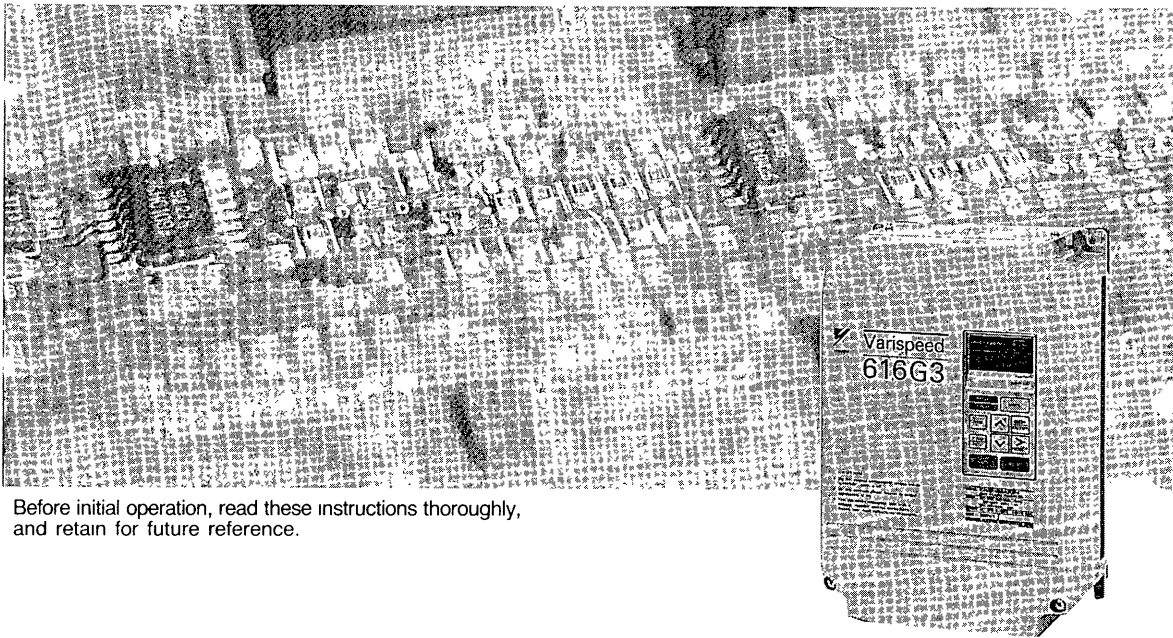


# GENERAL-PURPOSE INVERTER Varispeed-616G3 INSTRUCTIONS

200 to 230V, 0.5 to 30HP (0.4 to 22kW) 1.4 to 41kVA  
380 to 460V, 0.5 to 60HP (0.4 to 45kW) 1.4 to 82kVA



Before initial operation, read these instructions thoroughly,  
and retain for future reference.



YASKAWA



UL Listed



CSA Certified

TOA-S616-6.1E



692-538

An inverter is a device which converts three-phase AC commercial power supply to DC with an inverter section, producing AC variable frequency voltage from this converted DC.

This AC variable frequency voltage can then be used for speed control of three-phase squirrel-cage induction motors.

### WARNING

- 1) After turning OFF the main circuit power supply, do not touch circuit components until "CHARGE" lamp is extinguished. The capacitors are still charged and can be quite dangerous.
- 2) Do not connect or disconnect wires and connectors while power is applied to the circuit.
- 3) Do not check signals during operation.
- 4) Be sure to ground VS-616G3 using the ground terminal G (E).
- 5) Never connect main circuit output terminals T1 (U), T2 (V), T3 (W) to AC main circuit power supply.

### CAUTION

- 1) All the constants of VS-616G3 have been adjusted at the factory. Do not change their settings unnecessarily.
- 2) Do not perform any dielectric tests on any part of the VS-616G3 unit. The VS-616G3 contains semi-conductor devices and is vulnerable to damage from high voltage.
- 3) The control PC board employs CMOS ICs which are easily damaged by static electricity. Do not touch the CMOS elements.
- 4) Make sure to tighten screws on the main circuit and control circuit terminals.

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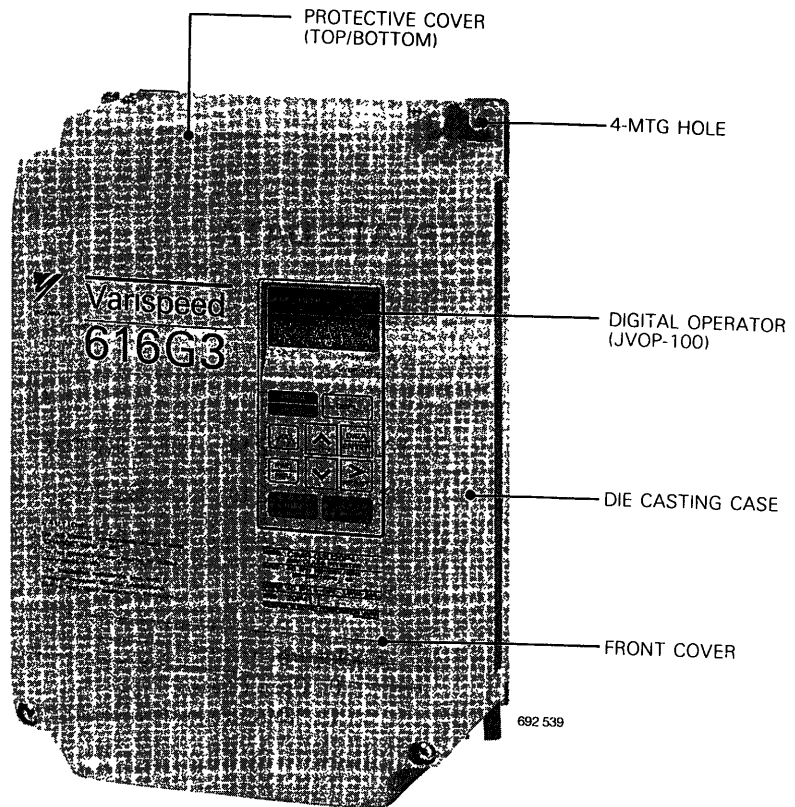
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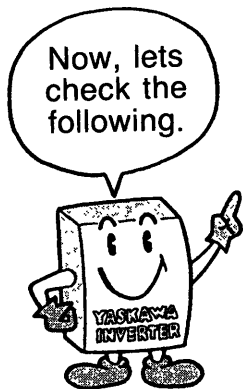
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# VS-616G3 CONFIGURATION



VS-616G3

## RECEIVING



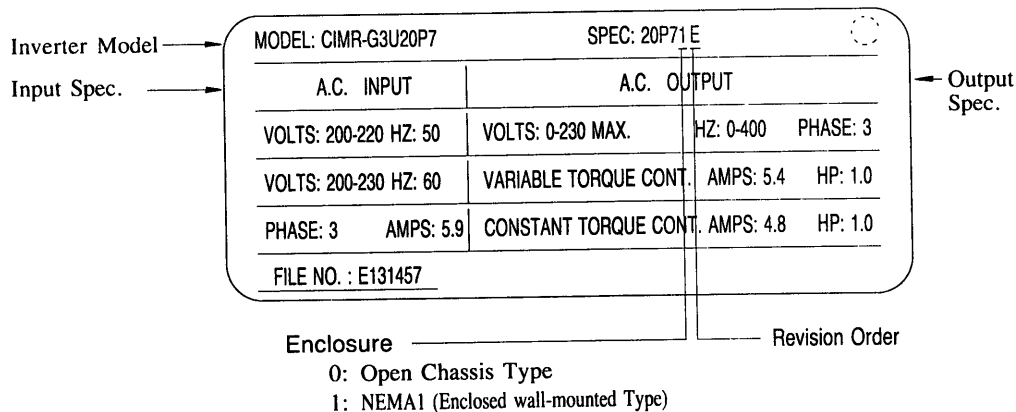
This VS-616G3 has been put through demanding tests at the factory before shipment. After unpacking, check the following:

- Verify that the received product matches the purchase order sheet (invoice) and/or packing slip.
- Transit damage.

If any part of the VS-616G3 is damaged or missing, immediately notify the shipper.

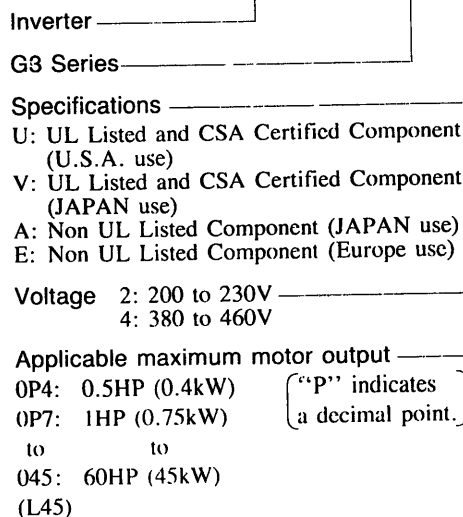
### NAMEPLATE DATA

Example



### MODEL DESIGNATION

**CIMR - G3 U 2 0P7**



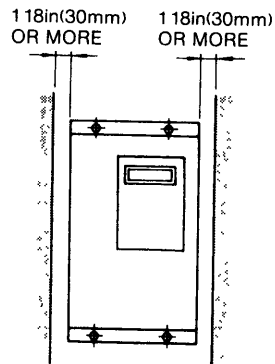
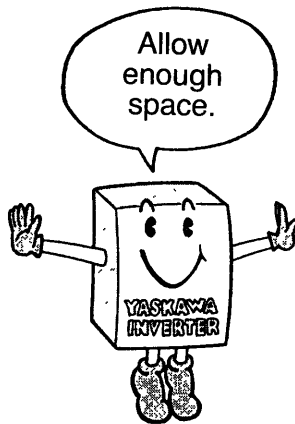
# INSTALLATION

## CAUTION

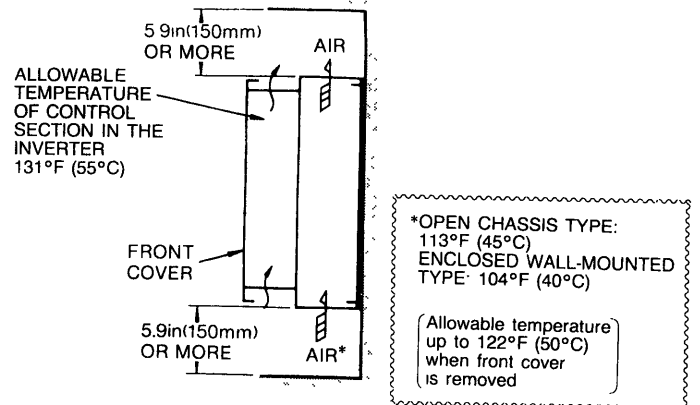
- Never move, lift or handle the VS-616G3 cabinet by the front cover.
- Lift the cabinet from the bottom.
- Do not drop the inverter.

## MOUNTING SPACE

Install the VS-616G3 vertically and allow sufficient space for effective cooling as shown in Fig. 1.



(a) Front View



(b) Side View

Note: For product external and mounting dimensions, refer to APPENDIX B "DIMENSIONS" on page 31.

Fig. 1 Minimum Mounting Space

## LOCATION

Location of the VS-616G3 is important in achieving proper performance and normal operating life. The VS-616G3 should be installed in an area where the following conditions exist.

- Protection from rain or moisture.
- Protection from direct sunlight.
- Protection from corrosive gases or liquids.
- Free from airborne dust or metallic particles.
- Free from vibration.
- Free from magnetic noise (e.g. welding machines, power units)
- Ambient temperature:
  - + 14 to 104°F, - 10 to + 40°C (For enclosed type),
  - + 14 to 113°F, - 10 to + 45°C (For open chassis type)
- Free from combustible materials, gases, etc.

### CAUTION

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



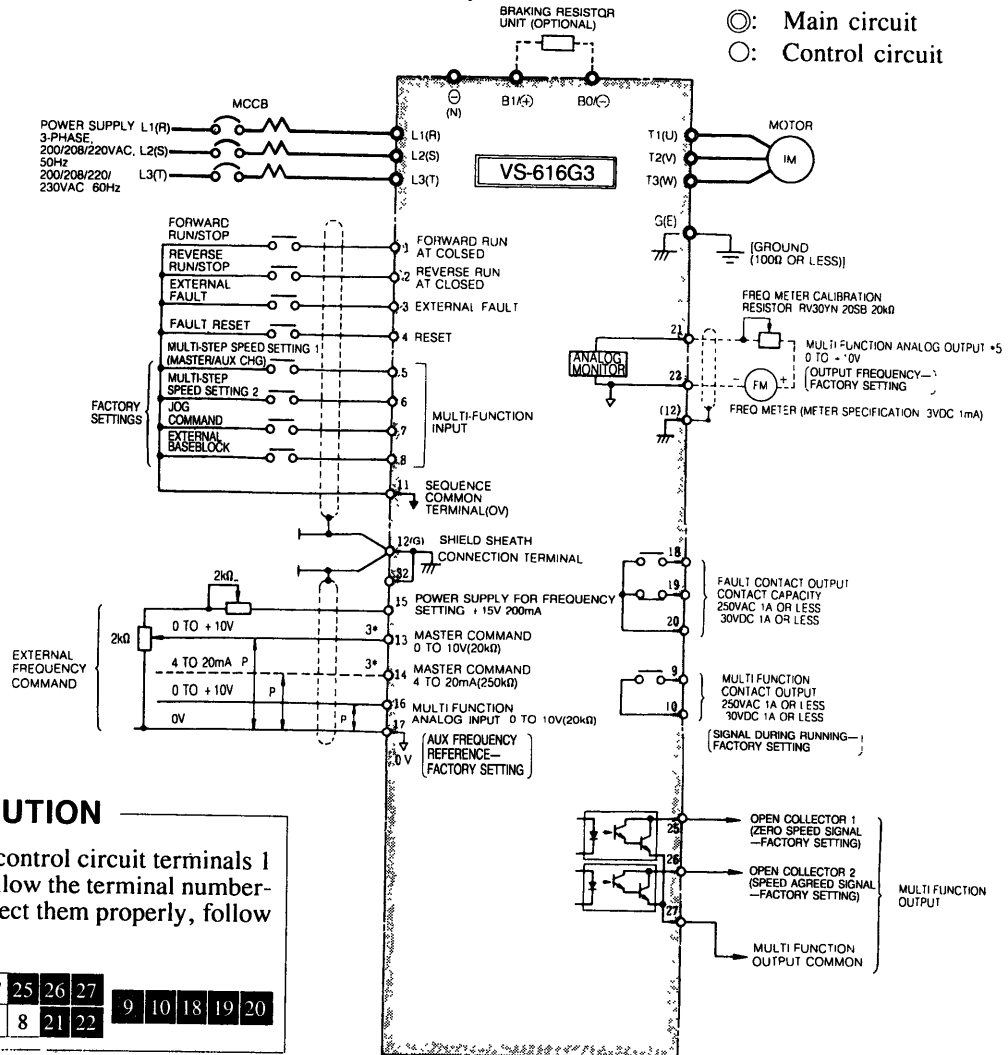
# WIRING

## CONNECTION DIAGRAM

### IMPORTANT

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

The following shows an interconnection diagram of the main circuit and control circuit. With the digital operator, the motor can be operated by wiring the main circuit only.



### CAUTION

The connections of control circuit terminals 1 through 27 do not follow the terminal numbering order. To connect them properly, follow the figure below.

