

# VARISPEED-626M5

# INSTRUCTION MANUAL

VECTOR-CONTROLLED INVERTER FOR MACHINE TOOLS (VS-626M5)

MODEL: CIMR-M5A

200V CLASS 5 to 50HP (3.7 to 37kW)

400V CLASS 7.5 to 60HP (5.5 to 45kW)

CONVERTER WITH POWER REGENERATIVE FUNCTION (VS-656MR5)

MODEL: CIMR-MR5A

200V CLASS 5 to 50HP (3.7 to 37kW) (7 to 60kVA)

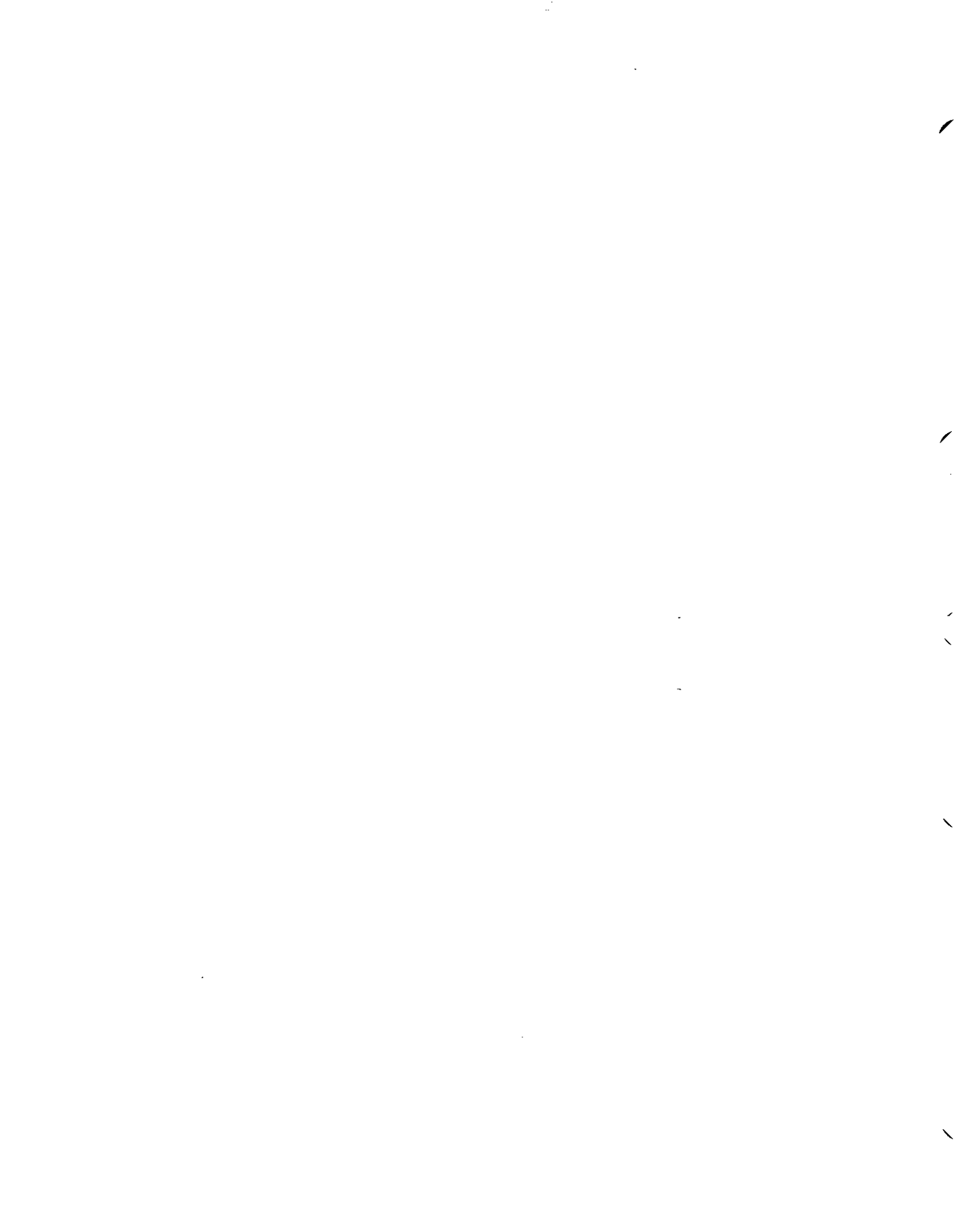
400V CLASS 7.5 to 60HP (5.5 to 45kW) (9 to 70kVA)

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

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# PREFACE

This instruction manual describes installation, maintenance and inspection, troubleshooting, and specifications of the VS-626M5 and the VS-656MR5. Read this instruction manual thoroughly before operation.

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## 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-626M5. 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.

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

## RECEIVING

### CAUTION

(Ref. page)

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

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## INSTALLATION

**CAUTION**

(Ref. page)

- Lift the mounting base. When moving the unit, never lift by the front cover. Otherwise, the main unit may be dropped causing damage to the unit. .... 17
- Mount the inverter and the converter on nonflammable material (i.e. metal). Failure to observe this caution can result in a fire. .... 17
- Install a fan or other cooling device to keep the ambient temperature of inverter and converter below 55°C (131°F) and the intake air temperature to heatsink below 45°C (113°F). Overheating may cause a fire or damage to the unit. .... 17
- Build an external emergency stop circuit that immediately stops operation and shuts down power in an emergency. Failure to observe this caution may result in personal injury. .... 17
- Install the inverter and the converter in pollution degree 2 environment. The inverter and converter may be damaged. .... 17

## 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 electric shock or a fire. .... 20
- Wiring should be performed only by qualified personnel. Failure to observe this warning can result in an electric shock or a fire. .... 20
- When wiring the emergency stop circuit check the wiring thoroughly before operation. Failure to observe this warning can result in an electric shock or a fire. .... 20
- Make sure to ground the ground terminal (200V class Ground to 100 Ω or less, 100V class Ground to 10 Ω or less). Failure to observe this warning can result in an electric shock or a fire. .... 23



## CAUTION

(Ref. page)

- Verify that the converter rated voltage coincides with the AC power supply voltage.  
Failure to observe this caution can result in personal injury or a fire. .... 20
- Do not perform a withstand voltage test of the inverter and the converter. It may cause semi-conductor elements to be damaged. .... 20
- Make sure to connect the inverter and the converter as shown in the connection diagram.  
The inverter or converter may be damaged. .... 20
- Tighten terminal screws to the specified tightening torque.  
Failure to observe this caution can result in a fire. .... 20
- Never connect the AC main circuit power supply to output terminals U/T1, V/T2, and W/T3.  
If voltage is applied to the output terminals, the internal circuits of the inverter will be damaged. .... 23

## OPERATION



## WARNING

(Ref. page)

- Only turn ON the input power supply after closing the upper and lower cover. Do not open the covers while current is flowing.  
Failure to observe this warning can result in an electric shock. .... 46
- Install a separate emergency stop switch. The stop button can be enabled only by a function setting.  
Failure to observe this warning can result in personal injury. .... 46



## CAUTION

(Ref. page)

- Never touch the heatsink since the temperature is very high.  
Failure to observe this caution can result in harmful burns to the body. .... 46
- Be sure that the motor and machine is within the applicable ranges before starting operation.  
Failure to observe this caution can result in personal injury. .... 46
- Do not check signals during operation.  
The machine or the unit may be damaged. .... 46
- All the constants of the inverter have been preset at the factory. Do not change the settings unnecessarily.  
The machine or the unit may be damaged. .... 46

## OPERATION OF DIGITAL OPERATOR

### WARNING

(Ref. page)

- Disconnect all power before removing digital operator (JVOP-132). Then wait for the time described on warning labels after main circuit power supply and control power supply are disconnected and all LEDs of the inverter and the converter are extinguished.  
Failure to observe this warning can result in an electric shock. .... 50

## MAINTENANCE AND INSPECTION

### WARNING

(Ref. page)

- Do not touch the inverter and the converter terminals. Some of the terminals carry high voltages and are extremely dangerous.  
Failure to observe this warning can result in an electric shock. .... 60
- Close upper and lower covers before powering up the inverter or the converter. To open the covers, make sure to shut OFF the molded-case circuit breaker.  
Failure to observe this warning can result in an electric shock. .... 60
- Perform maintenance or inspection only after verifying that the CHARGE LED and 7-segment LED go OFF, after the main circuit power supply and control power supply are turned OFF.  
The capacitors are still charged and can be dangerous. .... 60
- 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 electric shock.)  
Failure to observe this warning can result in an electric shock. .... 60

### CAUTION

(Ref. page)

- The control PC board employs CMOS ICs. Do not touch the CMOS elements.  
They are easily damaged by static electricity. .... 60
- 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. .... 60

## OTHERS

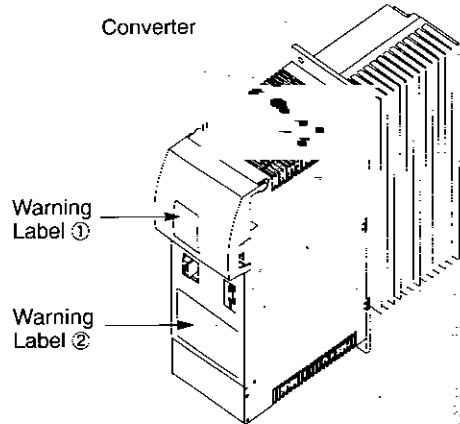
### WARNING

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

## WARNING LABEL

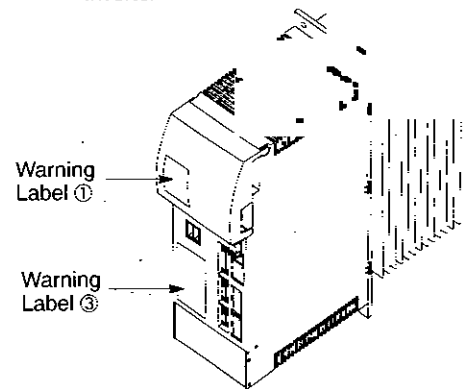
Warning labels are displayed on the upper cover and the front cover of the inverter and the converter, as shown below. Follow these instructions when handling the inverter and the converter.

Converter



Model CIMR-MR5A27P5 [200V 10HP (7.5kW)]

Inverter




Model CIMR-M5A27P5 [200V 10HP (7.5kW)]



## Warning Label ①

|   |  |
|---|--|
|  | <b>危険</b><br><b>WARNING</b>  |
|  | <p><b>感電の恐れがあります。</b></p> <p>通電中及び電源<br/>オフ後5分以内は、<br/>端子部に触らない<br/>でください。</p> <p><b>May cause electric<br/>shock.</b></p> <p>Disconnect all power and<br/>wait 5 min. before servicing.</p> |

## Warning Label ②

|  |                             |
|--|-----------------------------|
|   | <b>危険</b><br><b>WARNING</b> |
| <p><b>けが、感電の恐れがあります。</b></p> <p>・据え付け、運転の前には必ず取扱説明書を読んで、その指示に従ってください。</p> <p><b>感電の恐れがあります。</b></p> <p>・通電中及び電源オフ後5分以内は、表面カバーを開けないでください。<br/>・確実に接地を行ってください。</p> <p><b>May cause injury or electric shock.</b></p> <p>・ Please follow the instructions in the manual before installation or operation.</p> <p>・ Disconnect all power before opening front cover of unit. Wait 5 minutes until DC Bus capacitors discharge.</p> <p>・ Use proper grounding techniques.</p> <p>・ Make sure to ground the supply neutral (TÜV approval).</p> |                             |

## Warning Label ③

|   |                             |
|---|-----------------------------|
|    | <b>危険</b><br><b>WARNING</b> |
| <p><b>けが、感電の恐れがあります。</b></p> <p>・据え付け、運転の前には必ず取扱説明書を読んで、その指示に従ってください。<br/><b>感電の恐れがあります。</b></p> <p>・通電中及び電源オフ後5分以内は、表面カバーを開けないでください。<br/>・確実に接地を行ってください。</p> <p><b>May cause injury or<br/>electric shock.</b></p> <p>・ Please follow the instructions in the manual before installation or operation.</p> <p>・ Disconnect all power before opening front cover of unit. Wait 5 minutes until DC Bus capacitors discharge.</p> <p>・ Use proper grounding techniques.</p> |                             |

## Related Manuals

Refer to the following manuals as necessary.

| Manual Name  | Manual Number  | Contents  |
|--|----------------|---|
| VARISPEED-656MR5/626M5<br>CONNECTION BUS BAR/<br>CABLE<br>INSTRUCTIONS         | TOE-C736-40.20 | Describes information of VARISPEED-656MR5/626M5 Connection Bus Bar/Cable.       |
| VARISPEED-626M5<br>CONTROL SIGNAL CON-<br>NECTOR<br>INSTRUCTIONS               | TOE-C736-40.19 | Describes information of VARISPEED-626M5 Control Signal Connector.              |
| VARISPEED-676H5/626M5<br>DIGITAL OPERATOR EXTEN-<br>SION CABLE<br>INSTRUCTIONS | TOE-C736-40.18 | Describes informatin of VARISPEED-676H5/626M5 Digital Operator Extension Cable. |

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# 1 RECEIVING

## ⚠ CAUTION

- Do not install or operate any inverter or converter 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? | Open the upper cover of the VS-626M5 and check the model number on the nameplate. (Refer to page 14.) |
| Are any parts damaged?   | Visually check the exterior and verify that there was no damage during transport.                     |
| Are any screws or other components loose ?                         | Use a screwdriver or other tools to check for tightness.  |

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

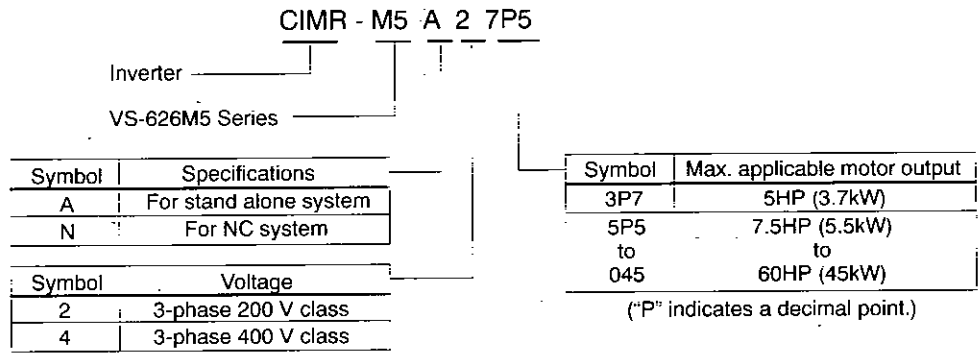
### (2) Checking the Nameplate Data

#### (a) Nameplate Data

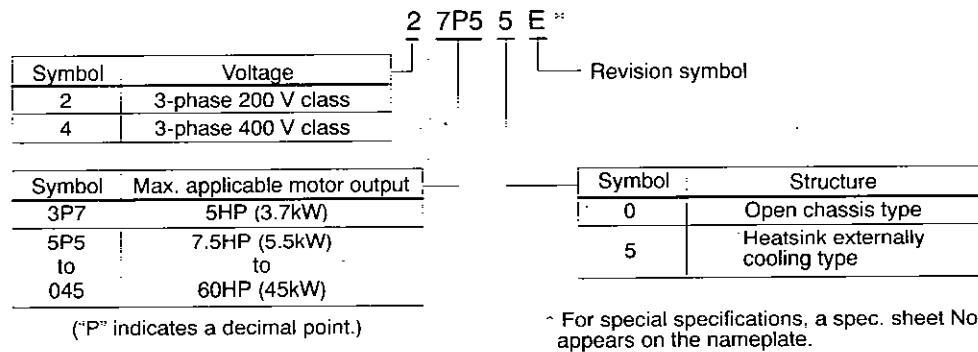
Example of model of 200VAC, 15HP (11kW)

|                  |                                  |                     |
|------------------|----------------------------------|---------------------|
| Inverter Model → | MODEL : CIMR - M5A2011           |                     |
| Input Spec. →    | INPUT : DC 270 - 325 V           | 13.6kW              |
| Output Spec. →   | OUTPUT : AC 3PH 0 - 230 V        | 12.9kVA             |
| Inverter Spec. → | SPEC : 20115E                    |                     |
| PROM No. →       | PRG : 0092                       |                     |
| Serial No. →     | SER NO : N123456 - 1 - 000;V9911 | MASS: 12 kg ← Mass  |
|                  | YASKAWA ELECTRIC CORPORATION     | MADE IN JAPAN<br>MS |

(b) Model Designation

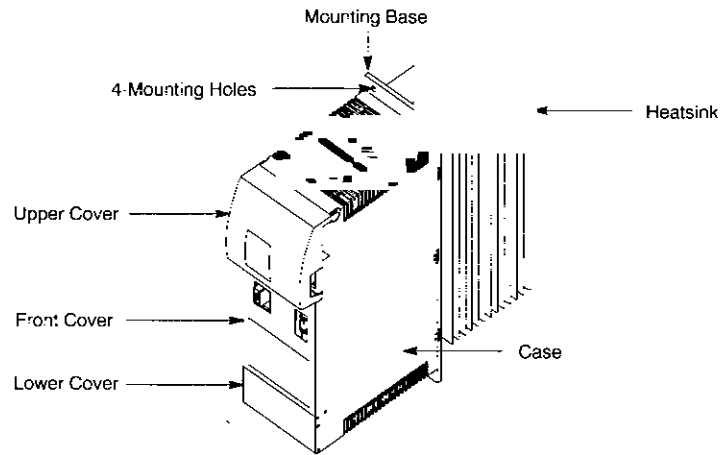


(c) Specification Designation



## 1.2 IDENTIFYING THE PARTS

### (1) Converter



[Upper and Lower Covers Opened]

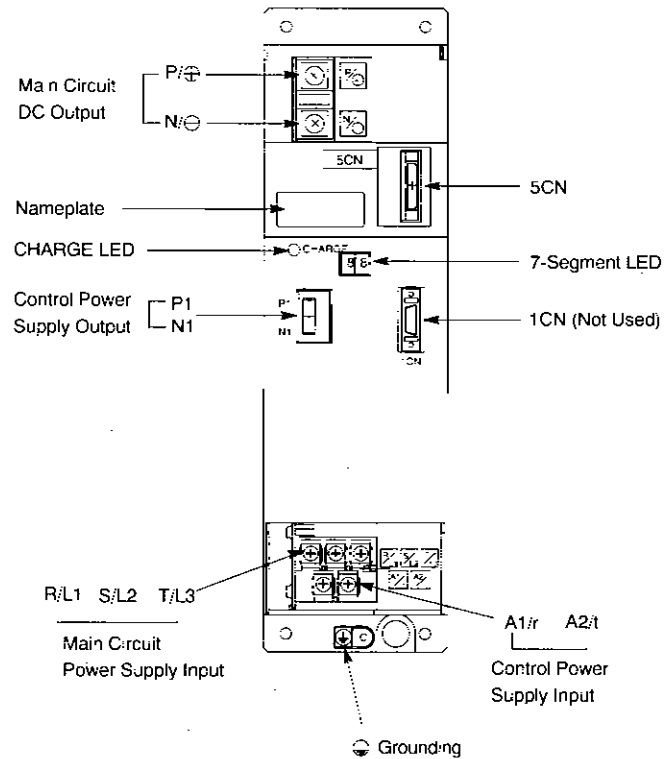
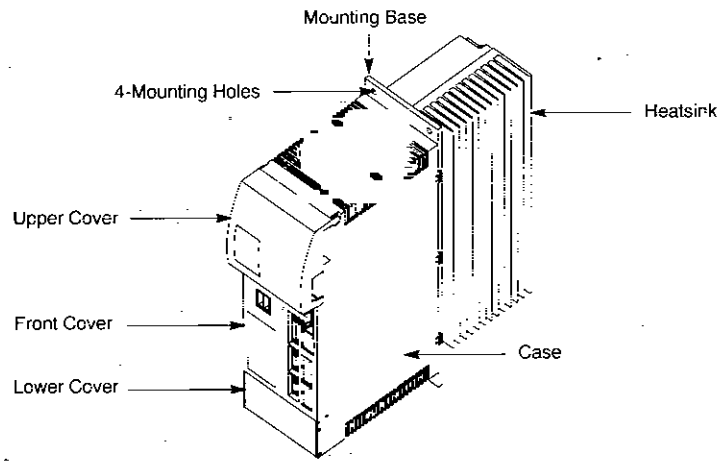


Fig. 1 Parts Name of VS-656MR5 (Model CIMR-MR5A27P5)

(2) Inverter



[Upper and Lower Covers Opened]

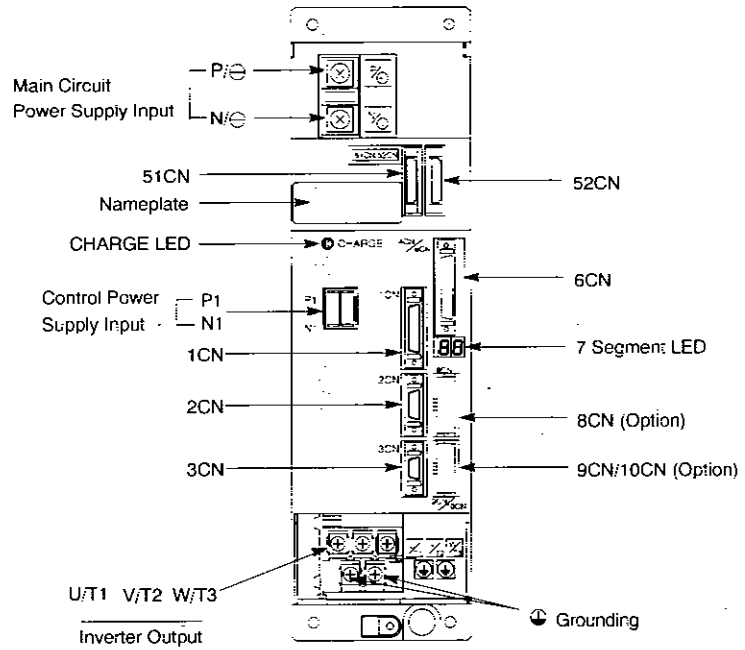


Fig. 2 Parts Name of VS-626M5 (Model CIMR-M5A27P5)



## 2 INSTALLATION

### CAUTION

- Lift the mounting 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 and the converter on nonflammable material (i.e. metal). Failure to observe this caution can result in a fire.
- Install a fan or other cooling device to keep the ambient temperature of inverter and converter below 55°C (131°F) and the intake air temperature to heatsink below 45°C (113°F). Overheating may cause a fire or damage to the unit.
- Build an external emergency stop circuit that immediately stops operation and shuts down power in an emergency. Failure to observe this caution may result in personal injury.
- Install the inverter and the converter in pollution degree 2 environment. The inverter and the converter may be damaged.

This chapter describes the configuration, location and space when mounting the VS-626M5 and the VS-656MR5.

### 2.1 CHOOSING A LOCATION TO MOUNT THE CONVERTER

To ensure proper performance and long operating life, follow the recommendations below when choosing a location for installing the VS-626M5 and the VS-656MR5. Make sure the inverter and the converter are protected from the following conditions:

- Extreme cold and heat.  
Use only within ambient temperature range: 0°C to +55°C (32°F to 131°F)
- Rain, moisture.
- Oil sprays, splashes
- Salt spray.
- Direct sunlight. (Avoid using outdoors.)
- Corrosive gases or liquids.
- Dust or metallic particles in the air.
- Physical shock, vibration.
- Magnetic noise. (Example: welding machines, power devices, etc.)
- High humidity.
- Radioactive materials.
- Combustibles: thinners, solvents, etc.

## 2.2 CLEARANCES

Install the VS-626M5 and the VS-656MR5 vertically and allow sufficient clearances for effective cooling as shown in Fig. 3 and Fig. 4.

### NOTE

1. For the external dimensions and mounting dimensions, refer to APPENDIX 2 "DIMENSIONS."
2. Allowable intake air temperature to the inverter and the converter:
  - Open chassis type : 0°C to +45°C (32°F to 113°F)
  - Heatsink externally cooling type
    - Inside of heatsink : 0°C to +45°C (32°F to 113°F)
    - Inside of unit : 0°C to +55°C (32°F to 131°F)
3. Near the heatsink, cooling air speed should be 2.5 m/s for effective cooling (for heatsink externally cooling type).

### (1) Heatsink Externally Cooling Type

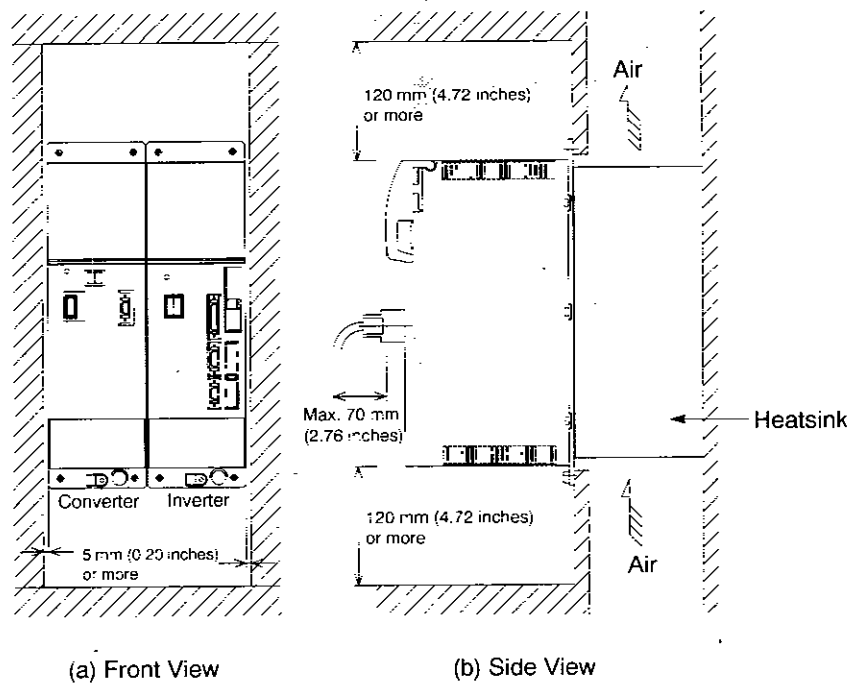


Fig. 3 Clearances (Heatsink externally cooling type)

(2) Open Chassis Type

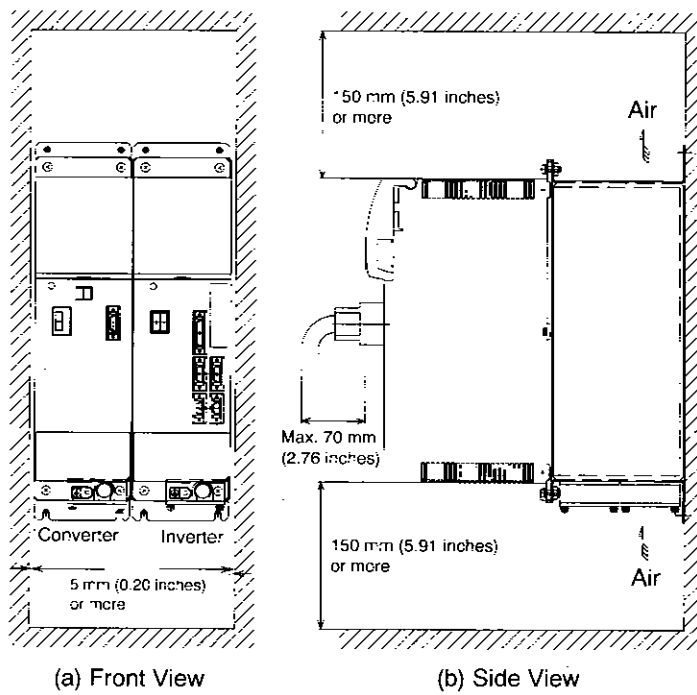


Fig. 4 Clearances (Open chassis type)

When using an open chassis type converter (11kW or more) in combination with an inverter (7.5kW or less), follow installation procedure as shown below.

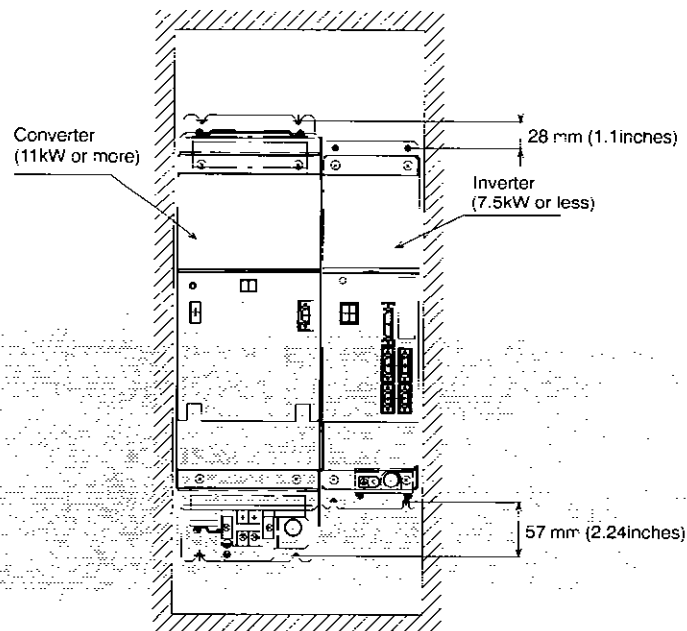


Fig. 5 Clearances when combining a converter (11kW or more) with an inverter (7.5kW or less)

### 3 WIRING



#### WARNING

- Only commence wiring after verifying that the power supply is turned OFF.  
Failure to observe this warning can result in an electric shock or a fire.
- Wiring should be performed only by qualified personnel.  
Failure to observe this warning can result in an electric 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 converter 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 and the converter.  
It may cause semi-conductor elements to be damaged.
- Make sure to connect the inverter and the converter as shown in the connection diagram.  
The inverter or the converter may be damaged.
- Tighten terminal screws to the specified tightening torque.  
Failure to observe this caution can result in a fire.

This chapter describes the connection with peripheral units, the main circuit wiring and the control circuit wiring of the VS-626M5 and the VS-656MR5.

### 3.1 CONNECTION WITH PERIPHERAL UNITS

The following shows standard connection of the VS-626M5 with peripheral units.

