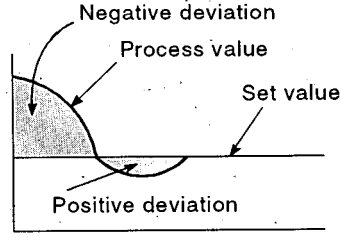




3) Forward action

The manipulated value (output frequency) is increased when deviation X (set value - process value) is negative, and is decreased when the deviation is positive.

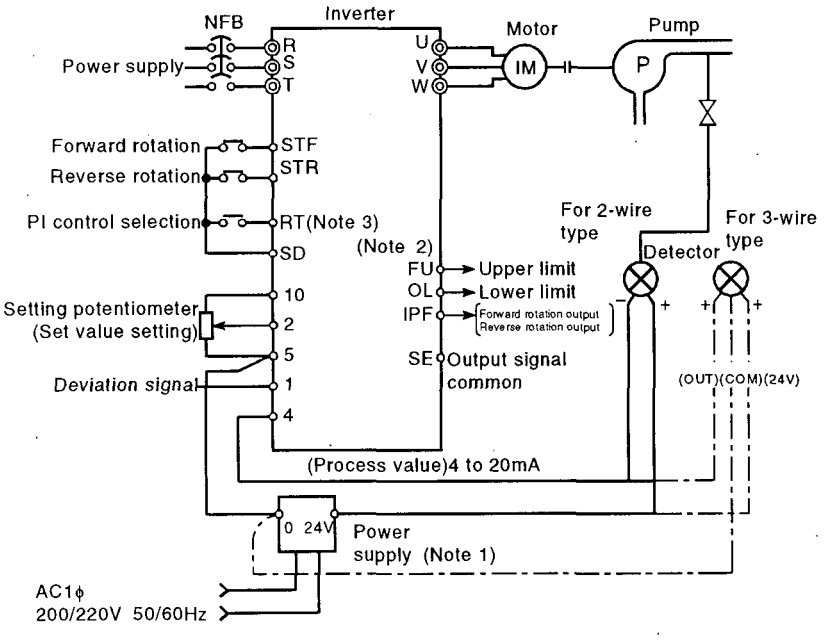




Relationship between Deviation and Manipulated Value (Output Frequency)

	Deviation	
	Positive	Negative
Reverse action	↗	↘
Forward action	↘	↗

4.8.2 Wiring Example



Note 1: Prepare the power supply according to the power supply specifications of the detector.

2: The output signals of the output signal terminals change according to the setting of Pr. 40 (output terminal assignment).

3: During PI control, this terminal does not act to provide its original second function selection capability.

4.8.3 Terminal Explanation

Terminal Number		Terminal Name	Description	Remarks	
Input terminals	(Note 3) RT	PI control selection terminal	Connect terminals RT and SD to exercise PI control.	Set any of 10, 11, 20 and 21 in Pr. 128.	
	2	Set value input terminal	Input the set value of PI control.		
	1	Deviation signal input terminal	Input an deviation signal calculated externally.		
	4	Process value input terminal	Input a 4 to 20mA process value signal from the detector.		
Output terminals	(Note 2) FU	Upper limit output terminal	Outputs a signal when the process value signal rises above the upper limit value.	Set "7" in Pr. 40*. (When Pr. 128=20,21)	Open collector output
	OL	Lower limit output terminal	Outputs a signal when the process value signal falls below the lower limit value.	Set "8" in Pr. 40*. (When Pr. 128=20,21)	
	IPF SU	Forward (reverse) rotation direction output terminal	Outputs "Hi" when the output display of the parameter unit shows forward rotation (FWD) or "Lo" when the display shows reverse rotation (REV) or stop (STOP).	Set "5" in Pr. 40*. (When Pr. 128=10, 11, 20, 21)	
	SE	Output signal common terminal	Common terminal for terminals FU, OL, IPF and SU		

*Selection of the PI control changes the original functions of the above I/O terminals.

4.8.4 Terminal Functions

(1) Terminal setting

1) To enable PI control, connect RT and SD. When these terminals remain disconnected, ordinary inverter operation is performed without PI control action being carried out.
2) Input the set value to across inverter terminals 2-5 or set it in Pr. 133 and input the process value signal to across inverter terminals 4-5. At this time, set 20 or 21 in Pr. 128.
3) To input the deviation signal externally calculated, input it to across terminals 1-5. At this time, set 10 or 11 in Pr. 128.
4) Setting method

Item	Input Method	Description	
Set value	Across inverter terminals 2-5	Set 0V to 0% and 5V to 100%.	When 1, 3, 5, 11, 13 or 15 is set in Pr. 73 (voltage selection) (5V is selected for terminal 2)
		Set 0V to 0% and 10V to 100%.	When 0, 2, 4, 10, 12 or 14 is set in Pr. 73 (voltage selection) (10V is selected for terminal 2)
Set value	Pr. 133	Set the set value (%) to Pr. 133.	
Deviation signal	Across inverter terminals 1-5	Set -5V to -100%, 0V to 0% and +5V to +100%.	When 2, 3, 5, 12, 13 or 15 is set in Pr. 73 (voltage selection) (5V is selected for terminal 1)
		Set -10V to -100%, 0V to 0% and +10V to +100%.	When 0, 1, 4, 10, 11 or 14 is set in Pr. 73 (voltage selection) (10V is selected for terminal 1)
Process value	Across inverter terminals 4-5	4mA corresponds to 0% and 20mA to 100%.	

4.8.5 Parameters

(1) Parameter list

Parameter Number	Name	Setting Range	Minimum Increment	Factory Setting	Remarks
128	Forward-reverse action selection	0, 1, 10, 11, 20, 21	-	0	0, 10, 20: PI reverse action 1, 11, 21: PI forward action
129*	PI proportional band	0.1 to 1000% 9999	0.1%	100%	Set 9999 to exercise integral control only.
130*	Integral time	0.1 to 3600 seconds 9999	0.1 seconds	1 second	Set 9999 to exercise proportional control only.
131	Upper limit	0 to 100% 9999	0.1%	9999	Upper limit value. If the feedback value rises above this setting, FUP is output.
132	Lower limit	0 to 100% 9999	0.1%	9999	Lower limit value. If the feedback value falls below this setting, FDN is output.
133*	PI control set value for PU operation	0 to 100%	0.01%	0%	Made valid only when PU command is given in the PU operation or PU/external combined operation mode.
40	Output terminal assignment	0 to 9999	1	1234	Used to assign the terminals from which the upper and lower limit signals and forward (reverse) rotation direction signal are output.

Note: *The settings of Pr. 129, 130 and 133 may also be changed during operation.

(2) Parameter setting

1) PI control action selection [Pr. 128]
Set reverse or forward action according to the object to be controlled.
Also, set this parameter to exercise PI control in the inverter only.
Example: Reverse action (Pr. 128 = 0, 10, 20) ..... for heating, pressure control, etc.
Forward action (Pr. 128 = 1, 11, 21) ..... for cooling, etc.

Operation Item / Set Value	PI Control		Process Value Input	PI Control Action
	Inverter only	Option FR-EPD/EPH		
0	Disabled	Enabled	Select either of the deviation signal and process value with the FBS terminal of the FR-EPD/EPH option.	Reverse action
1				Forward action
10	Enabled	Disabled	Deviation signal input (Terminal No. 1)	Reverse action
11				Forward action
20			Process value input (Terminal No. 4)	Reverse action
21				Forward action

To exercise PI control in the inverter only, always set any of 10, 11, 20 and 21 and connect terminals RT and SD.

2) PI proportional band [Pr. 129]
When the proportional band is narrow (parameter setting is small), a slight variation in process value will vary the manipulated value greatly. Hence, as the proportional band decreases, the response sensitivity = gain increases, but stability will reduce, e.g. hunting will occur.
Gain Kp = 1/proportional band

3) Integral time [Pr. 130]
This is a period of time required to obtain the same manipulated value as in the proportional (P) control action by the integral (I) control action only. As the integral time decreases, the set value is reached earlier, but hunting is more likely to occur.

4) Upper limit, lower limit [Pr. 131], [Pr. 132]
If the process value goes out of the setting range, an alarm can be output.
Set the upper limit value in Pr. 131 and the lower limit value in Pr. 132.
In this case, 4mA of the process value signal corresponds to 0% and 20mA to 100%.
Note: Use Pr. 40 (output terminal assignment) to set the output terminals of the upper and lower limits.

5) PI control set value for PU operation [Pr. 133]
Set the set value (%) in Pr. 133. The set value is valid only in the PU operation mode. In this case, the set frequency in Pr. 902 corresponds to 0% and the set frequency in Pr. 903 corresponds to 100%. In the external operation mode, the set value is the voltage across inverter terminals 2 and 5.

6) Output terminal assignment [Pr. 40]
Set the terminals which output the upper limit, lower limit and forward (reverse) rotation direction signals.

Set Value	Function Code	Function Name		
		Pr. 128 setting		
		0, 1	10,11	20,21
0	RUN	Inverter running	←	←
1	SU	Up to frequency	←	←
2	IPF/UVT	Instantaneous power failure or undervoltage	←	←
3	OL	Overload alarm	←	←
4	FU1	Frequency detection	←	←
5	FU2	Second frequency detection	Forward (reverse) rotation direction output*	Forward (reverse) rotation direction output*
7	THP	Electronic thermal relay pre-alarm	←	Upper limit output
8	PRG	Program mode	←	Lower limit output
9	PU	PU operation mode or open motor circuit detection	←	←

Set a 4-digit integer in Pr. 40 to assign the terminals.
The value in each digit represents the function of each terminal.

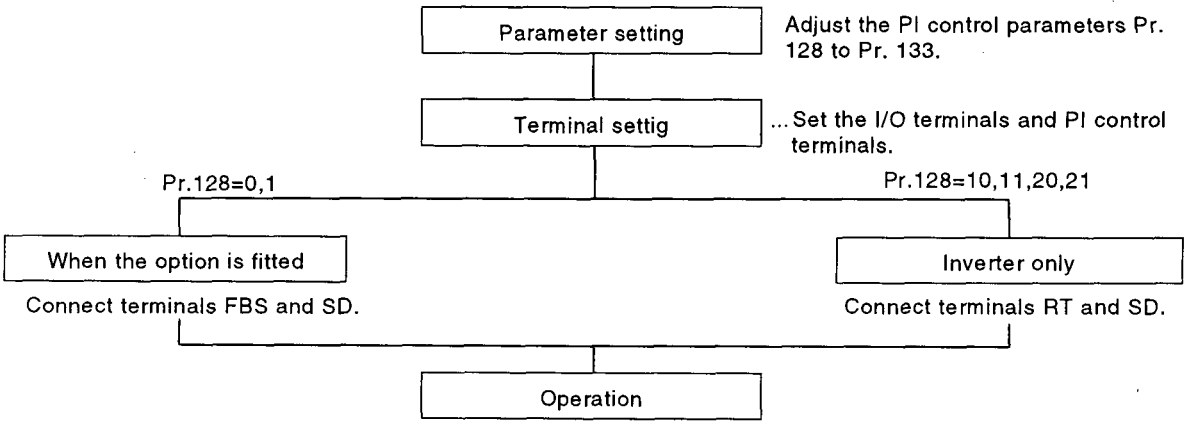
Pr.40 : [First digit] [Second digit] [Third digit] [Fourth digit]
↑ ↑ ↑ ↑
SU IPF OL FU

Example : When 20 is set in Pr. 128 and 7854 in Pr. 40:
Terminal SU = upper limit output terminal
Terminal IPF = lower limit output terminal
Terminal OL = forward (reverse) rotation direction output terminal
Terminal FU = FU1 (frequency detection) signal

* The forward (reverse) rotation direction output terminal outputs "Hi" during forward rotation or "Lo" during reverse rotation or stop.
("Lo" indicates that the transistor for open collector output is ON (conducting). "Hi" indicates that the above transistor is off (not conducting).)

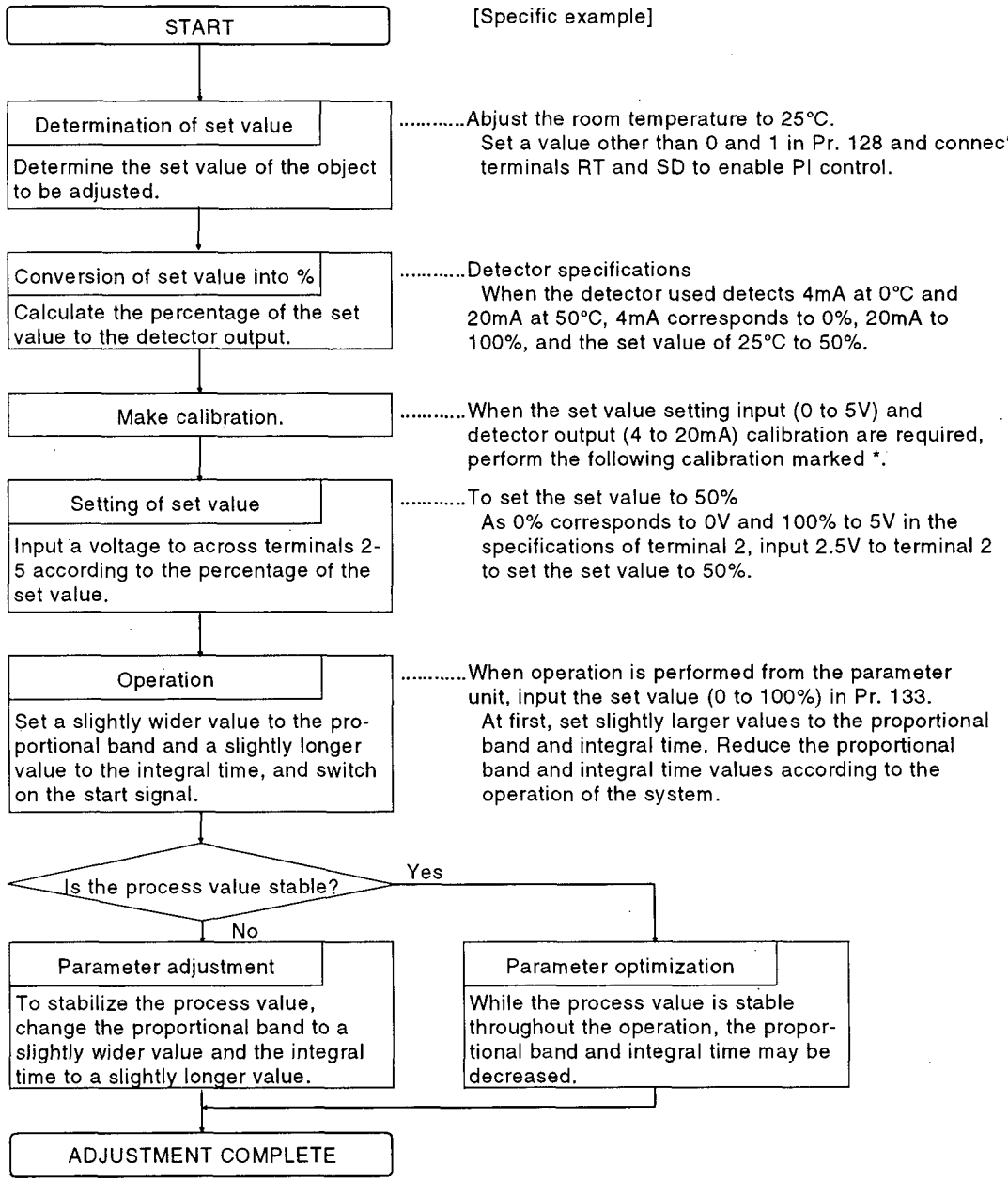
4.8.6 Adjustment

The following is a procedure for adjustment to be made when PI control function is selected:



4.8.7 Calibration

The following example shows the adjustment of a room temperature to 25°C under PI control using a detector which detects 4mA at 0°C and 20mA at 50°C. The set value is provided to across inverter terminals 2 and 5 (0 to 5V).



* When calibration is needed, use calibration parameters Pr. 902 to Pr. 905 to calibrate the detector output and set value setting input. Make calibration in the PU mode while the inverter is at a stop.

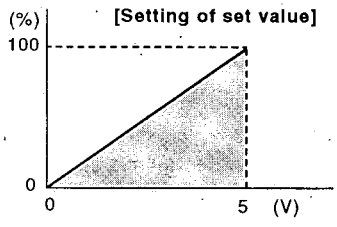
(1) Calibration of set value input

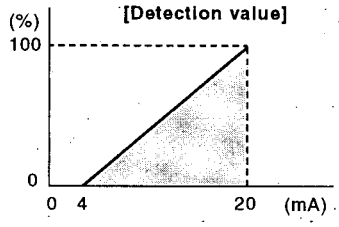
1) Apply a voltage for 0% set value setting input (e.g. 0V) to across terminals 2 and 5.
2) Make calibration using Pr. 902 "frequency setting voltage bias". At this time, input the frequency which the inverter should output at the deviation signal of 0% (e.g. 0Hz).
3) Apply a voltage for 100% set value setting input (e.g. 5V) to across terminals 2 and 5.
4) Make calibration using Pr. 903 "frequency setting voltage gain". At this time, input the frequency which the inverter should output at the deviation signal of 100% (e.g. 60Hz).

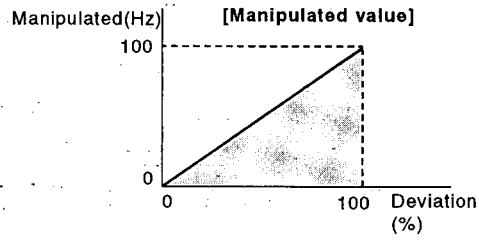
(2) Calibration of detector output

1) Apply a current for 0% detector setting output (e.g. 4mA) to across terminals 4-5.
2) Make calibration using Pr. 904 "frequency setting current bias".
3) Apply a current for 100% detector setting output (e.g. 20mA) to across terminals 4-5.
4) Make calibration using Pr. 905 "frequency setting current gain".

*The frequencies set in Pr. 904 and Pr. 905 should be the same as those set in Pr. 902 and Pr. 903, respectively.
(Practically, the frequencies set in Pr. 904 and Pr. 905 are independent of PI control action.)
The results of the above calibrations are shown below:







4.8.8 Instructions

(1) The input of the multi-speed (terminal RH, RM, RL) or jog operation (terminal JOG) signal with terminals RT and SD connected causes PI control to be stopped and the multi-speed or jog operation to be started.
(2) Note that when 20 or 21 is set in Pr. 128, the value input to across inverter terminals 1-5 is added as a set value to the set value across terminals 2-5.
(3) When 5 (programmed operation mode) is set in Pr. 79, PI control operation cannot be performed and programmed operation is performed.
(4) When the value set in Pr. 128 "PI control action selection" is other than 0 and 1, the functions of the terminals corresponding to "5, 7, 8" set in Pr. 40 change to those of the PI control function terminals.

4.8.9 Specifications

(1) PI setting ranges

Proportional band (P)	0.1 to 1000%
Integral time (I)	0.1 to 3600 seconds

(2) Input signals

(a) Set value, process value and deviation

Input Specifications		Input Terminals, Input Method	Input Signals
When process value is 4 to 20mA	Set value	Inverter terminal 2	0 to 5V, 0 to 10V
		Parameter unit	Digital signal
	Process value	Inverter terminal 4	4 to 20mA
When deviation is input directly	Deviation	Inverter terminal 1*	0 to ±5V or 0 to ±10V

* When the error has been calculated outside the inverter, input that value to inverter terminal 1 (±10V or ±5V). Set 10 or 11 in Pr. 128.

(b) Selection signal (contact input)
- PI control action selection
- Feedback input signal (4 to 20mA) selection

(3) Output signals (open collector output)
*** Permissible load 24VDC 0.1A**
- Upper limit
- Lower limit
- Rotation direction (forward rotation output, reverse rotation output)

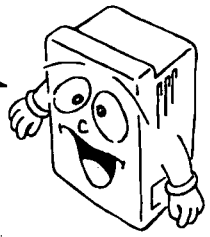
(4) Setting functions (parameter unit used)
- Upper limit value
- Lower limit value
- PI proportional band
- Integral time
- Forward-reverse action selection
- PI control set value setting for PU operation

(5) Detector power supply

Prepare the detector power supply according to the power supply specifications of the detector. This power cannot be supplied from the inverter.

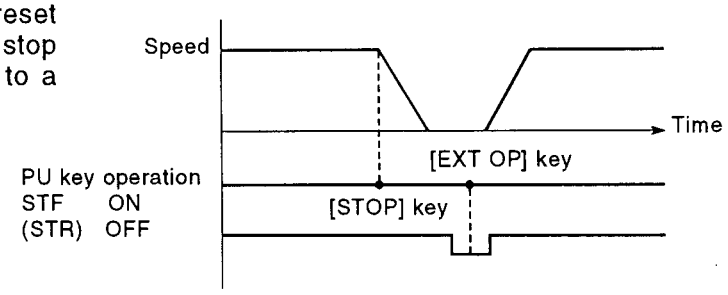
4.9 PU STOP KEY FUNCTION

Setting any of 14 to 17 in Pr. 75 "reset selection/PU disconnection detection/PU stop selection" allows the motor to be decelerated to a stop by pressing the PU's STOP key in any operation mode, e.g. PU, external, communication or other mode.



4.9.1 Operation

When any of 14 to 17 is set in Pr. 75 "reset selection/PU disconnection detection/PU stop selection", the motor can be decelerated to a stop by pressing the PU's STOP key.



Stop Example in External Operation Mode

4.9.2 Setting

(1) Setting of Pr. 75 "reset selection/PU disconnection detection/PU stop selection"

Pr. 75 Setting	Reset Selection	PU Disconnection Detection (Note)	PU Stop Selection
0	Reset input normally enabled	If the PU is disconnected, operation is continued as it is.	Only in the PU operation mode, the motor is decelerated to a stop by pressing the PU's STOP key.
1	Reset input enabled only when protective function is activated		
2	Reset input normally enabled	When the PU is disconnected, the inverter LED displays an error and inverter output is shut off.	
3	Reset input enabled only when protective function is activated		
14 (Factory setting)	Reset input normally enabled	If the PU isdisconnected, operation is continued as it is.	In any operation mode, e.g. PU, external, communication or other mode, the motor is stopped by pressing the PU's STOP key. (To restart, the following operation is required.)
15	Reset input enabled only when protective function is activated		
16	Reset input normally enabled	When the PU is disconnected, the inverter LED displays an error and inverter output is shut off.	
17	Reset input enabled only when protective function is activated		

(2) Restart setting

1) After completion of deceleration to a stop, switch off the start command. (Disconnect STF or STR from SD.)
2) Press the EXT OP key on the parameter unit.
3) Switch on the start command again.

Note 1: Use the FR-PU02E-1 (FR-ARWE-1) when any of "14 to 17" is set in Pr. 75 in other than the PU operation mode to stop the inverter by pressing the PU stop key.
When the parameter unit used is not the FR-PU02E-1 (FR-ARWE-1), the inverter cannot be stopped by pressing the PU stop key in other than the PU operation mode. Also, when any of "14 to 17" is set in Pr. 75, the inverter will not start if the start signal is entered in the external or communication mode. In this case, set any of "0 to 3" in Pr. 75.