11	12(G)	13	14	15	16	17	25	26	27
1	2	3	4	5	6	7	8	21	22
							9	10	18
									19
									20

- Notes:
1. indicates shielded leads and indicates twisted-pair shielded leads.
  2. Control circuit terminal 15 of +15V has a maximum output current capacity of 20mA.
  3. Either external terminal 13 or 14 can be used. (For simultaneous inputs, the two signals are added internally.)
  4. Multi-function analog output should be used for monitoring meters such as an output frequency meter and should not be used for the feedback control system. Use analog monitor cards (Model AO-08 or AO-12) for the control system.
  5. Control circuit terminal 12 (G) is frame ground of the unit.
  6. Switching between master frequency command at external terminal 13 or 14 and aux frequency command at 16 corresponds to the master/aux. selection contact input

Fig. 2 Connection Diagram

MAIN CIRCUIT

MAIN CIRCUIT TERMINALS

230V Class

Model CIMR- Max Applicable Motor Output	G3□20P4 to 27P5	G3□2011 to 2022
		0.5 to 10HP (0.4 to 7.5kW)
Terminals		
L1 (R)	Main circuit input power supply	
L2 (S)		
L3 (T)		
T1 (U)	Inverter output	
T2 (V)		
T3 (W)		
B0(⊖)	—	Braking resistor unit (B1/⊕-B0/⊖)
B1/⊕	Braking resistor unit (B1/⊕-B2)	
B2		—
⊖		
ℓ <sub>1</sub>	—	Cooling fan power supply
ℓ <sub>2</sub>		
G (E)	Ground terminal	

460V Class

Model CIMR- Max Applicable Motor Output	G3□40P4 to 47P5	G3□4011, 4015	G3□4018 to 4045, 4L45
		0.5 to 10HP (0.4 to 7.5kW)	15HP (11kW), 20HP (15kW)
Terminals			
L1 (R)	Main circuit input power supply		
L2 (S)			
L3 (T)			
T1 (U)	Inverter output		
T2 (V)			
T3 (W)			
B0/⊖	—	—	Braking resistor unit (B1/⊕-B0/⊖)
B1/⊕	Braking resistor unit (B1/⊕-B2)	Braking resistor unit (B1/⊕-B2)	
B2			—
⊖			
ℓ <sub>1</sub>	—	Cooling fan power supply	
ℓ <sub>2</sub>			
G (E)	Ground terminal		

**IMPORTANT**

**Wiring Distance 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 control constant Cn-23, -24. For details, refer to "7. CONSTANT/FUNCTION LIST" of INSTRUCTIONS FOR DIGITAL OPERATOR. Carrier frequency is preset to 15kHz at the factory prior to shipping.

Wiring Distance between Inverter and Motor	Up to 50 m	Up to 100 m	100 m or more
Allowable Carrier Frequency (Constant Cn-23, -24 set value)	15 kHz or less (15 0)	10 kHz or less (10 0)	5 kHz or less (5 0)

### MOLDED-CASE CIRCUIT BREAKER (MCCB) AND FUSE FOR BRANCH CIRCUIT PROTECTION

Be sure to connect MCCB's or fuses between the AC main circuit power supply and VS-616G3 input terminals L1 (R), L2 (S), L3 (T) to protect the wiring.

Recommended ratings of MCCB and Fuses are listed in Table 1. The fuses should be class RK5 fuses.

When a ground fault interrupter is used, select one with no influence for high frequency. In order to prevent malfunction, setting current should be 200 mA or above, and operating time should be 1.0 sec or longer.

- (Example)
- Mitsubishi Electric NV series (manufactured in 1988 and after)
  - Fuji Electric EGSG series (manufactured in 1984 and after)

Table 1 Branch Circuit Protection

#### 230V Class

VS-616G3	Model CIMR-G3□□	20P4	20P7	21P5	22P2	23P7	25P5	27P5	2011	2015	2018	2022
	Capacity kVA	1.4	2.1	2.7	4.1	6.9	10.3	13.7	20.6	27.4	34	41
	Rated Output Current A	3.2	4.8	6.4	9.6	16	24	32	48	64	80	96
MCCB or Fuse, Class RK5	Rated Current	6A	10A	20A	20A	30A	50A	60A	100A	100A	150A	150A

#### 460V Class

VS-616G3	Model CIMR-G3□□	40P4	40P7	41P5	42P2	43P7	45P5	47P5	4011	4015	4018	4022	4030	4037	4045 4L45
	Capacity kVA	1.4	2.2	3.4	4.1	6.9	10.3	13.7	20.6	27.4	34	41	54	68	82
	Rated Output Current A	1.6	2.6	4.0	4.8	8	12	16	24	32	40	48	64	80	96
MCCB or Fuse, Class RK5	Rated Current	5A	5A	10A	10A	20A	20A	30A	50A	60A	80A	100A	100A	150A	150A

### SURGE SUPPRESSOR

Surge suppressors should be connected to the coils of relays, magnetic contactors, magnetic valves, or magnetic relays. See Table 2.

Table 2 Surge Suppressors

Coils of Magnetic Contactor and Control Relay		Surge Suppressor*		
		Model	Specifications	Yaskawa Code No.
200 to 230V	Large-sized Magnetic Contactors	DCR2-50A22E	250 VAC 0.5μF + 200Ω	C002417
	Control Relays MY-2, -3(OMRON) HH-22, -23(Fuji) MM-2, -4(OMRON)	DCR2-10A25C	250 VAC 0.1μF + 100Ω	C002482
380 to 460V Units		DCR2-50D100B	1000 VDC 0.5μF + 220Ω	C002630

\*Made by MARCON Electronics.

**WIRE AND TERMINAL SCREW SIZES**

- Wire sizes and types are shown in Tables 3 and 4.
- Use 75°C copper wires only.
- Low voltage terminals shall be wired with Class I Wiring.

Table 3 200V Class Wire Size

Circuit	VS-616G3 Model CIMR-G3□†	kVA	Terminal Symbol	Terminal Screw	75°C Copper Wire Range		Wire Type
					AWG	mm²	
Main	20P4 20P7	1.4	L1 (R) L2 (S) L3 (T) ⊖ B1/⊕ B2 T1 (U) T2 (V) T3 (W)	M4	14 - 10	2 - 5.5	Power cable: 600V vinyl sheathed wire or equivalent
		2.1	G (E)		14 - 10	2 - 5.5	
	21P5 22P2	2.7	L1 (R) L2 (S) L3 (T) ⊖ B1/⊕ B2 T1 (U) T2 (V) T3 (W)	M4	14 - 10	2 - 5.5	
		4.1	G (E)		12 - 10	3.5 - 5.5	
	23P7	6.9	L1 (R) L2 (S) L3 (T) ⊖ B1/⊕ B2 T1 (U) T2 (V) T3 (W)	M4	10	5.5	
			G (E)		10	5.5	
	25P5 27P5	10.3	L1 (R) L2 (S) L3 (T) ⊖ B1/⊕ B2 T1 (U) T2 (V) T3 (W)	M5	8	8	
		13.7	G (E)		10	5.5	
	2011	20.6	L1 (R) L2 (S) L3 (T) ⊖ B0/⊖ B1/⊕ T1 (U) T2 (V) T3 (W)	M6	4	22	
			G (E)	*	8 - 2	8 - 38	
			ℓ1 (f), ℓ2 (A)	M4	14 - 10	2 - 5.5	
	2015	27.4	L1 (R) L2 (S) L3 (T) ⊖ B0/⊖ B1/⊕ T1 (U) T2 (V) T3 (W)	M8	3 - 1/0	30 - 60	
			G (E)	*	8 - 2	8 - 38	
			ℓ1 (f), ℓ2 (A)	M4	14 - 10	2 - 5.5	
	2018	34	L1 (R) L2 (S) L3 (T) ⊖ B0/⊖ B1/⊕ T1 (U) T2 (V) T3 (W)	M8	2 - 1/0	38 - 60	
G (E)			*	6 - 2	14 - 38		
ℓ1 (f), ℓ2 (A)			M4	14 - 10	2 - 5.5		
2022	41	L1 (R) L2 (S) L3 (T) ⊖ B0/⊖ B1/⊕ T1 (U) T2 (V) T3 (W)	M8	1/0	60		
		G (E)	*	6 - 2	14 - 38		
		ℓ1 (f), ℓ2 (A)	M4	14 - 10	2 - 5.5		
Control	Common to all models	—	1 - 22 25 - 27	M3.5	18 - 14	0.75 - 2	Twisted shielded wire with class I wiring or equivalent.

\* indicates the use of Pressure Lug Terminals.

† □ indicates “U” or “V”.

**IMPORTANT**

When determining wire sizing, voltage drop should be considered. Select the wire size so that voltage drop will be less than 2% of the normal rated voltage. Voltage drop is obtained by the following equation:

$$\text{Phase-to-phase voltage drop (V)} = \sqrt{3} \text{ wire resistance } (\Omega/\text{km}) \times \text{wiring distance (m)} \times \text{current (A)} \times 10^{-3}$$

Table 4 400V Class Wire Size

Circuit	VS-616G3 Model CIMR-G3□ <sup>1</sup>	kVA	Terminal Symbol	Terminal Screw	75°C Copper Wire Range		Wire Type
					AWG	mm <sup>2</sup>	
Main	40P4 40P7 41P5 42P2	1.4	L1 (R) L2 (S) L3 (T) ⊖ B1/⊕ B2 T1 (U) T2 (V) T3 (W)	M4	14 - 10	2 - 5.5	Power cable: 600V vinyl sheathed wire or equivalent
		2.2	G (E)		14 - 10	2 - 5.5	
	43P7	6.9	L1 (R) L2 (S) L3 (T) ⊖ B1/⊕ B2 T1 (U) T2 (V) T3 (W)	M4	14 - 10	2 - 5.5	
			G (E)	M5	12 - 10	3.5 - 5.5	
	45P5	10.3	L1 (R) L2 (S) L3 (T) ⊖ B1/⊕ B2 T1 (U) T2 (V) T3 (W)	M4	12 - 10	3.5 - 5.5	
			G (E)	M5	12 - 10	3.5 - 5.5	
	47P5	13.7	L1 (R) L2 (S) L3 (T) ⊖ B1/⊕ B2 T1 (U) T2 (V) T3 (W)	M4	10	5.5	
			G (E)	M5	10	5.5	
	4011 4015	20.6 27.4	L1 (R) L2 (S) L3 (T) ⊖ B1/⊕ B2 T1 (U) T2 (V) T3 (W)	M5	8	8	
			G (E)	*	10 - 2	5.5 - 38	
			ℓ <sub>1</sub> (t), ℓ <sub>2</sub> (s)	M4	14 - 10	2 - 5.5	
	4018	34	L1 (R) L2 (S) L3 (T) B0/⊖ B1/⊕ T1 (U) T2 (V) T3 (W)	M6	6 - 4	14 - 22	
			G (E)	*	8 - 2	8 - 38	
			ℓ <sub>1</sub> (t), ℓ <sub>2</sub> (s)	M4	14 - 10	2 - 5.5	
	4022	41	L1 (R) L2 (S) L3 (T) B0/⊖ B1/⊕ T1 (U) T2 (V) T3 (W)	M6	4	22	
			G (E)	*	8 - 2	8 - 38	
			ℓ <sub>1</sub> (t), ℓ <sub>2</sub> (s)	M4	14 - 10	2 - 5.5	
	4030	54	L1 (R) L2 (S) L3 (T) B0/⊖ B1/⊕ T1 (U) T2 (V) T3 (W)	M8	3 - 1/0	30 - 60	
G (E)			*	8 - 2	8 - 38		
ℓ <sub>1</sub> (t), ℓ <sub>2</sub> (s)			M4	14 - 10	2 - 5.5		
4037	68	L1 (R) L2 (S) L3 (T) B0/⊖ B1/⊕ T1 (U) T2 (V) T3 (W)	M8	2 - 1/0	38 - 60		
		G (E)	*	6 - 2	14 - 38		
		ℓ <sub>1</sub> (t), ℓ <sub>2</sub> (s)	M4	14 - 10	2 - 5.5		
4045	82	L1 (R) L2 (S) L3 (T) B0/⊖ B1/⊕ T1 (U) T2 (V) T3 (W)	M8	1/0	60		
		G (E)	*	6 - 2	14 - 38		
		ℓ <sub>1</sub> (t), ℓ <sub>2</sub> (s)	M4	14 - 10	2 - 5.5		
Control	Common to all models	—	1 - 22 25 - 27	M3.5	18 - 14	0.75 - 2	Twisted shielded wire with class I wiring or equivalent.

\* indicates the use of Pressure Lug Terminals.

<sup>1</sup> □ indicates "U" or "V".

Table 5 Closed-Loop Connectors

Wire Range		Terminal Screw	Torque (N-m)	Closed-Loop Connectors
AWG	mm <sup>2</sup>			
22	0.5	M 3.5	0.95	1.25 - 3.5
18	0.75			
16	1.25			
14	2	M 4	1.43	2 - 4
		M 5	2.24	2 - 5
12	3.5	M 4	1.43	3.5 - 4
		M 5	2.24	3.5 - 5
10	5.5	M 4	1.43	5.5 - 4
		M 5	2.24	5.5 - 5
8	8	M 5	2.24	8 - 5
		M 6	4.41	8 - 6
6	14	M 6	4.41	14 - 6
4	22	M 6	4.41	22 - 8
3	30	M 8	9.8	30 - 8
2	38	M 8	9.8	38 - 8
		M 10	20.4	38 - 10
1	50	M 8	9.8	50 - 8
1/0	60	M 10	20.4	60 - 10

**CAUTION**

The external interconnection wiring must be performed with following procedures.

After completing VS-616G3 interconnections, be sure to check that connections are correct. Never use control circuit buzzer check.

**MAIN CIRCUIT INPUT/OUTPUT**

- (1) Phase rotation of input terminals L1 (R), L2 (S), L3 (T) has no effect on motor rotation.
- (2) To reverse motor rotation, interchange any two of the motor leads.
- (3) Never connect the AC main circuit power supply to output terminals T1 (U), T2 (V), or T3 (W). Inverter damage may occur.
- (4) Care should be taken to prevent contact of wiring leads with VS-616G3 cabinet, for short-circuit may result.
- (5) Never connect power factor correction capacitors to VS-616G3 output.
- (6) Never open or close contactors in the output circuit unless the inverter is properly sized.

**GROUNDING**

Ground the casing of the VS-616G3 using ground terminal G (E).

- (1) Ground resistance should be 100Ω or less.
- (2) Never ground the VS-616G3 in common with welding machines, motors, and other large-current electrical equipment. Run the ground lead in a separate conduit from leads of large-current electrical equipment.
- (3) Use ground leads which comply with AWG standards using the shortest length possible.
- (4) When several VS-616G3 units are used side by side, all the units should preferably be grounded directly to the ground poles. However, connecting the ground terminal of VS-616G3 units in parallel, and grounding only one of the VS-616G3 units to the ground pole is also permissible (Fig. 3). However, do not form a loop with the ground leads.

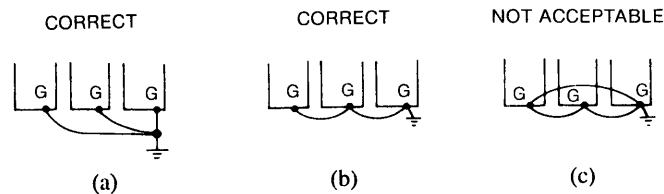


Fig. 3 Grounding of Three VS-616G3 Units

## CONTROL CIRCUIT

## CONTROL CIRCUIT TERMINALS

Classification	Terminal	Signal Function	Description		Signal Level	
Sequence Input Signal	1	Forward operation-stop signal	Forward run at closed, stop at open		Photo-coupler insulation Input +24VDC 8mA	
	2	Reverse operation-stop signal	Reverse run at closed, stop at open			
	3	External fault input	Fault at closed, normal state at open			
	4	Fault reset input	Reset at closed			
	5	Master/Aux. change (Multi-step speed ref.1)	Aux. freq. ref. at "closed"	Multi-function contact inputs: Forward/reverse, run mode, multi-speed, jog frequency, accel/decel time, external fault, external base block stop, hold command, inverter overheat prediction, DB command, aux. input effective, speed search, energy-saving operation		
	6	Multi-step speed ref.2	Effective at "closed"			
	7	Jog command	Jog run at "closed"			
	8	External coasting stop	Inv. output stop at "closed"			
	11	Sequence control input common terminal	—			
Analog Input Signal	15	Power supply terminal for speed ref.	Speed ref. power supply		+15V (Allowable current 20mA max.)	
	13	Master speed frequency ref.	0 to +10V/100% freq.		0 to +10V (20kΩ)	
	14		4 to 20mA/100% freq.		4 to 20mA (250Ω)	
	16	Aux. frequency ref.	10V/100%	Multi-function analog inputs: Speed command, speed gain, speed bias, overtorque, overvoltage bias, rate of accel / decel DB current	0 to +10V (10kΩ)	
	17	Common terminal for control circuit	0V		—	
	12	Connection to shield sheath of signal lead	—		—	
Sequence Output Signal	9	During running (NO)	"Closed" when running	Multi-function contact outputs: Output during running, zero speed, agreed speed, arbitrary agreed speed, frequency detection, overtorque, undervoltage, run mode, coasting stop, braking resistor overheat	Dry contact Contact capacity: 250VAC 1A or less 30VDC 1A or less	
	10					
	25	Zero speed detection	Makes at min. freq. (Cn-07) or less			Open collector output +48V 50mA or less
	26	Speed agreed detection	Makes when the freq. reaches to ±1% of set freq.			
	27	Open collector output common		—		
	18	Fault contact output (NO, NC)	Fault at closed between terminals 18 and 20		Dry contact Contact capacity: 250VAC 1A or less 30VDC 1A or less	
	19		Fault at open between terminals 19 and 20			
20						
Analog Output Signal	21	Frequency meter output	0 to 10V/100% freq.	Multi-function analog output: frequency, current, voltage, and kilowatt meter selection available.	0 to 11V max. 2mA or less	
	22	Common				

## ■ TYPICAL CONTROL CIRCUIT TERMINAL ARRANGEMENT

11	12(G)	13	14	15	16	17	25	26	27	9	10	18	19	20
1	2	3	4	5	6	7	8	21	22					

**CAUTION**

External interconnection wiring should be performed using the following procedures.