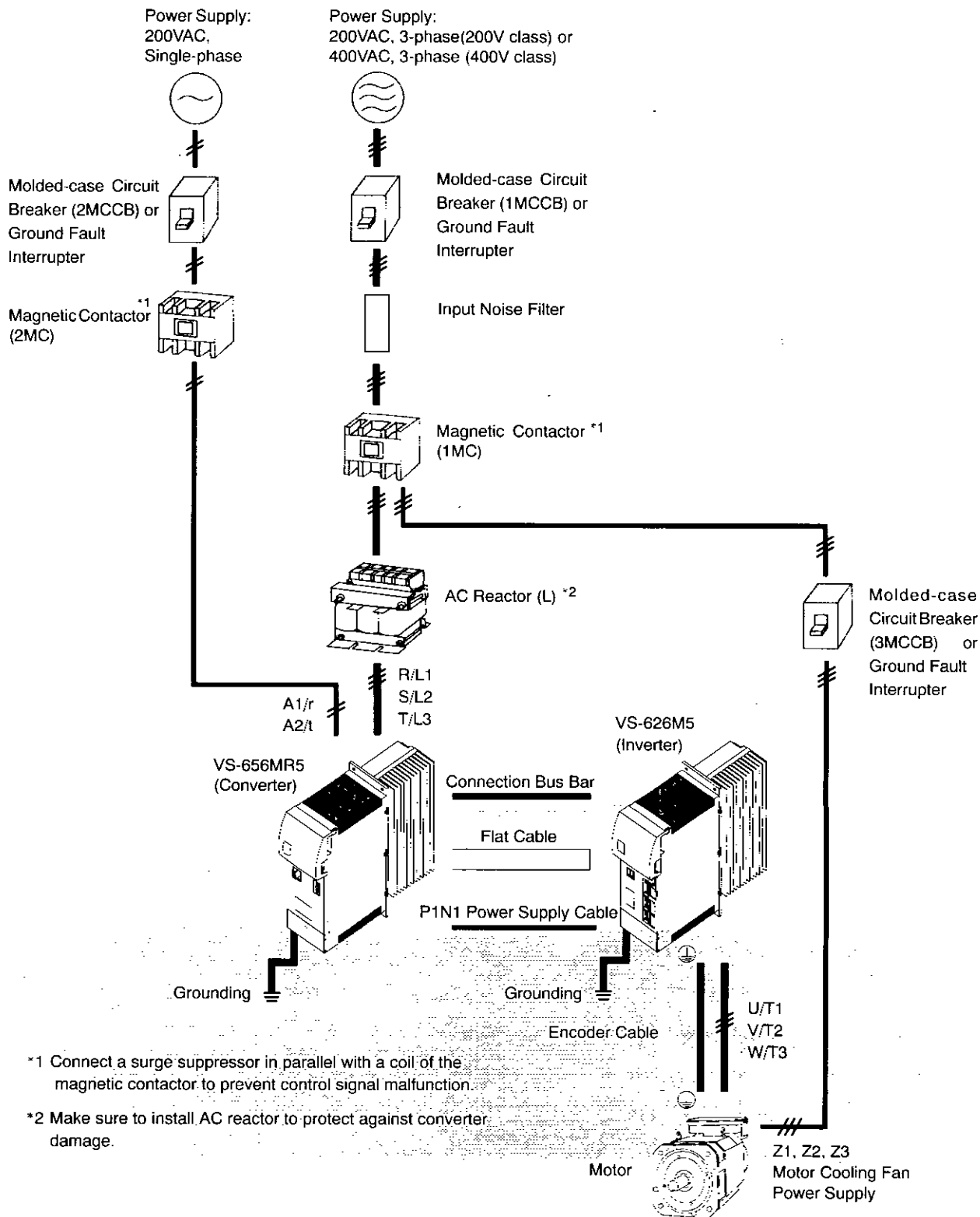


Fig. 6 Connection with Peripheral Units (Heatsink Externally Cooling Type)

## 3.2 CONNECTION DIAGRAM

Below is a standard connection diagram of the VS-626M5 and the VS-656MR5.

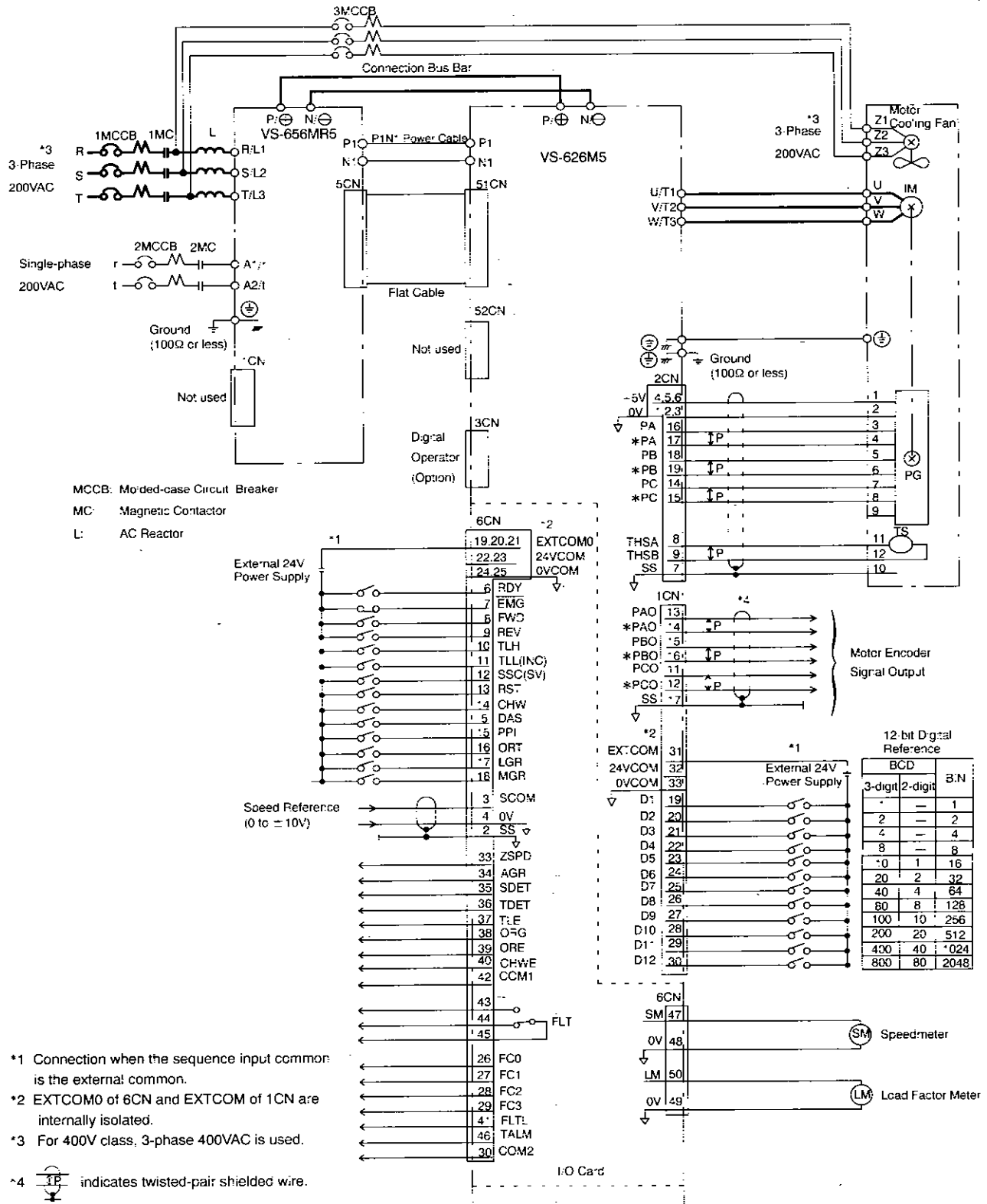


Fig. 7 Connection Diagram (200V class, Heatsink externally cooling type)

### 3.3 WIRING THE MAIN CIRCUIT

#### WARNING

- Make sure to ground the ground terminal  $\oplus$ .  
(200V class: Ground to 100 $\Omega$  or less, 400V class: Ground to 10 $\Omega$  or less)  
Failure to observe this warning can result in an electric shock or a fire.

#### CAUTION

- Never connect the AC main circuit power supply to output terminals U/T1, V/T2 and W/T3. If voltage is applied to the output terminals, the internal circuits of the inverter will be damaged.

#### (1) Wiring Precautions for Main Circuit Input

##### (a) Installation of Molded-case Circuit Breaker (MCCB)

Make sure to connect MCCB between the main circuit power supply input and VS-656MR5 input terminals R/L1, S/L2 and T/L3 to protect wiring.

##### (b) Installation of Ground Fault Interrupter

Inverter outputs use high-speed switching, so high-frequency leakage current is generated. Therefore, at the converter primary side, use a ground fault interrupter that detects only the leakage current in the frequency range that is hazardous to humans and excludes high-frequency leakage current.

- For the special-purpose ground fault interrupter for Inverters, choose a ground fault interrupter with a sensitivity amperage of at least 30 mA per converter.
- When using a general ground fault interrupter, choose a ground fault interrupter with a sensitivity amperage of 200 mA or more per converter and with an operating time of 0.1 s or more.

##### (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 main circuit power supply input side, regenerative braking does not function and the inverter has to stop. (At this time, protective function activates to display a fault.)

Frequent opening/closing of the magnetic contactor at the main circuit power supply input side may cause the inverter and the converter to malfunction.

(d) Terminal Block Connection Sequence

Main circuit power supply input phases can be connected to any terminal regardless of the order of R/L1, S/L2 and T/L3 on the terminal block.

(e) Installation of AC Reactor

Since the VS-656MR5 performs power regeneration, make sure to install an AC reactor corresponding to converter capacity. Installation of AC reactor is effective for improvement of power factor on the power supply side.

(f) Installation of Surge Absorber

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

The surge absorber will absorb the energy stored in the coil of the inductive loads and thus must have a capacity suited to the coil.

Never connect surge absorbers to the output terminals U/T1, V/T2, W/T3 of the controller. If there is no surge absorber, making or breaking of the magnetic contactor generates surge voltage from the winding, disrupting the signal on the inverter control signal line.

(g) Prohibition of Installation of Phase Advancing Capacitor

Do not connect a phase advancing capacitor or surge suppressor to main circuit power supply input side (R/L1, S/L2, T/L3). It may become overheated and damaged by high harmonic components of the inverter. Also, the inverter may malfunction because of overcurrent.

(h) Using Input Noise Filters

Noise filters can eliminate a noise leaking from power line to the drive unit, and reduce a noise leaking from the drive unit to the power line.

Use the correct noise filter specified for inverter use as indicated in example 1.

- Example 1

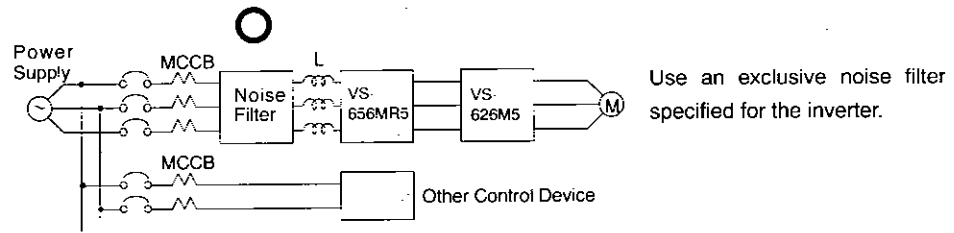


Fig. 8 Correct Input Noise Filter Installation



## • Example 2

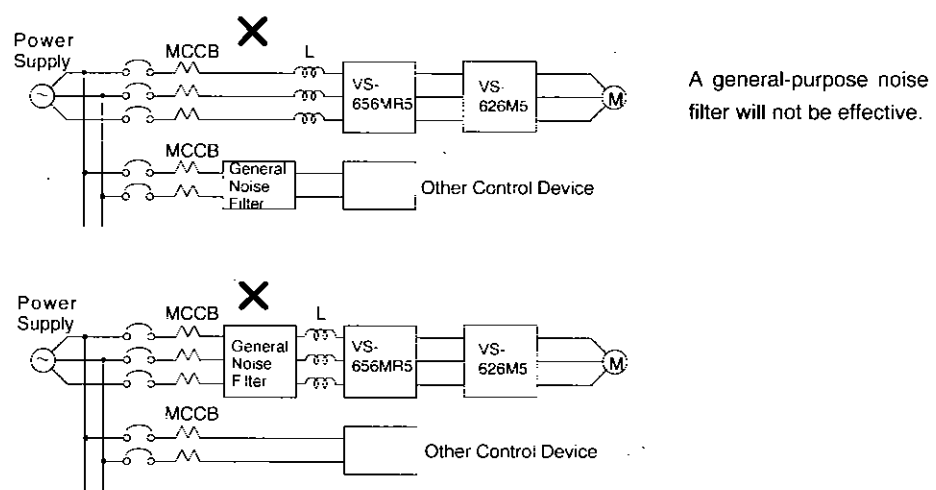


Fig. 9 Incorrect Input Noise Filter Installation

## (2) Wiring Precautions for Converter Control Power Supply Input

Make sure to connect MCCB with the converter control power supply input terminals A1/r and A2/t to protect wiring.

## (3) Wiring Precautions for Main Circuit between Converter and Inverter

## (a) Connection of Main Circuit DC Power Supply

Connect converter main circuit DC output terminals P/⊕ and N/⊖ to inverter main circuit power supply input terminals P/⊕ and N/⊖ using exclusive-use connection bus bar. Secure bus bar using all the power terminal screws and tighten to torque value of 4 to 5 N·m.

## (b) Connection of Converter Control Power Supply Output

Connect converter control power supply output terminals P1 and N1 to inverter left-side control power supply input terminals P1 and N1 using exclusive-use power cable.

## (4) Wiring Precautions for Inverter Main Circuit Output

## (a) Connection of Inverter and Motor

Connect output terminals U/T1, V/T2 and W/T3 to motor lead wires U, V and W. Connection method is indicated on the back of the terminal cover. Verify that the motor rotates in the forward direction (CCW: counterclockwise when viewed from the motor load side) with the forward run command.

(b) **Strict Prohibition of Connection of Voltage to Output Terminals**

Never connect the AC main circuit power supply to output terminals U/T1, V/T2 and W/T3. If voltage is applied to the output terminals, the internal circuits of the inverter will be damaged.

(c) **Strict Prohibition of Short Circuiting or Grounding of Output Terminal**

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

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

Never connect a phase advancing capacitor or LC/RC noise filter to the output circuit. The inverter can be damaged or internal part burnt if these devices are connected.

(e) **Prohibition 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 is activated because of inrush current.

(f) **Dealing with Emission Noise**

To reduce the emission noise from output side, cover the wirings with a metallic shield other than installing a output noise filter. Make the wiring distance between the power line and signal line 30 cm or longer, and the emission noise will be reduced.

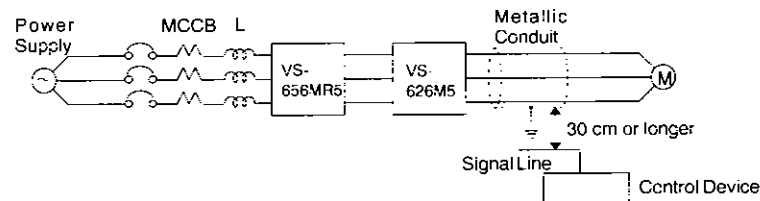


Fig. 10 Dealing with Emission Noise

(g) **Wiring Distance between Inverter and Motor**

The signal and power cables between the inverter and the motor must be separated and the cable extension must be as short as possible (20 m or less).

## (5) Grounding

- Make sure to ground the ground terminal (⊕).  
200V class: Ground to 100Ω or less  
400V class: Ground to 10Ω or less
- Never ground the inverter or the converter in common with welding machines, motors, or other large-current electrical equipment. Wiring for grounding cable must be separated from the large-current electrical equipment.
- Use ground lead listed in technical standards of electric installation and make the length as short as possible.  
Leakage current flows through the inverter. Therefore, if the distance between the ground electrode and the ground terminal is too long, potential on the ground terminal of the inverter will become unstable.
- Always ground converters, inverters and motors using a ground terminal even when equipment is grounded through sill channel or steel plate.
- Ground the units as shown in Fig. 11 (a). Do not loop the ground wires as shown in (b). Fig. 12 (a) shows correct grounding from ground terminals of inverter and motor. Avoid making 2 lines together as shown in (b).

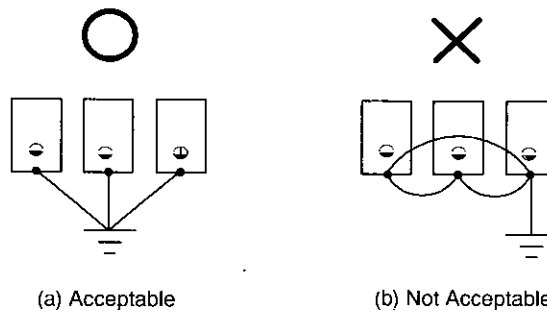


Fig. 11 Grounding

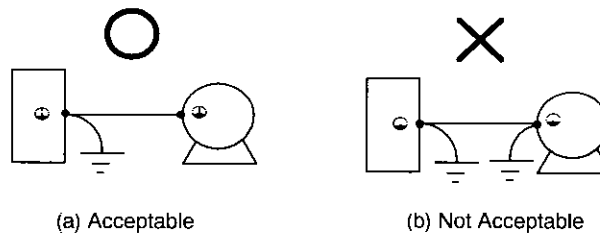


Fig. 12 Grounding of Motor and Inverter

(6) Functions of Main Circuit Terminals

The following tables outline the functions of the main circuit terminals.

Table 2 Converter Main Circuit Terminals

| Symbol     | Symbol               | Name  | Functions  |
|------------|----------------------|---|--|
| 200V class | R/L1<br>S/L2<br>T/L3 | Main circuit power supply input             | 3-phase<br>200 - 220VAC 50Hz<br>200 - 230VAC 60Hz        |
|            | A1/r<br>A2/t         | Control power supply input                  | Single-phase<br>200 - 220VAC 50Hz<br>200 - 230VAC 60Hz   |
|            | A11/r1*<br>A21/t1    | Power supply input for heatsink cooling fan | Single-phase<br>200 - 220VAC 50Hz<br>200 - 230VAC 60Hz   |
|            | P/⊕<br>N/⊖           | Main circuit DC output                      | 270 - 325VDC<br>(For inverter main circuit power supply) |
|            | P1<br>N1             | Control power supply output                 | 282 - 325VDC<br>(For inverter control power supply)      |
|            | ⊕                    | Grounding                                   | Ground terminal<br>(Ground resistance : 100Ω or less)    |
| 400V class | R/L1<br>S/L2<br>T/L3 | Main circuit power supply input             | 3-phase<br>400 - 440VAC 50Hz<br>400 - 460VAC 60Hz        |
|            | A1/r<br>A2/t         | Control power supply input                  | Single-phase<br>200 - 220VAC 50Hz<br>200 - 230VAC 60Hz   |
|            | A11/r1*<br>A21/t1    | Power supply input for heatsink cooling fan | Single-phase<br>200 - 220VAC 50Hz<br>200 - 230VAC 60Hz   |
|            | P/⊕<br>N/⊖           | Main circuit DC output                      | 540 - 650VDC<br>(For inverter main circuit power supply) |
|            | P1<br>N1             | Control power supply output                 | 282 - 325VDC<br>(For inverter control power supply)      |
|            | ⊕                    | Grounding                                   | Ground terminal<br>(Ground resistance : 10Ω or less)     |

\* For open chassis type inverters of 11kW or more.

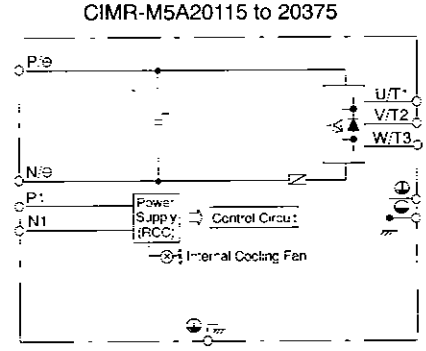
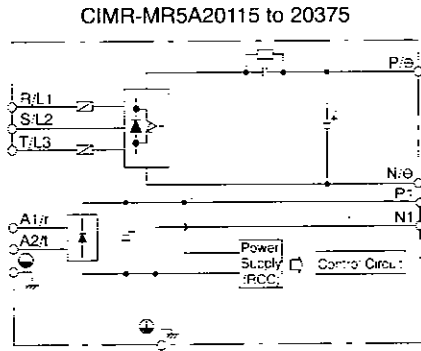
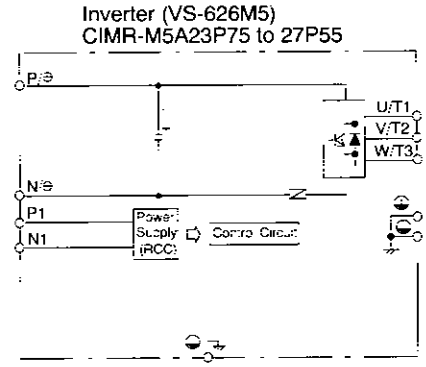
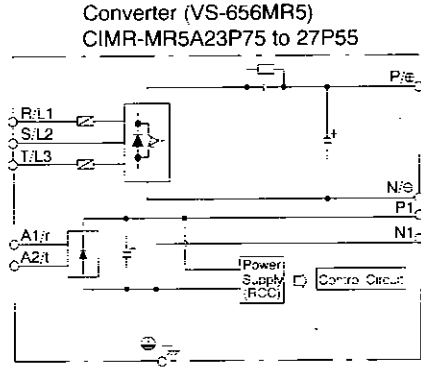
Table 3 Inverter Main Circuit Terminals

| Voltage class | Symbol               | Name  | Functions  |
|---------------|----------------------|---|--|
| 200V class    | P/⊕<br>N/⊖           | Main circuit power supply input             | 270 - 325VDC<br>(Supplied from converter)              |
|               | P1<br>N1             | Control power supply input                  | 282 - 325VDC<br>(Supplied from converter)              |
|               | A12/r2*<br>A22/t2    | Power supply input for heatsink cooling fan | Single-phase<br>200 - 220VAC 50Hz<br>200 - 230VAC 60Hz |
|               | U/T1<br>V/T2<br>W/T3 | Inverter output                             | Inverter output to motor                               |
|               | ⊕                    | Grounding                                   | Ground terminal<br>(Ground resistance : 100Ω or less)  |
| 400V class    | P/⊕<br>N/⊖           | Main circuit power supply input             | 540 - 650VDC<br>(Supplied from converter)              |
|               | P1<br>N1             | Control power supply input                  | 282 - 325VDC<br>(Supplied from converter)              |
|               | A12/r2*<br>A22/t2    | Power supply input for heatsink cooling fan | Single-phase<br>200 - 220VAC 50Hz<br>200 - 230VAC 60Hz |
|               | U/T1<br>V/T2<br>W/T3 | Inverter output                             | Inverter output to motor                               |
|               | ⊖                    | Grounding                                   | Ground terminal<br>(Ground resistance : 10Ω or less)   |

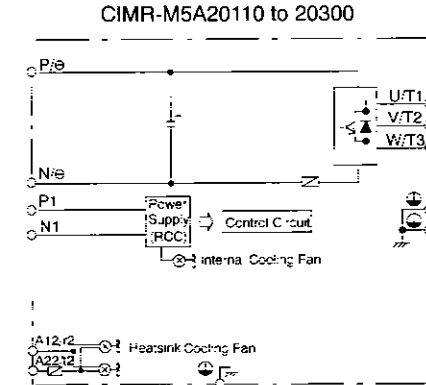
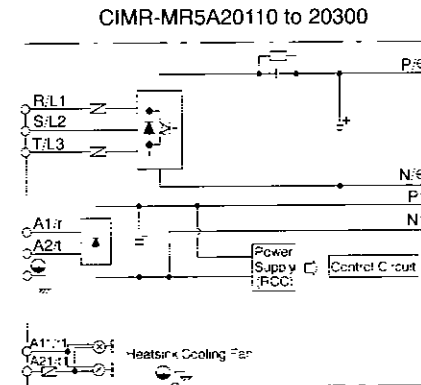
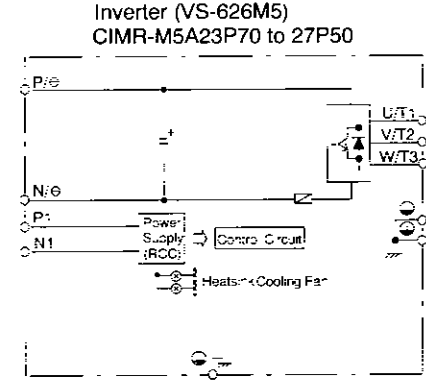
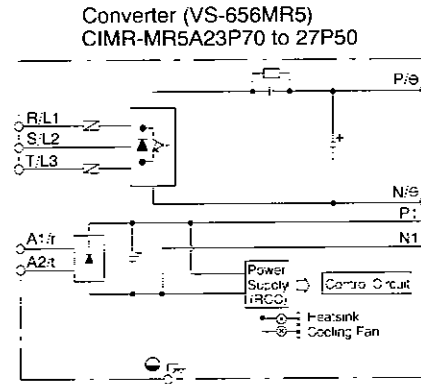
\* For open chassis type inverters of 11kW or more.

(7) Main Circuit Configuration

(a) 200V class Heatsink Externally Cooling Type

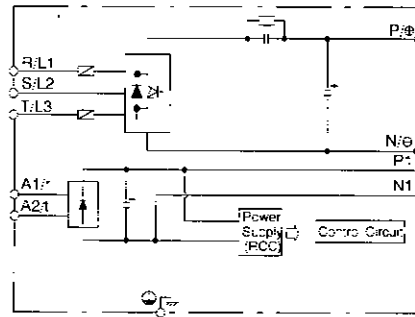


(b) 200V class Open Chassis Type

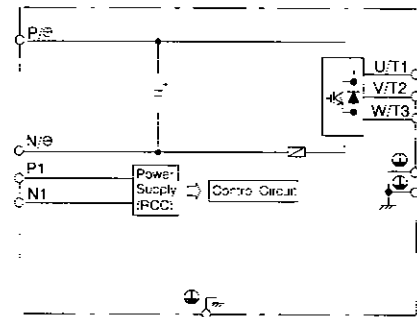


(c) 400V class Heatsink Externally Cooling Type

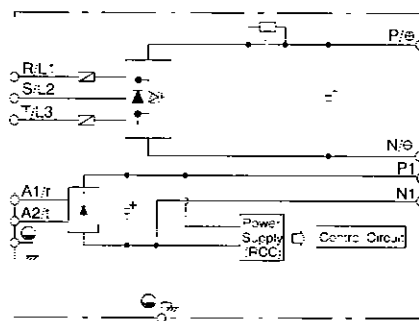
Converter (VS-656MR5)  
CIMR-MR5A45P55 to 47P55



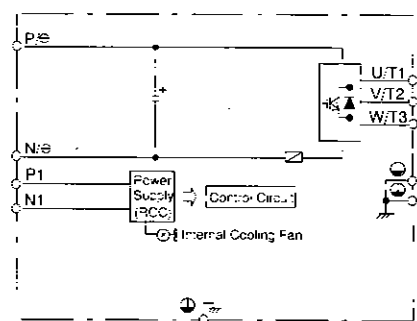
Inverter (VS-626M5)  
CIMR-M5A45P55 to 47P55



CIMR-MR5A40115 to 40455

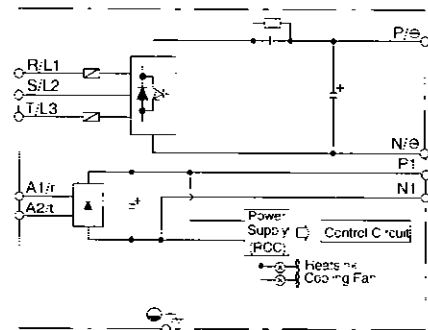


CIMR-M5A40115 to 40455

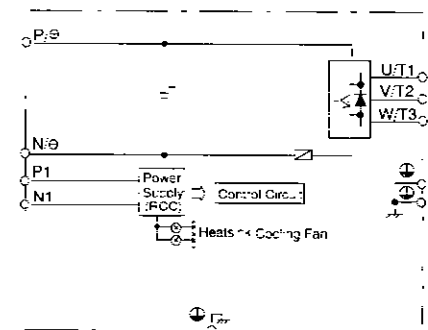


(d) 400V class Open Chassis Type

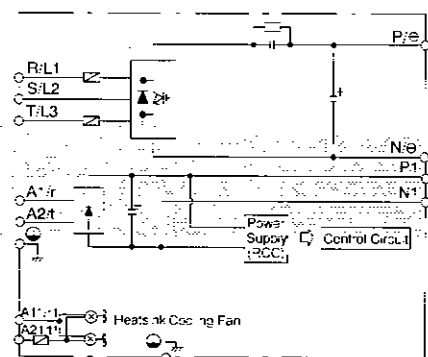
Converter (VS-656MR5)  
CIMR-MR5A45P50 to 47P50



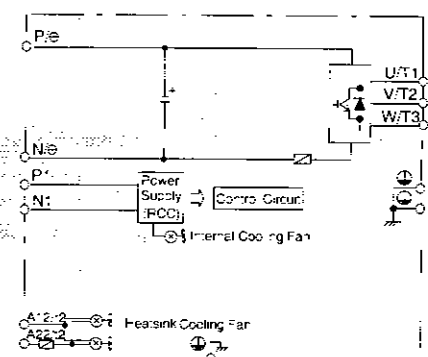
Inverter (VS-626M5)  
CIMR-M5A45P50 to 47P50



CIMR-MR5A40110 to 40220



CIMR-M5A40110 to 40220



### (8) Parts Required for Wiring

Select wires or closed-loop connectors to be used from Tables 4 or 7.

Table 4 200V class Converter Power Cable Specifications

| Model<br>CIMR-<br>MR5A <input type="checkbox"/> | Terminal Symbol      | Terminal<br>Screw | Tightning Torque<br>lb-in (N · m) | Wire Size  |   |   |  |
|---|----------------------|-------------------|-----------------------------------|--|---|---|--|
|   |                      |                   |                                   | UL-approved 75<br>°C (167°F) tem-<br>perature-rated<br>copper wire<br>[AWG (mm <sup>2</sup> )] | 600V vinyl-<br>sheath insulated<br>wire (LV, VV) 60<br>°C (140°F)<br>(mm <sup>2</sup> ) | 600V cross-<br>linked polyethyl-<br>ene wire (LC)<br>90°C (194°F)<br>(mm <sup>2</sup> ) | 600V rubber-in-<br>sulated cabtyre<br>cable (CT) 60°C<br>(140°F)<br>(mm <sup>2</sup> ) |
| 23P7  | P/⊕, N/⊖             | M6                | 26 (2.94)                         | (* 1)  |   |   |  |
|   | R/L1, S/L2, T/L3     | M5                | 20.8 (2.35)                       | 14 (2.1)   | 2   | 2   | 2  |
|   | A1/r, A2/t           | M5                | 20.8 (2.35)                       | 14 (2.1)   | 2   | 2   | 2  |
|   | ⊕                    | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 10 (5.3)   | 2   | 2   | 2  |
| 25P5  | P/⊕, N/⊖             | M6                | 26 (2.94)                         | (* 1)  |   |   |  |
|   | R/L1, S/L2, T/L3     | M5                | 20.8 (2.35)                       | 12 (3.3)   | 3.5   | 2   | 3.5  |
|   | A1/r, A2/t           | M5                | 20.8 (2.35)                       | 14 (2.1)   | 2   | 2   | 2  |
|   | ⊕                    | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 10 (5.3)   | 3.5   | 2   | 2  |
| 27P5  | P/⊕, N/⊖             | M6                | 26 (2.94)                         | (* 1)  |   |   |  |
|   | R/L1, S/L2, T/L3     | M5                | 20.8 (2.35)                       | 10 (5.3)   | 3.5   | 2   | 3.5  |
|   | A1/r, A2/t           | M5                | 20.8 (2.35)                       | 14 (2.1)   | 2   | 2   | 2  |
|   | ⊕                    | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 10 (5.3)   | 3.5   | 2   | 3.5  |
| 2011  | P/⊕, N/⊖             | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|   | R/L1, S/L2, T/L3     | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 8 (8.4)  | 8   | 3.5   | 8  |
|   | A1/r, A2/t           | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|   | ⊕                    | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 8 (8.4)  | 5.5   | 3.5   | 5.5  |
| 2015  | P/⊕, N/⊖             | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|   | R/L1, S/L2, T/L3     | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 6 (13.3)   | 14  | 5.5   | 14   |
|   | A1/r, A2/t           | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|   | ⊕                    | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 8 (8.4)  | 8   | 5.5   | 5.5  |
| 2018  | P/⊕, N/⊖             | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|   | R/L1, S/L2, T/L3     | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 4 (21.2)   | 22  | 8   | 22   |
|   | A1/r, A2/t           | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|   | ⊕                    | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 6 (13.3)   | 8   | 5.5   | 8  |
| 2022  | P/⊕, N/⊖             | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|   | R/L1, S/L2, T/L3     | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 4 (21.2)   | 22  | 14  | 22   |
|   | A1/r, A2/t           | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|   | ⊕                    | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 6 (13.3)   | 14  | 8   | 8  |
| 2030  | P/⊕, N/⊖             | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|   | R/L1, S/L2, T/L3     | M8                | 69.4 - 86.8 (7.8 - 9.8)           | 2 (33.6)   | 38  | 22  | 38   |
|   | A1/r, A2/t           | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|   | ⊕                    | M8                | 69.4 - 86.8 (7.8 - 9.8)           | 6 (13.3)   | 14  | 8   | 14   |
| 2037  | P/⊕, N/⊖             | M6 × 4            | 26 (2.94)                         | (* 1)  |   |   |  |
|   | R/L1, S/L2, T/L3     | M10               | 130.2 - 173.4<br>(14.7 - 19.6)    | 1/0 (53.5)   | 50  | 30  | 60   |
|   | A1/r, A2/t           | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|   | ⊕                    | M8                | 69.4 - 86.8 (7.8 - 9.8)           | 4 (21.2)   | 22  | 14  | 14   |
| 2011 to 2030                                    | A11/r1, A21/t1 (* 2) | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |

\*1 Connect using exclusive-use connection bus bar.

