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VARISPEED-616G5
INSTRUCTION MANUAL

MULTI-FUNCTION ALL-DIGITAL TYPE (VS-616G5)

MODEL: CIMR-G5C□□□

400V CLASS 0.55 to 160kW (1.4 to 230kVA)

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

REFERENCE

VARISPEED-616G5 DESCRIPTIVE MANUAL FOR CONSTANTS (TOEZ-S616-10.11)



YASKAWA

MANUAL NO. TOE-S616-10.12

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PREFACE

YASKAWA's VS–616G5 is a user–friendly inverter provided with vector control for standard models in addition to V/f control. This instruction manual describes installation, maintenance and inspection, troubleshooting, and specifications of the VS–616G5. Read this instruction manual thoroughly before operation.

YASKAWA ELECTRIC CORPORATION

General Precautions

- Some drawings in this manual are shown with the protective cover or shields removed, in order to describe detail with more clarity. Make sure all covers and shields are replaced before operating this product.
- This manual may be modified when necessary because of improvement of the product, modification, or changes in specifications.
  Such modifications are denoted by a revised manual No.
- To order a copy of this manual, if your copy has been damaged or lost, contact your YASKAWA representative
- YASKAWA is not responsible for any modification of the product made by the user, since that will void your guarantee.

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NOTES FOR SAFE OPERATION

Read this instruction manual thoroughly before installation, operation, maintenance or inspection of the VS–616G5. In this manual, NOTES FOR SAFE OPERATION are classified as "WARNING" or "CAUTION".

⚠WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury to personnel and damage to equipment.
It may also be used to alert against unsafe practices.

Even items described in ⚠ CAUTION may result in a vital accident in some situations. In either case, follow these important notes.

NOTE : These are steps to be taken to insure proper operation.

RECEIVING

⚠ CAUTION

(Ref. page)

- Do not install or operate any inverter which is damaged or has missing parts.
  Failure to observe this caution may result in personal injury or equipment damage. 10

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INSTALLATION

⚠ CAUTION

(Ref. page)

- Lift the cabinet by the base. When moving the unit, never lift by the front cover.
  Otherwise, the main unit may be dropped causing damage to the unit. 12
- Mount the inverter on nonflammable material (i.e. metal).
  Failure to observe this caution can result in a fire. 12
- When mounting units in an enclosure, install a fan or other cooling device to keep the intake air temperature below 45°C.
  Overheating may cause a fire or damage to the unit. 12

WIRING

⚠ WARNING

(Ref. page)

- Only commence wiring after verifying that the power supply is turned OFF.
  Failure to observe this warning can result in an electrical shock or a fire. 17
- Wiring should be performed only by qualified personnel.
  Failure to observe this warning can result in an electrical shock or a fire. 17
- When wiring the emergency stop circuit, check the wiring thoroughly before operation.
  Failure to observe this warning can result in personal injury. 17
- Make sure to ground the supply neutral.
  Failure to observe this warning can result in an electrical shock and inverter damage. 21
- Make sure to ground the ground terminal ⏚ before connecting the other terminals.
  Failure to observe this warning can result in an electrical shock. 21

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⚠ CAUTION

(Ref. page)

- Verify that the inverter rated voltage coincides with the AC power supply voltage.
  Failure to observe this caution can result in personal injury or a fire. 17
- Do not perform a withstand voltage test of the inverter.
  It may cause semi-conductor elements to be damaged. 17
- To connect a braking resistor, braking resistor unit or braking unit, follow the procedures described in APPENDIX 3.
  Improper connection may cause a fire. 17
- Tighten terminal screws to the specified tightening torque.
  Failure to observe this caution can result in a fire. 17
- Never connect the AC main circuit power supply to output terminals U, V and W.
  The inverter will be damaged and invalidate the guarantee. 21

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OPERATION

⚠ WARNING

(Ref. page)

- Only turn ON the input power supply after replacing the front cover. Do not remove the cover while current is flowing.
  Failure to observe this warning can result in an electrical shock. 36
- When the retry function (L5–02) is selected, do not approach the inverter or the load, since it may restart suddenly after being stopped.
  (Construct machine system, so as to assure safety for personnel, even if the inverter should restart.)
  Failure to observe this warning can result in personal injury. 36
- Since the stop button can be disabled by a function setting, install a separate emergency stop switch.
  Failure to observe this warning can result in personal injury. 36
- If an alarm is reset with the operation signal ON, the inverter restarts automatically. Only reset the alarm after verifying that the operation signal is OFF.
  Failure to observe this warning can result in personal injury. 36

⚠ CAUTION

(Ref. page)

- Never touch the heatsink or discharging resistor since the temperature is very high.
  Failure to observe this caution can result in harmful burns to the body. 36
- Since it is easy to change operation speed from low to high speed, verify the safe working range of the motor and machine before operation.
  Failure to observe this caution can result in personal injury and machine damage. . . 36
- Install a holding brake separately if necessary.
  Failure to observe this caution can result in personal injury. 36
- Do not change signals during operation.
  The machine or the inverter may be damaged. 36
- All the constants of the inverter have been preset at the factory. Do not change the settings unnecessarily.
  The inverter may be damaged. For supply voltage, follow Par. 4.3. 36

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MAINTENANCE AND INSPECTION

⚠ WARNING

(Ref. page)

- Never touch high–voltage terminals in the inverter.
  Failure to observe this warning can result in an electrical shock. 61
- Replace all protective covers before powering up the inverter. To remove the cover, make sure to disconnect supply mains.
  Failure to observe this warning can result in an electrical shock. 61
- Perform maintenance or inspection only after verifying that the CHARGE LED goes OFF, after the main circuit power supply is turned OFF.
  The capacitors are still charged and can be dangerous. 61
- Only authorized personnel should be permitted to perform maintenance, inspections or parts replacement.
  [Remove all metal objects (watches, bracelets, etc.) before operation.]
  (Use tools which are insulated against electrical shock.)
  Failure to observe this warning can result in an electrical shock. 61

⚠ CAUTION

(Ref. page)

- The control PC board employs CMOS ICs. Do not touch the CMOS elements.
  They are easily damaged by static electricity. 61
- Do not connect or disconnect wires or connectors while power is applied to the circuit.
  Failure to observe this caution can result in personal injury. 61
- When removing the wiring, remove the ground wire last.

OTHERS

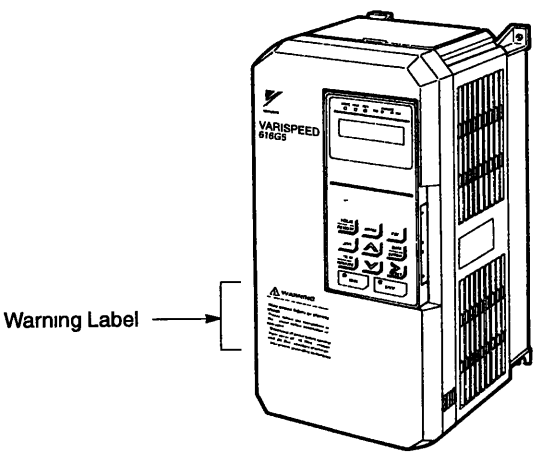
⚠ WARNING

- Never modify the product.
  Failure to observe this warning can result in an electrical shock or personal injury and will invalidate the guarantee.

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WARNING LABEL

A warning label is displayed on the front cover of the inverter, as shown below. Follow these instructions when handling the inverter.



Model CIMR–G5C43P7

Warning Label

⚠ WARNING

May cause injury or electric shock.

- Please follow the instructions in the manual before installation or operation.
- Disconnect all power before opening front cover of unit. Wait 1 minute until DC Bus capacitors discharge.
- Use proper grounding techniques.
- Make sure to ground the supply neutral.

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1 RECEIVING

> **⚠ CAUTION**
>
> • Do not install or operate any inverter which is damaged or has missing parts.
> Failure to observe this caution may result in personal injury or equipment damage.

This chapter describes how to verify the inverter after delivery to the user.

1.1 INSPECTION CHECKPOINTS

(1) Receiving Checkpoints

Table 1 Checkpoints

Checkpoints	Description
Does the inverter model number correspond with the purchase order?	Check the model number on the nameplate on the side of the VS-616G5 (Refer to page 11)
Are any parts damaged?	Visually check the exterior and verify that there was no damage during transport
Is hardware properly seated and securely tightened?	Remove inverter front cover Check all visible hardware with appropriate tools
Was an instruction manual received?	VS-616G5 Instruction manual (No TOE-S616-10 12) VS-616G5 Descriptive manual for constants (No TOEZ-S616-10 11)

If any of the above checkpoints are not satisfactory, contact your YASKAWA representative.

(2) Checking the Nameplate Data

(a) Nameplate Data

Example of European model CIMR-G5C40P4

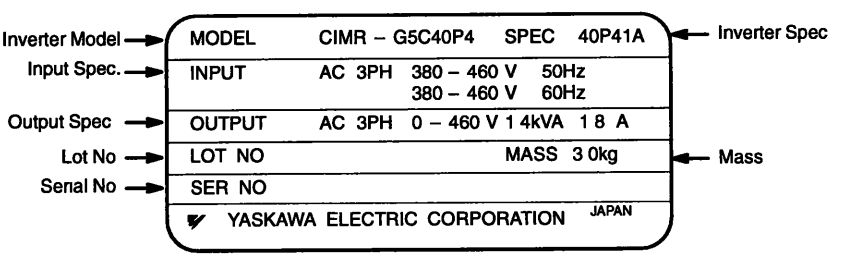
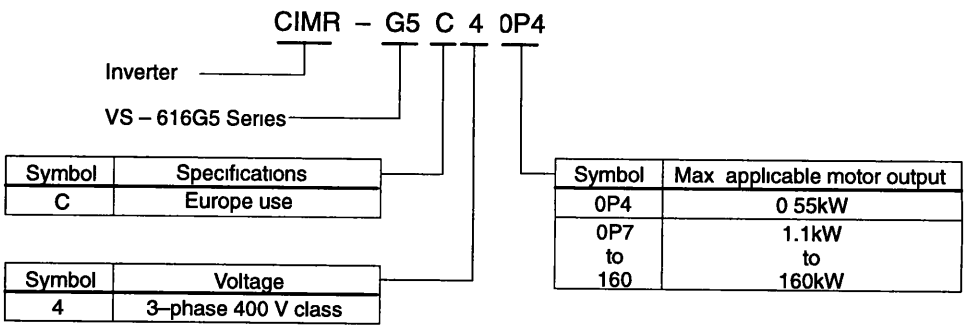


Fig. 1 Nameplate Data

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(b) Model Designation



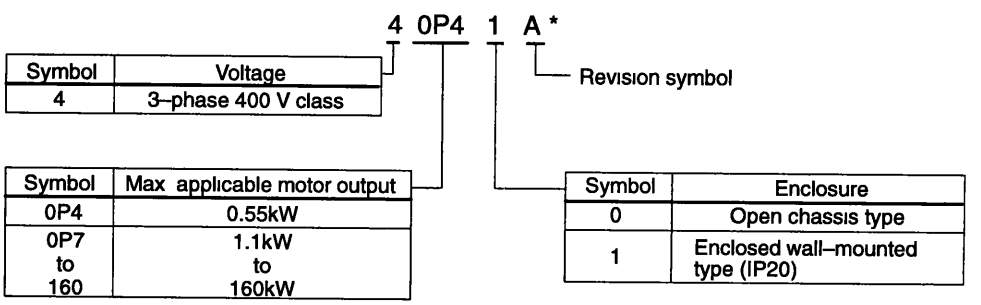
Symbol	Specifications
C	Europe use

Symbol	Voltage
4	3–phase 400 V class

Symbol	Max applicable motor output
0P4	0 55kW
0P7 to 160	1.1kW to 160kW

Fig. 2 Model Designation

(c) Specification Designation



Symbol	Voltage
4	3–phase 400 V class

Symbol	Max applicable motor output
0P4	0.55kW
0P7 to 160	1.1kW to 160kW

Symbol	Enclosure
0	Open chassis type
1	Enclosed wall–mounted type (IP20)

* For special specifications, a spec. sheet No. appears on the nameplate

Fig. 3 Specification Designation

1.2 IDENTIFYING THE PARTS

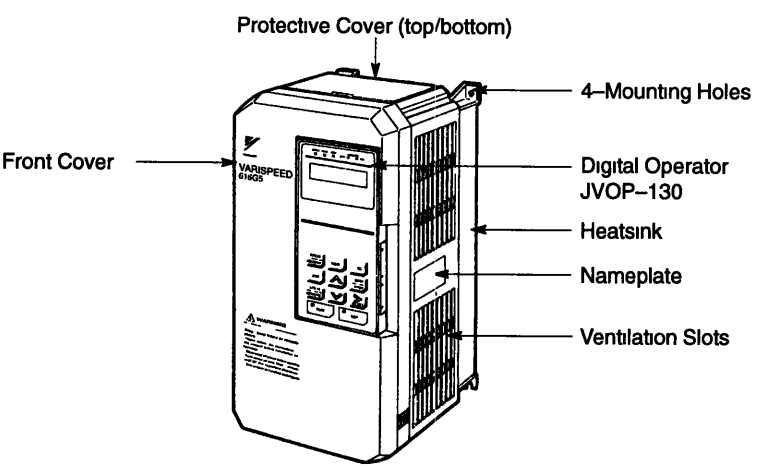


Fig. 4 Configuration of VS–616G5 (Model CIMR–G5C40P4)

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2 INSTALLATION

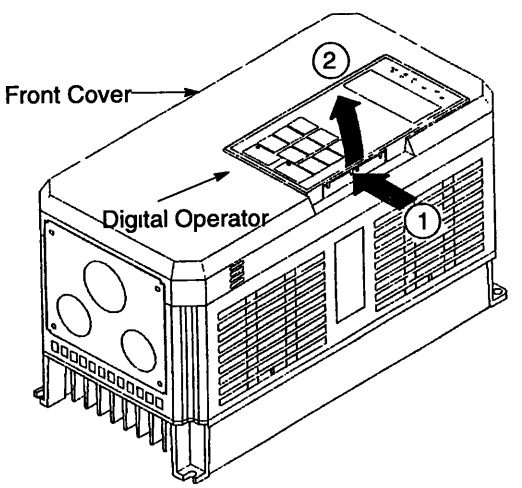
> **⚠ CAUTION**
>
> - Lift the cabinet by the base. When moving the unit, never lift by the front cover.
> Otherwise, the main unit may be dropped causing damage to the unit.
> - Mount the inverter on nonflammable material (i.e. metal).
> Failure to observe this caution can result in a fire.
> - When mounting units in an enclosure, install a fan or other cooling device to keep the intake air temperature below 45°C.
> Overheating may cause a fire or damage to the unit.

This chapter describes the configuration, location and space when mounting the VS–616G5.

2.1 REMOVING AND REPLACING THE DIGITAL OPERATOR

Remove and replace the digital operator as follows.

(1) Removing the Digital Operator

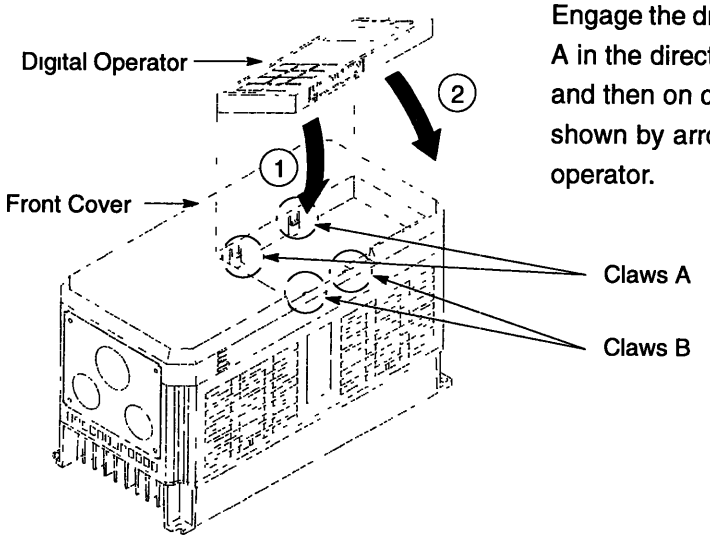


Push the digital operator lever in the direction shown by arrow 1 and lift the digital operator in the direction shown by arrow 2 to remove the digital operator from the front cover.

Fig. 5 Removing the Digital Operator

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(2) Replacing the Digital Operator



Engage the digital operator on claws A in the direction shown by arrow 1 and then on claws B in the direction shown by arrow 2 to lock the digital operator.

Fig. 6 Replacing the Digital Operator

NOTE

Never fit the digital operator in any other direction or by any other method.
The digital operator will not be connected to the inverter.

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2.2 REMOVING AND REPLACING THE FRONT COVER

To remove the front cover, first move the digital operator in the direction shown by arrow 1. (See Par. 2.1.) Then squeeze the cover in the direction shown by arrows 2 on both sides and lift in the direction shown by arrow 3.

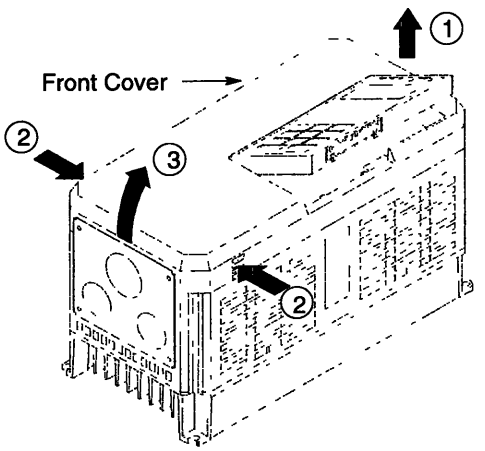


Fig. 7 Removing and Replacing the Front Cover

NOTE

Do not replace the front cover with the digital operator connected. The digital operator will not be connected to the inverter. Replace the front cover first and then install the digital operator on the cover. See Par. 2.1 for replacing the digital operator.

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2.3 CHOOSING A LOCATION TO MOUNT THE INVERTER

To ensure proper performance and long operating life, follow the recommendations below when choosing a location for installing the VS–616G5. Make sure the inverter is protected from the following conditions:

☐ Extreme cold and heat

Use only within ambient temperature range. –10°C to +40°C

☐ Rain, moisture

☐ Oil sprays, splashes

☐ Salt spray.

☐ Direct sunlight. (Avoid using outdoors.)

☐ Corrosive gases or liquids.

☐ Dust or metallic particles in the air. (For enclosed wall–mounted type)

☐ Physical shock, vibration.

☐ Magnetic noise. (Example: welding machines, power devices, etc.)

☐ High humidity.

☐ Radioactive materials.

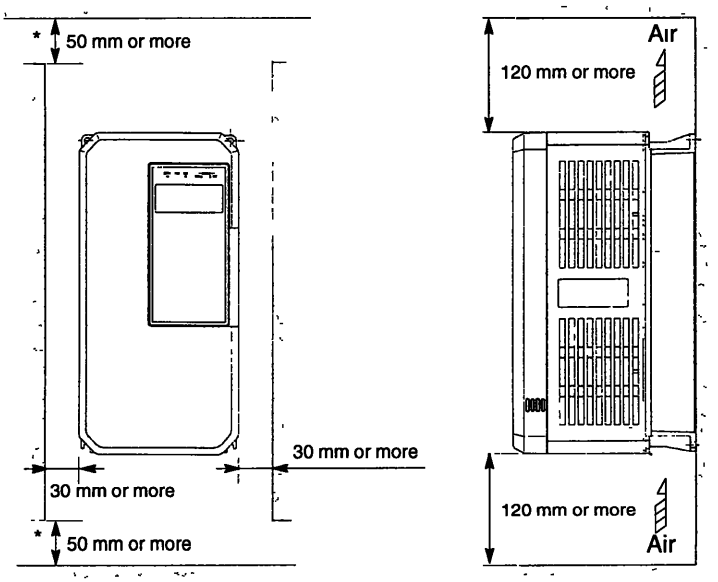
☐ Combustibles: thinners, solvents, etc.

Climatic condition for temperature, humidity and air pressure should be 3K3 (prEN50178).

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2.4 CLEARANCES

Install the VS–616G5 vertically and allow sufficient clearances for effective cooling as shown in Fig. 8.



(a) Front View (b) Side View

Fig. 8 Clearances

NOTE

1. The clearances required at top/bottom and both sides are common in open chassis type (IP00) and enclosed wall–mounted type (IP20).
2. Remove the top and bottom covers to use the open chassis type of 15kW or less.
3. When installing the models of 30kW or more equipped with eyebolts, extra spacing will be required on either side. For detailed dimensions, contact your YASKAWA representative.
4. For the external dimensions and mounting dimensions, refer to APPENDIX 2 "DIMENSIONS".
5. Allowable intake air temperature to the inverter:
   Open chassis type : –10°C to +45°C
   Enclosed wall–mounted type : –10°C to +40°C
6. Ensure sufficient space for the sections at the upper and lower parts marked with * in order to permit the flow of intake/exhaust air to/from the inverter.

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3 WIRING

⚠ WARNING

- Only commence wiring after verifying that the power supply is turned OFF.
  Failure to observe this warning can result in an electrical shock or a fire.
- Wiring should be performed only by qualified personnel.
  Failure to observe this warning can result in an electrical shock or a fire.
- When wiring the emergency stop circuit, check the wiring thoroughly before operation.
  Failure to observe this warning can result in personal injury.

⚠ CAUTION

- Verify that the inverter rated voltage coincides with the AC power supply voltage.
  Failure to observe this caution can result in personal injury or a fire.
- Do not perform a withstand voltage test of the inverter.
  It may cause semi–conductor elements to be damaged.
- To connect a braking resistor, braking resistor unit or braking unit, follow the procedures described in APPENDIX 3.
  Improper connection may cause a fire.
- Tighten terminal screws to the specified tightening torque.
  Failure to observe this caution can result in a fire.

This chapter describes the main circuit wiring and the control circuit wiring of the VS–616G5.

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3.1 CONNECTION DIAGRAM

Below is a connection diagram of the main circuit and control circuit. Using the digital operator, the motor can be operated by wiring the main circuit only.