After completion, be sure to check that connections are correct. Never use a control circuit buzzer check.

(1) Separation of control circuit leads and main circuit leads

Signal leads 1 through 32 must be separated from main circuit leads L1 (R), L2 (S), L3 (T), B1/⊕, B2, T1 (U), T2 (V), T3 (W), ⊖ (N) and other power cables to prevent erroneous operation caused by noise interference.

(2) Control circuit leads 9, 10, 18, 19, 20 (contact output) must be separated from leads 1 to 8, 11 to 17, 21, 22 and 25 to 27.

(3) Use twisted shielded or twisted-pair shielded wire for the control circuit line and connect the shield sheath to the inverter terminal 12 (G). See Fig. 4.

Wiring distance should be less than 164 ft (50 m).

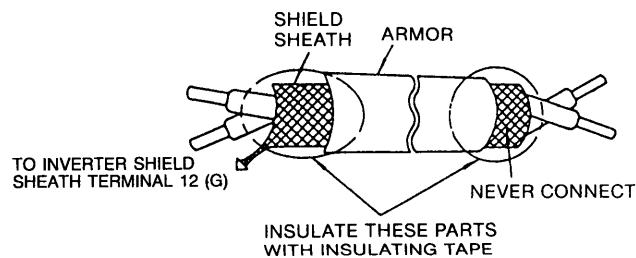


Fig. 4 Shielded Wire Termination



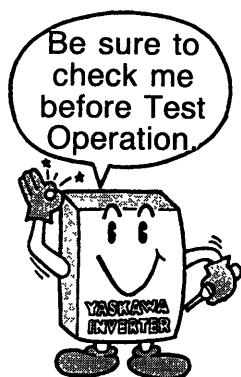
## INITIAL OPERATION

To assure safety, prior to initial operation, disconnect the machine coupling so that the motor is isolated from the machine. If initial operation must be performed while the motor is still coupled to the machine, use great care to avoid potentially hazardous conditions.

## CHECKS BEFORE INITIAL OPERATION

After completion of installation and wiring, check for:

- (1) proper wiring and terminal connections
- (2) wire clippings that could cause short circuit
- (3) screw-type terminals are tightened.
- (4) proper load



## SETTING THE LINE VOLTAGE USING JUMPER (FOR 460V CLASS)

The line voltage jumper shown in Fig. 5 must be set according to the main circuit power supply. Insert the jumper at the appropriate location corresponding to the input line voltage. It has been preset at the factory at 460V.

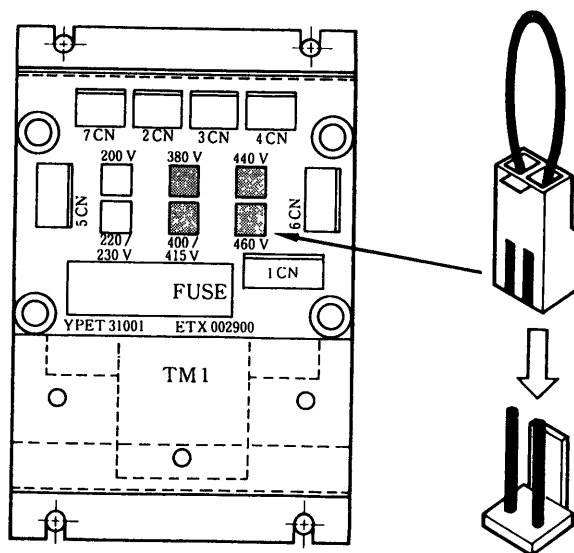

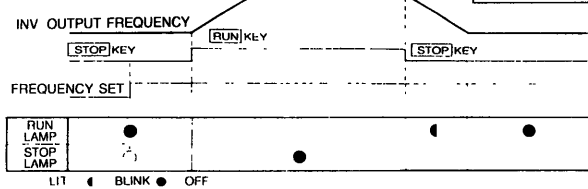
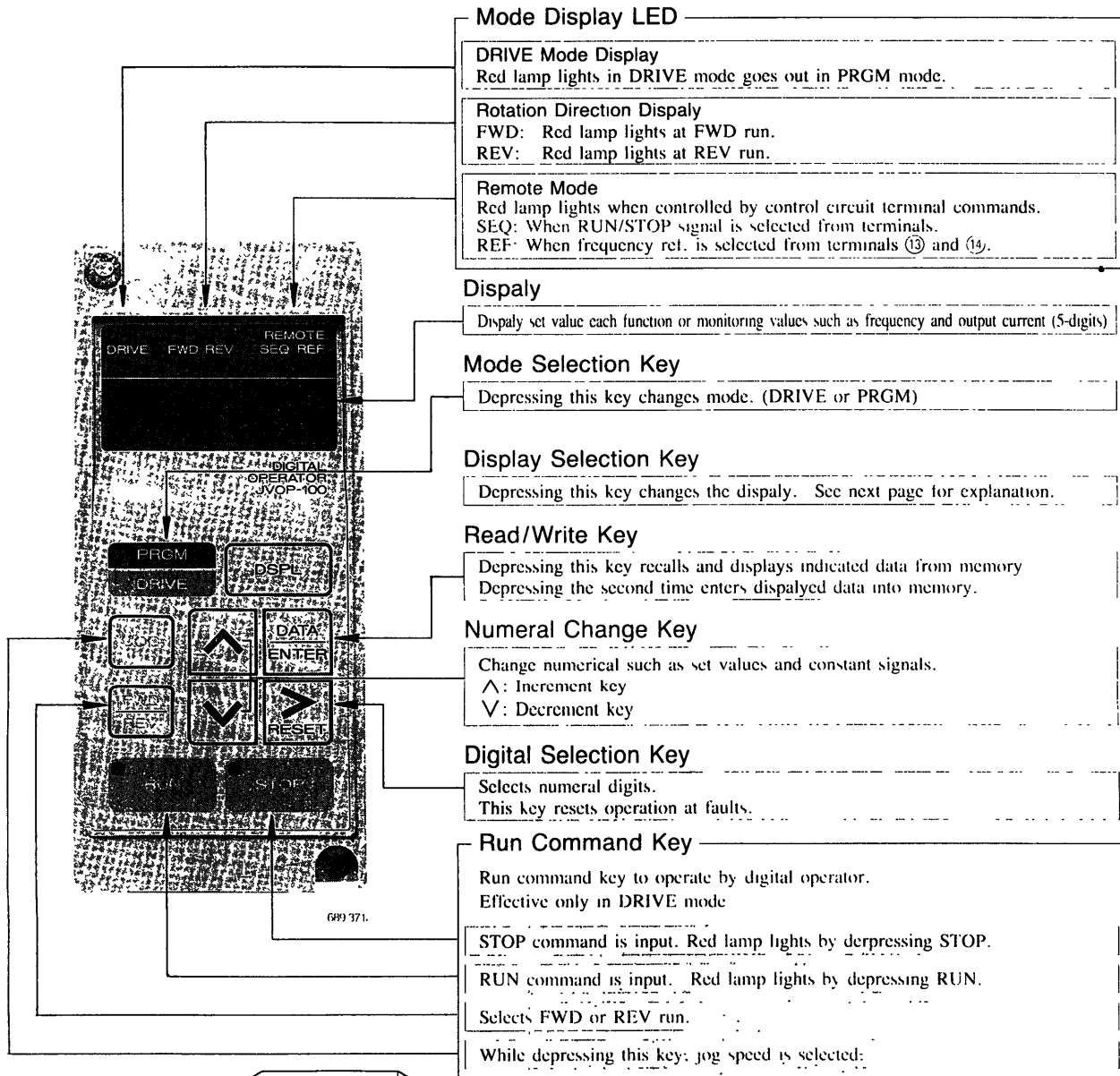


Fig. 5 Line Voltage Jumper

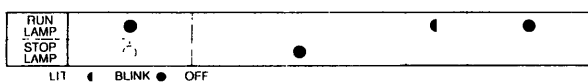
# OPERATION

## DIGITAL OPERATOR

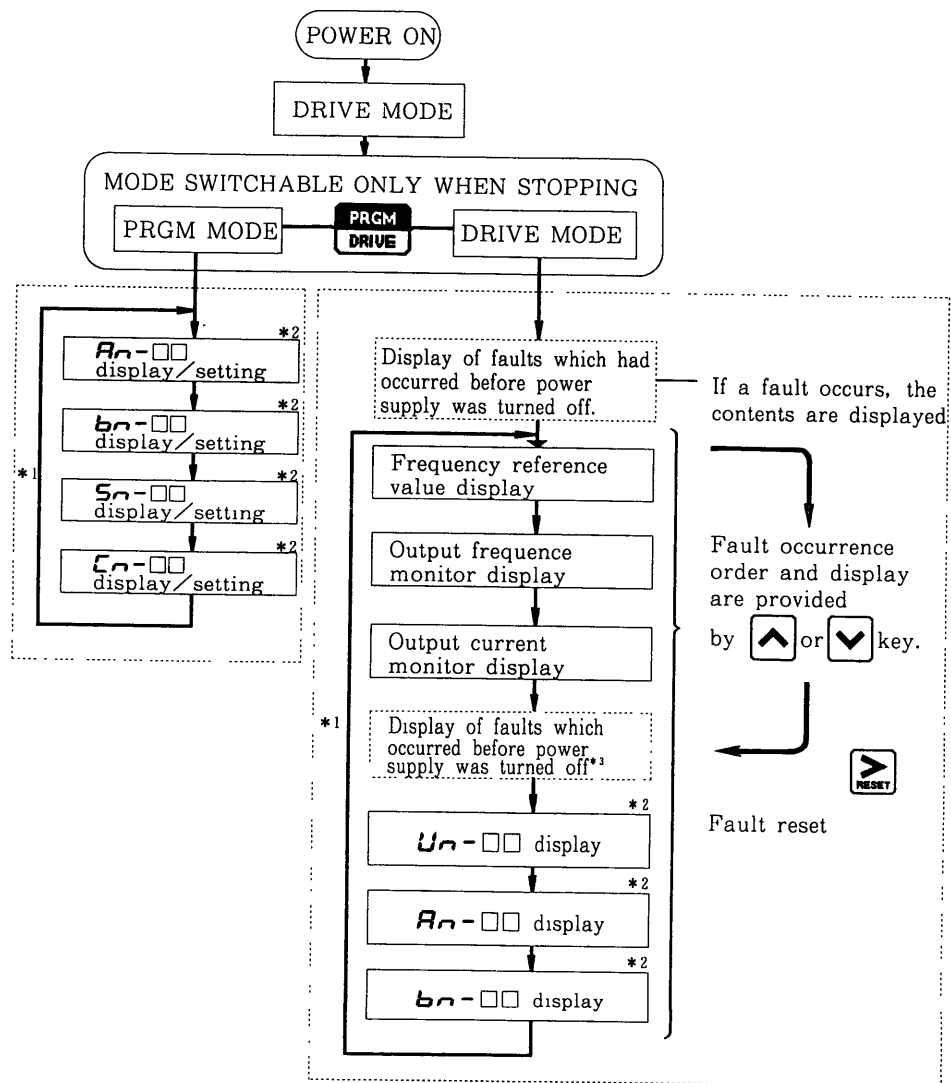
Digital operator has DRIVE mode and PRGM mode. Selecting DRIVE mode enables the inverter to operate. PRGM mode enables the programs to be written-in. DRIVE and PRGM modes can be switched by  key only when stopped.



RUN or STOP lamp changes in accordance with the following operations.



## DRIVE MODE AND PRGM MODE



- \*1: The constant group to be displayed is changed each time display selection key **DSPL** is depressed.
- \*2: For details of constants ( $A_n$ -□□,  $b_n$ -□□,  $C_n$ -□□,  $S_n$ -□□,  $U_n$ -□□), refer to "BASIC CONSTANTS" on page 22.
- \*3: Faults that occurred in the previous operation are displayed. Even if the power supply is turned OFF at fault occurrence, the constants are stored so that they are displayed after the power supply is turned ON again. (When no fault occurred, fault display of the previous operation is skipped.)

### ■ DRIVE MODE

Monitor item is changed each time the display key **DSPL** is depressed. At fault occurrence, the digital operator displays the fault.

Depressing **RESET** key changes to the display immediately before the fault occurred.

Description	Key Operation	Digital Operator Display	Remarks
Drive mode selected	<b>PRGM</b> <b>DRIVE</b>	LED <b>DRIVE</b> Lights	No display when no fault occurred before power supply was turned OFF.
Display of faults which occurred before power supply was turned OFF.			
Frequency reference value display/setting	<b>DSPL</b>	<b>F00.00</b>	
Output frequency monitor display	<b>DSPL</b>	<b>0.00</b>	
Output current monitor display	<b>DSPL</b>	<b>0.0A</b>	
Display of faults which occurred before power supply was turned OFF.	<b>DSPL</b>	<b>U1U1</b>	Example : Main circuit undervoltage trip
<b>Un-01</b> *	<b>DSPL</b>	<b>Un-01</b>	Monitor value is displayed by <b>DATA ENTER</b> Key.
<b>An-01</b> *	<b>DSPL</b>	<b>An-01</b>	
<b>bn-01</b> *	<b>DSPL</b>	<b>bn-01</b>	

\*: Check the display data referring to "BASIC CONSTANTS" on page 22.

■ PRGM MODE

Monitor item is changed each time the **DSPL** key is depressed.

Description	Key Operation	Digital Operator Display	Remarks
PRGM mode selected	<b>PRGM DRIVE</b>	<i>An-01</i>	LED <b>DRIVE</b> OFF
<i>An-01</i> *	<b>DSPL</b>	<i>An-01</i>	Data is displayed by <b>DATA ENTER</b>
<i>bn-01</i> *	<b>DSPL</b>	<i>bn-01</i>	
<i>sn-01</i> *	<b>DSPL</b>	<i>sn-01</i>	
<i>cn-01</i> *	<b>DSPL</b>	<i>cn-01</i>	

\*: Check the display data referring to "BASIC CONSTANTS" on page 22.

[Example: Change Accel Time Setting]

Accel time can be set in either the DRIVE or PRGM mode.

Accel Time Setting	Key Operation	Digital Operator Display	Remarks
• Select accel time constant	<b>DSPL</b>	<i>bn-01</i>	10 sec is factory setting.
• Display accel time data	<b>DATA ENTER</b>	<i>10.0</i>	
• Set accel time to 12.5 seconds.	<b>RESET</b> , <b>↑</b> , <b>↓</b>	<i>12.5</i>	
• Write-in data.	<b>DATA ENTER</b>	<i>End</i>	

## BASIC CONSTANTS

The constants described here are those required for basic operation. Consult the JVOP-100 digital operator manual for a complete list of constants.

### ■ Un-□□□ (Monitor Type)

No.	Item	Display	Unit
Un-01	Frequency reference	120.00	Hz
Un-02	Output frequency	120.00	Hz
Un-03	Output current	4.8A	A
Un-04	Voltage reference	200V	V
Un-05	DC voltage (V.P-N)	Pn270	V
Un-06	Output power ("-" displayed at regeneration)	0.75	kW

### ■ An-□□□ (Frequency References)

No.	Item	Display	Unit
An-01	Master frequency	120.00	Hz
An-09	Jog frequency	6.00	Hz

### ■ bn-□□□ (Constants to be Changed during Operation)

No.	Item	Display	Unit
bn-01	Acceleration time	10.0	sec
bn-02	Deceleration time	10.0	sec
bn-11	Analog output gain	1.000	—

### ■ Sn-□□□ (System Constants to be Changed at Stopping)

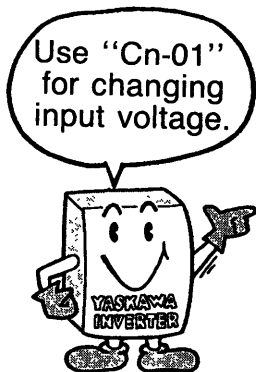
No.	Operation Conditions		Data (digits)				Setting prior to Shipment
			1	2	3	4	
Sn-04	RUN MODE	Master frequency reference: Control terminal 13 or 14 input	—	—	—	0	0011
		Master frequency reference: Digital operator An-01	—	—	—	1	
		Operated by control terminal run command.	—	—	0	—	
		Operated by run command from the digital operator.	—	—	1	—	
	STOP MODE	Frequency deceleration to stop	0	0	—	—	
		Coasting to stop	0	1	—	—	
		Full range DC injection braking to stop	1	0	—	—	
		Coasting to stop (restart possible after the time set bn-02)	1	1	—	—	

### ■ Cn-□□□ (Control Constants to be Changed at Stopping)

No.	Item	Display	Unit
Cn-09	Motor rated current (to agree with motor NP)	3.3	A
Cn-11	DC injection braking current	50	%
Cn-12	DC injection braking time at stop	0.5	sec
Cn-14	Frequency reference (upper limit)	100	%
Cn-15	Frequency reference (lower limit)	12	%
Cn-36	No. of retry operations at fault	5	times

## INPUT VOLTAGE SETTING

Set the input power supply voltage to be used, by using the digital operator.  
The factory set for 230V class is 200V, and for the 460V class is 400V.