\*2 For open chassis type inverters of 11kW or more. Not provided for heatsink externally cooling type.  
(Model 2037 is under development.)

- Notes:
1. Wire size is selected assuming external suspended wiring of single 3-core cables at an ambient temperature of 30°C (86°F).
  2. If ambient temperature exceeds 30°C (86°F), the allowable current of wire may be lowered.
  3. Temperature for each wire indicates maximum allowable conductor temperature.



Table 5 400V class Converter Power Cable Specifications

| Model<br>CIMR-<br>MR5A | Terminal Symbol         | Terminal<br>Screw | Tightning Torque<br>lb-in (N · m) | Wire Size  |   |   |  |
|------------------------|-------------------------|-------------------|-----------------------------------|--|---|---|--|
|                        |                         |                   |                                   | UL-approved 75<br>°C (167°F) tem-<br>perature-rated<br>copper wire<br>[AWG (mm <sup>2</sup> )] | 600V vinyl-<br>sheath insulated<br>wire (IV, VV) 60<br>°C (140°F)<br>(mm <sup>2</sup> ) | 600V cross-<br>linked polyethyl-<br>ene wire (IC)<br>90°C (194°F)<br>(mm <sup>2</sup> ) | 600V rubber-in-<br>sulated cabtyre<br>cable (CT) 60°C<br>(140°F)<br>(mm <sup>2</sup> ) |
| 45P5                   | P/⊕, N/⊖                | M6                | 26 (2.94)                         | (* 1)  |   |   |  |
|                        | R/L1, S/L2, T/L3        | M5                | 20.8 (2.35)                       | 14 (2.1)   | 2   | 2   | 2  |
|                        | A1/r, A2/r              | M5                | 20.8 (2.35)                       | 14 (2.1)   | 2   | 2   | 2  |
|                        | ⊖                       | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 10 (5.3)   | 2   | 2   | 2  |
| 47P5                   | P/⊕, N/⊖                | M6                | 26 (2.94)                         | (* 1)  |   |   |  |
|                        | R/L1, S/L2, T/L3        | M5                | 20.8 (2.35)                       | 14 (2.1)   | 2   | 2   | 2  |
|                        | A1/r, A2/r              | M5                | 20.8 (2.35)                       | 14 (2.1)   | 2   | 2   | 2  |
|                        | ⊖                       | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 10 (5.3)   | 2   | 2   | 2  |
| 4011                   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|                        | R/L1, S/L2, T/L3        | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 12 (3.3)   | 3.5   | 2   | 3.5  |
|                        | A1/r, A2/r              | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|                        | ⊖                       | M6, M6            | 30.4 - 43.4 (3.4 - 4.9)           | 10 (5.3)   | 3.5   | 2   | 2  |
| 4015                   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|                        | R/L1, S/L2, T/L3        | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 10 (5.3)   | 3.5   | 2   | 3.5  |
|                        | A1/r, A2/r              | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|                        | ⊖                       | M6, M6            | 30.4 - 43.4 (3.4 - 4.9)           | 10 (5.3)   | 3.5   | 2   | 3.5  |
| 4018                   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|                        | R/L1, S/L2, T/L3        | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 8 (8.4)  | 5.5   | 3.5   | 5.5  |
|                        | A1/r, A2/r              | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|                        | ⊖                       | M6, M6            | 30.4 - 43.4 (3.4 - 4.9)           | 10 (5.3)   | 5.5   | 3.5   | 3.5  |
| 4022                   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|                        | R/L1, S/L2, T/L3        | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 8 (8.4)  | 8   | 3.5   | 8  |
|                        | A1/r, A2/r              | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|                        | ⊖                       | M6, M6            | 30.4 - 43.4 (3.4 - 4.9)           | 8 (8.4)  | 5.5   | 3.5   | 5.5  |
| 4030                   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|                        | R/L1, S/L2, T/L3        | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 6 (13.3)   | 14  | 5.5   | 14   |
|                        | A1/r, A2/r              | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|                        | ⊖                       | M6, M6            | 30.4 - 43.4 (3.4 - 4.9)           | 8 (8.4)  | 8   | 5.5   | 5.5  |
| 4037                   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|                        | R/L1, S/L2, T/L3        | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 4 (21.2)   | 22  | 8   | 22   |
|                        | A1/r, A2/r              | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|                        | ⊖                       | M6, M6            | 30.4 - 43.4 (3.4 - 4.9)           | 6 (13.3)   | 8   | 5.5   | 8  |
| 4045                   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)                         | (* 1)  |   |   |  |
|                        | R/L1, S/L2, T/L3        | M6                | 30.4 - 43.4 (3.4 - 4.9)           | 4 (21.2)   | 22  | 14  | 22   |
|                        | A1/r, A2/r              | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |
|                        | ⊖                       | M6, M6            | 30.4 - 43.4 (3.4 - 4.9)           | 6 (13.3)   | 14  | 8   | 8  |
| 4011 to 4022           | A11/r1, A21/r1<br>(* 2) | M4                | 10.4 - 17.4 (1.2 - 2.0)           | 14 (2.1)   | 2   | 2   | 2  |

\*1 Connect using exclusive-use connection bus bar.

\*2 For open chassis type inverters of 11kW or more. Not provided for heatsink externally cooling type.  
(Models 4030 to 4045 are under development.)

- Notes:
1. Wire size is selected assuming external suspended wiring of single 3-core cables at an ambient temperature of 30°C (86°F).
  2. If ambient temperature exceeds 30°C (86°F), the allowable current of wire may be lowered.
  3. Temperature for each wire indicates maximum allowable conductor temperature.

Table 6 · 200V class Inverter Power Cable Specifications

| Model<br>CIMR-<br>M5A <input type="checkbox"/> | Terminal Symbol         | Terminal<br>Screw | Tightning Torque<br>lb-in (N · m)                  | Wire Size  |   |   |  |
|--|-------------------------|-------------------|--|--|---|---|--|
|  |                         |                   |  | UL-approved 75<br>°C (167°F) tem-<br>perature-rated<br>copper wire<br>[AWG (mm <sup>2</sup> )] | 600V vinyl-<br>sheath insulated<br>wire (IV, VV) 60<br>°C (140°F)<br>(mm <sup>2</sup> ) | 600V cross-<br>linked polyethyl-<br>ene wire (IC)<br>90°C (194°F)<br>(mm <sup>2</sup> ) | 600V rubber-in-<br>sulated cabtyre<br>cable (CT) 60°C<br>(140°F)<br>(mm <sup>2</sup> ) |
| 23P7   | P/⊕, N/⊖                | M6                | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M5                | 20.8 (2.35)  | 8 (8.4)  | 5.5   | 3.5   | 5.5  |
|  | ⊕                       | M5 × 2            | 20.8 (2.35)  | 10 (5.3)   | 3.5   | 2   | 3.5  |
| 25P5   | P/⊕, N/⊖                | M6                | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M5                | 20.8 (2.35)  | 8 (8.4)  | 5.5   | 3.5   | 5.5  |
|  | ⊕                       | M5 × 2            | 20.8 (2.35)  | 10 (5.3)   | 3.5   | 2   | 3.5  |
| 27P5   | P/⊕, N/⊖                | M6                | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M5                | 20.8 (2.35)  | 8 (8.4)  | 8   | 3.5   | 8  |
|  | ⊕                       | M5 × 2            | 20.8 (2.35)  | 8 (8.4)  | 5.5   | 3.5   | 5.5  |
| 2011   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M8                | 57 (6.47)  | 6 (13.3)   | 14  | 8   | 14   |
|  | ⊕                       | M6 × 2            | 30.4 - 43.4 (3.4 - 4.9)                            | 8 (8.4)  | 8   | 5.5   | 5.5  |
| 2015   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M8                | 57 (6.47)  | 4 (21.2)   | 22  | 14  | 22   |
|  | ⊕                       | M6 × 2            | 30.4 - 43.4 (3.4 - 4.9)                            | 6 (13.3)   | 14  | 8   | 8  |
| 2018   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M8                | 57 (6.47)  | 3 (26.7)   | 30  | 14  | 30   |
|  | ⊕                       | M6 × 2            | 30.4 - 43.4 (3.4 - 4.9)                            | 6 (13.3)   | 14  | 8   | 14   |
| 2022   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M8                | 57 (6.47)  | 2 (33.6)   | 50  | 22  | 38   |
|  | ⊕                       | M6 × 2            | 30.4 - 43.4 (3.4 - 4.9)                            | 6 (13.3)   | 14  | 8   | 14   |
| 2030   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M8                | 69.4 - 86.8 (7.8 - 9.8)                            | 2/0 (67.4)   | 80  | 38  | 80   |
|  | ⊕                       | M6 × 2            | 30.4 - 43.4 (3.4 - 4.9)                            | 4 (21.2)   | 22  | 14  | 14   |
| 2037   | P/⊕, N/⊖                | M6 × 4            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M10               | 130.2 - 173.4<br>(14.7 - 19.6)                     | 3/0 (85)   | 100   | 50  | 100  |
|  | ⊕                       | M8 × 2,<br>M6     | 69.4 - 86.8 (7.8 - 9.8)<br>30.4 - 43.4 (3.4 - 4.9) | 3 (26.7)   | 22  | 14  | 22   |
| 2011 to 2030                                   | A12/r2, A22/r2<br>(* 2) | M4                | 10.4 - 17.4 (1.2-2.0)                              | 14 (2.1)   | 2   | 2   | 2  |

\*1 Connect using exclusive-use connection bus bar.

\*2 For open chassis type inverters of 11kW or more. Not provided for heatsink externally cooling type.  
(Model 2037 is under development.)

- Notes:
1. Wire size is selected assuming external suspended wiring of single 3-core cables at an ambient temperature of 30°C (86°F).
  2. If ambient temperature exceeds 30°C (86°F), the allowable current of wire may be lowered.
  3. Temperature for each wire indicates maximum allowable conductor temperature.

Table 7 400V class Inverter Power Cable Specifications

| Model<br>CIMR-<br>M5A <input type="checkbox"/> | Terminal Symbol         | Terminal<br>Screw | Tightning Torque<br>lb-in (N · m)                  | Wire Size  |   |   |  |
|--|-------------------------|-------------------|--|--|---|---|--|
|  |                         |                   |  | UL-approved 75<br>°C (167°F) tem-<br>perature-rated<br>copper wire<br>(AWG (mm <sup>2</sup> )) | 600V vinyl-<br>sheath insulated<br>wire (IV, VV) 60<br>°C (140°F)<br>(mm <sup>2</sup> ) | 600V cross-<br>linked polyethyl-<br>ene wire (IC)<br>90°C (194°F)<br>(mm <sup>2</sup> ) | 600V rubber-in-<br>su'ated cabtyre<br>cable (CT) 60°C<br>(140°F)<br>(mm <sup>2</sup> ) |
| 45P5   | P/⊕, N/⊖                | M6                | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M5                | 20.8 (2.35)  | 12 (3.3)   | 2   | 2   | 2  |
|  | ⊕                       | M5 × 2            | 20.8 (2.35)  | 10 (5.3)   | 3.5   | 2   | 3.5  |
| 47P5   | P/⊕, N/⊖                | M6                | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M5                | 20.8 (2.35)  | 12 (3.3)   | 3.5   | 2   | 3.5  |
|  | ⊕                       | M5 × 2            | 20.8 (2.35)  | 10 (5.3)   | 3.5   | 2   | 3.5  |
| 4011   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M6                | 30.4 - 43.4 (3.4 - 4.9)                            | 10 (5.3)   | 5.5   | 2   | 5.5  |
|  | ⊕                       | M5 × 2,<br>M6     | 17.4 - 21.7 (2.1 - 2.5)<br>30.4 - 43.4 (3.4 - 4.9) | 10 (5.3)   | 3.5   | 2   | 3.5  |
| 4015   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M6                | 30.4 - 43.4 (3.4 - 4.9)                            | 8 (8.4)  | 8   | 3.5   | 8  |
|  | ⊕                       | M5 × 2,<br>M6     | 17.4 - 21.7 (2.1 - 2.5)<br>30.4 - 43.4 (3.4 - 4.9) | 8 (8.4)  | 5.5   | 3.5   | 5.5  |
| 4018   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M6                | 30.4 - 43.4 (3.4 - 4.9)                            | 8 (8.4)  | 14  | 5.5   | 14   |
|  | ⊕                       | M5 × 2,<br>M6     | 17.4 - 21.7 (2.1 - 2.5)<br>30.4 - 43.4 (3.4 - 4.9) | 8 (8.4)  | 8   | 5.5   | 5.5  |
| 4022   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M6                | 30.4 - 43.4 (3.4 - 4.9)                            | 6 (13.3)   | 14  | 8   | 14   |
|  | ⊕                       | M5 × 2,<br>M6     | 17.4 - 21.7 (2.1 - 2.5)<br>30.4 - 43.4 (3.4 - 4.9) | 8 (8.4)  | 8   | 5.5   | 5.5  |
| 4030   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M8                | 69.4 - 86.8 (7.8 - 9.8)                            | 4 (21.2)   | 22  | 14  | 22   |
|  | ⊕                       | M6 × 2,<br>M6     | 30.4 - 43.4 (3.4 - 4.9)<br>30.4 - 43.4 (3.4 - 4.9) | 6 (13.3)   | 14  | 8   | 8  |
| 4037   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M8                | 69.4 - 86.8 (7.8 - 9.8)                            | 3 (26.7)   | 30  | 14  | 30   |
|  | ⊕                       | M6 × 2,<br>M6     | 30.4 - 43.4 (3.4 - 4.9)<br>30.4 - 43.4 (3.4 - 4.9) | 6 (13.3)   | 14  | 8   | 14   |
| 4045   | P/⊕, N/⊖                | M6 × 2            | 26 (2.94)  | (* 1)  |   |   |  |
|  | U/T1, V/T2, W/T3        | M8                | 69.4 - 86.8 (7.8 - 9.8)                            | 1 (42.4)   | 60  | 30  | 50   |
|  | ⊕                       | M6 × 2,<br>M6     | 30.4 - 43.4 (3.4 - 4.9)<br>30.4 - 43.4 (3.4 - 4.9) | 6 (13.3)   | 14  | 8   | 14   |
| 4011 to 4022                                   | A12/r2, A22/r2<br>(* 2) | M4                | 10.4 - 17.4 (1.2 - 2.0)                            | 14 (2.1)   | 2   | 2   | 2  |

\*1 Connect using exclusive-use connection bus bar.

\*2 For open chassis type inverters of 11kW or more. Not provided for heatsink externally cooling type.  
(Models 4030 to 4045 are under development.)

- Notes:
1. Wire size is selected assuming external suspended wiring of single 3-core cables at an ambient temperature of 30°C (86°F).
  2. If ambient temperature exceeds 30°C (86°F), the allowable current of wire may be lowered.
  3. Temperature for each wire indicates maximum allowable conductor temperature.

Table 8 JST Closed-Loop Connectors (For 200V/400V Classes)

| Wire Size       |         | Terminal Screw | Closed-Loop Connectors |
|-----------------|---------|----------------|------------------------|
| mm <sup>2</sup> | AWG     |                |                        |
| 0.5             | 20      | M3.5           | 1.25 - 3.5             |
|                 |         | M4             | 1.25 - 4               |
| 0.75            | 18      | M3.5           | 1.25 - 3.5             |
|                 |         | M4             | 1.25 - 4               |
| 1.25            | 16      | M3.5           | 1.25 - 3.5             |
|                 |         | M4             | 1.25 - 4               |
| 2               | 14      | M3.5           | 2 - 3.5                |
|                 |         | M4             | 2 - 4                  |
|                 |         | M5             | 2 - 5                  |
|                 |         | M6             | 2 - 6                  |
|                 |         | M8             | 2 - 8                  |
| 3.5 - 5.5       | 12 - 10 | M4             | 5.5 - 4                |
|                 |         | M5             | 5.5 - 5                |
|                 |         | M6             | 5.5 - 6                |
| 8               | 8       | M8             | 5.5 - 8                |
|                 |         | M5             | 8 - 5                  |
|                 |         | M6             | 8 - 6                  |
| 14              | 6       | M8             | 8 - 8                  |
|                 |         | M6             | 14 - 6                 |
| 22              | 4       | M8             | 14 - 8                 |
|                 |         | M6             | 22 - 6                 |
| 30 - 38         | 3 - 2   | M8             | 22 - 8                 |
|                 |         | M8             | 38 - 8                 |
| 50 - 60         | 1 - 1/0 | M8             | 60 - 8                 |
|                 |         | M10            | 60 - 10                |
| 100             | 4/0     | M10            | 100 - 10               |

## (9) Control Signal Connectors

Table 9 Control Signal Connectors

|   | Connector No. | Function   | Connector Type     |   | Connector Pin Nos. | Applicable Max. Wire Size | Connector Manufacturer |
|---|---------------|--|--------------------|---|--------------------|---------------------------|------------------------|
|   |               |  | Inverter Side      | Wiring Side                             |                    |                           |                        |
| Control PC Board<br>(VS-626M5)                        | 51CN          | Control signal connector with converter unit                       | 8830E-068-170LD-32 | 8822E-034-171D                          |                    | Use a special cable.      | KEL Corp.              |
|   | 52CN          | Control signal connector with other drive unit                     |                    |   |                    |                           |                        |
|   | 1CN           | Control signals  | 10236-52A2JL       | ·10136-3000VE<br>·10336-52A0-008 (case) |                    | 0.2 mm <sup>2</sup>       | Sumitomo 3M Ltd.       |
|   | 2CN           | Encoder signal input   | 10220-52A2JL       | ·10120-3000VE<br>·10320-52A0-008 (case) |                    | 0.2 mm <sup>2</sup>       | Sumitomo 3M Ltd.       |
|   | 3CN           | Digital operator   | 10214-52A2JL       | ·10114-3000VE<br>·10314-52A0-008 (case) |                    | Use a special cable.      | Sumitomo 3M Ltd.       |
| I/O Card<br>(VS-626M5)                                | 6CN           | Control signals  | 10250-52A2JL       | ·10150-3000VE<br>·10350-52A0-008 (case) |                    | 0.2 mm <sup>2</sup>       | Sumitomo 3M Ltd.       |
| Encoder Method Orientation Card<br>(VS-626M5)         | 8CN           | Load shaft encoder signal input                                    | 10220-52A2JL       | ·10120-3000VE<br>·10320-52A0-008 (case) |                    | 0.2 mm <sup>2</sup>       | Sumitomo 3M Ltd.       |
|   | 9CN           | Load shaft encoder signal output                                   | 10214-52A2JL       | ·10114-3000VE<br>·10314-52A0-008 (case) |                    | 0.2 mm <sup>2</sup>       | Sumitomo 3M Ltd.       |
| Magnetic Sensor Method Orientation Card<br>(VS-626M5) | 10CN          | Control signals  | 10214-52A2JL       | ·10114-3000VE<br>·10314-52A0-008 (case) |                    | 0.2 mm <sup>2</sup>       | Sumitomo 3M Ltd.       |
| Control PC Board<br>(VS-656MR5)                       | 5CN           | Control signal connector with other drive unit                     | 8831E-034-170LD    | 8822E-034-171D                          |                    | Use a special cable.      | KEL Corp.              |
|   | 1CN           | Communication cable connector (for factory test prior to shipment) | 10214-52A2JL       | ·10114-3000VE<br>·10314-52A0-008 (case) |                    | —                         | Sumitomo 3M Ltd.       |

## NOTE

Some of the connectors attached with control PC board and option cards are of the same type. Therefore, make sure to mount the cards to the correct connectors each of which is identified by device symbol. If connection is wrong, it may cause damage to the inverter.

### 3.4 WIRING THE CONTROL CIRCUIT

The following tables outline the functions of the control circuit signals.

#### (1) Control Signals

Table 10 Control Circuit Signals (1, 2CN)

| Connector | Signal    | No.                                     | Function                                       | Signal Level                                  |                                   |
|-----------|-----------|---|--|---|-----------------------------------|
| 1CN       | +24VIN    | 1                                       | —  | —   |                                   |
|           | /EXT1     | 2                                       | —  | —   |                                   |
|           | /EXT2     | 3                                       | —  | —   |                                   |
|           | ESP0      | 4                                       | —  | —   |                                   |
|           | ESP1      | 5                                       | —  | —   |                                   |
|           | ALM+      | 6                                       | —  | —   |                                   |
|           | ALM-      | 7                                       | —  | —   |                                   |
|           | ALMC      | 8                                       | —  | —   |                                   |
|           | BAT-      | 9                                       | —  | —   |                                   |
|           | BAT+      | 10                                      | —  | —   |                                   |
|           | PAO       | 13                                      | Encoder phase A signal output                  | RS-422A specification<br>Line driver<br>+5V   |                                   |
|           | *PAO      | 14                                      |  |   |                                   |
|           | PBO       | 15                                      | Encoder phase B signal output                  |   |                                   |
|           | *PBO      | 16                                      |  |   |                                   |
|           | PCO       | 11                                      | Encoder phase C signal output                  |   |                                   |
|           | *PCO      | 12                                      |  |   |                                   |
|           | SS        | 17                                      | Shield (0V)                                    |   | —                                 |
|           | 0V        | 18                                      | 0V   |   | —                                 |
|           | D1 to D12 | 19 to 30                                | 12-bit digital references 1 to 12              |   | 24VDC<br>Current when closed: 5mA |
|           | EXTCOM    | 31                                      | 12-bit digital signal common                   |   |                                   |
| 24VCOM    | 32        | 12-bit digital signal power supply +24V |  |   |                                   |
| 0VCOM     | 33        | 12-bit digital signal power supply 0V   |  |   |                                   |
| VCC       | 34        | —                                       | —  |   |                                   |
| MNTR1     | 35        | —                                       | —  |   |                                   |
| MNTR2     | 36        | —                                       | —  |   |                                   |
| 2CN       | +5V       | 4, 5, 6                                 | +5V power supply for encoder                   | +5V   |                                   |
|           | 0V        | 1, 2, 3                                 | Encoder power supply common                    | Load current: 350mA or less                   |                                   |
|           | PA        | 16                                      | Encoder phase A signal input                   | RS-422A specification<br>Line receiver<br>+5V |                                   |
|           | *PA       | 17                                      |  |   |                                   |
|           | PB        | 18                                      | Encoder phase B signal input                   |   |                                   |
|           | *PB       | 19                                      |  |   |                                   |
|           | PC        | 14                                      | Encoder phase C signal input                   |   |                                   |
|           | *PC       | 15                                      |  |   |                                   |
|           | THSA      | 8                                       | Motor thermistor signal                        | —   |                                   |
|           | THSB      | 9                                       |  |   |                                   |
|           | SS        | 7                                       | Shielded wire connection (0V)                  | —   |                                   |
|           | +24V      | 10                                      | +24V power supply for winding selection device | +24V  |                                   |
|           | CC        | 11                                      | Winding selection device power supply common   |   |                                   |
| CA1       | 12        | Winding status signal                   |  |   |                                   |
| CA2       | 13        |   | Load current: 10mA or less                     |   |                                   |

Table 11 Control Circuit Signals (6CN)

| Connector | Signal  | No.      | Function                                  | Signal Level   | Related Constants  |
|-----------|---------|----------|---|--|--|
| 6CN       | +15V    | 1        | +15V output                               | +15V Load current: 10mA or less  | C1-26, 10, C1-38 bit 5<br>C1-11, 12                        |
|           | SS      | 2        | Shield (0V)                               | —  |  |
|           | SCOM    | 3        | Analog speed reference input              | 0 to $\pm 10V$<br>(Input impedance: 50k $\Omega$ )                             |  |
|           | 0V      | 4        | Analog speed reference 0V                 | —  |  |
|           | DAS     | 5        | Digital/analog speed reference selection  | 24VDC<br>Current when closed: 5mA  | C1-36 bit 7  |
|           | RDY     | 6        | Operation ready                           |  | Selected when C1-37 bit 2=0                                |
|           | EMG2    |          | Emergency stop 2                          |  | Selected when C1-37 bit 2=1                                |
|           | EMG     | 7        | Emergency stop                            |  | —  |
|           | FWD     | 8        | Forward run                               |  | —  |
|           | REV     | 9        | Reverse run                               |  | —  |
|           | TLH     | 10       | Torque limit H                            |  | Selected when C1-36 bit 2=0<br>C1-26, C1-38 bit 2          |
|           | TLL     | 11       | Torque limit L                            |  | Selected when C1-36 bit 1, 0=00                            |
|           | INC     |          | Incremental                               |  | Selected when C1-36 bit 1, 0=10                            |
|           | SSC     | 12       | Soft start cancel                         |  | Selected when C1-36 bit 3=0                                |
|           | SV      |          | Servo mode                                |  | Selected when C1-36 bit 3=1                                |
|           | RST     | 13       | Fault reset                               |  | —  |
|           | CHW     | 14       | Winding selection                         |  | —  |
|           | PPI     | 15       | P control/PI control selection            |  | Selected when C1-36 bit 4=0<br>Selected when C1-40 bit 3=0 |
|           | ORT     | 16       | Orientation                               |  | C1-39 bit 0  |
|           | NCORT   |          | NC orientation                            | Selected when C1-40 bit 3=1  |  |
|           | LGR     | 17       | L gear selection                          | C1-27, 28, 29  |  |
|           | MGR     | 18       | M gear selection                          |  |  |
|           | EXTCOM0 | 19 to 21 | Sequence input signal power supply common |  | —  |
|           | 24VCOM  | 22, 23   | Sequence input signal power supply 24V    | —  |  |
|           | 0VCOM   | 24, 25   | Sequence input signal power supply 0V     | —  |  |
|           | FC0     | 26       | Fault code 0                              | Open-collector output<br>Exclusive-use for 24VDC<br>Load current: 50mA or less | —  |
|           | FC1     | 27       | Fault code 1                              |  |  |
|           | FC2     | 28       | Fault code 2                              |  |  |
|           | FC3     | 29       | Fault code 3                              |  |  |
|           | FLTL    | 41       | Fault (Open at fault)                     |  |  |
|           | TALM    | 46       | Minor fault                               |  |  |
|           | COM2    | 30       | Fault code signal common                  |  |  |
|           | ZSPD    | 33       | Zero-speed                                | C1-19  |  |
|           | AGR     | 34       | Speed agree                               | C1-20, C1-38 bit 6   |  |
|           | SDET    | 35       | Speed detection                           | C1-21, C1-22, C1-40 bit 2  |  |
|           | TDET    | 36       | Torque detection                          | C1-23  |  |
|           | TLE     | 37       | Torque limit                              | Open-collector output<br>Exclusive-use for 24VDC<br>Load current: 50mA or less | —  |
|           | ORG     | 38       | Load origin                               | —  |  |
|           | ORE     | 39       | Orientation completion                    | —  |  |
|           | CHWE    | 40       | Winding selection completion              | C2-09, 10 or C3-09, 10   |  |
|           | COM1    | 42       | Sequence output signal common             | —  |  |
|           | FLTNO   | 43       | Fault contact output                      | Relay contact output<br>Exclusive-use for 24VDC                                | —  |
|           | FLTNC   | 44       | Closed between 43 and 45 at fault         | Load current: 1A or less   |  |
|           | FLTCOM  | 45       | Open between 44 and 45 at fault           | Minimum Permissible load: 10mA<br>(as reference value)                         |  |
|           | SM      | 47       | Speedometer output                        | 0 to +10V Load current: 2mA or less  | C1-16, 54  |
|           | 0V      | 48       | 0V for speedometer                        | —  |  |
|           | LM      | 50       | Load ratio meter output                   | 0 to +10V Load current: 2mA or less  | C1-17, 54, 18, C1-40 bit 4<br>C1-38 bit 1, 0               |
|           | 0V      | 49       | 0V for load ratio meter                   | —  | C1-38 bit 7  |



6CN 5 to 18 sequence input signals can be input with 0V common, +24V common or external common. Wiring differs according to input method. Refer to Para. 3.4 (3) for correct wiring.