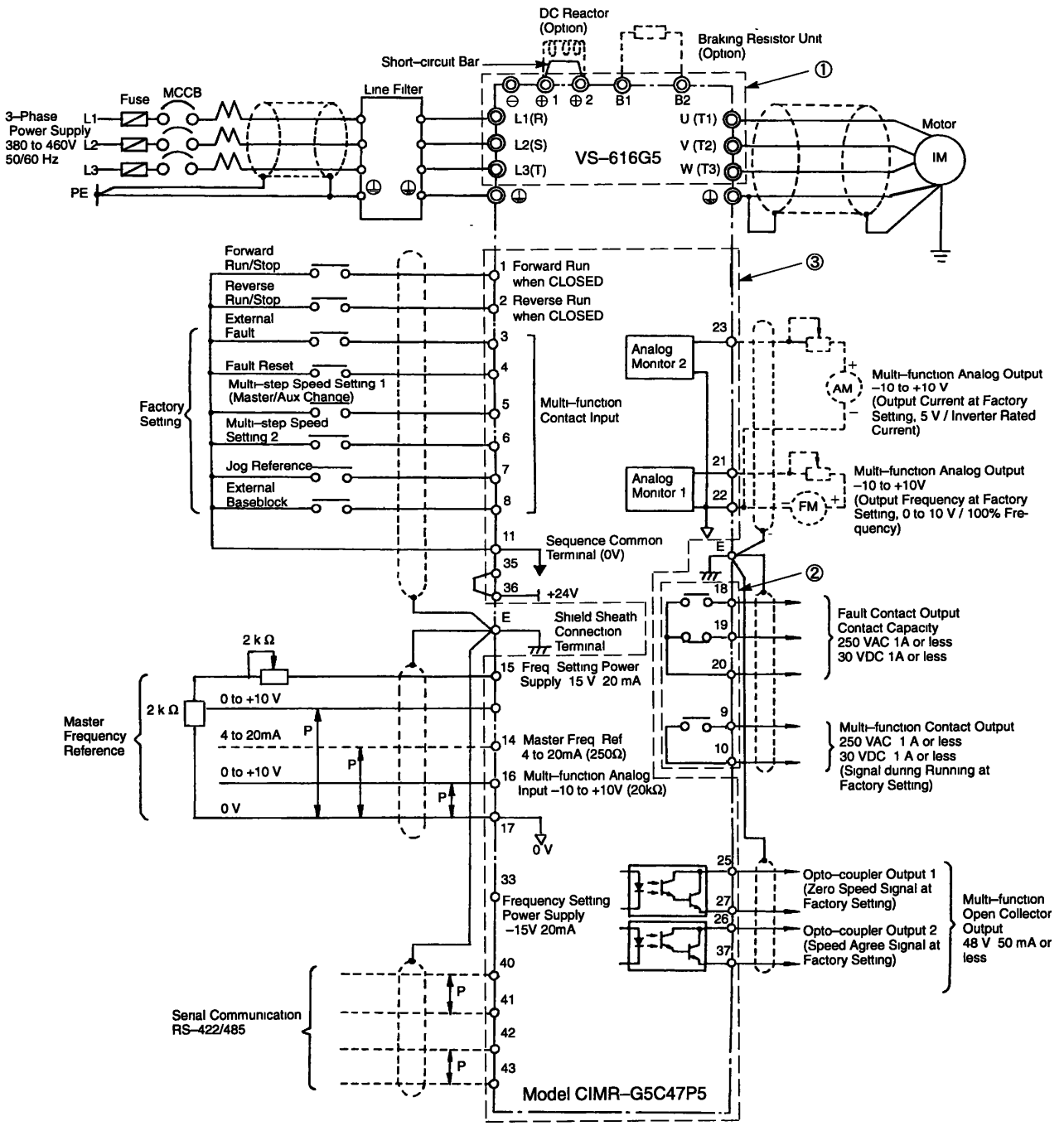


Fig. 9 Connection Diagram

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Circuit Descriptions

Refer to the numbers indicated in the diagram on the left.

① These circuits are hazardous and are separated from accessible surfaces by protective barriers.

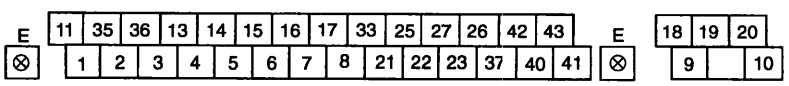
② These circuits are separated from all other circuits by protective barriers consisting of double and reinforced insulation. These circuits may be interconnected with SELV (or equivalent) or non–SELV circuits, but not both.

③ Inverter supplied by four–wire–system source (neutral grounded)
These circuits are SELV circuits and are separated from all other circuits by protective barriers consisting of double and reinforced insulation. These circuits may only be interconnected with other SELV (or equivalent) circuits. These circuits can be accessible or interconnected with other accessible SELV circuits.

Inverter supplied by three–wire–system source (ungrounded or corner grounded)
These circuits are not separated from hazardous circuits by protective barriers, but only with basic insulation. These circuits cannot be accessed and must not be interconnected with any circuits which are accessible, unless they are isolated from accessible circuits by supplemental insulation.

NOTE

Layout of control circuit terminals



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NOTE

1.  indicates shielded wires and  indicates twisted–pair shielded wires.
2. Either control circuit terminal 13 or 14 can be used. (For simultaneous inputs, the two signals are added internally.)
3. Control circuit terminal 15/33 of +15 V/–15 V has a maximum output current capacity of 20 mA.
4. Multi–function analog output should be used for monitoring meters (e.g. output frequency meter) and should not be used for feedback control system. Use analog monitor cards (Model AO–08 or AO–12) for the control system, for a more accurate signal.
5. When using a braling resistor unit, set the constant L3–04 to "0" (stall prevention level during decel is "disabled"). If it is not changed, the motor may not stop within the set decel time.
6. When using model ERF braking resistor (inverter–mounted type), set the braking resistor protection selection to "enabled". If it is not changed, the braking resistor cannot be protected.
7. When installing a DC reactor (optional for models of 15kW or below), remove the short–circuit bar between ⊕1 and ⊕2 terminals and connect a DC reactor with the terminals.
8. The models 55 to 160kW cannot be connected with DC power supply.
9. Select RS–422 or RS–485 of serial communication (terminals 40 to 43) by using the dip switch on the control PC board. The terminal functions differ between RS–422 and RS–485.

Table 2 Functions of RS–422 and RS–485

Terminal No.	RS–422		RS–485	
40	R+	Receiver	R+/S+	Receiver/ Driver
41	R–		R–/S–	
42	S+	Driver	R+/S+	Receiver/ Driver
43	S–		R–/S–	

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3.2 WIRING THE MAIN CIRCUIT

⚠ WARNING

- Make sure to ground the supply neutral.
  Failure to observe this warning can result in an electrical shock and inverter damage.
- Make sure to ground the ground terminal ⏚ before connecting other terminal.
  Failure to observe this warning can result in an electrical shock or a fire.

⚠ CAUTION

- Never connect the AC main circuit power supply to output terminals U, V and W.
  The inverter will be damaged and invalidate the guarantee

(1) Wiring Precautions for Main Circuit Input

(a) Installation of Mains Fuses

An input fuse is not provided with VS–616G5. Make sure to connect fuses between the AC main circuit power supply and VS–616G5 input terminals L1, L2 and L3 to protect the input diode or cables.

- Input diode protection

  A semiconductor protection fuse is recommended to protect the input diode when a short–circuit occurs in the inverter. Table 3 shows the recommended fuse specifications. Another fuse can be applied if I^2t is smaller than that in the table and rated current is larger than inverter input current shown in the table

- Cable protection

  General fuse can be applied for cable protection. Follow the local safety regulation for selection. Select the fuse whose rated current is larger than the inverter input current shown in Table 3.

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Table 3 Input Fuse Selection

Inverter		Fuse				
Max. Applicble Motor Output (kW)	Rated Input Current (A)	Rated Current (A)	I²t max. (A²s) (at 460V)	V	Manufacturer	Type
0 55	2 2	20	140	700	GOULD SHAWMUT	A70P20
1 1	4.1	20	140	700		A70P20
1 5	5 8	20	140	700		A70P20
2 2	7 5	25	220	700		A70P25
3 7	9 6	25	220	700		A70P25
4 0	13.2	25	220	700		A70P25
5 5	16 8	30	320	700		A70P30
7 5	26	30	320	700		A70P30
11	33	50	880	700		A70P50
15	40	60	1280	700		A70P60
18 5	46	70	1760	700		A70P70
22	58	80	2280	700		A70P80
30	72	100	3600	700		A70P100
37	88	125	5600	700		A70P125
45	106	150	8000	700		A70P150
55	141	200	14400	700		A70P200
75	198	225	18400	700		A70P225
110	264	300	32400	700		A70P300
160	330	350	44000	700		A70P350

Note Select the fuse whose specifications are more than rated current and less than I^2t when using a fuse other than in the table

(b) Installation of Ground Fault Interrupter

When connecting a ground fault interrupter to input terminals L1, L2 and L3, select one that is not affected by high frequency.

Examples: NV series by Mitsubishi Electric Co., Ltd. (manufactured in or after1988), EG, SG series by Fuji Electric Co., Ltd. (manufactured in or after 1984)

(c) Installation of Magnetic Contactor

When the main circuit power supply is shut OFF in the sequence, a magnetic contactor (MC) can be used instead of a molded–case circuit breaker (MCCB). However, when a magnetic contactor is switched OFF at the primary side, regenerative braking does not function and the motor coasts to a stop.

- The load can be operated/stopped by opening/closing the magnetic contactor at the primary side. However, frequent switching may cause the inverter to malfunction.
- When using a braking resistor unit, use a sequencer to break power supply side on overload relay trip contact. If the inverter malfunctions, the braking resistor unit may be burned out.

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(d) Terminal Block Connection Sequence

Input power supply phases can be connected to any terminal regardless of the order of L1, L2 and L3 on the terminal block.

(e) Installation of Line Filter

Install an input line filter to reduce EMC noise. For specifications of the line filter, refer to Para. 3.4.

(f) Installation of Reactor

When connecting an inverter (15kW or less) to a large capacity power supply transformer (600kVA or more), or when switching a phase advancing capacitor, excessive peak current flows in the input power supply circuit, which may damage the converter section. In such cases, install a DC reactor (optional) between inverter ⊕1 and ⊕2 terminals or an AC reactor (optional) on the input side. Installation of a reactor is effective for improvement of power factor on the power supply side.

(g) Installation of Surge Suppressor

For inductive loads (magnetic contactors magnetic relays, magnetic valves, solenoids, magnetic brakes, etc.) connected near the inverter, use a surge suppressor simultaneously.

(h) Prohibition of Installation of Phase Advancing Capacitor

If a phase advancing capacitor or surge suppressor is connected in order to improve the power factor, it may become overheated and damaged by inverter high harmonic components. Also, the inverter may malfunction because of overcurrent.

(2) Wiring Precautions for Main Circuit Output

(a) Connection of Terminal Block and Load

Connect output terminals U(T1), V(T2) and W(T3) to motor lead wires U(T1), V(T2) and W(T3). Verify that the motor rotates in the forward direction (CCW: counterclockwise when viewed from the motor load side) with the forward run command. If the motor rotation is incorrect, exchange any two of output terminals U(T1), V(T2) or W(T3).

(b) Strict Prohibition of Connection of Input Power Supply to Output Terminals

Never connect the input power supply to output terminals U(T1), V(T2) and W(T3).

(c) Strict Prohibition of Short Circuiting or Grounding of Output Circuit

Never touch the output circuit directly or put the output line in contact with the inverter case. Otherwise, it may cause an electrical shock or grounding. In addition, never short circuit the output line.

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(d) Prohibition of Connection of Phase Advancing Capacitor or LC/RC Line Filter

Never connect a phase advancing capacitor or LC/RC line filter to the output circuit.

(e) Avoidance of Installation of Magnetic Starter

Do not connect a magnetic starter or magnetic contactor to the output circuit. If the load is connected while the inverter is running, the inverter overcurrent protective circuit operates because of inrush current.

(f) Installation of Thermal Overload Relay

An electronic overload protective function is incorporated into the inverter. However, connect a thermal overload relay when driving several motors with one inverter or when using a multi–pole motor. When using a thermal overload relay, set inverter constant L1–01 to 0 (motor protection selection: disabled). Additionally, for thermal overload relay, at 50Hz set the same rated current value as that described on the motor nameplate, or at 60Hz 1.1 times larger than the rated current value described on the motor nameplate.

(g) Wiring Distance between Inverter and Motor

If the total wiring distance between inverter and motor is excessively long and the inverter carrier frequency (main transistor switching frequency) is high, harmonic leakage current from the cable will adversely to affect the inverter and peripheral devices.

If the wiring distance between inverter and motor is long, reduce the inverter carrier frequency as described below. Carrier frequency can be set by constant C6–01.

Table 4 Wiring Distance between Inverter and Motor

Wiring Distance between Inverter and Motor	Up to 20m	Up to 40m	More than 40m
Carrier Frequency (Set value of constant C6–01)	15kHz or less (15.0)	10kHz or less (10 0)	5kHz or less (5 0)

(3) Grounding

- Never ground the inverter in common with welding machines, motors, or other large–current electrical equipment. Run all the ground wires in a conduit separate from wires for large–current electrical equipment.
- Use the ground wires described in Table 6 and keep the length as short as possible.

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- When using several inverter units side by side, ground the units as shown in Fig. 10, (a). Do not loop the ground wires as shown in (b).



(a) Acceptable (b) Not Acceptable

Fig. 10 Grounding of Three Inverter Units

(4) Functions of Main Circuit Terminals

The following table outlines the functions of the main circuit terminals. Wire according to each terminal function.

Table 5 Terminal Functions

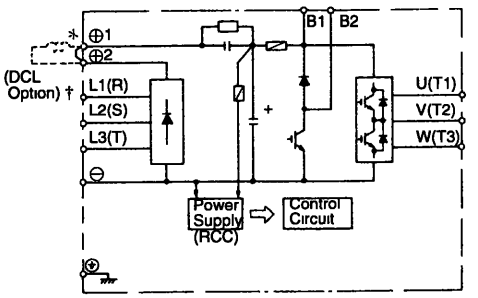
Models CIMR-G5C□	40P4 to 4015	4018 to 4045	4055 to 4160
Max Applicable Motor Output	0.55 to 15 kW	18.5 to 45 kW	55 to 160 kW
L1(R)	Main circuit input power supply		
L2(S)			
L3(T)			
U(T1)	Inverter output		
V(T2)			
W(T3)			
B1	Braking resistor unit	—	
B2			
⊖	· DC reactor (⊕1 – ⊕2) · DC bus terminals (⊕1 – ⊖)	· DC bus terminals (⊕1 – ⊖) · Braking unit (⊕3 – ⊖)	· Braking unit (⊕3 – ⊖) (⊕1 and ⊕2 terminals not provided)*
⊕1			
⊕2			
⊕3	—		
ℓ2	—	Cooling fan power supply	—
ℓ1			· Cooling fan power supply (Control power supply) ℓ1 – ℓ2 200 200 to 230 VAC input ℓ1 – ℓ2 400 380 to 460 VAC input
ℓ2 200		—	
ℓ2 400			
⏚	Ground terminal		

* The models of 55 to 160kW cannot be connected with DC power supply Terminal ⊕3 is for exclusive use for connecting a braking unit Do not connect DC power supply to terminal ⊕3

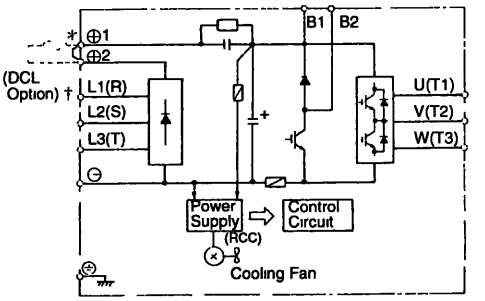
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(5) Main Circuit Configuration

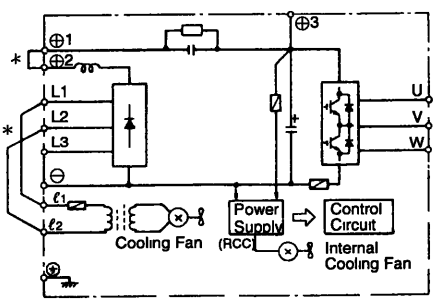
CIMR–G5C40P4 to 41P5



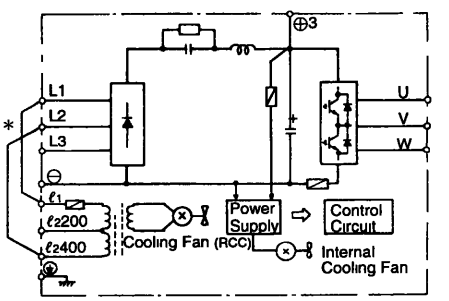
CIMR–G5C42P2 to 4015



CIMR–G5C4018 to 4045



CIMR–G5C4055 to 4160



* The wiring has been completed at the factory prior to shipping. When using main circuit power supply as DC input, remove the two common wires and connect the AC power supply to terminals $\ell 1$ and $\ell 2$ for models of CIMR–G5C4018 to 4045.

† When installing a DC reactor (option) on models of 15kW or below, remove the short–circuit bar between ⊕1 and ⊕2 terminals and connect a DC reactor with the terminals.

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(6) Parts Required for Wiring

Select wires or closed–loop connectors to be used for wiring from Tables 6 and 7.

Table 6 Wire Size

Circuit	Model CIMR–□	Terminal Symbol	Terminal Screw	Wire Size* mm²
Main	G5C40P4	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, U(T1), V(T2), W(T3)	M4	2 – 5 5
		⏚		
	G5C40P7	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, U(T1), V(T2), W(T3)	M4	2 – 5 5
		⏚		
	G5C41P5	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, U(T1), V(T2), W(T3)	M4	2 – 5 5
		⏚		
	G5C42P2	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, U(T1), V(T2), W(T3)	M4	2 – 5 5
		⏚		
	G5C43P7	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, U(T1), V(T2), W(T3)	M4	2 – 5 5
		⏚		
	G5C44P0	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, U(T1), V(T2), W(T3)	M4	3 5 – 5 5
		⏚		
	G5C45P5	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, U(T1), V(T2), W(T3)	M4	3 5 – 5 5
		⏚		
	G5C47P5	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, U(T1), V(T2), W(T3)	M5	5 5
		⏚		
	G5C4011	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, U(T1), V(T2), W(T3)	M5	8 – 14
		⏚	M6	8 – 14
	G5C4015	L1, L2, L3, ⊖, ⊕1, ⊕2, B1, B2, U(T1), V(T2), W(T3)	M5	8 – 14
		⏚	M6	8 – 14
	G5C4018	L1, L2, L3, ⊖, ⊕1, ⊕2, ⊕3, U, V, W	M6	14
		⏚		
		ℓ_1, ℓ_2	M4	0 5 – 5 5
	G5C4022	L1, L2, L3, ⊖, ⊕1, ⊕2, ⊕3, U, V, W	M6	22
		⏚	M6	16
		ℓ_1, ℓ_2	M4	0 5 – 5 5
	G5C4030	L1, L2, L3, ⊖, ⊕1, ⊕2, ⊕3, U, V, W	M8	22
		⏚	M6	16
		ℓ_1, ℓ_2	M4	0 5 – 5 5
	G5C4037	L1, L2, L3, ⊖, ⊕1, ⊕2, ⊕3, U, V, W	M8	30
		⏚	M6	16
		ℓ_1, ℓ_2	M4	0 5 – 5 5
	G5C4045	L1, L2, L3, ⊖, ⊕1, ⊕2, ⊕3, U, V, W	M8	50
		⏚	M6	30
		ℓ_1, ℓ_2	M4	0 5 – 5 5
	G5C4055	L1, L2, L3, U, V, W	M10	100
		⊖, ⊕3	M8	—
		⏚	M8	50
		ℓ_1, $\ell_2$200, $\ell_2$400	M4	0 5 – 5 5
	G5C4075	L1, L2, L3, U, V, W	M10	60 × 2P
		⊖, ⊕3	M8	—
		⏚	M8	60
		ℓ_1, $\ell_2$200, $\ell_2$400	M4	0 5 – 5 5
	G5C4110	L1, L2, L3, U, V, W	M10	60 × 2P
		⊖, ⊕3	M8	—
		⏚	M8	60
		ℓ_1, $\ell_2$200, $\ell_2$400	M4	0 5 – 5 5
	G5C4160	L1, L2, L3, U, V, W	M12	100 ×2P
		⊖, ⊕3	M8	—
		⏚	M8	100
		ℓ_1, $\ell_2$200, $\ell_2$400	M4	0 5 – 5 5
Control	Common to all models	1 – 43	–	Stranded 0 5 – 1 25 Solid 0 5 – 1 25
		E	M3 5	0 5 – 2

* Wire size is determined using 75°C temperature–rated copper wire

When connecting a braking resistor unit or a braking unit, select wire size reffering to the instructions of braking resistor unit and braking unit (manual No TOE–C726–2)

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Table 7 Closed–Loop Connectors

Wire Size mm²	Terminal Screw	Closed–Loop Connectors
0 5	M3 5	1 25 – 3 5
	M4	1 25 – 4
0 75	M3 5	1 25 – 3 5
	M4	1 25 – 4
1 25	M3 5	1 25 – 3 5
	M4	1 25 – 4
2	M3 5	2 – 3 5
	M4	2 – 4
	M5	2 – 5
	M6	2 – 6
	M8	2 – 8
3 5 / 5 5	M4	5 5 – 4
	M5	5 5 – 5
	M6	5 5 – 6
	M8	5 5 – 8
8	M5	8 – 5
	M6	8 – 6
	M8	8 – 8
14	M6	14 – 6
	M8	14 – 8
22	M6	22 – 6
	M8	22 – 8
30 / 38	M8	38 – 8
50 / 60	M8	60 – 8
	M10	60 – 10
80	M10	80 – 10
100		100 – 10
100	M12	100 – 12
150		150 – 12
200		200 – 12
325	M12 × 2	325 – 12
	M16	325 – 16

NOTE

When determining wire size, consider voltage drop. Select a wire size so that voltage drop will be less than 2% of the normal rated voltage. Voltage drop is calculated by the following equation:

Phase–to–phase voltage drop (V)

$= \sqrt{3} \times$ wire resistance (Ω/km) × wiring distance (m) × current (A) × 10^{-3}

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(7) Recommended Cable Gland

When installing the inverter unit as enclosed wall–mounted type (IP20), use the cable gland listed below or equivalent.

Cable gland: SKINTOP ST or SKINTOP STE manufactured by LAPP.
Blind cap BLK **. SKINDICHT manufactured by LAPP.
DP–***: DP HOLE PLUG manufactured by HEYCO

The optional attachment is required when installing the models of CIMR–G5C4018 to 4160 as enclosed wall–mounted type (IP20). For details, contact your YASKAWA representative.