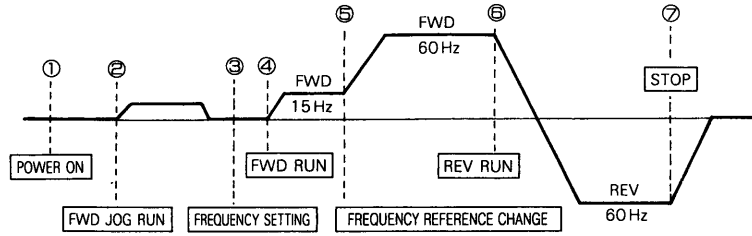
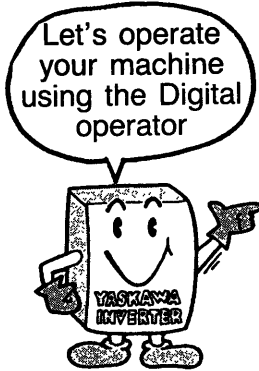


Input Voltage Setting Method	Key Operation	Digital Operator Display	Remarks
POWER ON			
Frequency reference value is displayed.		F00.00	
Change mode to PRGM.	PRGM DRIVE	An-01	LED DRIVE OFF.
Select Cn-01	DSPL Depress three times.	Cn-01	
Display data. Set to 220V.	DATA ENTER	200.0	
Change set value.	RESET, ↑, ↓	220.0	
Write-in new set value.	DATA ENTER	End	Displayed for 0.5 second
Switch to DRIVE mode.	PRGM DRIVE	F00.00	LED DRIVE lights.

## DIGITAL OPERATOR OPERATION

The following diagram shows a typical digital operator operation sequence.

### ■ OPERATION SEQUENCE



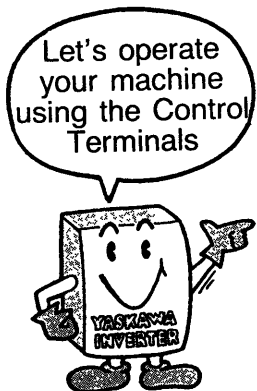
### ■ TYPICAL OPERATION

Description	Key operation	Digital Operator Display	Remarks
<p>① POWER ON</p> <ul style="list-style-type: none"> <li>Frequency reference value is displayed.</li> <li>Select output frequency monitor display.</li> <li>Check rotation direction (FWD at power ON.)</li> </ul>		F00.00	
<p>② FWD JOG RUN</p> <p>6 Hz</p> <ul style="list-style-type: none"> <li>Jog run operation (Activated while key is depressed.)</li> </ul> <p>Cont'd</p>	<p>DSPL</p> <p>JOG</p>	0.00	LED FWD lights.



Description	Key Operation	Digital Operator Display	Remarks
Cont'd			
<p>③ Frequency setting</p> <p>15 Hz</p> <ul style="list-style-type: none"> <li>• Select frequency reference value display.</li> <li>• Change reference setting.</li> <li>• Write-in set value.</li> <li>• Select output frequency monitor display.</li> </ul>	<p><b>DSPL</b></p> <p>Depress three times.</p> <p><b>RESET</b> <b>▲</b> <b>▼</b></p> <p><b>DATA ENTER</b></p> <p><b>DSPL</b></p>	<p><b>F00.00</b></p> <p><b>F 15.00</b></p> <p><b>F 15.00</b></p> <p><b>0.00</b></p>	<p>Stops blinking for 2 seconds</p>
<p>④ FWD run</p> <p>15 Hz</p> <ul style="list-style-type: none"> <li>• FWD run operation</li> </ul>	<p><b>RUN</b></p>	<p><b>15.00</b></p>	<p>LED <b>run</b> lights.</p>
<p>⑤ Frequency set value change</p> <p>60 Hz</p> <ul style="list-style-type: none"> <li>• Select frequency reference.</li> <li>• Change set value.</li> <li>• Write-in set value.</li> <li>• Select output frequency monitor display.</li> </ul>	<p><b>DSPL</b></p> <p>Depress six times.</p> <p><b>RESET</b> <b>▲</b> <b>▼</b></p> <p><b>DATA ENTER</b></p> <p><b>DSPL</b></p>	<p><b>F 15.00</b></p> <p><b>F60.00</b></p> <p><b>F60.00</b></p> <p><b>60.00</b></p>	<p>FWD run (60Hz)</p> <p>Stops blinking for 2 seconds</p>
<p>⑥ REV run</p> <p>60 Hz</p> <ul style="list-style-type: none"> <li>• Switch to REV run.</li> </ul>	<p><b>FWD REV</b></p>	<p><b>-60.00</b></p>	<p>REV run (60Hz)</p> <p>LED <b>REV</b> lights.</p>
<p>⑦ Stop</p> <ul style="list-style-type: none"> <li>• Deceleration to a stop.</li> </ul>	<p><b>STOP</b></p>	<p><b>0.00</b></p>	<p>LED <b>stop</b> lights.</p> <p>(LED <b>run</b> blinks during deceleration.)</p>

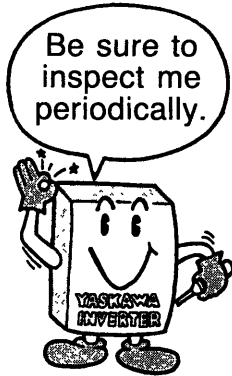
CONTROL TERMINAL OPERATION



Description	Key Operation	Digital Operator Display	Remarks
<p><b>POWER ON</b></p> <ul style="list-style-type: none"> <li>Frequency reference value displayed.</li> <li>Select PRGM mode.</li> </ul>		<p>F00.00</p> <p>Pr-01</p>	<p>LED DRIVE OFF.</p>
<p><b>OPERATION CONDITIONS SET</b></p> <ul style="list-style-type: none"> <li>Sn-01 displayed.</li> <li>Set Sn-04.</li> <li>Data displayed.</li> <li>Set data to 0000.</li> </ul>	<p></p> <p>Depress twice.</p> <p> </p> <p></p> <p> </p>	<p>Sn-01</p> <p>Sn-04</p> <p>0011</p> <p>0000</p>	
<p><b>SET VALUE WRITE-IN</b></p> <ul style="list-style-type: none"> <li>Check for "End" display. (Operation by control terminal signal enables.)</li> </ul>	<p></p>	<p>End</p>	<p>Displayed for 0.5 second</p>
<p><b>DRIVE MODE SELECTION</b></p> <ul style="list-style-type: none"> <li>Change to DRIVE mode.</li> </ul>	<p></p>	<p>F00.00</p>	<p>LED DRIVE lights</p>
<p><b>FREQUENCY SET</b></p> <ul style="list-style-type: none"> <li>Input external voltage (current) into control terminal 13 (14). Check frequency reference on the digital operator.</li> </ul>		<p>F60.00</p>	
<p><b>OUTPUT FREQUENCY DISPLAY</b></p> <ul style="list-style-type: none"> <li>Change to output frequency display.</li> </ul>	<p></p>	<p>0.00</p>	
<p><b>OPERATION CHECK</b></p> <ul style="list-style-type: none"> <li>Close between terminal 1 and 11 and terminals 7 and 11 to perform jog operation.</li> </ul>		<p>6.00</p>	<p>LED  lights.</p>
<p><b>RUN</b></p> <ul style="list-style-type: none"> <li>After checking for normal operation, close between terminals 7 and 11.</li> </ul>		<p>60.00</p>	<p>Increased to 60 Hz. LED  lights.</p>
<p><b>STOP</b></p> <ul style="list-style-type: none"> <li>Open between terminals 1 and 11 to stop.</li> </ul>		<p>0.00</p>	<p>Decreased to 0 Hz. LED  lights. LED  blinks during deceleration</p>

# MAINTENANCE

## PERIODIC INSPECTION



The VS-616G3 requires very few routine checks. It will function longer if it is kept clean, cool and dry, while observing the precautions listed on Page 8 under "LOCATION". Check for tightness of electrical connections, discoloration or other signs of overheating or aging. Use Table 6 as your inspection guide. Before servicing, turn off AC main circuit power and be sure that the CHARGE lamp is OFF.

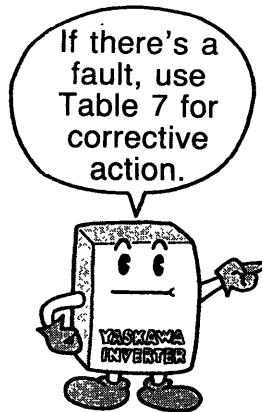
Table 6 Periodical Inspection

Component	Check	Corrective Action
External terminals, unit mounting bolts, connectors, etc.	Loose screws	Tighten
	Loose connectors	Tighten
Cooling fins	Build-up of dust and dirt	Blow with dry compressed air of $39.2 \times 10^4$ to $58.8 \times 10^4$ Pa (57 to 85 psi.) pressure.
Printed circuit board	Accumulation of conductive dust or oil.	Blow with dry compressed air of $39.2 \times 10^4$ to $58.8 \times 10^4$ Pa (57 to 85 psi) pressure. If dust and oil cannot be removed, replace the board.
Cooling fan	For abnormal noise and vibration. Whether the cumulative operation time exceeds 20,000 hours or not.	Replace the cooling fan.
Power elements	Accumulation of dust and dirt	Blow with dry compressed air of $39.2 \times 10^4$ to $58.8 \times 10^4$ Pa (57 to 85 psi) pressure.
Smoothing capacitor	Discoloration or odor	Replace the capacitor or inverter unit.

Note: Operating conditions are as follows:

- Ambient temperature : 30°C (86°F)/yearly average
- Load factor : 80% or below
- Operation rate : 12 hours or below / day

## FAULT DISPLAY



As Table 7 shows, the faults that the VS-616G3 detects are classified into troubles and alarms. If a problem occurs, the fault contact is output and the motor coasts to a stop. When an alarm is issued, the digital operator indicates the alarm for warning.

Table 7 Fault Display and Details

Indication	Fault Display	Description	Corrective Action
UV1	Undervoltage (PUV)	Low main power circuit voltage during operation.	<ul style="list-style-type: none"> <li>• Check wiring (at power supply side)</li> <li>• Correct power supply voltage.</li> </ul>
UV2	Undervoltage (CUV)	Low control circuit voltage during operation.	
UV3	Undervoltage (MC-ANS fault)	Main circuit magnetic contactor does not operate correctly.	
GF	Grounding	Grounding current > approx. 50% of inverter rated current	<ul style="list-style-type: none"> <li>• Check that motor insulation has not deteriorated.</li> <li>• Check that there is no damage to wiring at load side.</li> </ul>
OC	Overcurrent	Inv. output current > 200% of Inv. rated current	<ul style="list-style-type: none"> <li>• Check the motor winding resistance and ground.</li> <li>• Increase accel time.</li> </ul>
OV	Overvoltage	Detection level: Approx. 400V for 200V class Approx. 800V for 400V class [(Cn-01) ≥ 400V] Approx. 700V for 400V class [(Cn-01) < 400V]	Increase decel time and/or add braking resistor.
FU	Fuse blown	—	Check short-circuit at load, ground fault etc.
oH	Radiation fin overheated	Fin temperature 90°C (194°F)	Check fan or ambient temperature (less than 45°C, 113°F).
oL1	Overload	Protect the motor.	Measure motor temperature-rise and reduce load, then reset V/f.
oL2	Overload	Protect the inverter.	Reduce load, and increase accel time, then reset V/f.
oL3	Overtorque	When selecting inv. output OFF at “inv. output current > overtorque detection level” and overtorque detection.	—
rr	Regenerative transistor fault	—	Replace transistor.
rH	Braking resistor overheated	Protect braking resistor incorporated in inverter unit.	Reduce regenerative load, or use other resistor unit separately installed.
EF3	Control circuit terminal ③ fault	Stop mode selection possible	Check state of input terminal with data Un-07 Un-07. (Replace inverter if “/” is indicated as the state of open terminal.)
EF5	Control circuit terminal ⑤ fault		
EF6	Control circuit terminal ⑥ fault		
EF7	Control circuit terminal ⑦ fault		
EF8	Control circuit terminal ⑧ fault		

Table 7 Fault Display and Details (Cont'd)

Indication	Fault Display	Description	Corrective Action
<i>bUS</i>	Communication inverter card (option) communication error	Stop mode selection possible	Check communication cable between communication interface card (SI-B) and master controller.
<i>CPF00</i>	Operator communication error	Communication between G3 and operator is not established 5 seconds after the power supply is turned ON.	<ul style="list-style-type: none"> <li>• Insert operator connector plug again.</li> <li>• Replace control board.</li> <li>• Check wiring of control board.</li> </ul>
<i>CPF01</i>	Operator communication error	Communication error occurs for 2 seconds after communication between G3 and operator is once established after the power supply is turned ON.	<ul style="list-style-type: none"> <li>• Insert operator connector plug again.</li> <li>• Replace control board.</li> </ul>
<i>CPF02</i>	Control circuit fault	Inverter fault	• Replace control PC board.
<i>CPF03</i>	NV-RAM (S-RAM) fault		
<i>CPF04</i>	NV-RAM (BCC, Access Code) fault		
<i>CPF05</i>	A/D converter fault in CPU		
<i>CPF06</i>	Optional connection fault	—	• Check and secure the option card connector.
<i>CPF20</i>	Fault of A/D converter in analog speed reference card (option)	Option card fault	Replace option card.
<i>CPF21</i>	Self-analysis fault of CP-213 communication interface card (option)		
<i>CPF22</i>	Model code fault of CP-213 communication interface card (option)		
<i>CPF23</i>	Mutual analysis fault of CP-213 communication interface card (option)		

**CAUTION**

If "FU" fault occurs, check the output transistors first, before replacing the DC bus fuse.