2: When the inverter is powered on with any of 14 to 17 set in Pr. 75, the inverter makes communication for parameter unit identification. If the parameter unit other than the FR-PU02E-1 (FR-ARWE-1) is connected during this communication and the external signal is used to increase speed, the inverter will be decelerated to a stop at the end of parameter unit identification. Also, if the inverter is started without the parameter unit and the parameter unit other than the FR-PU02E-1 (FR-ARWE-1) is then fitted (for more than 1 second continuously), the inverter will be decelerated to a stop. When the parameter unit fitted is the FR-PU02E-1 (FR-ARWE-1), the inverter keeps running as it is.

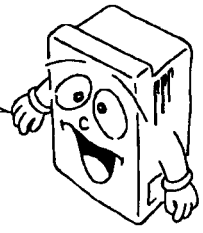
MEMO

5. PROTECTIVE FUNCTIONS

This chapter provides details the "protective functions" of this product.
Always read the precautions, etc., before starting use.

5.1 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, reset the inverter in accordance with page.



5.1.1 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 150% of the rated current, the protective circuit is activated to stop the inverter. When any main circuit device is overheated, the protective circuit is also activated to stop the output of the inverter.	1	Provided (Open)
Stedy Spd Oc	E.OC2	During constant speed			2	
Oc During Dec	E.OC3	During deceleration During stop			3	
Ov During Acc	E.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.THM (Motor protection)	Overload shut-off (electronic overcurrent protection)		The electronic overcurrent protection in the inverter detects inverter overload or motor overheat and activates the protective circuit to stop the inverter output. When a multi-pole motor or more than one motor is driven, for example, the motor(s) cannot be protected by the electronic overcurrent protection. Provide a thermal relay in the inverter output circuit. In this case, setting the electronic overcurrent protection value to 0A activates the inverter protection only. (Activated at a current 120% or more of the rated current.)	5	Provided (Open)
Inv. Overload	E.THT (Inverter protection)				6	
Inst. Pwr. Loss	E.IPF	Instantaneous power failure protection		If an instantaneous power failure has occurred in excess of 15msec (this applies also to inverter input power shut-off), this function is activated to stop the inverter output. (If the power failure is within 15msec, the control circuit operates without fault. If the power failure persists for more than about 100msec, the protective circuit is reset.)	7	Provided (Open)
Under Voltage	E.UvT	Undervoltage protection		If the inverter power supply voltage has 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 300V, this function stops the inverter output. When there is no jumper or DC reactor connected across terminals P and P1, the undervoltage protection is also activated.	8	Provided (Open)
Ground Fault	E.GF	Output side ground fault overcurrent protection		If a ground fault current has flown due to a ground fault occurring in the output (load) side of the inverter, this function stops the inverter output. A ground fault occurring at low ground resistance may activate the overcurrent protection (OC1 to OC3).	B	Provided (Open)
OH Fault	E.OHT	External thermal relay operation		If the external thermal relay for motor overheat protection or the internally mounted temperature relay in the motor has been switched on (relay contacts open), this function stops the inverter output and keeps it stopped. This protection is only provided when "1", "3", "5" or "7" 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) / Stll Prev STP (at a motor stop)	E.OLT (Indicates a stop due to the activation of the function for a long time during constant-speed operation)	Acceleration/constant-speed stall prevention current limit	If a current not less than 120% 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 120% 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 120%, this function increases the frequency again and accelerates up to the set speed or continues operation.	D	Not provided. (Provided by EOLT display. (Open))
		Deceleration stall prevention	If the brake operating amount has exceeded the specified value due to excessive regenerative energy during motor deceleration, this function stops the decrease in frequency to prevent the inverter from resulting in overvoltage trip. As soon as the regenerative energy has reduced, this function reduces the frequency again and continues deceleration.		
Option Fault	E.OPT	Inboard option connection alarm	Stops the inverter output if the dedicated option used in the inverter results in connection (connector) fault during operation.	E	Provided (Open)
Corrupt Memory	E. PE	Parameter storage device alarm	Stops the output if the fault of EPROM which stores the function set values has occurred.	F	Provided (Open)
Retry No. Over	E.rET	Retry count exceeded	If operation cannot be resumed within the number of retry times set, this function stops the inverter output.	F	Provided (Open)
CPU Fault	E.CPU	CPU error	If the operation of the built-in CPU does not end within a predetermined period of time, the inverter self-determines it as alarm and stops the output.	F	Provided (Open)
PU Leave Out	E.PUE	Parameter unit disconnection	Stops the inverter output if the parameter unit is disconnected. This protective function is activated when "2", "3", "16" or "17" has been set in Pr. 75 "reset selection/PU disconnection detection/PU stop selection".	F	Provided (Open)

- **To know the operating status at the occurrence of alarm**

When any alarm has occurred, the display automatically switches to the indication of the corresponding protective function (error). By pressing the [MONITOR] key at this point without resetting the inverter (see page 112), 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.

5.1.2 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	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Actual	Digital
A	A
B	b
C	C
E	E
F	F
G	G
H	H
I	I
J	J
L	L

Actual	Digital
M	M
N	n
O	O
P	P
T	r
U	U
V	v
r	r
-	-

5.1.3 Alarm History (History of Alarm Definitions)

Up to eight most recent alarms (alarm definitions) are stored in memory. To check these, use the help function. For more information, see "5 ALARM HISTORY" on page 57.

5.1.4 Erasing the Alarm History (History of Alarm Definitions)

To erase the alarm history (history of alarm definitions), use the help function. For more information. For more information, see "6 ALARM HISTORY CLEAR" on page 57.

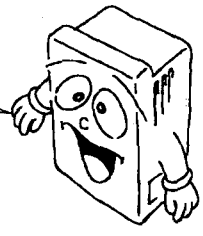
5.1.5 Alarm Code Output

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

Alarm Definition (Protective Function)		Inverter LED Display	Output Terminal Signal On/Off				Alarm Code
			SU	IPF	OL	FU	
Normal operation		—	0	0	0	0	0
Overcurrent shut-off	During acceleration	E.OC1	0	0	0	1	1
	During constant-speed operation	E.OC2	0	0	1	0	2
	During deceleration	E.OC3	0	0	1	1	3
Regenerative overvoltage shut-off		E.OV1 to 3	0	1	0	0	4
Electronic overcurrent protector	Motor protection	E.THM	0	1	0	1	5
	Inverter protection	E.THT	0	1	1	0	6
Instantaneous power failure		E.IPF	0	1	1	1	7
Undervoltage		E.UVT	1	0	0	0	8
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					

5.2 TROUBLESHOOTING

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



5.2.1 Checking the Parameter Unit Display

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

Display		Cause of Fault	Check Point	Remedy
Parameter Unit	Inverter LED			
OC During Acc	OC1 : Overcurrent during acceleration	Main circuit device overheat	Acceleration too fast? Check for output short circuit or ground fault. Check for cooling fan stop.	Increase acceleration time. Change fan. Remove obstacle to cooling fan. (Note)
Stedy Spd Oc	OC2 : Overcurrent during constant speed		Sudden load change? Check for output short circuit or ground fault. Check for cooling fan stop.	Keep load stable. Change fan. Remove obstacle to cooling fan. (Note)
OC During Dec	OC3 : Overcurrent during deceleration		Deceleration too fast? Check for output short circuit or ground fault. Check for cooling fan stop. Mechanical brake of motor operate too fast?	Increase deceleration time. Change fan. Remove obstacle to cooling fan. (Note) Check brake operation.
Ov During Acc	OV1 : Overvoltage during acceleration	Overvoltage on DC bus (terminals P-N)	Acceleration too fast?	Increase acceleration time.
Stedy Spd Ov	OV2 : Overvoltage during constant speed		Sudden load change?	Keep load stable.
Ov During Dec	OV3 : Overvoltage during deceleration		Deceleration too fast?	Increase deceleration time. (Set deceleration time which matches load GD^2.) Reduce braking duty.
Motor Overload	THM: Overload alarm	Thermal relay for motor	Motor used under overload?	Reduce load. Increase motor and inverter capacities.
Inv. Overload	THT : Overload alarm	Thermal relay for inverter		
Inst. Pwr. Loss	IPF : Instantaneous power failure	Instantaneous power failure	Check the cause of instantaneous power failure.	
Under Voltage	UVT : Undervoltage	•Drop of power supply voltage •Terminals P and P1 are open.	•Large-capacity motor started? •Is a jumper or DC reactor connected across terminals P and P1?	•Check power system equipment such as power supply capacity. •Connect a jumper or DC reactor across terminals P and P1.
Ground Fault	GF : Ground fault overcurrent	Ground fault occurred in output circuit.	Check motor and cables for ground fault.	Remedy ground fault area.
OH Fault	OHT: External thermal relay operation	External thermal relay operated.	Check motor for overheat.	Reduce load and frequency of operation.
Stll Prev STP	OLT : Stall prevention	Stall prevention or current limit function activated too long.	Motor used under overload?	Reduce load. Increase motor and inverter capacities.
Option Fault	OPT: Inboard option connection alarm	Option and inverter connected improperly.	Check for loose connector.	Securely connect.
Corrupt Memry	PE : Parameter storage device alarm	Storage device (EEPROM) faulty.	Number of parameter write times too many?	Change inverter.
Retry No. Over	RET : Retry count exceeded	Operation could not be resumed within the number of retry times set.	Check cause of alarm occurrence.	
CPU Fault	CPU: CPU error	CPU malfunction	Check for loose connector.	Change inverter. Securely connect.
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	ùCheck 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 by the fan failure.

*1: The parameter unit display remains unchanged but operation may be performed in the external operation mode.

*2: If the alarm is kept displayed on the parameter unit and unit LED after remedy, the internal circuit may be faulty. Consult your sales representative.

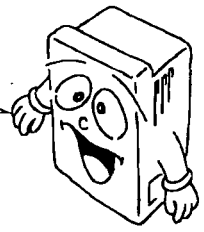
5.2.2 Faults and Check Points

Fault	Typical Check Point
Motor does not rotate.	(1) Checking the main circuit • Check that a proper power supply voltage is applied (inverter LED display is lit). • Check that the motor is connected properly. (2) Checking the input signals • Check that the start signal is present. • Check that both the forward and reverse rotation start signals are not present simultaneously. • Check that the frequency setting signal is not zero. • Check that the signal across terminals AU and SD is on when the frequency setting signal is 4 to 20mA. • Check that the output stop signal (across terminals MRS and SD) or reset signal (across RES and SD) is not on. (3) Checking the parameter set values • Check that the reverse rotation prevention (Pr. 78) is not set. • Check that the operation mode (Pr. 79) setting is correct. • Check that the bias and gain (Pr. 902 to Pr. 905) settings are correct. • Check that the starting frequency (Pr. 13) set value is not greater than the running frequency. • Check that various operational functions (such as three-speed operation), especially the maximum frequency, are not zero. (4) Confirmation of parameter unit type Make sure that the type of the parameter unit is FR-PU02E-1 (FR- ARWE-1). When the parameter unit used is not the FR-PU02E-1 (FR-ARWE-1), the inverter will not start if the start signal is entered in the external or communication mode, because Pr. 75 is factory-set to "14". Also, when operation is being performed without the parameter unit fitted and the parameter unit other than the FR-PU02E-1 (FR-ARWE-1) is then connected, the inverter will be decelerated to a stop. (5) Checking the load • Check that the load is not too heavy and the shaft is not locked. (6) Others • Check that alarm code (such as E.OC1) is not displayed on the inverter LED.
Motor rotates in opposite direction.	• Check that the phase sequence of the output terminals U, V and W is correct. • Check that the start signals (forward rotation, reverse rotation) are connected properly.
Speed greatly differs from the set value.	• Check that the frequency setting signal is proper. (Measure the input signal level.) • 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) • Check that the input signal lines are not affected by external noise. (Use of shielded cables)
Acceleration/deceleration is not smooth.	• Check that the acceleration/deceleration time set value is not too short. • Check that the load is not too heavy. • Check that the torque boost set value is not too large to activate the current limit function.
Motor current is large.	• Check that the load is not too heavy. • Check that the torque boost (manual) set value is not too large.
Speed does not increase.	• Check that the maximum frequency set value is proper, i.e. it is not too small. • Check that the load is not too heavy. • Check that the torque boost set value is not too large to activate the current limit function.
Speed varies during operation.	(1) Inspection of load • Check that the load is not varying. (2) Inspection of input signal • Check that the frequency setting signal is not varying. (3) Others • Check that the wiring length is proper. Remedy: Change the setting of special parameter 97 (Td compensation) to 0. This parameter is displayed only when 801 is set in Pr. 77. Note: Parameters Pr. 82 to 99, which are also displayed simultaneously when 801 is set in Pr. 77, must not be set to protect the inverter from damage.
"PU to inverter comms. error" is displayed on the PU screen.	• Check that the reset signal (terminals RES and SD) is not ON. • Check that the PU is connected securely.

Note: Pr. indicates a parameter.

5.3 MAINTENANCE AND INSPECTION

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



5.3.1 Precautions for Maintenance and Inspection

For 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 P and N 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 175.)

5.3.2 Check Items

(1) Daily inspections

- Check the following:
  (1) Motor operation fault
  (2) Improper installation environment
  (3) Cooling system fault
  (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 period inspection.

(1)	Cooling system	Clean the air filter, etc.
(2)	Screws and bolts	Check that they are securely tightened and retighten as necessary.
(3)	Conductors and insulating materials	Check for corrosion and damage.
(4)	Insulation resistance	Measure.
(5)	Cooling fan, smoothing capacitor, relay	Check and change if necessary.

Note: Have a proper understanding of the definitions of power and alarm indications provided for the transistorized inverter. Also, have a proper 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 64.)

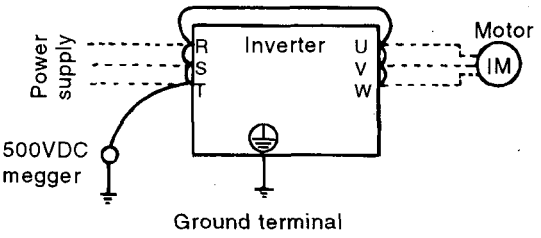
See the next page for the Inspection List.

(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.	O			See page 9.	Ambient temperature: −10°C to +50°C, non-freezing. Ambient humidity: 90% or less, non-condensing.	Thermometer, hygrometer, recorder
	Overall unit	Check for unusual vibration and noise.	O			Visual and auditory checks.	No fault.	
	Power supply voltage	Check that main circuit voltage is normal.	O			Measure voltage across inverter terminals R-S-T.	170 to 242V (323 to 506V) 50Hz 170 to 253V (323 to 506V) 60Hz	Tester, digital multimeter
Main circuit	General	(1) Check with megger (across main circuit terminals and ground terminal). (2) Check for loose screws and bolts. (3) Check for overheat on each part. (4) Clean.		O O O	O	(1) Disconnect all cables from inverter and measure across terminals R, S, T, U, V, W and ground terminal with megger. (2) Retighten. (3) Visual check.	(1) 5MΩ or more. (2), (3) No fault.	500VDC class megger
	Conductors, cables	(1) Check conductors for distortion. (2) Check cable sheaths for breakage.		O O		(1), (2) Visual check.	(1), (2) No fault.	
	Terminal block	Check for damage.		O		Visual check	No fault	
	Inverter module Converter module	Check resistance across terminals.			O	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.	O O	 O		(1), (2) Visual check. (3) Measure with capacity meter.	(1), (2) No fault. (3) 85% or more of rated capacity.	Capacity meter
	Relay	(1) Check for chatter during operation. (2) Check for rough surface on contacts.		O O		(1) Auditory check. (2) Visual check.	(1) No fault. (2) No fault.	
	Resistor	(1) Check for crack in resistor insulation. (2) Check for open cable.		O O		(1) Visual check. Cement resistor, wire-wound resistor. (2) Disconnect one end and measure with tester.	(1) No fault. (2) Error should be within ± 10% of indicated resistance value.	Tester, digital multimeter
Control circuit Protective circuit	Operation check	(1) Check balance of output voltages across phases with inverter operated independently. (2) Perform sequence protective operation test to make sure of no fault in protective and display circuits.		O O		(1) Measure voltage across inverter output terminals U-V-W. (2) Simulatively connect or disconnect inverter protective circuit output terminals.	(1) Phase-to-phase voltage balance within 4V (8V) for 200V (400V). (2) Fault must occur because of sequence.	Digital multimeter, rectifier type voltmeter
Cooling system	Cooling fan	(1) Check for unusual vibration and noise. (2) Check for loose connection.	O	 O		(1) Turn by hand with power off. (2) Retighten.	(1) Smooth rotation. (2) No fault.	
Display	Display	(1) Check for LED lamp blown. (2) Clean.	O	 O		(1) Lamps indicate indicator lamps on panel. (2) Clean with rag.	(1) Check that lamps are lit.	
	Meter	Check that reading is normal.	O			Check reading of meters on panel.	Must satisfy specified and management values.	Voltmeter, ammeter, etc.
Motor	General	(1) Check for unusual vibration and noise. (2) Check for unusual odor.	O O			(1) Auditory, sensory, visual checks. (2) Check for unusual odor due to overheat, damage, etc.	(1), (2) No fault.	
	Insulation resistance	Check with megger (across terminals and ground terminal).			O	Disconnect cables from U, V, W, including motor cables.	5MΩ or more.	500V megger

Note: The value for the 400V class is indicated in the parentheses.

- **Checking the inverter and converter modules**

<Preparation>

(1) Disconnect the external power supply cables (R, S, T) and motor cables (U, V, W).
(2) Prepare a tester. (Use 1Ω range.)

<Checking method>

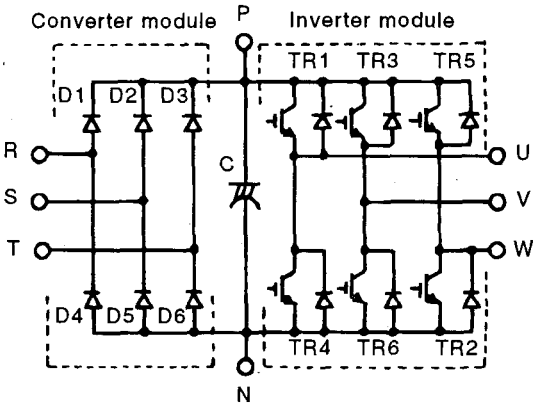
Change the polarity of the tester alternately at the inverter terminals R, S, T, U, V, W, P and N, and check for continuity.

Note: 1. Before measurement, check that the smoothing capacitor is discharged.
2. At the time of continuity, the measured value is several to several ten 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 ⊕	Tester Polarity ⊖	Measured Value		Tester Polarity ⊕	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

(This list assumes that an analog tester is used.)



5.3.3 Replacement of Parts

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

(1) Cooling fan
The cooling fan cools heat-generating parts such as the main circuit semiconductor devices. The life of the cooling fan bearing is usually 10,000 to 35,000 hours. Hence, the cooling fan must be changed every 2 to 3 years if the inverter is run continuously. When unusual noise and/or vibration is noticed during inspection, the cooling fan must be changed immediately.

(2) Smoothing capacitors
A large-capacity aluminum electrolytic capacitor is used for smoothing the DC in the main circuit, and an aluminum electrolytic capacitor is also used for stabilizing the control power in the control circuit. Their characteristics are adversely affected by ripple current, etc. When the inverter is operated in ordinary, air-conditioned environment, change the capacitors about every 5 years. When 5 years have elapsed, the capacitors will deteriorate more rapidly.
Check the capacitors at least every year (less than six months if the life will be expired soon).
Check the following:
1) Case (side faces and bottom face for expansion)
2) Sealing plate (for remarkable warp and extreme crack)
3) Explosion-proof valve (for excessive valve expansion and operation)
4) Appearance, external crack, discoloration, leakage. When the measured capacitance of the capacitor has reduced below 85% of the rating, change the capacitor. For capacitance measurement, it is recommended to use a handy device available on the market.

(3) Relays
To prevent a contact fault, etc., relays must be changed according to the number of accumulative switching times (switching life).
See the following table for the inverter parts replacement guide. Lamps and other short-life parts must also be changed during periodic inspection.

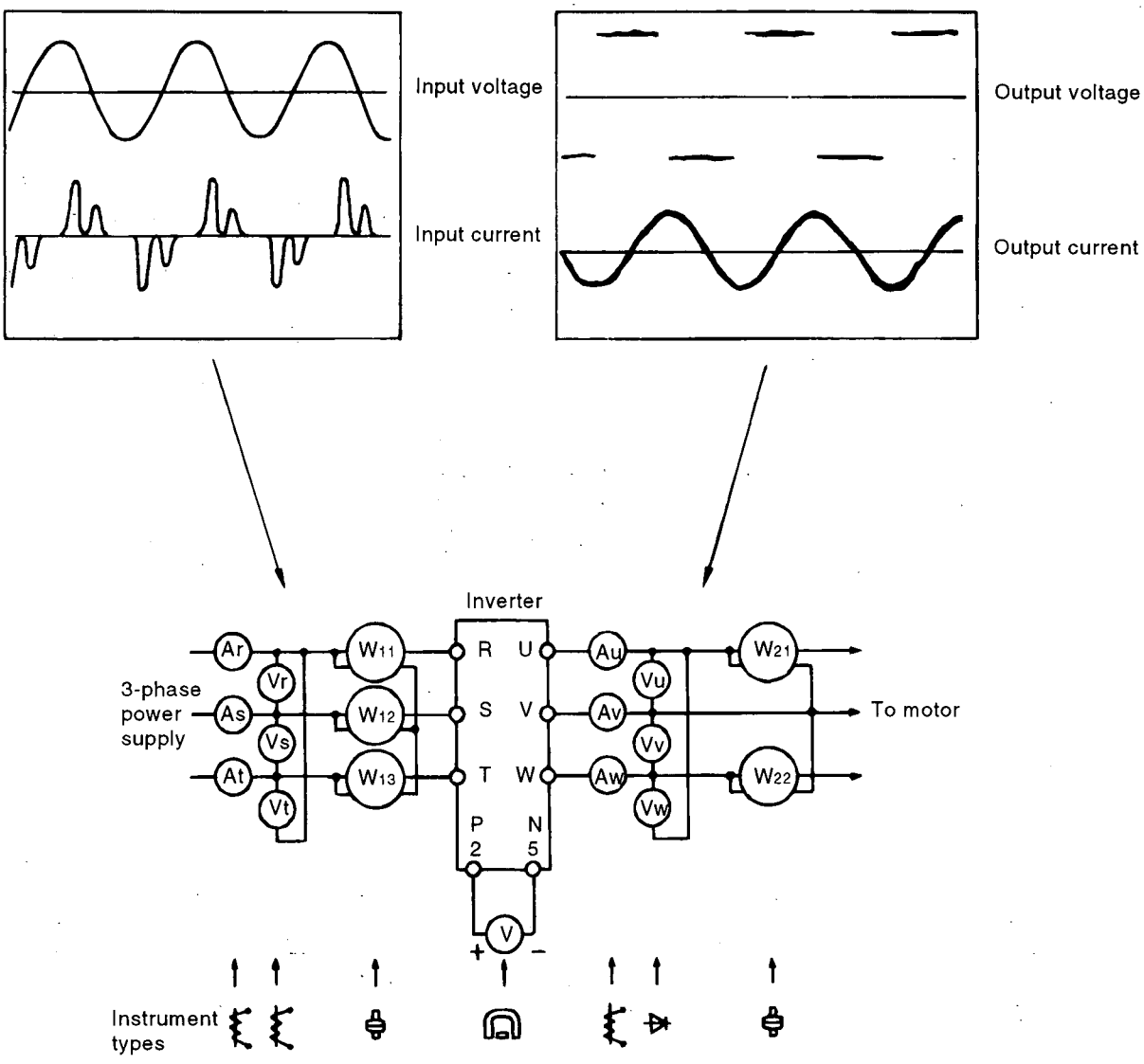
Replacement Parts of the Inverter

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

5.3.4 Measurement of Main Circuit Voltages, Currents and Powers

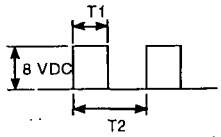
• Measurement of voltages and currents

Since the voltages and currents on the inverter power supply and output sides include harmonics, accurate measurement depends on the instruments used and circuits measured.
When instruments for commercial frequency are used for measurement, measure the following circuits using the instruments given on the next page.