Table 12 Control Circuit Signals (8, 9, 10CN)

| Connector        | Signal | No.         | Function                              | Signal Level                     |
|------------------|--------|-------------|---------------------------------------|----------------------------------|
| 8CN<br>(option)  | +5V    | 4, 5, 6     | +5V power supply for encoder          | +5V                              |
|                  | 0V     | 1, 2, 3     | Encoder power supply 0V               | Load current: 350mA or less      |
|                  | CPA    | 9           | -                                     | RS-422A specification            |
|                  | *CPA   | 11          |                                       |                                  |
|                  | CPB    | 12          | -                                     | Line receiver                    |
|                  | *CPB   | 13          |                                       |                                  |
|                  | CPC    | 7           | -                                     | +5V                              |
|                  | *CPC   | 8           |                                       |                                  |
|                  | SPA    | 16          | Encoder phase A signal input          | RS-422A specification            |
|                  | *SPA   | 17          |                                       |                                  |
|                  | SPB    | 18          | Encoder phase B signal input          | Line receiver                    |
|                  | *SPB   | 19          |                                       |                                  |
|                  | SPC    | 14          | Encoder phase C signal input          | +5V                              |
|                  | *SPC   | 15          |                                       |                                  |
| SS               | 20     | Shield (0V) | -                                     |                                  |
| 9CN<br>(option)  | SPAO   | 4           | Encoder phase A signal output         | RS-422A specification            |
|                  | *SPAO  | 5           |                                       |                                  |
|                  | SPBO   | 6           | Encoder phase B signal output         | Line driver                      |
|                  | *SPBO  | 7           |                                       |                                  |
|                  | SPCO   | 2           | Encoder phase C signal output         | +5V                              |
|                  | *SPCO  | 3           |                                       |                                  |
| SS               | 1      | Shield (0V) | -                                     |                                  |
| 10CN<br>(option) | SIG+   | 13          | Magnetic sensor signal +              | -                                |
|                  | SIG-   | 14          | Magnetic sensor signal -              | -                                |
|                  | +15V   | 12          | +15V power supply for magnetic sensor | +15V Load current: 100mA or less |
|                  | +12V   | 10          | +12V power supply for magnetic sensor | +12V Load current: 50mA or less  |
|                  | 0V     | 3, 5        | Magnetic sensor power supply 0V       | -                                |
|                  | SS     | 1           | Shield (0V)                           | -                                |

Table 13 Control Circuit Signals (51, 52, 5CN)

| Connector           | Signal | No. (51CN) | No. (52CN, 5CN) | Function                 |
|---------------------|--------|------------|-----------------|--------------------------|
| 51CN<br>52CN<br>5CN | 0V     | 1, 2       | 1, 2            | 0V                       |
|                     | BAT-   | 3          | 4               | -                        |
|                     | BAT+   | 5          | 6               | -                        |
|                     | S      | 4          | 3               | -                        |
|                     | *S     | 6          | 5               | -                        |
|                     | 0V     | 7 to 14    | 7 to 14         | 0V                       |
|                     | +24V   | 15 to 22   | 15 to 22        | -                        |
|                     | AXRUN  | 23         | 24              | Inverter (servo) running |
|                     | CONRST | 24         | 23              | Fault reset              |
|                     | CONRDY | 25         | 26              | Converter ready          |
|                     | CONFLT | 26         | 25              | Converter fault          |
|                     | ALM±   | 29         | 30              | -                        |
|                     | ALMC   | 27         | 28              | -                        |
|                     | ESP0   | 31         | 32              | -                        |
|                     | ESP1   | 28         | 27              | -                        |
|                     | /EXT2  | 30         | 29              | -                        |
|                     | /EXT1  | 32         | 31              | -                        |
|                     | +24VIN | 34         | 33              | -                        |



(2) Terminal Arrangement of Control Signal Connector

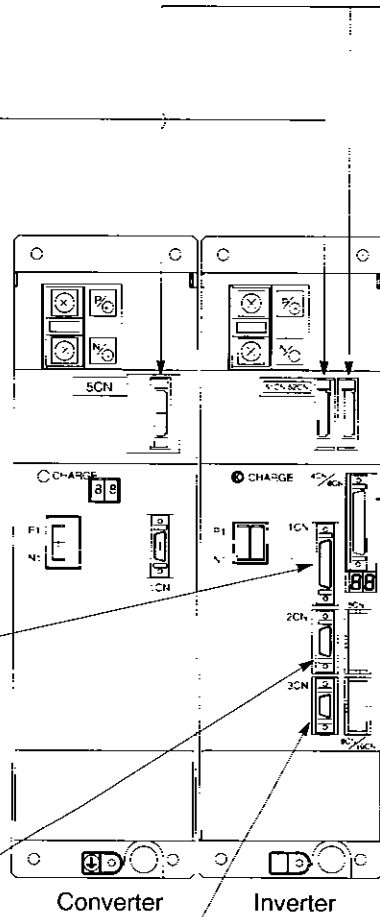
|    |        |    |        |
|----|--------|----|--------|
| 34 | +24VIN | 33 | —      |
| 32 | /EXT1  | 31 | ESP0   |
| 30 | /EXT2  | 29 | ALM±   |
| 28 | ESP1   | 27 | ALMC   |
| 26 | CONFLT | 25 | CONRDY |
| 24 | CONRST | 23 | AXRUN  |
| 22 | +24V   | 21 | +24V   |
| 20 | +24V   | 19 | +24V   |
| 18 | +24V   | 17 | +24V   |
| 16 | +24V   | 15 | +24V   |
| 14 | 0V     | 13 | 0V     |
| 12 | 0V     | 11 | 0V     |
| 10 | 0V     | 9  | 0V     |
| 8  | 0V     | 7  | 0V     |
| 6  | *S     | 5  | BAT+   |
| 4  | S      | 3  | BAT-   |
| 2  | 0V     | 1  | 0V     |

|    |        |    |        |
|----|--------|----|--------|
| 34 | —      | 33 | +24VIN |
| 32 | ESP0   | 31 | /EXT1  |
| 30 | ALM±   | 29 | /EXT2  |
| 28 | ALMC   | 27 | ESP1   |
| 26 | CONRDY | 25 | CONFLT |
| 24 | AXRUN  | 23 | CONRST |
| 22 | +24V   | 21 | +24V   |
| 20 | +24V   | 19 | +24V   |
| 18 | +24V   | 17 | +24V   |
| 16 | +24V   | 15 | +24V   |
| 14 | 0V     | 13 | 0V     |
| 12 | 0V     | 11 | 0V     |
| 10 | 0V     | 9  | 0V     |
| 8  | 0V     | 7  | 0V     |
| 6  | BAT+   | 5  | *S     |
| 4  | BAT-   | 3  | S      |
| 2  | 0V     | 1  | 0V     |

|    |        |    |        |
|----|--------|----|--------|
| 36 | MNTR2  | 18 | 0V     |
| 35 | MNTR1  | 17 | SS     |
| 34 | VCC    | 16 | *PBO   |
| 33 | 0VCOM  | 15 | PBO    |
| 32 | 24VCOM | 14 | *PAO   |
| 31 | EXTCOM | 13 | PAO    |
| 30 | D12    | 12 | *PCO   |
| 29 | D11    | 11 | PCO    |
| 28 | D10    | 10 | BAT+   |
| 27 | D9     | 9  | BAT-   |
| 26 | D8     | 8  | ALMC   |
| 25 | D7     | 7  | ALM-   |
| 24 | D6     | 6  | ALM+   |
| 23 | D5     | 5  | ESP1   |
| 22 | D4     | 4  | ESP0   |
| 21 | D3     | 3  | /EXT2  |
| 20 | D2     | 2  | /EXT1  |
| 19 | D1     | 1  | +24VIN |

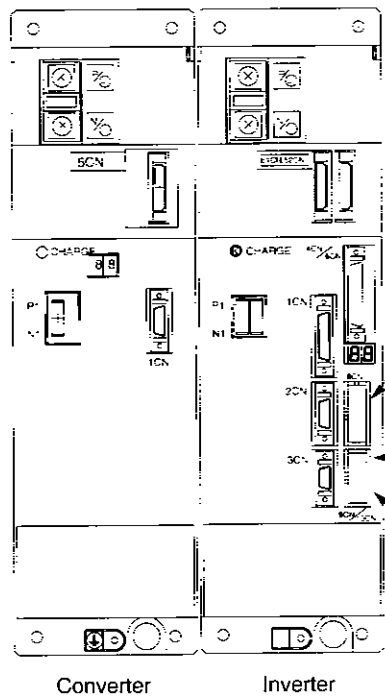
|    |        |    |          |
|----|--------|----|----------|
| 50 | LM     | 25 | 0VCOM    |
| 49 | 0V     | 24 | 0VCOM    |
| 48 | 0V     | 23 | 24VCOM   |
| 47 | SM     | 22 | 24VCOM   |
| 46 | TALM   | 21 | EXTCOM0  |
| 45 | FLTCOM | 20 | EXTCOM0  |
| 44 | FLINC  | 19 | COM      |
| 43 | FLTNO  | 18 | MGR      |
| 42 | COM1   | 17 | LGR      |
| 41 | FTL    | 16 | ORT      |
| 40 | CHWE   | 15 | PPI      |
| 39 | ORE    | 14 | CHW      |
| 38 | ORG    | 13 | RST      |
| 37 | TLE    | 12 | SSC(SV)  |
| 36 | TDET   | 11 | TLL(INC) |
| 35 | SDET   | 10 | TLH      |
| 34 | AGR    | 9  | REV      |
| 33 | ZSPD   | 8  | FWD      |
| 32 | —      | 7  | EMG      |
| 31 | —      | 6  | RDY      |
| 30 | COM2   | 5  | DAS      |
| 29 | FC3    | 4  | 0V       |
| 28 | FC2    | 3  | SCOM     |
| 27 | FC1    | 2  | SS       |
| 26 | FC0    | 1  | +15V     |

|    |     |    |      |
|----|-----|----|------|
| 20 | —   | 10 | +24V |
| 19 | *PB | 9  | THSB |
| 18 | PB  | 8  | THSA |
| 17 | *PA | 7  | SS   |
| 16 | PA  | 6  | +5V  |
| 15 | *PC | 5  | +5V  |
| 14 | PC  | 4  | +5V  |
| 13 | CA2 | 3  | 0V   |
| 12 | CA1 | 2  | 0V   |
| 11 | CC  | 1  | 0V   |



|    |     |   |     |
|----|-----|---|-----|
| 14 | —   | 7 | +5V |
| 13 | —   | 6 | OP1 |
| 12 | —   | 5 | 0V  |
| 11 | +5V | 4 | RX  |
| 10 | —   | 3 | 0V  |
| 9  | +5V | 2 | TX  |
| 8  | OP2 | 1 | 0V  |

Note: Terminal arrangement is as when the connectors on the PC board are viewed from the engaged part (front of the unit).



**8CN (Option)**

|    |      |    |      |
|----|------|----|------|
| 20 | SS   | 10 | —    |
| 19 | *SPB | 9  | CPA  |
| 18 | SPB  | 8  | *CPC |
| 17 | *SPA | 7  | CPC  |
| 16 | SPA  | 6  | +5V  |
| 15 | *SPC | 5  | +5V  |
| 14 | SPC  | 4  | +5V  |
| 13 | *CPB | 3  | 0V   |
| 12 | CPB  | 2  | 0V   |
| 11 | *CPA | 1  | 0V   |

Encoder Method Orientation Card

**9CN (Option)**

|    |   |   |       |
|----|---|---|-------|
| 14 | — | 7 | *SPBO |
| 13 | — | 6 | SPBO  |
| 12 | — | 5 | *SPA0 |
| 11 | — | 4 | SPA0  |
| 10 | — | 3 | *SPCO |
| 9  | — | 2 | SPCO  |
| 8  | — | 1 | SS    |

**10CN (Option)**

|    |      |   |    |
|----|------|---|----|
| 14 | SIG- | 7 | —  |
| 13 | SIG+ | 6 | —  |
| 12 | -15V | 5 | 0V |
| 11 | —    | 4 | —  |
| 10 | +12V | 3 | 0V |
| 9  | —    | 2 | —  |
| 8  | —    | 1 | SS |

Magnetic Sensor Method Orientation Card

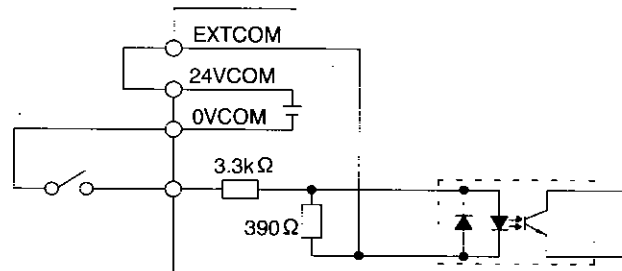
Note: Terminal arrangement is as when the connectors on the PC board are viewed from the engaged part (front of the unit).

## (3) Input Method Selection

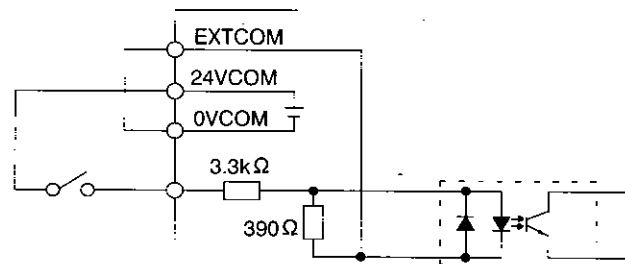
Inverter 1CN 12-bit digital reference and 6CN sequence input signal can be input with 0V common, +24V common or external common. Wiring differs according to input method used. Refer to Fig. 13 for correct wiring. For external common, use +24V (20 to 26V) power supply for input signal.

Since 1CN and 6CN common lines are insulated, common connections are possible respectively.

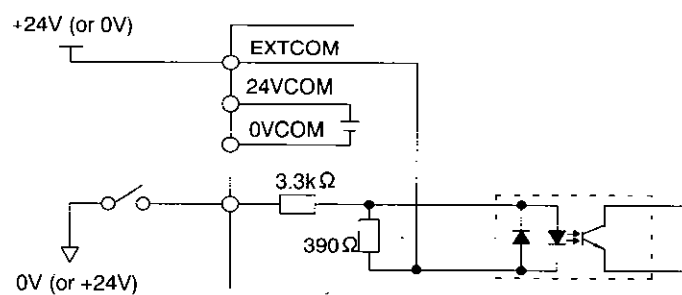
## (a) 0V Common



## (b) +24V Common



## (c) External Common



| Signal Name | Pin No. |            |
|-------------|---------|------------|
|             | 1CN     | 6CN        |
| EXTCOM      | 31      | 19, 20, 21 |
| 24VCOM      | 32      | 22, 23     |
| 0VCOM       | 33      | 24, 25     |

Fig. 13 Input Method Selection

#### (4) Precautions on Wiring of Power Lines and Control Signal Lines

For proper wiring between devices, pay attention to the following points in the design stage.

- Design the wiring route of control signal lines (1, 2, 6CN) in such a way that they will be separated from the main circuit wiring (R/L1, S/L2, T/L3) or other power lines.
- The length of the control signal lines (including motor encoder signal lines) must be less than 20 m.



1. If the power lines are provided along with the signal lines (motor encoder signal lines), a malfunction may be caused by the affect of noise generated from the power lines.
2. Excessively long motor encoder signal lines reduce the encoder power supply voltage because of voltage drop in the signal lines which may cause the inverter to malfunction.

- When twisted shielded wires are used for control signal lines, terminate them as shown in Fig. 14.

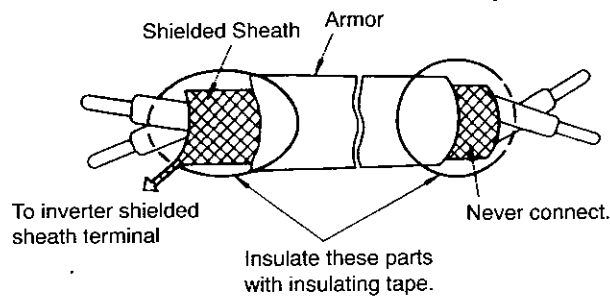


Fig. 14 Shielded Wire Termination

- Use twisted shielded wires for motor encoder signal lines and connect both ends as shown in Fig. 15.

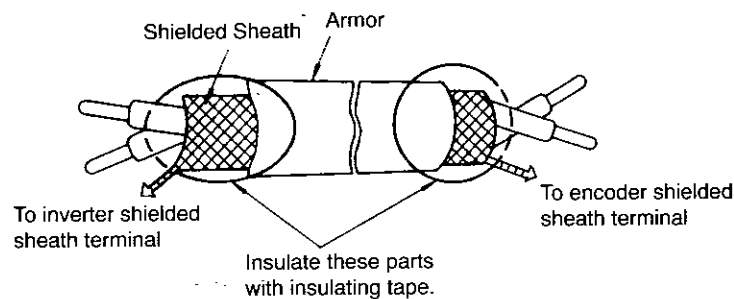


Fig. 15 Shielded Wire Termination (Shielded at Both Ends)

### 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.

## 4 OPERATION

### WARNING

- Only turn ON the input power supply after closing the upper and lower cover. Do not open the covers while current is flowing.  
Failure to observe this warning can result in an electric shock.
- Install a separate emergency stop switch. The stop button can be enabled only by a function setting.  
Failure to observe this warning can result in personal injury.

### CAUTION

- Never touch the heatsink since the temperature is very high.  
Failure to observe this caution can result in harmful burns to the body.
- Be sure that the motor and machine is within the applicable ranges before starting operation.  
Failure to observe this caution can result in personal injury.
- Do not check signals during operation.  
The machine or the unit may be damaged.
- All the constants of the inverter have been preset at the factory. Do not change the settings unnecessarily.  
The machine or the unit may be damaged.

### 4.1 TEST RUN

Before turning power ON, do the following:

- Verify there is no physical obstacle to operation.
- Notify people in the adjacent area before starting.

Turn ON power to the drive system after confirming security around the machines.

#### NOTE

Turn ON control power supply before turning ON main circuit power supply (or turn ON simultaneously). Turn OFF control power supply after turning OFF main circuit power supply (or turn OFF simultaneously). If not, a breakdown may occur in the converter or the inverter.

### (1) Turning ON Control Power Supply

When the control power supply is turned ON, “ - U ” is displayed in the converter 7-segment LED display section and “ - b ” is displayed in the inverter 7-segment LED display section. If not, search for the cause following the list of fault display in Tables 20 and 21.

For the details of LED displays, refer to Table 14.

### (2) Turning ON Main Circuit Power Supply

When the main circuit power supply is turned ON, the converter 7-segment LED display is changed to “ - b ”. At the same time, the inverter and the converter CHARGE LEDs light in red. If any fault is displayed, search for the cause following the list of fault display in Tables 20 and 21.

When “ - U ” is displayed continuously on the 7-segment LED of the converter, main circuit input voltage may be low or open-phase occurs. Check the input supply voltage.

### (3) Checking Motor Cooling Fan

When the main-circuit power supply is turned ON, the motor cooling fan starts rotating.

Verify that cooling air for the motor flows in the direction shown in Fig. 16.

According to the standard specifications, cooling air is taken in from the drive end and exhausted from opposite the drive end.

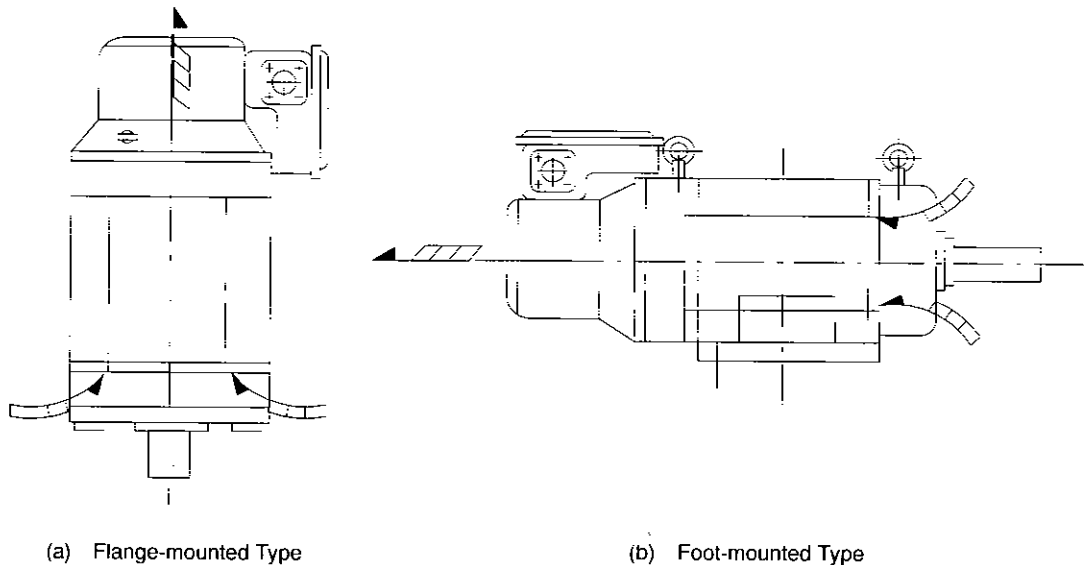


Fig. 16 Motor Cooling Air Passage

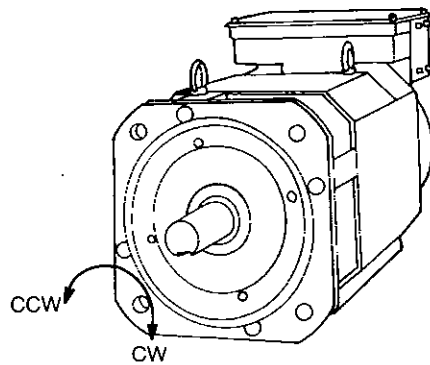
#### (4) Operation

After checking, input a run signal to start the drive unit operation. By inputting a run signal, the converter and inverter 7-segment LED displays are changed to “ - r .” Gradually raise speed reference from 0%. The motor starts rotating.

Verify that the motor turns in the proper direction. When forward run is commanded (by FWD) and speed reference is positive, the motor shaft turns counterclockwise (CCW) when viewed from the load machine. If the rotation direction is reversed, or if the motor does not turn but only buzzes or vibrates after the run signal is input, phases of the power cable or encoder signal wire may be connected wrong. Turn OFF power, and make sure that CHARGE LED and 7-segment LEDs are OFF. Then, check the wiring.

When the motor turns in the proper direction, switch forward and reverse run and verify that acceleration and deceleration are smooth in both forward and reverse directions.

At the same time, check for excessive motor vibration or noise. Stationary sound at several kHz is due to the control method and do not indicate any abnormality.



|             |     |     |     |
|-------------|-----|-----|-----|
| Run Command |     | ⊖   | ⊕   |
| Run Signal  | FWD | CCW | CW  |
|             | REV | CW  | CCW |

Fig. 17 Motor Rotation Direction

## 4.2 CONTENTS OF 7-SEGMENT LED DISPLAY

The following describes the contents of the 7-segment LED display of the converter and the inverter.

Table 14 Contents of 7-segment LED Display

#### Converter

| Display                       | Description   |
|-------------------------------|---|
| - U                           | Indicates the status where the main circuit power supply is not turned ON or input voltage is lower than specified value (undervoltage) even if power supply is ON.                       |
| - b                           | Indicates the status where the inverter is not running.   |
| - r                           | Indicates the converter is running.   |
| 2 -<br>(Fault occurrence No.) | Fault display. Displays the fault occurrence No. and fault contents alternately. (The example indicates the second occurrence fault is overcurrent. For other faults, refer to Table 20.) |
| 0 1<br>(Fault contents)       |   |



## Inverter

| Display  | Description  |
|--|--|
| - b  | Indicates the status where run command is not input (base blocked).  |
| - r  | Indicates the converter is running.  |
| 2 -<br>(Fault occurrence No.)<br>4 2<br>(Fault contents) | Fault display. Displays the fault occurrence No. and fault contents alternately. (The example indicates the second occurrence fault is motor thermistor disconnection. For other faults, refer to Table 20.)<br>When the fault occurrence is only one, displays the fault contents only. |

## (1) Display when Turning ON Converter Control Power Supply

When control power supply is turned ON, converter control PC board software version No. will be displayed on the 2-digit 7-segment LED. (Software version No. displayed from 0□20.)

Example: Software version No.0020

Turning ON  
Control Power Supply

88

When the control power supply is turned ON, "88" is displayed for 1 sec.

00

The first 2 letters of the software version are displayed for 2 sec.

20

The last 2 letters of the software version are displayed for 2 sec.

- U

Indicates the converter is ready for operation.

## (2) Fault Display

When more than two faults are detected by converter or inverter, up to four fault contents are recorded in converter and up to six in inverter to check the order of the fault occurrence. (The display automatically changes.)

Example: When overcurrent (fault No. 01) and output overvoltage (fault No. 11) occurred

1 -

Indicates the first fault. (Displayed for 1 sec.)

0 1

Indicates the overcurrent fault. (Displayed for 2 sec.)

2 -

Indicates the second fault. (Displayed for 1 sec.)

1 1

Indicates the output overvoltage fault. (Displayed for 2 sec.)

## 5 OPERATION OF DIGITAL OPERATOR

### WARNING

- Disconnect all power before removing digital operator (JVOP-132). Then wait for the time described on warning labels after main circuit power supply and control power supply are disconnected and all LEDs of the inverter and the converter are extinguished. Failure to observe this warning can result in an electric shock.

This section explains the functions, operation method, and control constants of the digital operator (JVOP-132). Be thoroughly familiar with the different procedures before turning power ON.

### 5.1 MOUNTING OF DIGITAL OPERATOR

VS-626M5 can support the multi-functional display digital operator (JVOP-132) as an option. The exclusive-use extension cable (72616-W5301 or 72616-W5303) is required when connecting the digital operator with the inverter. Use 3CN to mount the digital operator firmly as follows.

- ① Turn OFF the inverter power supply.
- ② Connect the extension cable on both inverter and digital operator sides. (See Fig. 18.)
- ③ After inserting the connector into the inverter, tighten two connector screws to prevent the connector from being removed.
- ④ Install the cable holder on the digital operator side with the provided tapping screws to prevent the cable from dropping.

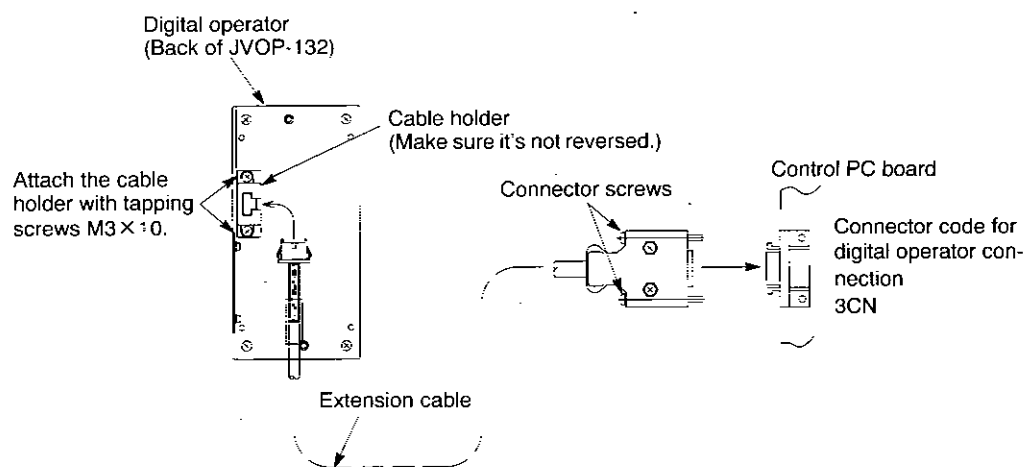


Fig. 18 Extension Cable Installation

## 5.2 FUNCTIONS OF DIGITAL OPERATOR

The digital operator enables the following:

(1) Display of Control Signal Status

Status of control signals of each unit is displayed by monitoring the status of operation. For the display items, see APPENDIX 5.

(2) Display and Setup of Control Constants

Control constants must be set up for normal operation in compliance with the specifications. APPENDIX 6 lists the control constants.

(3) Display of Protective Functions

If an error occurs during operation, protective functions are displayed. Tables 20 to 22 list the protective functions. These are not displayed when operation is normal.

(4) Function by the Digital Operator

Stand-alone operation without sequence input signals or speed reference is possible by using the digital operator. This function is effective for test run of inverter/converter connected only to motor. For the details of the operation, see Par. 5.3 (5) "Digital Operator Operation Mode."

Fig. 19 shows the display section and operation keys of the digital operator, and Fig. 20 shows the LED display status of the RUN and STOP keys. Table 15 shows the displayed characters and the corresponding alphabets and numbers, and Fig. 21 shows the display of bit selection signal.

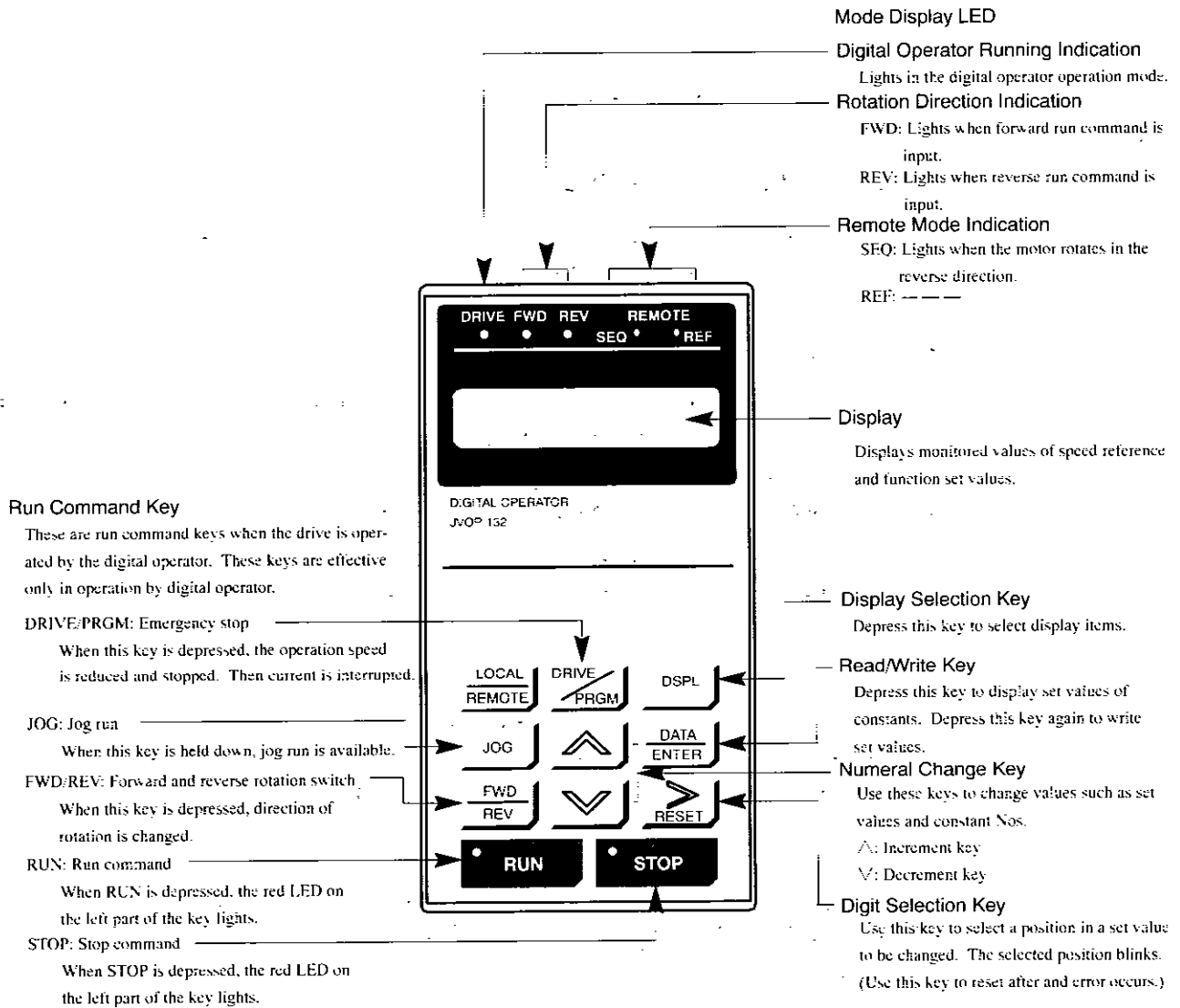


Fig. 19 Display Unit and Operation Keys of the Digital Operator

RUN and STOP LEDs light, blink, and go OFF depending on the status of operation.

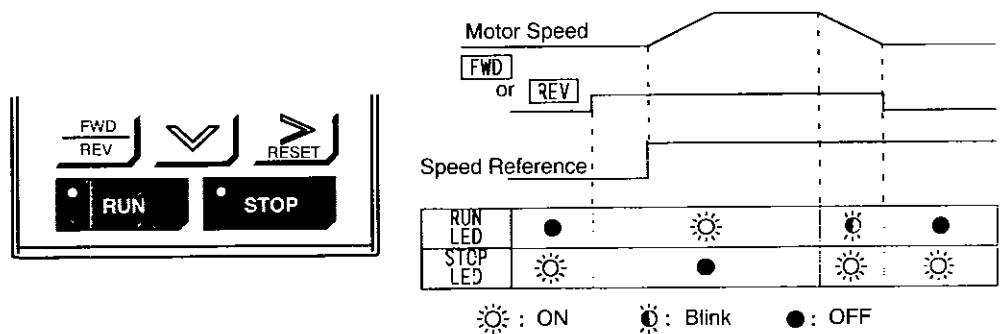


Fig. 20 LED Display of RUN and STOP Keys

Table 15 Indication of Numbers and Letters by 7-segment LED

| Numbers |          | Letters |          |   |          |
|---------|----------|---------|----------|---|----------|
| 0       | <i>0</i> | A       | <i>R</i> | N | —        |
| 1       | <i>1</i> | B       | <i>b</i> | O | —        |
| 2       | <i>2</i> | C       | <i>C</i> | P | <i>P</i> |
| 3       | <i>3</i> | D       | <i>d</i> | Q | —        |
| 4       | <i>4</i> | E       | <i>E</i> | R | <i>r</i> |
| 5       | <i>5</i> | F       | <i>F</i> | S | —        |
| 6       | <i>6</i> | G       | —        | T | —        |
| 7       | <i>7</i> | H       | —        | U | <i>U</i> |
| 8       | <i>8</i> | I       | —        | V | —        |
| 9       | <i>9</i> | J       | —        | W | —        |
| .       | .        | K       | —        | X | —        |
| —       | —        | L       | <i>L</i> | Y | —        |
|         |          | M       | —        | Z | —        |

Note: "—" is not displayed.

