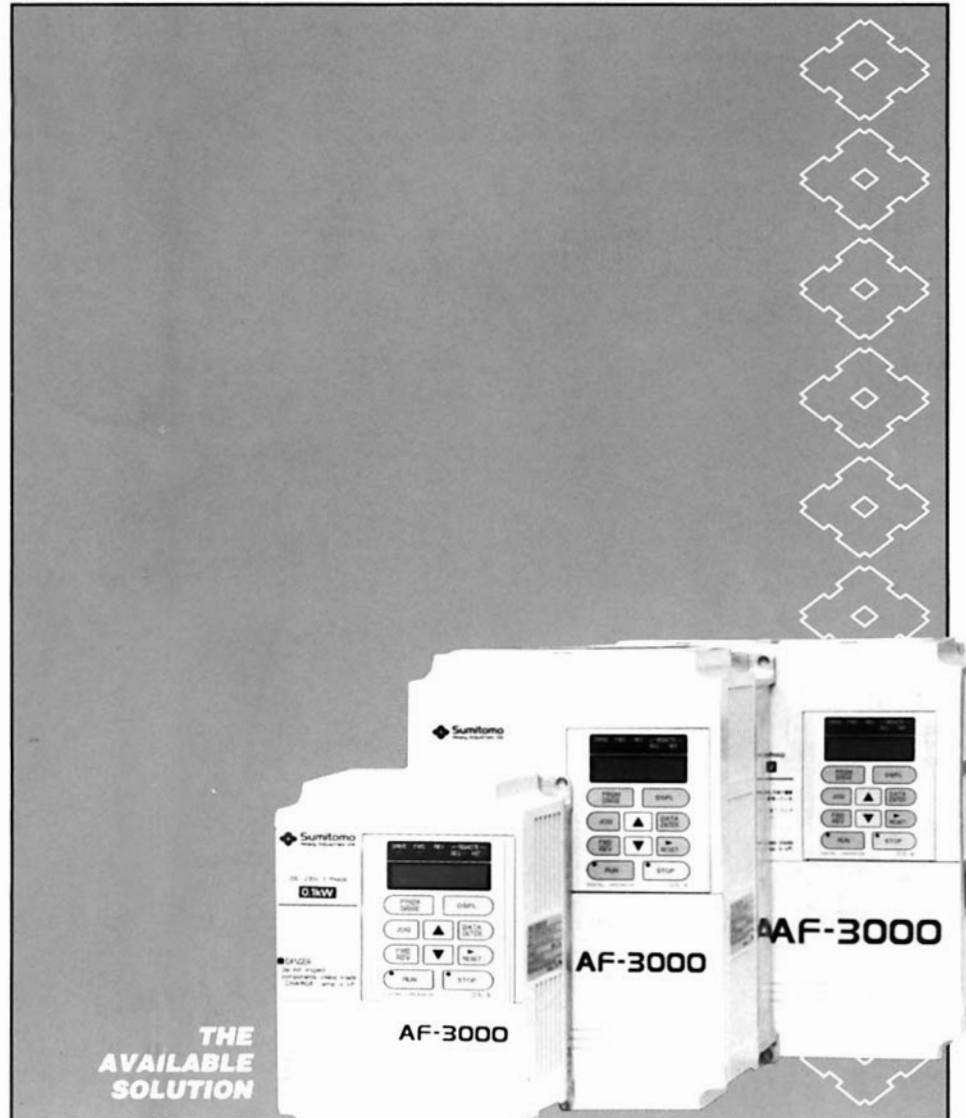
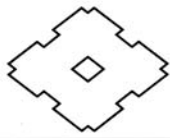


[®]
AF-3000
Compact AC Inverter
Operating & Maintenance Manual



**THE
AVAILABLE
SOLUTION**



DANGER

Voltage is present on capacitors for five minutes after input circuit is open. Risk of electric shock and/or electrical energy-high current levels.

WARNING

Disconnect electrical supply before servicing the electrical system.

Do not change the wiring while power is applied to the circuit.

Do not check signals during operation.

WARNING

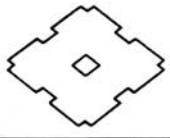
Refer to this manual for connection of circuits and the rating of auxiliary circuits.

Be sure to ground AF-3000 using the ground terminal G(E).

Never connect main circuit output terminals T1(U), T2(V), T3(W) to AC main circuit power supply.

CAUTION

Separate motor overcurrent, overload and overheating protection is required to be provided in accordance with CANADIAN ELECTRICAL CODE, PART I and NEC.



This instruction manual is composed of 2 sections: The first section describes handling, wiring, operation, maintenance/inspection, troubleshooting and specifications of the AF-3000 Digital Compact Inverter. The second outlines the digital operator performance, constants, operation, etc.

Before using the AF-3000, a thorough understanding of this manual is recommended for daily maintenance, inspection and troubleshooting.

In this manual, "constant (No. [])" indicates the item number of control constant set by digital operator.

DANGER

Voltage is present on capacitors for five minutes after input circuit is open. Risk of electric shock and/or electrical energy-high current levels.

WARNING

Disconnect electrical supply before servicing the electrical system.

Do not change the wiring while power is applied to the circuit.

Do not check signals during operation.

WARNING

Refer to this manual for connection of circuits and the rating of auxiliary circuits.

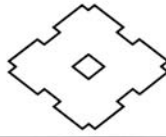
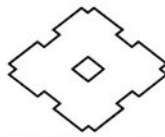
Be sure to ground AF-3000 using the ground terminal G.

Connect the motor to output terminals T1, T2, T3. Connect an AC power supply to input terminals L1, L2, L3 (for 240 V single-phase series, connect only to L1 and L2).

CAUTION

Separate motor overcurrent, overload and overheating protection is required to be provided in accordance with CANADIAN ELECTRICAL CODE, PART I and NEC.

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CAUTION

All the potentiometers of AF-3000 have been adjusted at the factory. Do not change their settings unnecessarily.

Do not make withstand voltage tests on any part of the AF-3000 unit. It is electronic equipment using semiconductors and vulnerable to high voltage.

Make sure to tighten screws on the main circuit and control circuit terminals. Refer to installation instructions for torque values. See par. 1.53 “(5) Wire and terminal screw sizes.”

Handle with care so as not to damage the inverter during transportation.

Do not pick up by the front cover or the unit cover (plastic portion). Use the die-cast portion.

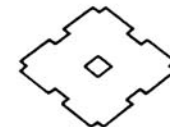
ADVERTISSEMENT

Des tensions subsistent aux bornes des condensateurs pendant cinq minutes après l'ouverture de circuit d'entrée.

Couper l'alimentation avant d'entreprendre le dépannage du système électrique.

ATTENTION

Une protection distincte contre les surintensités, la surcharge et la surchauffe de moteur doit être fournie conformément AU CODE CANADIAN DE L'ÉLECTRICITÉ PREMIER PARTIE et LE NATIONAL DE L'ÉLECTRICITE.