Typical Measuring Points and Instruments

Measuring Points and Instruments

Item	Measuring Point	Measuring Instrument	Remarks (Reference Measured Value) *
Power supply voltage V_1	Across R-S, S-T and T-R	Moving-iron type AC voltmeter	Commercial power supply 170 to 242V (342 to 506V) 50Hz 170 to 253V (342 to 506V) 60Hz
Power supply side current I_1	R, S and T line currents	Moving-iron type AC ammeter	
Power supply side power P_1	At R, S and T, and across R-S, S-T and T-R	Electrodynamic type single-phase wattmeter	$P_1=W_{11}+W_{12}+W_{13}$ (3-wattmeter method)
Power supply side power factor Pf_1	Calculate after measuring power supply voltage, power supply side current and power supply side power. $Pf_1=\frac{P_1}{\sqrt{3}V_1 \cdot V_1}\times 100\%$		
Output side voltage V_2	Across U-V, V-W and W-U	Rectifier type AC voltmeter (Note 1) (Not moving-iron type)	Difference between phases is within ± 1% of maximum output voltage.
Output side current I_2	U, V and W line currents	Moving-iron type AC ammeter	Current should be equal to or less than rated inverter current. Difference between phases is 10% or lower.
Output side power P_2	At U, V and W, and across U-V and V-W	Electrodynamic type single-phase wattmeter	$P_2 = W_{21} + W_{22}$ 2-wattmeter method (or 3-wattmeter method)
Output side power factor Pf_2	Calculate in similar manner to power supply side power factor. $Pf_2=\frac{P_2}{\sqrt{3}V_2 \cdot V_2}\times 100\%$		
Converter output	Across P-N	Moving-coil type (such as tester)	Inverter LED display is lit. 1.35 × V_1 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
	Across 1(+)-5		0 to ± 5V/0 to ± 10VDC
	Across 4(+)-5		4 to 20mADC
Frequency setting power supply	Across 10(+)-5		5VDC
	Across 10E(+)-5		10VDC
			"5" is common.
Frequency meter signal	Across FM(+)-SD		Approx. 5VDC at maximum frequency (without frequency meter)  Pulse width T1: Adjusted by Pr.900 Pulse cycle T2: Set by Pr.55 (Valid for frequency monitoring only)
	Across AM(+)-5		Approx. 10VDC at maximum frequency (without frequency meter)
			SD is common.
Start signal Select signal	Across STF, STR, RH, RM, RL, JOG/OH, RT, AU-SD		20 to 30VDC when open. ON voltage: 1V or less
Reset	Across RES(+)-SD		
Output stop	Across MRS(+)-SD		
Alarm signal	Across A-C Across B-C	Moving-coil type (such as tester)	Continuity check <Normal> <Fault> Across A-C: Discontinuity Continuity Across B-C: Continuity Discontinuity

Note 1: Accurate data will not be obtained by a tester.

* Value in parentheses indicate those for 400V class.

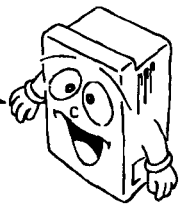
MEMO

6. PRECAUTIONS FOR SELECTING

This chapter provides details the "precautions for selecting" of this product.
Always read the precautions, etc., before starting use.

6.1 PRECAUTIONS FOR SELECTING PERIPHERAL DEVICE

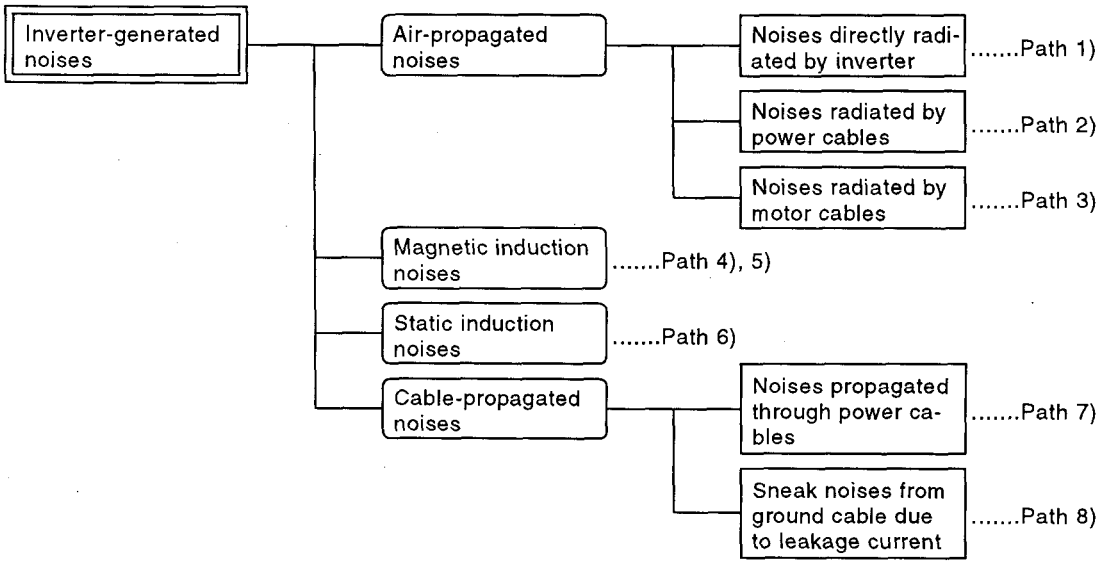
Trouble caused by noise and leakages are increasing due to the diffusion of electronic devices. Due to its operation principle, the inverter generates noise, and may adversely affect neighboring devices. The following types of measures can be taken depending on the installation place, so refer to these when making your selection.

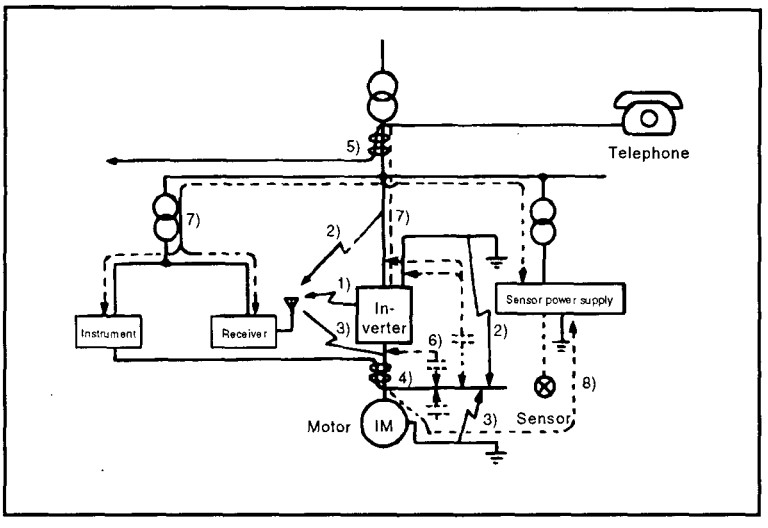


6.1.1 Measures Against Noises

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 insusceptible 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 SD.
   - 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.

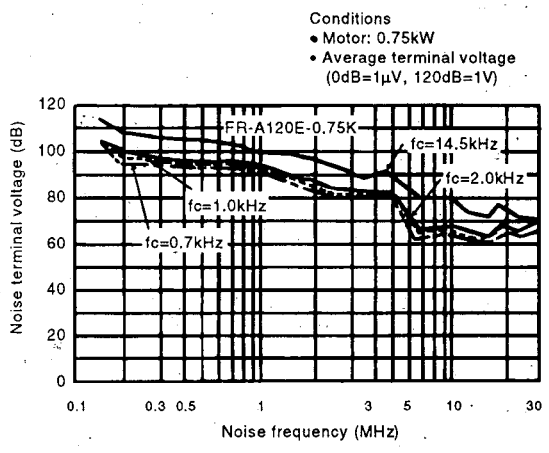




Noise Path	Measures
1), 2), 3)	When devices which handle low-level signals and are susceptible to misoperation due to noises (such as instruments, receivers and sensors) are installed near the inverter and their signal cables are contained in the same panel as the inverter or are run near the inverter,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

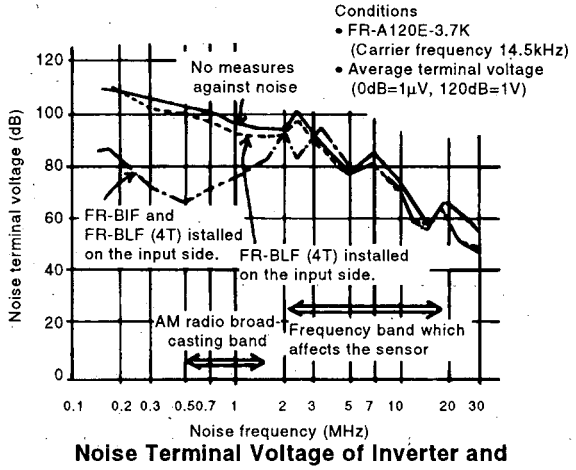
• Data example

By decreasing the carrier frequency, the noise terminal voltage* can be reduced.
When motor noise does not pose a problem, set the carrier frequency to a low value (1kHz) using Pr. 72.
When motor noise poses a problem, see the figure on the right.



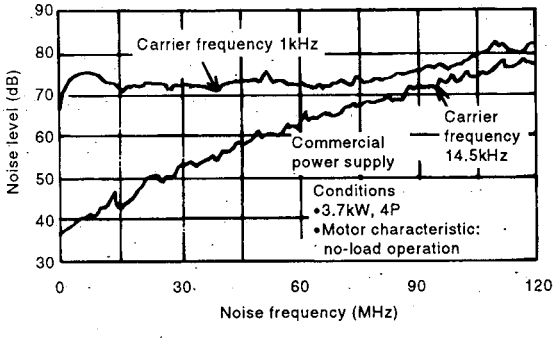
Relation between Noise Terminal Voltage and Carrier Frequency

In the frequency band of AM radio broadcasting, fitting the FR-BIF on the input side provides a large effect.
The FR-BSF01 and FR-BLF reduce a noise terminal voltage in a wide frequency band, having effects on measures against the misoperation of sensors and the like.
As the measures against the misoperation of sensors and the like, also take the following measures against induction noises.



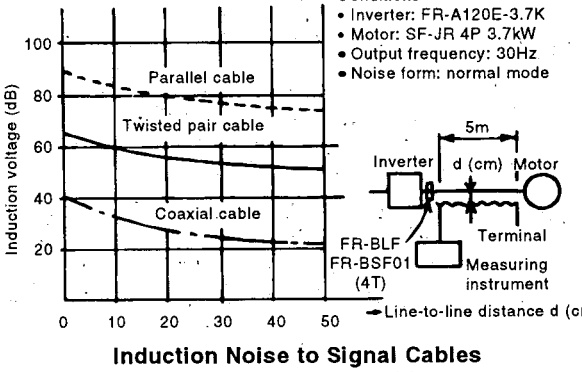
Noise Terminal Voltage of Inverter and Example of Its Reduction by Noise Filters

By increasing the carrier frequency of the inverter, motor noise reduces.
Since the motor-generated sound reduces at low speed, the motor can be run more silently by the inverter than by commercial power supply.



Relation between Carrier Frequency and Motor Noise

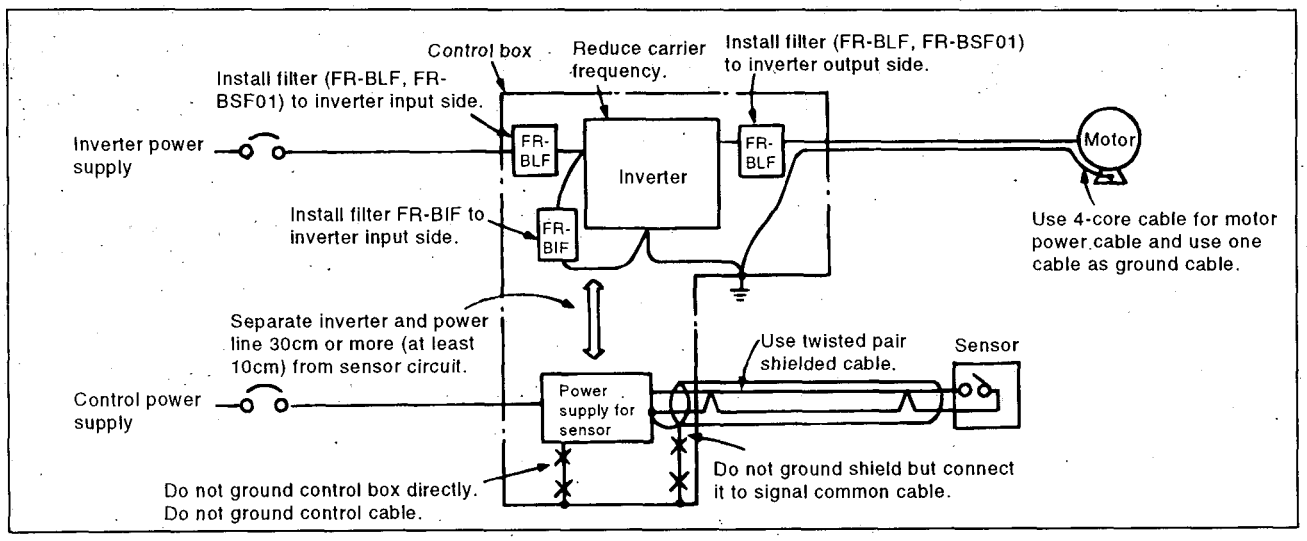
By using shield cables for signal cables, induction noise can be reduced greatly (to 1/10 - 1/100).
Induction noise can also be reduced by separating the signal cables from the inverter output cables. (Separation of 30cm reduces noise to 1/2-1/3.)
By fitting the FR-BSF01 or BLF on the inverter output side, induction noise to the signal cables can be reduced.



Induction Noise to Signal Cables by Inverter Output Cables

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

••Example of measures against noises

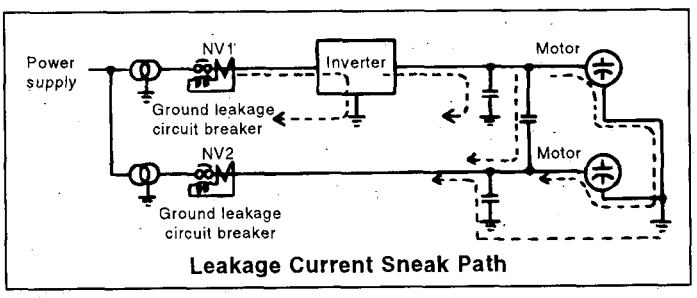


6.1.2 Leakage Current

Because of static capacitances existing in the inverter I/O wiring and motor, leakage current flows through them. Since its value depends on the static capacitances, carrier frequency, etc., leakage current increases when the low-noise type inverter is used.
In this case, take the following measures.

1) To-Ground leakage current

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



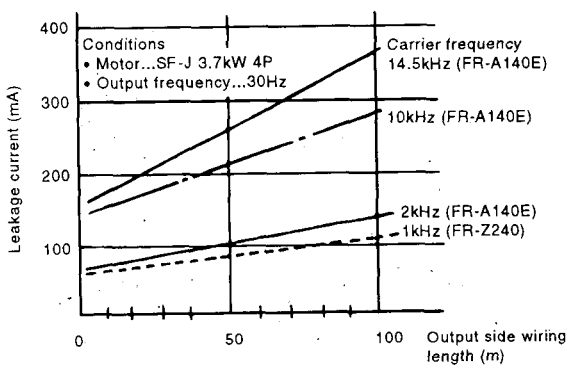
Leakage Current Sneak Path

- **Measures**
  - Decrease the carrier frequency (Pr. 72) of the inverter. Note that motor noise increases.
  - By using earth leakage circuit breakers compatible with harmonics and surges (e.g. Mitsubishi's New Super NV series) in the inverter's own line and other line, operation can be performed with low noise (with the carrier frequency kept high).

*: For information on selecting the earth leakage circuit breaker, see page 167.

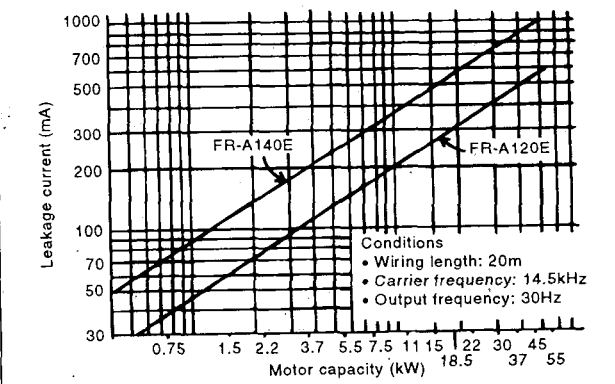
• To-ground leakage current data example

Note that long wiring length will increase leakage current. Decrease the carrier frequency of the inverter to reduce leakage current.



To-Ground Leakage Current versus Carrier Frequency and Wiring Length

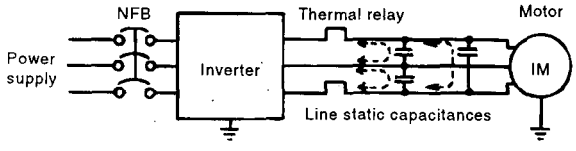
Higher motor capacity leads to larger leakage current. Larger leakage current occurs in 400V class than in 200V class.



To-Ground Leakage Current versus Motor Capacity

2) Line-to-line leakage currrent

Harmonics of the leakage current flowing in the static capacities between the inverter output cables may operate the external thermal relay unnecessarily. When the wiring length of a 400V class small-capacity model (especially 7.5kW or down) is long (50m or more), the external thermal relay is likely to operate unnecessarily because the ratio of the leakage current to the rated current of the motor increases.



Line-to-Line Leakage Current Path

••Line-to-line leakage current data example (200V class)

Motor Capacity (kW)	Rated Motor Current (A)	Leakage Current (mA)	
		Wiring Length 50m	Wiring Length 100m
0.4	1.8	310	500
0.75	3.2	340	530
1.5	5.8	370	560
2.2	8.1	400	590
3.7	12.8	440	630
5.5	19.4	490	680
7.5	25.6	535	725

••Motor SF-JR 4P
• Carrier frequency: 14.5Hz
• Cable used: 2mm², 4-core cabtyre cable

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

••Measures

••Use the electronic overcurrent protection of the inverter.

••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.

6.1.3 Selecting the Rated Sensitivity Current for the Ground Leakage Circuit Breaker

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

••New Super NV series (Type SF, CF)
Rated sensitivity current: $I\Delta n \geq 10x(Ig_1+Ig_2+Igm)$

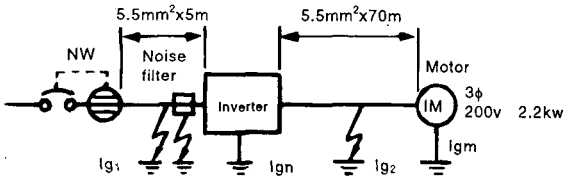
••Conventional NV series (Type CA, CS, SS)
Rated sensitivity current: $I\Delta n \geq 10x\{Ig_1+Ign+3x(Ig_2+Igm)\}$

Ig1,Ig2 : leakage currents of cable path during commercial power supply operation

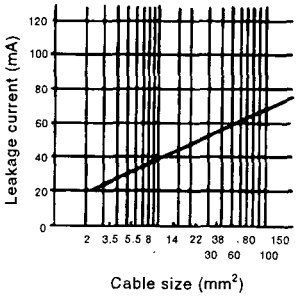
Ign* : leakage current of noise filter on inverter input side

Igm : leakage current of motor during commercial power supply operation

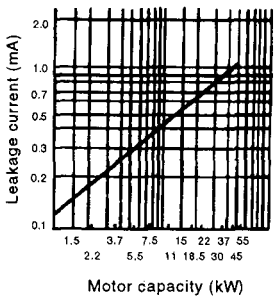
<Example>



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)



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.

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

	New Super NV	Conventional NV
Leakage current Ig1	$33 \times \frac{5m}{1000m} = 0.17$	
Leakage current Ign	0 (without noise filter)	
Leakage current Ig2	$33 \times \frac{70m}{1000m} = 2.31$	
Motor leakage current Igm	0.18	
Total leakage current	2.66	7.64
Rated sensitivity current (≥Igx10)	30	100

* For the leakage current value of the noise filter installed on the inverter input side, contact the corresponding filter manufacturer.

6.1.4 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.
Take the following measures

• The difference between harmonics and noise is shown below.

Item	Harmonics	Noise
Frequency	Normally 40 to 50%, 3kHz or less	Harmonics (several 10kHz to MHz order)
Environment	To wire paths, power impedance	To spaces, distance, laying paths
Quantitative understanding	Logical computation is possible	Occurs randomly, quantitative understanding is difficult
Generated amount	Approx. proportional to load capacity	According to current fluctuation rate (larger with speed switching)
Withstand of effected device	Clarified in standards for each device	Differs according to maker's device specifications
Examples of measures	Install a reactor (L)	Increase the length (l)

• Measures

The harmonic current generated from the inverter to the power supply side differs according to various conditions such as the control method (PWN, PAM), use of power-factor improvement reactor, output frequency on load side, and output current size.
Obtaining the output frequency and output current with the conditions of the rated load during the used max. frequency is the most optimum method.

Note: The power-factor improvement capacitor and surge killer on the inverter's output side may be damaged due to overheating caused by elements in the harmonics of the inverter output. The overcurrent protection may activate when an overcurrent flows to the inverter, so when using the inverter drive, do not insert the capacitor or surge killer on the inverter's output side. For power-factor improvement, insert the power-factor improvement reactor on the inverter's primary side or in the DC current. Refer to the technical material for datails.

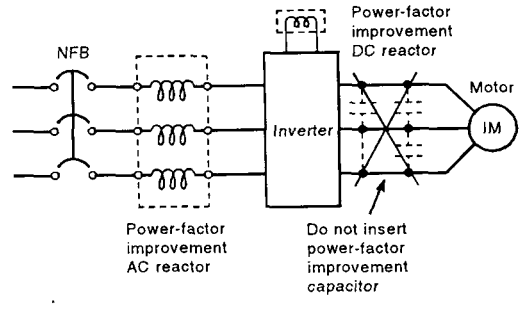


Fig.5.2 Inverter power-factor improvement

■Harmonic suppression guideline (Japan)

Harmonic currents generated by the inverter flow to a power receiving point via a power transformer. Since these outgoing harmonic currents affect other consumers, harmonic suppression guidelines were established.