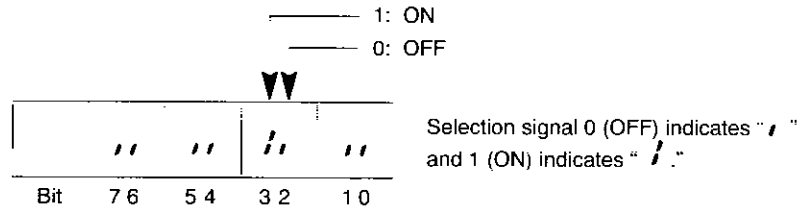


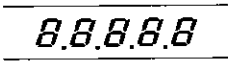
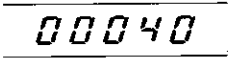
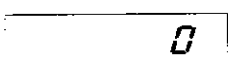
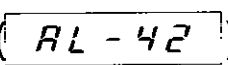
Fig. 21 Display of Bit Selection Signal

## 5.3 KEY OPERATIONS AND DISPLAY

This paragraph describes how to operate the digital operator keys and display.



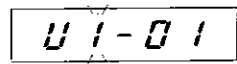

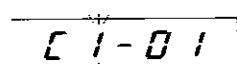

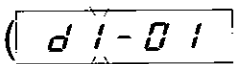



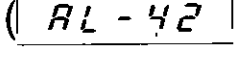

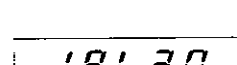
### (1) Indication at Power-ON

Digital operator display at control power supply ON is shown below.

| Description  | Digital Operator Display  | Remarks   |
|--|---|---|
| <ul style="list-style-type: none"> <li>Turn ON control power supply.</li> <li>All LEDs light.</li> </ul>                           |  | Displayed for 1.5 sec.  |
| <ul style="list-style-type: none"> <li>PROM No. is displayed.</li> </ul>   |  | Displayed for 0.5 sec.<br>The lower 5 digits of PROM No. are displayed.<br>The example uses PROM No. "VSM200040." |
| <ul style="list-style-type: none"> <li>U1-01 (motor speed) data is displayed.</li> </ul>   |  | Because the motor does not rotate when power supply is turned ON, "0" is displayed.                               |
| <ul style="list-style-type: none"> <li>The fault No. is displayed. (Displayed when a protective function is activated.)</li> </ul> |  | AL-42 indicates motor thermistor is disconnected when motor encoder signal 2CN is disconnected.                   |

### (2) Switching Display Functions

Depress [DSPL] key on the digital operator to change the mode of display.

| Description   | Key Sequence   | Digital Operator Display   | Remarks   |
|---|--|--|---|
| <ul style="list-style-type: none"> <li>Motor speed (U1-01) data is displayed.</li> </ul>  |  |  |   |
| <ul style="list-style-type: none"> <li>Motor speed data No. is displayed. (Operation status display has been selected.)</li> </ul>                                      | DSPL  |  | Control signal status of each unit can be monitored.  |
| <ul style="list-style-type: none"> <li>Control constants display is selected.</li> </ul>  | DSPL  |  | Control constants are displayed/set.  |
| <ul style="list-style-type: none"> <li>Digital operator run command display is selected. (Displayed when bits 0 and 1 of control constant C1-37 are set ON.)</li> </ul> | DSPL  |  | Use when operating by digital operator.   |
| <ul style="list-style-type: none"> <li>The fault No. display is selected. (Displayed when a protective function is activated.)</li> </ul>                               | DSPL  |  | Contents of currently occurring fault are displayed.<br>AL-42 indicates motor thermistor disconnection is detected. |
| <ul style="list-style-type: none"> <li>Fault record display is selected.</li> </ul>   | DSPL  |  | Contents of past faults are displayed.<br>1AL30 indicates the last fault is encoder signal disconnection.           |
| <ul style="list-style-type: none"> <li>Returns to operation status display.</li> </ul>  | DSPL  |  |   |

### (3) Operation Status Display Mode

To check data in operation status display mode, do as follows. The following shows the example where U1-09 (sequence input signal status) is to be changed.

| Description                              | Key Sequence | Digital Operator Display | Remarks  |
|--|--------------|--------------------------|--|
| · U1-01 is displayed.                    |              |                          |  |
| · Move blinking cursor to the data No.   |              |                          | Depress [>] key once more to return the blinking cursor.                   |
| · Select U1-09.                          |              |                          |  |
| · Display U1-09 data contents.           |              |                          | The display example is the status when [RDY] and [EMG] signals are closed. |
| · Return to operation status No. display |              |                          |  |

For explanations of operation status display, refer to APPENDIX 5.

### (4) Control Constant Display Mode

To check data or set/change a constant in control constant display mode, do as follow. The following shows the example where C1-10 (soft-start time) is to be changed.

| Description                               | Key Sequence | Digital Operator Display | Remarks  |
|---|--------------|--------------------------|--|
| · C1-01 is displayed.                     |              |                          |  |
| · Move blinking cursor to the data No.    |              |                          | Depress [>] key once more to return the blinking cursor. |
| · Select C1-10.                           |              |                          |  |
| · Display C1-10 data contents.            |              |                          | Depress [>] key once more to return the blinking cursor. |
| · Select data line to be changed.         |              |                          |  |
| · Change set value. (1→5)                 |              |                          | Displayed for 0.5 sec. *                                 |
| · Write-in set value.                     |              |                          |  |
|   |              |                          | Returns to previous display before write-in.             |
| · Return to control constant No. display. |              |                          |  |

\* When data outside the input range are set, "End" will not appear on the display and all data lines will continue blinking even when the [DATA/ENTER] is held down. To correct this condition, depress [DSPL] key returning to the data number display and correct the settings.

Refer to APPENDIX 6 for contents of control constants.



The following are constants that cannot be changed during operation:  
 C1-25 to 59, C2-09 to 27, C3-09 to 25: Cannot be changed during operation. Change when stopped.  
 C1-01 to 24, C2-01 to 08, C3-01 to 08: Can be changed during operation or when stopped.

(5) Digital Operator Operation Mode

In digital operator operation mode, operation is enabled by commands from the digital operator. The following table shows the operation. Change the lower 2 bits of C1-37 from "00" to "11" to turn ON the operation mode.

| Description  | Key Sequence | Digital Operator Display | Remarks  |
|--|--------------|--------------------------|--|
| · C1-37 is selected.                                       |              |                          |  |
| · Display C1-37 data contents.                             |              |                          |  |
| · Select the digit of bit 1 (second place from the right). |              |                          |  |
| · Change set value. (Turn ON lower two bits.)              |              |                          |  |
| · Write-in set value.                                      |              |                          | Displayed for 0.5 sec.                         |
|  |              |                          | Returns to previous display before write-in.   |
| · Return to control constants display.                     |              |                          | Effective for digital operator operation mode. |



Table 16 shows the reference list in digital operator operation. Operation control signals (sequence input) and speed references displayed among reference display are handled similar to constant setup.

Table 16 Parameters for Digital Operator Operations






| Constants No. | Name                              | Unit   | Contents   |
|---------------|-----------------------------------|--------|--|
| d1-01         | Operation signal (Sequence input) | Binary | <p>Bit 9 8 7 6 5 4 3 2 1 0</p> <p>TLJI<br/>TLL<br/>SSC<br/>CHW<br/>PPI<br/>ORT<br/>LGR<br/>MGR</p> |
| d1-02         | Speed reference                   | %      | Displayed in % for rated speed setting (C1-26)   |

Set the speed reference in digital operator operation to d1-02.

| Description                  | Key Sequence | Digital Operator Display | Remarks  |
|------------------------------|--------------|--------------------------|--|
| Select d1-01.                |              |                          |  |
| Select d1-02.                |              |                          |  |
| Display d1-02 data contents. |              |                          |  |
| Set speed reference (25%).   |              |                          | Speed reference is displayed as a percentage of rated speed settings (C1-26). For rated speed of 6000 r/min, 25% reference will become 1500 r/min reference. |
| Write-in set value.          | <br><br>     | <br>                     | Displayed for 0.5 sec.<br>Returns to previous display before write-in.   |

The following table shows the keys used in the digital operator operation mode. Rotating direction is selected by [FWD/REV] key and run/stop by [RUN] or [STOP] key.

Table 17 Key Operations in Digital Operator Operation Mode

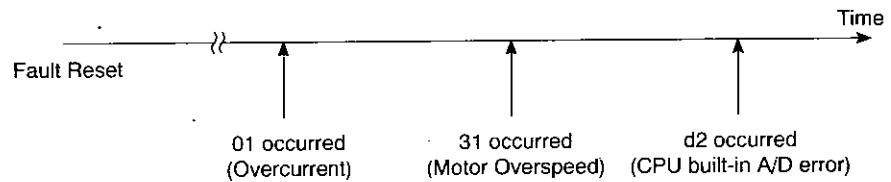
| Key   | Name               | Function   |
|---|--------------------|--|
|  | Emergency stop key | When the key is depressed, current is shut off after deceleration to stop.                                 |
|  | Jog run key        | Jog run can be performed when the key is held down. [Runs at 5% reference of rated speed setting (C1-26).] |
|  | FWD/REV run key    | FWD/REV run is switched when the key is depressed. (FWD/REV LED lights alternately.)                       |
|  | Run command key    | Depress the key to start operation. (Red LED on the left lights during run.)                               |
|  | Stop command key   | Depress the key to stop operation. (Red LED on the left lights during stop.)                               |

To return to operation mode using a regular external run command, change the lower 2 bits of C1-37 from “11” to “00.”

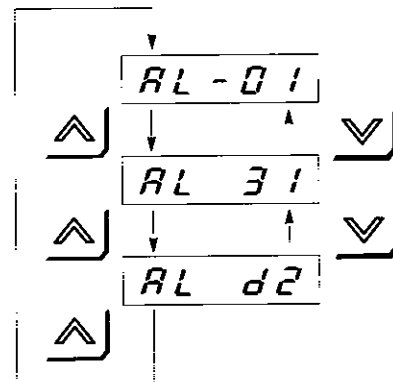
#### (6) Fault Display Mode

If a protective function is activated because of a fault, the fault code is displayed. Up to six faults are recorded to view the order of a series of faults.

Display Example



- Displays the first fault No.
- Displays the second fault No.
- Displays the third fault No.



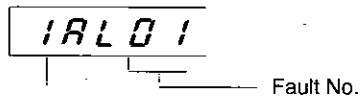
#### NOTE

##### Notes on resetting faults

- To reset a fault by the digital operator after removing the cause, press [RESET] key in fault display mode. In other modes, [RESET] key cannot reset the fault.
- Before resetting, turn OFF the run command signals (FWD, REV, ORT) that are externally input.

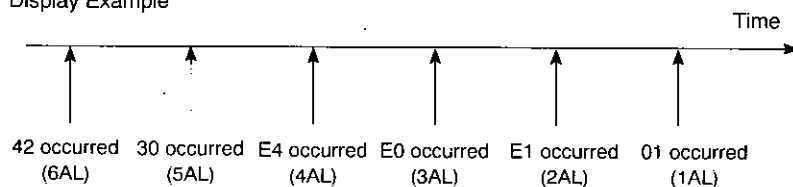
(7) Fault Record Display Mode

Up to six faults can be displayed in order from most recent to oldest.



Fault Occurrence No. (1 to 6)  
The larger the number, the older the fault data.

Display Example



• Displays the last fault No.

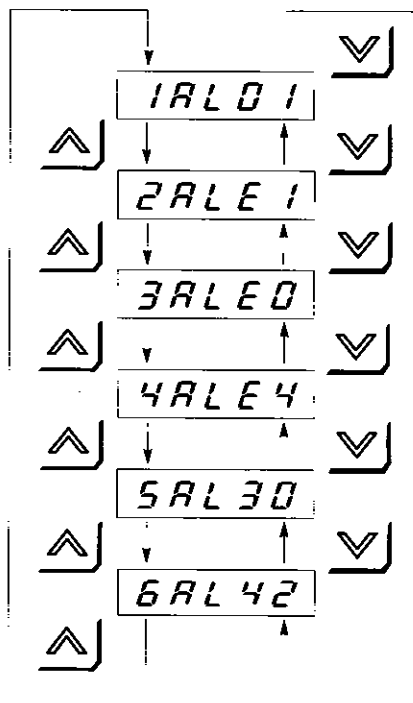
• Displays the second most recent fault No.

• Displays the third most recent fault No.

• Displays the fourth most recent fault No.

• Displays the fifth most recent fault No.

• Displays the sixth most recent fault No.



- Fault record data are not erased by fault reset or turning OFF power supply. (The data will not affect the operation.)
- To erase fault record data, turn ON bit 0 of C1-57 (right end) and turn OFF the control power supply. When power is turned ON again, data will be erased and bit 0 of C1-57 will automatically be turned OFF.

## 6 MAINTENANCE AND INSPECTION

### WARNING

- Do not touch the inverter and the converter terminals. Some of the terminals carry voltages and are extremely dangerous.  
Failure to observe this warning can result in an electric shock.
- Close upper and lower covers before powering up the inverter or the converter. To open the covers, make sure to shut OFF the molded-case circuit breaker.  
Failure to observe this warning can result in an electric shock.
- Perform maintenance or inspection only after verifying that the CHARGE LED and 7-segment LED go OFF, after the main circuit power supply and control power supply are 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 electric shock.)  
Failure to observe this warning can result in an electric 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.

This chapter describes basic maintenance and inspection procedures for the VS-626M5 and the VS-656MR5.

## 6.1 PERIODIC INSPECTION

The VS-626M5 and the VS-656MR5 will function longer if they are kept clean, cool and dry, while observing the precautions listed in Par. 2.1. Check for tightness of electrical connections, discoloration or other signs of overheating or aging. Use Table 18 as your inspection guide. Before servicing, turn OFF AC main circuit power and be sure that the CHARGE LED and 7-segment LED are OFF.

Table 18 Periodic Inspection

|                    | Component   | Check  | Corrective Action   |
|--------------------|---|--|---|
| Inverter Converter | 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 $39.2 \times 10^4$ to $58.8 \times 10^4$ Pa (4 to 6kg-cm <sup>2</sup> ) pressure.   |
|                    | Printed Circuit Board                                     | Accumulation of conductive dust or oil   | Blow with dry compressed air of $39.2 \times 10^4$ to $58.8 \times 10^4$ Pa (4 to 6kg-cm <sup>2</sup> ) pressure. If dust and oil cannot be removed, replace the board. |
|                    | Cooling Fan   | <ul style="list-style-type: none"> <li>• For abnormal noise and vibration</li> <li>• Whether the cumulative operation time exceeds 20,000 hours or not.</li> </ul> | Replace the cooling fan.  |
|                    | Power Elements  | Accumulation of dust and dirt  | Blow with dry compressed air of $39.2 \times 10^4$ to $58.8 \times 10^4$ Pa (4 to 6kg-cm <sup>2</sup> ) pressure.   |
|                    | Smoothing Capacitor                                       | Discoloration or odor  | Replace the capacitor or converter unit.  |
| Related to Bearing | Bearing Noise   | Abnormal noise or increase of noise level  | Replace the bearing.  |
|                    | Vibration   | Abnormal vibration   |   |
|                    | Bearing Temperature                                       | Abnormal temperature rise  |   |
|                    | Grease  | No leakage   | Remove the cause to recover.  |
| Motor Cooling Fan  | Operation Status  | Normal operation   | Remove the cause of fan halt or replace the fan if a fault is found.  |

## 6.2 PARTS REPLACEMENT SCHEDULE (GUIDELINES)

Replace the following parts periodically, for a long, safe, trouble free working life of VS-626M5 and VS-656MR5.

Table 19 Parts Replacement Schedule

|                    | Parts                                       | Interval (Approx.)     | Remarks  |
|--------------------|---|------------------------|--|
| Inverter Converter | 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.)                    |
| Motor              | Bearing                                     | 12000 hours or 2 years | Disassemble and replace worn items or provide necessary maintenance. |
|                    | Cooling Fan                                 | 15000 hours or 2 years | Replace the fan.   |
|                    | Overhaul                                    | 20000 hours or 5 years | Contact your YASKAWA representative.                                 |

Note: Operating conditions are as follows:

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

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## 7 TROUBLESHOOTING

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

When the VS-626M5 or the VS-656MR5 detects a fault, the fault No. is displayed on the 7-segment LED, activates the fault contact output and the motor coasts to a stop. Check the cause in Tables 20 to 22 and take corrective actions.

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

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



### NOTE

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#### Notes on resetting faults

- To reset a fault by the digital operator after removing the cause, press [RESET] key in fault display mode. In other modes, [RESET] key cannot reset the fault.
  - Before resetting, turn OFF run command signals (FWD, REV, ORT) that are externally input.
-

## 7.1 LIST OF CONVERTER FAULTS

If a fault occurs during operation, protective functions are activated depending on the fault and operation is stopped. The contents of the faults are displayed on the 7-segment LED in numbers.

Table 20 Converter Fault Diagnosis and Corrective Actions

| Fault No. | Name                                 | Contents   | Corrective Actions  |
|-----------|--------------------------------------|--|---|
| 01        | Overcurrent                          | Output current exceeded overcurrent detection level.   | <ul style="list-style-type: none"> <li>• Check the wiring.</li> <li>• Check the input supply voltage.</li> <li>• Check the AC reactor.</li> <li>• Check the load shaft (inverter, servo) capacity.</li> </ul> |
| 04        | Main circuit fuse blown              | Main circuit fuse was blown.   | Check for damaged transistor, load side short circuit, grounding, etc.  |
| 05        | Overload                             | Output current exceeded overload level.  | <ul style="list-style-type: none"> <li>• Reduce the load.</li> <li>• Check the load shaft (inverter, servo) capacity.</li> </ul>  |
| 11        | Output overvoltage                   | Output voltage exceeded overvoltage level.<br>Detection level:<br>200V class: Approx. 400V<br>400V class: Approx. 800V | <ul style="list-style-type: none"> <li>• Check the input supply voltage.</li> <li>• Check the load shaft (inverter, servo) capacity.</li> </ul>   |
| 12        | Main circuit undervoltage            | Main circuit input voltage became lower than undervoltage detection level.   | Check the input supply voltage.   |
| 13        | Control circuit undervoltage         | Control circuit power supply became lower than undervoltage detection level.   | Check the control supply voltage.   |
| 14        | Servo unit power supply fault        | Control supply voltage supplied to servo unit was not normal.  |   |
| 15        | Power supply frequency fault         | Excessive power supply frequency deviation (50Hz or 60Hz $\pm$ 5%)   | Check the input power waveform.   |
| 16        | Initial charging fault               | Charging of main circuit capacitor was not completed within set time.  | Replace the unit.   |
| 23        | Built-in MC operation fault          | Magnetic contactor did not function.   |   |
| 43        | Heatsink overheat 1                  | Heatsink temperature exceeded upper limit (minor fault).   | Check the ambient temperature for effective cooling.  |
| 44        | Heatsink overheat 2                  | Heatsink temperature over upper limit continued for one minute or longer.  |   |
| 45        | Heatsink thermistor disconnection    | Thermistor for heatsink temperature detection was disconnected.  | Replace the unit.   |
|           |                                      | The ambient temperature is low [-20°C (-4°F) or below].  | Raise the ambient temperature to above -20°C (-4°F).  |
| 46        | Control PC board temperature fault 1 | Control PC board temperature exceeded +80°C (176°F) (minor fault).   | Check the ambient temperature for effective cooling.  |
| 47        | Control PC board temperature fault 2 | Control PC board temperature exceeded +85°C (185°F).   |   |
| d2        | CPU built-in A/D error               | Built-in A/D converter error   | Replace the control PC board.   |
| F0        | ROM error                            | Memory (PROM) error  |   |
| F1        | EEPROM error                         | Memory (EEPROM) error  |   |
| F5        | CPU error                            | CPU error  |   |
| .         | Control PC board fault               | WDT time exceeded.   |   |

## 7.2 LIST OF INVERTER FAULTS

If a fault occurs during operation, protective functions are activated depending on the fault and operation is stopped. The contents of the faults are displayed on the digital operator (option) in AL codes and on the 7-segment LEDs in numbers.

Fault codes are output as signals to pins 26 to 29 of 6CN as shown in Fig.22. In the figure, ○ indicates ON and ● indicates OFF.

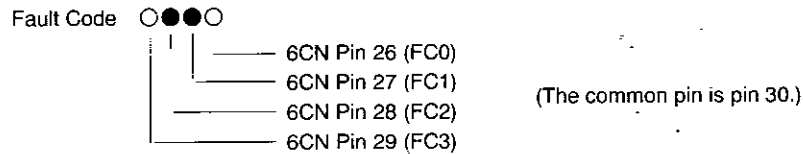


Fig. 22 Fault Code Output

Table 21 Inverter Fault Diagnosis and Corrective Actions

| Fault No.    | Name   | Contents  | Corrective Actions  | Fault Code |
|--------------|--|---|---|------------|
| <b>AL-01</b> | Overcurrent  | Output current exceeded overcurrent detection value, or inverter output (load) was short-circuited. | Check the wiring for looseness, etc.  | ●●●●       |
| <b>AL-02</b> | Ground fault   | Inverter output side ground current exceeded grounding detection level.                             | <ul style="list-style-type: none"> <li>Check the motor for deterioration of insulation.</li> <li>Check the wiring between inverter and motor.</li> </ul>  | ●●●●       |
| <b>AL-04</b> | Main circuit fuse blown                                    | DC circuit fuse was blown.  | <ul style="list-style-type: none"> <li>Check for damage to transistor, short-circuits on load side, ground fault, etc.</li> <li>Check the inverter output wiring.</li> </ul>  | ●●●●       |
| <b>AL-05</b> | Inverter output overload                                   | Output current of 120% of 30-minute rating runs for over one minute.                                | <ul style="list-style-type: none"> <li>Reduce the load.</li> <li>Check the load shaft (inverter, servo) capacity.</li> </ul>  | ●●●●       |
| <b>AL-06</b> | Motor overload   | Motor overload capacity exceeded.   | Reduce the load.  | ●●●●       |
| <b>AL-07</b> | Motor Overload (When the motor is locked) (IPM motor only) | The motor exceeded the overload level at low speed (30 r/min or less).                              | <ul style="list-style-type: none"> <li>Check that the load is heavy or a tool is jammed.</li> <li>Make sure that the motor shaft rotates. (Check if a motor fault or a contact between the rotor and the stator occurs, or if a bearing is damaged.)</li> </ul> | ●●●●       |
| <b>AL-10</b> | Converter fault  | A fault occurred in converter unit.   | Check fault contents by using converter LED.  | ●●●○       |
| <b>AL-11</b> | Main circuit overvoltage                                   | Main circuit DC bus voltage exceeded the overvoltage set value.                                     | <ul style="list-style-type: none"> <li>Check the input supply voltage.</li> <li>Check the load shaft (inverter, servo) capacity.</li> <li>Check the control constants.</li> </ul>   | ●●●○       |
| <b>AL-12</b> | Main circuit undervoltage                                  | Main circuit DC bus voltage became lower than undervoltage detection level during run.              | Check the input supply voltage.   | ●●●○       |
| <b>AL-13</b> | Control circuit undervoltage                               | Control circuit power supply became lower than undervoltage detection level.                        | Check the control supply voltage.   | ●●●○       |
| <b>AL-20</b> | Winding selection fault                                    | Winding selection was not completed within set time.  | <ul style="list-style-type: none"> <li>Check the control constant C1-25.</li> <li>Check magnetic contactor wiring for winding selection.</li> </ul>   | ●●○●       |

(Cont'd)



Table 21 Inverter Fault Diagnosis and Corrective Actions (Cont'd)

| Fault No.    | Name                                  | Contents  | Corrective Actions  | Fault Code |
|--------------|---------------------------------------|---|---|------------|
| <b>AL-21</b> | Emergency stop fault                  | Inverter did not stop within 10 seconds after emergency stop command.   | <ul style="list-style-type: none"> <li>Check control constant C1-25.</li> <li>Check the setting of control constant C1-24 and whether external torque limit signals TLL and TLH are input.</li> </ul>   | ●●○○       |
| <b>AL-30</b> | Encoder signal cable disconnection    | Motor encoder signal was disconnected or connected improperly.  | Check the wiring of encoder signal lines.   | ●●○○       |
| <b>AL-31</b> | Motor overspeed                       | Motor speed exceeded 120% of set rated speed.   | <ul style="list-style-type: none"> <li>Check that encoder signal lines are separated from main circuit or other power lines.</li> <li>Check the control constants.</li> </ul>   | ●●○○       |
| <b>AL-32</b> | Excessive speed deviation             | Speed falls to less than 50% of reference value.  | <ul style="list-style-type: none"> <li>Check that the load is heavy or a tool is jammed.</li> <li>Check whether external torque limit signals TLL and TLH are input.</li> <li>Check the control constants.</li> <li>Check the wiring of encoder signal lines.</li> </ul>  | ●●○○       |
| <b>AL-33</b> | Load fault                            | Inverter output (U/T1, V/T2, W/T3) was disconnected.  | Check inverter output wiring.   | ●●○○       |
| <b>AL-34</b> | Motor Lock Detection (IPM motor only) | The motor is locked. (The motor speed remains at 35 r/min or lower for 10 seconds during the torque reference saturation.)            | <ul style="list-style-type: none"> <li>Check that the load is heavy or a tool is jammed.</li> <li>Check the wiring between inverter and motor.</li> <li>Check the wiring of encoder signal lines.</li> <li>Make sure that the motor shaft rotates.</li> <li>Check if a motor fault or a contact between rotor and stator occurs, or if a bearing is damaged.</li> </ul> | ●●○○       |
| <b>AL-40</b> | Motor overheat 1                      | Motor temperature exceeded upper limit (minor fault).   | <ul style="list-style-type: none"> <li>Check the wiring.</li> <li>Check that motor cooling air is normal with power ON.</li> </ul>  | ●○●●       |
| <b>AL-41</b> | Motor overheat 2                      | Motor temperature over upper limit continued for over one minute.   | <ul style="list-style-type: none"> <li>Check that the fan is not clogged with dust or oil.</li> <li>Check the wiring of motor thermistor signal lines.</li> </ul>   | ●○●●       |
| <b>AL-42</b> | Motor thermistor disconnection        | Motor temperature detection thermistor was disconnected.  | <ul style="list-style-type: none"> <li>Check the motor thermistor signal wiring.</li> <li>Check the motor ambient temperature. [Raise the temperature to above -10°C (14°F) or more.]</li> </ul>  | ●○●●       |
| <b>AL-43</b> | Heatsink overheat 1                   | Heatsink temperature exceeded upper limit (minor fault).  | Check the ambient temperature for effective cooling.  | ●○●●       |
| <b>AL-44</b> | Heatsink overheat 2                   | Heatsink temperature over upper limit continued for one minute or longer.   |   | ●○●●       |
| <b>AL-45</b> | Heatsink thermistor disconnection     | <p>Thermistor for heatsink temperature detection was disconnected.</p> <p>The ambient temperature is low [-20°C (-4°F) or below].</p> | <ul style="list-style-type: none"> <li>Replace the unit.</li> <li>Raise the ambient temperature to above -20°C (-4°F).</li> </ul>   | ●○●●       |
| <b>AL-46</b> | Control PC board temperature fault 1  | Control PC board temperature exceeded +80°C (176°F) (minor fault).  | Check the ambient temperature for effective cooling.  | ●○●●       |
| <b>AL-47</b> | Control PC board temperature fault 2  | Control PC board temperature exceeded +85°C (185°F).  | Check the ambient temperature for effective cooling.  | ●○●●       |
| <b>AL-48</b> | Internal cooling fan fault            | Inverter internal cooling fan is stopped.   | Replace the internal cooling fan.   | ●○●●       |

(Cont'd)

Table 21 Inverter Fault Diagnosis and Corrective Actions (Cont'd)

| Fault No.    | Name   | Contents   | Corrective Actions  | Fault Code  |
|--------------|--|--|---|---|
| <b>AL-60</b> | Tune-up incomplete<br>(Encoder method orientation)                             | Orientation command was input before tuning up (minor fault).  | Perform orientation tune-up.  | ●○○●  |
| <b>AL-61</b> | Phase C signal detection error   | Phase C signal could not be detected during tuning up.   | <ul style="list-style-type: none"> <li>Check the wiring of encoder signal lines.</li> <li>Check that encoder signal lines are separated from main circuit or other power lines.</li> </ul>  | ●○○●  |
| <b>AL-62</b> | Phase C signal width error   | Phase C signal width exceeded 100 pulses.  |   | ●○○●  |
| <b>AL-63</b> | Fault of number of pulses per rotation<br>(Encoder method orientation)         | Number of pulses per rotation exceeded $4096 \pm 1$ during tuning up.  |   | <ul style="list-style-type: none"> <li>Verify that motor and inverter are grounded.</li> <li>Replace the orientation card.</li> <li>Replace the encoder.</li> </ul> |
| <b>AL-64</b> | Position detection signal cable disconnection                                  | Position detection encoder signal cable was disconnected or connected improperly.  | <ul style="list-style-type: none"> <li>Check the wiring of load shaft encoder signal lines.</li> <li>Replace the load shaft encoder.</li> <li>Replace the orientation card.</li> </ul>  | ●○○●  |
| <b>AL-65</b> | INC signal error<br>(Encoder method orientation)                               | INC signal input timing error (minor fault)  | After carrying out absolute positioning, change circuit to command INC signal.  | ●○○●  |
| <b>AL-70</b> | Tune-up incomplete<br>(magnetic sensor method orientation)                     | Orientation command was input before tuning up (minor fault).  | Perform orientation tune-up.  | ●○○○  |
| <b>AL-71</b> | Magnetic sensor signal detection error   | Incorrect magnetic sensor signal voltage level during tuning up.   | <ul style="list-style-type: none"> <li>Check the wiring of magnetic sensor signal lines.</li> <li>Replace the magnetic sensor or magnetizer.</li> </ul>   | ●○○○  |
| <b>AL-73</b> | Fault of number of pulses per rotation<br>(magnetic sensor method orientation) | Number of motor pulses per spindle rotation ( $4096 \div \text{speed gear ratio}$ ) exceeded $\pm 6\%$ during tuning up. | <ul style="list-style-type: none"> <li>Check control constants C1-27, 28, 29.</li> <li>Check the wiring of motor encoder signal lines.</li> </ul>   | ●○○○  |
| <b>AL-74</b> | Magnetic sensor signal disconnection   | Magnetic sensor signal cable was disconnected or connected improperly.   | <ul style="list-style-type: none"> <li>Check the wiring of magnetic sensor signal lines.</li> <li>Replace the magnetic sensor or magnetizer.</li> <li>Perform tune-up again.</li> </ul>   | ●○○○  |
| <b>AL-75</b> | INC signal error<br>(Magnetic sensor method orientation)                       | INC signal input timing error (minor fault)  | After carrying out absolute positioning, change circuit to command INC signal.  | ●○○○  |
| <b>AL-b0</b> | Initial Origin Detection Error<br>(For IPM motors only)                        | When the power is turned ON, a phase-C signal cannot be detected while detecting the initial origin.                     | <ul style="list-style-type: none"> <li>Check the wiring of the C-phase signal of the encoder.</li> <li>Replace the encoder or motor.</li> <li>Replace the control card.</li> </ul>  | ○●○○  |
| <b>AL-b1</b> | Encoder Pulse Number Error<br>(For IPM motor only)                             | The encoder pulse number per rotation exceeded the correct value by $\pm 10$ pulses.                                     | <ul style="list-style-type: none"> <li>Check the wiring of the encoder signal lines.</li> <li>Check if the encoder signal line is separated from the main circuit wiring and other power cables.</li> <li>Check if the motor and the inverter are properly grounded.</li> <li>Check the encoder cable specifications. (Check if a twisted-pair shielded wire is used.)</li> <li>Replace the encoder.</li> </ul> | ○●○○  |

(Cont'd)

Table 21 Inverter Fault Diagnosis and Corrective Actions (Cont'd)

| Fault No.    | Name   | Contents   | Corrective Actions  | Fault Code |
|--------------|--|--|---|------------|
| <b>AL-b2</b> | Low Speed Winding Overspeed Error (For IPM motor only) | The motor speed exceeded the max. speed for the low speed winding.   | Check the external sequence to verify that the winding change point is correct.   | ○●○○       |
| <b>AL-d1</b> | Speed reference A/D converter error                    | I/O card speed reference A/D converter error   | Replace the I/O card.   | ○○●○       |
| <b>AL-d2</b> | CPU built-in A/D converter error                       | CPU built-in A/D converter error   | Replace the control PC board.   | ○○●○       |
| <b>AL-d3</b> | Phase U A/D converter error                            | Phase U current detection A/D converter error  |   | ○○●○       |
| <b>AL-d4</b> | Phase W A/D converter error                            | Phase W current detection A/D converter error  |   | ○○●○       |
| <b>AL-d5</b> | Control circuit I/O fault 1                            | Data transmission error between CPUs.  | Replace the control PC board.   | ○○●○       |
| <b>AL-d6</b> | Control circuit I/O fault 2                            |  |   | ○○●○       |
| <b>AL-d7</b> | Control circuit I/O fault 3                            |  |   | ○○●○       |
| <b>AL-E0</b> | Motor code selection error                             | Selected motor code (C1-25) does not match inverter capacity (C1-56).  | Check motor model, motor code (C1-25), inverter model and inverter capacity selection (C1-56).  | ○○○●       |
| <b>AL-E1</b> | Motor code unrecorded                                  | Motor code set in C1-25 is not recorded.   | <ul style="list-style-type: none"> <li>Check motor model and motor code (C1-25).</li> <li>Check setting list for correct PROM version of motor code (C1-25).</li> </ul>                             | ○○○●       |
| <b>AL-E2</b> | Constant setting range error                           | Memory (EEPROM) data exceeded upper/lower limit.   | <ul style="list-style-type: none"> <li>Check that rated speed (C1-26) is within setting range.</li> <li>Check control constants.</li> <li>Replace the control PC board.</li> </ul>                  | ○○○●       |
| <b>AL-E3</b> | Orientation card mismatch                              | Selected orientation bit does not match orientation card.  | <ul style="list-style-type: none"> <li>Check orientation card model and orientation selection signal (bit 0 of C1-39).</li> <li>Replace the orientation card.</li> </ul>                            | ○○○●       |
| <b>AL-E4</b> | Inverter capacity selection error                      | Selected inverter capacity (C1-56) does not match the unit.  | Check inverter model and inverter capacity selection (C1-56).   | ○○○●       |
| <b>AL-F0</b> | ROM error  | Memory (PROM) error  | Replace the control PC board.   | ○○○○       |
| <b>AL-F1</b> | EEPROM error 1   | Memory (EEPROM) error  |   | ○○○○       |
| <b>AL-F2</b> | EEPROM error 2   |  |   | ○○○○       |
| <b>AL-F3</b> | EEPROM error 3   |  |   | ○○○○       |
| <b>AL-F4</b> | EEPROM error 4   |  |   | ○○○○       |
| <b>CPF00</b> | Control circuit fault 1 (operator transmission error)  | Transmission between the inverter and the digital operator cannot be established until 5 seconds after supplying power. Built-in memory fault, WDT activated.                            | <ul style="list-style-type: none"> <li>Insert the digital operator connector again.</li> <li>Check the wiring of power supply signal line of 1CN.</li> <li>Replace the control PC board.</li> </ul> | —          |
| <b>CPF01</b> | Control circuit fault 2 (operator transmission error)  | Transmission between the inverter and the digital operator is established once after supplying power, but later transmission fault continues for more than 2 seconds. WDT time exceeded. |   | —          |

## 7.3 MOTOR FAULTS AND CORRECTIVE ACTIONS

If any of the following faults occurs in the motor, check the cause and provide the relevant corrective actions.