WARNING

Twist wires together before inserting in grounding terminal.

CAUTION

Separate motor overcurrent, overload and overheating protection is required to be provided in accordance with CANADIAN ELECTRICAL CODE, PART I and NEC.

Use 75°C copper wires only.

Low voltage terminals shall be wired with Class I Wiring.

When mounting units in an enclosure, remove the top, bottom and terminal covers.

AVERTISSEMENT

Enroulez les fils ensemble avant de les introduire dans la borne.

Des tensions subsistent aux bornes des condensateurs pendant cinq minutes après l'ouverture de circuit d'entrée.

Couper l'alimentation avant d'entreprendre le dépannage du système électrique.

ATTENTION

Une protection distincte contre les surintensités, la surcharge et la surchauffe de moteur doit être fournie conformément AU CODE CANADIEN DE L'ÉLECTRICITÉ PREMIER PARTIE et LE NATIONAL DE L'ÉLECTRICITE.

The AF-3000 is an ultra-compact, all-digital inverter which provides low noise operation.

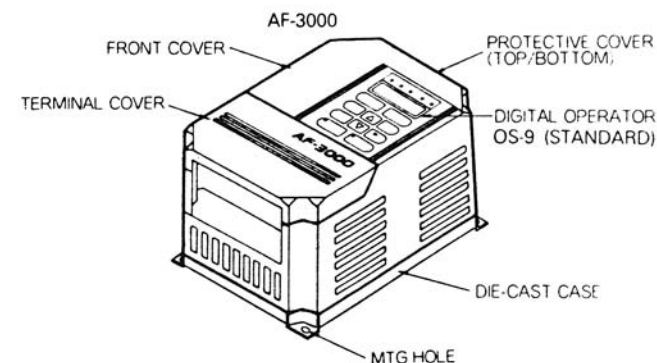
Two types are available : 1) with digital operator or 2) with drive status indicating plate (indicating plate).

The digital operator allows maximum utilization of the drive by providing access to the inverter's program constants and operation variables.

The model with the indicating plate provides status and fault codes while preventing unauthorized access to the programming constants. It is also useful for those applications where the programming operator can be moved from one unit to another.

1.1 PARTS NAMES OF AF-3000

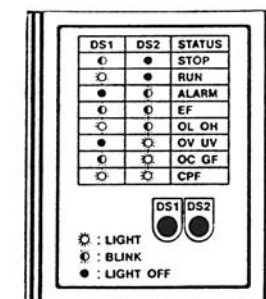
- With digital operator

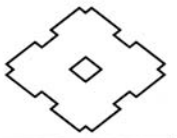


- With indicating cover

The indicating cover shown to the right will be mounted in place of the digital operator which is installed in the unit.

INDICATING COVER





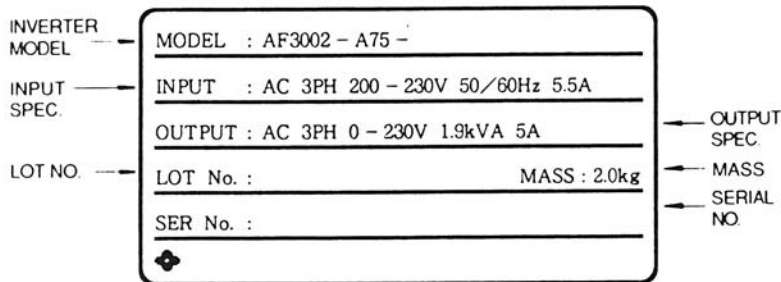
1.2 RECEIVING

This AF-3000 has been put through demanding tests at the factory prior to shipment. After unpacking, check the following.

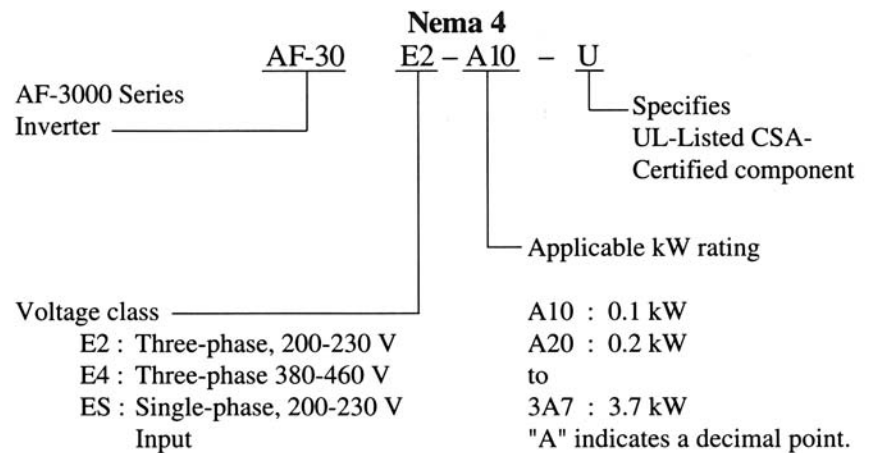
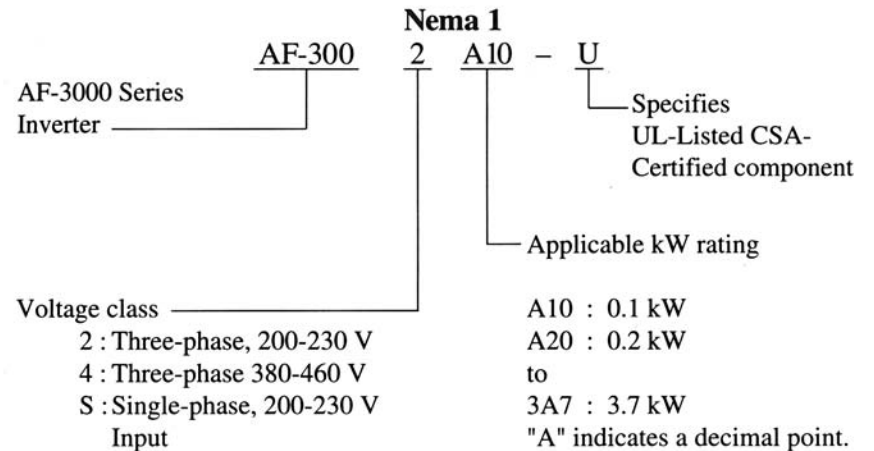
- Verify the part numbers with the purchase order sheet and/or packing slip.
- Transit damage.

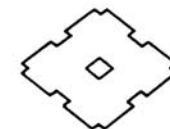
If any part of the AF-3000 is damaged or missing, immediately notify the shipper.