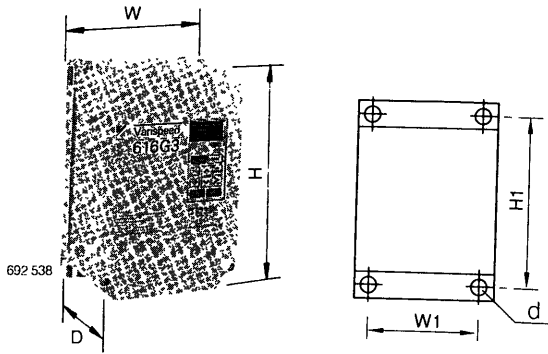
# APPENDIX A SPECIFICATIONS

Inverter Model CIMR-G3□□□		200 to 230V												380 to 460V													
		20P4	20P7	21P5	22P2	23P7	25P5	27P5	2011	2015	2018	2022	40P4	40P7	41P5	42P2	43P7	45P5	47P5	4011	4015	4018	4022	4030	4037	4045 41A5	
Max. Applicable Motor Output HP (kW)*1	Constant Torque Ratings	0.5 (0.4)	1 (0.75)	2 (1.5)	3 (2.2)	5 (3.7)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	0.5 (0.4)	1 (0.75)	2 (1.5)	3 (2.2)	5 (3.7)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	
	Variable Torque Ratings	1 (0.75)	1 (0.75)	2 (1.5)	3 (2.2)	5 (3.7)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	1 (0.75)	1 (0.75)	2 (1.5)	3 (2.2)	5 (3.7)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)
Output Characteristics	Inverter Capacity kVA	1.4	2.1	2.7	4.1	6.9	10.3	13.7	20.6	27.4	34	41	1.4	2.2	3.4	4.1	6.9	10.3	13.7	20.6	27.4	34	41	54	68	82	
	Rated Output Current (Constant Torque Ratings) A	3.2	4.8	6.4	9.6	16	24	32	48	64	80	96	1.6	2.6	4.0	4.8	8	12	16	24	32	40	48	64	80	96	
	Max. Continuous Output Current (Variable Torque Ratings) A	3.6	5.4	7.2	10.8	18	27	36	54	72	90	108	1.8	2.9	4.5	5.4	9	13.5	18	27	36	45	54	72	90	108	
	Max. Output Voltage	3-Phase, 200/208/220/230V (Proportional to input voltage)												3-Phase, 380/400/415/440/460V (Proportional to input voltage by programming)													
	Rated Output Frequency	50, 60, 72, 90, 120, 180 Hz (up to 400 Hz available)																									
Power Supply	Rated Input Voltage and Frequency	3-Phase 200/208/220V, 50 Hz 200/208/220/230V, 60 Hz												3-Phase 380/400/415/440/460V, 50/60 Hz													
	Allowable Voltage Fluctuation	± 10%																									
	Allowable Frequency Fluctuation	± 5%																									
Control Characteristics	Control Method	Sine wave PWM																									
	Frequency Control Range	0.1 to 400 Hz																									
	Frequency Accuracy	Digital command: 0.01% +14 to 104°F -10 to 40°C												Analog command: 0.1% 77 ± 18°F 25 ± 10°C													
	Frequency Resolution	Digital operator reference: 0.1 Hz. Analog reference: 0.06 Hz/60 Hz																									
	Output Frequency Resolution	0.01 Hz (1/30000)																									
	Overload Capacity	150% constant torque rating current for 1 minute / 110% variable torque rating current for 1 minute																									
	Frequency Setting Signal	0 to 10 VDC (20 kΩ), 4-20 mA (250 Ω) 0-± 10V (OPTIONAL)																									
	Accel/Decel Time	0.1 to 6000 sec (Accel/Decel time setting independently)																									
	Braking Torque	Approx. 20%																									
	No. of V/f Patterns	15 types of V/f pattern selection and arbitrary program V/f pattern setting enabled												<div style="border: 1px solid black; padding: 5px; display: inline-block;">                     4: For general purpose                      4: For high starting torque                      4: For fans and pumps                      3: For machine tools                 </div>													
Protective Functions	Motor Overload Protection	Electric thermal overload relay																									
	Instantaneous Overcurrent	Motor coasts to a stop at approx. 200% of inverter rated current.																									
	Blown Fuse Protection	Motor coasts to a stop by blown-fuse.																									
	Overload	Motor coasts to a stop after 1 minute at 150% constant torque rating current.												Motor coasts to a stop after 1 minute at 110% variable torque rating current.													
	Overvoltage	Motor coasts to a stop if converter output voltage exceeds 400V.												Motor coasts to a stop if converter output voltage exceeds 800V. (approx 700V).*5													
	Undervoltage	Motor coasts to a stop if converter output voltage drops to 210V or below.												Motor coasts to a stop if converter output voltage drops to 420V or below.													
	Momentary Power Loss	Immediately stop by 15 ms and above momentary power loss. (Continuous system operation during power loss less than 2 sec is equipped as standard.)*6 Setting made before shipment.																									
	Fin Overheat	Thermostat																									
	Stall Prevention	Stall prevention at accel/deccl and constant speed operation																									
	Ground Fault	Provided by electronic circuit																									
Environmental Conditions	Power Charge Indication	Charge lamp stays ON until bus voltage drops below 50V.																									
	Location	Indoor (protected from corrosive gases and dust)																									
	Ambient Temperature	+ 14 to + 104°F (- 10 to + 40°C) (Enclosed type, totally-enclosed type) + 14 to + 122°F (- 10 to + 50°C)*7 (Open chassis type) (not frozen)																									
	Storage Temperature*3	- 4 to 140°F (- 20 to + 60°C)																									
	Humidity	90% RH (non - condensing)																									
Vibration	9.81m/s² (1G) less than 20Hz, up to 1.96m/s² (0.2G) at 20 to 50Hz																										

\*1 YASKAWA standard 4-pole motor is used to determine max applicable motor output  
 \*2 Allowable values for the applications not required overload  
 \*3 Temperature during shipping (for short period)  
 \*4 There are two types low carrier frequency, compact type model-4045 and low noise type model-41A5  
 \*5 Approx 700V when input voltage set value (Cn-01) is less than 400 0V Approx 800V when it exceeds 400 0V  
 \*6 For models of 4 1kVA or less, continuous system operation during power loss less than 1 sec Two seconds ride-thru available as option.  
 \*7 Up to 122°F (50°C) allowed when front cover is removed (open chassis type)

APPENDIX B

DIMENSIONS in inch (mm)



Voltage V	Motor Capacity HP (kW)	VS-616G3						Mass lb (kg)
		Enclosed Type						
		W	H	D	W1	H1	Mtg. Hole d	
200 to 230	0.5 (0.4)	8.05 (204.5)	11.97 (304)	5.12 (130)	7.09 (180)	11.22 (285)	M6	9 (4)
	1 (0.75)							
	2 (1.5)							
	3 (2.2)	8.05 (204.5)	11.97 (304)	6.50 (165)	7.09 (180)	11.22 (285)	M6	15 (7)
	5 (3.7)							
	7.5 (5.5)	8.05 (204.5)	13.94 (354)	7.87 (200)	7.09 (180)	13.19 (335)	M6	22 (10)
	10 (7.5)							
	15 (11)	9.84 (250)	19.69 (500)	9.45 (240)	7.87 (200)	19.09 (485)	M6	42 (19)
	20 (15)	12.80 (325)	21.65 (550)	9.65 (245)	10.83 (275)	21.06 (535)		
	25 (18.5)	12.80 (325)	21.65 (550)	10.04 (255)	10.83 (275)	21.06 (535)	M6	70 (32)
30 (22)								
380 to 460	0.5 (0.4)	8.05 (204.5)	13.94 (354)	6.50 (165)	7.09 (180)	13.19 (335)	M6	15 (7)
	1 (0.75)							
	2 (1.5)							
	3 (2.2)	8.05 (204.5)	13.94 (354)	7.87 (200)	7.09 (180)	13.19 (335)	M6	22 (10)
	5 (3.7)							
	7.5 (5.5)	8.05 (204.5)	13.94 (354)	7.87 (200)	7.09 (180)	13.19 (335)	M6	22 (10)
	10 (7.5)							
	15 (11)	9.84 (250)	19.69 (500)	10.04 (255)	7.87 (200)	19.09 (485)	M6	46 (21)
	20 (15)							
	25 (18.5)	12.80 (325)	21.65 (550)	10.04 (255)	10.43 (265)	21.06 (535)	M6	70 (32)
	30 (22)							
	40 (30)	13.78 (350)	28.54 (725)	11.02 (280)	9.84 (250)	27.76 (705)	M8	92 (42)
	50, 60 (37, 45)							
60 *	19.69 (500)	36.42 (925)	11.02 (280)	15.75 (400)	35.43 (900)	M10	161 (73)	

\*Shows dimensions for model CIMR-G3□4L45 (low noise type).

- Notes
1. For detailed dimensions, contact your YASKAWA Representative.
  2. NEMA1 (Enclosed type) will be designed and manufactured on your order.

# APPENDIX C

## V/f PATTERN (Sn-02)

The following V/f patterns can be selected by Sn-02. Set inverter input voltage to Cn-01 before V/f pattern selection.

- Sn-02 data ① to ⑤ : Impossible to change
- Sn-02 data ⑥ : Possible to set freely (The following shows the data after initialization.)

### ■ 0.5HP (0.4kW) to 2HP (1.5kW) V/f PATTERN SELECTION (230V Class\*)

Application	Specification	Sn-02	V/f Pattern	Application	Specification	Sn-02	V/f Pattern		
General Purpose	50Hz	①		High Starting Torque	50Hz	⑧			
								⑨	
	60Hz	60Hz Saturation	① ⑥			60Hz	Low Starting Torque	①	
		50Hz Saturation	②				②	High Starting Torque	
		72Hz	③				90Hz	③	
	Variable Torque Operation (Fans and Pumps)	50Hz	Variable Torque 1		④	Constant HP Operation (Machine Tools)	120Hz	④	
Variable Torque 2			⑤						
60Hz		Variable Torque 1	⑥	180Hz	⑤				
		Variable Torque 2	⑦						



■ 3HP (2.2kW) to 60HP (45kW) V/f PATTERN SELECTION (230V Class\*)

Application	Specification	Sn-02	V/f Pattern	Application	Specification	Sn-02	V/f Pattern	
General Purpose	50Hz	①		High Starting Torque (Motor 7)	50Hz	⑧		
	60Hz	60Hz Saturation	① ⑥			50Hz	⑨	
		50Hz Saturation	②			60Hz	⑩	
	72Hz	③			90Hz	⑪		
Variable Torque Operation (Fans and Pumps)	50Hz	Variable Torque 1	④	Constant HP Operation (Machine Tools)	120Hz	⑫		
		Variable Torque 2	⑤					
	60Hz	Variable Torque 1	⑥		180Hz	⑬		
		Variable Torque 2	⑦					

\* Voltage values are doubled for 460V class.

40 to 60HP (30 to 45kW) for only 460V class.

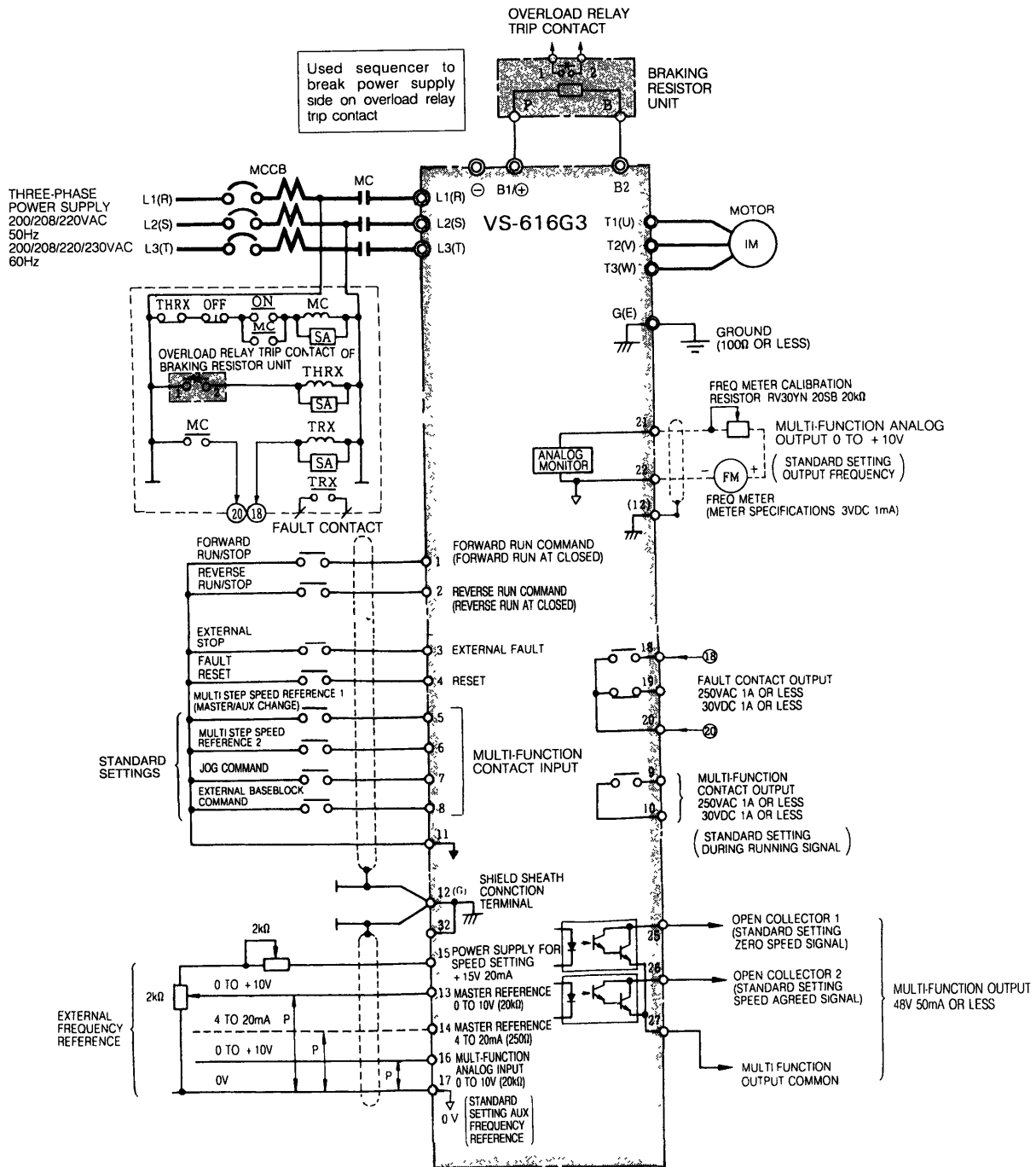
- Notes: 1. Consider the following points as V/f pattern selecting conditions.
- (1) Select a pattern in accordance with the motor voltage-frequency characteristics.
  - (2) Select a pattern in accordance with the motor maximum r/min.
2. High starting torque should be selected only in the following cases:
- (1) Wiring distance is long (approx. 492ft 150m or more).
  - (2) Voltage drop at start is large.
  - (3) AC reactor is inserted in the inverters input or output circuit.
  - (4) The motor is smaller than the maximum applicable motor.

# APPENDIX D

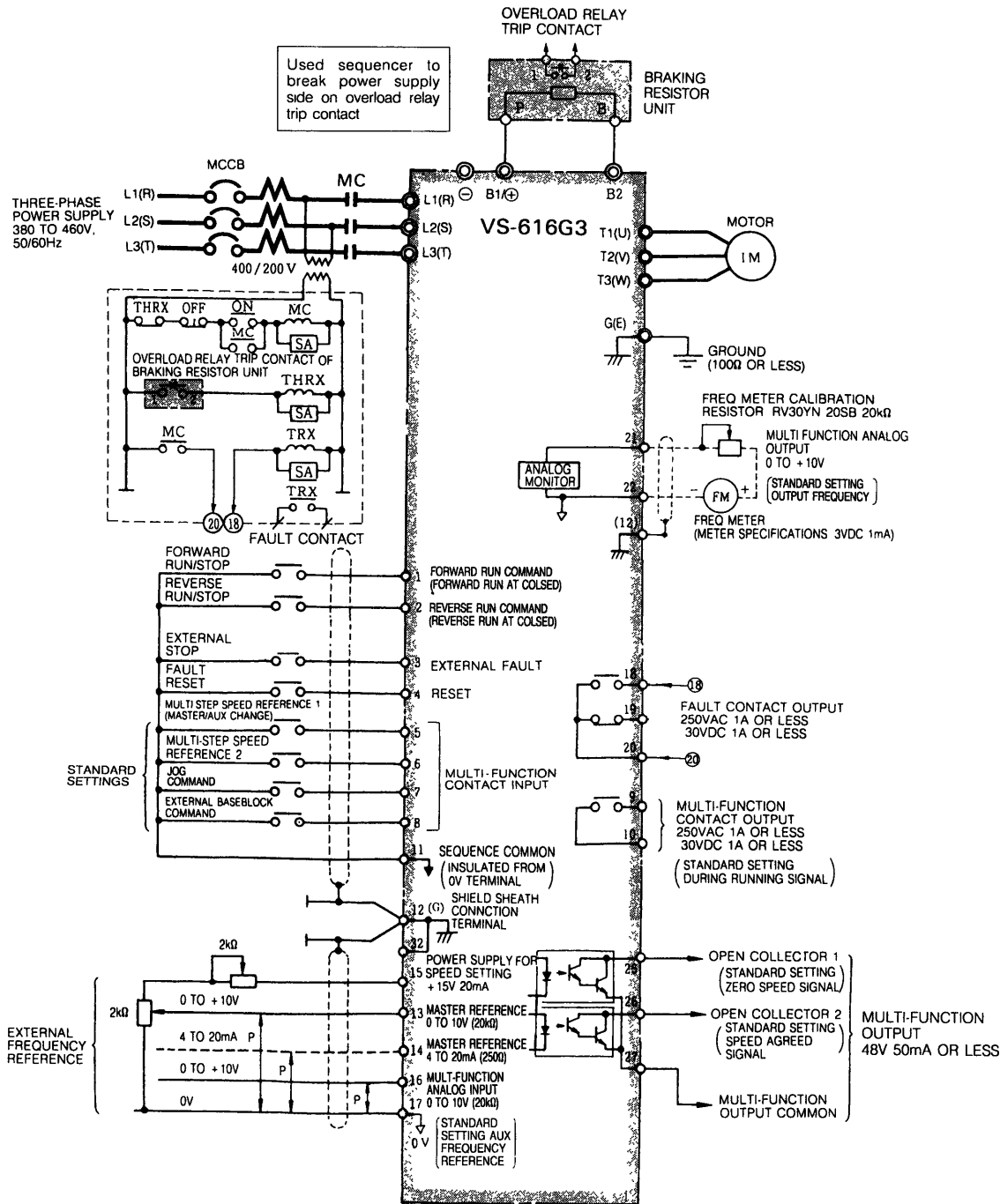
## TYPICAL CONNECTION DIAGRAM

### (1) Braking Unit

For Models CIMR-G3□20P4 to -G3□27P5  
(230V Class, 0.5 to 10HP, 0.4 to 7.5kW)