1) "Household appliance and general-purpose product harmonic suppression guideline"
   The inverters of 200V class 3.7kW and less are covered by the "household appliance and general-purpose product harmonic suppression guideline" issued by the Ministry of International Trade and Industry in September, 1994. In accordance with this guideline, Corporation "Japan Electrical Manufacturers' Association" determined the phased control levels. To conform to this standard, the power factor improving reactor (FR-BAL) or harmonic suppression reactor must be connected to any of the inverters installed on and after January 1, 1997. For details of the harmonic suppression reactors, please contact us.
2) "Specific consumer harmonic suppression guideline"
   This harmonic suppression guideline sets forth the maximum values of harmonic currents outgoing from a high-voltage or specially high-voltage consumer who will install, add or renew harmonic generating equipment. If any of the maximum values is exceeded, this harmonic suppression guideline requires that consumer takes certain suppression measures.

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

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

(1) Application of the specific consumer guideline

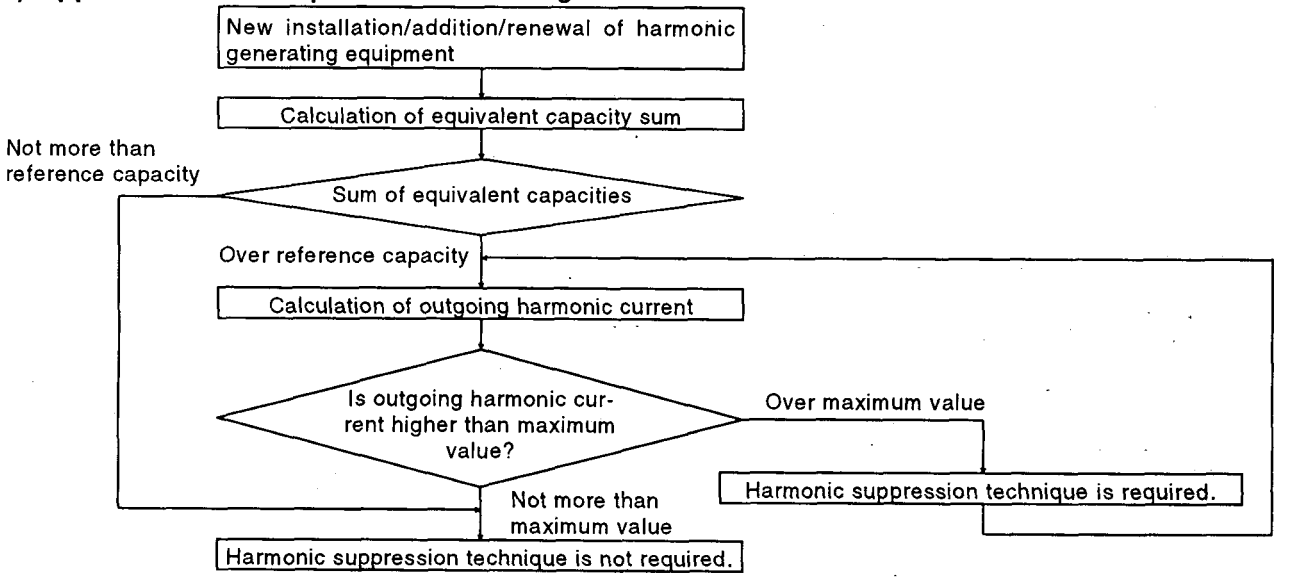


Table 2 Conversion Factors for FR-A100E Series

Classification	Circuit Type		Conversion Factor
3	Three-phase bridge (capacitor-smoothed)	Not used Reactor	K31=3.4
		Used Reactor (AC side)	K32=1.8
		With reactor (on DC side)	K33=1.8
		Without reactor (on AC/DC side)	K33=1.4
5	Self-excited three-phase bridge	When high power factor converter is used	K5=0

Table 3 Equivalent Capacity Limits

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

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

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

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

$P0=\Sigma(Ki \times Pi)$ [kVA]
Ki: Conversion factor (refer to Table 2)
Pi: Rated capacity of harmonic generating equipment* [kVA]
i: Number indicating the conversion circuit type

*: Rated capacity: Determined by the capacity of the applied motor and found in Table 5. It should be noted that the rated capacity used here is used to calculate generated harmonic amount and is different from the power supply capacity required for actual inverter drive.

2) Calculation of outgoing harmonic current

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

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

Table 5 Rated Capacities and Outgoing Harmonic Currents for Inverter Drive

Applied Motor (kW)	Rated Current [A]		Fundamental Wave Current Converted from 6.6kV (mA)	Rated Capacity (kVA)	Fundamental Wave Current Converted from 6.6kV (mA) (No reactor, 100% operation ratio)							
	200V	400V			5th	7th	11th	13th	17th	19th	23rd	25th
0.4	Not applied	0.81	49	0.57	31.85	20.09	4.165	3.773	2.107	1.519	1.274	0.882
0.75		1.37	83	0.97	53.95	34.03	7.055	6.391	3.569	2.573	2.158	1.494
1.5		2.75	167	1.95	108.6	68.47	14.20	12.86	7.181	5.177	4.342	3.006
2.2		3.96	240	2.81	156.0	98.40	20.40	18.48	10.32	7.440	6.240	4.320
3.7		6.50	394	4.61	257.1	161.5	33.49	30.34	16.94	12.21	10.24	7.092
5.5	19.1	9.55	579	6.77	376.1	237.4	49.22	44.58	24.90	17.95	15.05	10.42
7.5	25.6	12.8	776	9.07	504.4	318.2	65.96	59.75	33.37	24.06	20.18	13.97
11	36.9	18.5	1121	13.1	728.7	459.6	95.29	86.32	48.20	34.75	29.15	20.18
15	49.8	24.9	1509	17.6	980.9	618.7	128.3	116.2	64.89	46.78	39.24	27.16
18.5	61.4	30.7	1860	21.8	1209	762.6	158.1	143.2	79.98	57.66	48.36	33.48
22	73.1	36.6	2220	25.9	1443	910.2	188.7	170.9	95.46	68.82	57.72	39.96
30	98.0	49.0	2970	34.7	1931	1218	252.5	228.7	127.7	92.07	77.22	53.46
37	121	60.4	3660	42.8	2379	1501	311.1	281.8	157.4	113.5	95.16	65.88
45	147	73.5	4450	52.1	2893	1825	378.3	342.7	191.4	138.0	115.7	80.10
55	180	89.9	5450	63.7	3543	2235	463.3	419.7	234.4	169.0	141.7	98.10

3) Judgment of harmonic suppression technique requirement
If the outgoing harmonic current is higher than the maximum value per 1kW contract power × contract power, a harmonic suppression technique is required.

4) Harmonic suppression techniques

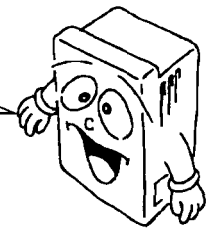
No.	Item	Description
1	Reactor installation (ACL, DCL)	Install a reactor (ACL) in the AC side of the inverter or a reactor (DCL) in its DC side or both to suppress harmonic currents.
2	High power factor converter (FR-HC)	Switches the converter circuit on-off to convert an input current waveform into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

6.1.5 Peripheral Device List

Voltage	Motor Output (kW)	Applicable Inverter Type	No-Fuse Breaker (NFB) or Earth Leakage Circuit Breaker (NV)		Magnetic Contactor (MC)	Cables (mm^2)	
			Standard	With power factor improving reactor		R,S,T	U,V,W
200V class	0.75	FR-A120E-0.75k	Type NF30, NV30 10A	Type NF30, NV30 10A	S-N10	2	2
	1.5	FR-A120E-1.5k	Type NF30, NV30 15A	Type NF30, NV30 15A	S-N10	2	2
	2.2	FR-A120E-2.2k	Type NF30, NV30 20A	Type NF30, NV30 15A	S-N11,N12	2	2
	3.7	FR-A120E-3.7k	Type NF30, NV30 30A	Type NF30, NV30 30A	S-N20	3.5	3.5
	5.5	FR-A120E-5.5k	Type NF50, NV50 50A	Type NF50, NV50 40A	S-N25	5.5	5.5
	7.5	FR-A120E-7.5k	Type NF100, NV100 60A	Type NF50, NV50 50A	S-N35	14	8
	11	FR-A120E-11k	Type NF100, NV100 75A	Type NF100, NV100 75A	S-K50	14	14
	15	FR-A120E-15k	Type NF225, NV225 125A	Type NF100, NV100 100A	S-K65	22	22
	18.5	FR-A120E-18.5k	Type NF225, NV225 150A	Type NF225, NV225 125A	S-K80	30	30
	22	FR-A120E-22k	Type NF225, NV225 175A	Type NF225, NV225 150A	S-K95	38	30
	30	FR-A120E-30k	Type NF225, NV225 225A	Type NF225, NV225 175A	S-K125	60	50
	37	FR-A120E-37k	Type NF400, NV400 250A	Type NF225, NV225 225A	S-K150	80	80
	45	FR-A120E-45k	Type NF400, NV400 300A	Type NF400, NV400 300A	S-K180	100	80
	55	FR-A120E-55k	Type NF400, NV400 400A	Type NF400, NV400 350A	S-K220	150	125
400V class	0.75	FR-A140E-0.75k	Type NF30, NV30 5A	Type NF30, NV30 5A	S-N10	2	2
	1.5	FR-A140E-1.5k	Type NF30, NV30 10A	Type NF30, NV30 10A	S-N10	2	2
	2.2	FR-A140E-2.2k	Type NF30, NV30 15A	Type NF30, NV30 10A	S-N20	2	2
	3.7	FR-A140E-3.7k	Type NF30, NV30 20A	Type NF30, NV30 15A	S-N20	2	2
	5.5	FR-A140E-5.5k	Type NF30, NV30 30A	Type NF30, NV30 20A	S-N20	3.5	2
	7.5	FR-A140E-7.5k	Type NF30, NV30 30A	Type NF30, NV30 30A	S-N20	3.5	3.5
	11	FR-A140E-11k	Type NF50, NV50 50A	Type NF50, NV50 40A	S-N20	5.5	5.5
	15	FR-A140E-15k	Type NF100, NV100 60A	Type NF50, NV50 50A	S-N25	14	8
	18.5	FR-A140E-18.5k	Type NF100, NV100 75A	Type NF100, NV100 60A	S-N35	14	8
	22	FR-A140E-22k	Type NF100, NV100 100A	Type NF100, NV100 75A	S-K50	22	14
	30	FR-A140E-30k	Type NF225, NV225 125A	Type NF100, NV100 100A	S-K65	22	22
	37	FR-A140E-37k	Type NF225, NV225 150A	Type NF225, NV225 125A	S-K80	30	22
	45	FR-A140E-45k	Type NF225, NV225 175A	Type NF225, NV225 150A	S-K80	38	30
	55	FR-A140E-55k	Type NF225, NV225 200A	Type NF225, NV225 175A	S-K100	50	50

6.2 DRIVING A 400V CLASS MOTOR WITH THE INVERTER

In a PWM type inverter, a micro surge voltage attributable to a wiring constant is generated at the motor terminals.
Especially for a 400V class motor, the micro surge voltage may deteriorate the insulation.
When the 400V class motor is driven by the inverter, consider the following measures:



- **Measures**

It is recommended to take either of the following measures:

(1) Rectifying the motor insulation

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

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

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

On the secondary side of the inverter, connect a filter which suppresses the micro surge voltage to make the terminal voltage of the motor 850V or less.
When the motor is to be driven by Mitsubishi inverter, connect the optional surge voltage suppressing filter (see page 191) on the secondary side of the inverter.

MEMO

7. SPECIFICATIONS

This chapter provides details the "specifications" of this product.
Always read the precautions, etc., before starting use.

7.1 SPECIFICATIONS

7.1.1 Standard Specifications

■ 200V Class

Type FR-A120E-[ ]			0.75K	1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Applicable motor output (kW) *1			0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated capacity (kVA) *2		1.5	2.7	3.7	5.7	8.8	11.8	17.1	22.1	26.7	32.4	43.4	53.3	64.8	80.6
	Rated current (A)		4.1	7.0	9.6	15	23	31	45	58	70	85	114	140	170	212
	Overload current rating *3		120% 60 seconds, 150% 0.5 seconds (inverse-time characteristics)													
	Voltage *4		Three phase, 200 to 220V 50Hz, 200 to 230V 60Hz													
	Regenerative braking torque	Maximum value/time	15% or more (capacitor feedback) *5													
		Permissible duty	Continuous *5													
Power supply	Rated input AC voltage, frequency		Three phase, 200 to 220V 50Hz, 200 to 230V 60Hz													
	Permissible AC voltage fluctuation		170 to 242V 50Hz, 170 to 253V 60Hz													
	Permissible frequency fluctuation		±5%													
	Power supply capacity (kVA) *6		2.1	4.0	4.8	8.0	11.5	16	20	27	32	41	52	65	79	99
Protective structure (JEM 1030)			Enclosed type (IP20)						Open type (IP00)							
Cooling system			Self cooling	Forced air cooling												
Approx. weight (kg) (with PU) **			2.5	3.3	3.3	3.5	7.5	7.5	7.7	14	14.5	17	17	29	50	69

■ 400V Class

Type FR-A140E-[ ]			0.75K	1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Applicable motor output (kW) *1			0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated capacity (kVA) *2		1.5	2.7	3.7	5.7	8.8	12.2	17.5	22.1	26.7	32.8	43.4	53.3	64.8	80.8
	Rated current (A)		2.0	3.5	4.8	7.5	11.5	16	23	29	35	43	57	70	85	106
	Overload current rating *3		120% 60 seconds, 150% 0.5 seconds (inverse-time characteristics)													
	Voltage *4		Three phase, 380 to 460V 50Hz/60Hz													
	Regenerative braking torque	Maximum value/time	15% or more (capacitor feedback) *5													
		Permissible duty	Continuous *5													
Power supply	Rated input AC voltage, frequency		Three phase, 380 to 460V *9 50Hz/60Hz													
	Permissible AC voltage fluctuation		323 to 506V 50/60Hz													
	Permissible frequency fluctuation		±5%													
	Power supply capacity (kVA) *6		2.1	4.0	4.8	8.0	11.5	16	20	27	32	41	52	65	79	99
Protective structure (JEM 1030)			Enclosed type (IP20)						Open type (IP00)							
Cooling system			Forced air cooling													
Approx. weight (kg) (with PU) **			4.0	4.0	4.0	4.5	8.2	8.2	8.2	16	16	20	32	54	54	72

** : The value for the 7.5K or down is approximate weight including that of the PU.

■ Common Specifications

Control specifications	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			0.5 to 120Hz
	Frequency setting resolution		Analog input	0.015Hz/60Hz (terminal 2 input: 12 bits/0 to 10V, 11bits/0 to 5V, terminal 1 input: 12 bits/–10 to +10V, 11 bits/–5 to +5V)
			Digital input	0.01Hz
	Frequency accuracy			Within ±0.2% of maximum output frequency (25°C±10°C)/analog input, within 0.01% of set output frequency/digital input
	Voltage/frequency characteristic			Base frequency set as required between 0 to 120Hz. Constant torque or variable torque pattern can be selected.
	Torque boost			Manual and automatic torque boost
	Acceleration/deceleration time setting			0 to 3600 seconds (acceleration and deceleration can be set individually), linear or S-pattern acceleration/deceleration mode can be selected.
	DC dynamic brake			Operation frequency (0 to 120Hz), operation time (0 to 10 seconds), voltage (0 to 30%) variable
	Stall prevention operation level			Current limit can be set (0 to 150% variable), presence or absence can be selected.
Operational specifications	Frequency setting signal		Analog input	0 to 5VDC, 0 to 10VDC, 0 to ± 5VDC, 0 to ±10VDC, 4 to 20mA
			Digital input	BCD 3-digit or 12-bit binary using parameter unit (when the FR-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 120Hz, 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, operation mode selection.
		Operating status		4 types can be selected from inverter running, up to frequency, instantaneous power failure (under-voltage), frequency detection, second frequency detection, during program mode operation, during PU operation or open motor circuit detection, overload alarm and electronic overcurrent protector pre-alarm. Open collector output.
		Alarm (inverter trip)		Contact output...change-over contact (230VAC 0.3A, 30VDC 0.3A) Open collector...alarm code (4 bit) output
		For meter		1 type can be selected from output frequency, motor current (steady or peak value), output voltage, frequency set value, running speed, overload, converter output voltage (steady or peak value), electronic overcurrent protector load factor, input power, output power and load meter. 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, input power, output power, load meter, motor exciting current, cumulative operation time, actual operation time, cumulative power.
			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, cumulative operation time, cumulative power.
			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 *11
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), ground fault current *10, output short circuit, main circuit device overheat, stall prevention, overload alarm
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.
	Ambient humidity			90%RH or less (non-condensing)
	Storage temperature *8			–20°C to +65°C
	Ambience			Indoors. No corrosive gases, oil mist, dust and dirt.
	Altitude, vibration			Below 1000m, 5.9m/s^2 {0.6G} or less (conforms to JIS C 0911)

Note: *1 The applicable motor capacity indicated is the maximum applicable capacity when the Mitsubishi 4-pole standard motor is used.

*2 The rated capacity indicated assumes that the output voltage is 220V for the 200V class and 440V for the 400V class.

*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 60Hz. 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.

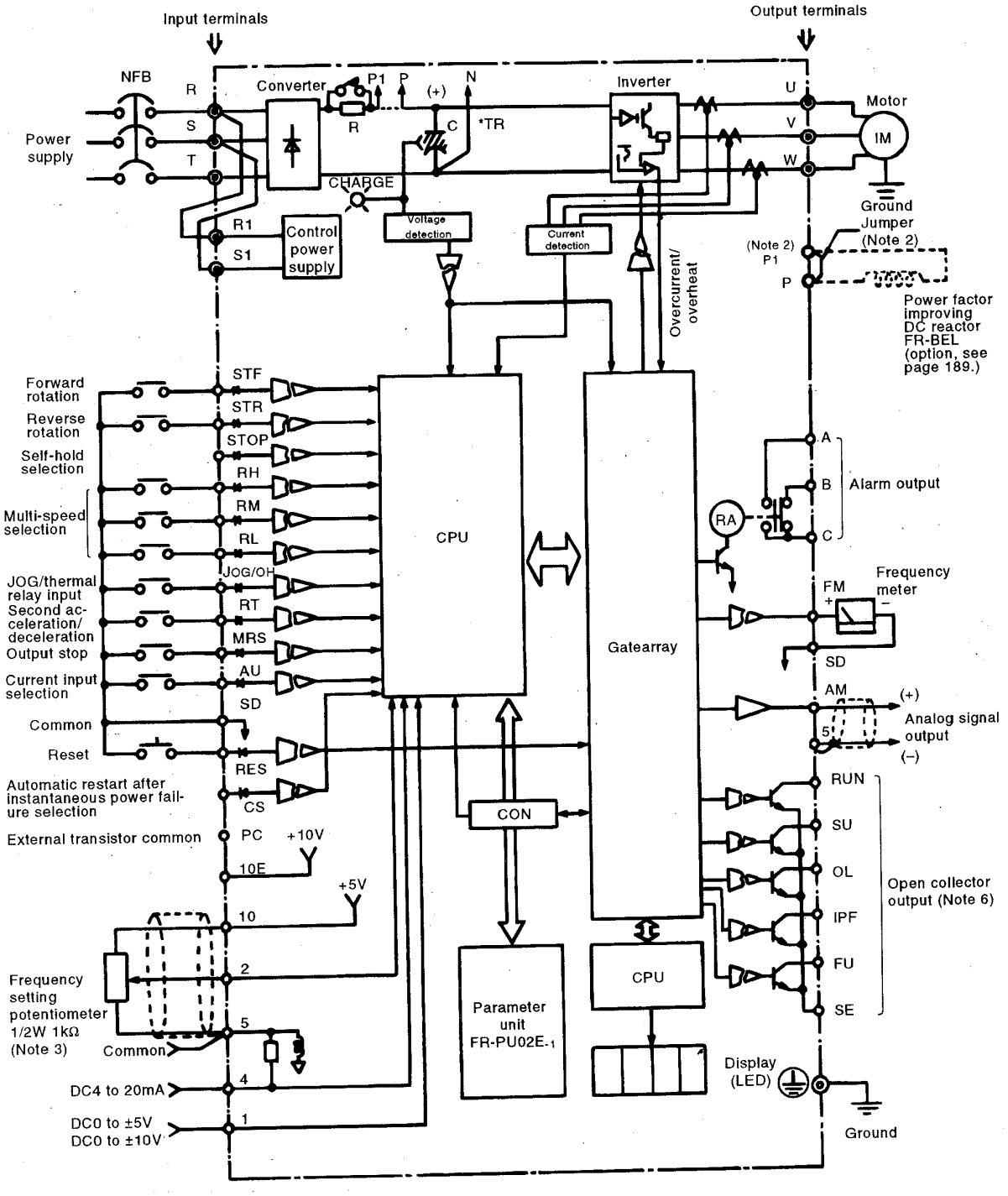
*8 Temperature applicable for a short period in transit, etc.

*9 Where a power supply is 342V and below or 484V and above for the 400V class, change the position of the jumper to the internal transformer, according to page 19.

*10 May not be protected depending on the ground fault mode.

*11 When the PU02ER-1 is used, troubleshooting and graphic display are not available.

7.1.2 Block Diagram



Note: 1. When the FR-BEL is used, disconnect this jumper.
2. The output terminals other than running (RUN) allow alarm definitions to be output in alarm code and 9 different functions to be assigned individually. If the voltage is applied in the wrong direction, the inverter will be damaged. Take care not to wire the cables incorrectly.
3. When the frequency setting is changed frequently, it is recommended to use 2W1KΩ potentiometer.