Table 22 Motor Faults and Corrective Actions

| Fault  | Cause   | Corrective Action   |
|--|---|---|
| Motor does not rotate.                             | Protective function has been activated.                                 | Check fault No. and carry out appropriate steps.  |
|  | Converter main circuit power is not turn ON.                            | <ul style="list-style-type: none"> <li>• Turn ON power supply.</li> <li>• Check supply voltage.</li> </ul>  |
|  | Inverter output disconnection, improper connection                      | Check the wiring between inverter and motor.  |
|  | Control signal does not function.                                       | <ul style="list-style-type: none"> <li>• Check sequence input signal on operation status display (U1-09) (RDY, EMG, FWD and REV).</li> <li>• Check if speed reference is input or not on operation status display (U1-02).</li> </ul> |
|  | Torque limiting   | Check whether external torque limit signals TLL or TLH is input on operation status display (U1-09).  |
|  | Motor winding wire disconnection  | <ul style="list-style-type: none"> <li>• Check resistance between motor terminals (a circuit tester necessary).</li> <li>• Replace the motor.</li> </ul>  |
|  | Motor fault (rotor and stator rub together, broken bearing)             | <ul style="list-style-type: none"> <li>• Check motor shaft rotation manually.</li> <li>• Replace the motor.</li> </ul>  |
| Control PC board fault                             | Replace the control PC board.   |   |
| Motor rotates slowly or vibrates with no rotation. | Inverter output disconnection, improper connection                      | Check the wiring between inverter and motor.  |
|  | Encoder signal line disconnection, improper connection, loose connector | Check the wiring of encoder signal line.  |
|  | Motor encoder fault   | <ul style="list-style-type: none"> <li>• Check for abnormal changes in motor speed on speedometer or operation status display (U1-01).</li> <li>• Replace the encoder or the motor.</li> </ul>  |
|  | Speed reference signal disconnection, improper connection               | Check the wiring of speed reference signal.   |
|  | Torque limiting   | Check whether external torque limit signals TLL or TLH is input on operation status display (U1-09).  |
|  | Control PC board fault  | Replace the control PC board.   |
| Motor rotates in reverse direction.                | Improper connection of inverter output or motor encoder signal line     | Check the wiring according to the connection diagram.   |

(Cont'd)

Table 22 Motor Faults and Corrective Actions (Cont'd)

| Fault                                     | Cause   | Corrective Action  |
|---|---|--|
| Motor does not rotate at commanded speed. | Speed reference signal error  | <ul style="list-style-type: none"> <li>Check speed reference on operation status display (U1-02).</li> <li>Readjust master speed reference function.</li> </ul>  |
|   | Incorrect setting of motor rated speed                                      | Check the setting of control constant C1-26.   |
|   | Motor speed adjustment error  | Check motor speed on operation status display (U1-01) and adjust the speed using control constant C1-12.   |
|   | Speed is controlled by P control.   | Check if PPI signal is input or not on operation status display (U1-09).   |
|   | Torque limiting   | Check whether external torque limit signals TLL or TLH is input on operation status display (U1-09).   |
|   | Control PC board fault  | Replace the control PC board.  |
| Extended accel/decel time                 | Soft starter time setting error (Set time is too long.)                     | Check the setting of control constant C1-10.   |
|   | Motor code selection error  | Check the setting of control constant C1-25 on the setting list.   |
|   | Torque limiting   | Check whether external torque limit signals TLL or TLH is input on operation status display (U1-09).   |
|   | Excess load on load machine   | <ul style="list-style-type: none"> <li>Check load status on the load factor meter for loss and inertia moment of the load machine.</li> <li>Increase the capacity of inverter and motor.</li> </ul>  |
|   | Control PC board fault  | Replace the control PC board.  |
| Heavy motor noise, vibration              | Inverter output disconnection   | Check wiring between inverter and motor.   |
|   | Grounding error of motor or inverter  | Check continuity of motor and inverter to see if they are securely grounded.   |
|   | Malfunction due to noise (Poor encoder characteristics)                     | <ul style="list-style-type: none"> <li>Check that encoder signal lines are separated from inverter output wiring or other power lines.</li> <li>Check encoder cable specifications (whether the cable is a twisted pair shielded wire).</li> </ul> |
|   | Control constant setting error (especially speed control proportional gain) | Check control constants on the setting list.   |
|   | Motor installation error  | Check for loose mounting bolts.  |
|   | Unbalanced motor  | <ul style="list-style-type: none"> <li>Check if rotor is balanced.</li> <li>Replace the motor.</li> </ul>  |
|   | Motor fault (Motor bearing fault, rotor fault)                              | <ul style="list-style-type: none"> <li>Run a motor alone to check if noise and vibration are within specifications.</li> <li>Replace the motor.</li> </ul>   |
|   | Defective load machine coupling or centering                                | Confirm that coupling and centering are appropriate according to the connection with load machine.   |
|   | Insufficient strength of load machine                                       | Check the load machine for deformations or resonance.  |
|   | Loose foundation bolts  | Check for loose foundation bolts on load machine.  |
| Control PC board fault                    | Replace the control PC board.   |  |

(Cont'd)

Table 22 Motor Faults and Corrective Actions (Cont'd)

| Fault  | Cause  | Corrective Action  |
|--|--|--|
| Motor does not stop.   | Control signal does not operate.   | Check that operation signal (FWD or REV) is open on operation status display (U1-09).  |
|  | Control PC board fault   | Replace the control PC board.  |
| Motor does not stop at orientation.<br>(encoder method orientation)            | Orientation signal ORT is not input.   | Check that orientation signal ORT is closed on operation status display (U1-09).   |
|  | Encoder signal line disconnection, improper connection, loose connector                      | Check the wiring of encoder signal lines.  |
|  | Encoder fault  | <ul style="list-style-type: none"> <li>· Check for abnormal changes in motor speed on the speedometer or operation status display (U1-01).</li> <li>· Replace the encoder or the motor.</li> </ul>   |
|  | Fault of orientation card or control PC board  | Replace the orientation card or the control PC board.  |
| Motor does not stop at orientation.<br>(magnetic sensor method orientation)    | Orientation signal ORT is not input.   | Check that orientation signal ORT is closed on operation status display (U1-09).   |
|  | Incorrect transmission ratio setting   | Verify the machine data for transmission ratio values (C1-27 to 29).   |
|  | Magnetic sensor signal line disconnection, improper connection, loose connector              | Check the wiring of magnetic sensor signal lines.  |
|  | Fault of magnetic sensor or magnetizer   | Rotate the load shaft and verify that ORG signal lights once per rotation on operation status display (U1-10).   |
|  | Fault of orientation card or control PC board  | Replace the orientation card or the control PC board.  |
| Stop position differs from commanded position.<br>(encoder method orientation) | Incorrect setting of stop position reference   | Check whether the position reference is correct on operation status display (U2-04).   |
|  | Incorrect selection of binary/BCD reference or incorrect setting of BCD reference resolution | Check the setting of control constants C2-22 bit 3 and C2-12.  |
|  | Incorrect selection of reference point at incremental positioning                            | Check the setting of control constant C2-22 bit 5.   |
|  | Improper setting of load shaft zero-point position   | <ul style="list-style-type: none"> <li>· Perform positioning at zero-point to measure position accuracy.</li> <li>· Perform tune-up again to set the load shaft zero-point.</li> </ul>   |
|  | Encoder signal line disconnection, improper connection, loose connector                      | Check the wiring of encoder signal lines.  |
|  | Malfunction due to noise (Poor encoder characteristics)                                      | <ul style="list-style-type: none"> <li>· Check that encoder signal lines are separated from inverter output wiring or other power lines.</li> <li>· Check encoder cable specifications (whether the cable is a twisted pair shielded wire).</li> </ul> |
|  | Control PC board fault   | Replace the control PC board.  |

(Cont'd)

Table 22 Motor Faults and Corrective Actions (Cont'd)

| Fault  | Cause  | Corrective Action   |
|--|--|---|
| Stop position differs from commanded position.<br>(magnetic sensor method orientation) | Magnetic sensor signal line disconnection, loose connector   | Check the wiring of magnetic sensor signal lines.   |
|  | Fault of orientation card or control PC board  | Replace the orientation card or the control PC board.   |
| Orientation completion signal is not output.   | Orientation signal ORT is not input.   | Check that orientation signal ORT is closed on operation status display (U1-09).  |
|  | Incorrect setting of selection signal<br>(Completion signal is not output at tuning of initial setting.) | Set tune-up operation selection signal (C2-22 or C3-22, bit 4) to "1."  |
|  | Incorrect speed changing ratio setting   | Verify the machine data for transmission ratio values (C1-27 to 29).  |
|  | Position control proportional gain is high.  | <ul style="list-style-type: none"> <li>• Check that no vibration occurs in the forward and reverse directions near the stop position.</li> <li>• Lower position control proportional gain to reduce vibration.</li> </ul>                         |
|  | Position control proportional gain is low.   | <ul style="list-style-type: none"> <li>• Check that the load shaft has reached the stop position on operation status display (U2-03 or U3-03).</li> <li>• Increase position control proportional gain to reach the commanded position.</li> </ul> |
|  | Fault of orientation card or control PC board  | Replace the orientation card or the control PC board.   |

# APPENDIX 1 SPECIFICATIONS

Table A-1 Standard 200V Series

| Model UAASK <input type="checkbox"/> FZ |  | A-04                                     | A-06   | A-08              | A-11             | A-15             | A-19             | A-22             | J-30             | J-37             |                          |                   |  |
|---|--|--|--|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|--------------------------|-------------------|--|
| Motor                                   | Rated Output <sup>*1</sup>                                   | 30-minute Rating (50%ED)                 | 5.7 <sup>2</sup><br>(3.7)  | 7.5<br>(5.5)      | 10<br>(7.5)      | 15<br>(11)       | 20<br>(15)       | 25<br>(18.5)     | 30<br>(22)       | 40<br>(30)       | 50<br>(37)               |                   |  |
|   | HP (kW)  | Continuous Rating                        | 3<br>(2.2)   | 5<br>(3.7)        | 7.5<br>(5.5)     | 10<br>(7.5)      | 15<br>(11)       | 20<br>(15)       | 25<br>(18.5)     | 30<br>(22)       | 40<br>(30)               |                   |  |
|   | Rated speed (r/min)  | Base Speed                               | 1500   |                   |                  |                  |                  |                  |                  |                  | 1150                     |                   |  |
|   |  | Maximum Speed                            | 8000   |                   |                  |                  | 6000             |                  |                  |                  | 4500                     |                   |  |
|   | Output Torque at Base Speed Continuous Rating                | N·m                                      | 14.0   | 23.5              | 35.0             | 47.7             | 70.0             | 95.0             | 117.6            | 182.3            | 249.1                    |                   |  |
|   |  | lb·ft (kgf·m)                            | 10.4<br>(1.43)   | 17.4<br>(2.40)    | 25.8<br>(3.57)   | 35.8<br>(4.87)   | 51.7<br>(7.14)   | 70.6<br>(9.74)   | 86.9<br>(12.0)   | 134<br>(18.6)    | 183.7<br>(25.4)          |                   |  |
|   | Rotor Inertia (GD <sup>2</sup> /4)                           | lb·ft <sup>2</sup> (kg·m <sup>2</sup> )  | 0.209<br>(0.0088)  | 0.411<br>(0.0173) | 0.617<br>(0.026) | 0.759<br>(0.032) | 1.614<br>(0.068) | 1.970<br>(0.083) | 2.326<br>(0.098) | 6.122<br>(0.258) | 8.068<br>(0.340)         |                   |  |
|   | Rotor GD <sup>2</sup>  | lb·ft <sup>2</sup> (kgf·m <sup>2</sup> ) | 0.831<br>(0.035)   | 1.637<br>(0.069)  | 2.492<br>(0.105) | 3.061<br>(0.129) | 6.478<br>(0.273) | 7.902<br>(0.333) | 9.278<br>(0.391) | 24.54<br>(1.034) | 32.27<br>(1.360)         |                   |  |
|   | Overload Capacity  | 120%, 1 minute of 30-minute rating       |  |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
|   | Vibration  | (μ·m)                                    | V5   |                   |                  |                  |                  |                  |                  |                  | V10                      |                   |  |
| Noise Level                             | 75dB (A) or less   |  |  |                   |                  |                  |                  |                  | 80dB (A) or less |                  |                          |                   |  |
| Ambient Temperature, Humidity           | 0°C to +40°C (32°F to 104°F), 95%RH or less (non-condensing) |  |  |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
| Approx. Mass                            | lb (kg)  | 71<br>(32)                               | 119<br>(54)  | 130<br>(59)       | 150<br>(68)      | 207<br>(94)      | 238<br>(108)     | 269<br>(122)     | 481<br>(218)     | 580<br>(263)     |                          |                   |  |
| Controller                              | Model CIMR-M5A <input type="checkbox"/>                      |  | 23P7   | 25P5              | 27P5             | 2011             | 2015             | 2018             | 2022             | 2030             | 2037                     |                   |  |
|   | Continuous Rating Input Current (A)                          |  | 17.6   | 17.6              | 26.2             | 35.7             | 52.4             | 71.4             | 88.1             | 104.8            | 142.8                    |                   |  |
|   | Continuous Rating Output Current (A)                         |  | 21   | 21                | 31               | 40               | 56               | 80               | 98               | 113              | 160                      |                   |  |
|   | Control Method   |  | Sine wave PWM inverter (Vector control)  |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
|   | Speed Control Range  |  | 40 r/min to maximum motor speed  |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
|   | Speed Regulation   |  | 0.2% maximum speed or less   |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
|   | Overload Capacity  |  | 120%, 1 minute of 30-minute rating   |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
|   | Approx. Mass   |  | lb (kg)  |                   |                  | 11 (5)           |                  |                  | 27 (12)          |                  |                          | 35 (16) : 57 (26) |  |
|   | Dimensions in inches (mm) <sup>*3</sup>                      |  | Width  |                   | 3.94 (100)       |                  |                  | 5.91 (150)       |                  |                  | 7.84 (200) : 11.82 (300) |                   |  |
|   |  |  | Height   |                   | 13.78 (350)      |                  |                  |                  |                  |                  |                          |                   |  |
| Depth                                   |  |  | 12.60 (320)  |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
| Converter <sup>*4</sup>                 | Model CIMR-MR5A <input type="checkbox"/>                     |  | 23P7   | 25P5              | 27P5             | 2011             | 2015             | 2018             | 2022             | 2030             | 2037                     |                   |  |
|   | Required Power Capacity (kVA)                                |  | 7  | 9                 | 12               | 19               | 24               | 30               | 36               | 48               | 60                       |                   |  |
|   | Continuous Rating Input Current (A)                          |  | 13.3   | 13.3              | 19.7             | 26.8             | 39.3             | 53.6             | 66.1             | 78.6             | 107.2                    |                   |  |
|   | Continuous Rating Output Current (A)                         |  | 17.6   | 17.6              | 26.2             | 35.7             | 52.4             | 71.4             | 88.1             | 104.8            | 142.8                    |                   |  |
|   | Power Supply   |  | Three-phase, 200VAC (50/60Hz): 220VAC (50/60Hz): 230VAC (60Hz)<br>(Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%.<br>Line-to-line voltage unbalance: 5% or less) |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
|   | Control Power Supply   |  | Single-phase, 200VAC (50/60Hz): 220VAC (50/60Hz): 230VAC (60Hz)<br>(Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%)<br>Required power capacity: 100VA             |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
|   | Control Method   |  | Power regenerative control (120° current conduction)   |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
|   | Overload Capacity  |  | 1 minute at 120%, 1 second at 200% of inverter 30-minute rating  |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
|   | Approx. Mass   |  | lb (kg)  |                   |                  | 11 (5)           |                  |                  | 27 (12)          |                  |                          | 35 (16) : 57 (26) |  |
|   | Dimensions in inches (mm) <sup>*3</sup>                      |  | Width  |                   | 3.94 (100)       |                  |                  | 5.91 (150)       |                  |                  | 7.84 (200) : 11.82 (300) |                   |  |
| Height                                  |  |  | 13.78 (350)  |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
| Depth                                   |  |  | 12.60 (320)  |                   |                  |                  |                  |                  |                  |                  |                          |                   |  |
| AC Reactor Code No.                     |  | X10057                                   | X10058   | X10059            | X10060           | X10061           | X10062           | X10063           | X10064           | X10120           |                          |                   |  |

(Cont'd)



Table A-1 Standard 200V Series(Cont'd)

| Controller | Common | Model CIMR-M5A <input type="checkbox"/> | 23P7   | 25P5 | 27P5 | 2011 | 2015 | 2018 | 2022 | 2030 | 2037 |
|------------|--------|---|--|------|------|------|------|------|------|------|------|
|            |        | CIMR-MR5A <input type="checkbox"/>      |  |      |      |      |      |      |      |      |      |
|            |        | Ambient Temperature                     | 0°C to +55°C (32°F to 131°F) (not frozen)  |      |      |      |      |      |      |      |      |
|            |        | Heatsink Intake Air Temperature         | 0°C to +45°C (32°F to 113°F)   |      |      |      |      |      |      |      |      |
|            |        | Storage Temperature <sup>*5</sup>       | -20°C to +60°C (-4°F to +140°F)  |      |      |      |      |      |      |      |      |
|            |        | Humidity                                | 90% RH or less (non-condensing)  |      |      |      |      |      |      |      |      |
|            |        | Location                                | Indoor (protected from corrosive gases and dust), elevation: 1000 m (3280 ft) or less                          |      |      |      |      |      |      |      |      |
|            |        | Vibration                               | 9.8 m/s <sup>2</sup> (1G) at 10 to less than 20 Hz, up to 2 m / s <sup>2</sup> (0.2G) at 20 to 50 Hz           |      |      |      |      |      |      |      |      |
|            |        | Protective Structure                    | IEC IP00<br>(Protected so that parts of the human body cannot reach electrically charged parts from the front) |      |      |      |      |      |      |      |      |

- \*1 Rated output power is guaranteed when input voltage is three-phase, 200V (50/60Hz), 220V (50/60Hz), 230V (60Hz). If input voltage is lower than 200V, rated output power is not guaranteed.
- \*2 15-minute rating (50%ED)/continuous rating for model UAASKA-04FZ 5/3HP (3.7/2.2kW)
- \*3 Dimensions of Heatsink externally cooling type. Refer to APPENDIX 2 for Open chassis type.
- \*4 An AC reactor is required between converter and main circuit power supply.
- \*5 Temperature during shipping.

Table A-2 Standard 400V Series

| Model UAASK <input type="checkbox"/> FZ* ** *E |   | A-06   | A-08           | A-11          | A-15          | A-19          | A-22          | J-30             | J-37          | J-45          |               |
|--|---|--|----------------|---------------|---------------|---------------|---------------|------------------|---------------|---------------|---------------|
| Motor  | Rated Output <sup>*1</sup>                    | 30-minute Rating (50%ED)   | 7.5 (5.5)      | 10 (7.5)      | 15 (11)       | 20 (15)       | 25 (18.5)     | 30 (22)          | 40 (30)       | 50 (37)       | 60 (45)       |
|  | HP (kW)                                       | Continuous Rating  | 5 (3.7)        | 7.5 (5.5)     | 10 (7.5)      | 15 (11)       | 20 (15)       | 25 (18.5)        | 30 (22)       | 40 (30)       | 50 (37)       |
|  |   | Rated speed (r/min)  | Base Speed     | 1500          |               |               |               |                  |               | 1150          |               |
|  |   | Maximum Speed  | 8000           |               | 6000          |               |               | 4500             |               |               |               |
|  | Output Torque at Base Speed Continuous Rating | N·m  | 23.5           | 35.0          | 47.7          | 70.0          | 95.0          | 117.6            | 182.3         | 249.0         | 306.8         |
|  |   | lb-ft (kgf-m)  | 17.4 (2.40)    | 25.8 (3.57)   | 35.8 (4.87)   | 51.7 (7.14)   | 70.6 (9.74)   | 86.9 (12.0)      | 134 (18.6)    | 183.7 (25.4)  | 226.4 (31.3)  |
|  | Rotor Inertia (GD <sup>2</sup> /4)            | lb-ft <sup>2</sup> (kg-m <sup>2</sup> )  | 0.411 (0.0173) | 0.617 (0.026) | 0.759 (0.032) | 1.614 (0.068) | 1.970 (0.083) | 2.326 (0.098)    | 6.122 (0.258) | 8.068 (0.340) | 11.22 (0.473) |
|  | Rotor GD <sup>2</sup>                         | lb-ft <sup>2</sup> (kgf-m <sup>2</sup> )   | 1.637 (0.069)  | 2.492 (0.105) | 3.061 (0.129) | 6.478 (0.273) | 7.902 (0.333) | 9.278 (0.391)    | 24.54 (1.034) | 32.27 (1.360) | 44.85 (1.890) |
|  | Overload Capacity                             | 120%, 1 minute of 30-minute rating   |                |               |               |               |               |                  |               |               |               |
|  | Vibration (μm)                                | V5   |                |               |               |               |               | V10              |               |               |               |
|  | Noise Level                                   | 75dB (A) or less   |                |               |               |               |               | 80dB (A) or less |               |               |               |
|  | Ambient Temperature, Humidity                 | 0°C to +40°C (32°F to 104°F), 95%RH or less (non-condensing)   |                |               |               |               |               |                  |               |               |               |
|  | Approx. Mass                                  | lb (kg)  | 119 (54)       | 130 (59)      | 150 (68)      | 207 (94)      | 238 (108)     | 269 (122)        | 481 (218)     | 580 (263)     | 783 (355)     |
|  | Inverter                                      | Model CIMR-M5A <input type="checkbox"/>  | 45P5           | 47P5          | 4011          | 4015          | 4018          | 4022             | 4030          | 4037          | 4045          |
| Continuous Rating Input Current (A)            |   | 8.8  | 13.1           | 17.9          | 26.2          | 35.7          | 44.1          | 52.4             | 71.4          | 88.2          |               |
| Continuous Rating Output Current (A)           |   | 10.4   | 15.5           | 20            | 28            | 40            | 49            | 56.5             | 80            | 98            |               |
| Control Method                                 |   | Sine wave PWM inverter (Vector control)  |                |               |               |               |               |                  |               |               |               |
| Speed Control Range                            |   | 40 r/min to maximum motor speed  |                |               |               |               |               |                  |               |               |               |
| Speed Regulation                               |   | 0.2% maximum speed or less   |                |               |               |               |               |                  |               |               |               |
| Overload Capacity <sup>*5</sup>                |   | 120%, 1 minute of 30-minute rating   |                |               |               |               |               |                  |               |               |               |
| Approx. Mass                                   |   | lb (kg)  | 11 (5)         |               | 27 (12)       |               |               | 35 (16)          |               |               |               |
| Dimensions in inches (mm) <sup>*2</sup>        |   | Width  | 3.94 (100)     |               |               | 5.91 (150)    |               |                  | 9.84 (250)    |               |               |
|  |   | Height   | 13.78 (350)    |               |               |               |               |                  |               |               |               |
|  | Depth   | 12.60 (320)  |                |               |               |               |               |                  |               |               |               |
| Controller                                     | Model CIMR-MR5A <input type="checkbox"/>      | 45P5   | 47P5           | 4011          | 4015          | 4018          | 4022          | 4030             | 4037          | 4045          |               |
|  | Required Power Capacity (kVA)                 | 9  | 12             | 19            | 24            | 30            | 36            | 48               | 60            | 70            |               |
|  | Continuous Rating Input Current (A)           | 6.7  | 9.85           | 13.4          | 19.7          | 26.8          | 35.1          | 39.3             | 53.6          | 66.2          |               |
|  | Continuous Rating Output Current (A)          | 8.8  | 13.1           | 17.9          | 26.2          | 35.7          | 44.1          | 52.4             | 71.4          | 88.2          |               |
|  | Power Supply                                  | Three-phase, 400VAC (50/60Hz); 440VAC (50/60Hz); 460VAC (60Hz)<br>(Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%.<br>Line-to-line voltage unbalance: 5% or less) |                |               |               |               |               |                  |               |               |               |
|  | Control Power Supply                          | Single-phase, 200VAC (50/60Hz); 220VAC (50/60Hz); 230VAC (60Hz)<br>(Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%)<br>Required power capacity: 100VA             |                |               |               |               |               |                  |               |               |               |
|  | Control Method                                | Power regenerative control (120° current conduction)   |                |               |               |               |               |                  |               |               |               |
|  | Overload Capacity                             | 1 minute at 120%, 1 second at 200% of inverter 30-minute rating  |                |               |               |               |               |                  |               |               |               |
|  | Approx. Mass                                  | lb (kg)  | 11 (5)         |               | 27 (12)       |               |               | 46 (21)          |               |               |               |
|  | Dimensions in inches (mm) <sup>*2</sup>       | Width  | 3.94 (100)     |               |               | 5.91 (150)    |               |                  | 9.84 (250)    |               |               |
|  |   | Height   | 13.78 (350)    |               |               |               |               |                  |               |               |               |
|  |   | Depth  | 12.60 (320)    |               |               |               |               |                  |               |               |               |
|  | AC Reactor Code No.                           |  | X02501         | X10099        | X10100        | X10101        | X10102        | X10103           | X10104        | X10105        | X10106        |

(Cont'd)

Table A-2 Standard 400V Series(Cont'd)

|            |        | Model CIMR-M5A <input type="checkbox"/> | 45P5   | 47P5 | 4011 | 4015 | 4018 | 4022 | 4030 | 4037 | 4045 |  |
|------------|--------|---|--|------|------|------|------|------|------|------|------|--|
|            |        | CIMR-MR5A <input type="checkbox"/>      |  |      |      |      |      |      |      |      |      |  |
| Controller | Common | Ambient Temperature                     | 0°C to +55°C (32°F to 131°F) (not frozen)  |      |      |      |      |      |      |      |      |  |
|            |        | Heatsink Intake Air Temperature         | 0°C to +45°C (32°F to 113°F)   |      |      |      |      |      |      |      |      |  |
|            |        | Storage Temperature *4                  | -20°C to +60°C (-4°F to +140°F)  |      |      |      |      |      |      |      |      |  |
|            |        | Humidity                                | 90% RH or less (non-condensing)  |      |      |      |      |      |      |      |      |  |
|            |        | Location                                | Indoor (protected from corrosive gases and dust), elevation: 1000 m (3280 ft) or less                          |      |      |      |      |      |      |      |      |  |
|            |        | Vibration                               | 9.8 m/s <sup>2</sup> (1G) at 10 to less than 20 Hz, up to 2 m/s <sup>2</sup> (0.2G) at 20 to 50 Hz             |      |      |      |      |      |      |      |      |  |
|            |        | Protective Structure                    | IEC IP00<br>(Protected so that parts of the human body cannot reach electrically charged parts from the front) |      |      |      |      |      |      |      |      |  |

- \*1 Rated output power is guaranteed when input voltage is three-phase, 400V (50/60Hz), 440V (50/60Hz), 460V (60Hz). If input voltage is lower than 400V, rated output power is not guaranteed.
- \*2 Dimensions of Heatsink externally cooling type. Refer to APPENDIX 2 for Open chassis type.
- \*3 An AC reactor is required between converter and main circuit power supply.
- \*4 Temperature during shipping.
- \*5 When using model 4037 and 4045 inverters, overload capacity is limited if the temperature of heatsink intake air is high. Following diagram shows the operating time at 1-minute rating and the heatsink intake air temperature.