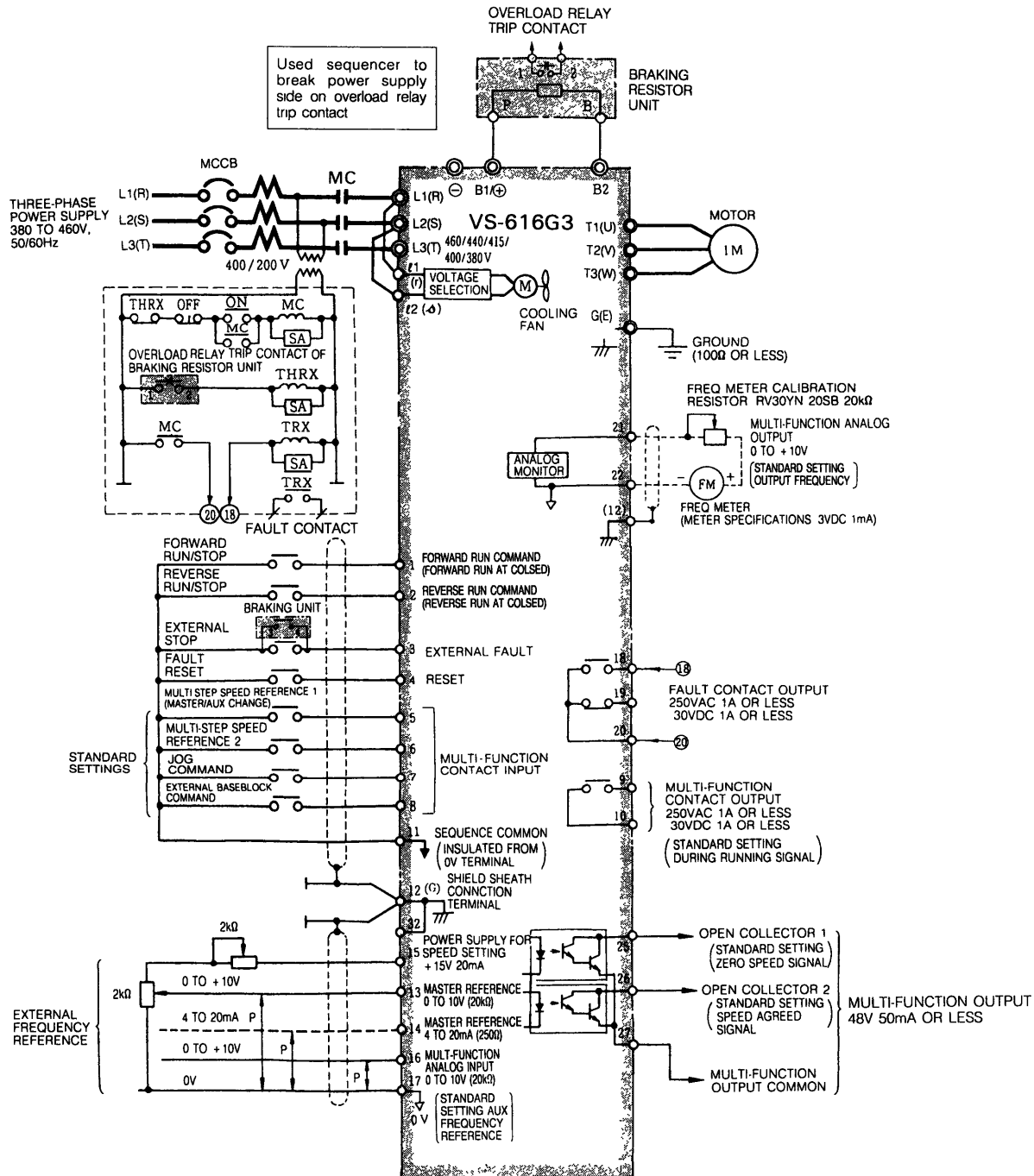


For Models CIMR-G3□40P4 to -G3□47P5  
(460V Class, 0.5 to 10HP, 0.4 to 7.5kW)

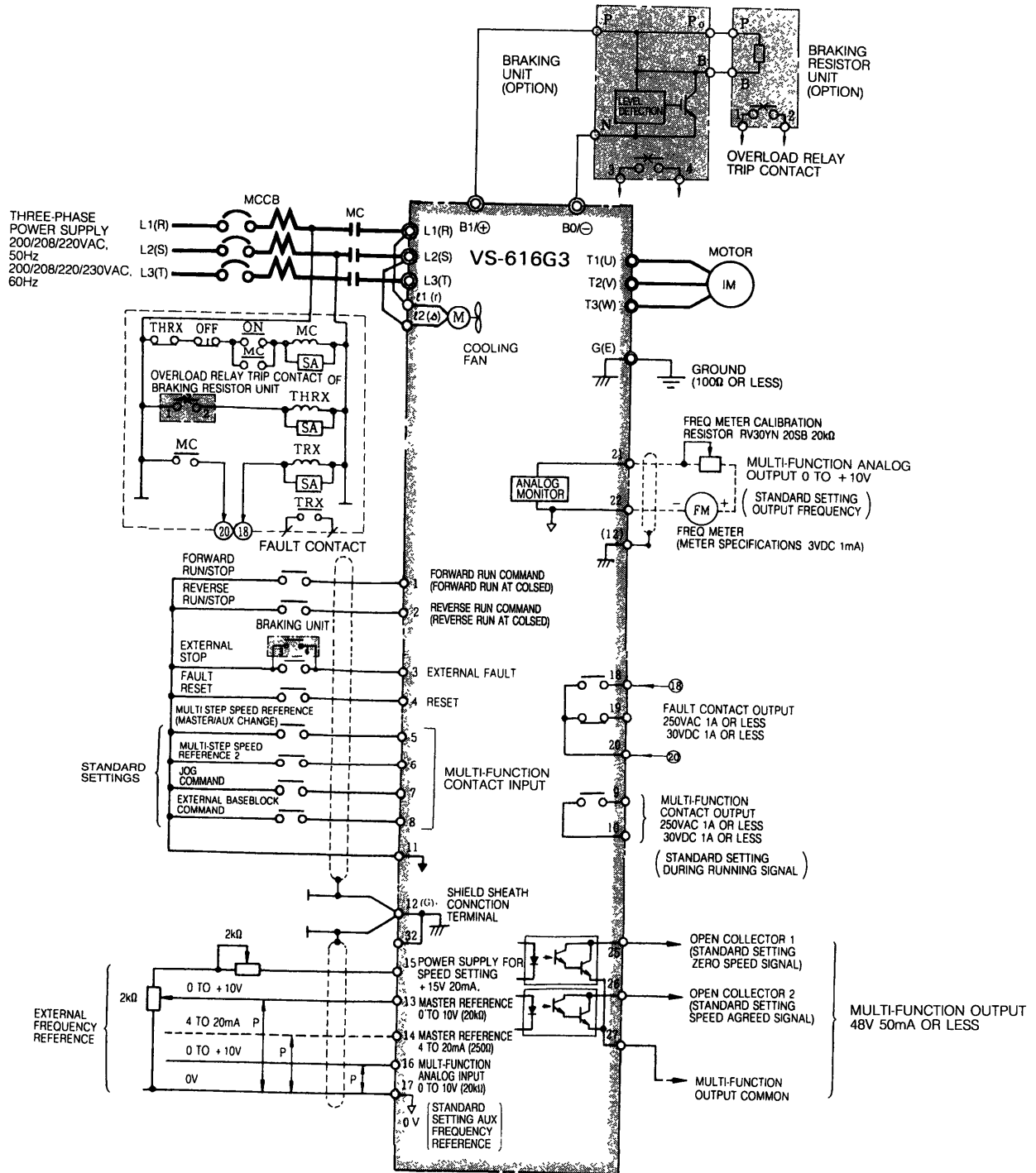


# TYPICAL CONNECTION DIAGRAM

For Models CIMR-G3 4011 to -G3 4015  
(460V Class, 15 and 20HP, 11 and 15kW)

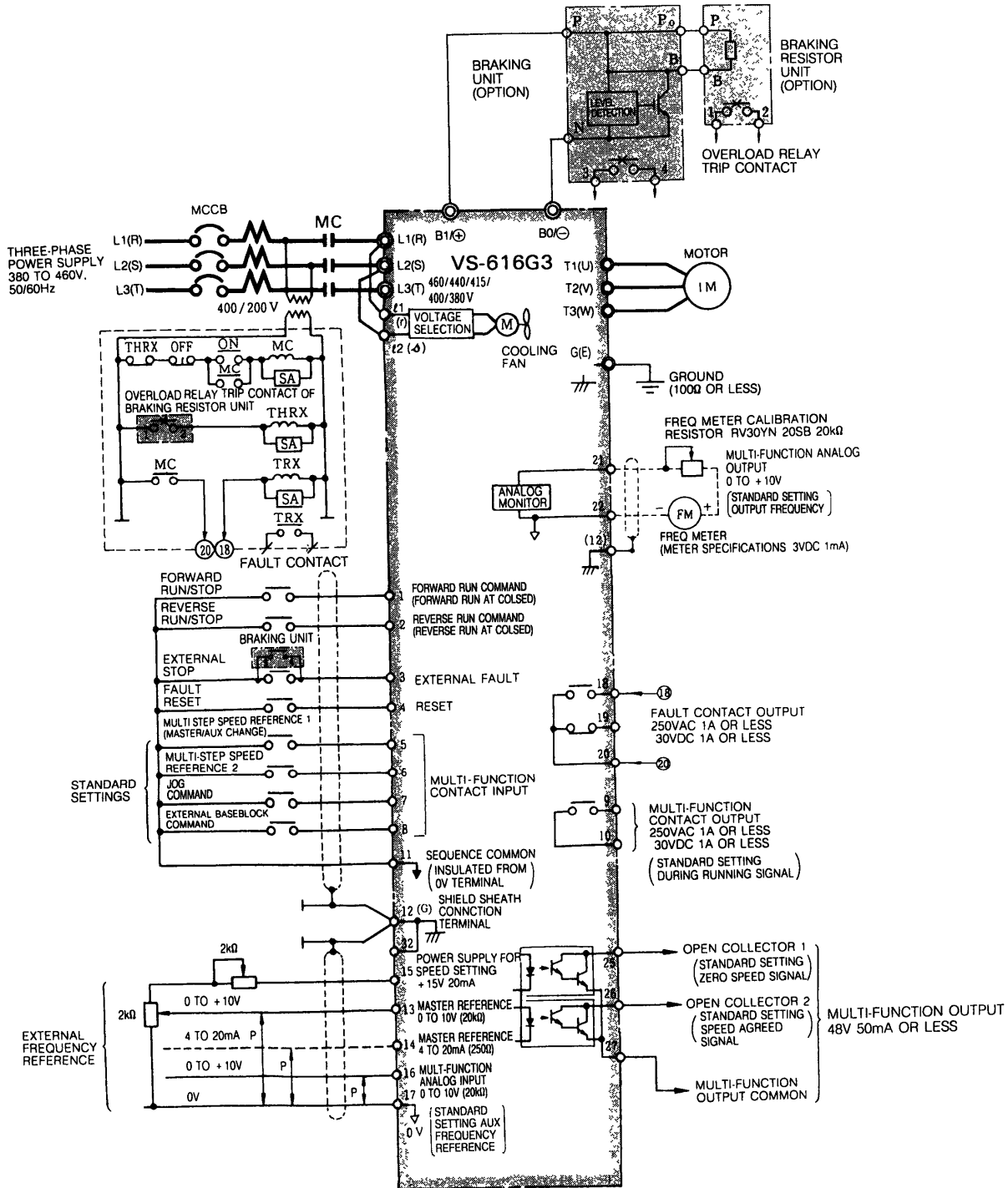


(2) Braking Unit and Braking Resistor Unit  
 For Models CIMR-G3□2011 to -G3□2022  
 (230V Class, 15 to 30HP, 11 to 22kW)



# TYPICAL CONNECTION DIAGRAM

For Models CIMR-G3□4018 to -G3□4045  
(460V Class, 25 to 60HP, 18.5 to 45kW)



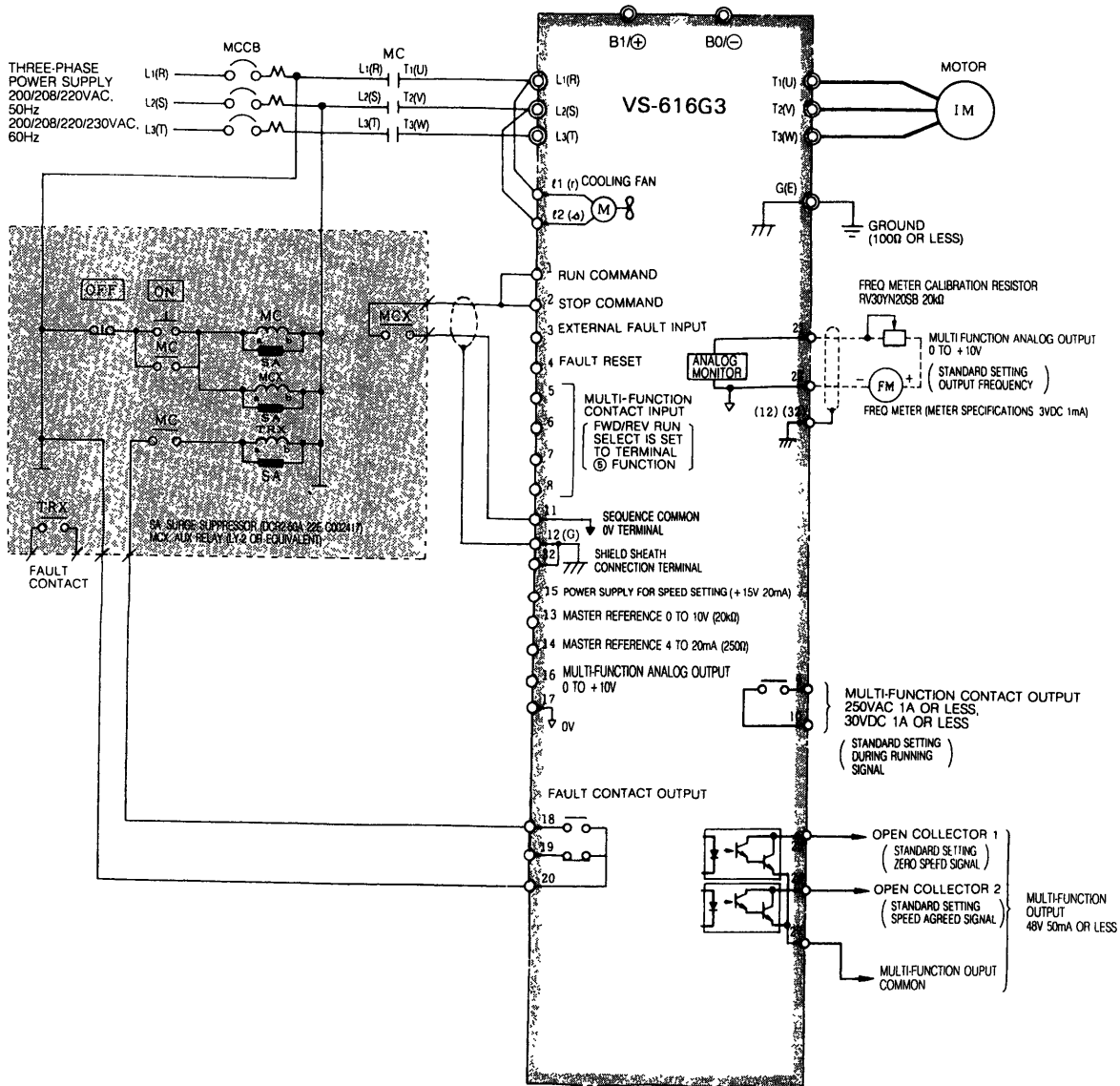
(3) Run/Stop by Main Circuit Magnetic Contactor  
For Model CIMR-G3□2022 (230V Class, 30HP, 22kW)

Turn on the power supply after checking that the motor has stopped. This circuit cannot be used for an application with a duty cycle of 1 hour or less.