1.2.1 Nameplate Data



1.2.2 Type Designation





INSTALLATION

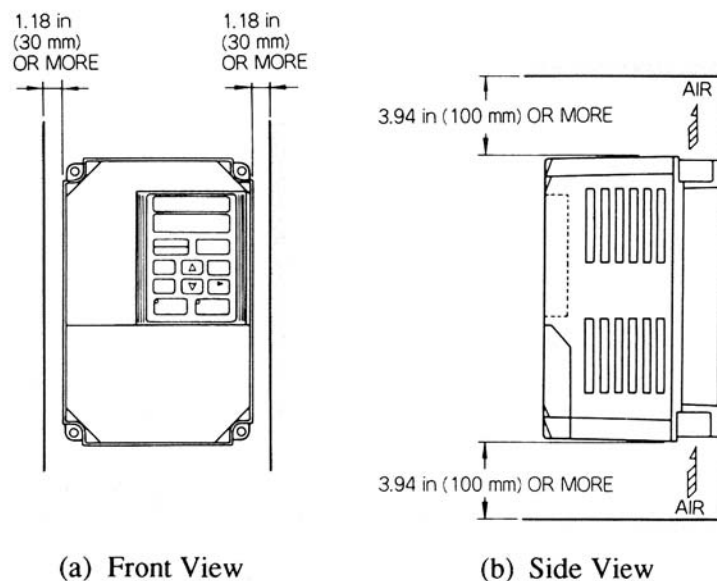
1.3 INSTALLATION

1.3.1 Transportation

- Handle with care so as not to damage the inverter during transportation.
- Do not pick-up by the face plate. Use the die-cast portion.
- Do not drop the inverter.

1.3.2 Mounting Space

Install the AF-3000 vertically and allow sufficient space for effective cooling as shown in Fig. 1.1.



Note : For external dimensions, refer to Par. 1.8.2 "Dimensions in inches (mm)" on page 50.

Fig. 1.1 Mounting Space

1.3.3 Location

Location of the equipment is important to achieve proper performance and normal operating life. The AF-3000 units should be installed in areas where the following conditions exist.

- Ambient temperature : +14 to 104° F, -10 to +40°C.
- Protected from rain, oil mist or moisture.
- Protected from direct sunlight.
- Protected from corrosive gases or liquids.
- Free from airborne dust or metallic particles.
- Free from vibration.
- Free from magnetic noise.
- Protected from high humidity.
- Free from combustibles.

CAUTION

When mounting units in a common enclosure, install a cooling fan or some other means to cool the air entering the inverter below 113° F (45 °C).

WIRING

1.4 WIRING

Connect main circuit and control circuit wiring securely as described in the following.

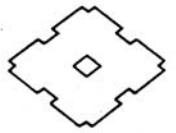
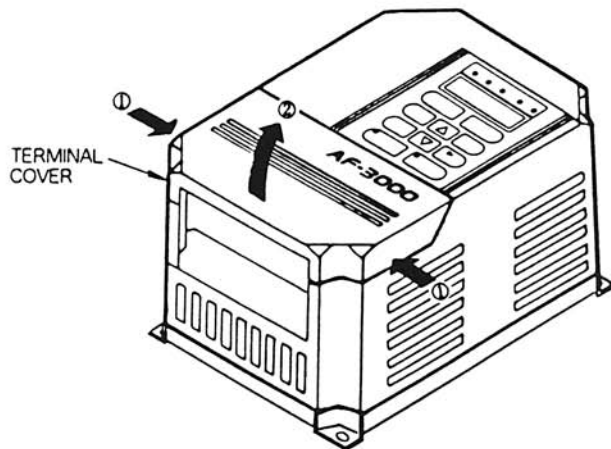
CAUTION

Use UL Listed and CSA Certified closed-loop (ring) connectors sized for the wire gauge involved. The connectors are to be installed using the correct crimp tool specified by the connector manufacturer.

1.4.1 Terminal Cover Mounting/Removing and Terminal Position

Terminal cover mounting/removing

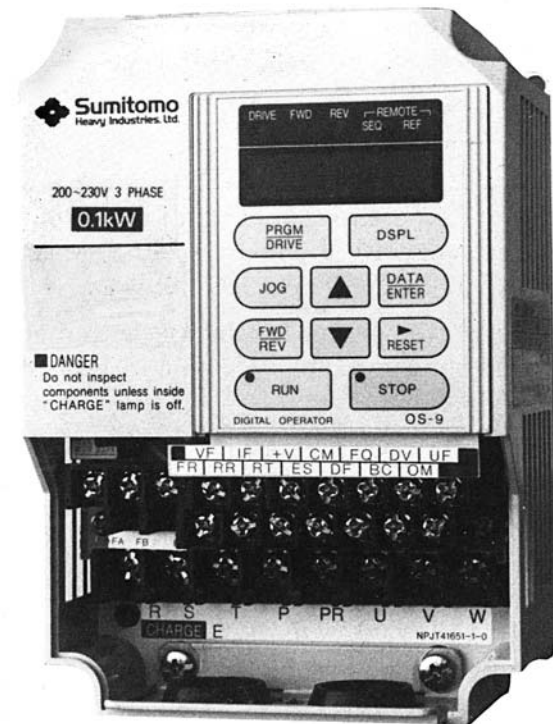
For removing, press the cover in the direction of ① (on both sides) and, at the same time, lift in the direction of ②. For mounting, reverse the method.



Terminal position

Main circuit and control circuit terminal blocks are shown in the photo below. Usually the terminal designations are shown on the terminal nameplate.

For some inverters, the terminal numbers are printed on the printed circuit board.



WIRING

1.4.2 Standard Wiring Diagram

Models with digital operator can be operated from the digital operator only by main circuit wiring. When these models are operated by control circuit terminals, control constant change is required. For details, refer to "OPERATION MODE SELECTION" on page 80.

Models without digital operator (with indicating cover) are preset in operation mode from control circuit terminals at the factory prior to shipping.

"Suitable for use on a circuit capable of delivering not more than 1000 rms symmetrical amperes, 240 V Max." Models AF-3002 or AF-300S -A10, -A20, -A40 only.

"Suitable for use on a circuit capable of delivering not more than 1000 rms symmetrical amperes, 460 V Max." Models AF-3004 -A20, -A40 only.

"Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 240 V Max." Models AF-3002 or AF-300S -A75, -1A5, -2A2, -3A7 only.

"Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 460 V Max." Models AF-3004 -A75, -1A5, -2A2, -3A7 only.