Table 8 Recommended Cable Gland

VS–616G5 model CIMR–□	Cable Lead–in Hole		Cable Gland		Model of Blind Cap
	Diameter (mm)	Q'ty	Model	Diameter of Applicable Cable (mm)	
G5C40P4 to G5C44P0	35	1	STE21/29	18 to 25	DP–1375
	28	2	ST21	13 to 18	DP–1093
G5C45P5 G5C47P5	35	3	STE21/29	18 to 25	DP–1375
	22	1	ST13 5	6 to 12	DP–875
G5C4011 G5C4015	44	2	ST29	18 to 25	DP–1750
	35	1	STE21/29	18 to 25	DP–1375
	22	1	ST13 5	6 to 12	DP–875
G5C4018 G5C4022	50	3	ST36	22 to 32	BLK36
G5C4030 to G5C4045	62	2	ST48	37 to 44	BLK48
	50	1	ST36	22 to 32	BLK36
G5C4055 G5C4075	62	2	ST48	37 to 44	BLK48
	44	1	ST29	18 to 25	DP–1750
G5C4110 G5C4160	62	6	ST48	37 to 44	BLK48
	44	1	ST29	18 to 25	DP–1750

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3.3 WIRING THE CONTROL CIRCUIT

The following table outlines the functions of the control circuit terminals. Wire according to each terminal function.

(1) Functions of Control Circuit Terminals

Table 9 Control Circuit Terminals

Classification	Terminal	Signal Function	Description		Signal Level
Sequence Input Signal	1	Forward run/stop	Forward run when closed, stop when open		Photo-coupler insulation Input +24 VDC 8 mA
	2	Reverse run/stop	Reverse run when closed, stop when open		
	3	External fault input	Fault when closed, normal state when open	Multi-function contact inputs (H1-01 to H1-06)	
	4	Fault reset input	Reset when closed		
	5	Master/Auxiliary change (Multi-step speed reference 1)	Auxiliary frequency reference when closed		
	6	Multi-step speed reference 2	Effective when closed		
	7	Jog reference	Jog run when closed		
	8	External baseblock	Inv output stop when closed		
	11	0V for sequence input	—		
	35	Sequence input internal common			
	36	+24V for sequence input			
Analog Input Signal	15	+15 V Power supply output	For analog command +15 V power supply		+15 V (Allowable current 20 mA max)
	33	-15 V Power supply output	For analog command -15 V power supply		-15 V (Allowable current 20 mA max)
	13	Master frequency reference	-10 to +10 V/-100% to +100% 0 to +10 V/100%		-10 to +10 V (20 kΩ), 0 to +10 V (20 kΩ)
	14		4 to 20 mA/100%, -10 to +10 V/-100% to +100%, 0 to +10 V/100%		4 to 20mA (250Ω)
	16	Multi-function analog input	-10 to +10V/-100% to +100% 0 to +10 V/100%	Auxiliary analog input (H3-05)	-10 to +10V (20kΩ), 0 to +10V (20kΩ)
	17	Common terminal for control circuit	0 V		—
Sequence Output Signal	9	During running (NO contact)	Closed when running	Multi-function output	Dry contact Contact capacity 250 VAC 1 A or less 30 VDC 1 A or less
	10				
	25	Zero speed detection	Closed at zero-speed level (b2-01) or below		Open collector output 48 V 50 mA or less *
	27				
	26	Speed agree detection	Closed when the freq reaches to ±2 Hz of set freq		
	37				
	18	Fault contact output (NO/NC contact)	Fault when closed between terminals 18 and 20 Fault when open between terminals 19 and 20		Dry contact Contact capacity 250 VAC 1 A or less 30 VDC 1 A or less
	19				
	20				
Analog Output Signal	21	Frequency meter output	0 to +10 V/100% freq	Multi-function analog monitor 1 (H4-01,H4-02)	0 to ±10 V Max ±5% 2 mA or less
	22	Common	—		
	23	Current monitor	5 V/inverter rated current	Multi-function analog monitor 2 (H4-04,H4-05)	
Serial Communication (RS-422/485)	40	R+ Receiver (RS-422) R+/S+ Receiver/Driver (RS-485)	RS-422 or RS-485 can be selected by the dip switch on the control PC board		—
	41	R- Receiver (RS-422) R-/S- Receiver/Driver (RS-485)			
	42	S+ Driver (RS-422) R+/S+ Receiver/Driver (RS-485)			
	43	S- Driver (RS-422) R-/S- Receiver/Driver (RS-485)			
	E	Connection to shield sheath of signal lead or optional unit grounding	—		—

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* When an inductive load such as a relay coil is driven, insert a fly-wheel diode as shown in the following figure

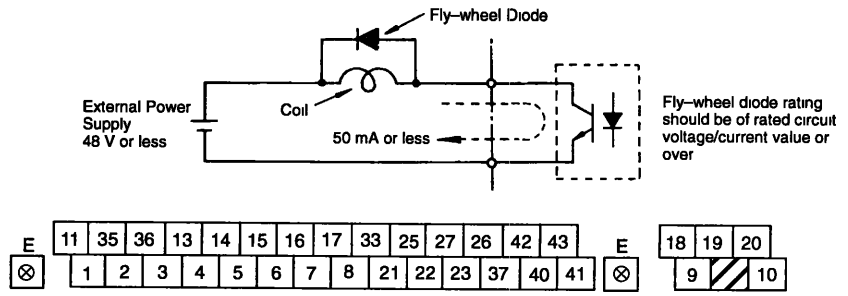
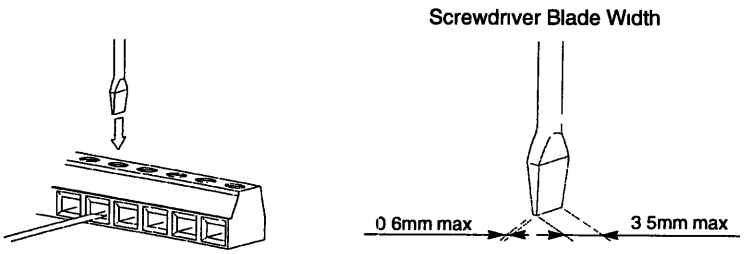


Fig. 11 Control Circuit Terminal Arrangement

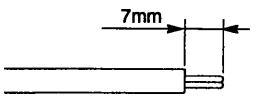
NOTE

Do not connect the wire to the terminal shown as ▨.

(2) Wiring the Control Circuit Terminals



Insert the wire into the lower part of the terminal block and connect it tightly with a screwdriver. Wire sheath strip length must be 7 mm.



(3) Precautions on Control Circuit Wiring

- Separate control circuit wires 1 to 11, 13 to 23, 25 to 27, 33, 35 to 37, 40, to 43 and E from main circuit wires L1, L2, L3, B1, B2, U, V, W, ⊖, ⊕1, ⊕2, ⊕3 and other power cables to prevent erroneous operation caused by noise interference.
- Separate the wiring of control circuit terminals 9, 10, 18, 19 and 20 (contact output) from those of terminals 1 to 8, 11, 13 to 17, 21 to 23, 25 to 27, 33, 35 to 37, 40 to 43.
- Use twisted shielded or twisted-pair shielded wire for the control circuit line and connect the shielded sheath to inverter terminal E. (See Fig. 12.) Wiring distance should be less than 50 m.

Fig. 12 Shielded Wire Termination

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3.4 CONFORMATION TO EMC STANDARDS

In order to coform to EMC standards, the exclusive–use methods are required for line filter application, cable shielding and inverter installation. The following explains the outline of the methods.

The line filter and the inverter must be mounted on the same metal plate. The filter should be mounted as close to the inverter as practical. Keep cable as short as possible. The metal plate should be securely grounded. The ground of line filter and inverter must be bonded to the metal plate with as much area as possible.

For mains input cable, screened cable is recommended at least within the panel. The screen of the cable should be connected to a solid ground. For the motor cable, screened cable (max. 20 m) must be used and the screen of the motor cable is connected to ground at both ends by a short connection, using as large an area as practical.

For more detailed explanation, refer to "Making YASKAWA Inverter Products Conform with EMC Directive" (EZZ006908).

The following table and figures show the line filter list for EMC standards and the installation/wiring of inverter and line filter.

Table 10 Line Filter List for EMC Standards

Inverter Model CIMR–G5C□	Line Filter (manufactured by Schaffner)			
	Model	Rated Current (A)	Mass (kg)	Dimensions in mm W × D × H
40P4	FS4874–7/07	7	1 1	50 × 126 × 255
40P7				
41P5				
42P2	FS4874–18/07	18	1 7	55 × 142 × 305
43P7				
44P0				
45P5	FS4874–30/07	30	1 8	60 × 150 × 335
47P5				
4011	FS4874–42/07	42	2 8	70 × 185 × 329
4015				
4018	FS4874–55/07	55	3 1	80 × 185 × 329
4022	FS4874–75/34	75	4 0	80 × 220 × 329
4030				
4037	FS4874–100/35	100	5 5	90 × 220 × 379
4045	FS4874–130/35	130	7 5	110 × 240 × 429
4055	FS4874–180/07	180	11	110 × 240 × 438
4075	FS4874–300/99	300	15	300 × 564 × 160
4110	FS4874–400/99	400	22	300 × 564 × 160
4160				

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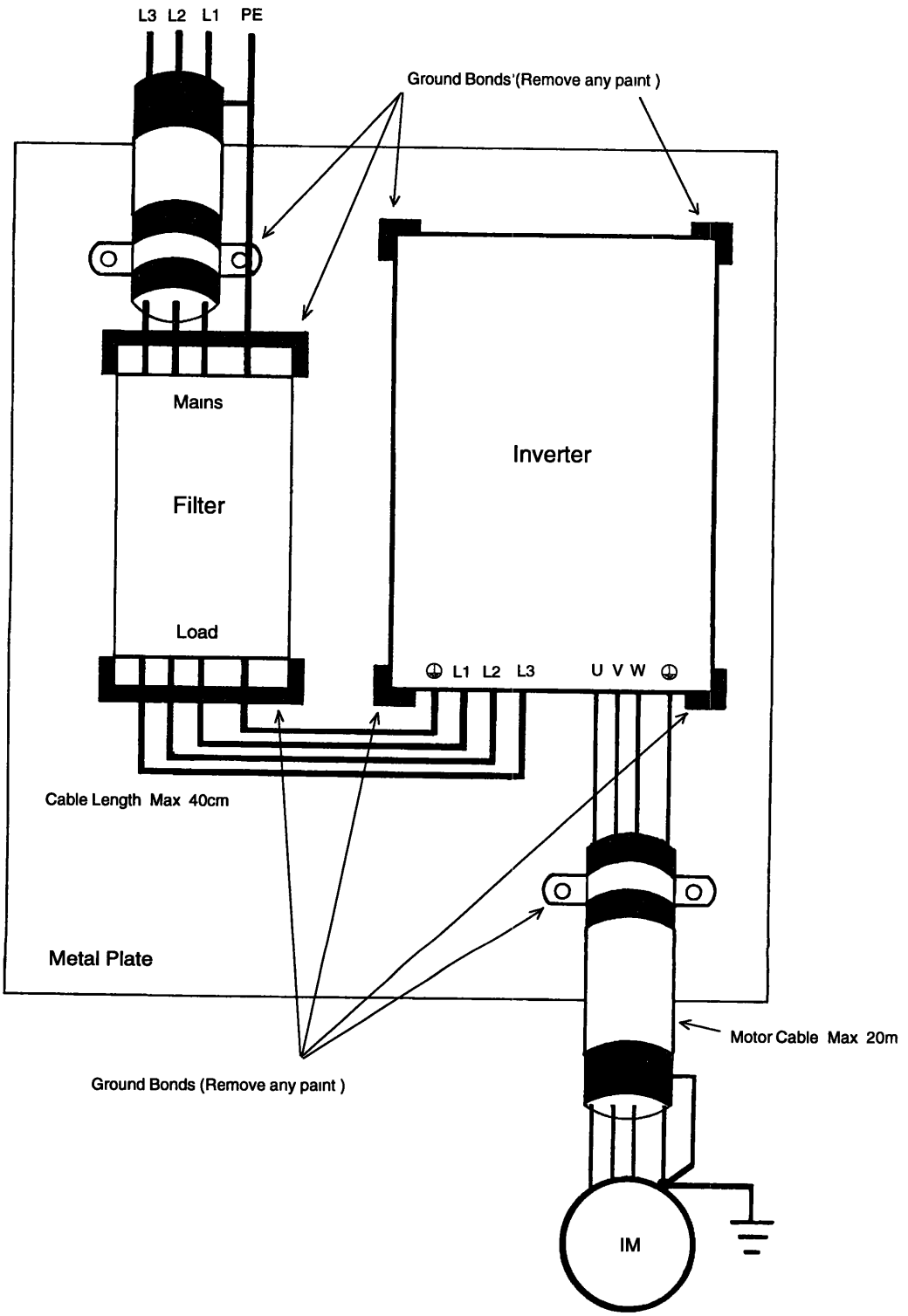


Fig. 13 Installation of Line Filter and Inverter (Models CIMR–G5C 40P4 to 4015)

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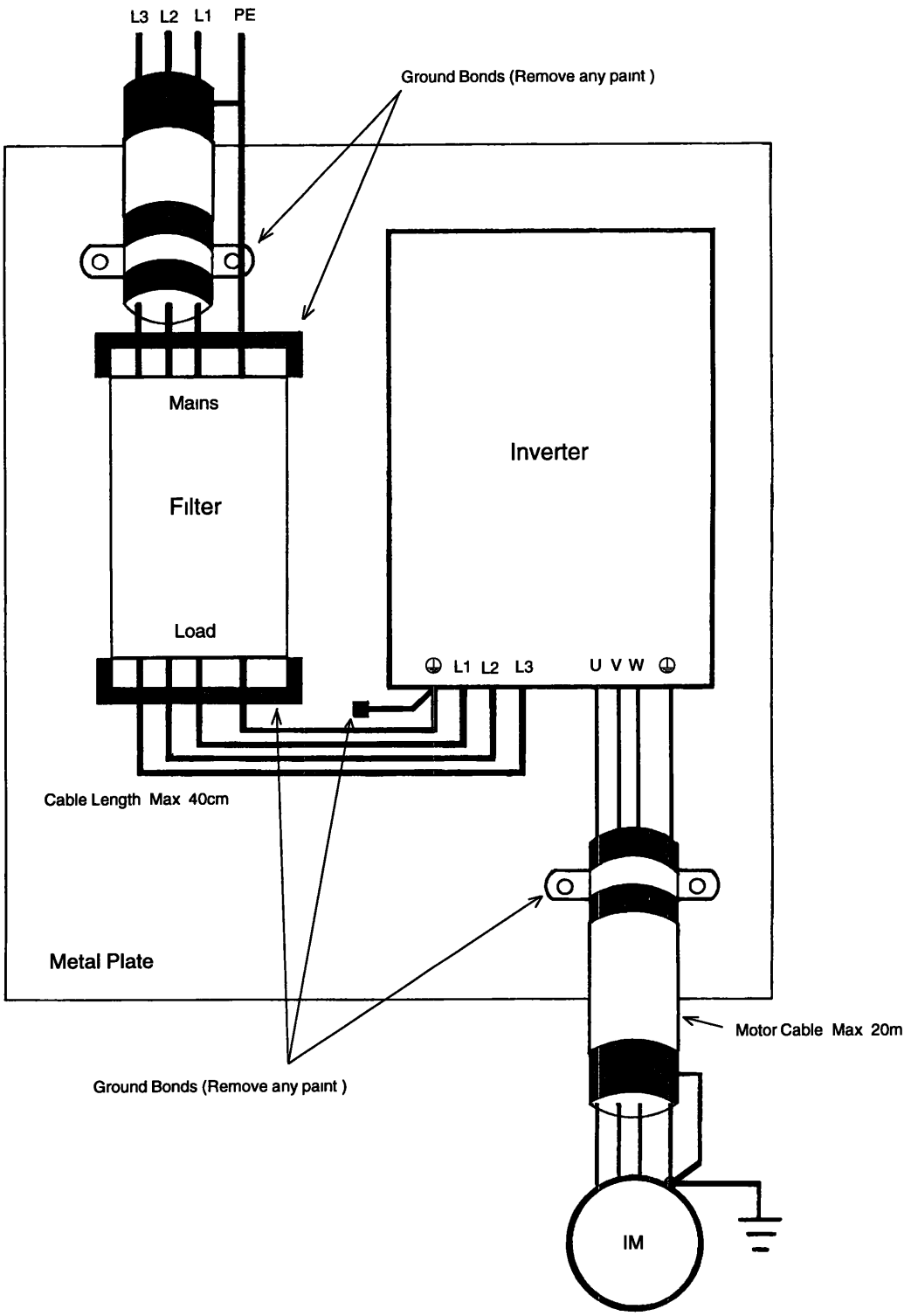


Fig. 14 Installation of Line Filter and Inverter (Models CIMR–G5C 4018 to 4160)

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3.5 WIRING INSPECTION

After completing of installation and wiring, check for the following items. Never use control circuit buzzer check.

☐ Wiring is proper.
☐ Wire clippings or screws are not left in the unit.
☐ Screws are securely tightened.
☐ Bare wire in the terminal does not contact other terminals.

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4 OPERATION

⚠ WARNING

- Only turn ON the input power supply after replacing the front cover. Do not remove the cover while current is flowing.
  Failure to observe this warning can result in an electrical shock.
- When the retry function (L5–02) is selected, do not approach the inverter or the load, since it may restart suddenly after being stopped.
  (Construct machine system, so as to assure safety for personnel, even if the inverter should restart.) Failure to observe this warning can result in personal injury.
- Since the stop button can be disabled by a function setting, install a separate emergency stop switch.
  Failure to observe this warning can result in personal injury.
- If an alarm is reset with the operation signal ON, the inverter restarts automatically. Only reset the alarm after verifying that the operation signal is OFF.
  Failure to observe this warning can result in personal injury.

⚠ CAUTION

- Never touch the heatsink or discharging resistor since the temperature is very high.
  Failure to observe this caution can result in harmful burns to the body.
- Since it is easy to change operation speed from low to high speed, verify the safe working range of the motor and machine before operation.
  Failure to observe this caution can result in personal injury and machine damage.
- Install a holding brake separately if necessary.
  Failure to observe this caution can result in personal injury.
- Do not change signals during operation.
  The machine or the inverter may be damaged.
- All the constants of the inverter have been preset at the factory. Do not change the settings unnecessarily.
  The inverter may be damaged. For supply voltage, follow Par. 4.3.

This chapter describes the basic operation procedures of the VS–616G5.

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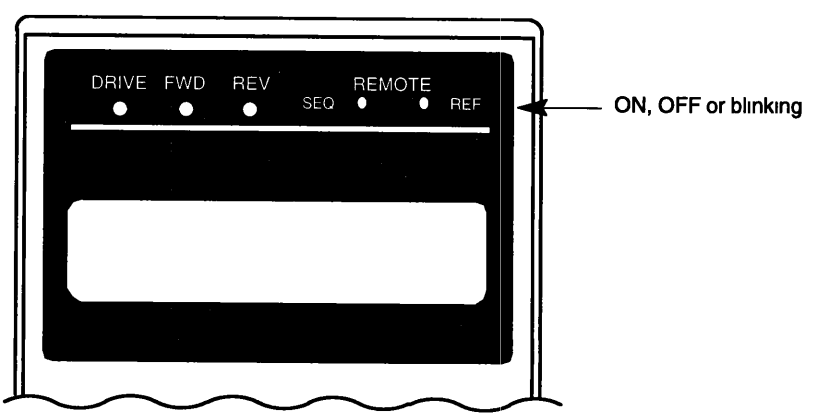
4.1 OPERATION MODE SELECTION

The VS–616G5 has two operation modes, LOCAL and REMOTE, as described below. These two modes can be selected by the digital operator "LOCAL/REMOTE" key only while the operation is stopped. The selected operation mode can be verified by observing the digital operator SEQ and REF LEDs as shown below. The operation mode is set to REMOTE (run by control circuit terminals 13 and 14 frequency reference and run command from a control circuit terminal) prior to shipment. Multi–function contact inputs from control circuit terminals 3 to 8 are enabled in both operation modes LOCAL/REMOTE.

- LOCAL : Both frequency reference and run command are set by the digital operator. SEQ and REF LEDs go OFF.
- REMOTE : Master frequency reference and run command can be selected as described below.

Table 11 Reference Selection in REMOTE Mode

Con–stant No	Digital Operator Display	Name	Remarks
b1–01	Reference Source	Reference selection	0 Master frequency reference from operator (d1–01) (Operator REF LED is OFF) 1 Master frequency reference from control circuit terminals 13 and 14 (Operator REF LED is ON) 2 Master frequency reference set by transmission (Operator REF LED blinks) 3 Master frequency reference set by option (Operator REF LED blinks)
b1–02	Run Source	Operation method selection	0 Master frequency reference from operator (d1–01) (Operator REF LED is OFF) 1 Master frequency reference from control circuit terminals 13 and 14 (Operator REF LED is ON) 2 Master frequency reference set by transmission (Operator REF LED blinks) 3 Master frequency reference set by option (Operator REF LED blinks)



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4.2 TEST RUN CHECKPOINTS

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. Check the following items before a test run.

☐ Wiring and terminal connections are correct.
☐ No short circuit caused by wire clippings.
☐ Screw–type terminals are securely tightened.
☐ Motor is securely mounted.
☐ All items are correctly earthed (grounded).

4.3 SETTING THE LINE VOLTAGE USING JUMPER (FOR 18.5kW AND ABOVE)

Set the line voltage jumper according to the main circuit power supply. (See Fig. 15.) Insert the jumper at the appropriate location corresponding to the input line voltage. It has been preset at the factory to 440V.