System Constant Setting

System Constant No.	Data			
	4th digit	3rd digit	2nd digit	1st digit
Sn-04	-	/	0	/ *
Sn-11	-	/	-	-

\* Frequency reference setting  
0: Set by control circuit terminal  
1: Digital operator set value (An-01)



- Notes:
1. Braking is not activated at deceleration stop. It coasts to a stop.
  2. Use MC or MCX of delay release type for restart operation after momentary power loss.
  3. Frequency setting resistor is not required for the use of digital operator's set value as frequency reference.

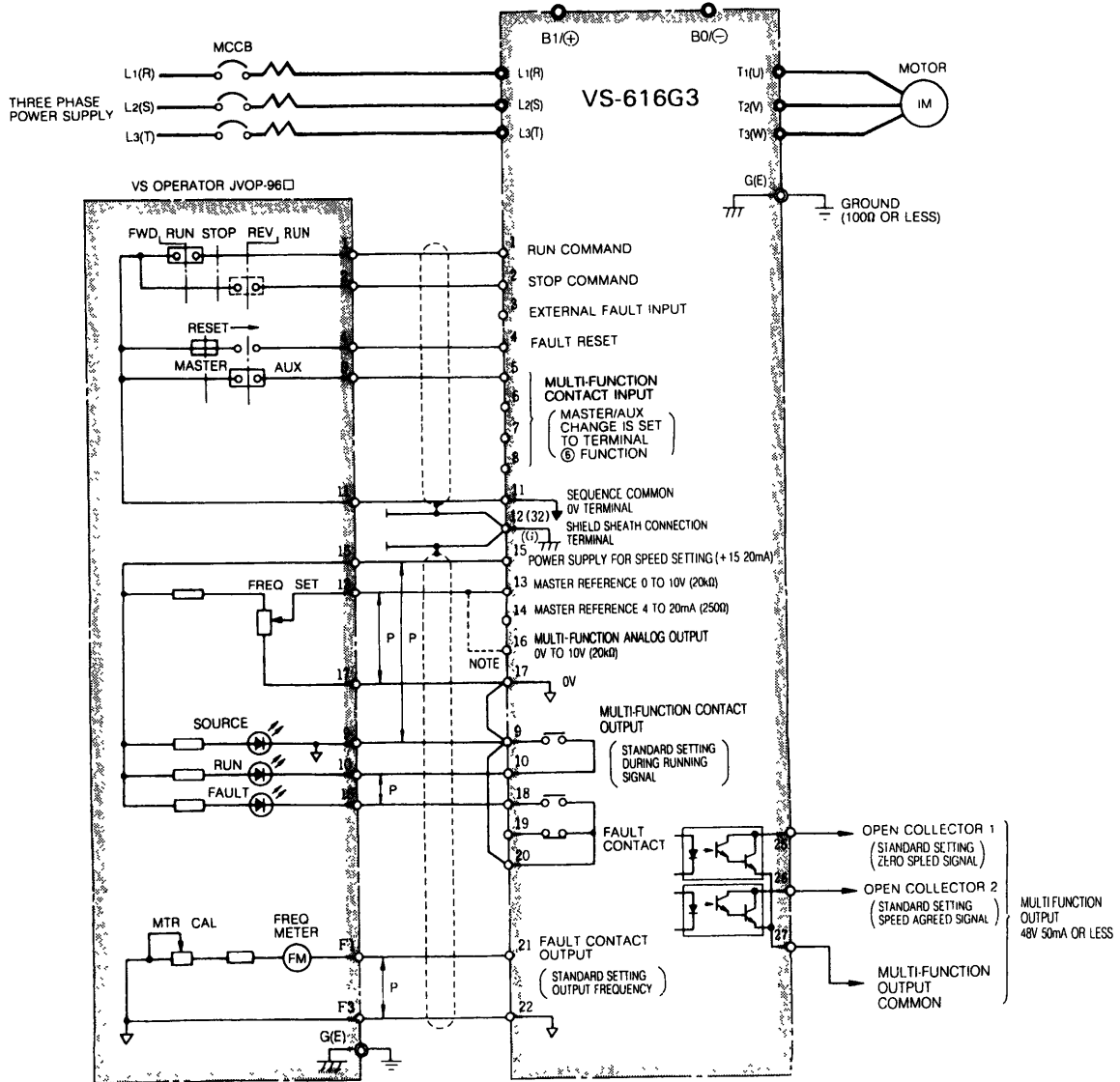
TYPICAL CONNECTION DIAGRAM

(4) With VS Operator Model JVOP - 95 • □

System Constant Setting

System Constant No.	Data			
	4th digit	3rd digit	2nd digit	1st digit
Sn-04	—	—	0	0
Sn-05	0	—	0	—
Sn-15	—	—	0	3
Sn-19	—	—	0	0*
Sn-20	—	—	0	0

\* Connect to control circuit terminal 13 or 16 according to the application. For terminal 16, set Sn-19 = x x 00.



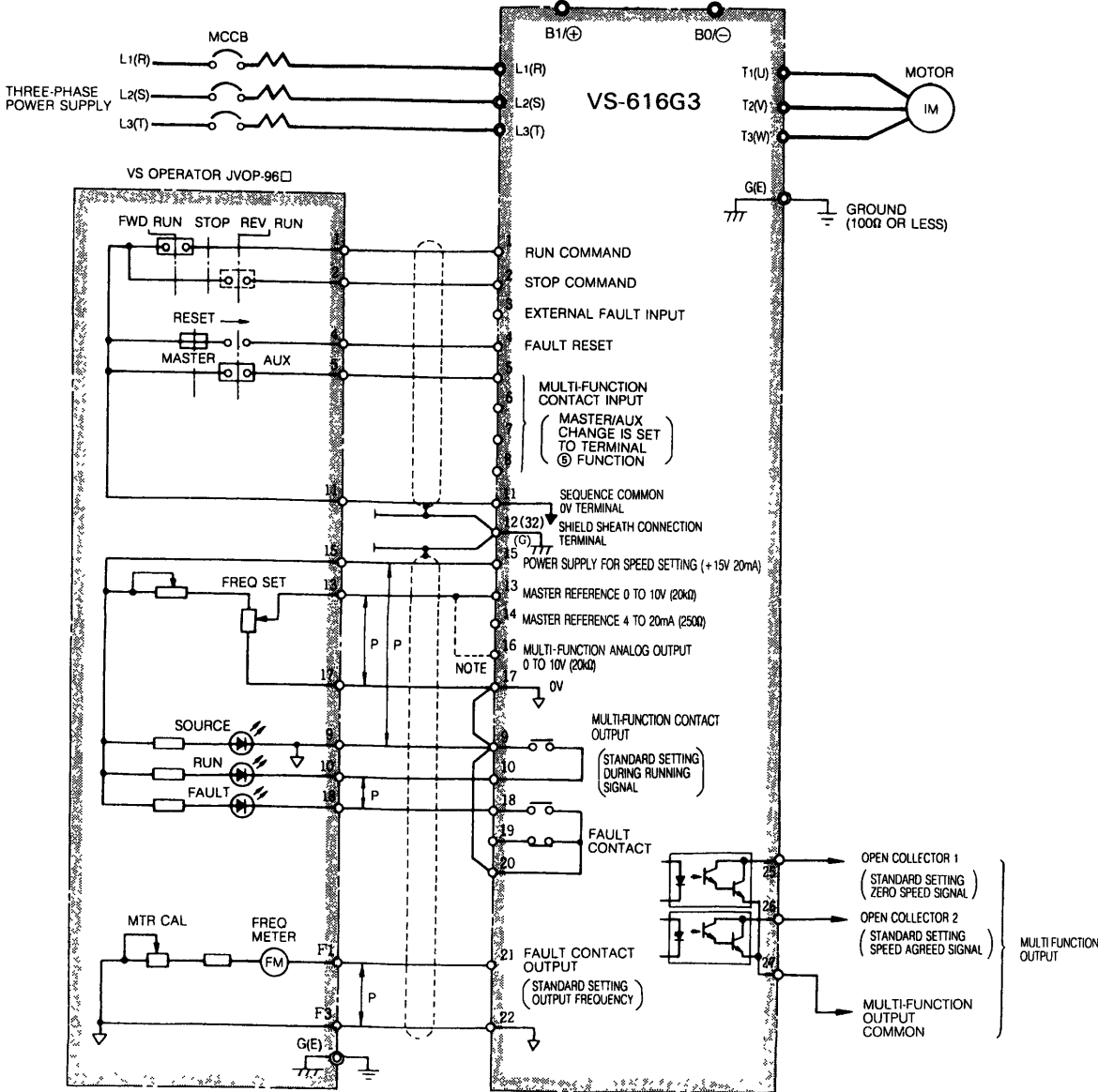


(5) With VS Operator Model JVOP - 96 □

System Constant Setting

System Constant No.	Data			
	4th digit	3rd digit	2nd digit	1st digit
Sn-04	—	—	0	0
Sn-05	0	—	0	—
Sn-15	—	—	0	3
Sn-19	—	—	0	0*
Sn-20	—	—	0	0

\* Connect to control circuit terminal 13 or 16 according to the application. For terminal 16, set Sn-19 = x × 0.0.

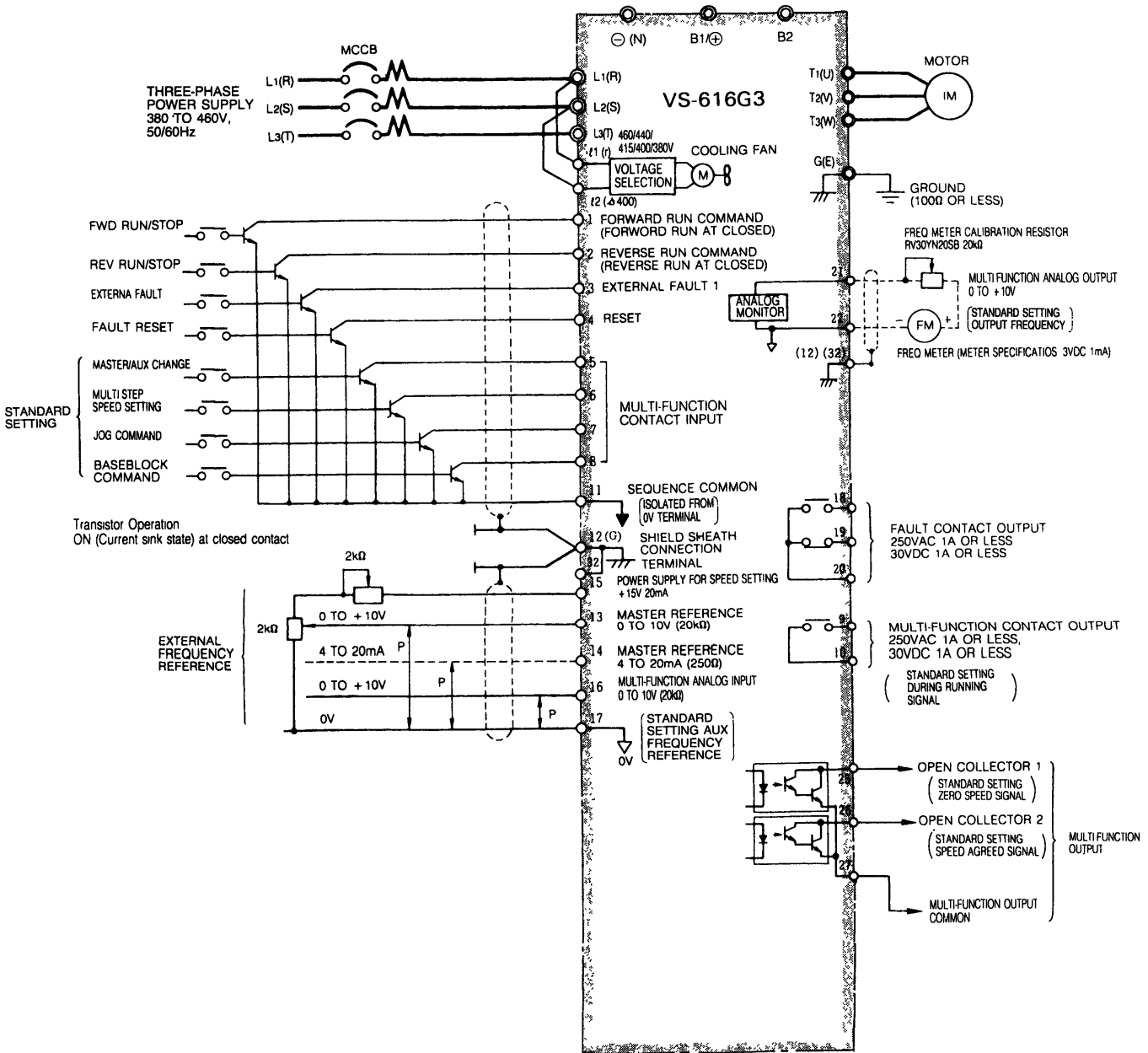


# TYPICAL CONNECTION DIAGRAM

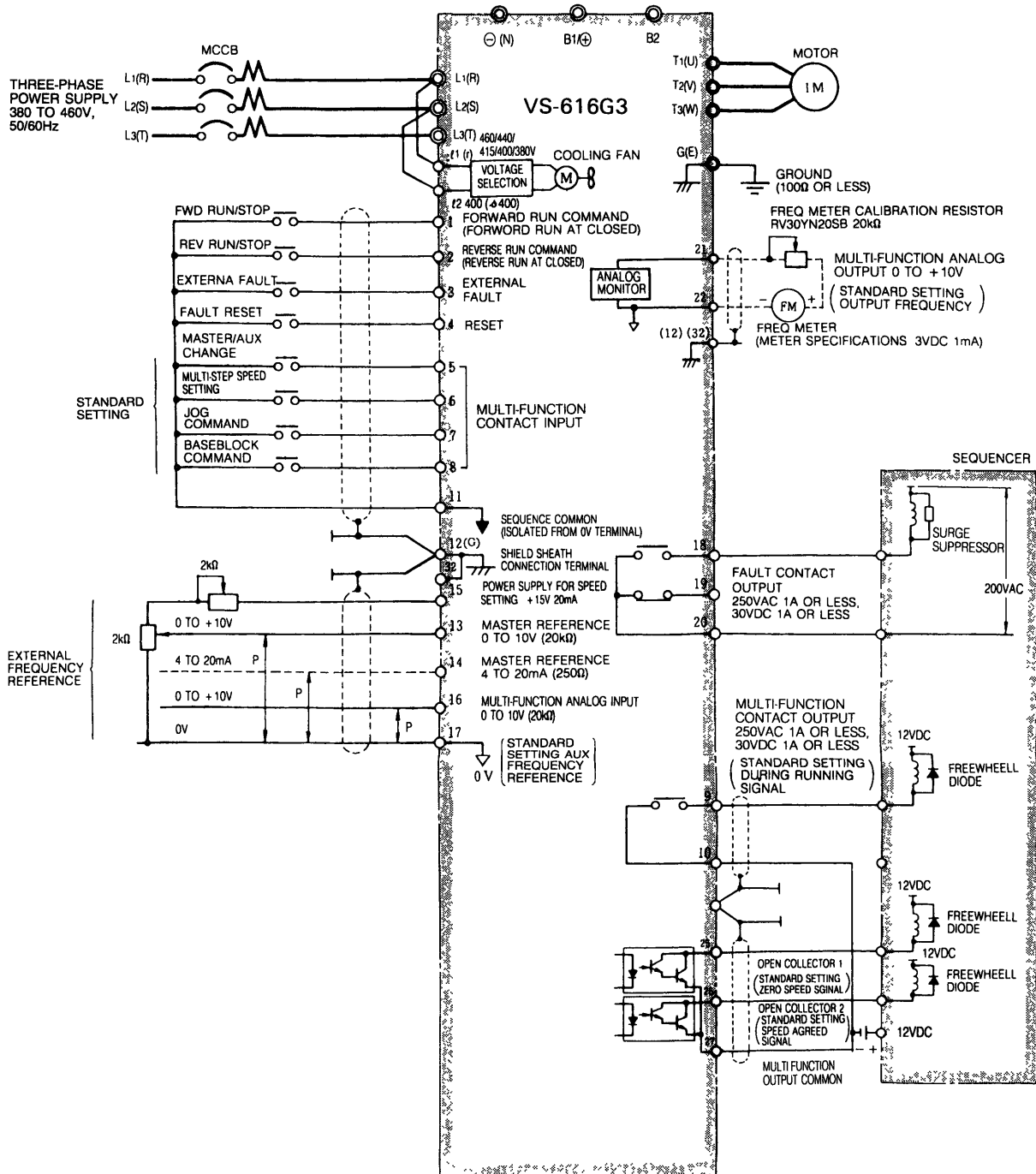
## (6) With Transistor Open Collector for Operation Signal