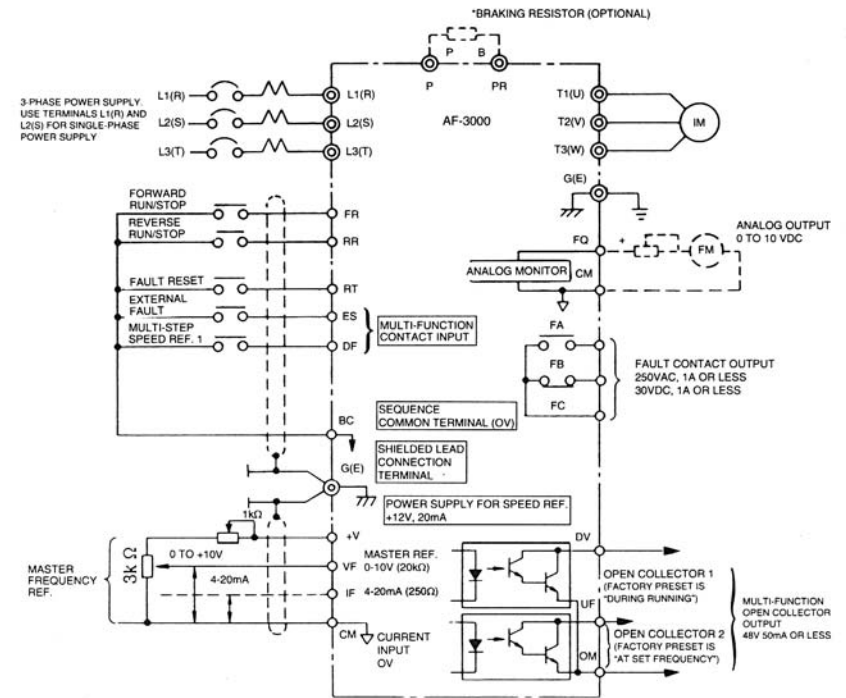
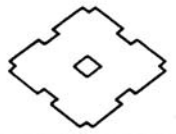


Fig. 1.2 Standard Wiring Diagram

Notes :

1. indicates shielded leads and twisted-pair shielded leads.
 2. External terminal (+V) of +12 V has maximum output current capacity of 20 mA.
 3. Terminal symbols : shows main circuit : shows control circuit
 4. Terminal point (BC) (sequence common) is isolated from terminal point (CM) (OV).
- * Set thermal overload relay between braking resistor and inverter when using braking resistor to protect braking resistor from overheating.
Also, use sequencer to break power supply side on thermal overload relay trip contact when using braking resistor.

WIRING



1.4.3 Main Circuit

(1) Main circuit wiring

Connect wiring as shown in Fig. 1.3.

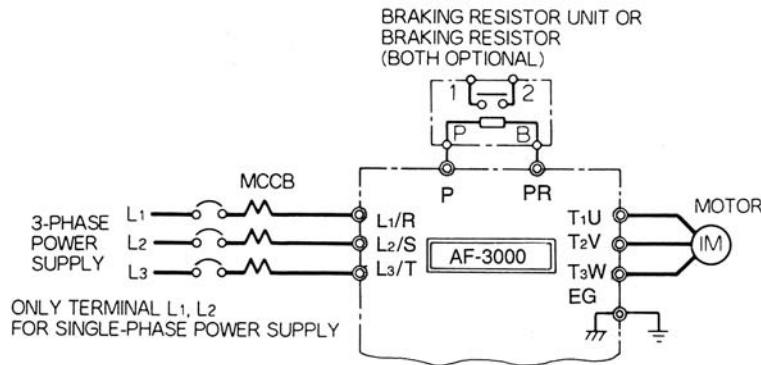


Fig. 1.3 Main Circuit Wiring

(2) Main circuit terminals

Table 1.1 AF-3000 Main Circuit Terminals

Terminal	Description
L1/R	Main circuit power input
L2/S	"L1", "L2" are used for single-phase input specifications.
L3/T	
T1/U	
T2/V	Inverter output
T3/W	
P	Braking resistor or braking resistor unit connector (options)
PR	
E/G*	Grounding (ground resistance should be 100 ohms or less)

* Use screw for frame ground.

• Main circuit terminal arrangement 3-phase series (all models)

L1R	L2S	L3T	P	PR	T1U	T2V	T3W
-----	-----	-----	---	----	-----	-----	-----

240 V single-phase series
0.13 to 2 HP (0.1 TO 1.5 kW)

L1R	L2S		P	PR	T1U	T2V	T3W
-----	-----	--	---	----	-----	-----	-----

BLANK

240 V single-phase series
3/5 HP(2.2/3.7kW)

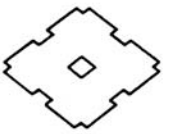
L1R	L2S	P	PR	T1U	T2V	T3W
-----	-----	---	----	-----	-----	-----

(3) Molded-case circuit breaker (MCCB) and power supply magnetic contactor (MC)

Be sure to connect MCCBs between AC main circuit power supply and AF-3000 input terminals (L1/R), (L2/S), (L3/T) to protect wiring. Recommended MCCBs are listed in Table 1.2.

When a ground fault interrupter is used, select one not influenced by high frequency. Setting current should be 200 mA or more and operating time, 0.1 sec or more to prevent malfunctions.

(Example) NV series by Mitsubishi Electric Co., Ltd.
(manufactured in and after 1988),
EGSG series by Fuji Electric., Co., Ltd.
(manufactured in and after 1984)



1.4.3 Main Circuit (Cont'd)

Table 1.2 Molded-case Circuit Breakers and Magnetic Contactors

• 230 V Class 3-phase Input Series

AF-3000	Model AF3002	A10	A20	A40	A75	1A5	2A2	3A7
	Capacity kVA	0.3	0.6	1.1	1.9	2.5	4.2	6.7
	Rated Output Current A	0.8	1.5	3	5	6.5	11	17.5
Molded-case Circuit Breakers		5A	5A	5A	10A	20A	20A	30A

• 240 V Class 1-phase Input Series

AF-3000	Model AF300S	A10	A20	A40	A75	1A5	2A2	3A7
	Capacity kVA	0.3	0.6	1.1	1.9	2.5	4.2	6.7
	Rated Output Current A	0.8	1.5	3	5	6.5	11	17.5
Molded-case Circuit Breakers		5A	5A	10A	20A	20A	40A	50A

• 460 V Class 3-phase Input Series

AF-3000	Model AF3004	A20	A40	A75	1A5	2A2	3A7
	Capacity kVA	0.8	1.2	2	3	3.7	6.1
	Rated Output Current A	1	1.6	2.6	4	4.8	8
Molded-case Circuit Breakers		5A	5A	5A	10A	10A	20A

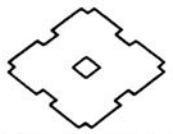
(4) Surge absorber

The surge absorbers should be connected to the coils of control relays, magnetic contactors, magnetic valves, or magnetic brake used for the AF-3000 periphery. Otherwise, large surge voltage occurs at switching and may cause devices to be damaged or to malfunction. Select type from Table 1.3.

Table 1.3 Surge Absorbers

Coils of Magnetic Contactor and Control Relay		Surge Absorber *		
		Model DCR2-	Specifications	Code No.
200 V to 230 V	Large-size Magnetic Contactors	50A 22E	250 VAC 0.5 μ F 200 Ω	C002417
	Control Relay MY-2, -3 (OMRON) HH-22, -23 (Fuji) MM-2, -4(OMRON)	10A 25C	250 VAC 0.1 μ F 100 Ω	C002482
380 to 460 V Units		50D 100B	1000 VDC 0.5 μ F 220 Ω	C002630

* Made by MARCON Electronics.