Example

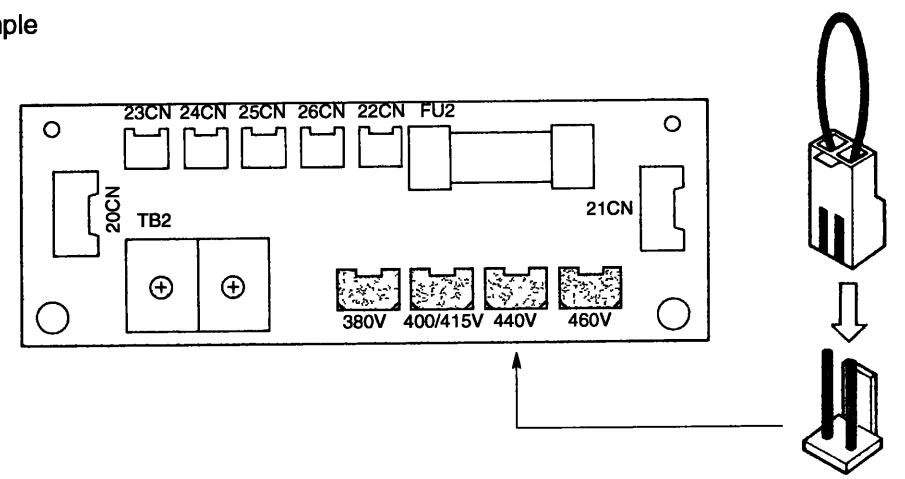


Fig. 15 Line Voltage Jumper (For 18.5kW to 45kW)

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4.4 TEST RUN

(1) Digital Operator Display at Power–up

When the system is ready for operation, turn ON the power supply Verify that the inverter powers up properly. If any problems are found, turn OFF the power supply immediately. The digital operator display illuminates as shown below when turning the power supply ON.

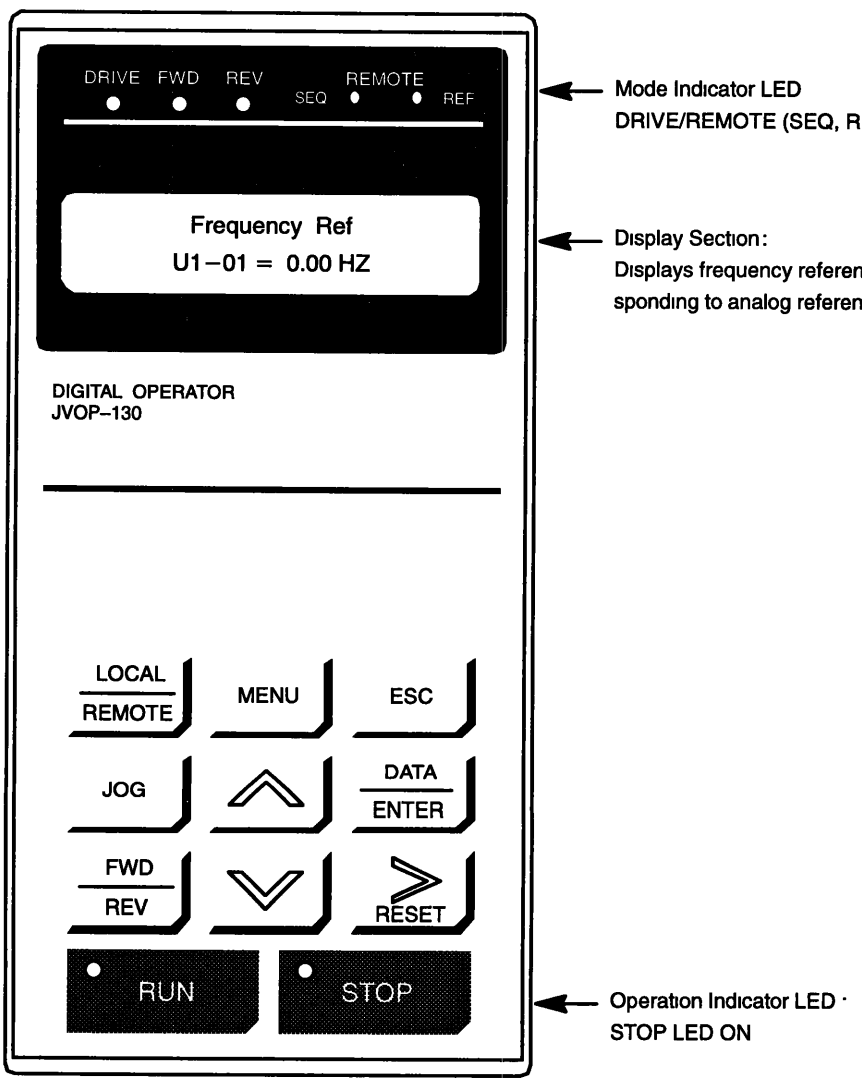


Fig. 16 Digital Operator Display at Power–up

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(2) Operation Check Points

Check the following items during operation.

- ☐ Motor rotates smoothly.
- ☐ Motor rotates in the correct direction.
- ☐ Motor does not have abnormal vibration or noise.
- ☐ Acceleration and deceleration are smooth.
- ☐ Current matches the load flow.
- ☐ Status indicator LEDs and digital operator display are correct.

(3) Example of Basic Operation

(a) Operation by Digital Operator

The diagram below shows a typical operation pattern using the digital operator.

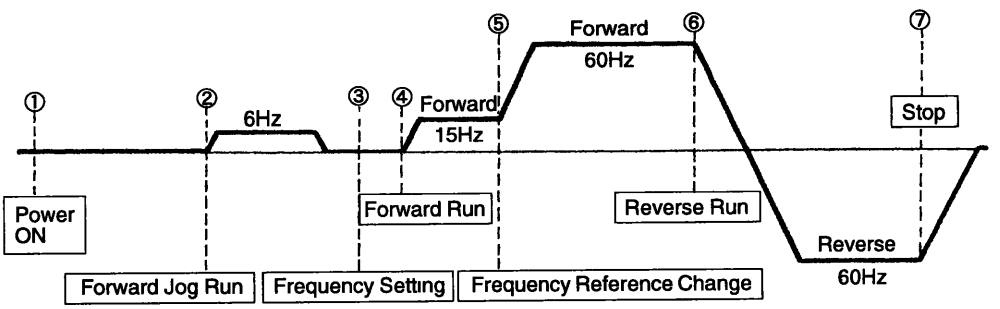


Fig. 17 Operation Sequence by Digital Operator

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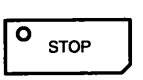
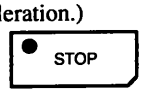
Table 12 Typical Operation by Digital Operator

Description	Key Sequence	Digital Operator Display
① Power ON · Displays frequency reference value.		Frequency Ref U1–01 = 0 00 HZ
Operation Condition Setting · Select LOCAL mode	LOCAL/REMOTE	REMOTE LED OFF (SEQ, REF)
② Forward Jog Run (6 Hz) · JOG run procedure (Runs while depressing JOG key.)	JOG	
③ Frequency Setting · Change reference value	DATA/ENTER	Frequency Ref 000 00 HZ
		Digit to be changed blinks
	Change the value by depressing ▼ ▲ RESET	Frequency Ref 015 00 HZ
	DATA/ENTER	Entry Accepted
· Write–in set value.		Frequency Ref 015 00 HZ
· Select output frequency monitor display.	ESC	Frequency Ref U1–01 = 15 00 HZ
	▲	Output Freq U1–02 = 0 00 HZ
④ Forward Run · Forward run (15 Hz)	RUN	Output Freq U1–02 = 15 00 HZ
		RUN LED lights FWD LED lights RUN

(Cont'd)

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Table 12 Typical Operation by Digital Operator (Cont'd)

Description	Key Sequence	Digital Operator Display
⑤ Frequency Reference Value Change (15 Hz to 60 Hz) · Select frequency reference value display		Frequency Ref U1–01 = 015.00 HZ
		Frequency Ref 015 00 HZ
· Change set value.	Change the value by depressing 	Frequency Ref 060 00 HZ
· Write–in set value.		Entry Accepted
		Frequency Ref 060 00 HZ
· Select output frequency monitor display		Frequency Ref U1–01 = 60 00 HZ
		Output Freq U1–02 = 60 00 HZ
⑥ Reverse Run · Switch to reverse run		Output Freq U1–02 = –60 00 HZ REV LED lights.
⑦ Stop · Decelerates to a stop.		Output Freq U1–02 = 0.00 HZ STOP LED lights (RUN LED blinks during deceleration.) 

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(b) Operation by Control Circuit Terminal Signal

The diagram below shows a typical operation pattern using the control circuit terminal signals.

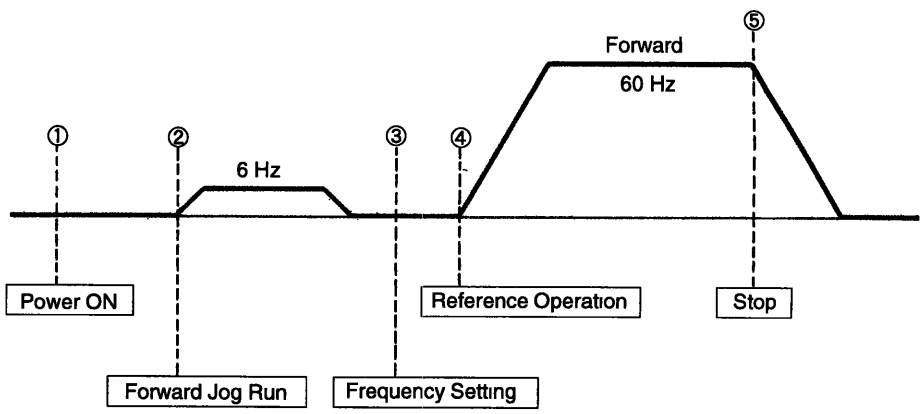


Fig. 18 Operation Sequence by Control Circuit Terminal Signal

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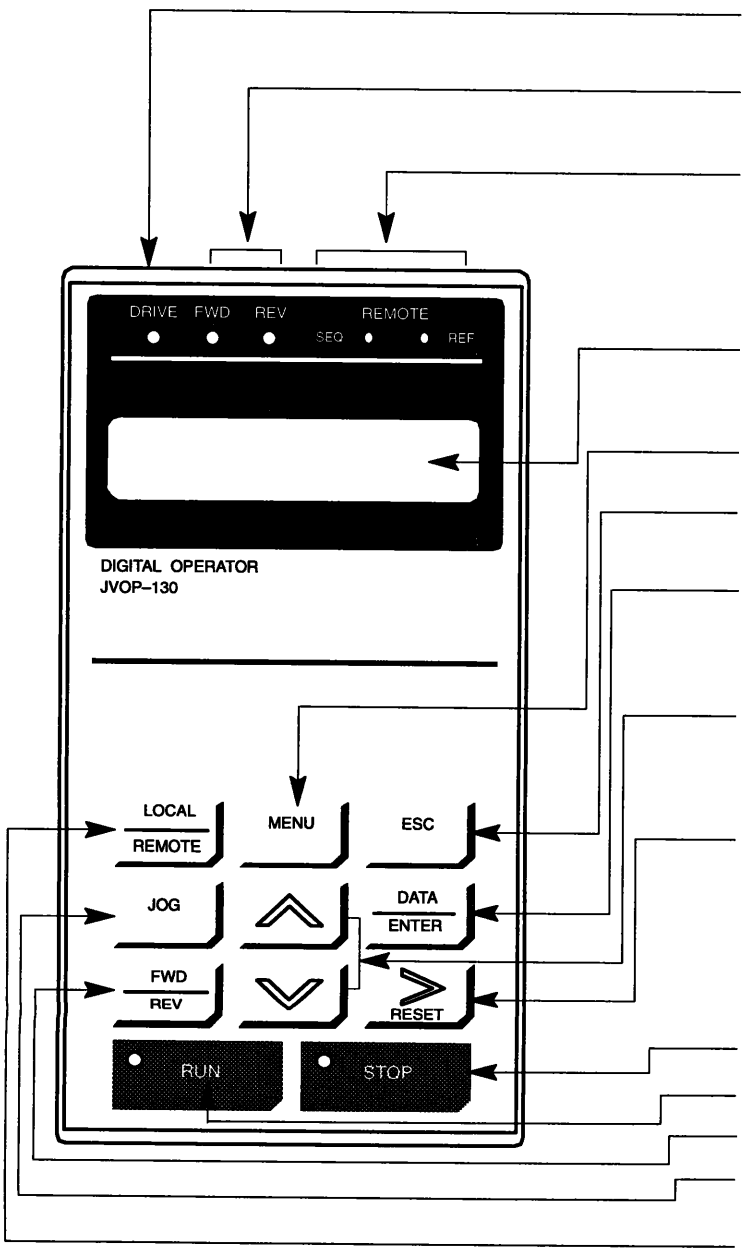
Table 13 Typical Operation by Control Circuit Terminal Signal

Description	Key Sequence	Digital Operator Display
① Power ON · Displays frequency reference value. REMOTE mode is preset at the factory		Frequency Ref U1-01 = 0.00 HZ REMOTE LED lights (SEQ, REF)
Output Frequency Display · Switch to output frequency display		Output Freq U1-02 = 0.00 HZ
② Forward Jog Run (6Hz) · Close between control circuit terminals 1 and 11 with 7 and 11 closed to perform JOG run · Open between terminals 1 and 11, 7 and 11 after verifying normal operation.		Output Freq U1-02 = 6.00 HZ RUN LED lights FWD LED lights RUN
③ Frequency Setting · Input frequency reference voltage (current) by control circuit terminal 13 or 14 and verify the input value by the digital operator.		Frequency Ref U1-01 = 60.00 HZ For reference voltage 10V
Output Frequency Display · Select output frequency monitor display		Output Freq U1-02 = 0.00 HZ
④Forward Run · Close between control circuit terminals 1 and 11 to perform forward run.		Output Freq U1-02 = 60.00 HZ RUN LED lights. FWD LED lights. RUN
⑤ Stop · Open between control circuit terminals 1 and 11 to stop operation		Output Freq U1-02 = 0.00 HZ STOP LED lights. (RUN LED blinks during deceleration.) STOP

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5 SETTING OPERATION CONDITIONS

5.1 DIGITAL OPERATOR KEY DESCRIPTION



Mode Indicator LEDs

Drive Mode Display
Lights when selecting drive mode OFF when selecting any mode other than drive mode

Rotating Direction Display
FWD Lights at forward run
REV Lights at reverse run

Remote Mode
Lights when selecting input mode from the control circuit terminal
SEQ Lights when selecting run command from control circuit terminal
REF Lights when selecting frequency reference from control circuit terminals 13 and 14

Display
Displays set values of each function or monitoring values such as frequency and output current (2 lines × 16 characters)

Menu Key
Displays the menu for mode selection

Escape Key
Returns to the status entered before [DATA/ENTER] key was depressed

Write/Read Key
Selects mode, group, function or constant name Displays each constant set value while displaying a constant name By depressing this key again, the set value is written in

Menu/Number Change Keys
Selects mode, group, function, constant name or set value
∧ Increment key
∨ Decrement key

Digit Selection Key
Selects a digit of a set value to be changed The selected digit blinks (Resets operation at faults)

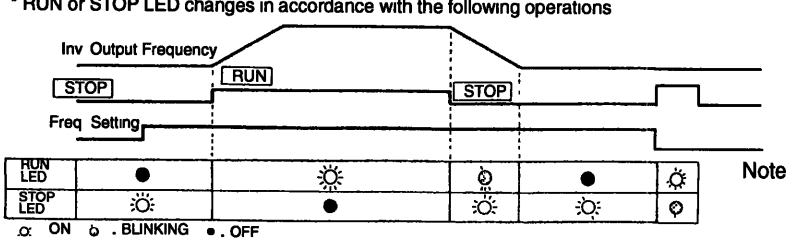
Operation Command Keys

Operation command keys operate the inverter Enabled only in the drive mode

* STOP	Red LED lights by depressing STOP
* RUN	Red LED lights by depressing RUN
FWD/REV	Selects forward or reverse run
JOG	Jog run is enabled while depressing this key

Operation Mode Selection Key
The operation mode is alternated between REMOTE and LOCAL (digital operator)

* RUN or STOP LED changes in accordance with the following operations



Note : Only a digit that is blinking can be changed

Fig. 19 Digital Operator Key Description

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5.2 DIGITAL OPERATOR MODE SELECTION

The digital operator of the VS–616G5 has the following four modes.

Table 14 Digital Operator Modes

Mode	Description
Opetation	Inverter operation is enabled Displays monitor value, fault trace or faults that occurred previously
Initialize	Sets and reads language displayed on the digital operator, level to set/read constants and control method
Programming	Sets/reads constants
Auto–tuning	Motor–related constants necessary for vector control are automatically set This mode is not displayed at V/f control or V/f control with PG feedback
Modified Constants	Sets/reads constants changed from the values preset at the factory in programming mode or auto–tuning mode The constants changed in initialize mode are not displayed

Depressing the [MENU] key displays "Operation". Change the mode display by using  or  key and select a mode by the [DATA/ENTER] key. Table 13 shows typical operation.

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Table 15 Typical Operation of Mode Selection

Description	Key Sequence	Digital Operator Display	Remarks
· Displays Operation	MENU	** Main Menu ** Operation	
· Change the mode (Displays Initialize)	∧	** Main Menu ** Initialize	
· Change the mode (Displays Programming)	∧	** Main Menu ** Programming	
· Change the mode (Displays Auto-Tuning)	∧	** Main Menu ** Auto-Tuning	
· Change the mode (Displays Modified Consts)	∧	** Main Menu ** Modified Consts	
Select Modified Consts	DATA/ENTER	Accel Time 1 C1-01 = 20.0 Sec	Displays accel time and its setting when accel time (C1-01) has been changed
Return the display to Modified Consts	ESC	** Main Menu ** Modified Consts	
Change the mode (Displays Operation)	∧	** Main Menu ** Operation	

The mode can be changed even during operation. Even if the mode is changed to the programming mode to set/read constants during operation, the inverter continues operation. The inverter does not operate even if the run command is input, when the programming mode is selected and the inverter is stopped.

When the constants are set/read during operation, depress [MENU] key and then [DATA/ENTER] key to return to the frequency reference value display (the same as power-ON display).

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5.3 OPERATION MODE

The inverter can operate in this mode Operation data or faults can be displayed. Each time when depressing [^] or [v] key, an item to be monitored is changed. If any fault occurs, the digital operator changes to the fault display automatically and returns to the previous display by the [> RESET] key.

Table 16 Typical Operation in Operation Mode

Description	Key Sequence	Digital Operator Display	Remarks
POWER ON *1 — Displays Operation	MENU	** Main Menu ** Operation	
Select Operation	DATA/ENTER		
Displays frequency reference value setting *1		Frequency Ref U1-01 = 60 00 HZ	To set frequency reference, depress the [DATA/ENTER] key The value to be set blinks (This setting is enabled at frequency reference from the digital operator or when using multi-step speed commands d1-01 to 09)
Displays output frequency *1	[^]	Output Freq U1-02 = 60 00 HZ	
Displays output current *1	[^]	Output Current U1-03 = 12 3 A	
Displays output voltage *1 *2	[^]	Output Voltage U1-06 = 400 0 VAC	
U2-□□ *3	[^]	Function U2 Fault Trace	
U3-□□ *3	[^]	Function U3 Fault History	
U1-□□ *3	[^]	Function U1 Monitor	

*1· Data to be displayed after the power supply ON can be selected by setting constant o1-02 (monitor selection after power up) among frequency reference value, output frequency, output current or selected monitor (Initial setting is set to the output voltage monitor)

*2 Another item to be displayed instead of output voltage can be selected by setting constant o1-01 (monitor selection)

*3 For items to be displayed such as U1-□□, U2-□□ and U3-□□, refer to Table A-3 "Monitor Constants List"

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(1) Changing Frequency Reference Value

(Example)

Frequency reference value is changed from 0.00Hz to 60.00Hz using the digital operator.

Table 17 Changing Frequency Reference Value

Description	Key Sequence	Digital Operator Display	Remarks
The inverter is in the LOCAL mode (Can be operated from the keypad)			
· Displays Operation	MENU	** Main Menu ** Operation	
· Select Operation (Displays frequency reference)	DATA ENTER	Frequency Ref U1-01 = 0 00 HZ	
· Depress [DATA/ENTER] key The value to be set blinks	DATA ENTER	Frequency Ref 0 00 00 HZ	
· Change the value to 60 00Hz	▽ △ RESET	Frequency Ref 0 6 0 00 HZ	
· Write-in the constant	DATA ENTER	Entry Accepted	
		Frequency Ref 0 6 0 00 HZ	Returns to the frequency reference value display after Entry Accepted is displayed for 1 5 seconds
	ESC	Frequency Ref U1-01 = 60 00 HZ	

Note Only the digit that is blinking can be changed

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(2) Monitor Display

(Example)

Monitoring DC bus voltage (U1–07) during frequency reference display.

Table 18 Typical Monitor Display Operation

Description	Key Sequence	Digital Operator Display	Remarks
· Displaying frequency reference		Frequency Ref U1–01 = 60 00 HZ	
· Displays U1–□□ monitor		Function U1 Monitor	
Select U1–□□		Frequency Ref U1–01 = 60 00 HZ	
· Displays U1–07		DC Bus Voltage U1–07 = 303 VDC	
Returns to U1–□□ display		Function U1 Monitor	
· Returns to frequency reference display		Frequency Ref U1–01 = 60 00 HZ	

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(3) Fault Display

When detecting a fault, the VS–616G5 displays the fault contents on the digital operator and activates fault contact output, the motor coasts to a stop. For the display at fault occurrence or troubleshooting, refer to Table 31 "Fault Diagnosis and Corrective Actions". Since the VS–616G5 stores the information obtained at fault occurrence in the inverter, the information can be verified. For details, refer to Table A–3 "Monitor Constants List".

(Example)

Verifying the status at fault occurrence and resetting the fault when overcurrent occurs during operation at 60.00Hz.

Table 19 Typical Operation of Fault Display

Description	Key Sequence	Digital Operator Display	Remarks
· Displaying frequency reference		Frequency Ref U1–01 = 60 00 HZ	
· Overcurrent occurs		OC Over Current	Displays the fault
Verify the status at fault occurrence	^	Last Fault Over Current	Displays the status immediately before the fault occurred
	^	Frequency Ref U2–03 = 60 00 HZ	
	^	Output Freq U2–04 = 60 00 HZ	
	^	Output Current U2–05 = 12 3 A	
· Reset the fault	RESET	Frequency Ref U1–01 = 60 00 HZ	By resetting the fault, the display entered just prior to the fault occurrence is returned

NOTE

Fault reset cannot be activated while forward/reverse run signal from control circuit terminal is ON. Turn OFF the signal and check the safety of the sorrounding area, then reset the inverter.

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5.4 INITIALIZE MODE

As described below, the language displayed on the digital operator, the access level to set/read constants or control method (V/f control, vector control) can be selected. Set constants A1–01 and A1–02 before use of the VS–616G5. The following table shows the main constants for initialize mode.