System Constant Setting

System Constant No.	Data			
	4th digit	3rd digit	2nd digit	1st digit
50-04	-	-	0	0



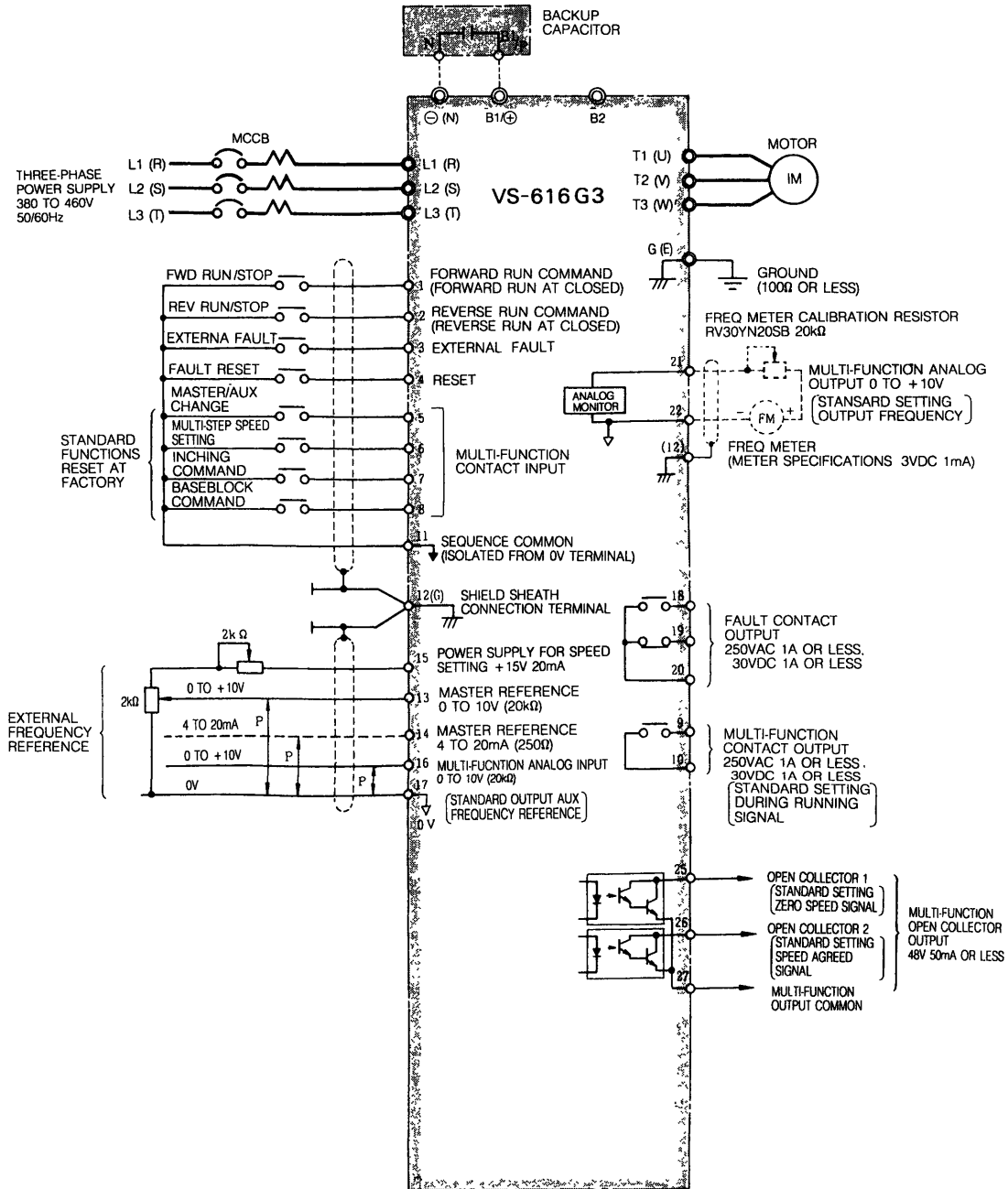
(7) With Contact Output, Photo-coupler Output



TYPICAL CONNECTION DIAGRAM

(8) With Backup Capacitor for Momentary Power Loss

For Models CIMR-G3□20P4 to -G3□22P2 (230V Class, 3HP, 2.2kW or less)  
 and Models CIMR-G3□40P4 to -G3□42P2 (460V Class 3HP, 2.2kW or less)



# APPENDIX E

## OPTIONS

### (1) OPTION CARDS

(Except digital output card DO-08, there terminals are to be connected only class 2 circuits.)

	Name	Code No.	Function	Installing Position	Document No.
Speed Reference	Analog Speed Reference Card AI-14U	73600-C001X	Permits setting a high-accuracy, high-resolution analog speed reference <ul style="list-style-type: none"> <li>• Input signal level: 0 to +10VDC (20kΩ) 1 channel 4 to 20mA DC (250Ω) 1 channel</li> <li>• Input signal level: 14 bits (1/16384)</li> </ul>	Attach the card at 2CN on the control circuit board. (See Note 1)	TOE-C736-30.13
	Analog Speed Reference Card AI-14B	73600-C002X	Permits setting a high-accuracy, high-resolution analog speed reference <ul style="list-style-type: none"> <li>• Input signal level: 0 to ±10VDC (20kΩ), 4 to 20mA DC (250Ω) 3 channels</li> <li>• Input resolution: 13 bits + sign (1/8192)</li> </ul>	Attach the card at 2CN on the control circuit board. (See Note 1)	TOE-C736-30.14
	Digital Speed Reference Card DI-08	73600-C003X	Permits setting an 8-bit digital speed reference <ul style="list-style-type: none"> <li>• Input signal: Binary 16 bits/BCD 2 digits + Sign</li> <li>• Input voltage: +24V (isolated)</li> <li>• Input current: 8mA</li> </ul>	Attach the card at 2CN on the control circuit board. (See Note 1)	TOE-C736-30.15
	Digital Speed Reference Card DI-16G	73600-C011X	Permits setting 16-bit digital speed reference. <ul style="list-style-type: none"> <li>• Input signal: Binary 16 bits/BCD 4 digits + sign</li> <li>• Input voltage: +24V (isolated)</li> <li>• Input current: 8mA/point</li> </ul> } Supplied by external device.	Attach the card at 2CN on the control circuit board. (See Note 1)	—
Communication Interface Card SI-B		73600-C006X	Permits operation or constant setting by command from master controller. <ul style="list-style-type: none"> <li>• Communication method: Synchronous</li> <li>• Communication speed: 19.2kBPS (up to 136.5kBPS possible)</li> <li>• Interface: RS-232, RS-422, RS-485</li> </ul>	Attach the card at 2CN on the control circuit board. (See Note 1)	—
Monitor	Analog Monitor Card AO-08	73600-D001X	Provides an analog signal for monitoring the output state (output frequency, output current, etc.) of the inverter. <ul style="list-style-type: none"> <li>• Output resolution: 8 bits (1/256)</li> <li>• Output voltage: 0 to +10V (not isolated)</li> <li>• Output channel: 2 channels</li> </ul>	Attach the card at 3CN on the control circuit board. (See Note 2)	TOE-C736-30.21
	Analog Monitor Card AO-12	73600-D002X	Provides an analog signal for monitoring the output state (output frequency, output current, etc.) of the inverter. <ul style="list-style-type: none"> <li>• Output resolution: 11 bits (1/2048)</li> <li>• Output voltage: 0 to +10V (not isolated)</li> <li>• Output channel: 2 channels</li> </ul>	Attach the card at 3CN on the control circuit board. (See Note 2)	TOE-C736-30.22
	Pulse Monitor Card PO-36F	73600-D003X	Provides a pulse string signal corresponding to the output frequency of the inverter. <ul style="list-style-type: none"> <li>• Output pulse: 1F, 6F, 10F, 12F, 36F (F: Output frequency)</li> <li>• Output voltage: +12V ± 10% (isolated)</li> <li>• Output current: 20mA max.</li> </ul>	Attach the card at 3CN on the control circuit board. (See Note 2)	TOE-C736-30.23
	Digital Output Card DO-08	73600-D004X	Extends multifunction output signal output status. Output method : Open collector output × 6 points (48 VDC 50mA or less) : Relay contact (1a)       250VAC 1A or less output × 2 points       30VDC 1A or less	Attach the card at 3CN on the control circuit board. (See Note 2)	TOE-C736-30.24

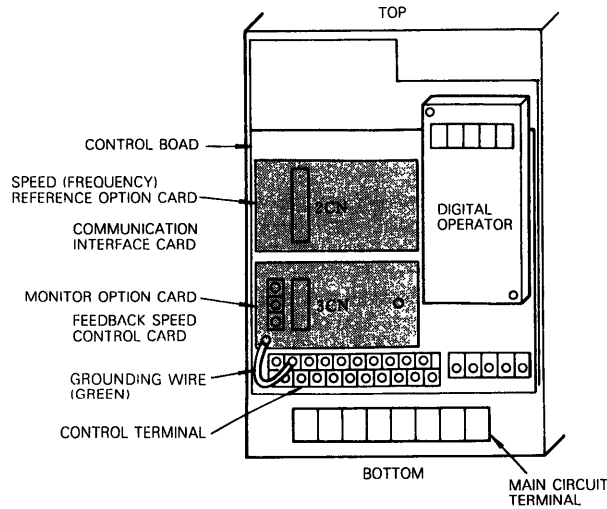
- Notes
1. Only one option card can be installed at 2CN at a time.
  2. Only one option card can be installed at 3CN at a time.
  3. When a communication interface card is attached at 2CN, no option card can be attached at 3CN.
  4. All option card terminals (except digital output card DO-08) should be connected to class 2 circuits.

(1) OPTION CARDS (Cont'd)

(Except digital output card DO-08, there terminals are to be connected only class 2 circuits.)

Name	Code No.	Function	Installing Position	Document No.
PG Speed Control Card		Used to compensate for speed fluctuations due to slip, utilizing a motor PG (pulse generator) which provides a means of speed feedback.	Attach the card at 3CN on the control circuit board. (See Note 2)	TOE-C736-30.3
PG-C	73600-D005X	<ul style="list-style-type: none"> <li>• For single-ended push-pull input or open collector input</li> <li>• Phase A (single phase) input</li> <li>• PG frequency range: 50 to 32767 Hz</li> <li>• Pulse monitor output: +12V, 20 mA</li> <li>• Input voltage: +12V</li> <li>• Input current: 300mA</li> </ul> External power supply required.		
PG-D	73600-D006X	<ul style="list-style-type: none"> <li>• For differential input</li> <li>• Phase A (differential pulse) input</li> <li>• PG frequency range: 50 to 32767 Hz</li> <li>• I/O standard is in compliance with RS-422A.</li> <li>• Input voltage: +12V</li> <li>• Input current: 300mA</li> </ul> External power supply required.		

- Notes:
1. Only one option card can be installed at 2CN at a time.
  2. Only one option card can be installed at 3CN at a time.
  3. When a communication interface card is attached at 2CN, no option card can be attached at 3CN.
  4. All option card terminals (except digital output card DO-08) should be connected to class 2 circuits.



Option Card Installing Position

(2) OPTION UNITS

Name	Model (Code No.)	Function	Installing Position	Document No.
Digital Monitor	JVOP - 101 (73041 - 0911X)	Permits display of frequency and current by digital monitor and indication of a problem. Not equipped with key pads for RUN/STOP operation and setting a constant so that it can be safely used at the site.	On the inverter <sup>*1</sup>	TOE- C730-50.4
Remote Operator	JVOP - 102 (73041 - 0912X)	Digital operator (JVOP-100) and digital monitor (JVOP-101) are built-in. Can perform operation or monitoring by serial communication at a distance of 328ft (100m) maximum from the inverter. 200mA current 100P Power supply: 85 to 264VAC, 50 to 60Hz (D-SUB connector, cover, for power supply connector provided)	Separately-mounted For open chassis or enclosed type	—
Remote Monitor	JVOP - 103 (73041 - 0913X)			
Remote Interface	JVOP - 104 (73041 - 0914X)	Mounted on the inverter for remote operation or monitoring [up to 328ft (100m)] by remote operator (JVOP-102) or remote monitor (JVOP-103). 20mA current 100P/RS-232C (D-SUB connector, cover provided)	On the inverter	—
Operator/Monitor Adapter	JVOP - 109 (73041 - 0919X)	This removable adapter panel can be used on the inverter cover with an extension cable when the digital operator or digital monitor needs to be removed from the inverter cover.	On the inverter <sup>*1</sup>	TOE- C736-50.11
Adapter Panel Exclusive Use Extension Cable	3.3ft (1m) cable (72616-W3001-01) 9.9ft (3m) cable (72616-W3003-01)	Used for remote mounting of the digital operator/monitor using adapter panel (JVOP-109)	—	
VS Operator (Small Plastic Version)	JVOP - 95•□ <sup>*2</sup> (73041 - 0905X - □)	An exclusive control panel for remotely setting frequency and for starting and stopping an inverter using analog commands [distance up to 164ft (50m)]. Scale on the frequency indicator: 60/120Hz, 90/180Hz	Separately installed	—
VS Operator (Standard Version)	JVOP - 96•□ <sup>*2</sup> (73041 - 0906X•□)	An exclusive control panel for remotely setting frequency and for starting and stopping an inverter using analog commands [distance up to 164ft (50m)]. Scale on the frequency indicator, 75Hz, 150Hz, 220Hz	Separately installed	—
Extension Cable <sup>*1</sup> for Digital Operator or Monitor	3.3ft (1m) cable (72616 - W3001) 9.9ft (3m) cable (72616 - W3003)	This extension cable is used when the digital operator or digital monitor is used after removing from the inverter front cover. The cable is available in 3.3ft (1m) and 9.9ft (3m) lengths. The package of the extension cable includes a simple indicating cover. Depending on the application, the use of the operator/monitor adapter JVOP-109 is recommended.	On the inverter <sup>*1</sup>	TOE- C730-50.10

(2) OPTION UNITS (Cont'd)

Name	Model (Code No.)	Function	Installing Position	Document No.
Braking Unit	CDBR - □ (73600 - R□□□0)	Used in combination with the braking resistor unit to reduce the motor deceleration time.	Separately installed	TOE- C736-50.5
Braking Resistor Unit	LKEB - □ (73600 - K□□□0)	Shortens the motor deceleration time by consuming the regenerative energy through the resistor.	Separately installed	TOE- C736-50.5
Back up Capacitor Unit for Momentary Power Loss	P00□0 (73600 - P00□0)	Designed for momentary power loss of control power. (Backup time: 2sec.)	Separately installed	TOE- C736-50.6
Control Power Unit for DI-16G	AVR387 (72600-AVR387)	Used to supply power to digital reference card (DI-16G). • Input: 200 to 240VAC ± 10% 50/60Hz • Output: + 24VDC 0.2A	Separately installed	—
	AVR388 (72600-AVR388)	Use AVR388 for momentary power loss. (Backup time: 2sec.)		
Control Power Unit for PG-C	AVR385 (72600-AVR385)	Used to supply power to PG speed control card (PG-C). • Input: 200 to 240VAC ± 10% 50/60Hz • Output: + 12VDC 0.3A	Separately installed	—
	AVR386 (72600-AVR386)	Use AVR386 for momentary power loss. (Backup time: 2sec.)		

- \*1 Only one of the options, JVOP-101 or -109, can be installed at a time.  
When attaching either option, the digital operator (JVOP-100, provided as a standard feature) must be removed.
- \*2 The type of frequency indicator is to be shown in the box after the model name and the code number.

In Case of VS Operator

Frequency Indicator (max. scale)	Model	Code No.
60/120/75Hz	1	01
90/180/150Hz	2	02
220Hz	3	03

- \*3 Exclusive extension cables with blind cover can not be removed on the inverter front cover.  
When digital operator/monitor is operated remotely (3.3ft 1m, 9.9ft 3m), use exclusive use extension cable (with indicating cover) or adapter panel and adapter panel exclusive use extension cable.



**NOTES**

# GENERAL-PURPOSE INVERTER

## Varispeed-616G3

# INSTRUCTIONS

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