(5) Wire and terminal screw sizes

- Use 600 V vinyl-sheathed lead or equivalent.
- Use 75°C copper wires only.
- Low voltage terminals shall be wired with Class I Wiring.

Table 1.4 Torque Value and Wire Size for Field Wiring Terminals

● 230 V Class 3-phase Input Series

Circuit	AF-3002	Inverter Capacity (kVA)	Terminal Symbol	Terminal Screw	Wire Size		Torque Nm
					AWG	mm ²	
Main Circuit	A10	0.3	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	A20	0.6	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	A40	1.1	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	A75	1.9	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	1A5	2.5	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	12-10	3.5 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	2A2	4.2	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	12-10	3.5 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
3A7	6.7	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	12-10	3.5 to 5.5	1.43	
		G/E		14-10	2 to 5.5	1.43	
Control Circuit	Common to All Models		Refer to page 22	M3.5	20-14	0.5 to 2	0.95

Table 1.4 Torque Value and Wire Size for Field Wiring Terminals (cont'd)

● 240 V Class Single-phase Input Series

Circuit	AF-300S	Inverter Capacity (kVA)	Terminal Symbol	Terminal Screw	Wire Size		Torque Nm
					AWG	mm ²	
Main Circuit	A10	0.3	L1/R, L2/S, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	A20	0.6	L1/R, L2/S, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	A40	1.1	L1/R, L2/S, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	A75	1.9	L1/R, L2/S, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	1A5	2.5	L1/R, L2/S, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	2A2	4.2	L1/R, L2/S, P, PR, T1/U, T2/V, T3/W	M5	12-8	3.5 to 8	2.24
			G/E		14-8	2 to 8	1.43
3A7	6.7	L1/R, L2/S, P, PR, T1/U, T2/V, T3/W	M5	10-8	5.5 to 8	2.24	
		G/E		14-8	2 to 8	1.43	
Control Circuit	Common to All Models		Refer to page 22	M3.5	20-14	0.5 to 2	0.95

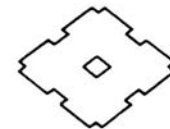


Table 1.4 Torque Value and Wire Size for Field Wiring Terminals (cont'd)

● 460 V Class 3-phase Input Series

Circuit	AF-3004	Inverter Capacity (kVA)	Terminal Symbol	Terminal Screw	Wire Size		Torque Nm
					AWG	mm ²	
Main Circuit	A20	0.8	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	A40	1.2	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	A75	2	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	1A5	3	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	2A2	3.7	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
	3A7	6.1	L1/R, L2/S, L3/T, P, PR, T1/U, T2/V, T3/W	M4	14-10	2 to 5.5	1.43
			G/E		14-10	2 to 5.5	1.43
Control Circuit	Common to All Models		Refer to page 22	M3.5	20-14	0.5 to 2	0.95

IMPORTANT

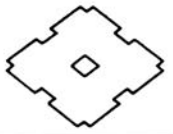
- Lead size should be determined considering voltage drop of leads. Voltage drop can be obtained by the following equation : select such lead size that voltage drop will be within 2% of normal rated voltage.

$$\begin{aligned} &\text{phase-to-phase voltage drop (V)} \\ &= \sqrt{3} \times \text{lead resistance } (\Omega/\text{km}) \times \text{wiring distance (m)} \\ &\quad \times \text{current (A)} \times 10^3 \end{aligned}$$

- Insertion of power supply coordination AC reactor
When the power supply capacity exceeds 600 kVA, connect an AC reactor at the inverter input side for power supply coordination. This reactor is also effective for power factor improvement of the power supply.

- Wiring length between inverter and motor
If total wiring distance between inverter and motor is excessively long and inverter carrier frequency (main transistor switching frequency) is high, harmonic leakage current from the cable will increase to affect the inverter unit or peripheral devices. If the wiring distance between inverter and motor is long, reduce the inverter carrier frequency as shown below. Carrier frequency can be set by constant No. 40. For details, refer to "CARRIER FREQUENCY" on page 102. Carrier frequency is set to 10 kHz at the factory prior to shipping.

Wiring Distance between Inverter and motor	Up to 30 m	Up to 50 m	Up to 100 m	100 m or more
Allowable Carrier Frequency (Constant No. 40 set value)	15 kHz or less (6)	10 kHz or less (4)	5 kHz or less (2)	2.5 kHz or less (1)



(6) Wiring

(a) Main circuit input/output

- (1) Phase rotation of input terminals $(L1/R)$, $(L2/S)$, $(L3/T)$ is available in either direction, clockwise or counterclockwise.
- (2) When inverter output terminals $(T1/U)$, $(T2/V)$, and $(T3/W)$ are connected to motor terminals $(T1/U)$, $(T2/V)$, and $(T3/W)$, respectively, motor rotates counterclockwise, when viewed from opposite drive end, upon forward run command. To reverse the rotation, interchange any two of the motor leads.
- (3) Never connect AC main circuit power supply to output terminals $(T1/U)$, $(T2/V)$, or $(T3/W)$. Inverter may be damaged.
- (4) Care should be taken to prevent contact of wiring leads with the AF-3000 cabinet, for a ground fault or a short-circuit may result.
- (5) Insert an L noise filter to the AF-3000 output, but never connect power factor correction capacitor, LC or RC to AF-3000 output.
- (6) Be sure to tighten the main circuit terminal screws.
- (7) Be sure to separate the main circuit wiring from inverter and peripheral device control lines. Otherwise, it may cause the devices to malfunction.

(b) Grounding

Ground the casing of the AF-3000 using ground terminal G/E.

- (1) Ground resistance should be 100Ω or less.
- (2) Never ground AF-3000 in common with welding machines, motors, or other large-current electrical equipment, or a ground pole. Run the ground lead in a conduit separate from leads for large-current electrical equipment.
- (3) Use ground leads which comply with AWG standards and keep length as short as possible.
- (4) Where several AF-3000 units are used side by side, all the units should be grounded as shown in (a) or (b) of Fig. 1.4. Do not form a loop with the ground leads as shown in (c).