Table 20 Initialize Mode

Constant No.	Digital Operator Display	Name	Description
A1–00	Select Language	Language selection (change enable during run)	0 English 1 Japanese
A1–01	Access Level	Access level (change enable during run)	0 Exclusive for monitoring 1 Constants for user selection (Constants to be set/read can be programmed by operator) 2 QUICK–START (Constants required for test run are set/read) 3 BASIC (Normally–used constants are set/read) 4 ADVANCED (All constants are set/read)
A1–02	Control Method	Control method selection	0 V/f control 1 V/f control with PG feedback 2 Open loop vector 3 Flux vector
* A1–03	Init Parameters	Reset to factory defaults	0 No Initialization 1110 Initialization of user setting 2220 2–wire initialization 3330 3–wire initialization
* A1–04	Enter Password	Password	Password setting
A2–01 to A2–32	User Param 1 to 32	User setting constant	When A1–01=1 (user program) is selected, selects the constants that can be set/read by digital operator

*Do not set the constants unnecessarily, or the constants are initialized (A1–03) or some constants cannot be changed (A1–04)

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(1) Changing Control Method

(Example)
The control method is changed from open loop vector to V/f control.

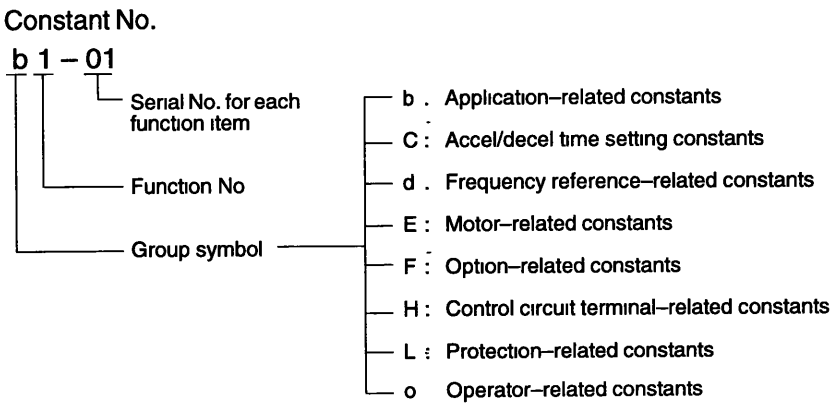
Table 21 Changing Control Method

Description	Key Sequence	Digital Operator Display	Remarks
Displaying frequency reference		Frequency Ref U1-01 = 60 00 HZ	
· Displays Operation	MENU	** Main Menu ** Operation	
· Displays Initialize	∨ ∧	** Main Menu ** Initialize	
· Select Initialize	DATA ENTER	Select Language English	When selecting Initialize, Select Language is displayed
· Change the constant name (Displays Control Method)	∨ ∧	Control Method Open Loop Vector	
· By depressing DATA/ENTER key, constant No and set value are displayed	DATA ENTER	A1-02 = 02 *** Open Loop Vector	
· Change the control method (Displays V/F Control)	∨ ∧	A1-02 = 00 V/F Control	
· Select V/F Control	DATA ENTER	Entry Accepted	After displaying Entry Accepted for 1 5 seconds, returns to the control method display
Return to Operation	MENU	** Main Menu ** Operation	
· Select Operation to display frequency reference	DATA ENTER	Frequency Ref U1-01 = 60 00 HZ	

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5.5 PROGRAMMING MODE

The constants of the VS–616G5 are composed of group symbols, function Nos and serial Nos. for each function item as shown below. Use [▲] or [▼] key to change the group, function or name display and select one by [DATA/ENTER] key. For details of the constants, refer to Table A–4 "Constants List" or Descriptive Manual for Constants.



Constants to be set/read by digital operator can be selected by setting the access level (constant A1–01) as described below.

Table 22 Constant Access Level

A1–01	Name	Description
0	Exclusive for monitoring	Constants can be set/read in operation mode or initialize mode. Constants cannot be set/read in programming mode or modified constants mode
1	User selected constants	· Up to 32 constants to be set/read by digital operator can be selected · When A1–01=01 is selected, constants specified by A2–01 to 32 can be set/read by digital operator Set the constant numbers in A2–01 to 32 · When constant numbers are not set in A2–01 to 32, user selected constants by A1–01 cannot be set/read.
2	QUICK–START	Constants required for quick–start operation are set/read For details, refer to Descriptive Manual for Constants
3	BASIC	Constants required for basic operation are set/read For details, refer to Descriptive Manual for Constants.
4	ADVANCED	Constants required for advanced operation are set/read For details, refer to Descriptive Manual for Constants.

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(Example 1)
Select QUICK–START and change the decel time 1 (C1–02) from 10.0 to 20.0 seconds while frequency reference is displayed.

Table 23 Changing Constant Data when QUICK–START is Selected

Description	Key Sequence	Digital Operator Display	Remarks
Displaying frequency reference		Frequency Ref U1–01 = 60 00 HZ	
· Displays Operation	MENU	** Main Menu ** Operation	
· Displays Programming	∨ ∧	** Main Menu ** Programming	
· Select Programming	DATA ENTER	Reference Source Terminal	When selecting Programming, the constant name and setting are displayed
· Change the constant name display (Displays Decel Time 1)	∨ ∧	Decel Time 1 C1–02 = 10 0 Sec	
Depress DATA/ENTER key The value to be set blinks	DATA ENTER	Decel Time 1 0010 0 Sec	
· Change the value to 20 0 seconds	∨ ∧ RESET	Decel Time 1 0020 0 Sec	
· Write–in the constant	DATA ENTER	Entry Accepted	After displaying Entry Accepted for 1 5 seconds, returns to the decel time 1 display
· Return to Operation	MENU	** Main Menu ** Operation	
· Select Operation to display frequency reference	DATA ENTER	Frequency Ref U1–01 = 60 00 HZ	

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(Example 2)
Select BASIC and change the decel time 1 (C1–02) from 10.0 to 20.0 seconds while frequency reference is displayed.

Table 24 Changing Constant Data when BASIC is Selected

Description	Key Sequence	Digital Operator Display	Remarks
· Displaying frequency reference		Frequency Ref U1–01 = 60 00 HZ	
Displays Operation	MENU	** Main Menu ** Operation	
· Displays Programming	∨ ∧	** Main Menu ** Programming	
· Select Programming	DATA ENTER	Function b1 Sequence	When selecting Programming, Function b1 is displayed
Change the function display (Displays Accel/Decel)	∨ ∧	Function C1 Accel/Decel	Searches for C1
· Select the function (accel/decel time)	DATA ENTER	Accel Time 1 C1–01 = 10 0 Sec	
· Change the name display (Displays Decel Time 1)	∨ ∧	Decel Time 1 C1–02 = 10 0 Sec	Displays C1–02
· Depress DATA/ENTER key The value to be set blinks	DATA ENTER	Decel Time 1 0010 0 Sec	
· Change the value to 20 0 seconds	∨ ∧ RESET	Decel Time 1 0020 0 Sec	
· Write–in the constant	DATA ENTER	Entry Accepted	After displaying Entry Accepted for 1 5 seconds, returns to decel time display
· Return to Operation	MENU	** Main Menu ** Operation	
· Select Operation to display frequency reference	DATA ENTER	Frequency Ref U1–01 = 60 00 HZ	

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(Example 3)
Select ADVANCED and change the decel time 1 (C1–02) from 10.0 to 20.0 seconds while frequency reference is displayed.

Table 25 Changing Constant Data when ADVANCED is Selected

Description	Key Sequence	Digital Operator Display	Remarks
· Displaying frequency reference		Frequency Ref U1–01 = 60 00 HZ	
· Displays Operation	MENU	** Main Menu ** Operation	
Displays Programming	∨ ∧	** Main Menu ** Programming	
· Select Programming	DATA ENTER	Group b Application	When selecting the programming mode, the group menu is displayed
· Change the group name (Displays Tuning)	∨ ∧	Group C Tuning	
Select the group (Selects Tuning group)	DATA ENTER	Function C1 Accel/Decel	When selecting the group, the function menu is displayed Select a function name using ∧ or ∨ key if necessary
· Select the function (Selects accel/decel time)	DATA ENTER	Accel Time 1 C1–01 = 10 0 Sec	When selecting the function, the constant name is displayed
· Change the constant name (Displays Decel Time 1)	∨ ∧	Decel Time 1 C1–02 = 10 0 Sec	Displays C1–02
· Depress DATA/ENTER key The value to be set blinks	DATA ENTER	Decel Time 1 0010 0 Sec	
· Change the value to 20 0 seconds.	∨ ∧ RESET	Decel Time 1 0020 0 Sec	
· Write–in the constant	DATA ENTER	Entry Accepted	After displaying Entry Accepted for 1 5 seconds, returns to decel time 1 display
· Return to Operation (Displays Operation)	MENU	** Main Menu ** Operation	
· Select Operation to display frequency reference	DATA ENTER	Frequency Ref U1–01 = 60 00 HZ	

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5.6 MODIFIED CONSTANTS MODE

Compares the constant values preset at the factory with the values changed by the user, and displays the constants changed from the preset constants automatically. In the modified constants mode, constants can be read; in addition, they can also be set or changed.

(Example)
Read the constants C1–01 (accel time 1) and E1–01 (input voltage) when the factory settings have been changed. In addition, change the setting of E1–01 (input voltage) from 420V to 460V in this mode.

Table 26 Typical Operation in Modified Constants Mode

Description	Key Sequence	Digital Operator Display	Remarks
Displaying frequency reference		Frequency Ref U1–01 = 60 00 HZ	
· Displays Operation	MENU	** Main Menu ** Operation	
· Displays Modified Consts	∨ ∧	** Main Menu ** Modified Consts	
Select the Modified Consts	DATA ENTER	Accel Time 1 C1–01 = 20 0 Sec	When selecting Modified Consts the constants which have been changed from factory settings are displayed
Displays the next–to–be–changed constant (Displays input voltage)	∨ ∧	Input Voltage E1–01 = 420 VAC	
· Depress DATA/ENTER key The value to be set blinks	DATA ENTER	Input Voltage 420 VAC	
· Change the value to 460V	∨ ∧ RESET	Input Voltage 460 VAC	
· Write–in the constant	DATA ENTER	Entry Accepted	After displaying Entry Accepted for 1 5 seconds, returns to input voltage display
· Displays the next–to–be–changed constant	∨ ∧	Accel Time 1 C1–01 = 20 0 Sec	
Returns to Main Menu (Displays Operation)	MENU	** Main Menu ** Operation	
Select Operation to display frequency reference	DATA ENTER	Frequency Ref U1–01 = 60 00 HZ	

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5.7 MEMOBUS CONTROL

VS–616G5 can perform serial transmission by using a programmable controller (PLC) and MEMOBUS communication MEMOBUS is composed of one master PLC and 1 to 31 (maximum) slave units (VS–616G5).

The master performs signal transmission with one slave at one time. Therefore, address numbers are assigned to each slave in advance and the master specifies a number to perform signal transmission. The slave which receives the command from the master executes the function and response to the master.

(1) Communication Specification

- Communication with PLC in accordance with MEMOBUS specifications is enabled only in RTU mode.
- RS–422 or RS–485 transmission is selectable by SW2.
- Transmission method : Asynchronous, half–duplex transmission
- Transmission parameter :
  - Baud rate: Selectable from 1200, 2400, 4800, 9600 BPS by setting constant H5–02.
  - Data length: Fixed to 8 bits
  - Parity: Parity/no–parity, even/odd parity selectabe by setting constant H5–03
  - Stop bit: Fixed to 1 bit
- Maximum number of units to be connected : 31 units (when RS–485 is used)
- Self–diagnosis function of transmission part provided

(2) Data to be Sent/Received by Communication

Data to be sent/received by communication are run commands, frequency reference, fault constants, inverter status and constant setting/reading

(a) Operation Mode Selection (b1–01, b1–02)

Select the run command and frequency reference input method in constants b1–01 and b1–02. To provide a run command and frequency reference by communication, set these constants to "2". Also, without regard to this selection, monitoring of running status, constant setting/reading, fault reset and multi–function input command from the PLC are enabled. The multi–function input command becomes OR with the command input from control circuit terminals 3 to 8.

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(b) MEMOBUS Frequency Reference Unit (o1–03, o1–04)

Enabled when bit 0 of register No. 0F is "1". The frequency reference units, the frequency reference and output frequency monitors from master are indicated. The unit is 0.01 Hz when bit 0 of register No. 0 is "0".

(c) MEMOBUS Slave Address (H5–01)

The slave address number is set. Set another slave address number connected on the same transmission line.

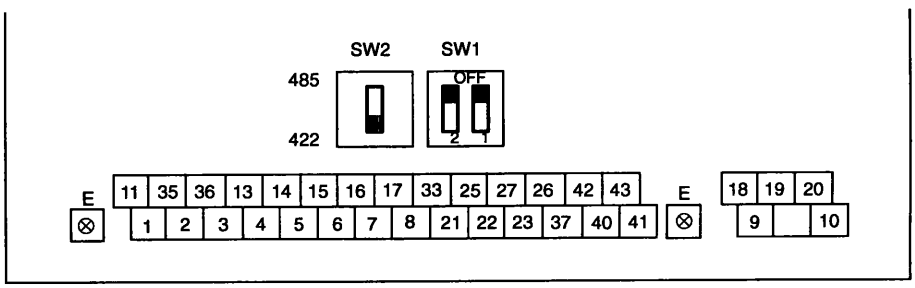


Fig. 20 Arrangement of Control Circuit Terminals, SW1 and SW2

(3) Functions of SW1 and SW2

(a) SW1 (for terminating resistor)

Provide a terminating resistor to each receiver side when transmission is perfomed by RS–422A (four–wire system) between one master and one slave. Provide a terminating resistor in devices (both ends) connected to the communication cable when transmission is performed by RS–485 (two–wire system) between one master and more than one slave. The VS–616G5 is provided with a built–in terminating resistor. Switch the resistor ON/OFF by SW1.

Table 27 Functions of SW1

Communication Cable Connecting Method	SW1 Setting
Four–wire system (1 to 1)	Switch both 1 and 2 to the ON side (numbering side).
Two–wire system (1 to n)	Switch 1 to the OFF side and 2 to the ON side only for devices (both ends) connected to the communication cable For other devices, switch both 1 and 2 to the OFF side.

(b) SW2

Table 28 Functions of SW2

Transmission Method	SW2 Setting
RS–422A (four–wire system)	To 422 side
RS–485 (two–wire system)	To 485 side

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6 MAINTENANCE AND INSPECTION

⚠ WARNING

- Never touch high–voltage terminals in the inverter.
  Failure to observe this warning can result in an electrical shock.
- Replace all protective covers before powering up the inverter. To remove the cover, make sure to disconnect supply mains.
  Failure to observe this warning can result in an electrical shock.
- Perform maintenance or inspection only after verifying that the CHARGE LED goes OFF, after the main circuit power supply is turned OFF.
  The capacitors are still charged and can be dangerous.
- Only authorized personnel should be permitted to perform maintenance, inspections or parts replacement.
  [Remove all metal objects (watches, bracelets, etc.) before operation.]
  (Use tools which are insulated against electrical shock.)
  Failure to observe this warning can result in an electrical shock.

⚠ CAUTION

- The control PC board employs CMOS ICs. Do not touch the CMOS elements.
  They are easily damaged by static electricity.
- Do not connect or disconnect wires or connectors while power is applied to the circuit.
  Failure to observe this caution can result in personal injury.
- When removing the wiring, remove the ground wire last.

This chapter describes basic maintenance and inspection procedures for the VS–616G5.

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6.1 PERIODIC INSPECTION

The VS–616G5 will function longer if it is kept clean, cool and dry, while observing the precautions listed in Par. 2.3. Check for tightness of electrical connections, discoloration or other signs of overheating or aging. Use Table 29 as your inspection guide. Before servicing, turn OFF AC main circuit power and be sure that the CHARGE LED is OFF.

Table 29 Periodic Inspection

Component	Check	Corrective Action
External Terminals, Unit Mounting Bolts, Connectors, etc	Loose screws	Tighten
	Loose connectors	Tighten
Heatsink	Build–up of dust and dirt	Blow with dry compressed air of 39.2×10^4 to 58.8×10^4 Pa (4 to 6kg cm^2) pressure
Printed Circuit Board	Accumulation of conductive dust or oil	Blow with dry compressed air of 39.2×10^4 to 58.8×10^4 Pa (4 to 6kg cm^2) 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 39.2×10^4 to 58.8×10^4 Pa (4 to 6kg cm^2) pressure
Smoothing Capacitor	Discoloration or odor	Replace the capacitor or inverter unit

6.2 PARTS REPLACEMENT SCHEDULE (GUIDELINES)

Replace the following parts periodically, for a long, safe, trouble free working life of VS–616G5.

Table 30 Parts Replacement Schedule

Parts	Interval (Approx)	Remarks
Cooling Fan	2 to 3 years	Replace with new one.
Smoothing Capacitor	5 years	Replace with new one (Decided after inspection.)
Breakers or Relays	—	Decided after inspection
Fuse	10 years	Replace with new one
Aluminum Electrolytic Capacitor on PC Board	5 years	Replace with new one. (Decided after inspection)

NOTE

Operating conditions are as follows:

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

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7 TROUBLESHOOTING

This chapter describes the inverter fault display and the fault contents caused by motor / machine malfunctions and the corrective actions to be taken.

7.1 FAULT DIAGNOSIS AND CORRECTIVE ACTIONS

(1) When the VS–616G5 detects a fault, the fault is displayed on the digital operator and activates the fault contact output and the motor coasts to a stop. Check the cause in the table below and take the corrective actions.

(2) If the inspections or corrective actions described cannot solve the problem, contact your YASKAWA representative immediately.

(3) To restart, turn ON the reset input signal or depress [>RESET] key or shut OFF the main circuit power supply once, to reset the stop status.

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Table 31 Fault Diagnosis and Corrective Actions

Fault Display	Description	Details	Corrective Action	Rank* (Standard Value)
UV1 DC Bus Undervolt	Main circuit undervoltage (PUV)	Undervoltage in the direct current main circuit during running Detection level 400 V class Approx 380 V or less	· Check the power supply wiring Correct the line voltage	A
UV2 CTL PS Undervolt	Control circuit undervoltage (CUV)	Undervoltage in the control circuit during running		A
UV3 MC Answerback	MC fault	The pre-charge contactor opened during running		A
UV Under Voltage	Momentary power loss	· The main circuit direct current voltage fell below the PUV level · The control power source fell below the CUV level · The pre-charge contactor opened	—	B
OC Overcurrent	Overcurrent (OC)	The inverter output current exceeded the OC level	· Check the motor coil resistance Extend the accel/decel time Check the motor insulation · Multi-meter check	A
GF Ground Fault	Grounding (GF) (Earth fault)	Inverter output grounding current exceeded 50% of inverter rated current	· Check that motor insulation has not deteriorated · Check that connection between inverter and motor is not damaged	A
OV DC Bus Overvolt	Overvoltage (OV)	The main circuit direct current voltage exceeded the OV level Detection level 400 V class Approx 800 V	Extend the deceleration time, add braking circuit	A
SC Short Circuit	Load short-circuit (SC)	Inverter output (load) is short-circuited	Check the motor coil resistance Check the motor insulation	A
PUF DC Bus Fuse Open	Fuse blown (FU)	· The direct current circuit fuse is blown · The output transistors were damaged	Check for damaged transistor, load side short circuit, grounding, etc	A
OH1 Heatsnk MAX tmp	Heatsink overheat (OH1)	The transistor heatsink temperature exceeded the allowable value	Check the fan and ambient temperature	A
OL1 Motor Overloaded	Motor overload (OL1)	Inverter output exceeded the motor overload level	Reduce the load	A
OL2 Inv Overloaded	Inverter overload (OL2)	Inverter output exceeded the inverter overload level	Reduce the load, extend the acceleration time	A
OL3	Overtorque detection 1	When torque detection selection 1 is enabled (L6-01=1 to 4), inverter output current (in V/f control) or inverter torque reference (in vector control) exceeded torque detection level 1 (L6-02) for the time set by torque detection time 1 (L6-03) or longer	—	A (when L6-01 =3 or 4) B (when L6-01 =1 or 2)
OL4	Overtorque detection 2	When torque detection selection 2 is enabled (L6-01=1 to 4), inverter output current (in V/f control) or inverter torque reference (in vector control) exceeded torque detection level 2 (L6-05) for the time set by torque detection time 2 (L6-06) or longer	—	A (when L6-04 =3 or 4) B (when L6-04 =1 or 2)

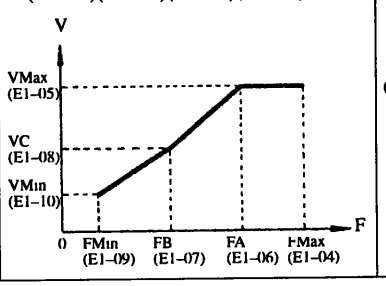
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Table 31 Fault Diagnosis and Corrective Actions (Cont'd)

Fault Display	Description	Details	Corrective Action	Rank* (Standard Value)
PF Input Pha Loss	Input open–phase	Inverter input power supply has open–phase Large unbalance in input voltage	· Check the line voltage Re–tighten the input terminal screws	A
LF Output Pha Loss	Output open–phase	Inverter output has open–phase	Check the output wiring · Check the motor impedance · Re–tighten the output terminal screws	A
RR Dyn Brk Transistr	Braking transistor failure	The braking transistor has failed	Replace the inverter	A
RH Dyn Brk Resistor	Braking resistor unit overheat	The braking resistor unit temperature has exceeded the allowable value (Protects only inverter built–in type)	Reduce the regenerative load	A
OS Overspeed Det	Overspeed (OS)	The motor speed exceeded the overspeed level	—	A
PGO PG open	PG open circuit (PGO)	The PG line is broken	Check the PG line · Check the condition of the motor lock or the load	A
DEV Speed Deviation	Speed deviation (DEV)	The deviation of the speed reference and speed feedback exceeded the regulation level	Check the load	B
OPR Oper Disconnect	Digital operator connection fault	The digital operator was disconnected during operation by run command from the digital operator	Check the operator connection	A
ERR EEPROM R/W Err	EEPROM writing fault (ERR)	EEPROM internal data did not match when initializing the constant	Replace the control card	A
CALL Serial Com Call	SI–B transmission error	Control data was not received normally when power supply is turned ON	Check transmission devices and transmission signals	C
CE Memobus Com Err	Transmission error	Control data was not received normally when power supply is turned ON	Check transmission devices and transmission signals	A
CF Out of Control	Control fault	In open loop vector control, it took 3 seconds or more for torque limit during deceleration to stop	Check the motor–related constants	A
SVE Zero Servo Fault	Zero–servo fault	The rotation position deviated by 10000 r/min or more during zero–servo operation	· Check that the torque limit value is not too low Check that the load torque is not excessive · Check the noise of PG signals	A
EF External Fault	Operation reference fault (External)	Both FWD and REV run commands were closed for 500 ms or more	Check sequence circuit	B
EF3 External Fault 3	External fault at terminal 3	Fault occurred in the external control circuit	Check the condition of the input terminal If the fault is displayed when terminal is not connected, replace the inverter	A
EF4 External Fault 4	External fault at terminal 4			B
EF5 External Fault 5	External fault at terminal 5			B
EF6 External Fault 6	External fault at terminal 6			B