7.1.3 Terminals

Type	Symbol	Terminal Name	Description	
Main circuit	R, S, T	AC power input	Connect to the commercial power supply.When using the high power factor converter (FR-HC), keep these terminals open.	
	U, V, W	Inverter output	Connect a three-phase squirrel-cage motor.	
	R1, S1	Power supply for control circuit	Connected to the AC power supply terminals R and S. To retain an alarm display or alarm output or to use the high power factor converter (FR-HC), remove the jumper from across terminals R1 and S1 and input external power to these terminals.	
	P, N	Brake unit connection	Connect the optional FR-BU brake unit or power return converter (FR-RC) and high power factor converter (FR-HC).	
	P, P1	Power factor improving DC reactor connection	Disconnect the jumper from terminals P-P1 and connect the optional power factor improving reactor (FR-BEL).	
	⏚	Ground	For grounding the inverter chassis. Must be earthed.	
Control circuit (input signals) Contact (start, function selection, etc.)	STF	Forward rotation start	Turn on the signal across STF and SD for forward rotation and turn off to stop. Acts as a programmed operation start signal in the programmed operation mode. (Turn on to start and turn off to stop.)	When the signals across terminals STF-SD and STR-SD are turned on simultaneously, the stop command is given.
	STR	Reverse rotation start	Turn on the signal across STR and SD for reverse rotation and turn off to stop.	
	STOP	Start self-holding selection	Turn on the signal across terminals STOP and SD to select the self-holding of the start signal.	
	RH, RM, RL	Multi-speed selection	Turn on the signal across RH/RM/RL and SD as appropriate to select up to 7 speeds. Act as group 1, 2 and 3 select signals in the programmed operation mode. When the "operation mode external-signal switching" is selected, terminal RH acts as the operation mode external-signal switching signal input terminal.	
	JOG/OH	JOG mode selection or external thermal relay input	Turn on the signal across terminals JOG and SD to select jog operation (factory setting). Jog operation can be performed with the start signal (STF or STR). Can also be used as the thermal relay contact input terminal to stop the inverter by the operation of the external thermal relay.	
	RT	Second acceleration/ deceleration time selection	Turn on the signal across terminals RT and SD to select the second acceleration/deceleration time. When the second torque boost and second V/F (base frequency) functions have been set, these functions can also be selected by turning on the signal across terminals RT and SD. When the high powerfactor converter (FR-HC) is connected (Pr. 30 = "4" or "5"), this terminal serves as the "inverter operation enable signal input terminal" or "instantaneous power failure detection signal input terminal".	
	MRS*	Output stop	Turn on the signal across terminals MRS and SD (20ms or longer) to stop the inverter output. Used to shut off the inverter output to bring the motor to a stop by the magnetic brake. Can also be used as the DC injection brake operation start signal or PU operation interlock signal. When the high power factor converter (FR-HC) is connected (Pr. 30 = "3"), this terminal acts as the "inverter operation enable signal input terminal".	
	RES	Reset	Used to reset the protective circuit activated. Turn on the signal across terminals RES and SD for more than 0.1 sec, then turn it off.	
	AU	Current input selection	Only when the signal across terminals AU-SD is turned on, the inverter can be operated with the 4 to 20mADC frequency setting signal. When the high power factor converter is connected (Pr. 30 = "3", "4" or "5"), this terminal serves as the "inverter operation enable signal input terminal" or "instantaneous power failure detection signal input terminal".	
	CS*	Automatic restart after instantaneous power failure selection	When the signal across terminals CS and SD has been turned on, restart can be made automatically when the power is restored after an instantaneous power failure. Note that this operation requires restart parameters to be set. When the inverter is shipped from the factory, it is set to disallow restart.	
	SD	Contact input common	Common to the contact input terminals and terminal FM. Isolated from the common terminal of the control circuit.	
	PC	External transistor common	When transistor output (open collector output), such as a programmable controller (PC), is connected, connect the external power supply common for transistor output to this terminal to prevent a fault caused by sneak current.	

Type		Symbol	Terminal Name	Description	
Control circuit (input signals)	Analog frequency setting	10E	Frequency setting power supply	10VDC, permissible load current 10mA	When the frequency setting potentiometer is connected in the factory-set state, connect it to terminal 10. When it is connected to terminal 10E, change the input specifications of terminal 2.
		10		5VDC, permissible load current 10mA	
		2	Frequency setting (voltage)	By entering 0 to 5VDC (0 to 10VDC), the maximum output frequency is reached at 5V (or 10V) and I/O are proportional. Switch between input 0 to 5VDC (factory setting) and 0 to 10VDC from the parameter unit. Input resistance 10kΩ. Max. permissible voltage 20VDC.	
		4	Frequency setting (current)	By entering 4 to 20mADC, the maximum output frequency is reached at 20mA and I/O are proportional. This input signal is valid only when the signal across terminals AU and SD is on. Input resistance 250Ω. Max. permissible current 30mA.	
		1	Auxiliary frequency setting	By entering 0 to ±5VDC 0 to ±10VDC, this signal is added to the frequency setting signal of terminal 2 or 4. Switch between input 0 to ±5VDC (factory setting) and 0 to ±10VDC (factory setting) from the parameter unit. Input resistance 10kΩ. Max. permissible voltage 20VDC.	
		5	Frequency setting input common	Common to the frequency setting signals (terminals 2, 1 or 4) and analog output terminal AM. 0V line of the common circuit of the control circuit. Do not ground.	
Control circuit (output signals)	Contact	A, B, C	Alarm output	Change-over contact output indicating that the output has been stopped by the inverter protective function activated. 200VAC 0.3A, 30VDC 0.3A. Alarm: discontinuity across B-C (continuity across A-C), normal: continuity across B-C (discontinuity across A-C).	
	Open collector (Note)	RUN	Inverter running	Switched low when the inverter output frequency is equal to or higher than the starting frequency (factory set to 0.5Hz, variable). Switched high during stop or DC injection brake operation (**). Permissible load 24VDC 0.1A.	
		SU	Up to frequency ***	Switched low when the output frequency has reached within ±10% of the set frequency (factory setting, variable). Switched high during acceleration, deceleration or stop (**). Permissible load 24VDC 0.1A.	
		OL *	Overload alarm ***	Switched low when the current limit function has caused stall prevention to be activated. Switched high when stall prevention is reset (**). Permissible load 24VDC 0.1A.	
		IPF *	Instantaneous power failure ***	Switched low when instantaneous power failure or undervoltage protection is activated (**). Permissible load 24VDC 0.1A.	
		FU *	Frequency detection ***	Switched low when the output frequency has reached or exceeded the detection frequency set optionally. Switched high when below the detection frequency (**). Permissible load 24VDC 0.1A	
		SE	Open collector output common	Common to the RUN, SU, OL, IPF and FU terminals. Isolated from the common circuit of the control circuit.	
	Pulse	FM	For meter	One selected from 12 monitoring items, such as output frequency, is output. The output signal is proportional to the magnitude of each monitoring item. Terminals FM and AM can be used at the same time.	Factory-set output item: frequency Permissible load current 1mA 1440Hz at 60Hz. (Max. frequency 2400Hz)
	Analog	AM	Analog signal output		Factory-set output item: frequency Output signal 0 to 10VDC Permissible load current 1mA (Max. output voltage 10VDC)

*The function of this terminal will change when the commercial power supply operation-inverter operation switch-over function is selected. (Refer to page 83.)

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

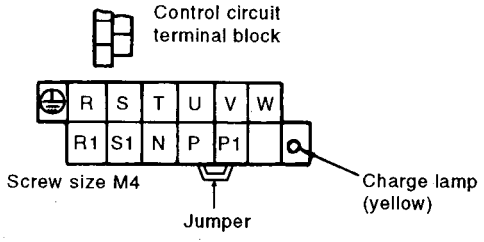
***The output of these terminals can be reassigned by the output terminal assignment function (see page 83).

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

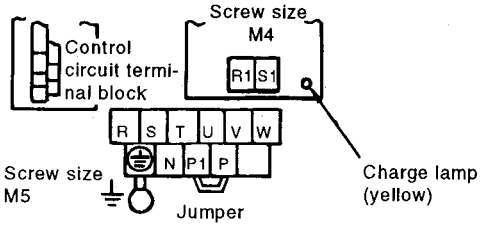
7.1.4 Terminal Block Arrangement

Terminal Block for Main Circuit <200V Class>

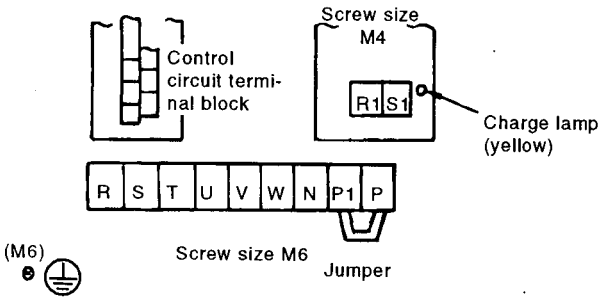
FR-A120E-0.75K(P) to 3.7K(P)



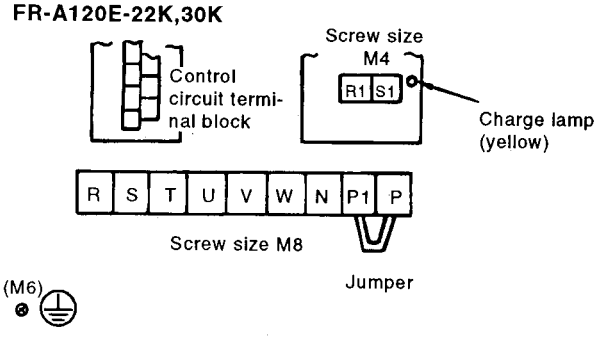
FR-A120E-5.5K(P),7.5K(P),11K



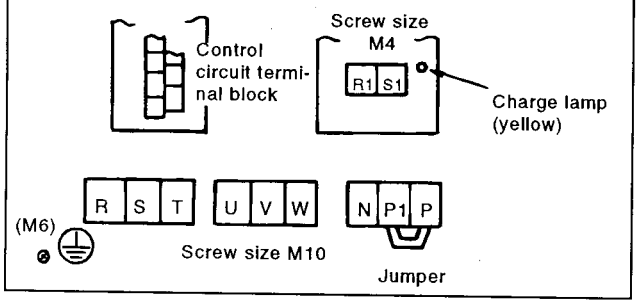
FR-A120E-15K,18.5K



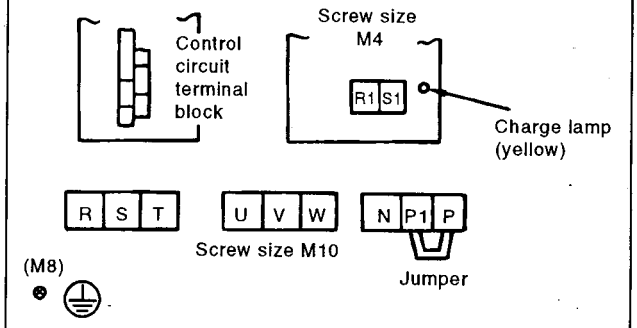
FR-A120E-22K,30K



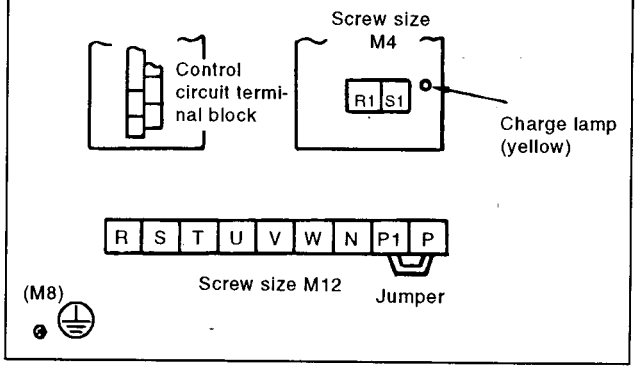
FR-A120E-37K



FR-A120E-45K

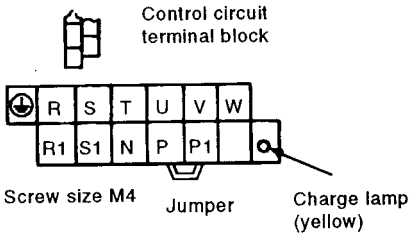


FR-A120E-55K

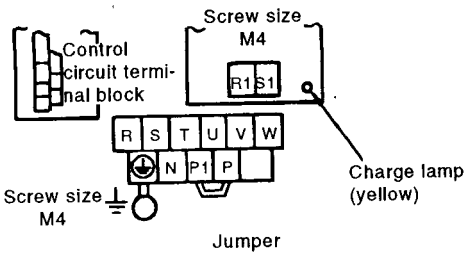


Terminal Block for Main Circuit <400V Class>

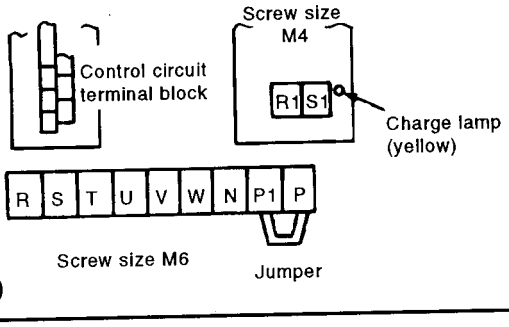
FR-A140E-0.75(P) to 3.7K(P)



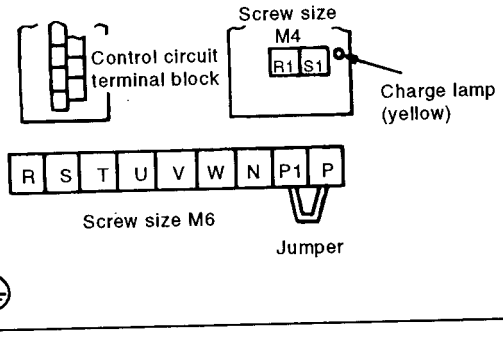
FR-A140E-5.5K(P) to 11K



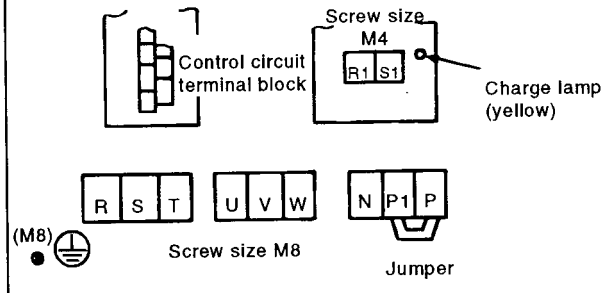
FR-A140E-15K,18.5K



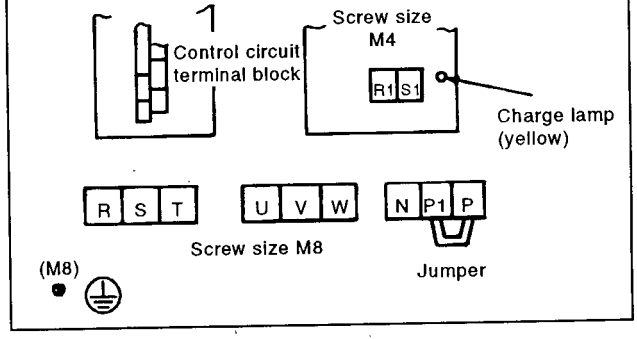
FR-A140E-22K



FR-A140E-30K,37K,45K

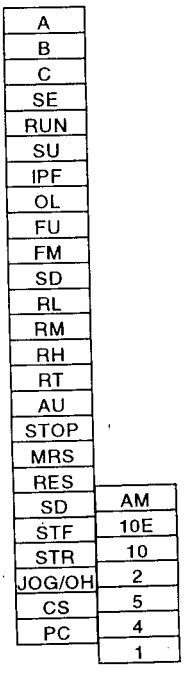


FR-A140E-55K



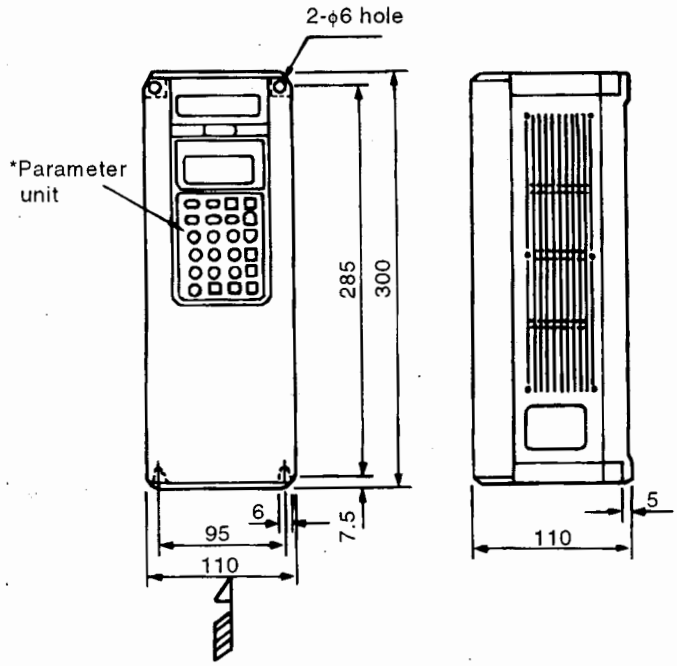
Terminal Block for Control Circuit

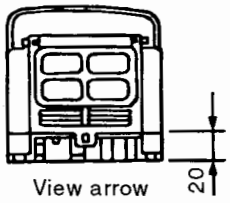
Common to all models
Structure.....2-stage molded terminals
Screw size..... M3



7.1.5 Outline Drawings

•*FR-A120E- 0.75K(P)

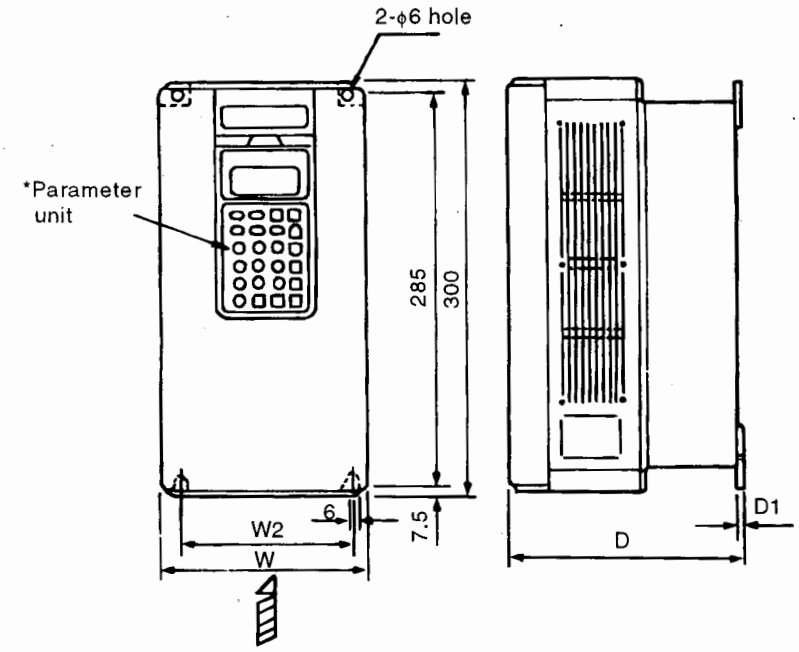


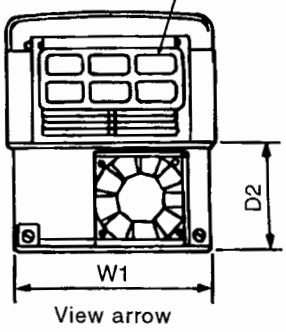


• FR-A120E- 1.5K(P), 2.2K(P), 3.7K(P), 5.5K(P), 7.5K(P), 11K

•*FR-A140E- 0.75K(P), 1.5K(P), 2.2K(P), 3.7K(P), 5.5K(P), 7.5K(P), 11K

*The 11K inverter does not have the protective bush.



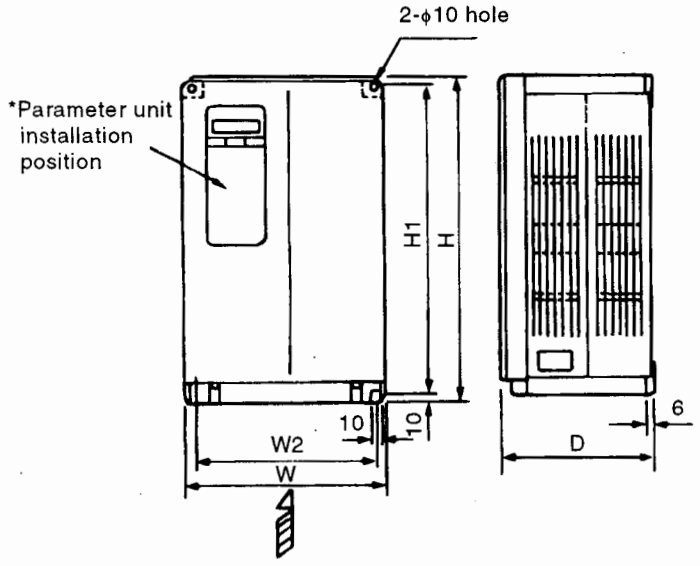


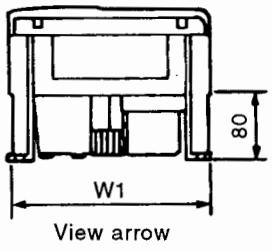
[Unit: mm]

Inverter Type	W	W1	W2	D	D1	D2
FR-A120E-1.5K(P)	150	142	125	140	6	42
FR-A120E-2.2K(P)	150	142	125	140	6	42
FR-A120E-3.7K(P)	150	142	125	170	2.3	76
FR-A120E-5.5K(P)	220	210	195	190	2.3	67
FR-A120E-7.5K(P)	220	210	195	190	2.3	67
FR-A120E-11K	220	210	195	190	2.3	67

Inverter Type	W	W1	W2	D	D1	D2
FR-A140E-0.75K(P)	150	142	125	170	2.3	76
FR-A140E-1.5K(P)	150	142	125	170	2.3	76
FR-A140E-2.2K(P)	150	142	125	170	2.3	76
FR-A140E-3.7K(P)	150	142	125	170	2.3	76
FR-A140E-5.5K(P)	220	210	195	190	2.3	67
FR-A140E-7.5K(P)	220	210	195	190	2.3	67
FR-A140E-11K	220	210	195	190	2.3	67

- **FR-A120E-** [15K], [18.5K], [22K], [30K]
- **FR-A140E-** [15K], [18.5K], [22K]



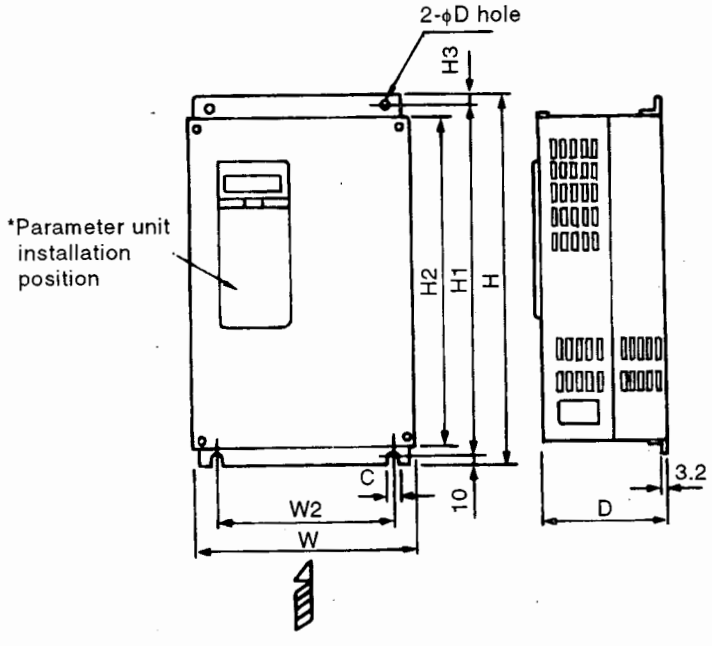


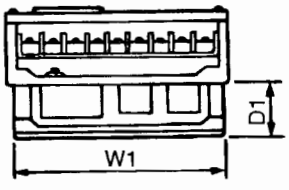
[Unit: mm]

Inverter Type	W	W1	W2	H	H1	D
FR-A120E-15K	250	242	230	400	380	190
FR-A120E-18.5K	250	242	230	400	380	190
FR-A120E-22K	300	292	280	450	430	195
FR-A120E-30K	300	292	280	450	430	195

Inverter Type	W	W1	W2	H	H1	D
FR-A140E-15K	250	242	230	400	380	190
FR-A140E-18.5K	250	242	230	400	380	190
FR-A14E-22K	300	292	280	450	430	195

- **FR-A120E-** [37K], [45K], [55K]
- **FR-A140E-** [30K], [37K], [45K], [55K]





[Unit: mm]

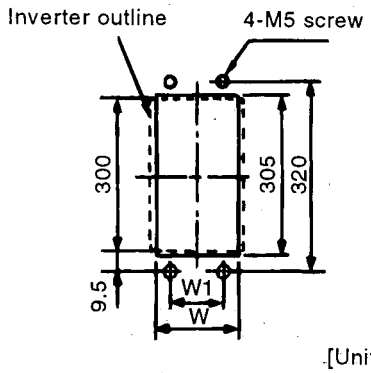
Inverter Type	W	W1	W2	H	H1	H2	H3	D	D1	C
FR-A120E-37K	340	324	270	550	530	510	10	195	78	10
FR-A120E-45K	450	434	380	550	525	495	15	250	130	12
FR-A120E-55K	480	464	410	700	675	645	15	250	130	12

Inverter Type	W	W1	W2	H	H1	H2	H3	D	D1	C
FR-A140E-30K	340	324	270	550	530	510	10	250	78	10
FR-A140E-37K	450	434	380	550	525	495	15	250	130	12
FR-A140E-45K	450	434	380	550	525	495	15	250	130	12
FR-A140E-55K	480	464	410	700	675	645	15	250	130	12

* The 11K to 55K models are not equipped with the parameter unit as standard.