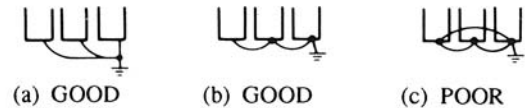
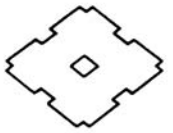


Fig. 1.4 Grounding of Three AF-3000 Units



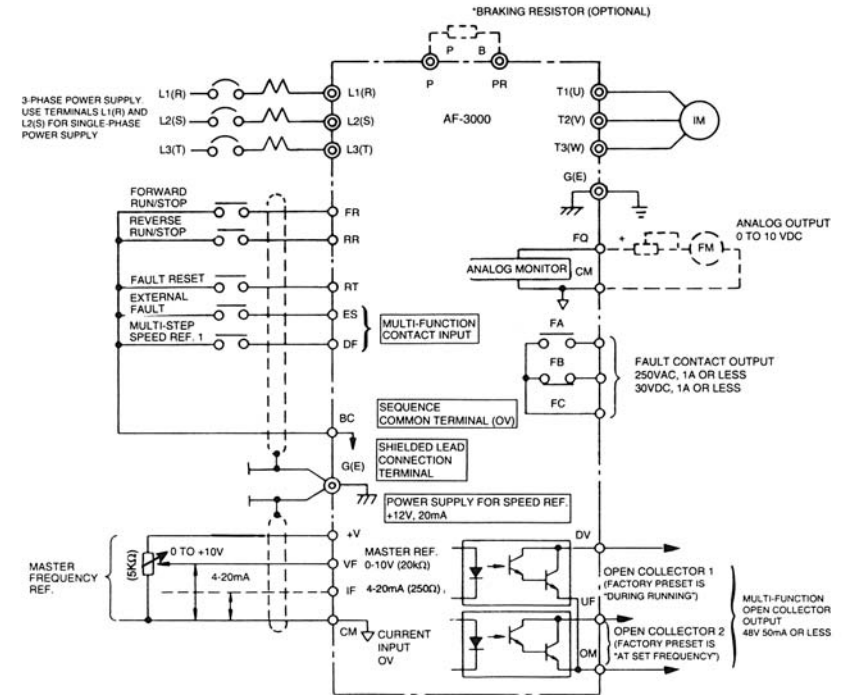
1.4.4 Control Circuit

CAUTION

Low voltage terminals shall be wired with Class I Wiring.

(1) Control circuit wiring

The control signals are connected by screws. Fig. 1.5 shows the relation between the I/O signals (factory pre-set values) and screw terminal numbers. The terminal functions shown in the figure indicate standard setting prior to shipping. Since operation mode from the digital operator is set for the model with the digital operator, it is necessary to change the control constants when operation is performed from the control circuit terminals. For details, refer to "OPERATION MODE SELECTION" on page 80. For the model without digital operator (with indicating cover), operation mode from the control circuit terminals is the standard setting preset at the factory prior to shipping.



Notes :





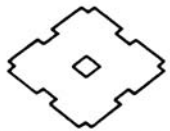
1.  indicates shielded leads and  twisted-pair shielded leads.
2. Terminal symbols :  shows main circuit ;  shows control circuit.

Fig. 1.5 Control Circuit Wiring



(2) Control circuit terminals (factory preset)

Table 1.5 Control Circuit Terminal Functions

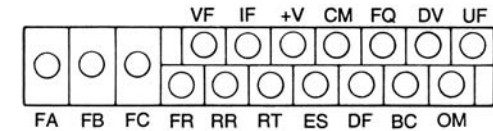
Classification	Terminal	Signal Name	Function	Signal Level	
Sequence Input Signal	FR	Forward run /stop signal	Forward run at "closed", stop at "open"	Photo-coupler insulation input 24 VDC 8 mA	
	RR	Reverse run/stop signal	Reverse run at "closed", stop at "open"		
	RT	Fault reset input	Reset at "closed"		Multifunction contact input: 2 signals available to select
	ES*	External fault	Fault at "closed"		
	DF*	Multi-step speed ref. 1	Effective at "closed"		
	BC	Sequence control input common terminal	—		
Analog Input Signal	+V	Power supply terminal for frequency setting	Speed ref. power supply	+12 V (Allowable current 20 mA max.)	
	VF	Frequency ref.	0 to +10V/Max. output frequency	0 to +10 V (20k Ω)	
	IF		4 to 20 mA/Max. output frequency	4 to 20 mA (250 Ω)	
	CM	Common terminal for control circuit	0V	—	
Sequence Output Signal	DV	During running	"L" level at run	Multi-function photo-coupler output: two signals available to select †	
	UF	Frequency agreed signal	"L" level at set frequency=output frequency		
	OM	Photo-coupler output common			
	FA	Fault signal contact output	*Closed* between A and C at fault *Open* between B and C at fault	Contact capacity 250 VAC : 1A or less 30 VDC: 1A or less	
	FB				
FC	Fault signal contact output common				
Analog Output Signal	FQ	Frequency meter	0 to 10 V/max. output frequency Possible to select current meter output. ‡	0 to 11 V max. 2 mA or less	
	CM	Common			

* For details, refer to "MULTIFUNCTION CONTACT INPUT FUNCTION SELECTION" on page 94.

† For details, refer to "MULTIFUNCTION PHOTO-COUPLER OUTPUT FUNCTION" on page 98.

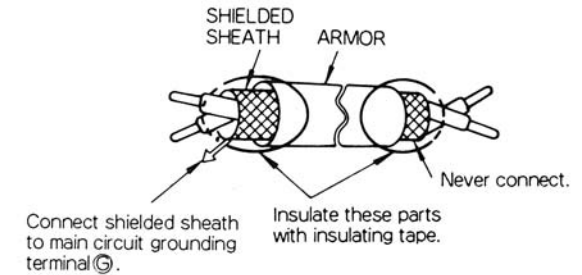
‡ For details, refer to "MULTIFUNCTION ANALOG OUTPUT MONITOR SETTING" on page 90.

• Control circuit terminal arrangement

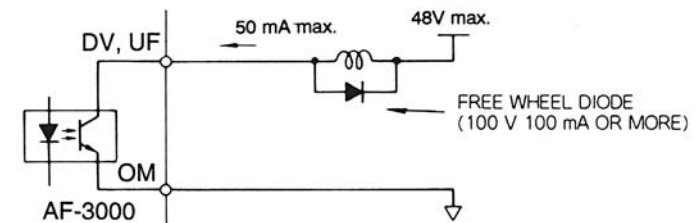


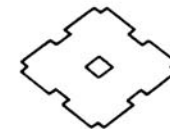
(3) Precautions on control circuit wiring

- Separate the control signal line from power lines. Otherwise, it may cause a malfunction.
- For frequency setting signal (analog), use shielded lead and conduct termination sufficiently.



- Wiring length of the control signal line must be 50 m or less.
- To drive the contact input signal by transistor, use one having ratings of 50 V 50 mA or more. Circuit leakage current at signal OFF must be 300 μ A or less.
- To drive an inductive load (relay coil, etc.) by multifunction photocoupler output, be sure to insert a free wheel diode.





1.5 OPERATION

1.5.1 Pre-operation Check

Check the following items after completion of installation and wiring :

- (1) Proper wiring.
Double check that the power supply is not connected to the output terminals (T1/U) , (T2/V) and (T3/W) .
- (2) No shortcircuit due to wiring contamination (dust, oil, etc.).
- (3) Screws and terminals are tightened.
- (4) For safe operation, the motor should be uncoupled from the load. Pay close attention to output current when the motor is operated with the load coupled.
- (5) Wiring is not grounded.
- (6) Run command is not input.
When the forward/reverse run command is input in the operation mode (factory setting for the model with indicating cover) from the control circuit terminal, the motor is activated automatically after the main circuit power supply is turned on. Turn on the inverter only after making sure that the run command is not input.