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Table 31 Fault Diagnosis and Corrective Actions (Cont'd)

Fault Display	Description	Details	Corrective Action	Rank* (Standard Value)
EF7 External Fault 7	External fault at terminal 7	Fault occurred in the external control circuit	Check the condition of the input terminal If the fault is displayed when terminal is not connected, replace the inverter	B
EF8 External Fault 8	External fault at terminal 8			B
OPE01 kVA Selection	kVA selection fault (OPE01)	kVA selection fault	Check and set the constant data	C
OPE02 Limit	Constant setting range fault (OPE02)	Constant data is out of range	Check the constant data settings	C
OPE03 Terminal	Multi-function contact input selection fault (OPE03)	· In H1-01 to H1-06 settings · The same values are set except for F, FF and 20 to 2F Both UP/DOWN and HOLD commands are set · UP and DOWN commands are not set at the same time · Two or more HOLD, UP/DOWN, sample/hold commands are set · Two or more speed search 1, 2, 3 commands are set In B5-01 setting, both PID control and UP/DOWN commands are set · In H3-09 setting, terminal 13/14 selection and the value other than "Not used" are set at the same time	Check the constants	C
OPE05 Sequence Select	Option reference selection fault (OPE05)	· In B1-01 setting, C-option is not connected although frequency reference from C-option is selected · In B1-02 setting, C-option is not connected although run command from C-option is selected	Check the constants	C
OPE06 PG Opt Missing	Control method selection fault (OPE06)	In A1-02 setting · PG is not connected although V/f control with PG feedback is selected · PG-B is not connected although flux vector control is selected	Check the constants	C
OPE07 Analog Selection	Multi-function analog input selection fault (OPE07)	· In H3-05 and H3-09 settings, the same values are set except for 0 and 1F · While AI-14B is connected, "0" is set in F2-01 and option/inverter selection is set in multi-function contact input	Check the constants	C
OPE10 V/f Ptrn Setting	V/f data setting fault (E1-04 to E1-10)	When the settings of E1-04 to E1-10 do not satisfy the following conditions F Max ≧ F A > F B ≧ F Min (E1-04)(E1-06)(E1-07)(E1-09)  	Check the constants	C

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Table 31 Fault Diagnosis and Corrective Actions (Cont'd)

Fault Display	Description	Details	Corrective Action	Rank* (Standard Value)
OPE11 Carr Frq/On–Delay	Constant setting fault	When one of the following setting fault occurs Carrier frequency upper limit (C6–01) > 5kHz, and Carrier frequency lower limit (C6–02) ≦ 5kHz · Carrier frequency proportional gain (C6–03) > 6 and (C6–01) < (C6–02) Setting error of upper/lower limit of C6–01 to 03 and C8–15	Check the constants	C
CPF00 COM–ERR(OP&INV)	Control circuit fault 1 (CPF00) (Digital operator transmission fault)	· Transmission between the inverter and digital operator cannot be established 5 seconds after supplying power · MPU peripheral element check fault (initial)	Insert the digital operator connector again Check the control circuit wiring Replace the control card	A
CPF01 COM–ERR(OP&INV)	Control circuit fault 2 (CPF01) (Digital operator transmission fault)	Transmission between the inverter and digital operator is established once after supplying power, but later transmission fault continues for more than 2 seconds MPU peripheral element check fault (online)	Insert the digital operator connector again · Check the control circuit wiring Replace the control card	A
CPF02 BB Circuit Err	Baseblock circuit fault (CPF02)	Inverter control unit fault	Replace the control card	A
CPF03 EEPROM Error	EEPROM fault (CPF03)			A
CPF04 Internal A/D Err	CPU internal A/D converter fault (CPF04)			A
CPF05 External A/D Err	CPU external A/D converter fault (CPF05)			A
CPF06 Option Error	Option connection fault (CPF06)	The option card is not installed correctly	Install the option card again	A
CPF20 Option A/D Error	A/D converter fault in analog speed reference card (CPF20)	Option card (AI–14B) A/D converter fault	Replace the option card	A

* The ranks are classified as follows

Rank A Major fault (Motor coasts to a stop, operator indication lights, and fault contact is output)

Rank B Fault [Operation continues, operator indication blinks, no fault contact is output, and minor fault contact is output (when multi–function output is selected)

Rank C Warning (Operation cannot be performed, operator indication lights, no fault contact is output, no minor fault contact is output)

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7.2 MOTOR FAULTS AND CORRECTIVE ACTIONS

(1) If any of the following faults occurs in the motor, check the cause and provide the relevant corrective action.

(2) If these inspections and corrective actions cannot solve the problem, contact your YASKAWA representative immediately.

Table 32 Motor Faults and Corrective Actions

Fault	Check Point	Corrective Action
Motor does not rotate	Power supply voltage applied to power supply terminals L1, L2, L3 ? CHARGE LED is ON ?	· Turn ON power supply Turn OFF power supply, and then ON again Check power supply voltage Make sure terminal screws are tight
	Use rectifier type voltmeter to test Voltage output to output terminals U(T1), V(T2), W(T3) correct?	Turn OFF power supply, then turn ON again
	Motor locks due to excessive load?	Reduce the load and release the lock
	Fault displayed in operator display?	Check troubleshooting table
	FWD or REV run command entered?	Check the wiring
	Frequency setting voltage entered?	Correct the wiring Check frequency setting voltage
	Reference selection (b1–01), operation method selection (b1–02) correct?	Input the correct set value
Motor rotation reverses	Wiring of terminals U(T1), V(T2), W(T3) correct?	Match wiring to the phase order of the motor leads U(T1), V(T2), W(T3)
	FWD and REV wiring run signals entered?	Correct the wiring
Motor rotates, but variable speed not available	Wiring of frequency setting circuit correct?	Correct the wiring
	Reference selection (b1–01), operation method selection (b1–02) correct?	With the digital operator, check the reference selection or operation method selection
	Load excessively large?	Reduce the load
Motor r/min too high or too low	Motor ratings (number of poles, voltage) correct?	Check motor nameplate specifications
	Accel/decel speed change ratio for gears, etc correct?	Check speed changer (gears, etc)
	Maximum frequency set value correct?	Check the maximum frequency set value
	Use rectifier voltmeter Voltage between motor terminals not excessively reduced?	Check V/f characteristics values
Motor r/min not stable during operation	Load excessively large?	Reduce the load
	Load variation excessively large?	Reduce the load variation · Increase inverter motor capacity
	3–phase or single–phase power supply used? For 3–phase power supply, open phase?	· For 3–phase power supply, check the wiring if power supply is open phase · For single–phase power supply, connect AC reactor to the power supply

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APPENDIX 1 SPECIFICATIONS

Table A–1 Specifications

	Model CIMR–G5C □	40P4	40P7	41P5	42P2	43P7	44P0	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055	4075	4110	4160
	Max. Applicable Motor Output * kW	0.55	1.1	1.5	2.2	3.7	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55	75	110	160
Output Characteristics	Inverter Capacity kVA	1.4	2.6	3.7	4.7	6.1	8.6	11	14	21	26	31	37	50	61	73	98	130	170	230
	Rated Output Current A	1.8	3.4	4.8	6.2	8	11	14	18	27	34	41	48	65	80	96	128	165	224	302
	Max. Output Voltage	3–Phase 380/400/415/440/460 V (Proportional to input voltage)																		
	Rated Output Frequency	Up to 400 Hz available by programming																		
Power Supply	Rated Input Voltage and Frequency	3–Phase 380/400/415/440/460 V 50/60 Hz (neutral grounded)																		
	Allowable Voltage Fluctuation	+10%, –15%																		
	Allowable Frequency Fluctuation	±5%																		
Control Characteristics	Control Method	Sine wave PWM																		
	Starting Torque	150% / 1 Hz (150% / 0 r./ min with PG)†																		
	Speed Control Range	1:100 (1:1000 with PG)†																		
	Speed Control Accuracy	±0.2% (±0.02% with PG)†																		
	Speed Response	5 Hz (30 Hz with PG)†																		
	Torque Limit	Available (4 quadrants can be changed by parameter setting)																		
	Torque Accuracy	±5%																		
	Frequency Control Range	0.1 to 400 Hz																		
	Frequency Accuracy	Digital command ±0.01% (–10°C to +40°C)																		
		Analog command ±0.1% (25°C ± 10°C)																		
	Frequency Resolution	Digital operator reference ±0.01 Hz																		
		Analog reference : ±0.03 Hz/60 Hz (11 bit + code)																		
	Output Frequency Resolution	0.001 Hz																		
	Overload Capacity	150% of rated output current for 1 minute																		
	Frequency Setting Signal	–10 to 10 V, 0 to 10 V, 4 to 20 mA																		
	Accel/Decel Time	0.01 to 6000.0 sec (Accel/decel time setting independently, 4 steps available)																		
	Braking Torque	Approx. 20%																		

(Cont'd)

* Based on a YASKAWA standard 4–pole motor for max. applicable motor output

† Occasional tuning may be required

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Table A−1 Specifications (Cont'd)

	Model CIMR–G5C□	40P4	40P7	41P5	42P2	43P7	44P0	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055	4075	4110	4160
Protective Functions	Motor Overload Protection	Protected by electronic 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% of rated output current																		
	Overvoltage	Motor coasts to a stop if converter output voltage exceeds 820 V																		
	Undervoltage	Motor coasts to a stop if converter output voltage drops to 380 V or below																		
	Momentary Power Loss	Immediately stop by 15 ms and above momentary power loss (Factory setting) Continuous operation during power loss less than 2 sec is equipped as standard																		
	Heatsink Overheat	Protected by thermistor																		
	Stall Prevention	Stall prevention during accel/decel and constant speed operation																		
	Ground Fault	Protected by electronic circuit (Overcurrent level)																		
	Power Charge Indication	Charge LED stays ON until bus voltage drops below 50 V																		
Environment	Ambient Temperature	−10°C to +40°C (Enclosed wall–mounted type) −10°C to +45°C (Open chassis type)																		
	Humidity	90%RH or less																		
	Storage Temperature	−20°C to +60°C																		
	Location	Indoor (protected from corrosive gases and dust)																		
	Elevation	1000 m or less																		
	Vibration	9.81m/s^2 (1G) at 10 to less than 20 Hz, up to 1.96m / s^2 (0.2G) at 20 to 50 Hz																		
Applicable Standards		prEN50178 EN50082–2 EN50081–2 (with RFI filter, screened cable)																		

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APPENDIX 2 DIMENSIONS (mm)

The figures below show a 400V 1.1kW model. Use open chassis type 15kW or less with the top and bottom covers removed.

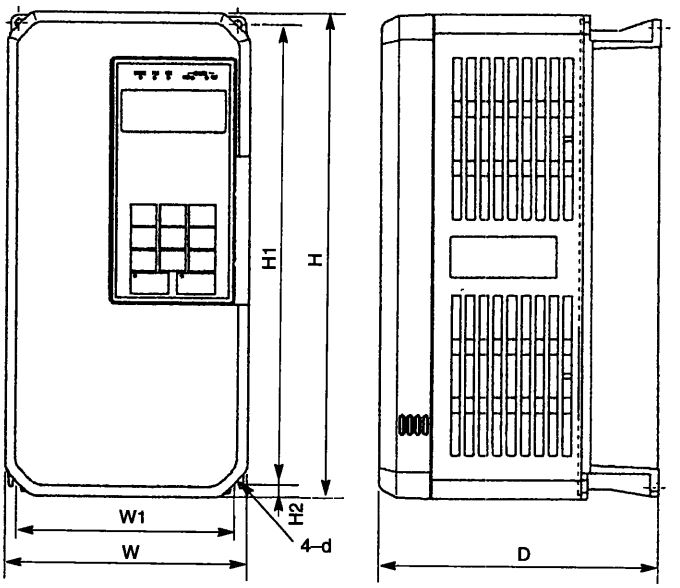


Fig. A–1 Dimensions of VS–616G5

Table A–2 VS–616G5 Dimensions (mm) and Approx. Mass (kg)

Voltage	Motor Capacity kW	Open Chassis Type (IP00)							Enclosed Wall-mounted Type (NEMA1)							
		W	H	D	W1	H1	H2	Mass (kg)	W	H	D	W1	H1	H2	Mass (kg)	d *
400V Class	0 55	140	280	160	126	266	7 0	3	140	280	160	126	266	7 0	3	M5
	1 1															
	1 5	140	280	180	126	266	7 0	4	140	280	180	126	266	7 0	4	M5
	2 2							4 5							4 5	
	3 7															
	4 0															
	5 5	200	300	205	186	285	8 0	6	200	300	205	186	285	8 0	6	M6
	7 5															
	11	250	380	225	236	365	7 5	11	250	380	225	236	365	7 5	11	M6
	15															
	18 5	325	450	285	275	435	7 5	29	330	610	285	275	435	87 5	32	M6
	22							31							34	
	30	325	625	285	275	610	7 5	44	330	785	285	275	610	87 5	48	M6
	37															
	45									850				152 5		
	55	455	820	350	350	795	12 5	81	460	1130	350	350	795	212 5	87	M10
	75							82							88	
	110	575	925	375	445	895	15 0	135	580	1290	375	445	895	270	145	M12
	160			400				145			400				155	

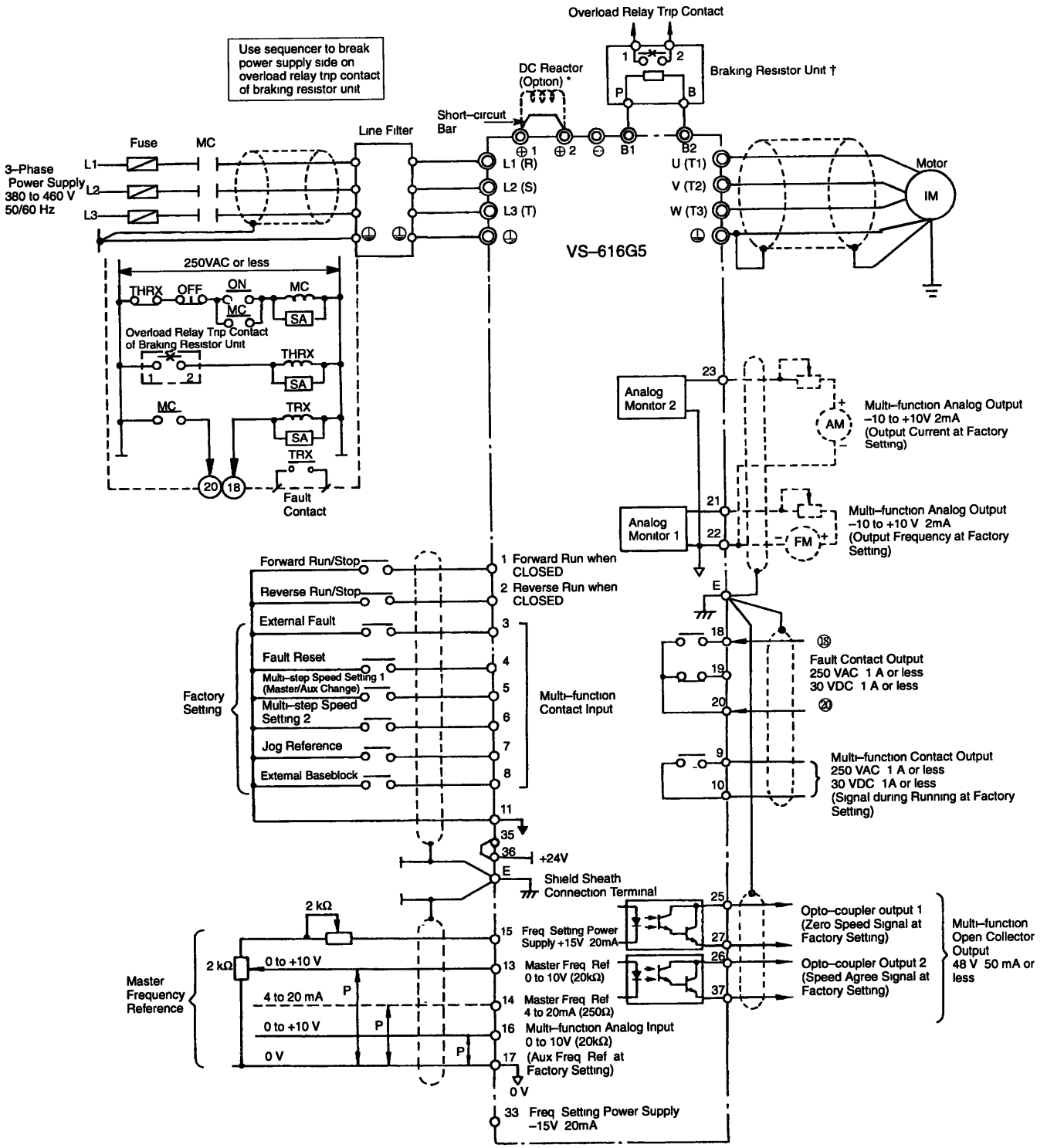
* Mounting holes are the same for the open chassis type and the enclosed wall–mounted type

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APPENDIX 3 TYPICAL CONNECTION DIAGRAM

3.1 BRAKING RESISTOR UNIT

For Models CIMR–G5C40P4 to –G5C4015 (400 V Class 0.55 to 15 kW)



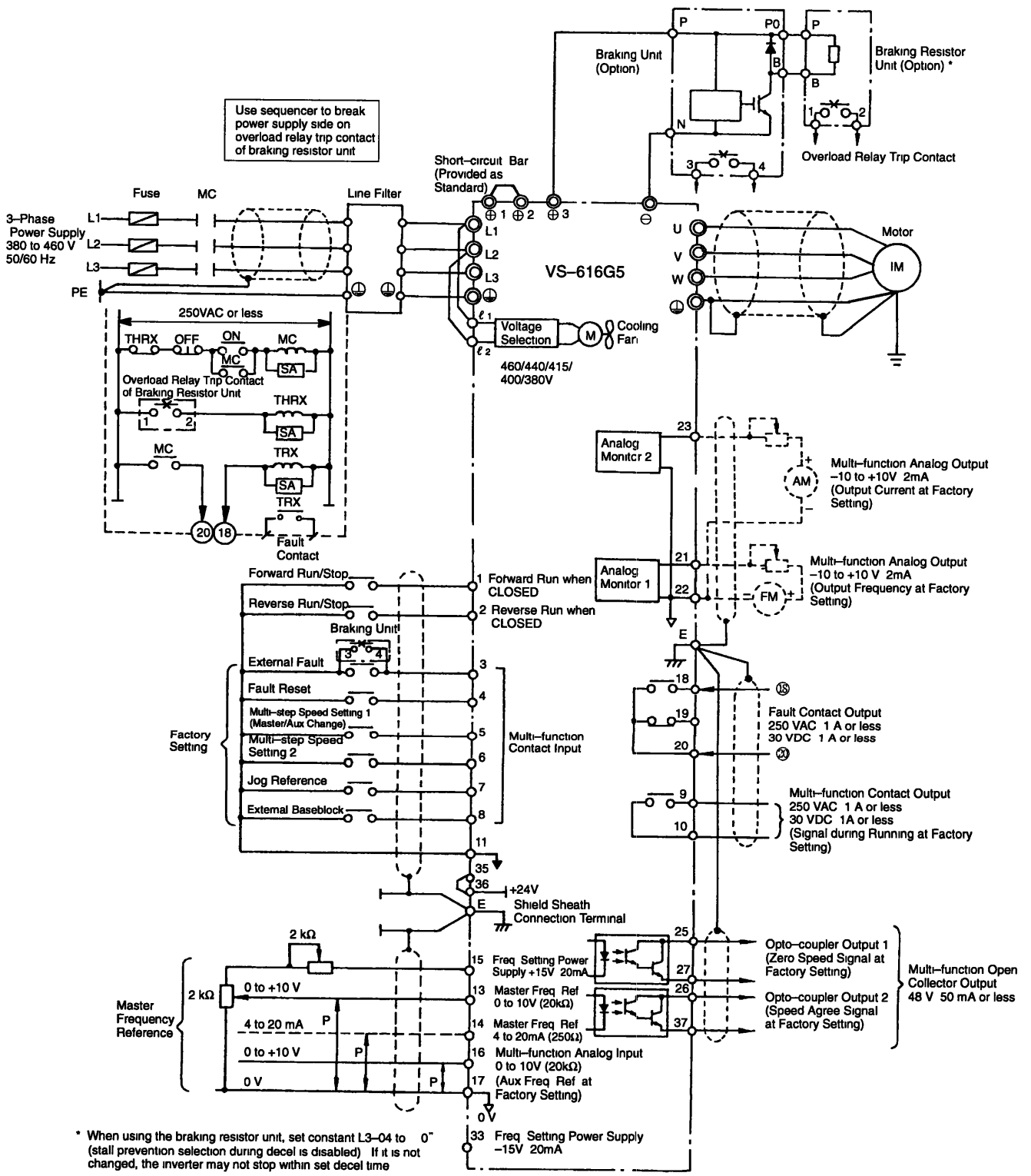
* When installing a DC reactor (option), remove the common bar between ⊕1 and ⊕2 terminals (provided as standard) and connect a DC reactor with the terminals

† When using the braking resistor unit, set constant L3–04 to "0" (stall prevention selection during decel is disabled) If it is not changed, the inverter may not stop within set decel time

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3.2 BRAKING UNIT AND BRAKING RESISTOR UNIT

For models CIMR–G5C4018 to –G5C4045 (400 V Class 18.5 to 45 kW)