7.1.6 Panel Cutting Dimension Diagrams
(For using the optional heat sink outside mounting attachment FR-ACN)

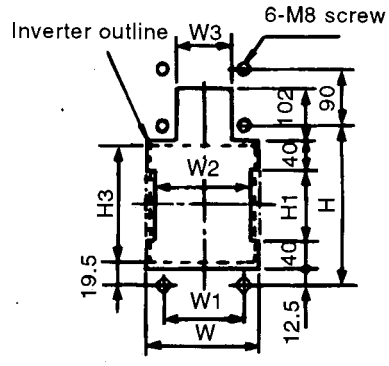
- FR-A120E-1.5K to11K
- FR-A140E-0.75K to11K



[Unit: mm]

Inverter Type	W	W1
FR-A120E-1.5K to 3.7K	144	125
FR-A120E-5.5K to 11K	212	195
FR-A140E-0.75K to 3.7K	144	125
FR-A140E-5.5K to 11K	212	195

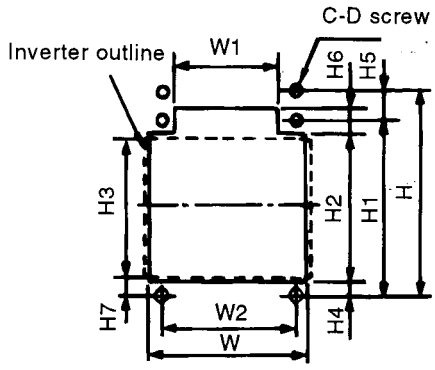
- FR-A120E-15K to 30K
- FR-A140E-15K to 22K



[Unit: mm]

Inverter Type	W	W1	W2	W3	H	H1	H2
FR-A120E-15K, 18.5K	260	230	244	200	440	335	400
FR-A120E-22K,30K	310	280	294	250	490	385	450
FR-A140E-15K, 18.5K	260	230	244	200	440	335	400
FR-A140E-22K	310	280	294	250	490	385	450

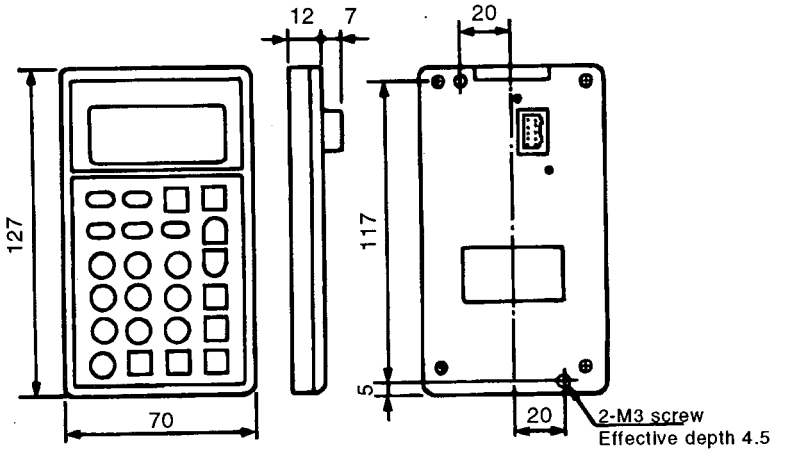
- FR-A120E-37K to 55K
- FR-A140E-30K to 55K



[Unit: mm]

Inverter Type	W	W1	W2	H	H1	H2	H3	H4	H5	H6	H7	C	D
FR-A120E-37K	330	265	290	—	540	516	510	12	85	95	15	6	M8
FR-A120E-45K	440	380	410	590	—	510	495	15	—	70	32.5	4	M10
FR-A120E-55K	470	390	430	730	—	650	645	15	—	70	24.5	4	M10
FR-A140E-30K	330	265	290	—	540	516	510	12	85	95	15	6	M8
FR-A140E-37K, 45K	440	380	410	590	—	510	495	15	—	70	32.5	4	M10
FR-A140E-55K	470	390	430	730	—	650	645	15	—	70	24.5	4	M10

7.1.7 FR-PU02-1/FR-PU02E-1/FR-PU02ER-1 Parameter Unit Dimension Diagram

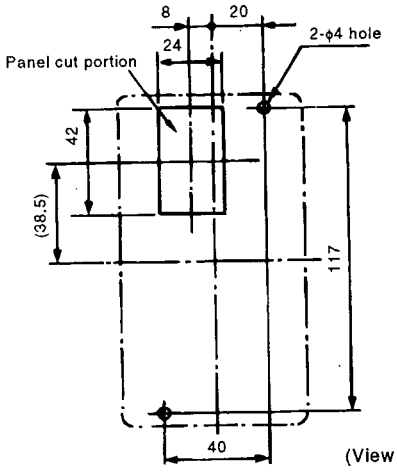


Note: The length of the installation screw should be selected so that it does not exceed the effective installation screw depth of the parameter unit.

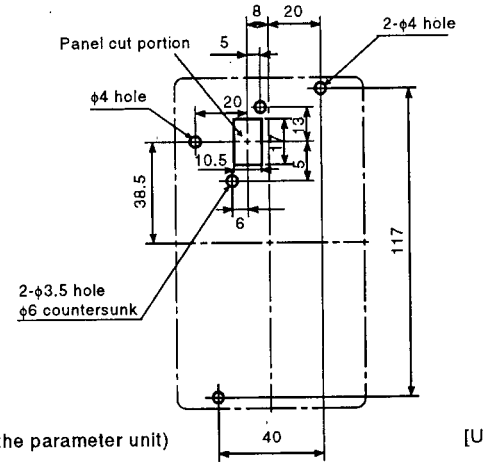
[Unit: mm]

Panel cutting dimensions for installation of the parameter unit to a panel or the like

- **Palameter unit cable (straight type) is used and is not fixed to the panel**



- **Parameter unit cable (L type) is used and fixed to the panel**



(View as seen from the parameter unit)

[Unit: mm]

FR-PU02E(ER)-1 Specifications

Item	Specifications	
Ambient temperature	Operating	-10 to +50°C (Note 1)
	Storage	-20 to +65°C
Ambient humidity	90%RH	Non-condensing
Operating ambience	Indoors, no oil mist, corrosive gases, 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) (Note 3)	
Size	127 (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.

3. Never use a sharp-pointed object to operate the keys. Otherwise, the membrane will be damaged.

7.2 OPTIONS

7.2.1 Option List

	Option Name	Type	Application, Specifications, Etc.	Applicable Inverter
Inboard type (dedicated to FR-A)	Computer link function	FR-EPB	• RS-422, RS-485 interface for computer link (serial communication) • PLG feedback control	Common to all models
	Programmable controller link function	FR-EPC	• MELSECNET/MINI-S3 (optical cable) interface • PLG feedback control	
	Automatic control compatible function	FR-EPD	• PI control • Battery backup for programmed operation (programmed operation function is standard.)	
	I/O function	FR-EPE	• 12-bit digital input • Relay output (3 points) • Extension analog output	
	Computer link + extension output function	FR-EPG	• RS422/RS485 interface for computer link (serial communication) • Selective relay output • Analog current output	
	Pulse train input function	FR-EPH	• Pulse train input • Selective relay output • Analog current output • PI control	
External option (dedicated to FR-A)	Parameter unit (Japanese)	FR-PU02-1	Interactive parameter unit using LCD display	
	Parameter unit (English)	FR-PU02E-1	The LCD display and ten-key pad of the FR-PU02-1 are indicated in English.	
	Parameter unit (4 languages)	FR-PU02ER-1	For use in English, German, French and Spanish.	
	Parameter copy unit (Japanese)	FR-ARW-1	Allows parameter settings to be read in batch and copied to the other inverter.	
	Parameter copy unit (English)	FR-ARWE-1	The LCD display and ten-key pad of the FR-ARW-1 are indicated in English.	
	Parameter copy unit (4 languages)	FR-ARWER-1	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)	
	Heat sink outside mounting attachment	FR-ACN□□	Used to place only the heat generating section of the inverter in the back of the control box.	1.5K to 55K According to capacity
	Dirt-protection structure attachment	FR-ACV□□	By installing this option, the inverter meets the totally enclosed structure specifications (IP40).	0.75K to 22K According to capacity
	Conduit connection attachment	FR-AFN□□	Used to connect a conduit pipe directly to the inverter.(11K to 55K meet IP20 by installing this option.)	0.75K to 55K According to capacity
	FR-Z series intercompatibility attachment	FR-AAT□□	Mounting plate used to make the mounting dimensions identical to those of the FR-Z series.	
	EMC Directive-compliant noise filter	SF□□	Noise filter which complies with the EMC Directive (EN50081-2).(Only the 400V class complies)	0.75K to 55K According to capacity
External option	Power factor improving DC reactor	FR-BEL-(H)□□*	Used to improve the inverter input power factor (overall power factor about 95%) and cooperate with the power supply.	Common to all models
	Power factor improving AC reactor	FR-BAL-(H)□□*	Used to improve the inverter input power factor (overall power factor about 90%) and cooperate with the power supply.	
	Radio noise filter	FR-BIF-(H)□□*	For radio noise reduction	
	Line noise filter	FR-BSF01	For line noise reduction (applies to small capacities)	
		FR-BLF	For line noise reduction	
	Parameter unit cable	FR-CBL□□	Cable for connection with the parameter unit or parameter copy unit. Straight or L shape type available.	
	Digital operation panel	FR-DU01	For operation from the control box surface.	
	Surge voltage suppressing filter	FR-ASF-H	Absorbs surge voltage on the inverter output side.	400V class 0.75 to 55K According to capacity
	Brake unit	FR-BU-(H)15K to (H)55K *	Used to improve the braking capability of the inverter (for high-inertia load or negative load). Use the brake unit and resistor unit together.	According to capacity
	Resistor unit	FR-BR-(H)15K to (H)55K *		
	Power return unit	FR-RC-(H)15K to (H)55K *	Energy-saving, high-function brake unit which can return the motor-generated braking energy to the power supply.	
	High power factor converter	FR-HC(H)7.5K to (H)55K *	For harmonic suppression	

	Option Name	Type	Application, Specifications, Etc.	Applicable Inverter
FR series controllers and setters	Manual controller	FR-AX	For independent operation.With frequency meter, frequency setting potentiometer and start switch.	Common to all models
	DC tach. follower	FR-AL	For joint operation using external signals. (0 to 5VDC, 0 to 10VDC) (1VA) *	
	Three speed selector	FR-AT	For three-speed (high, middle, low) switching operation. (1.5VA)	
	Motorized speed setter	FR-FK	For remote operation. Allows operation to be controlled from several places. (5VA)	
	Ratio setter	FR-FH	For ratio control. Allows ratios to be set to five inverters. (3VA)	
	PG follower	FR-FP	For follow-up operation using the signal of a pilot generator (PG). (2VA)	
	Master controller	FR-FG	For parallel operation of several (up to 35) inverters. (5VA)	
	Soft starter	FR-FC	For soft start and stop. Allows parallel operation and acceleration/deceleration. (3VA)	
	Deviation detector	FR-FD	For synchronous operation. Used with a deviation sensor and synchro. (5VA)	
	Preamplifier	FR-FA	Can be used as A/V conversion or operational amplifier. (3VA)	
Others	Pilot generator	QVAH-10	For follow-up operation. 70/35VAC 500Hz (at 2500rpm)	
	Deviation sensor	YVGC-500W-NS	For synchronous operation (mechanical deviation detection). Output 90VAC/90°	
	Frequency setting potentiometer	WA2W1KΩ	For frequency setting. Wire-wound type. 2W1KΩ B characteristic.	
	Frequency meter	YM206RI 1mA	Dedicated frequency meter (up to 120Hz scale). Moving-coil DC ammeter.	
	Calibration resistor	RV24YN 10KΩ	For calibration of the frequency meter. Carbon-film type. B characteristic.	

* Type for 400V class has H.

** Rated power consumption.

Power supply specifications of the FR series controllers and setters: 200VAC 50Hz, 200/220VAC 60Hz 115VAC 60Hz

7.2.2 Inboard Dedicated Options

Option / Function	FR-EPB (Computer link function)	FR-EPC (Programmable controller link function)	FR-EPD (Automatic control compatible function)	FR-EPE (I/O function)	FR-EPG (Computer link + extension output function)	FR-EPH (Pulse train input function)
PLG feedback control	●	●				
12-bit digital input				●		
Relay output				●	●	●
Extension analog output				●		
Computer link	●				●	
MELSECNET/MINI-S3		●				
PI control			●			
Programmed operation			●			●
Analog current output					●	●
Pulse train input						●

Out of the above option units, only one can be installed in the inverter.
Each option unit has several function as listed above.

	Function, Application, Etc.	Rating, Etc.
PLG feedback control	• The motor speed is detected by the pulse encoder, this detection signal is fed back to the inverter, and its speed variation is automatically compensated for. Hence, the motor speed can be kept constant if load variation occurs. • The actual motor speed can be monitored on the inverter LED display and parameter unit. [Application example] extruder, winder, conveyor, etc.	• Speed variation ratio: within ±0.2% at the load variation of 0 to 100% (*) (at 1800r/min) • Applicable motor: standard motor of 2 to 8 poles • Encoder specifications: 3 phase, differential output, 1024P/rev. • 5VDC power supply Example: Tamagawa Seiki's TS 1508 N 207, etc. (*) Load of 100% indicates the continuous operation torque of the motor at each running frequency.
12-bit digital input	• Input interface used to set the inverter frequency accurately using external BCD or binary digital signals. • Either 12-bit binary or BCD 3-digit signal can be selected. • Gain and offset can also be adjusted.	• Input voltage, current: 24VDC, 5mA (per circuit) • Input signal format: contact signal input or transistor open collector (sink type) input Example: MELSEC AY40, AY40A, etc.
Relay output (3 points)	• Any three signals can be selected and output as relay contacts (change-over contacts) from among the 10 standard output signals (RUN, SU, IPF/UVT, OL, FU1, FU2, RBP, THP, PRG, PU) of the inverter. The FR-EPG and EPH have one point of relay output.	• Signal types: change-over contact (three output relays installed) • Contact capacity: 230VAC 0.3A 30VDC 0.3A
Extension analog output Analog current output	• 16 signals, which can be monitored on the FM and AM terminals, such as output frequency, output voltage, output current and motor torque, are expanded and output. • A 1mA DC or 5V (10V) DC meter can be connected. (FR-EPE) • A 20mADC or 5V(10V)DC meter can be connected. (FR-EPG, EPH terminals AM0, AM1) • Gain and offset can also be adjusted.	• Output voltage { across LM0-LM2 / across AM0-AMC }: 0 to 10VDC, max. 1mA • Output current { across LM1-LM2 / across AM1-AMC }: 0 to 1mADC (20mA) Output resolution: 3mV for voltage output Output resolution: 1μA for current output (20μA) • Output accuracy ±10%
Computer link function (serial communication)	• Allows inverter operation/monitoring and parameter read/write to be performed using user program from a computer, e.g. personal computer or FA controller, which is connected by communication cables. • Noiseless communication system using twisted pair cables.	• Conforming standard: EIA Standard, for RS-422 and RS-485 • Transmission format: multidrop link system • Communication speed: max. 19200 baud rates • Max. number of inverters : RS-422 - 10 inverters connected RS-485 - 32 inverters • Overall extension: 500m
MELSECNET/MINI-S3 interface	• Allows inverter operation/monitoring and parameter read/write to be performed using user program from the master station in the Mitsubishi programmable controller data link system MELSECNET/MINI-S3 (AJ71PT32-S3) which is connected by optical fiber. • Communication is made via optical link system without noise.	• Max. number of inverters connected: 16 inverters (up to 64 inverters when used with remote I/O stations) • Interstation transmission distance: 50m max. 1m min

	Function, Application, Etc.	Rating, Etc.
PI control	• PI control function is required when process control, e.g. flow rate, air volume or pressure, is carried out by the inverter. • The set value can be set from any of terminal 2, 1 or parameter unit. The measured value (feedback signal) is input to terminal 4 by a 4 to 20mA DC current signal.	• PI control range: proportional band 1 to 1000% integral time 0.1 to 3600 seconds • Output signal: high limit, low limit, during forward rotation, during reverse rotation
Battery backup for programmed operation	• Allows the timer to be battery backed for programmed operation. If a power failure occurs, automatic operation can be continued after the power is restored. (Programmed operation is standard in the inverter. See Pr. 87.) Group selection and time-out output signal for the programmed operation are incorporated.	• Battery life: 10 years (lithium battery) • Permissible power failure time: max. 18 hours when Pr. 200=0.2 (seconds selected) Max. 30 days when Pr. 200=1.3 (minutes selected)
Pulse train input	• Allows a pulse train signal to be used as a speed command input to the inverter.	• Max. permissible number of pulses: 100KPPS or less • Input interface: Open collector system • Input voltage/current: 24VDC, 10mA

Information on programmable controller link function

When the FR-EPC is used to perform programmable controller link (PC link) operation, operation can also be performed under the control of the external terminal signal according to the conditions set in Pr. 123 (operation command control place selection) and Pr. 124 (speed command control place selection).

• Control place selection function

Control Place Selection		Functions Equivalent to External Terminals														
Mode	Pr. 123 (operation command)	Pr. 124 (speed command)	STF	SRT	STOP *1	JOG *1	RT	2 *2	4 *1	1 *1	RH,M,L	AU	RES *3	MRS	OH *1	CE *1
Link	0:PC	0:PC	PC	PC	—	—	PC	PC	—	AUX	PC	—	EIT	EIT	EXT	EXT
	0:PC	1:External terminal	PC	PC	—	—	PC	EXT	EXT	EXT	EXT	EIT	EIT	EIT	EXT	EXT
	1:External terminal	0:PC	EXT	EXT	EXT	EXT	EXT	PC	—	AUX	PC	—	EIT	EXT	EXT	EXT
	1:External terminal	1:External terminal	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EIT	EIT	EXT	EXT	EXT
External	—	—	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT

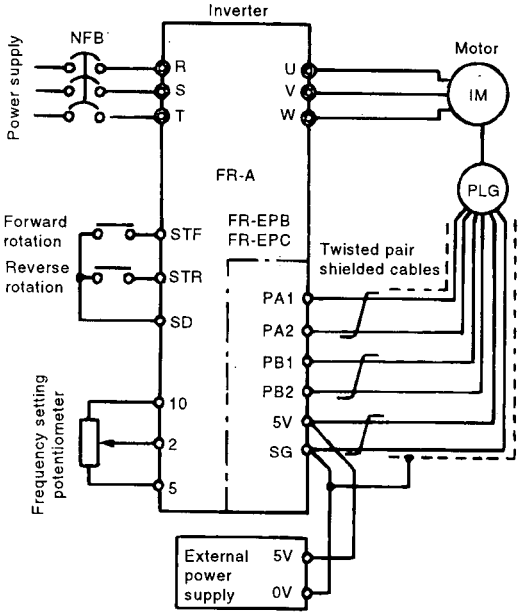
Pr. 123 and Pr. 124 may be set for both the PC link and PU.

[Explanation of the table] EXT: Operation from external terminal is only valid.
PC: Operation from PC link is only valid.
EIT: Operation from either external terminal or PC link is valid.
—: Operation from neither external terminal nor PC link is valid.
AUX: Operation from external terminal signal is only valid when "1" is set in Pr. 28 (multi-speed input compensation).
*1: Operation from PC link is disabled.
*2: From PC link, running frequency is changed (when "speed command" setting is "PC").
*3: From PC link, inverter reset command is used.

Note: When the external terminal ("1") is selected in Pr. 124 (speed command control place selection), command control in bit 0 is made valid as the current input selection (AU). To use the conventional program, note the setting of bit 0.

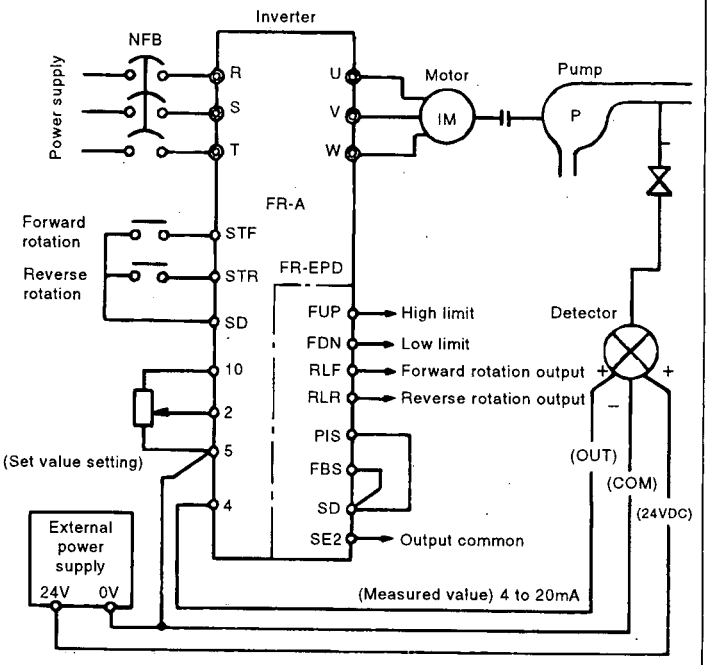
<Connection examples>

• PLG feedback contorol

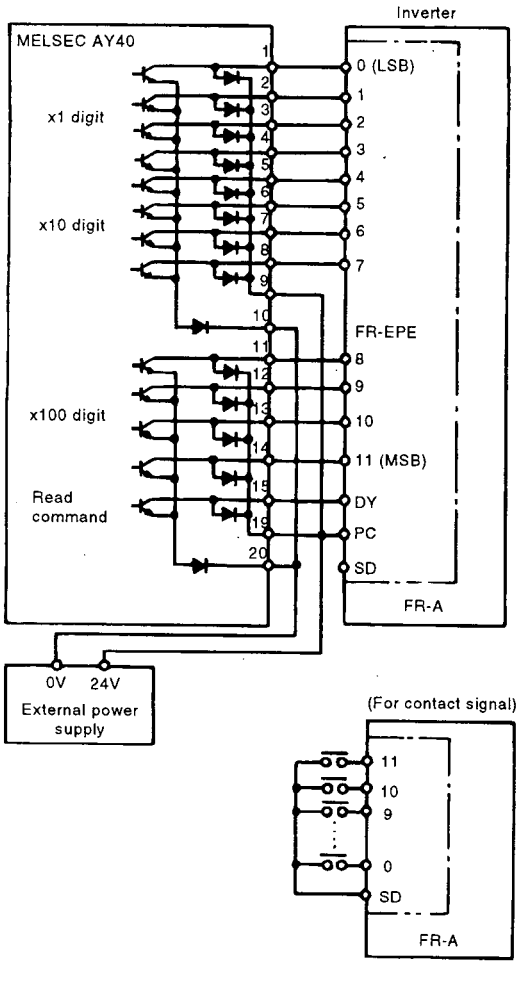


When a motor with brake is used, note the release timing of the brake. For more information, see the instruction manual of the option.