1.5.2 Pre-operation Setting

Since the standard inverter models are provided with the values indicated in Par.2.8 (see page 70 and beyond), the digital operator (OS-9) must be used in order to change the constants from the initial values to the values in accordance with the load specifications.

- (1) Preset values prior to shipping
The following describes the functions and initial constant set values which are often used for operation.
 - (a) Output frequency and accel/decel time
The maximum output frequency is set to 60 Hz and accel/decel time to 5 seconds at the factory prior to shipping. To change the values, refer to "ACCEL/DECEL TIME SETTING" on page 87.

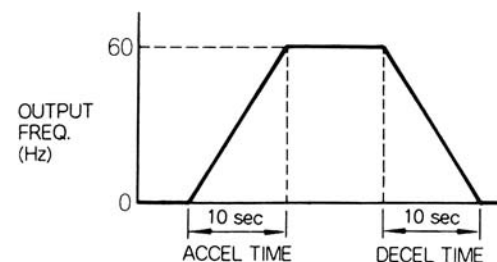
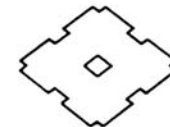


Fig. 1.6 Output Frequency and Accel/Decel Time



(b) Frequency setting signal and output frequency

Fig. 1.7 shows the inverters output frequency change as a result of changes of the input voltage signal at terminal (VF) or current at terminal (IF)

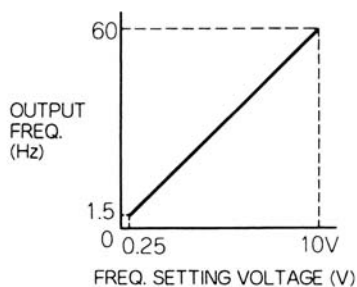
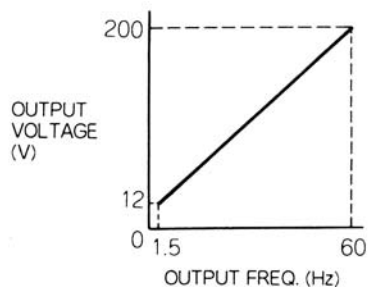


Fig. 1.7 Frequency Setting Signal and Output Frequency

(c) V/f characteristics

Fig. 1.8 shows the output voltage for inverter output frequency. When its characteristic (max. voltage / frequency) differs from that of the optimum motor, refer to "V/f CHARACTERISTIC SETTING" on page 84.



Note : For 460 V class, the value is twice that of 230 V class.