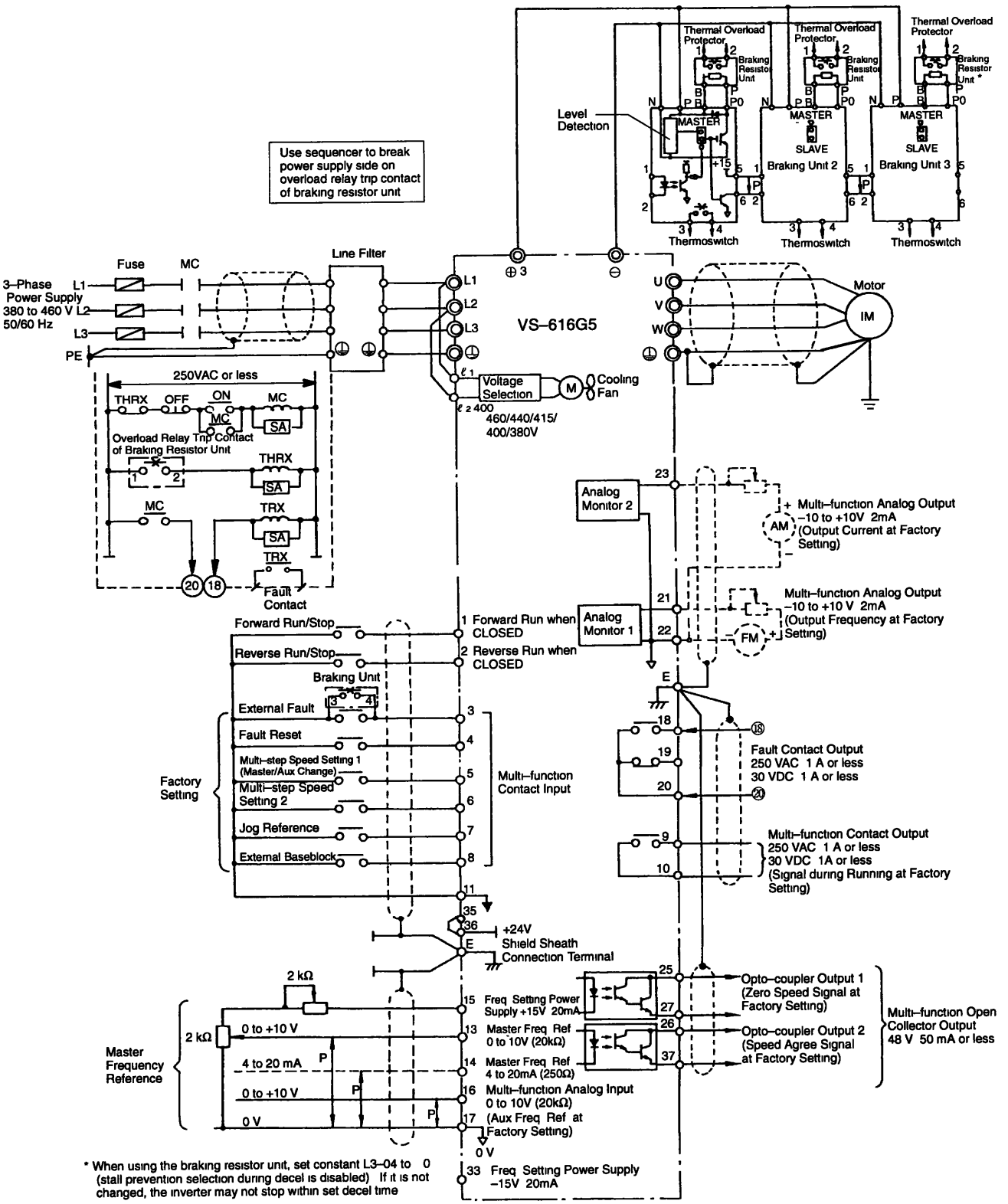


* When using the braking resistor unit, set constant L3–04 to 0" (stall prevention selection during decel is disabled) If it is not changed, the inverter may not stop within set decel time

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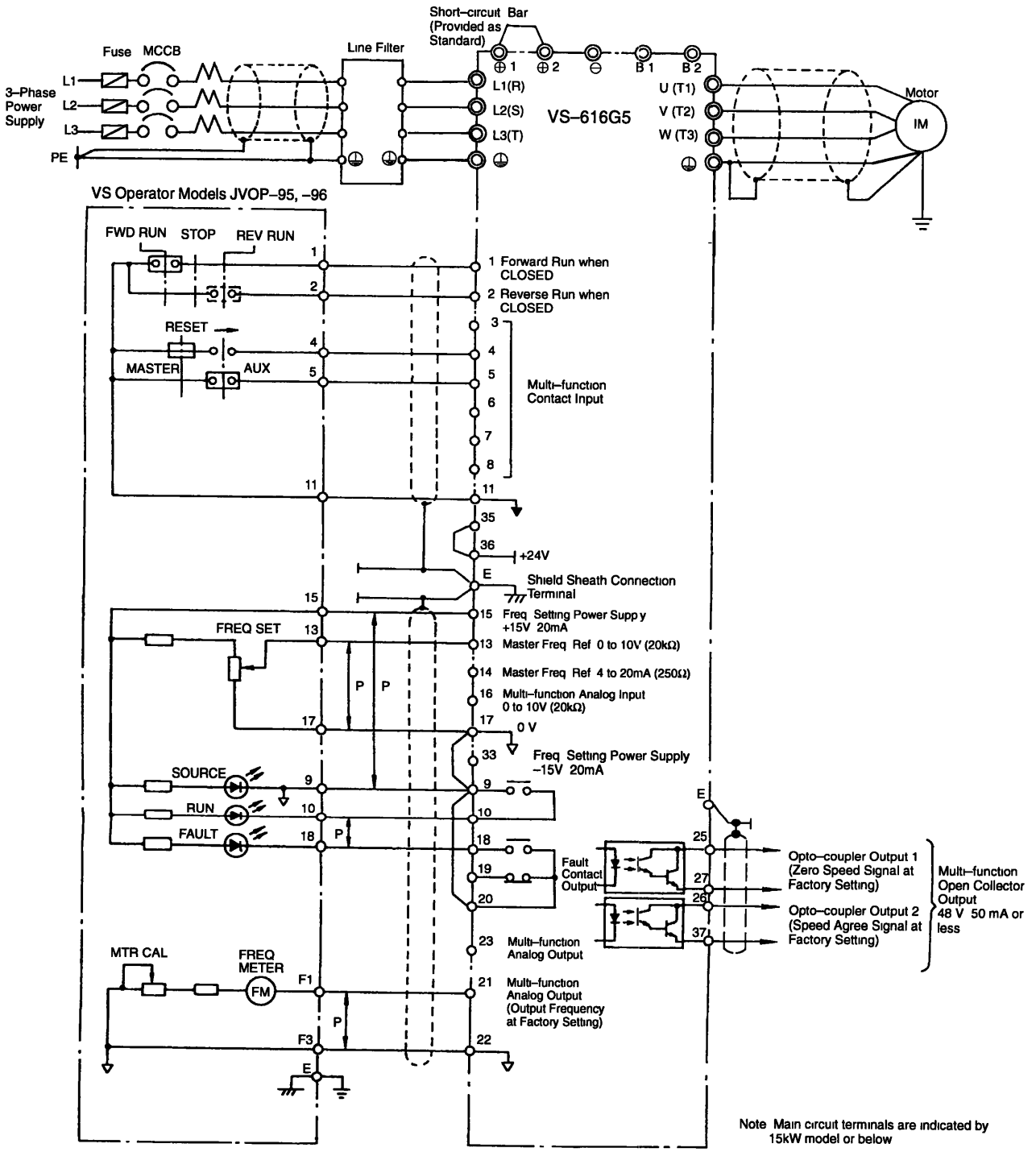
3.3 THREE BRAKING UNITS IN PARALLEL

For Models CIMR–G5C4055 to –G5C4160 (400 V Class 55 to 160 kW)



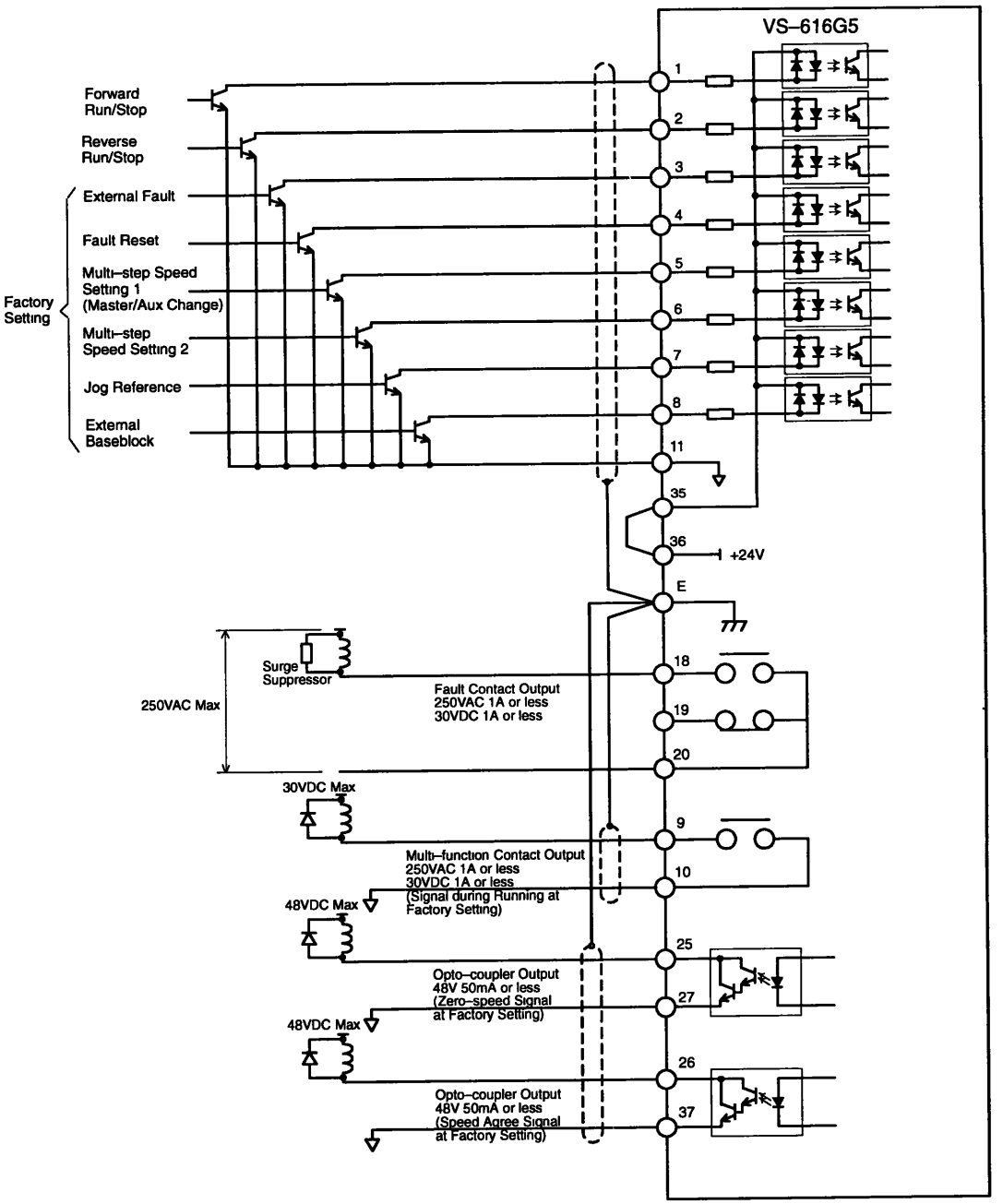
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3.4 VS OPERATOR MODELS JVOP–95 AND JVOP–96



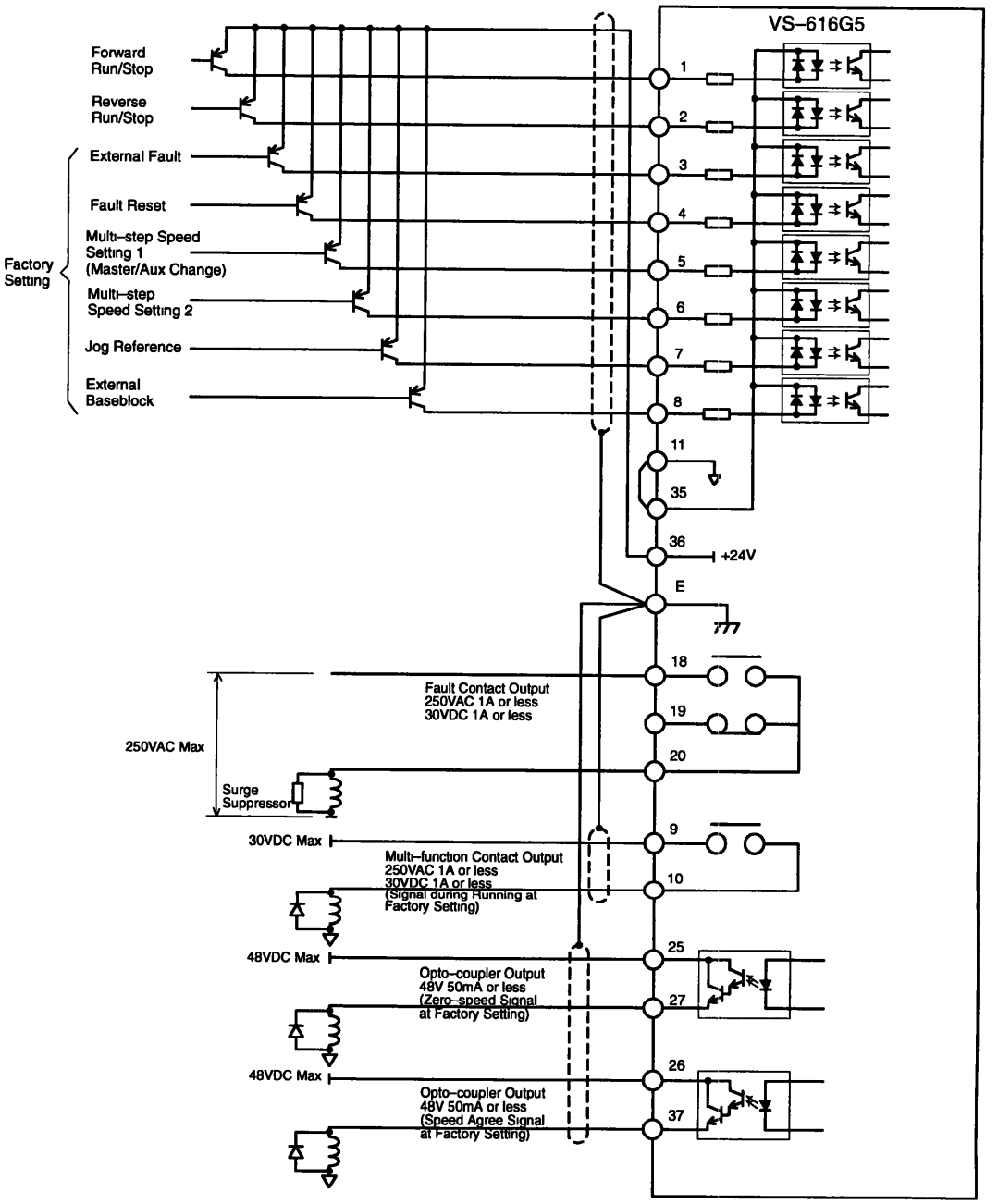
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3.5 SEQUENCE INPUT AND OUTPUT CONNECTION WITH NPN TRANSISTOR (0V COMMON)



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3.6 SEQUENCE INPUT AND OUTPUT CONNECTION WITH PNP TRANSISTOR (SUPPLY SIDE COMMON)



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APPENDIX 4 CONSTANTS LIST

Table A–3 Monitor Constants List

Digital Operator Function Display	Digital Operator Display	Constant No	Constant Name	Unit	Control Method* (○=Monitor enable, ×=Monitor disable)			
					V/f control	V/f with PG Feed-back	Open Loop Vector	Flux Vector
Monitor	Frequency Ref	U1–01	Frequency reference	0.01Hz†	○	○	○	○
	Output Freq	U1–02	Output frequency	0.01Hz†	○	○	○	○
	Output Current	U1–03	Output current	0.1A‡	○	○	○	○
	Control Method	U1–04	Control method	—	○	○	○	○
	Motor Speed	U1–05	Motor speed	0.01Hz†	×	○	○	○
	Output Voltage	U1–06	Output voltage	0.1V	○	○	○	○
	DC Bus Voltage	U1–07	DC bus voltage	1V	○	○	○	○
	Output kWatts	U1–08	Output power	0.1kW	○	○	○	○
	Torque Reference	U1–09	Torque reference (internal)	0.1%	×	×	○	○
	Input Term Sts	U1–10	Input terminal status	—	○	○	○	○
	Output Term Sts	U1–11	Output terminal status	—	○	○	○	○
	Int Ctl Sts 1	U1–12	Internal control status	—	○	○	○	○
	Elapsed Time	U1–13	Cumulative operation time	1H	○	○	○	○
	FLASH ID	U1–14	Software No. (at FLASH side)	—	○	○	○	○
	Term 13 level	U1–15	Control circuit terminal 13 input voltage	0.1%	○	○	○	○
	Term 14 level	U1–16	Control circuit terminal 14 input voltage	0.1%	○	○	○	○
	Term 16 level	U1–17	Control circuit terminal 16 input voltage	0.1%	○	○	○	○
	Mot SEC Current	U1–18	Motor secondary current (Iq)	0.1%	○	○	○	○
	Mot EXC Current	U1–19	Motor exciting current (Id)	0.1%	×	×	○	○
	SFS Output	U1–20	Output frequency after soft-start	0.01Hz†	○	○	○	○
	ASR Input	U1–21	ASR input	0.01%	×	○	×	○
	ASR Output	U1–22	ASR output	0.01%	×	○	×	○
	Speed Deviation	U1–23	Speed deviation	0.01%	×	○	×	○
	PID Feedback	U1–24	PID feedback amount	0.01%	○	○	○	○
	DI–16 Reference	U1–25	DI–16H input status	—	○	○	○	○
	Voltage Ref (Vq)	U1–26	Output voltage reference Vq	0.1V	×	×	○	○
	Voltage Ref (Vd)	U1–27	Output voltage reference Vd	0.1V	×	×	○	○
	CPU ID	U1–28	Software No. (at CPU side)	—	○	○	○	○
	ACR(q) Output	U1–32	ACR q-axis output	0.1%	×	×	○	○
	ACR(d) Output	U1–33	ACR d-axis output	0.1%	×	×	○	○
	OPE Detected	U1–34	Constant No. for OPE detection	—	○	○	○	○

* Even if ○ is indicated, some constants are not displayed depending on access level

† Depends on the setting of o1–01

‡ 0.1A for models of 11kW or above

Not displayed for some models depending on software version No

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Table A–3 Monitor Constants List (Cont'd)

Digital Operator Function Display	Digital Operator Display	Constant No.	Constant Name	Unit	Control Method * (○=Monitor enable, ×=Monitor disable)			
					V/f control	V/f with PG Feed-back	Open Loop Vector	Flux Vector
Fault Trace	Current Fault	U2–01	Current fault	—	○	○	○	○
	Last Fault	U2–02	Last fault	—	○	○	○	○
	Frequency Ref	U2–03	Frequency reference at fault	0 01Hz	○	○	○	○
	Output Freq	U2–04	Output frequency at fault	0 01Hz	○	○	○	○
	Output Current	U2–05	Output current at fault	0 01A †	○	○	○	○
	Motor Speed	U2–06	Motor speed at fault	0 01Hz	×	○	○	○
	Output Voltage	U2–07	Output voltage reference at fault	0 1V	○	○	○	○
	DC Bus Voltage	U2–08	DC bus voltage at fault	1V	○	○	○	○
	Output kWatts	U2–09	Output power at fault	0 1kW	○	○	○	○
	Torque Reference	U2–10	Torque reference at fault	0 1%	×	×	○	○
	Input Term Sts	U2–11	Input terminal status at fault	—	○	○	○	○
	Output Term Sts	U2–12	Output terminal status at fault	—	○	○	○	○
	Inverter Status	U2–13	Operation status at fault	—	○	○	○	○
	Elapsed Time	U2–14	Cumulative operation time at fault	1H	○	○	○	○
Fault History	Last Fault	U3–01	Most recent fault	—	○	○	○	○
	Fault Message 2	U3–02	Second most recent fault	—	○	○	○	○
	Fault Message 3	U3–03	Third most recent fault	—	○	○	○	○
	Fault Message 4	U3–04	Fourth / Oldest fault	—	○	○	○	○
	Elapsed Time 1	U3–05	Cumulative operation time at fault	1H	○	○	○	○
	Elapsed Time 2	U3–06	Accumulated time of second fault	1H	○	○	○	○
	Elapsed Time 3	U3–07	Accumulated time of third fault	1H	○	○	○	○
	Elapsed Time 4	U3–08	Accumulated time of fourth / oldest fault	1H	○	○	○	○

* Even if ○ is indicated, some constants are not displayed depending on access level

† 0 1A for models of 11kW or above

Note If another fault occurs (i e fifth fault), then the oldest fault (U3–04) is lost The fifth fault now becomes the most recent fault (U3–01) and all the other faults move down one step

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Table A–4 Constants List

The initial settings are for open loop vector control (A1–02=2), 0.4kW models.