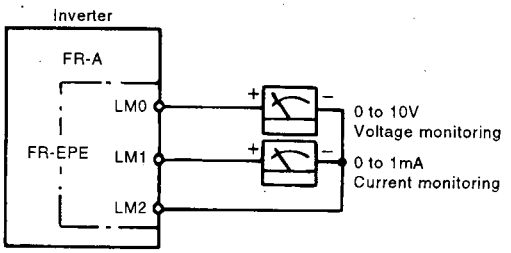
• PI control (for pressure control)



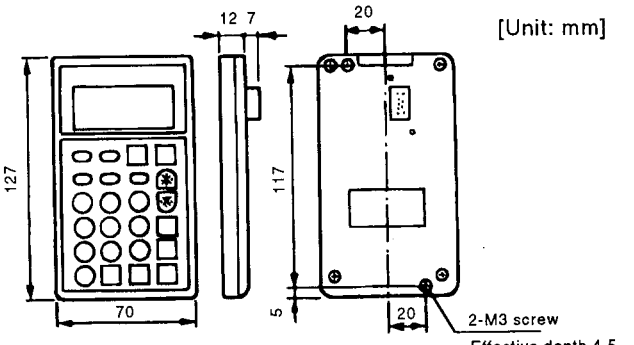
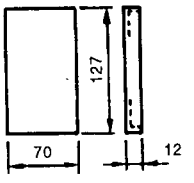
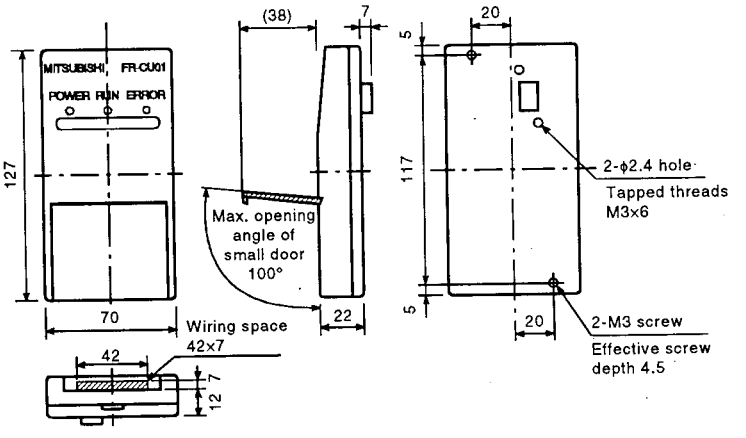
• 12-bit digital input (for BCD code)



• Extension analog output



7.2.3 External Dedicated Options

Option (Type)	Specifications, Structure, Etc.	Remarks
Parameter copy unit FR-ARW-1 (Japanese) FR-ARWE-1 (English) FR-ARWER-1 (4 languages)	• Allows parameters set to application to be read in batch and easily written to another inverter. • LCD and ten-key pad representations are available in three ways: Japanese, English and four languages (English, German, French, Spanish). ••External dimensions are the same as those of the FR-PU02-1 parameter unit. • Can also be used as the parameter unit. [Unit: mm]  The keys marked * have different functions from those for the FR-PU02(E)-1.	The FR-ZRW(E) used with the FR-A series cannot be used.
Accessory cover	• When the parameter unit is removed from the inverter, this cover is fitted to that position. • This cover can be fitted and removed by a single action. [Unit: mm] 	This cover is supplied to the model which is not equipped with the parameter unit.
Serial communication unit FR-CU01	• An add-on unit which can be fitted after removal of the parameter unit. • Allows the inverter to be run/monitored and the parameters to be set from an FA controller or the like via the RS485 interface. • Multidrop link system, up to 31 inverters connected. • Communication speed: 1200 baud  [Unit: mm]	

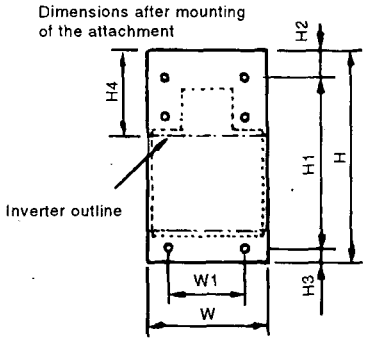
Heat sink outside mounting attachment FR-ACN□□

- By using this attachment, the heat sink acting as the heat generator of the inverter can be placed at the back of the control box. Since the inverter-generated heat can be dissipated to the outside of the control box, the control box can be made compact.
- For the mounting state and panel cut dimensions, see the outline drawing (page 179).

Note: Since the cooling fan exists in the cooling section placed out of the box, do not use this attachment in environments subjected to water drop, oil mist, dust, etc.

Type	Applicable Inverter	
	200V Class	400V Class
FR-ACN01	FR-A120E-1.5K/2.2K	——
FR-ACN02	FR-A120E-3.7K	FR-A140E-0.75K/1.5K/2.2K/3.7K
FR-ACN03	FR-A120E-5.5K/7.5K/11K	FR-A140E-5.5K/7.5K/11K
FR-ACN04	FR-A120E-15K/18.5K	FR-A140E-15K/18.5K
FR-ACN05	FR-A120E-22K/30K	FR-A140E-22K
FR-ACN06	FR-A120E-37K	FR-A140E-30K
FR-ACN07	FR-A120E-45K	FR-A140E-37K/45K
FR-ACN08	FR-A120E-55K	FR-A140E-55K

Dimensions after mounting of the attachment



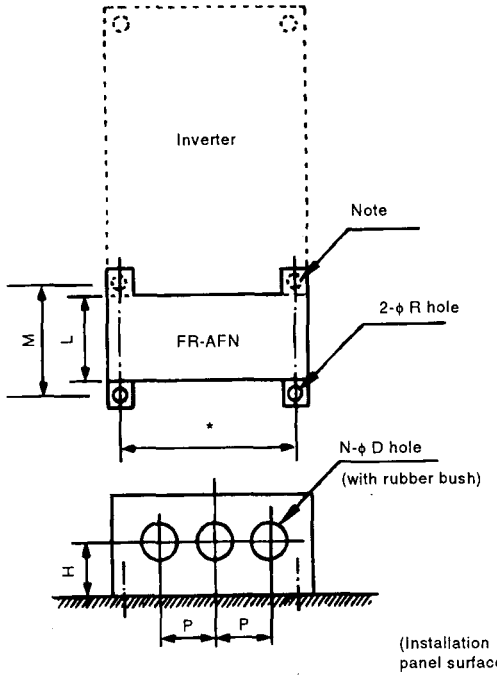
[Unit: mm]

Type	W	W1	H	H1	H2	H3	H4
FR-ACN01	150	125	336	320	8	8	17
FR-ACN02	150	125	336	320	8	8	17
FR-ACN03	220	195	336	320	8	8	17
FR-ACN04	280	230	554	530	12	12	122
FR-ACN05	330	280	604	580	12	12	122
FR-ACN06	340	290	682	625	19	38	122
FR-ACN07	460	410	625	590	15	20	80
FR-ACN08	490	430	775	730	17	28	80

Option (Type)	Specifications, Structure, Etc.
Dirt-protection structure attachment FR-ACV□□	• By installing this option in the slits at the top, bottom, right and left of the inverter, the inverter can be changed to be an enclosed structure model (IP40). (The box-shaped attachment is added to the wiring section of 11K to 22K.) • Adequate for wall mounting application, etc. IP40 (JEM1030): Structure which prevents a wire, copper band or the like in excess of 1mm in diameter or thickness from entering into the inverter. Note: 1. This structure is not protected from water and fluid entry and is therefore not appropriate for environments often exposed to water drop and oily smoke. 2. When this attachment is used, the permissible ambient temperature of the inverter is -10 to +40°C.
Conduit connection attachment FR-AFN□□	• Used to connect a conduit pipe directly to the bottom of the inverter. • By installing this attachment, 11K to 55K (200V, 400V) are changed in structure specification to IP20. (IP00 is standard.)
FR-Z series intercompatibility attachment FR-AAT□□	• This attachment allows the inverter to be installed using the installation holes for conventional FR-Z series model. Convenient when the existing conventional model is changed for the FR-A100 series. Note: When the attachment is used, the depth after installation of the inverter increases.

Type	Applicable Inverter	
	200V Class	400V Class
FR-ACV01	FR-A120E-0.75K	——
FR-ACV02	FR-A120E-1.5K/2.2K/3.7K	FR-A140E-0.75K/1.5K/2.2K/3.7K
FR-ACV03	FR-A120E-5.5K/7.5K/11K	FR-A140E-5.5K/7.5K/11K
FR-ACV04	FR-A120E-15K/18.5K	FR-A140E-15K/18.5K
FR-ACV05	FR-A120E-22K	FR-A140E-22K

Type	Applicable Inverter	
	200V Class	400V Class
FR-AFN02	FR-120E-0.75K	——
FR-AFN03	FR-120E-1.5K/2.2K	——
FR-AFN04	FR-120E-3.7K	FR-A140E-0.75K/1.5K/2.2K/3.7K
FR-AFN05	FR-120E-5.5K/7.5K/11K	FR-A140E-5.5K/7.5K/11K
FR-AFN06	FR-120E-15K/18.5K	FR-A140E-15K/18.5K
FR-AFN07	FR-120E-22K/30K	FR-A140E-22K
FR-AFN08	FR-120E-37K	FR-A140E-30K
FR-AFN09	FR-120E-45K	FR-A140E-37K/45K
FR-AFN10	FR-120E-55K	FR-A140E-55K



Note: Secured by a total of four places, the two installation screws at the bottom of the inverter and the two places at the bottom of the FR-AFN.

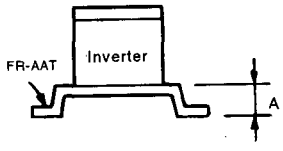
Attachment Outline Drawing [Unit: mm]

Type	L	H	P	N	D	M	R
FR-AFN02	45	71	48	2	35	60	6
FR-AFN03	45	75	48	3	35	60	6
FR-AFN04	45	115	48	3	35	60	6
FR-AFN05	55	115	60	3	44	70	6
FR-AFN06	70	115	68	3	50	90	10
FR-AFN07	145	115	68	4	50	165	10
FR-AFN08	145	95	68	4	50	102.5	10
FR-AFN09	285	120	113	3	91	227.5	12
FR-AFN10	285	120	113	4	91	227.5	12

*Same dimensions as those of the inverter.

Type	Applicable Inverter (200V Class)			Applicable Inverter (400V Class)	
	Z120	Z220	Z320	Z240	Z340
FR-AAT01	0.4K 0.75K 1.5K 2.2K 3.7K	0.4K 0.75K 1.5K 2.2K 3.7K	0.75K 1.5K 2.2K 3.7K	—	—
FR-AAT02	—	5.5K 7.5K 11K	5.5K 7.5K 11K	2.2K 3.7K 7.5K	2.2K 3.7K 7.5K
FR-AAT03	—	15K	15K	—	—
FR-AAT04	—	22K	22K	15K 22K	15K 22K
FR-AAT05	—	30K	—	—	—
FR-AAT06	—	37K	—	37K	—
FR-AAT07	—	55K	—	55K	—
FR-AAT08	—	45K	—	—	—

	A
FR-AAT01 to 05	12 mm
FR-AAT06 to 08	15 mm



Option (Type)	External Dimensions (Unit: mm)	Wiring, Etc.

Power factor improving DC reactor (for power coordination) FR-BEL-H ☐☐K*

	Type	A	B	C	D	E	F	G	H	Mass (kg)	Fig.
200V	0.4K	100	54	84	1.6	85	6	M4	25	0.5	1
	0.75K	120	53	102	1.6	105	6	M4	25	0.7	1
	1.5K	130	65	110	1.6	115	6	M4	30	1.1	1
	2.2K	130	65	110	1.6	115	6	M4	30	1.2	1
	3.7K	150	75	102	2	135	6	M4	40	1.7	1
	5.5K	150	75	126	2	135	6	M5	40	2.2	1
	7.5K	150	75	126	2	135	6	M5	40	2.3	1
	11K	170	93	132	2.3	155	6	M5	50	3.1	1
	15K	170	93	170	2.3	155	6	M8	56	3.8	2
	18.5K	185	94	184	2.6	165	7	M8	56	5.1	2
	22K	185	119	182	2.6	165	7	M8	70	5.4	2
	30K	185	119	201	2.6	165	7	M8	70	6.7	2
	37K	195	136	215	2.6	175	7	M10	70	7.4	2
	45K	195	136	215	2.6	175	7	M10	70	8.0	2
	55K	195	136	246	3.2	175	9	M12	80	9.8	2
400V	H0.4K	100	54	80	1.6	85	5	M3.5	28	0.5	1
	H0.75K	110	54	85	1.6	95	5	M3.5	28	0.7	1
	H1.5K	130	63	89	1.6	115	5	M3.5	32	0.9	1
	H2.2K	130	63	101	1.6	115	5	M3.5	32	1.1	1
	H3.7K	150	75	102	2	135	6	M4	40	1.7	1
	H5.5K	150	75	124	2	135	6	M4	40	2.2	1
	H7.5K	150	75	124	2	135	6	M4	40	2.3	1
	H11K	170	93	132	2.3	155	6	M5	50	3.1	1
	H15K	170	93	160	2.3	155	6	M6	56	3.7	2
	H18.5K	185	94	173	2.6	165	7	M6	56	4.8	2
	H22K	185	119	171	2.6	165	7	M6	70	5.0	2
	H30K	185	119	189	2.6	165	7	M6	70	6.7	2
	H37K	195	136	199	2.6	175	7	M8	70	7.0	2
	H45K	195	138	219	3.2	175	9	M8	80	8.6	2
	H55K	195	138	219	3.2	175	9	M8	80	9.0	2

Note: The numeral in the type indicates a motor capacity (kW).

Note: Use the FR-BAL AC reactor for inverter capacities of 0.4K to 3.7K.

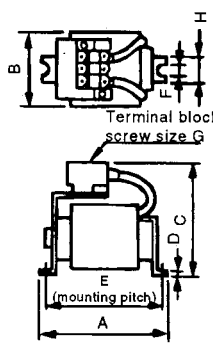


Fig. 1

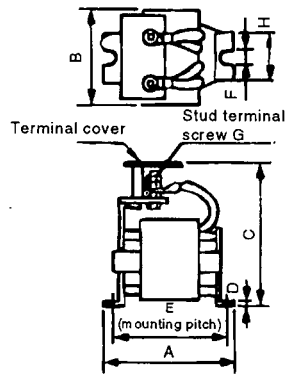
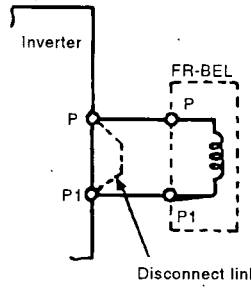


Fig. 2

- Input power factor: about 95%



Note:1. The input power factor is improved to about 95 %.

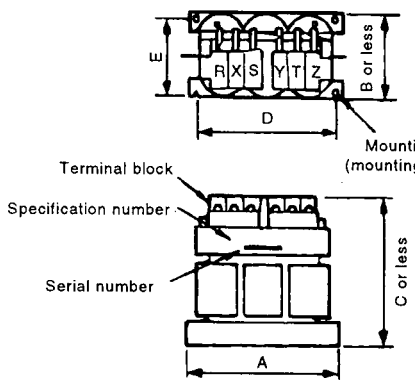
2. The link across inverter terminals P and P1 must be disconnected.
(If it is not disconnected, there is no power factor improvement.)

3. The wiring distance from the inverter should be within 5m.

4. The size of the cable used should be identical to or larger than that of the power supply cable (R, S, T). (See page 167.)

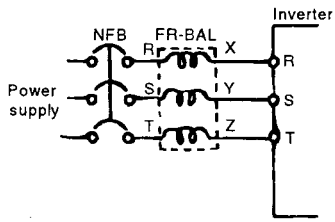
5. Select the reactor according to the motor capacity. (If the inverter capacity is greater than the motor capacity, select the reactor according to the motor capacity.)

Power factor improving AC reactor (for power coordination) FR-BAL-H ☐☐K*



Capacity	FR-BAL (200V) A	B	C	D	E	F	Mass (kg)	FR-BAL-H (400V) A	B	C	D	E	F	Mass (kg)
0.4KW	135	64	120	120	45	M4	2	125	64	120	120	45	M4	2.1
0.75KW	135	74	120	120	57	M4	3	150	76	145	145	55	M4	3.7
1.5KW	160	76	145	145	55	M4	4	150	92	145	145	70	M4	5.3
2.2KW	160	96	145	145	75	M4	6	150	96	145	145	75	M4	5.9
3.7KW	220	95	200	200	70	M5	8.5	220	95	195	200	70	M5	8.5
5.5KW	220	101	200	200	75	M5	9.5	220	101	200	200	75	M5	9.5
7.5KW	220	125	205	200	100	M5	14.5	220	125	200	200	100	M5	14
11KW	280	140	245	255	100	M6	19	280	140	235	255	100	M6	18.5
15KW	295	156	280	270	110	M6	27	295	156	270	270	110	M8	27
22KW	290	200	300	240	170	M8	35	290	200	300	240	170	M8	35
30KW	290	220	300	240	190	M8	43	290	220	300	240	190	M8	43
37KW	330	240	360	270	190	M10	50	330	220	360	270	190	M10	50
45KW	330	240	360	270	190	M10	60	330	220	410	270	190	M10	60
55KW	330	245	400	270	190	M10	70	330	220	450	270	190	M10	70

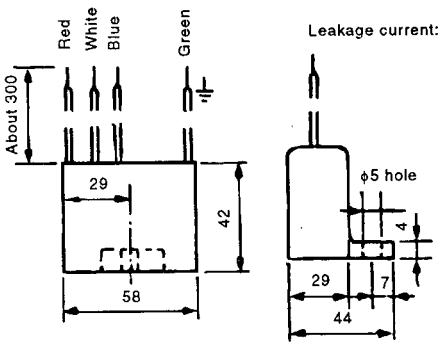
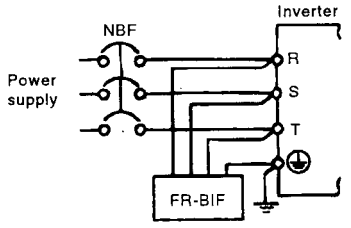
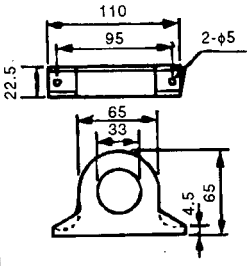
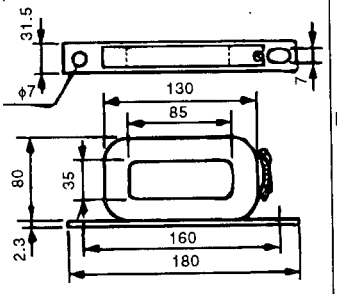
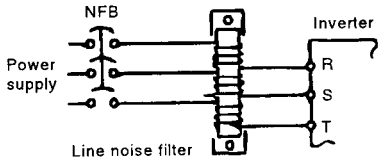
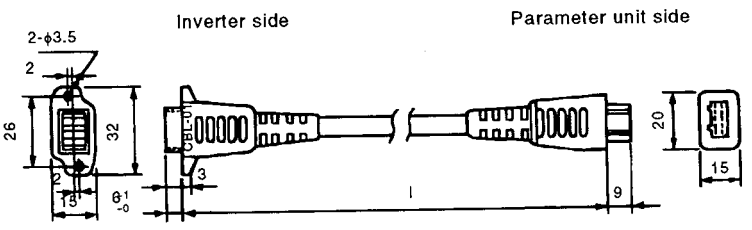
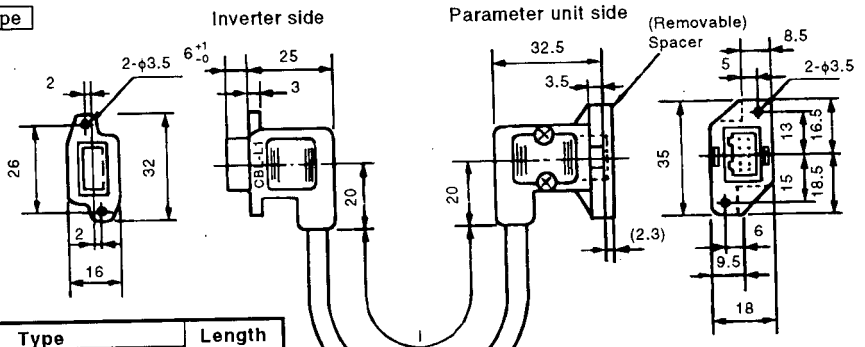
- Input power factor: about 90%



Note: 1. The input power factor is improved to about 90%.

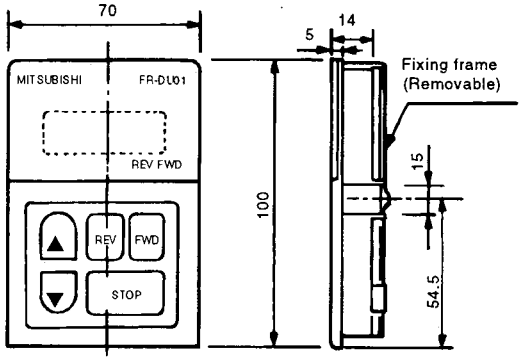
2. Select the reactor according to the motor capacity. If the inverter capacity is greater than the motor capacity, select the reactor according to the motor capacity.

3. Use the reactor for 22 kW when a 18.5 K inverter is used.

Option (Type)	Specifications, Structure, Etc.	Remarks
Radio noise filter FR-BIF .....200V Class FR-BIF-H....400V Class		 Note:1. This filter must not be connected to the output circuit of the inverter. 2. The cables should be as short as possible and connected to the terminal block of the inverter.
Line noise filter FR-BSF01 (applies to small capacities) FR-BLF	FR-BSF01  FR-BLF  [Unit: mm]	 Note:1. Wind the cable 4 or more times in the same direction in each phase. (A greater effect is produced as the winding times increase.) 2. If the cable size is too large to wind, use four or more filters in series and wind the cable in the same direction in each phase. 3 This filter can also be used on the output side as on the input side. The winding on the output side should be within 3 turns. 4. Use the FR-BSF01 for capacities of 3.7kW and down. A cable of large size (38mm^2 or more) cannot be used. If the cable size is large, use the FR-BLF.
Parameter unit cable FR-CBL☐☐	Straight type  L shape type  The PU side connector of this L type can be fixed to panel with the accessory screws. [Unit: mm]	

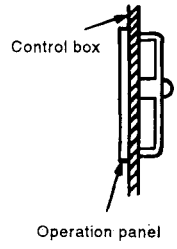
Type		Length l (m)
Straight Type	L	
FR-CBL01	FR-CBL-L1	1
FR-CBL03	FR-CBL-L3	3
FR-CBL05	FR-CBL-L5	5

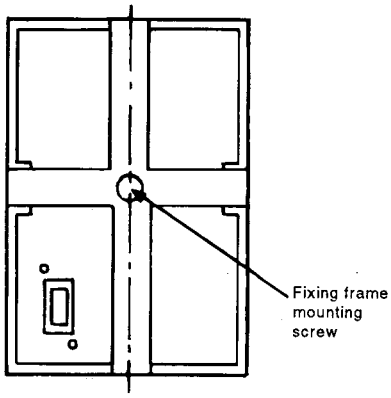
Option (Type)	Specifications, Structure, Etc.
Digital operation panel (for installation on panel surface) FR-DU01	



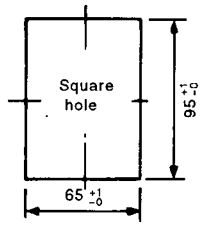
Note:1. This panel cannot be installed on the inverter. Use this panel with the parameter unit cable.