Fig. 1.8 V/f Characteristics

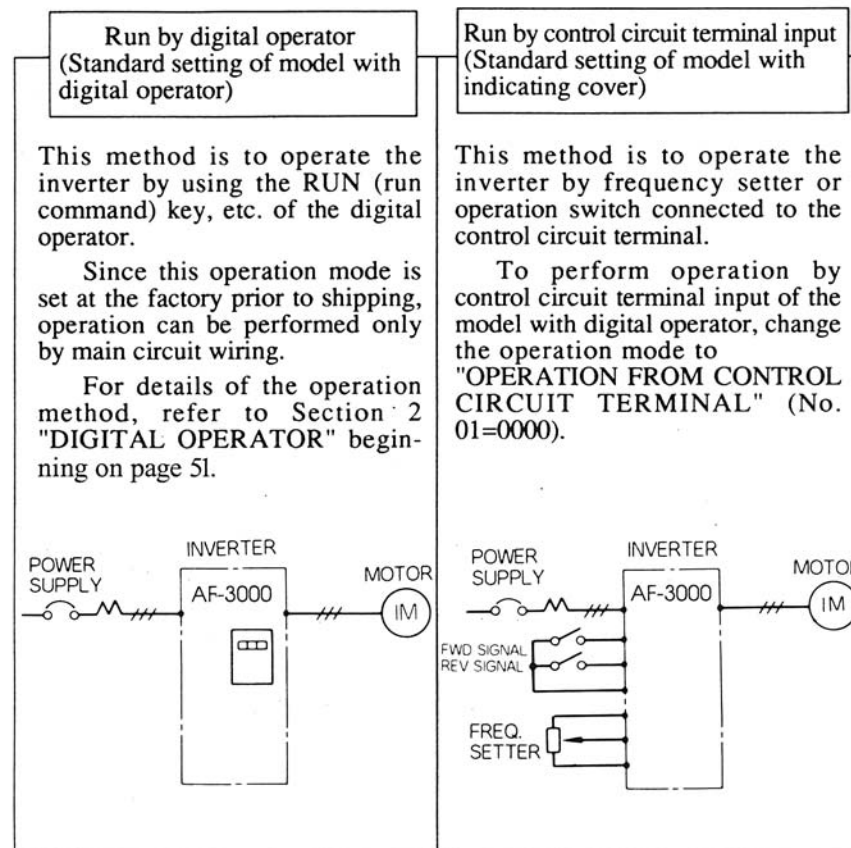
(2) Motor rated current setting

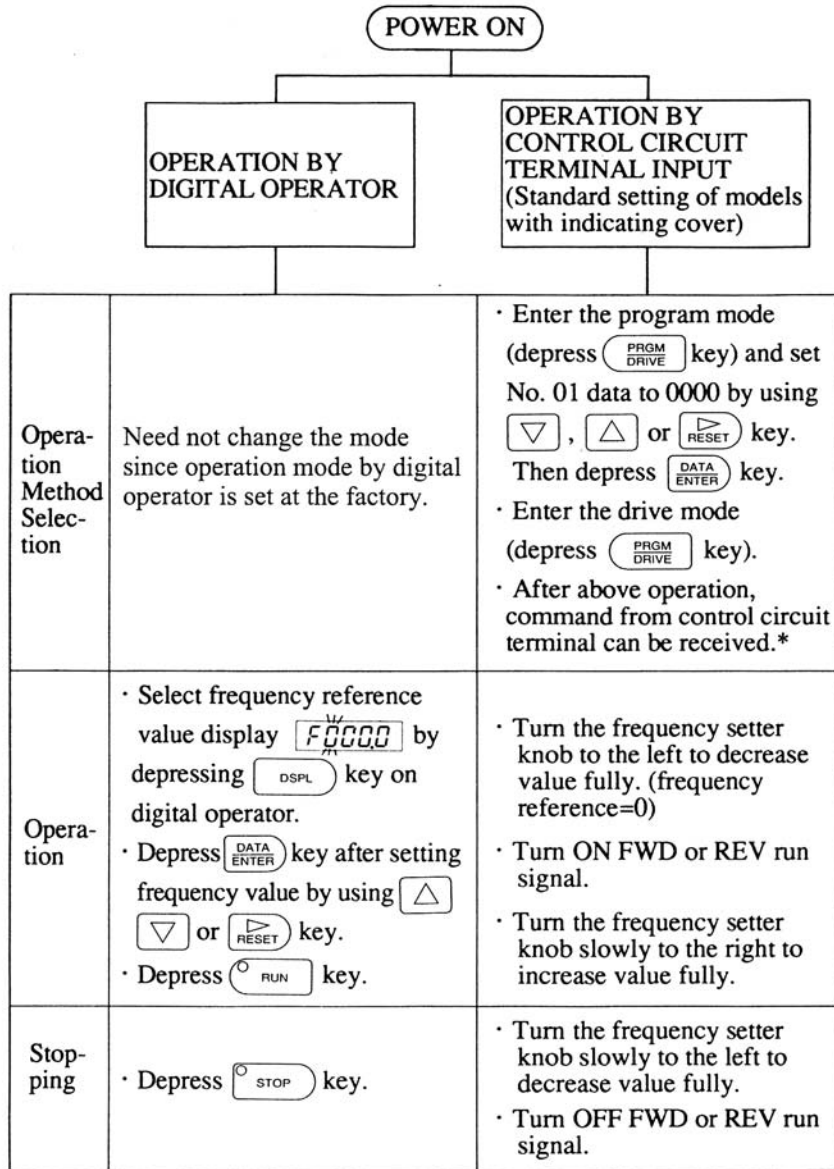
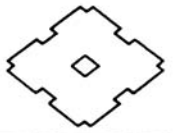
Since the inverter is provided with an electronic thermal overload to protect the motor from overheating, the motor rated current should be programmed into constant (No. 19). Typical 4-pole motor current value is set as the initial value. For details, refer to "ELECTRONIC THERMAL OVERLOAD FUNCTION" on page 88.

Note : Provide a thermal overload relay or thermal protector for each motor when more than one motor is operated simultaneously from a single inverter.

1.5.3 Test Run Method

The inverter can be operated in the following two ways. The model with digital operator is set to "OPERATION MODE BY DIGITAL OPERATOR" and the model without digital operator (with indicating cover) is set to "OPERATION MODE FROM CONTROL CIRCUIT TERMINAL" prior to shipping.





*Not applicable for models without digital operator.

Note : Refer to Par. 2.4 "DIGITAL OPERATOR OPERATION EXAMPLE" (page 60) for details of digital operator operation.

1.5.4 Inverter Status Display LEDs

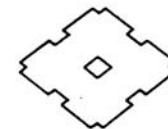
With the model without digital operator, LEDs provided for the inverter are of help to know the inverter status. These LEDs can be seen through the indicating cover on the inverter front side. There are two LEDs : green (DS1) and red (DS2). Inverter status can be seen by these two LED lighting modes. Table 1.6 shows the LED lighting modes and the contents. Check that the inverter is in the normal status at power ON in the test run stage.

Table 1.6 LED Display and Contents

Inverter Status	LED Display		Display Contents	Remarks
	DS1 (GR)	DS2 (RD)		
Normal			Operation ready (during STOP)	—
			During normal RUN	
Alarm			Undervoltage (UV), external B.B, while stopped.	Automatic recovery by protective operation release
Protective operation			Inverter external fault (EF is input.)	Can be reset after removing the cause of fault.
			Overload protection such as inverter overload (OL), fin overheat, etc.	
			Voltage protection such as overvoltage (OV), undervoltage (UV)	
Inverter fault			Overcurrent protection (OC) Ground fault (GF)	Cannot be reset.* (Replace the inverter.)
			Digital hardware memory fault (CPF)	
			Hardware fault such as control power supply fault, CPU runaway, etc.	Cannot be reset. (Replace the inverter.)

● : LED light off, : LED blink, : LED light.

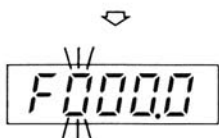
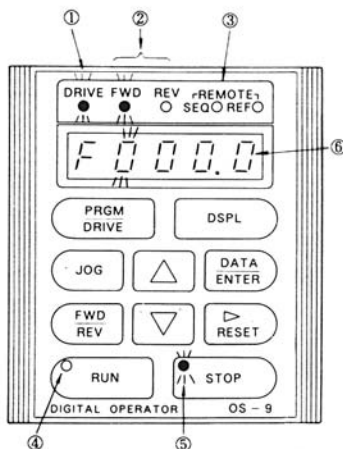
*By initializing control constants using the digital operator, errors may be reset. For details of constant initialization, refer to "PASSWORD SETTING" on page 79.



1.5.5 Digital Operator Display

When the inverter power supply is turned ON for the first time, the digital operator displays as shown below. If an alarm is displayed, refer to Par 1.7 "FAULT DISPLAY AND TROUBLESHOOTING" on page 34 to remove the factor. For details of the digital operator display, refer to Par. 2.2 "DESCRIPTION OF DIGITAL OPERATOR DISPLAY AND OPERATING SECTIONS" on page 52. (in this paragraph, the status is where no command is input to the inverter).

- ① Drive mode display (DRIVE) : Lights.
- ② Rotating direction display (FWD) : Lights. (REV) : Extinguished.
- ③ REMOTE mode display (REMOTE SEQ, REF) : Extinguished.
- ④ During RUN display (RUN) : Lights.
- ⑤ During STOP display (STOP) : Lights.
- ⑥ 7-segment LED display (5 digits) : Output frequency reference set value




1.5.6 Check Points at Test Run

The following describes the check points at test run. If any fault occurs, recheck the wiring and load status. For details, refer to Par.1.7.3 "Corrective Action for Motor Faults" on page 40.

- Motor rotates smoothly.
- Motor rotates in the proper direction.
- Motor does not have any abnormal vibration or beat.
- Acceleration or deceleration goes smoothly.
- Current suitable for load flows.
- Status display LEDs or digital operator display is proper.

PRECAUTIONS

- (1) The motor does not start up if both FWD and REV run signals are turned ON simultaneously. If they are turned ON simultaneously during run, the motor stops according to the stopping method selection of constant (No.01) 3rd digit. (Deceleration to a stop is selected for factory setting.)
- (2) When output frequency is reduced to 1.5 Hz (preset value prior to shipping) at deceleration, the DC injection braking operates for 0.5 second (preset value prior to shipping) and metallic noise is generated by the motor. However, this noise is normal. To eliminate this noise, refer to "DC INJECTION BRAKING" on page 99.
- (3) If a fault occurs during acceleration or deceleration and the motor coasts to a stop, check the motor stop and then the following items. For details, refer to Par. 1.7 "FAULT DISPLAY AND TROUBLESHOOTING" on page 34.
 - Load is not excessively large.
 - Accel/decel time is long enough for load.
- (4) Resetting must be performed by fault reset input signal (or  key of the digital operator) or by turning OFF the power supply.
- (5) If an input contactor is used to stop and start the inverter, the maximum number of starts/hour is 1.