Constant No	Name (Digital Operator Display)	Initial Setting	User Setting	Constant No	Name (Digital Operator Display)	Initial Setting	User Setting
A1–00	Language selection for digital operator display (Select Language)	1 *		b6–01	Dwell frequency at start (Dwell Ref @ Start)	0.0	
A1–01	Constant access level (Access Level)	2		b6–02	Dwell time at start (Dwell Time @ Start)	0.0	
A1–02	Control method selection (Control Method)	2 *		b6–03	Dwell frequency at stop (Dwell Ref @ Stop)	0.0	
A1–03	Initialize (Init Parameters)	0000		b6–04	Dwell time at stop (Dwell Time @ Stop)	0.0	
A1–04	Password 1 (Enter Password)	0000		b7–01	Droop control gain † (Droop Gain)	0.0	
A1–05	Password 2 (Select Password)	0000		b7–02	Droop control delay time † (Droop Delay Time)	0.05	
A2–01 to A2–32	User setting constant (User Param 1 to 32)	—		b8–01	Energy–saving gain (Energy Save Gain)	80	
b1–01	Reference selection (Reference Source)	1		b8–02	Energy–saving frequency (Energy Save Freq)	0.0	
b1–02	Operation method selection (Run Source)	1		b9–01	Zero–servo gain (Zero Servo Gain)	5	
b1–03	Stopping method selection (Stopping Method)	0		b9–02	Zero–servo completion width (Zero Servo Count)	10	
b1–04	Prohibition of reverse operation (Reverse Oper)	0		C1–01	Acceleration time 1 (Accel Time 1)	10.0	
b1–05	Operation selection for setting of E1–09 or less (Zero–Speed Oper)	0		C1–02	Deceleration time 1 (Decel Time 1)	10.0	
b1–06	Read sequence input twice (Cntl Input Scans)	1		C1–03	Acceleration time 2 (Accel Time 2)	10.0	
b1–07	Operation selection after switching to remote mode † (LOC/REM RUN Sel)	0		C1–04	Deceleration time 2 (Decel Time 2)	10.0	
b2–01	Zero speed level (DC injection braking starting frequency) (DCInj Start Freq)	0.5		C1–05	Acceleration time 3 (Accel Time 3)	10.0	
b2–02	DC injection braking current (DCInj Current)	50		C1–06	Deceleration time 3 (Decel Time 3)	10.0	
b2–03	DC injection braking time at start (DCInj Time @ Start)	0.00		C1–07	Acceleration time 4 (Accel Time 4)	10.0	
b2–04	DC injection braking time at stop (DCInj Time @ Stop)	0.50		C1–08	Deceleration time 4 (Decel Time 4)	10.0	
b3–01	Speed search selection at start (SpdSrch at Start)	0 ‡		C1–09	Emergency stop time (Fast Stop Time)	10.0	
b3–02	Speed search operating current (SpdSrch Current)	100 ‡		C1–10	Accel/decel time setting unit (Acc/Dec Units)	1	
b3–03	Speed search deceleration time (SpdSrch Dec Time)	2.0		C1–11	Accel/decel time switching frequency (Acc/Dec SW Freq)	0.00	
b4–01	Timer function ON–delay time (Delay–ON Timer)	0.0		C2–01	S–curve characteristic time at acceleration start (SCrv Acc @ Start)	0.20	
b4–02	Timer function OFF–delay time (Delay–OFF Timer)	0.0		C2–02	S–curve characteristic time at acceleration end (SCrv Acc @ End)	0.20	
b5–01	PID control mode selection (PID Mode)	0		C2–03	S–curve characteristic time at deceleration start (SCrv Dec @ Start)	0.20	
b5–02	Proportional gain (P) (PID Gain)	1.00		C2–04	S–curve characteristic time at deceleration end (SCrv Dec @ End)	0.00	
b5–03	Integral (I) time (PID I Time)	1.0		C3–01	Slip compensation gain (Slip Comp Gain)	1.0 ‡	
b5–04	Integral (I) limit (PID I Limit)	100.0		C3–02	Slip compensation primary delay time (Slip Comp Time)	200 ‡	
b5–05	Differential (D) time (PID D Time)	0.00		C3–03	Slip compensation limit (Slip Comp Limit)	200	
b5–06	PID limit (PID Limit)	100.0		C3–04	Slip compensation selection during regeneration (Slip Comp Regen)	0	
b5–07	PID offset adjustment (PID Offset)	0.0		C3–05	Flux calculation method (Flux Select)	0	
b5–08	PID primary delay time constant (PID Delay Time)	0.00		C4–01	Torque compensation gain (Torq Comp Gain)	1.00	

* Not initialized (Domestic standard specifications A1–01=1, A1–02=2)

† Not displayed for some models depending on software version No

‡ Differs depending on the control method selection (A1–02)

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Table A–4 Constants List (Cont'd)

Constant No	Name (Digital Operator Display)	Initial Setting	User Setting	Constant No	Name (Digital Operator Display)	Initial Setting	User Setting
C4–02	Torque compensation time constant (Torq Comp Time)	20 *		d4–01	Frequency reference hold function selection (MOP Ref Memory)	0	
C5–01	ASR proportional (P) gain 1 (ASR P Gain 1)	20 00 *		d4–02	+ – Speed limits † (Trim Control Lvl)	25	
C5–02	ASR integral (I) time 1 (ASR I Time 1)	0 500 *		d5–01	Torque control selection (Torq Control Sel)	0	
C5–03	ASR proportional (P) gain 2 (ASR P Gain 2)	20 00 *		d5–02	Torque reference delay time (Torq Ref Filter)	0	
C5–04	ASR integral (I) time 2 (ASR I Time 2)	0 500 *		d5–03	Speed limit selection (Speed Limit Sel)	1	
C5–05	ASR limit (ASR Limit)	5 0		d5–04	Speed limit (Speed Lmt Value)	0	
C5–06	ASR primary delay time (ASR Delay Time)	0 004		d5–05	Speed limit bias (Speed Lmt Bias)	10	
C5–07	ASR switching frequency (ASR Gain SW Freq)	0 0		d5–06	Speed/torque control switching timer (Ref Hold Time)	0	
C5–08	ASR integral (I) limit † (ASR I Limit)	400		E1–01	Input voltage setting (Input Voltage)	400	
C6–01	Carrier frequency upper limit (Carrier Freq Max)	15 0 ‡		E1–02	Motor selection (Motor Selection)	0	
C6–02	Carrier frequency lower limit (Carrier Freq Min)	15 0 ‡		E1–03	V/f pattern selection (V/F Selection)	0F	
C6–03	Carrier frequency proportional gain (Carrier Freq Gain)	0 ‡		E1–04	Max output frequency (Max Frequency)	50	
C7–01	Hunting prevention selection (Hunt Prev Select)	1		E1–05	Max voltage (Max Voltage)	400	
C7–02	Hunting prevention gain (Hunt Prev Gain)	1 00		E1–06	Base frequency (Base Frequency)	50	
C8–08	AFR gain (AFR Gain)	1 00		E1–07	Mid output frequency (Mid Frequency A)	3 0 *	
C8–30	Carrier frequency selection during auto–tuning † (Carrier in tune)	0		E1–08	Mid output frequency voltage (Mid Voltage A)	22 *	
d1–01	Frequency reference 1 (Reference 1)	0 00		E1–09	Min output frequency (Min Frequency)	0 5 *	
d1–02	Frequency reference 2 (Reference 2)	0 00		E1–10	Min output frequency voltage (Min Voltage)	4 0 *	
d1–03	Frequency reference 3 (Reference 3)	0 00		E1–11	Mid output frequency 2 † (Mid Frequency B)	0 0	
d1–04	Frequency reference 4 (Reference 4)	0 00		E1–12	Mid output frequency voltage 2 † (Mid Voltage B)	0 0	
d1–05	Frequency reference 5 (Reference 5)	0 00		E1–13	Base voltage † (Base Voltage)	0 0	
d1–06	Frequency reference 6 (Reference 6)	0 00		E2–01	Motor rated current (Motor Rated FLA)	1 00 ‡	
d1–07	Frequency reference 7 (Reference 7)	0 00		E2–02	Motor rated slip (Motor Rated Slip)	2 90 ‡	
d1–08	Frequency reference 8 (Reference 8)	0 00		E2–03	Motor no–load current (No–Load Current)	0 60 ‡	
d1–09	Jog frequency reference (Jog Reference)	6 00		E2–04	Number of motor poles (Number of Poles)	4	
d2–01	Frequency reference upper limit (Ref Upper Limit)	100 0		E2–05	Motor line–to–line resistance (Term Resistance)	38 198 ‡	
d2–02	Frequency reference lower limit (Ref Lower Limit)	0 0		E2–06	Motor leak inductance (Leak Inductance)	18 2 ‡	
d3–01	Jump frequency 1 (Jump Freq 1)	0 0		E2–07	Motor iron–core saturation coefficient 1 (Saturation Comp 1)	0 50	
d3–02	Jump frequency 2 (Jump Freq 2)	0 0		E2–08	Motor iron–core saturation coefficient 2 (Saturation Comp 2)	0 75	
d3–03	Jump frequency 3 (Jump Freq 3)	0 0		E2–09	Motor mechanical loss (Mechanical Loss)	0 0	
d3–04	Jump frequency width (Jump Bandwidth)	1 0		E3–01	Motor 2 control method selection † (Control Method)	2	

* Differs depending on the control method selection (A1–02)

† Not displayed for some models depending on software version No

‡ Setting unit and initial setting differ depending on inverter capacity

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Table A–4 Constants List (Cont'd)

Constant No	Name (Digital Operator Display)	Initial Setting	User Setting	Constant No	Name (Digital Operator Display)	Initial Setting	User Setting
E4–01	Motor 2 max output frequency * (V/F2 Max Freq)	50 0		F4–03	Channel 2 monitor selection (AO Ch2 Select)	3	
E4–02	Motor 2 max voltage * (V/F2 Max Voltage)	400 0		F4–04	Channel 2 gain (AO Ch2 Gain)	0 50	
E4–03	Motor 2 max voltage frequency * (V/F2 Base Freq)	50 0		F5–01	Channel 1 output selection (DO–02 Ch1 Select)	0	
E4–04	Motor 2 mid output frequency 1 * (V/F2 Mid Freq)	3 0 †		F5–02	Channel 2 output selection (DO–02 Ch2 Select)	1	
E4–05	Motor 2 mid output frequency voltage 1 * (V/F2 Mid Voltage)	22 0 †		F6–01	Output mode selection (DO–08 Selection)	0	
E4–06	Motor 2 min output frequency * (V/F2 Min Freq)	0 5 †		F7–01	Frequency multiple selection (PO–36F Selection)	1	
E4–07	Motor 2 min output frequency voltage * (V/F2 Min Voltage)	4 0 †		H1–01	Multi–function input (terminal 3) (Terminal 3 Sel)	24	
E5–01	Motor 2 rated current * (Motor 2 rated FLA)	1 0 ‡		H1–02	Multi–function input (terminal 4) (Terminal 4 Sel)	14	
E5–02	Motor 2 rated slip * (Motor 2 Slip Freq)	2 90 ‡		H1–03	Multi–function input (terminal 5) (Terminal 5 Sel)	3(0) #	
E5–03	Motor 2 no–load current * (Motor 2 No–load I)	0 60 ‡		H1–04	Multi–function input (terminal 6) (Terminal 6 Sel)	4(3) #	
E5–04	Motor 2 number of poles * (Motor 2 # Poles)	4		H1–05	Multi–function input (terminal 7) (Terminal 7 Sel)	6(4) #	
E5–05	Motor 2 line–to–line resistance * (Motor 2 term Ohms)	38 198 ‡		H1–06	Multi–function input (terminal 8) (Terminal 8 Sel)	8(6) #	
E5–06	Motor 2 leak inductance * (Motor 2 Leak)	18 2 ‡		H2–01	Multi–function input (terminal 9–10) (Terminal 9 Sel)	0	
F1–01	PG constant (PG Pulse/Rev)	600		H2–02	Multi–function input (terminal 25–27) (Terminal 25 Sel)	1	
F1–02	Operation selection at PG open circuit (PG Fdbk Loss Sel)	1		H2–03	Multi–function input (terminal 26–27) (Terminal 26 Sel)	2	
F1–03	Operation selection at overspeed (PG Overspeed Sel)	1		H3–01	Signal level selection (terminal 13) (Term 13 Signal)	0	
F1–04	Operation selection at deviation (PG Deviation Sel)	3		H3–02	Gain (terminal 13) (Terminal 13 Gain)	100 0	
F1–05	PG rotation (PG Rotation Sel)	0		H3–03	Bias (terminal 13) bias (Terminal 13 Bias)	0 0	
F1–06	PG division rate (PG pulse monitor) (PG Output Ratio)	1		H3–04	Signal level selection (terminal 16) (Term 16 Signal)	0	
F1–07	Integral value during accel/decel enable/disable (PG Ramp PI/I Sel)	0		H3–05	Multi–function analog input (terminal 16) (Terminal 16 Sel)	0	
F1–08	Overspeed detection level (PG Overspd Level)	115		H3–06	Gain (terminal 16) (Terminal 16 Gain)	100 0	
F1–09	Overspeed detection delay time (PG Overspd Time)	0 0 †		H3–07	Bias (terminal 16) (Terminal 16 Bias)	0 0	
F1–10	Excessive speed deviation detection level (PG Deviate Level)	10		H3–08	Signal level selection (terminal 14) (Term 14 Signal)	2	
F1–11	Excessive speed deviation detection delay time (PG Deviate Time)	0 5		H3–09	Multi–function analog input (terminal 14) (Terminal 14 Sel)	1F	
F1–12	Number of PG gear teeth 1 (PG# Gear Teeth 1)	0		H3–10	Gain (terminal 14) (Terminal 14 Gain)	100 0	
F1–13	Number of PG gear teeth 2 (PG# Gear Teeth 2)	0		H3–11	Bias (terminal 14) (Terminal 14 Bias)	0 0	
F1–14	PG open–circuit detection time * (PGO Time)	2 0		H3–12	Analog input filter time constant (Filter Avg Time)	0 00	
F2–01	Bi–polar or uni–polar input selection (AI–14 Input Sel)	0		H4–01	Monitor selection (terminal 21) (Terminal 21 Sel)	2	
F3–01	Digital input option (DI Input)	0		H4–02	Gain (terminal 21) (Terminal 21 Gain)	1 00	
F4–01	Channel 1 monitor selection (AO Ch1 Select)	2		H4–03	Bias (terminal 21) (Terminal 21 Bias)	0 0	
F4–02	Channel 1 gain (AO Ch1 Gain)	1 00		H4–04	Monitor selection (terminal 23) (Terminal 23 Sel)	3	

* Not displayed for some models depending on software version No

† Differs depending on the control method selection (A1–02)

‡ Setting unit and initial setting differ depending on inverter capacity

Initial settings in the parentheses are values obtained at 3–wire initialization

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Table A–4 Constants List (Cont'd)

Constant No	Name (Digital Operator Display)	Initial Setting	User Setting	Constant No	Name (Digital Operator Display)	Initial Setting	User Setting
H4–05	Gain (terminal 23) (Terminal 23 Gain)	0 50		L6–02	Torque detection level 1 (Torq Det 1 Lvl)	150	
H4–06	Bias (terminal 23) (Terminal 23 Bias)	0 0		L6–03	Torque detection time 1 (Torq Det 1 Time)	0 1	
H4–07	Analog output signal level selection (AO Level Select)	0		L6–04	Torque detection selection 2 (Torq Det 2 Sel)	0	
H5–01	Station address (Serial Comm Adr)	1F		L6–05	Torque de ection level 2 (Torq Det 2 Lvl)	150	
H5–02	Communication speed selection (Serial Baud Rate)	3		L6–06	Torque detection time 2 (Torq Det 2 Time)	0 1	
H5–03	Communication parity selection (Serial Com Sel)	0		L7–01	Forward torque limit (Torq Limit Fwd)	200	
H5–04	Stopping method after communication error (Serial Fault Sel)	3		L7–02	Reverse torque limit (Torq Limit Rev)	200	
H5–05	Communication error detection selection * (Serial Flt Dtct)	1		L7–03	Forward regenerative torque limit (Torq Lmt Fwd Rgn)	200	
L1–01	Motor protection selection (MOL Fault Select)	1		L7–04	Reverse regenerative torque limit (Torq Lmt Rev Rgn)	200	
L1–02	Motor protection time constant (MOL Time Const)	1 0		L8–01	Protect selection for internal DB resistor (DB Resistor Prot)	0	
L2–01	Momentary power loss detection (PwrL Selection)	0		L8–02	Overheat pre–alarm level (OH Pre–Alarm Lvl)	95	
L2–02	Momentary power loss ridethru time (PwrL Ridethru t)	1 0 †		L8–03	Operation selection after overheat pre–alarm (OH Pre–Alarm Sel)	3	
L2–03	Min baseblock time (PwrL Baseblock t)	0 5 †		L8–05	Input open–phase protection selection (Ph Loss In Sel)	0	
L2–04	Voltage recovery time (PwrL V/F Ramp t)	0 3 †		L8–07	Output open–phase protection selection (Ph Loss Out Sel)	0	
L2–05	Undervoltage detection level (PUV Det Level)	380		o1–01	Monitor selection (Monitor Select)	6	
L3–01	Stall prevention selection during accel (StallP Accel Sel)	1		o1–02	Monitor selection after power up (Power–On Monitor)	1	
L3–02	Stall prevention level during accel (StallP Accel Lvl)	150		o1–03	Frequency units of reference setting and monitor (Display Scaling)	0	
L3–03	Stall prevention limit during accel (StallP CHP Lvl)	100 ‡		o1–04	Frequency units of constant setting (Display Units)	0	
L3–04	Stall prevention selection during decel (StallP Decel Sel)	1		o1–05	Constant No display selection (Address Display)	0	
L3–05	Stall prevention selection during running (StallP Run Sel)	1		o2–01	LOCAL/REMOTE key enable/disable (Local/Remote Key)	1	
L3–06	Stall prevention level during running (StallP Run Level)	160		o2–02	STOP key during control circuit terminal operation (Oper STOP Key)	1	
L4–01	Speed agree detection level (Spd Agree Level)	0 0		o2–03	User constant initial value (User Defaults)	0	
L4–02	Speed agree detection width (Spd Agree Width)	2 0		o2–04	kVA selection (Inverter Model #)	20 †	
L4–03	Speed agree detection level (+/–) (Spd Agree Lvl + –)	0 0		o2–05	Frequency reference setting method selection * (Operator M O P)	0	
L4–04	Speed agree detection width (+/–) (Spd Agree Wdth + –)	2 0		o2–06	Operation selection when digital operator is disconnected (Oper Detection)	0	
L4–05	Operation when frequency reference is missing (Ref Loss Sel)	0		o2–07	Cumulative operation time setting (Elapsed Time Set)	–	
L5–01	Number of auto restart attempts (Num of Restarts)	0		o2–08	Cumulative operation time selection (Elapsed Time Run)	0	
L5–02	Auto restart operation selection (Restart Sel)	0		o2–09	Initialize mode selection * (Init Mode Sel)	2 #	
L6–01	Torque detection selection 1 (Torq Det 1 Sel)	0					

* Not displayed for some models depending on software version No

† Setting unit and initial setting differ depending on inverter capacity

‡ Differs depending on the control method selection (A1–02)

Differs depending on area

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Table A–5 Multi–digital Output

Set Value	Function Name	Set Value	Function Name
00	During RUN 1	10	Minor Fault
01	Zero Speed	11	Reset Cmd Active
02	Fref/Fout Agree 1	12	Timer Output
03	Fref/Set Agree 1	13	Fref/Fout Agree 2
04	Freq Detect 1	14	Fref/Set Agree 2
05	Freq Detect 2	15	Freq Detect 3
06	Inverter Ready	16	Freq Detect 4
07	DC Bus undervolt	17	Trq Det 1 N C
08	BaseBlk 1	18	Trq Det 2 N O
09	Option Reference	19	Trq Det 2 N C
0A	Remote Operation	1A	Reverse Dir
0B	Trq Det 1 N O	1B	BaseBlk 2
0C	Loss of Ref	1C	Motor 2 Selected
0D	DB Overheat	1D	Regenerating
0E	Fault	1E	Restart Enabled
0F	Not Used	1F	Overload (OL1)
—		20	OH Prealarm
		21–2F	Not Used
		30	Current / Trq LIM
		31	Speed Limit
		32	Not Used
		33	Zero Servo End
		34	During RUN 2
		35–3F	Not Used

Table A–6 Multi–analog Input

Set Value	Function Name	Set Value	Function Name
00	Aux Reference	10	Fwd Torque Limit
01	Frequency Gain	11	Rev Torque Limit
02	Frequency Bias	12	Regen Torq Limit
03	Voltage Bias	13	Torque Reference
04	Acc/Dec Change	14	Torque Comp
05	DCInj Current	15	Speed Limit
06	OverTorque Level	16–1F	Not Used
07	Stall Prev Level	—	
08	Ref Lower Limit		
09	Jump Frequency		
0A	PID Feedback		
0B–0F	Not Used		

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Table A–7 Constants Array

MENU
- Operation
  - U Monitor
  - A Initialize
  - Programming
    - b Application
    - C Tuning
    - d Reference
    - E Motor
    - F Option
    - H Terminal
    - L Protection
    - o Operator
  - Modified constants
  - Auto-tuning

Group	Function	Constant No Q	B	A	F
U1	Monitor	01–14	15–19	20–29	
U2	Fault trace	01–14			
U3	Fault history	01–08			
A1	Initialize	00–04			
A2	User constants			01–32	
b1	Sequence	01–03	04	05–07	
b2	DC braking		01–04		05–07
b3	Speed search			01–03	04
b4	Delay timers			01 02	
b5	PID control			01–08	
b6	Reference hold			01–04	
b7	Droop control			01, 02	
b8	Energy saving			01, 02	
b9	Zero servo			01, 02	
C1	Accel/decel	01 02	03 04, 09	05–08, 10, 11	
C2	S-curve accel/decel			01–04	
C3	Motor-slip compensation		01	02–04	04
C4	Torque compensation		01	02	
C5	ASR tuning		01–04	05–07	
C6	Carrier frequency		01	02, 03	
C7	Hunting prevention			01	02–04
C8	Factory tuning				01–28
d1	Preset reference	01–04, 09	05–08		
d2	Reference limit		01, 02		
d3	Jump frequency		01–04		
d4	Sequence			01, 02	
d5	Torque control			01–04	
E1	V/f pattern 1	01–10		11–13	
E2	Motor setup 1	01–04		05–09	
E3	Motor 2 control method			01	
E4	V/f pattern 2			01–07	
E5	Motor setup 2			01–05	
F1	PG option setup	01	02–07	08–13	
F2	AI–14 setup		01		
F3	DI–08, 16 setup		01		
F4	AO–08 setup		01–04		
F5	DO–02 setup		01, 02		
F6	DO–08 setup		01		
F7	PO–36F setup		01		
H1	Digital inputs		01–06		
H2	Digital outputs		01–03		
H3	Analog inputs		01–07	08–12	
H4	Analog outputs		01–06		
H5	Serial communication setup			01–04	
L1	Motor overload		01, 02		
L2	Power loss ride-thru		01–03	04, 05	
L3	Stall prevention		01, 02, 04–06	03	07, 08
L4	Reference detection		01, 02	03–05	
L5	Fault restart		01, 02		
L6	Torque detection		01–03	04–06	
L7	Torque limit	01–04			05, 06
L8	Hardware protection		01	02, 03, 05, 07	04, 06, 07–13
o1	Monitor select		01–04	05	
o2	Key select		01–04	05–08	

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