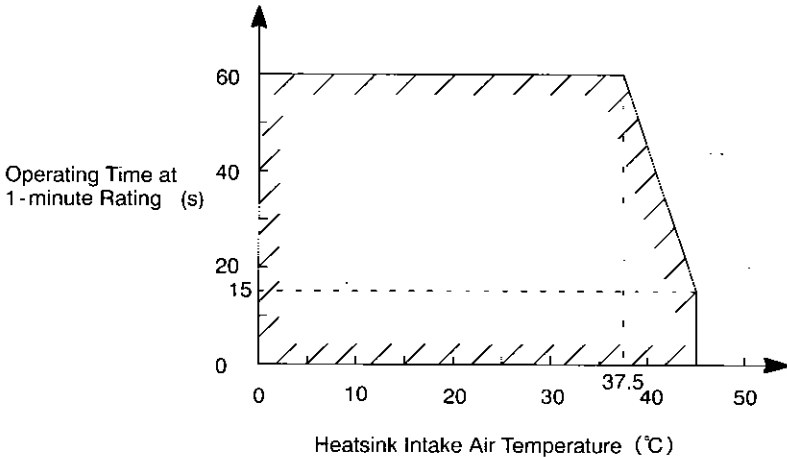


Table A-3 Winding Selection 200V Series

| Motor   |  | Model UAASK <input type="checkbox"/> FZ                      | B-06   | B-08          | B-11          | B-15             | B-19          | B-22          | B-30      |            |  |
|---|--|--|--|---------------|---------------|------------------|---------------|---------------|-----------|------------|--|
|   |  | Rated Output *1  | 30-minute Rating (50%ED)   | 7.5 (5.5)     | 10 (7.5)      | 15 (11)          | 20 (15)       | 25 (18.5)     | 30 (22)   | 40 (30)    |  |
| HP (kW)                                       | Continuous Rating                        | 5 (3.7)  | 7.5 (5.5)  | 10 (7.5)      | 15 (11)       | 20 (15)          | 25 (18.5)     | 27 (20)       |           |            |  |
| Rated speed (r/min)                           | Base Speed                               | 500  |  |               | 400           |                  |               |               |           |            |  |
|   | Maximum Speed                            | 6000   |  |               | 4800          |                  |               |               |           |            |  |
| Output Torque at Base Speed Continuous Rating | N·m                                      | 71   | 105  | 143           | 262           | 358              | 442           | 477           |           |            |  |
|   | lb·ft (kgf·m)                            | 52.3 (7.21)  | 77.6 (10.7)  | 105.9 (14.5)  | 193.6 (26.7)  | 264.5 (36.5)     | 326.2 (45.0)  | 351.8 (48.7)  |           |            |  |
| Rotor Inertia (GD <sup>2</sup> /4)            | lb·ft <sup>2</sup> (kg·m <sup>2</sup> )  | 1.614 (0.068)  | 1.970 (0.083)  | 2.563 (0.108) | 6.146 (0.259) | 11.22 (0.473)    | 13.00 (0.548) | 14.78 (0.623) |           |            |  |
|   | lb·ft <sup>2</sup> (kgf·m <sup>2</sup> ) | 6.478 (0.273)  | 7.902 (0.333)  | 10.25 (0.432) | 24.54 (1.034) | 44.90 (1.892)    | 51.97 (2.190) | 59.14 (2.492) |           |            |  |
| Overload Capacity                             |  | 120%, 1 minute of 30-minute rating                           |  |               |               |                  |               |               |           |            |  |
| Vibration (μm)                                |  | V5   |  |               |               |                  |               | V10           |           |            |  |
| Noise Level                                   |  | 75dB (A) or less   |  |               |               | 80dB (A) or less |               |               |           |            |  |
| Ambient Temperature, Humidity                 |  | 0°C to +40°C (32°F to 104°F), 95%RH or less (non-condensing) |  |               |               |                  |               |               |           |            |  |
| Approx. Mass                                  |  | lb (kg)  | 207 (94)   | 238 (108)     | 291 (132)     | 481 (218)        | 783 (355)     | 893 (405)     | 948 (430) |            |  |
| Inverter                                      |  | Model CIMR-M5A <input type="checkbox"/>                      | 25P5   | 27P5          | 2011          | 2015             | 2018          | 2022          | 2030      |            |  |
|   |  | Continuous Rating Input Current (A)                          | 17.6   | 26.2          | 35.7          | 52.4             | 71.4          | 88.1          | 104.8     |            |  |
|   |  | Continuous Rating Output Current (A)                         | 21   | 31            | 40            | 56               | 80            | 98            | 113       |            |  |
|   |  | Control Method   | Sine wave PWM inverter (Vector control)  |               |               |                  |               |               |           |            |  |
|   |  | Speed Control Range  | 40 r/min to maximum motor speed  |               |               |                  |               |               |           |            |  |
|   |  | Speed Regulation   | 0.2% maximum speed or less   |               |               |                  |               |               |           |            |  |
|   |  | Overload Capacity  | 120%, 1 minute of 30-minute rating   |               |               |                  |               |               |           |            |  |
|   |  | Approx. Mass   | lb (kg)  | 11 (5)        |               |                  | 27 (12)       |               |           | 35 (16)    |  |
|   |  | Applicable Magnetic Contactor Model                          | HV-75AP3   |               |               |                  | HV-150AP3     |               |           |            |  |
|   |  | Dimensions in inches (mm) *2                                 | Width  | 3.94 (100)    |               |                  | 5.91 (150)    |               |           | 7.84 (200) |  |
| Height  | 13.78 (350)                              |  |  |               |               |                  |               |               |           |            |  |
| Depth   | 12.60 (320)                              |  |  |               |               |                  |               |               |           |            |  |
| Controller                                    |  | Model CIMR-MR5A <input type="checkbox"/>                     | 25P5   | 27P5          | 2011          | 2015             | 2018          | 2022          | 2030      |            |  |
|   |  | Required Power Capacity (kVA)                                | 9  | 12            | 19            | 24               | 30            | 36            | 48        |            |  |
|   |  | Continuous Rating Input Current (A)                          | 13.3   | 19.7          | 26.8          | 39.3             | 53.6          | 66.1          | 78.6      |            |  |
|   |  | Continuous Rating Output Current (A)                         | 17.6   | 26.2          | 35.7          | 52.4             | 71.4          | 88.1          | 104.8     |            |  |
|   |  | Power Supply   | Three-phase, 200VAC (50/60Hz); 220VAC (50/60Hz); 230VAC (60Hz)<br>(Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%.<br>Line-to-line voltage unbalance: 5% or less) |               |               |                  |               |               |           |            |  |
|   |  | Control Power Supply   | Single-phase, 200VAC (50/60Hz); 220VAC (50/60Hz); 230VAC (60Hz)<br>(Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%)<br>Required power capacity: 100VA             |               |               |                  |               |               |           |            |  |
|   |  | Control Method   | Power regenerative control (120° current conduction)   |               |               |                  |               |               |           |            |  |
|   |  | Overload Capacity  | 1 minute at 120%, 1 second at 200% of inverter 30-minute rating  |               |               |                  |               |               |           |            |  |
|   |  | Approx. Mass   | lb (kg)  | 11 (5)        |               |                  | 27 (12)       |               |           | 35 (16)    |  |
|   |  | Dimensions in inches (mm) *2                                 | Width  | 3.94 (100)    |               |                  | 5.91 (150)    |               |           | 7.84 (200) |  |
| Height  | 13.78 (350)                              |  |  |               |               |                  |               |               |           |            |  |
| Depth   | 12.60 (320)                              |  |  |               |               |                  |               |               |           |            |  |
| AC Reactor Code No.                           |  | X10058   | X10059   | X10060        | X10061        | X10062           | X10063        | X10064        |           |            |  |

(Cont'd)

Table A-3 Winding Selection 200V Series(Cont'd)

| Controller | Common | Model CIMR-M5A <input type="checkbox"/> | 25P5   | 27P5 | 2011 | 2015 | 2018 | 2022 | 2030 |
|------------|--------|---|--|------|------|------|------|------|------|
|            |        | CIMR-MR5A <input type="checkbox"/>      |  |      |      |      |      |      |      |
|            |        | Ambient Temperature                     | 0°C to +55°C (32°F to 131°F) (not frozen)  |      |      |      |      |      |      |
|            |        | Heatsink Intake Air Temperature         | 0°C to +45°C (32°F to 113°F)   |      |      |      |      |      |      |
|            |        | Storage Temperature <sup>*4</sup>       | -20°C to +60°C (-4°F to +140°F)  |      |      |      |      |      |      |
|            |        | Humidity                                | 90% RH or less (non-condensing)  |      |      |      |      |      |      |
|            |        | Location                                | Indoor (protected from corrosive gases and dust), elevation: 1000 m (3280 ft) or less                          |      |      |      |      |      |      |
|            |        | Vibration                               | 9.8 m/s <sup>2</sup> (1G) at 10 to less than 20 Hz, up to 2 m / s <sup>2</sup> (0.2G) at 20 to 50 Hz           |      |      |      |      |      |      |
|            |        | Protective Structure                    | IEC IP00<br>(Protected so that parts of the human body cannot reach electrically charged parts from the front) |      |      |      |      |      |      |

\*1 Rated output power is guaranteed when input voltage is three-phase, 200V (50/60Hz), 220V (50/60Hz), 230V (60Hz). If input voltage is lower than 200V, rated output power is not guaranteed.

\*2 Dimensions of Heatsink externally cooling type. Refer to APPENDIX 2 for Open chassis type.

\*3 An AC reactor is required between converter and main circuit power supply.

\*4 Temperature during shipping.

Table A-4 Winding Selection 400V Series

| Motor                         | Model<br>UAASK <input type="checkbox"/> FZ***E               | B-06   | B-08             | B-11             | B-15             | B-19             | B-22             | B-30*1           |                  |
|-------------------------------|--|--|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                               | Rated Output<br>*2   | 30-minute Rating<br>(50%ED)  | 7.5<br>(5.5)     | 10<br>(7.5)      | 15<br>(11)       | 20<br>(15)       | 25<br>(18.5)     | 30<br>(22)       | 40<br>(30)       |
|                               |  | HP<br>(kW)   | 5<br>(3.7)       | 7.5<br>(5.5)     | 10<br>(7.5)      | 15<br>(11)       | 20<br>(15)       | 25<br>(18.5)     | 27<br>(20)       |
|                               | Rated speed<br>(r/min)                                       | Base Speed   | 500              |                  |                  | 400              |                  |                  |                  |
|                               |  | Maximum Speed  | 6000             |                  |                  | 4800             |                  |                  |                  |
|                               | Output Torque at Base<br>Speed Continuous Rating             | N·m  | 71               | 105              | 143              | 262              | 358              | 442              | 477              |
|                               |  | lb·ft<br>(kgf·m)   | 52.3<br>(7.21)   | 77.6<br>(10.7)   | 105.9<br>(14.5)  | 193.6<br>(26.7)  | 264.5<br>(36.5)  | 326.2<br>(45.0)  | 351.8<br>(48.7)  |
|                               | Rotor Inertia (GD <sup>2</sup> /4)                           | lb·ft <sup>2</sup><br>(kg·m <sup>2</sup> )   | 1.614<br>(0.068) | 1.970<br>(0.083) | 2.563<br>(0.108) | 6.146<br>(0.259) | 11.22<br>(0.473) | 13.00<br>(0.548) | 14.78<br>(0.623) |
|                               | Rotor GD <sup>2</sup>  | lb·ft <sup>2</sup><br>(kgf·m <sup>2</sup> )  | 6.478<br>(0.273) | 7.902<br>(0.333) | 10.25<br>(0.432) | 24.54<br>(1.034) | 44.90<br>(1.892) | 51.97<br>(2.190) | 59.14<br>(2.492) |
|                               | Overload Capacity  | 120%. 1 minute of 30-minute rating   |                  |                  |                  |                  |                  |                  |                  |
| Vibration                     | (μ·m)  | V5   |                  |                  |                  | V10              |                  |                  |                  |
| Noise Level                   |  | 75dB (A) or less   |                  |                  |                  | 80dB (A) or less |                  |                  |                  |
| Ambient Temperature, Humidity | 0°C to +40°C (32°F to 104°F), 95%RH or less (non-condensing) |  |                  |                  |                  |                  |                  |                  |                  |
| Approx. Mass                  | lb<br>(kg)   | 207<br>(94)  | 238<br>(108)     | 291<br>(132)     | 481<br>(218)     | 783<br>(355)     | 893<br>(405)     | 948<br>(430)     |                  |
| Inverter                      | Model CIMR-M5A <input type="checkbox"/>                      | 45P5   | 47P5             | 4011             | 4015             | 4018             | 4022             | 4030             |                  |
|                               | Continuous Rating Input Current (A)                          | 8.8  | 13.1             | 17.9             | 26.2             | 35.7             | 44.1             | 52.4             |                  |
|                               | Continuous Rating Output Current (A)                         | 10.4   | 15.5             | 20               | 28               | 40               | 49               | 56.5             |                  |
|                               | Control Method   | Sine wave PWM inverter (Vector control)  |                  |                  |                  |                  |                  |                  |                  |
|                               | Speed Control Range  | 40 r/min to maximum motor speed  |                  |                  |                  |                  |                  |                  |                  |
|                               | Speed Regulation   | 0.2% maximum speed or less   |                  |                  |                  |                  |                  |                  |                  |
|                               | Overload Capacity  | 120%. 1 minute of 30-minute rating   |                  |                  |                  |                  |                  |                  |                  |
|                               | Approx. Mass   | lb (kg)  | 11 (5)           |                  |                  | 27 (12)          |                  | 35 (16)          |                  |
|                               | Applicable Magnetic Contactor Model                          | HV-75AP3   |                  |                  |                  | HV-150AP3        |                  |                  |                  |
|                               | Dimensions in inches<br>(mm) *3                              | Width  | 3.94 (100)       |                  |                  | 5.91 (150)       |                  |                  | 9.84 (250)       |
| Height                        |  | 13.78 (350)  |                  |                  |                  |                  |                  |                  |                  |
| Depth                         |  | 12.60 (320)  |                  |                  |                  |                  |                  |                  |                  |
| Controller                    | Model CIMR-MR5A <input type="checkbox"/>                     | 45P5   | 47P5             | 4011             | 4015             | 4018             | 4022             | 4030             |                  |
|                               | Required Power Capacity (kVA)                                | 9  | 12               | 19               | 24               | 30               | 36               | 48               |                  |
|                               | Continuous Rating Input Current (A)                          | 6.7  | 9.85             | 13.4             | 19.7             | 26.8             | 33.1             | 39.3             |                  |
|                               | Continuous Rating Output Current (A)                         | 8.8  | 13.1             | 17.9             | 26.2             | 35.7             | 44.1             | 52.4             |                  |
|                               | Power Supply   | Three-phase, 200VAC (50/60Hz); 220VAC (50/60Hz); 230VAC (60Hz)<br>(Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%,<br>Line-to-line voltage unbalance: 5% or less) |                  |                  |                  |                  |                  |                  |                  |
|                               | Control Power Supply   | Single-phase, 200VAC (50/60Hz); 220VAC (50/60Hz); 230VAC (60Hz)<br>(Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%)<br>Required power capacity: 100VA             |                  |                  |                  |                  |                  |                  |                  |
|                               | Control Method   | Power regenerative control (120° current conduction)   |                  |                  |                  |                  |                  |                  |                  |
|                               | Overload Capacity  | 1 minute at 120%, 1 second at 200% of inverter 30-minute rating  |                  |                  |                  |                  |                  |                  |                  |
|                               | Approx. Mass   | lb (kg)  | 11 (5)           |                  |                  | 27 (12)          |                  | 46 (21)          |                  |
|                               | Dimensions in inches<br>(mm) *3                              | Width  | 3.94 (100)       |                  |                  | 5.91 (150)       |                  |                  | 9.84 (250)       |
| Height                        |  | 13.78 (350)  |                  |                  |                  |                  |                  |                  |                  |
| Depth                         |  | 12.60 (320)  |                  |                  |                  |                  |                  |                  |                  |
| AC Reactor Code No.           |  | X02501   | X10099           | X10100           | X10101           | X10102           | X10103           | X10104           |                  |

(Cont'd)

Table A-4 Winding Selection 400V Series(Cont'd)

| Controller | Common | Model CIMR-M5A <input type="checkbox"/> | 45P5   | 47P5 | 4011 | 4015 | 4018 | 4022 | 4030 |
|------------|--------|---|--|------|------|------|------|------|------|
|            |        | CIMR-MR5A <input type="checkbox"/>      |  |      |      |      |      |      |      |
|            |        | Ambient Temperature                     | 0°C to +55°C (32°F to 131°F) (not frozen)  |      |      |      |      |      |      |
|            |        | Heatsink Intake Air Temperature         | 0°C to +45°C (32°F to 113°F)   |      |      |      |      |      |      |
|            |        | Storage Temperature <sup>*5</sup>       | -20°C to +60°C (-4°F to +140°F)  |      |      |      |      |      |      |
|            |        | Humidity                                | 90% RH or less (non-condensing)  |      |      |      |      |      |      |
|            |        | Location                                | Indoor (protected from corrosive gases and dust), elevation: 1000 m (3280 ft) or less                          |      |      |      |      |      |      |
|            |        | Vibration                               | 9.8 m/s <sup>2</sup> (1G) at 10 to less than 20 Hz, up to 2 m/s <sup>2</sup> (0.2G) at 20 to 50 Hz             |      |      |      |      |      |      |
|            |        | Protective Structure                    | IEC IP00<br>(Protected so that parts of the human body cannot reach electrically charged parts from the front) |      |      |      |      |      |      |

\*1 20-minute rating (50% ED) / continuous rating for model UAASKB-30FZ\*\*\*E 40/27HP (30/20kW).

\*2 Rated output power is guaranteed when input voltage is three-phase, 400V (50/60Hz), 440V (50/60Hz), 460V (60Hz). If input voltage is lower than 400V, rated output power is not guaranteed.

\*3 Dimensions of Heatsink externally cooling type. Refer to APPENDIX 2 for Open chassis type.

\*4 An AC reactor is required between converter and main circuit power supply.

\*5 Temperature during shipping.

## APPENDIX 2 DIMENSIONS

### 2.1 INVERTER (VS-626M5) Heatsink Externally Cooling Type

The figures below show a 200V 10HP (7.5kW) model.

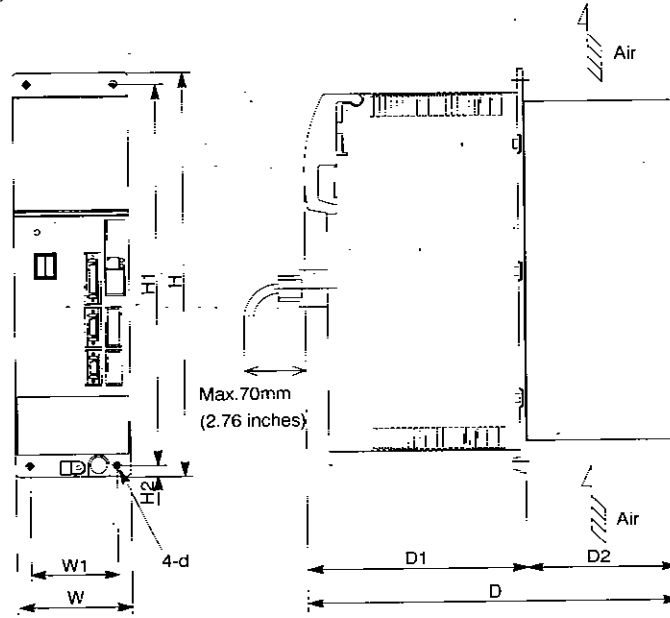


Fig. A-1 Dimensions of VS-626M5

Table A-5 VS-626M5 Dimensions and Approx. Mass

| Voltage Class | Model CIMR-M5A <input type="checkbox"/> | Heatsink Externally Cooling Type Dimensions in mm (inches) |                |               |                |                |               |               |               |                      |    |
|---------------|---|--|----------------|---------------|----------------|----------------|---------------|---------------|---------------|----------------------|----|
|               |   | W  | H              | D             | W1             | H1             | H2            | D1            | D2            | Approx. Mass kg (lb) | d  |
| 200V class    | 23P7                                    | 100<br>(3.94)  | 350<br>(13.78) | 320<br>(12.6) | 75<br>(2.95)   | 330<br>(12.99) | 10<br>(0.39)  | 190<br>(7.48) | 130<br>(5.12) | 5<br>(11)            | M5 |
|               | 25P5                                    |  |                |               |                |                |               |               |               |                      |    |
|               | 27P5                                    | 150<br>(5.91)  | 350<br>(13.78) | 320<br>(12.6) | 100<br>(3.94)  | 330<br>(12.99) | 10<br>(0.39)  | 190<br>(7.48) | 130<br>(5.12) | 12<br>(26)           | M5 |
|               | 2011                                    |  |                |               |                |                |               |               |               |                      |    |
|               | 2015                                    |  |                |               |                |                |               |               |               |                      |    |
|               | 2018                                    |  |                |               |                |                |               |               |               |                      |    |
|               | 2022                                    | 200<br>(7.87)  | 350<br>(13.78) | 320<br>(12.6) | 150<br>(5.91)  | 330<br>(12.99) | 10<br>(0.39)  | 190<br>(7.48) | 130<br>(5.12) | 16<br>(35)           | M5 |
|               | 2030                                    |  |                |               |                |                |               |               |               |                      |    |
| 2037          | 300<br>(11.81)                          | 350<br>(13.78)   | 320<br>(12.6)  | 250<br>(9.84) | 330<br>(12.99) | 10<br>(0.39)   | 190<br>(7.48) | 130<br>(5.12) | 26<br>(57)    | M6                   |    |
| 400V class    | 45P5                                    | 100<br>(3.94)  | 350<br>(13.78) | 320<br>(12.6) | 75<br>(2.95)   | 330<br>(12.99) | 10<br>(0.39)  | 190<br>(7.48) | 130<br>(5.12) | 6<br>(13)            | M5 |
|               | 47P5                                    |  |                |               |                |                |               |               |               |                      |    |
|               | 4011                                    | 150<br>(5.91)  | 350<br>(13.78) | 320<br>(12.6) | 100<br>(3.94)  | 330<br>(12.99) | 10<br>(0.39)  | 190<br>(7.48) | 130<br>(5.12) | 12<br>(26)           | M5 |
|               | 4015                                    |  |                |               |                |                |               |               |               |                      |    |
|               | 4018                                    |  |                |               |                |                |               |               |               |                      |    |
|               | 4022                                    |  |                |               |                |                |               |               |               |                      |    |
|               | 4030                                    | 250<br>(9.84)  | 350<br>(13.78) | 320<br>(12.6) | 200<br>(7.87)  | 330<br>(12.99) | 10<br>(0.39)  | 190<br>(7.48) | 130<br>(5.12) | 16<br>(35)           | M5 |
|               | 4037                                    |  |                |               |                |                |               |               |               |                      |    |
| 4045          |   |  |                |               |                |                |               |               |               |                      |    |



## 2.2 INVERTER (VS-626M5) Open Chassis Type

The figures below show a 200V 10HP (7.5kW) model.

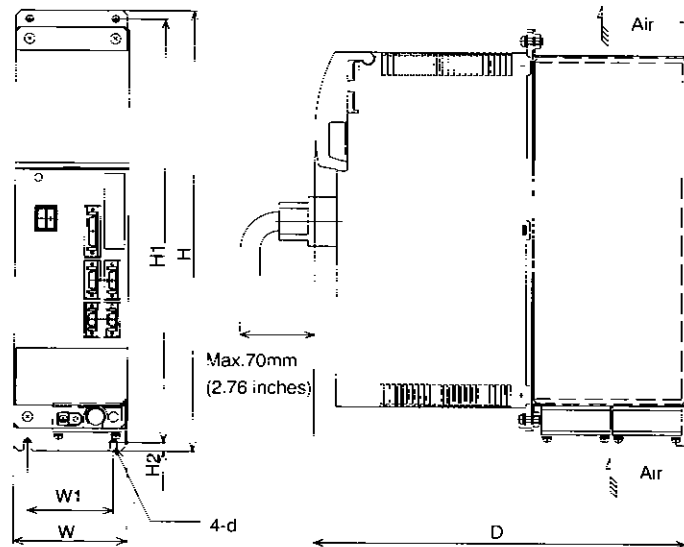


Fig. A-2 Dimensions of VS-626M5

Table A-6 VS-626M5 Dimensions and Approx. Mass

| Voltage Class | Model CIMR-M5A | Open Chassis Type Dimensions in mm (inches) |                |                |                |                |               |            | Approx. Mass<br>kg (lb) | d |
|---------------|----------------|---|----------------|----------------|----------------|----------------|---------------|------------|-------------------------|---|
|               |                | W   | H              | D              | W1             | H1             | H2            |            |                         |   |
| 200V class    | 23P7           | 100<br>(3.94)                               | 385<br>(15.16) | 324<br>(12.76) | 75<br>(2.95)   | 370<br>(14.57) | 7.5<br>(0.30) | 6<br>(13)  | M5                      |   |
|               | 25P5           |   |                |                |                |                |               |            |                         |   |
|               | 27P5           |   |                |                |                |                |               |            |                         |   |
|               | 2011           | 150<br>(5.91)                               | 470<br>(18.5)  | 324<br>(12.76) | 100<br>(3.94)  | 455<br>(17.91) | 6.5<br>(0.26) | 16<br>(35) | M5                      |   |
|               | 2015           |   |                |                |                |                |               |            |                         |   |
|               | 2018           |   |                |                |                |                |               |            |                         |   |
|               | 2022           |   |                |                |                |                |               |            |                         |   |
| 2030          | 200<br>(7.87)  | 470<br>(18.5)                               | 324<br>(12.76) | 150<br>(5.91)  | 455<br>(17.91) | 6.5<br>(0.26)  | 21.5<br>(47)  | M5         |                         |   |
| 400V class    | 45P5           | 100<br>(3.94)                               | 385<br>(15.16) | 324<br>(12.76) | 75<br>(2.95)   | 370<br>(14.57) | 7.5<br>(0.30) | 7<br>(15)  | M5                      |   |
|               | 47P5           |   |                |                |                |                |               |            |                         |   |
|               | 4011           | 150<br>(5.91)                               | 470<br>(18.5)  | 324<br>(12.76) | 100<br>(3.94)  | 455<br>(17.91) | 6.5<br>(0.26) | 16<br>(35) | M5                      |   |
|               | 4015           |   |                |                |                |                |               |            |                         |   |
|               | 4018           |   |                |                |                |                |               |            |                         |   |
| 4022          |                |   |                |                |                |                |               |            |                         |   |

## 2.3 CONVERTER (VS-656MR5) Heatsink Externally Cooling Type

The figures below show a 200V 10HP (7.5kW) model.

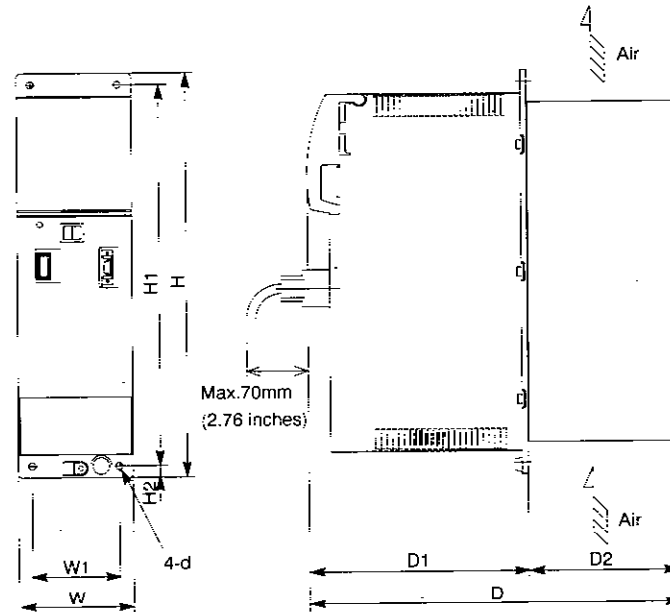


Fig. A-3 Dimensions of VS-656MR5

Table A-7 VS-656MR5 Dimensions and Approx. Mass

| Voltage Class | Model CIMR-MR5A | Heatsink Externally Cooling Type Dimensions in mm (inches) |                |               |               |                |              |               |               | Approx. Mass kg (lb) | d  |  |
|---------------|-----------------|--|----------------|---------------|---------------|----------------|--------------|---------------|---------------|----------------------|----|--|
|               |                 | W  | H              | D             | W1            | H1             | H2           | D1            | D2            |                      |    |  |
| 200V class    | 23P7            |  |                |               |               |                |              |               |               |                      |    |  |
|               | 25P5            | 100<br>(3.94)  | 350<br>(13.78) | 320<br>(12.6) | 75<br>(2.95)  | 330<br>(12.99) | 10<br>(0.39) | 190<br>(7.48) | 130<br>(5.12) | 5<br>(11)            | M5 |  |
|               | 27P5            |  |                |               |               |                |              |               |               |                      |    |  |
|               | 2011            |  |                |               |               |                |              |               |               |                      |    |  |
|               | 2015            | 150<br>(5.91)  | 350<br>(13.78) | 320<br>(12.6) | 100<br>(3.94) | 330<br>(12.99) | 10<br>(0.39) | 190<br>(7.48) | 130<br>(5.12) | 12<br>(26)           | M5 |  |
|               | 2018            |  |                |               |               |                |              |               |               |                      |    |  |
|               | 2022            |  |                |               |               |                |              |               |               |                      |    |  |
|               | 2030            | 200<br>(7.87)  | 350<br>(13.78) | 320<br>(12.6) | 150<br>(5.91) | 330<br>(12.99) | 10<br>(0.39) | 190<br>(7.48) | 130<br>(5.12) | 16<br>(35)           | M5 |  |
| 400V class    | 45P5            | 100<br>(3.94)  | 350<br>(13.78) | 320<br>(12.6) | 75<br>(2.95)  | 330<br>(12.99) | 10<br>(0.39) | 190<br>(7.48) | 130<br>(5.12) | 7<br>(15)            | M5 |  |
|               | 47P5            |  |                |               |               |                |              |               |               |                      |    |  |
|               | 4011            |  |                |               |               |                |              |               |               |                      |    |  |
|               | 4015            | 150<br>(5.91)  | 350<br>(13.78) | 320<br>(12.6) | 100<br>(3.94) | 330<br>(12.99) | 10<br>(0.39) | 190<br>(7.48) | 130<br>(5.12) | 12<br>(26)           | M5 |  |
|               | 4018            |  |                |               |               |                |              |               |               |                      |    |  |
|               | 4022            |  |                |               |               |                |              |               |               |                      |    |  |
|               | 4030            |  |                |               |               |                |              |               |               |                      |    |  |
|               | 4037            | 250<br>(9.84)  | 350<br>(13.78) | 320<br>(12.6) | 200<br>(7.87) | 330<br>(12.99) | 10<br>(0.39) | 190<br>(7.48) | 130<br>(5.12) | 21<br>(46)           | M5 |  |
|               | 4045            |  |                |               |               |                |              |               |               |                      |    |  |

## 2.4 CONVERTER (VS-656MR5) Open Chassis Type

The figures below show a 200V 10HP (7.5kW) model.