2. Installation method





Panel cut diagram



3. Acceptable plate thickness 0.6 to 3.2mm
4. Parameters cannot be read or written.
5. IP65 protection

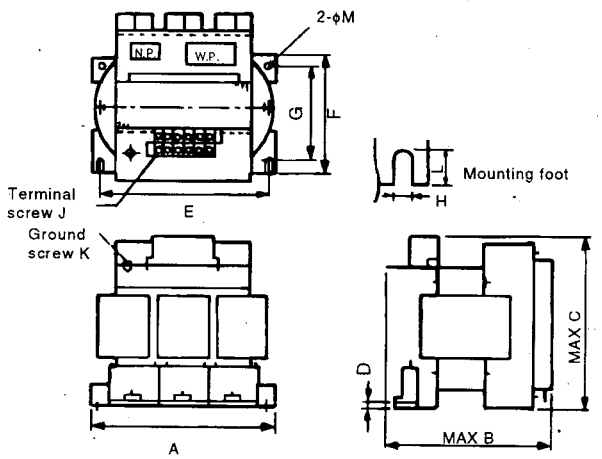
[Unit: mm]

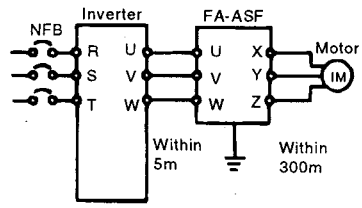
Surge voltage suppressing filter FR-ASF-H□□K

• This filter suppresses a surge voltage generated in the motor terminal voltage when a 400V class motor is driven by the inverter.

Voltage	Filter Type	Applicable Inverter	Dimensions (mm) A	B	C	D	E	F	G	H x L	M	Terminal Screw J	Ground Screw K	Mounting Screw	Approx. Mass (kg)
400V	FR-ASF-H1.5K	FR-A140E-0.75K/1.5K	220	160	193	2.3	200	134	95	6 x 17	6	M4	M4	M5	8.0
	FR-ASF-H3.7K	FR-A140E-2.2K/3.7K	220	180	200	3.2	200	155	115	6 x 18	6	M4	M4	M5	11.0
	FR-ASF-H7.5K	FR-A140E-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-A140E-11K/15K	335	285	260	6	310	235	200	φ10		M6	M6	M8	28
	FR-ASF-H22K *	FR-A140E-18.5K/22K	335	349	340	6	310	281	240	φ10		M8	M6	M8	38
	FR-ASF-H37K*(Note)	FR-A140E-30K/37K	375	388	445	6	350	388	330	φ10		M8	M8	M8	55
	FR-ASF-H55K*(Note)	FR-A140E-45K/55K	395	568	445	6	370	553	490	φ10		M10	M8	M8	73

* The filters of H15K and up are partly different in shape.
Note: H37K/H55K has a cover on the resistor.

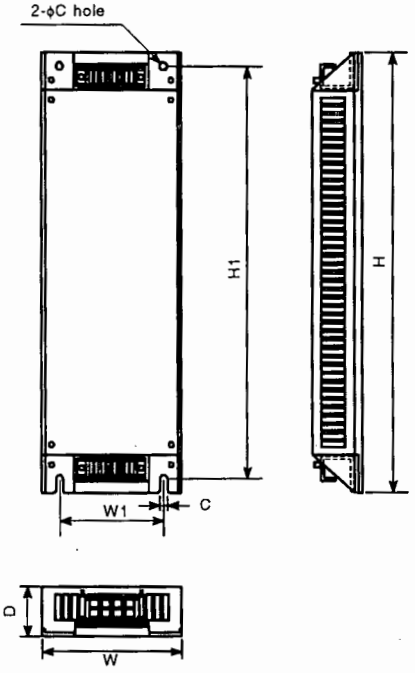




Note: 1. Connect the cables from the output terminals (U, V, W) of the inverter to the input terminals (U, V, W) of the filter and the cables from the motor terminals to the output terminals (X, Y, Z) of the filter. Run the cables with extreme care. Incorrect wiring may overheat and damage the resistor.
2. The wiring length from the inverter output terminals to the filter input terminals should be within 5m.
3. The wiring length from the filter terminals to the motor terminals should be within 300m.
4. The terminals used for wiring should be sleeved solderless terminals.

Option (Type)	Specifications, Structure, Etc.
EMC Directive-compliant noise filter SF□□	• This noise filter complies with the European EMC Directive. • Outline dimension drawing

	Noise Filter Model	Applicable Inverter Model	Noise Filter Outline Dimensions (Unit: mm) H	D	W	H1	W1	C	Approx. Weight (kg)	Loss (W)	Reference Leakage Current Value (mA)
400V	SF1197	FR-A140E-0.75K to 3.7K	360	47.5	144	340	117	6	1.5	9.7	57
	SF1174B	FR-A140E-5.5K/7.5K	360	38	213	340	180	6	1.8	51	51
	SF1175	FR-A140E-11K/15K	530	60	253	505	220	10	4.7	56	76
	SF1176	FR-A140E-18.5K/22K	600	60	303	575	260	10	5.9	71	108
	SF1177	FR-A140E-30K	700	80	327	675	280	10	9.4	65	156
	SF1178	FR-A140E-37K/45K	770	80	450	735	384	12	16	74	156
	SF1179	FR-A140E-55K	920	80	467	895	410	12	19	125	156



• Safeguards against leakage current

Take the following measures to prevent peripheral misoperation and accidental electric shock from occurring due to leakage current:

1) Earth the noise filter before connecting the power supply. In this case, make sure that the noise filter is connected to the ground securely via the earth of the enclosure.
2) Take the leakage current of the noise filter into account when selecting the earth leakage circuit breaker and earth leakage relay. Also, the earth leakage circuit breaker may not be used since the leakage current of a large-capacity noise filter is large. In such a case, use an earth leakage relay having large sensitivity current, or if an earth leakage circuit breaker and earth leakage relay cannot be used, earth the noise filter securely as described in 1).

Option (Type)	Specifications, Structure, Etc.
High power factor converter FR-HC	• As this converter improves the input power factor to approx. 1 (at the load factor of 100%), the power supply capacity can be reduced to about 2/3. • The power return function supplied as standard provides a large braking capability. (100% continuous return possible) • More than one inverter can be connected to one high power factor converter. • The high power factor converter is used with the external box and reactors 1, 2 which are supplied as standard accessories.

■ Specifications

Type FR-HC-□□		200V Class				400V Class			
		7.5K	15K	30K	55K	H7.5	H15K	H30K	H55K
Applicable inverter capacity (Note 1)		3.7kW to 7.5kW	7.5kW to 15kW	15kW to 30kW	30kW to 55kW	3.7kW to 7.5kW	7.5kW to 15kW	15kW to 30kW	30kW to 55kW
Rated input voltage, frequency		Three-phase, 200V to 220V, 50Hz 200V to 220V, 60Hz				Three-phase, 380V to 460V, 50/60Hz			
Rated input current (A)		33	61	115	215	17	31	57	110
Approx. weight	Unit (kg)	8	15	29	70	9	16	35	72
	Total of accessories (reactors 1, 2, external box) (kg)	20.3	30.8	66.6	96.3	22.7	31.9	51.3	93.3

Note: •When the inverter connected has a capacity less than the applicable range, the high power factor converter may be used as a common or regenerative converter but its power harmonic suppression effect will decrease.

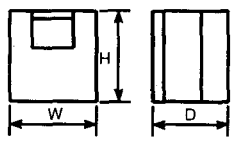
•Connect at least one inverter which has a capacity higher than half that of the high power factor converter. If the sum of connected inverter capacities is lower than half that of the high power factor converter, the high power factor converter may be used as a common or regenerative converter but its power harmonic suppression effect will decrease.

■ Outline dimensions

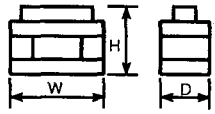
[Unit: mm]

Voltage	Capacity	High Power Factor Converter FR-HC			Reactor 1 FR-HCL01			Reactor 2 FR-HCL02			External Box FR-HCB		
		W	H	D	W	H	D	W	H	D	W	H	D
200V	7.5K	220	300	190	160	155	100	240	230	160	190	320	165
	15K	250	400	190	190	205	130	260	270	170			
	30K	340	550	195	220	230	170	340	320	180	270	450	203
	55K	480	700	250	210	260	225	430	470	360			
400V	7.5K	220	300	190	160	150	100	240	220	160	190	320	165
	15K	250	400	190	190	195	130	260	260	170			
	30K	340	550	195	220	215	140	340	310	180			
	55K	480	700	250	280	255	190	400	380	285	270	450	203

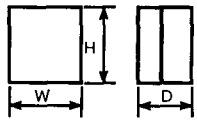
High power factor converter



Reactor 1, 2

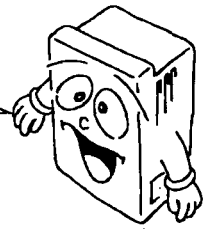


External box



7.3 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-A100E series inverters. For the parameter numbers of the other series, see the corresponding catalog or instruction manual.



● : Indicates that the parameter must be set.

O : Indicates that the parameter may be set as required.

Function	Parameter Number	Name	A Justment of acceleration/deceleration time and pattern	B Motor overheat protection	C Selection of optimum output characteristic for load characteristic	D Limit of output frequency	E Operation over 60Hz	F Adjustment of frequency setting signal and output	G Calibration of frequency meter	H Adjustment of digital frequency meter	I Adjustment of motor output torque	J Multi-speed operation	K Jog operation	L Frequency jump operation	M Reversible operation according to analog signal polarity	N Automatic restart after instantaneous power failure	O Adjustment of brake operation	P Operation timing of magnetic brake	Q Inverter stop at activation of external thermal relay	R Display of speed, etc.	S Function rewrite prevention	T Reverse rotation prevention	U Acceleration/deceleration in the shortest time	V Optimum acceleration/deceleration within continuous rating range	W Energy-saving operation	X Elevator operation	Y Automatic restart at alarm stop	Z Sub-motor operation	AA Commercial power supply-inverter operation mode switch-over function	AB PI control function
Basic functions	0	Torque boost (manual)									●													O		O		●		
	1	Maximum frequency				●	O					O																		
	2	Minimum frequency				●						O																		
	3	Base frequency			●																							●		
	4	Multi-speed setting (high speed)										●																		
	5	Multi-speed setting (middle speed)										●																		
	6	Multi-speed setting (low speed)										●																		
	7	Acceleration time	●																				O	O				●		
	8	Deceleration time	●																				O	O				●		
	9	Electronic thermal O/L relay		●																										
Standard operation functions	10	DC injection brake operation frequency															●													
	11	DC injection brake operation time															●													
	12	DC injection brake voltage															●													
	13	Starting frequency									O															O				
	14	Applied load selection			O																					O				
	15	Jog frequency										O	●																	
	16	Jog acceleration/deceleration time	O										●																	
	17	External thermal O/L relay input																	●											
	19	Base frequency voltage			O																					O				
	20	Acceleration/deceleration reference frequency	●																				O	O						
	21	Acceleration/deceleration time increments	●																				O	O						
	22	Stall prevention operation level									O												O							
	23	Stall prevention operation level at double speed									O												O							
	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										O			●															
	29	Acceleration/deceleration pattern	O																											
	30	High power factor converter connection 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									O																			
	39	Automatic torque boost operation starting current									O																			

Function	Parameter Number	Name	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	AA	AB
		Purpose of Use	Justment of acceleration/ deceleration time and pattern	Motor overheat protection	Selection of optimum output characteristic for load characteristic	Limit of output frequency	Operation over 60Hz	Adjustment of frequency setting signal and output	Calibration of frequency meter	Adjustment of digital frequency meter	Adjustment of motor output torque	Multi-speed operation	Jog operation	Frequency jump operation	Reversible operation according to analog signal polarity	Automatic restart after instantaneous power failure	Adjustment of brake operation	Operation timing of magnetic brake	Inverter stop at activation of external thermal relay	Display of speed, etc.	Function rewrite prevention	Reverse rotation prevention	Acceleration/deceleration in the shortest time	Optimum acceleration/deceleration within continuous rating range	Energy-saving operation	Elevator operation	Automatic restart at alarm stop	Sub-motor operation	Commercial power supply-inverter operation mode switch-over function	PI control function
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								○																				
	50	Second output frequency detection															○													
Display functions	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						●	●																					
	56	Current monitoring reference						●	●																					
Automatic restart functions	57	Restart coasting time														●														
	58	Restart cushion time														●												○		
Additional function	59	Remote setting function selection														●												○		
Operation selection functions	60	Intelligent mode selection																						●	●	○				
	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																									●			
	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																												
Commercial power supply switch-over functions	107	Commercial power supply switching sequence output terminal selection																										●		
	108	MC switching interlock time																										●		
	109	Start waiting time																										●		
	110	Alarm-time commercial power supply switching selection																										●		
	111	Inverter-commercial power supply automatic switch-over frequency																										●		

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	AA	AB
				Justment of acceleration/ deceleration time and pattern	Motor overheat protection	Selection of optimum output characteristic for load characteristic	Limit of output frequency	Operation over 60Hz	Adjustment of frequency setting signal and output	Calibration of frequency meter	Adjustment of digital frequency meter	Adjustment of motor output torque	Multi-speed operation	Jog operation	Frequency jump operation	Reversible operation according to analog signal polarity	Automatic restart after instantaneous power failure	Adjustment of brake operation	Operation timing of magnetic brake	Inverter stop at activation of external thermal relay	Display of speed, etc.	Function rewrite prevention	Reverse rotation prevention	Acceleration/deceleration in the shortest time	Optimum acceleration/deceleration within continuous rating range	Energy-saving operation	Elevator operation	Automatic restart at alarm stop	Sub-motor operation	Commercial power supply-inverter operation mode switch-over function	PI control function
PI control functions	128	Forward-reverse action selection																													●
	129	PI proportional band																													●
	130	Integral time																													●
	131	Upper limit value																													●
	132	Lower limit value																													●
	133	PI control target value setting for PU operation																													●
Auxiliary functionss	145	Parameter unit language switching																													
	155	RT activated condition																													
	156	Stall prevent. select. at regeneration																													
	157	OL signal waiting time																													
	158	AM terminal function selection																													
	159	PWM f decrease at low speed																													
Calibration functions	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					○	●	●																						

MEMO

APPENDICES

This chapter provides matters to be referred to for use of this product.
Always read the precautions, etc., before starting use.

APPENDICES

Appendix 1.
INSTRUCTIONS FOR COMPLIANCE WITH THE EUROPEAN DIRECTIVES (FOR 400V class only. LVD compliant product has CE and TÜV marking.)

1. EMC DIRECTIVE

(1) Our view of inverters for the EMC Directive

An inverter does not function independently. It is a component designed for installation in a control box and for use with another equipment to control a machine or equipment. Therefore, we do not think that the EMC Directive applies directly to inverters. For this reason, we do not place a CE mark on the inverter. CE mark placed on the inverter shows compliance to the Low Voltage Directive. The European power drive manufacturers' organization (CEMEP) also holds this point of view.

(2) Compliance

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

(3) Outline of installation method

It is recommended to install an inverter in the following method:

* Use the inverter with an European Standard-compliant noise filter.
* For wiring between the inverter and motor, use shielded cables or run cables in metal conduit and ground the cables or conduit at the inverter and motor ends. Use the shortest possible cable length.
* Install the inverter in a grounded metal enclosure. The enclosure should prevent radiated noise leakage.
* Insert a line noise filter and ferrite core into the power and control lines as required.

Full information including the European Standard-compliant noise filter specifications are published in the "EMC Installation Guidelines" (manual number BCN- A21041-202). Please contact your sales representative.

2. Low Voltage Directive

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

Inverters are covered by the Low Voltage Directive.

(2) Compliance

We declare we meet Low Voltage Directive and place CE marking on the inverter.
The European verification institution has approved that our inverters conform to DIN VDE0160.

(3) Instructions

To conform to DIN VDE0160, the following specifications and instructions listed are different from those of the standard models.

* The rated input voltage range is 3-phase, 380V to 415V, 50/60Hz.
* Do not use residual current device as the only protection against indirect contact. Protective earth connection is essential.
* Wire the earth terminal independently. (Do not connect two or more cables.)
* Only use EN or IEC compliant no-fuse breaker and magnetic contactors.
* Use the inverter under condition of Over Voltage Category II and Pollution Degree 2 or better.
  1) Insert an EN or IEC Standard-compliant isolation transformer or surge suppressor to make the Over Voltage Category II if power supply over voltage category is III or IV.
  2) Install in a cabinet with IP54 rating or better to have Pollution Degree 2.
* For the input and output of the inverter, only use cables of the type and size set forth in EN60204 Appendix C.
* The rating of the alarm output relay is 30VDC, 0.3A. There is basic insulation between the alarm output relay and the inverter control circuit.

Appendix 2.
INSTRUCTIONS FOR COMPLIANCE WITH THE UL STANDARD
(UL listed product has UL marking.)

1. UL STANDARD

The UL Standard is the most general standard for motor control equipment in the U.S.A. This standard sets forth the safety of equipment, instruments and materials to protect lives and properties from fire, electric shock and other accidents. Inverters are covered by UL508C (Power Conversion Equipment) as part of power conversion equipment.

2. REQUIREMENT OF UL LISTING

In The U.S.A., laws are multiplexed, i. e. there are the federal law and state, municipal and other local laws. The Federal Government provides for only the least required legal regulations and the local governments provide for particulars. Therefore we are not compelled by the federal law to compelled by the federal law to comply with the UL Standard. It should be noted that the laws of several local governments require products to be certified as safe by the UL or other testing institution, and in local gvernments which do not have legal regulations, the minimum requirement of the federal law that "products should be safe" must be fulfilled.

3. INSTRUCTIONS

When using the UL-listed FR-A100E, refer to the following:

(1) Installation
The FR-A100E is UL-listed as a product used in an enclosure. Install it in an enclosure.

(2) Wiring of power supply and motor
When wiring the input (R, S, T) and output (U, V, W) terminals of the inverter, refer to the following list and use the UL-listed round crimping terminals. Use a crimping tool recommended your terminal manufacture to crimping terminals.

Applicable Inverter Model	Screw Size	Tightening Torque kgf · cm	Crimping Terminals		Wires (Note)			
					mm^2		AWG	
			R, S, T	U, V, W	R, S, T	U, V, W	R, S, T	U, V, W
FR-A120E-0.75K to 2.2K	M4	15	2-4	2-4	2	2	14	14
FR-A120E-3.7K	M4	15	5.5-4	5.5-4	3.5	3.5	12	12
FR-A120E-5.5K	M5	26	5.5-5	5.5-5	5.5	5.5	10	10
FR-A120E-7.5K	M5	26	14-5	8-5	14	8	6	8
FR-A120E-11K	M5	26	14-5	14-5	14	14	6	6
FR-A120E-15K	M6	45	22-6	22-6	22	22	4	4
FR-A120E-18.5K	M6	45	38-6	38-6	30	30	2	2
FR-A120E-22K	M8	80	38-8	38-8	38	30	2	2
FR-A120E-30K	M8	80	60-8	60-8	60	50	1/0	1/0
FR-A120E-37K	M10	150	80-10	80-10	80	80	3/0	3/0
FR-A120E-45K	M10	150	100-10	80-10	100	80	4/0	3/0
FR-A120E-55K	M12	250	150-12	125-12	150	125	MCM300	MCM250
FR-A140E-0.75K to 3.7K	M4	15	2-4	2-4	2	2	14	14
FR-A140E-5.5K	M4	15	5.5-4	2-4	3.5	2	12	14
FR-A140E-7.5K	M4	15	5.5-4	5.5-4	3.5	3.5	12	12
FR-A140E-11K	M4	15	5.5-4	5.5-4	5.5	5.5	10	10
FR-A140E-15K/18.5K	M6	45	14-6	8-6	14	8	6	8
FR-A140E-22K	M6	45	22-6	14-6	22	14	4	6
FR-A140E-30K	M8	80	22-6	22-8	22	22	4	4
FR-A140E-37K	M8	80	38-8	22-8	30	22	2	4
FR-A140E-45K	M8	80	38-8	38-8	38	30	2	2
FR-A140E-55K	M8	80	60-8	60-8	50	50	1/0	1/0

Note: Use 75°C copperwires.

(3) Short circuit ratings
The drive is suitable for use on a Circuit Capable of delivering not more than ___*___ RMS Symmetrical Amperes, 500 volts Maximum.

Inverter Capacity	*
0.75kW	1000
1.5kW to 37kW	5000
45kW, 55kW	10000

Appendix 3.
WARRANTY

"WARRANTY"

1. Exceptions to the warranty, such as opportunity losses

We do not warrant to reimburses you or your customers for opportunity losses, damage to produce other than ours, or any other businesses which result from a failure of our product, whether such failure has occured within the free warranty period or not.

2. Repair after production stop

If we stop producing any of our models (products), we will repair such model within seven years after the month of the year when its production is stopped.

3. Delivery condition

It is understood that a standard product which does not include setting and/or adjustment in applications is delivered when it arrives on your promises, and we are not obliged to adjust or test run such product on the spot.

⚠ Application of this product

- This product is not designed or manufactured for use with any equipment or system which will be operated under conditions hazardous to life.
- If you are planning to use this product in any specific application such as passenger mobile, medical, aerospace, atomic, power or submarine junction equipment or system, please refer to our business department.
- This product is manufactured under rigorous quality control. However, safety devices should be installed if this product is applied to any facility that may result in a serious accident or loss due to a failure of this product.
- This product should only be used with a load of three-phase induction motor.

REVISIONS

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

Print Date	*Manual Number	Revision
Feb, 1996	IB (NA) 66603-A	First edition
Nov, 1996	IB (NA) 66603-B	Add warnings and cautions Page A-1 to A-5, 93 Additions • Power harmonic guidelines (Japan)(Page 165) • EMC Directive-compliant noise filter (Page 192) • High power factor converter (Page 78, 79, 80, 193) • Instructions for compliance with the European Directives • Instructions for conformance with the UL Standard Partly add Page 18, 21, 25, 26, 28, 43, 67, 71, 86, 87, 89, 97, 98, 107, 129, 135, 147, 151, 173, 183 Partly modified Page 146, 167, 175, 176

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100

TYPE	FR-A100E EIBUN TORISETU
CODE	1A2G42

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