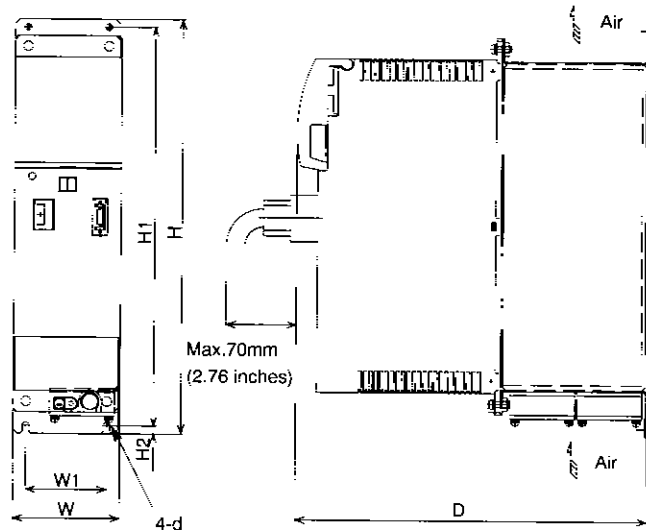


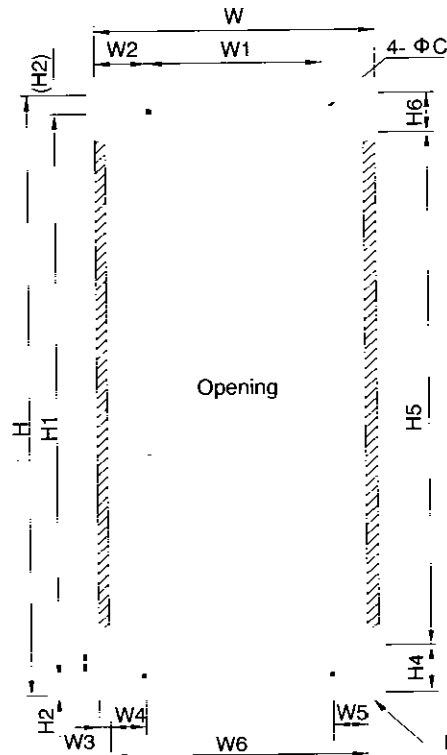
Fig. A-4 Dimensions of VS-656MR5

Table A-8 VS-656MR5 Dimensions and Approx. Mass

| Voltage Class | Model CIMR-MR5A <input type="checkbox"/> | Heatsink Externally Cooling Type Dimensions in mm (inches) |                |                |                |                |               |            | Approx. Mass kg (lb) | d |
|---------------|--|--|----------------|----------------|----------------|----------------|---------------|------------|----------------------|---|
|               |  | W  | H              | D              | W1             | H1             | H2            |            |                      |   |
| 200V class    | 23P7                                     | 100<br>(3.94)  | 385<br>(15.16) | 324<br>(12.76) | 75<br>(2.95)   | 370<br>(14.57) | 7.5<br>(0.30) | 6<br>(13)  | M5                   |   |
|               | 25P5                                     |  |                |                |                |                |               |            |                      |   |
|               | 27P5                                     |  |                |                |                |                |               |            |                      |   |
|               | 2011                                     | 150<br>(5.91)  | 470<br>(18.5)  | 324<br>(12.76) | 100<br>(3.94)  | 455<br>(17.91) | 6.5<br>(0.26) | 16<br>(35) | M5                   |   |
|               | 2015                                     |  |                |                |                |                |               |            |                      |   |
|               | 2018                                     |  |                |                |                |                |               |            |                      |   |
|               | 2022                                     |  |                |                |                |                |               |            |                      |   |
| 2030          | 200<br>(7.87)                            | 470<br>(18.5)  | 324<br>(12.76) | 150<br>(5.91)  | 455<br>(17.91) | 6.5<br>(0.26)  | 21.5<br>(47)  | M5         |                      |   |
| 400V class    | 45P5                                     | 100<br>(3.94)  | 385<br>(15.16) | 324<br>(12.76) | 75<br>(2.95)   | 370<br>(14.57) | 7.5<br>(0.30) | 8<br>(18)  | M5                   |   |
|               | 47P5                                     |  |                |                |                |                |               |            |                      |   |
|               | 4011                                     |  |                |                |                |                |               |            |                      |   |
|               | 4015                                     | 150<br>(5.91)  | 470<br>(18.5)  | 324<br>(12.76) | 100<br>(3.94)  | 455<br>(17.91) | 6.5<br>(0.26) | 16<br>(35) | M5                   |   |
|               | 4018                                     |  |                |                |                |                |               |            |                      |   |
|               | 4022                                     |  |                |                |                |                |               |            |                      |   |

## 2.5 PANEL CUTOUT DIMENSIONS (Heatsink Externally Cooling Type)

Refer to Table A-9 for panel cutout.



Dust Gasket (Hatched Area)

Note: Gasket is attached on mounting area of converter and inverter unit.

Table A-9 Panel Cutout Dimensions in mm (inches)

| Voltage class | CIMR-M5A <input type="checkbox"/><br>CIMR-MR5A <input type="checkbox"/> | W              | W1            | W2             | W3            | W4            | W5            | W6             | H             | H1            | H2           | H3           | H4           | H5            | H6           | C                |
|---------------|---|----------------|---------------|----------------|---------------|---------------|---------------|----------------|---------------|---------------|--------------|--------------|--------------|---------------|--------------|------------------|
|               |   |                |               |                |               |               |               |                |               |               |              |              |              |               |              |                  |
| 200V class    | 23P7<br>25P5<br>27P5  | 99<br>(3.90)   | 75<br>(2.95)  | 12<br>(0.47)   | 3.5<br>(0.14) | 8.5<br>(0.33) | 5.5<br>(0.22) | 89<br>(3.50)   | 350<br>(13.8) | 330<br>(13.0) | 10<br>(0.39) | 18<br>(0.71) | 28<br>(1.10) | 300<br>(11.8) | 22<br>(0.87) | Φ6<br>(0.24 dia) |
|               | 2011<br>2015<br>2018<br>2022  | 149<br>(5.87)  | 100<br>(3.94) | 24.5<br>(0.96) | 4.5<br>(0.18) | 20<br>(0.79)  | 20<br>(0.79)  | 140<br>(5.51)  | 350<br>(13.8) | 330<br>(13.0) | 10<br>(0.39) | 18<br>(0.71) | 28<br>(1.10) | 300<br>(11.8) | 22<br>(0.87) | Φ6<br>(0.24 dia) |
|               | 2030  | 199<br>(7.83)  | 150<br>(5.91) | 24.5<br>(0.96) | 4.5<br>(0.18) | 20<br>(0.79)  | 20<br>(0.79)  | 190<br>(7.48)  | 350<br>(13.8) | 330<br>(13.0) | 10<br>(0.39) | 18<br>(0.71) | 28<br>(1.10) | 300<br>(11.8) | 22<br>(0.87) | Φ6<br>(0.24 dia) |
|               | 2037  | 299<br>(11.78) | 250<br>(9.84) | 24.5<br>(0.96) | 4.5<br>(0.18) | 20<br>(0.79)  | 20<br>(0.79)  | 290<br>(11.42) | 350<br>(13.8) | 330<br>(13.0) | 10<br>(0.39) | 18<br>(0.71) | 28<br>(1.10) | 300<br>(11.8) | 22<br>(0.87) | Φ7<br>(0.28 dia) |
| 400V class    | 45P5<br>47P5  | 99<br>(3.90)   | 75<br>(2.95)  | 12<br>(0.47)   | 3.5<br>(0.14) | 8.5<br>(0.33) | 5.5<br>(0.22) | 89<br>(3.50)   | 350<br>(13.8) | 330<br>(13.0) | 10<br>(0.39) | 18<br>(0.71) | 28<br>(1.10) | 300<br>(11.8) | 22<br>(0.87) | Φ6<br>(0.24 dia) |
|               | 4011<br>4015<br>4018<br>4022  | 149<br>(5.87)  | 100<br>(3.94) | 24.5<br>(0.96) | 4.5<br>(0.18) | 20<br>(0.79)  | 20<br>(0.79)  | 140<br>(5.51)  | 350<br>(13.8) | 330<br>(13.0) | 10<br>(0.39) | 18<br>(0.71) | 28<br>(1.10) | 300<br>(11.8) | 22<br>(0.87) | Φ6<br>(0.24 dia) |
|               | 2030<br>4037<br>4045  | 249<br>(9.80)  | 200<br>(7.87) | 24.5<br>(0.96) | 4.5<br>(0.18) | 20<br>(0.79)  | 20<br>(0.79)  | 240<br>(9.45)  | 350<br>(13.8) | 330<br>(13.0) | 10<br>(0.39) | 18<br>(0.71) | 28<br>(1.10) | 300<br>(11.8) | 22<br>(0.87) | Φ6<br>(0.24 dia) |

## 2.6 CALORIFIC VALUE AND COOLING AIR SPEED

Tables A-10 to A-13 show the calorific value and cooling air speed of the inverter and the converter unit.

Table A-10 Calorific Value and Cooling Air Speed of Inverter Unit (200V class)

| Inverter Model<br>CIMR-M5A <input type="checkbox"/> |                         | 23P7                 |                    | 25P5                 |                    | 27P5                 |                    | 2011                 |                    | 2015                 |                    | 2018                 |                    | 2022                 |                    | 2030                 |                    | 2030                 |                    |
|---|-------------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|
| Output  |                         | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute |
| Open chassis type                                   |                         |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |
| Total calorific value (W)                           |                         | 185                  | 257                | 185                  | 257                | 244                  | 316                | 307                  | 427                | 454                  | 597                | 565                  | 680                | 717                  | 836                | 869                  | 1147               | 1061                 | 1344               |
| Heatsink external-ly cooling type                   | Outside of heatsink (W) | 127                  | 188                | 127                  | 188                | 167                  | 229                | 218                  | 320                | 335                  | 456                | 421                  | 519                | 537                  | 638                | 650                  | 887                | 809                  | 1029               |
|   | Inside of heatsink (W)  | 58                   | 69                 | 58                   | 69                 | 77                   | 87                 | 89                   | 107                | 119                  | 141                | 144                  | 161                | 180                  | 198                | 219                  | 260                | 252                  | 315                |
| Cooling air speed near heatsink (m/s)               |                         | 2.5                  |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |

Table A-11 Calorific Value and Cooling Air Speed of Inverter Unit (400V class)

| Inverter Model<br>CIMR-M5A <input type="checkbox"/> |                         | 45P5                 |                    | 47P5                 |                    | 4011                 |                    | 4015                 |                    | 4018                 |                    | 4022                 |                    | 4030                 |                    | 4037                 |                    | 4045                 |                    |
|---|-------------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|
| Output  |                         | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute |
| Open chassis type                                   |                         |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |
| Total calorific value (W)                           |                         | 117                  | 192                | 170                  | 247                | 273                  | 288                | 354                  | 488                | 512                  | 583                | 630                  | 674                | 759                  | 939                | 934                  | 1130               | 1298                 | 1691               |
| Heatsink external-ly cooling type                   | Outside of heatsink (W) | 56                   | 120                | 94                   | 159                | 146                  | 159                | 207                  | 321                | 328                  | 388                | 419                  | 457                | 488                  | 641                | 612                  | 778                | 910                  | 1243               |
|   | Inside of heatsink (W)  | 61                   | 72                 | 76                   | 88                 | 127                  | 129                | 147                  | 167                | 184                  | 195                | 211                  | 217                | 271                  | 298                | 322                  | 352                | 388                  | 448                |
| Cooling air speed near heatsink (m/s)               |                         | 2.5                  |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |

Table A-12 Calorific Value and Cooling Air Speed of Converter Unit (200V class)

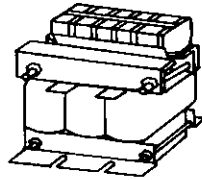
| Converter Model<br>CIMR-MR5A <input type="checkbox"/> |                               | 23P7                 |                    | 25P5                 |                    | 27P5                 |                    | 2011                 |                    | 2015                 |                    | 2018                 |                    | 2022                 |                    | 2030                 |                    | 2037                 |                    |
|---|-------------------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|
| Output  |                               | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute |
| Open chassis type<br>Total calorific value<br>(W)     |                               | 84                   | 108                | 84                   | 108                | 119                  | 144                | 152                  | 197                | 204                  | 254                | 273                  | 318                | 335                  | 380                | 392                  | 491                | 524                  | 698                |
| Heatsink<br>externally<br>cooling<br>type             | Outside of<br>heatsink<br>(W) | 40                   | 60                 | 40                   | 60                 | 58                   | 79                 | 82                   | 121                | 116                  | 158                | 165                  | 203                | 203                  | 241                | 232                  | 316                | 331                  | 426                |
|   | Inside of<br>heatsink<br>(W)  | 44                   | 48                 | 44                   | 48                 | 61                   | 65                 | 70                   | 76                 | 88                   | 96                 | 108                  | 115                | 132                  | 139                | 160                  | 175                | 193                  | 272                |
| Cooling air speed near<br>heatsink (m/s)              |                               | 2.5                  |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |

Table A-13 Calorific Value and Cooling Air Speed of Converter Unit (400V class)

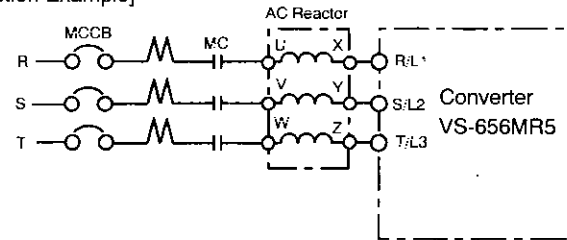
| Converter Model<br>CIMR-MR5A <input type="checkbox"/> |                               | 45P5                 |                    | 47P5                 |                    | 4011                 |                    | 4015                 |                    | 4018                 |                    | 4022                 |                    | 4030                 |                    | 4037                 |                    | 4045                 |                    |
|---|-------------------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|
| Output  |                               | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute | Con-<br>tinu-<br>ous | 30-<br>min-<br>ute |
| Open chassis type<br>Total calorific value<br>(W)     |                               | 58                   | 73                 | 76                   | 88                 | 117                  | 138                | 185                  | 209                | 193                  | 210                | 233                  | 250                | 310                  | 356                | 365                  | 398                | 435                  | 477                |
| Heatsink<br>externally<br>cooling<br>type             | Outside of<br>heatsink<br>(W) | 20                   | 32                 | 29                   | 39                 | 40                   | 58                 | 59                   | 79                 | 79                   | 93                 | 100                  | 115                | 118                  | 157                | 158                  | 186                | 200                  | 236                |
|   | Inside of<br>heatsink<br>(W)  | 38                   | 41                 | 47                   | 49                 | 77                   | 80                 | 126                  | 130                | 114                  | 117                | 133                  | 135                | 192                  | 199                | 207                  | 212                | 235                  | 241                |
| Cooling air speed near<br>heatsink (m/s)              |                               | 2.5                  |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |

# APPENDIX 3 PERIPHERAL UNITS

## 3.1 SPECIFICATIONS OF AC REACTOR (Model: UZBA-B for 50/60Hz)



[Connection Example]



Select an AC reactor from the table below according to converter (VS-656MR5) model.

### (1) 200V Class

| Model<br>CIMR-<br>MR5A | Cur-<br>rent<br>A | Induc-<br>tance<br>mH | Code No. | Fig.<br>No. | Dimensions in mm (inches) |               |               |               |                |                     |               |              |              |               |               |    |              |             | Approx<br>Mass<br>kg (lb) | Heat<br>Loss<br>W |     |
|------------------------|-------------------|-----------------------|----------|-------------|---------------------------|---------------|---------------|---------------|----------------|---------------------|---------------|--------------|--------------|---------------|---------------|----|--------------|-------------|---------------------------|-------------------|-----|
|                        |                   |                       |          |             | A<br>(Max)                | A1            | B             | B1<br>(Max)   | B2             | C1                  | C2            | D            | E            | F             | I             | J  | K            | L           |                           |                   | M   |
| 25P7                   | 20                | 0.53                  | X010057  | 1           | 130<br>(5.12)             | —             | 88<br>(3.46)  | 66<br>(2.56)  | 44<br>(1.73)   | 105±5<br>(4.13±0.2) | 25<br>(0.98)  | 50<br>(1.97) | 70<br>(2.76) | 130<br>(5.12) | 3.2<br>(0.13) | M6 | 9<br>(0.35)  | 7<br>(0.28) | M4                        | 3<br>(6.6)        | 35  |
| 25P5                   | 30                | 0.55                  | X010058  | 1           | 130<br>(5.12)             | —             | 88<br>(3.46)  | 66<br>(2.56)  | 44<br>(1.73)   | 105±5<br>(4.13±0.2) | 40<br>(1.57)  | 50<br>(1.97) | 70<br>(2.76) | 130<br>(5.12) | 3.2<br>(0.13) | M6 | 9<br>(0.35)  | 7<br>(0.28) | M5                        | 3<br>(6.6)        | 45  |
| 27P5                   | 40                | 0.265                 | X010059  | 2           | 130<br>(5.12)             | 150<br>(5.91) | 98<br>(3.86)  | 65<br>(2.56)  | 49<br>(1.93)   | 105±5<br>(4.15±0.2) | 40<br>(1.57)  | 50<br>(1.97) | 80<br>(3.15) | 130<br>(5.12) | 3.2<br>(0.13) | M6 | 9<br>(0.35)  | 7<br>(0.28) | M6                        | 4<br>(8.8)        | 50  |
| 2011                   | 60                | 0.18                  | X010060  | 1           | 160<br>(6.3)              | —             | 105<br>(4.13) | 75<br>(2.95)  | 52.5<br>(2.07) | 130±5<br>(5.12±0.2) | 40<br>(1.57)  | 75<br>(2.95) | 85<br>(3.35) | 160<br>(6.3)  | 2.3<br>(0.09) | M6 | 10<br>(0.39) | 7<br>(0.28) | M6                        | 6<br>(13.2)       | 65  |
| 2015                   | 80                | 0.13                  | X010061  | 1           | 180<br>(7.09)             | —             | 108<br>(3.94) | 85<br>(3.35)  | 50<br>(1.97)   | 150±5<br>(5.91±0.2) | 42<br>(1.65)  | 75<br>(2.95) | 80<br>(3.15) | 180<br>(7.09) | 2.5<br>(0.09) | M6 | 10<br>(0.39) | 7<br>(0.28) | M6                        | 8<br>(17.6)       | 75  |
| 2018                   | 90                | 0.12                  | X010062  | 2           | 180<br>(7.09)             | 190<br>(7.48) | 108<br>(3.94) | 90<br>(3.54)  | 50<br>(1.97)   | 150±5<br>(5.91±0.2) | 45<br>(1.77)  | 75<br>(2.95) | 80<br>(3.15) | 180<br>(7.09) | 2.5<br>(0.09) | M6 | 10<br>(0.39) | 7<br>(0.28) | M8                        | 8<br>(17.6)       | 90  |
| 2022                   | 120               | 0.09                  | X010063  | 2           | 180<br>(7.09)             | 190<br>(7.48) | 130<br>(3.94) | 95<br>(3.74)  | 50<br>(1.97)   | 150±5<br>(5.91±0.2) | 45<br>(1.77)  | 75<br>(2.95) | 80<br>(3.15) | 180<br>(7.09) | 2.3<br>(0.09) | M6 | 10<br>(0.39) | 7<br>(0.28) | M8                        | 8<br>(17.6)       | 90  |
| 2050                   | 160               | 0.07                  | X010064  | 3           | 210<br>(8.27)             | —             | 100<br>(3.94) | 215<br>(8.27) | —              | 175±5<br>(6.89±0.2) | 40<br>(1.57)  | 75<br>(2.95) | 80<br>(3.15) | 205<br>(8.07) | 2.3<br>(0.09) | M6 | 10<br>(0.39) | 7<br>(0.28) | M10                       | 12<br>(26.5)      | 100 |
| 2057                   | 200               | 0.05                  | X010120  | 3           | 210<br>(8.27)             | —             | 116<br>(4.57) | 230<br>(9.05) | —              | 175±5<br>(6.89±0.2) | 130<br>(5.12) | 75<br>(2.95) | 95<br>(3.74) | 205<br>(8.07) | 2.3<br>(0.09) | M6 | 10<br>(0.39) | 7<br>(0.28) | M10                       | 15<br>(33.1)      | 110 |

### (2) 400V Class

| Model<br>CIMR-<br>MR5A | Cur-<br>rent<br>A | Induc-<br>tance<br>mH | Code No. | Fig.<br>No. | Dimensions in mm (inches) |    |               |               |                |                     |              |               |               |               |               |    |              |              | Approx<br>Mass<br>kg (lb) | Heat<br>Loss<br>W |     |
|------------------------|-------------------|-----------------------|----------|-------------|---------------------------|----|---------------|---------------|----------------|---------------------|--------------|---------------|---------------|---------------|---------------|----|--------------|--------------|---------------------------|-------------------|-----|
|                        |                   |                       |          |             | A<br>(Max)                | A1 | B             | B1<br>(Max)   | B2             | C1                  | C2           | D             | E             | F             | I             | J  | K            | L            |                           |                   | M   |
| 45P5                   | 15                | 1.42                  | X010050  | 1           | 130<br>(5.12)             | —  | 98<br>(3.86)  | —             | 49<br>(1.93)   | 105±5<br>(4.13±0.2) | 25<br>(0.98) | 50<br>(1.97)  | 80<br>(3.15)  | 130<br>(5.12) | 3.2<br>(0.13) | M6 | 9<br>(0.35)  | 7<br>(0.28)  | M4                        | 4<br>(8.8)        | 50  |
| 47P5                   | 20                | 1.06                  | X010099  | 1           | 160<br>(6.3)              | —  | 90<br>(3.54)  | 80<br>(1.97)  | 45<br>(1.77)   | 130±5<br>(5.12±0.2) | 25<br>(0.98) | 75<br>(2.95)  | 70<br>(2.76)  | 160<br>(6.3)  | 2.3<br>(0.09) | M6 | 10<br>(0.39) | 7<br>(0.28)  | M4                        | 5<br>(11)         | 50  |
| 4011                   | 30                | 0.7                   | X010100  | 1           | 160<br>(6.3)              | —  | 105<br>(4.13) | 95<br>(3.74)  | 52.5<br>(2.07) | 130±5<br>(5.12±0.2) | 40<br>(1.57) | 75<br>(2.95)  | 85<br>(3.35)  | 160<br>(6.3)  | 2.3<br>(0.09) | M6 | 10<br>(0.39) | 7<br>(0.28)  | M5                        | 6<br>(13.2)       | 65  |
| 4015                   | 40                | 0.53                  | X010101  | 1           | 180<br>(7.09)             | —  | 100<br>(3.94) | 85<br>(3.35)  | 50<br>(1.97)   | 150±5<br>(5.91±0.2) | 40<br>(1.57) | 75<br>(2.95)  | 80<br>(3.15)  | 180<br>(7.09) | 2.5<br>(0.09) | M6 | 10<br>(0.39) | 7<br>(0.28)  | M6                        | 8<br>(17.6)       | 90  |
| 4018                   | 50                | 0.42                  | X010102  | 1           | 180<br>(7.09)             | —  | 100<br>(3.94) | 85<br>(3.35)  | 50<br>(1.97)   | 150±5<br>(5.91±0.2) | 40<br>(1.57) | 75<br>(2.95)  | 80<br>(3.15)  | 180<br>(7.09) | 2.3<br>(0.09) | M6 | 10<br>(0.39) | 7<br>(0.28)  | M6                        | 8<br>(17.6)       | 90  |
| 4022                   | 60                | 0.36                  | X010103  | 1           | 180<br>(7.09)             | —  | 108<br>(3.94) | 85<br>(3.35)  | 50<br>(1.97)   | 150±5<br>(5.91±0.2) | 40<br>(1.57) | 75<br>(2.95)  | 80<br>(3.15)  | 180<br>(7.09) | 2.3<br>(0.09) | M6 | 10<br>(0.39) | 7<br>(0.28)  | M6                        | 8<br>(17.6)       | 90  |
| 4050                   | 80                | 0.26                  | X010104  | 1           | 210<br>(8.23)             | —  | 108<br>(3.94) | 98<br>(3.54)  | 50<br>(1.97)   | 175±5<br>(6.89±0.2) | 45<br>(1.77) | 75<br>(2.95)  | 80<br>(3.15)  | 205<br>(8.07) | 3.2<br>(0.13) | M6 | 10<br>(0.39) | 7<br>(0.28)  | M6                        | 12<br>(26.5)      | 95  |
| 4037                   | 90                | 0.24                  | X010105  | 1           | 210<br>(8.23)             | —  | 116<br>(4.57) | 115<br>(4.33) | 58<br>(2.28)   | 175±5<br>(6.89±0.2) | 48<br>(1.89) | 75<br>(2.95)  | 95<br>(3.74)  | 205<br>(8.07) | 3.2<br>(0.13) | M6 | 10<br>(0.39) | 7<br>(0.28)  | M8                        | 15<br>(33.1)      | 110 |
| 4045                   | 120               | 0.18                  | X010106  | 1           | 240<br>(9.4)              | —  | 126<br>(4.96) | 126<br>(4.72) | 63<br>(2.48)   | 205±5<br>(8.07±0.2) | 48<br>(1.89) | 130<br>(5.09) | 110<br>(4.33) | 240<br>(9.45) | 3.2<br>(0.13) | M8 | 8<br>(0.31)  | 10<br>(0.39) | M8                        | 23<br>(50.7)      | 130 |

Fig. 1

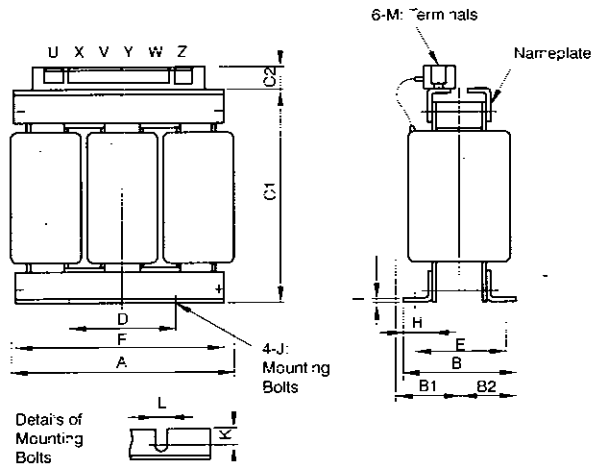


Fig. 2

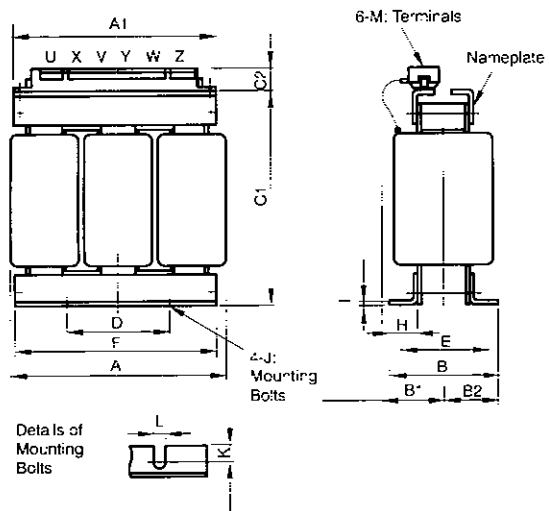
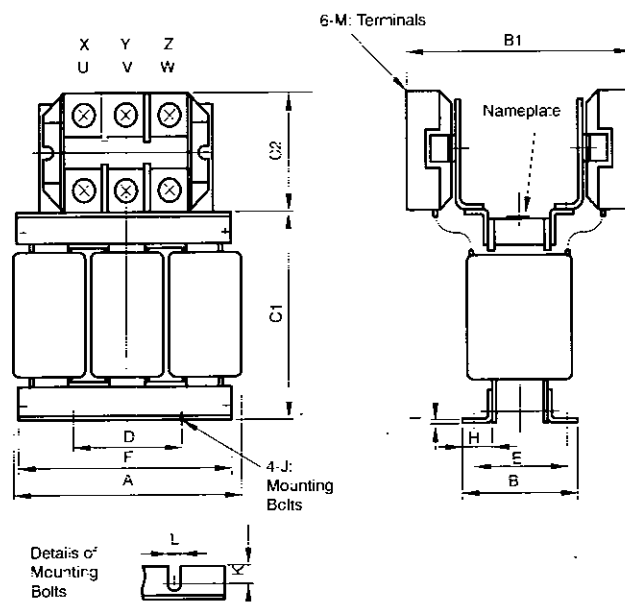
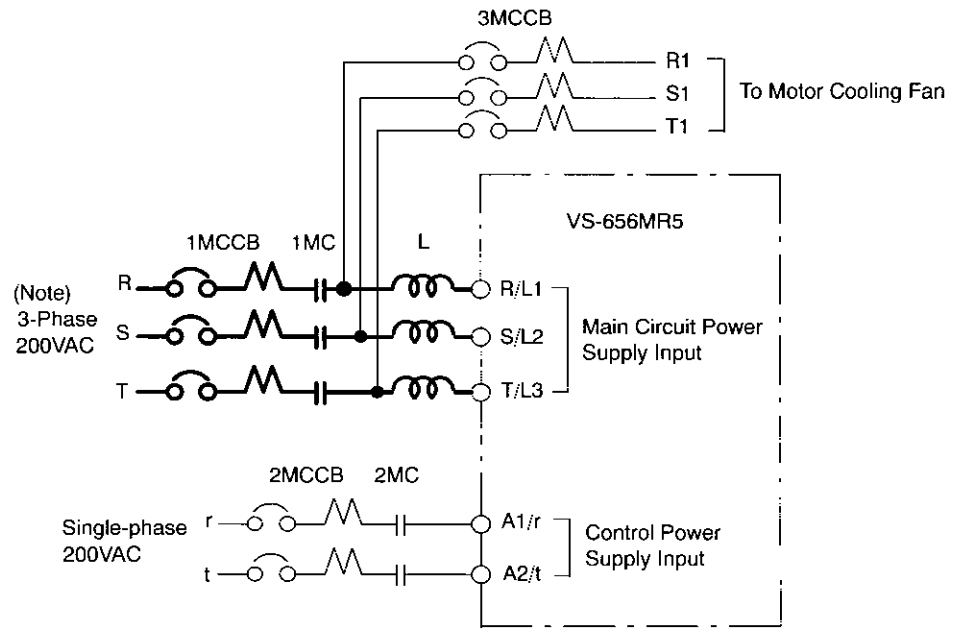


Fig. 3





### 3.2 SPECIFICATIONS OF MCCB AND MC



(Note) For 400V class, 3-phase 400VAC is used.

Select MCCB and MC from the table below according to converter (VS-656MR5) model.

| Voltage Class | Converter Model<br>CIMR-MR5A | Power Capacity (kVA) | MCCB Rated Current (A) |       |       | MC Rated Current (A) |     |
|---------------|------------------------------|----------------------|------------------------|-------|-------|----------------------|-----|
|               |                              |                      | 1MCCB                  | 1MCCB | 2MCCB | 3MCCB                | 1MC |
| 200V Class    | 23P7                         | 7                    | 30                     | 3     | 3     | 20                   | 3   |
|               | 25P5                         | 9                    | 40                     | 3     | 3     | 30                   | 3   |
|               | 27P5                         | 12                   | 50                     | 3     | 3     | 40                   | 3   |
|               | 2011                         | 19                   | 75                     | 3     | 3     | 60                   | 3   |
|               | 2015                         | 24                   | 100                    | 3     | 3     | 75                   | 3   |
|               | 2018                         | 30                   | 125                    | 3     | 3     | 100                  | 3   |
|               | 2022                         | 36                   | 150                    | 3     | 3     | 125                  | 3   |
|               | 2030                         | 48                   | 175                    | 3     | 3     | 150                  | 3   |
|               | 2037                         | 60                   | 250                    | 3     | 3     | 200                  | 3   |
| 400V Class    | 45P5                         | 9                    | 20                     | 3     | 2     | 15                   | 3   |
|               | 47P5                         | 12                   | 25                     | 3     | 2     | 20                   | 3   |
|               | 4011                         | 19                   | 40                     | 3     | 2     | 30                   | 3   |
|               | 4015                         | 24                   | 50                     | 3     | 2     | 40                   | 3   |
|               | 4018                         | 30                   | 60                     | 3     | 2     | 50                   | 3   |
|               | 4022                         | 36                   | 75                     | 3     | 2     | 60                   | 3   |
|               | 4030                         | 48                   | 100                    | 3     | 2     | 80                   | 3   |
|               | 4037                         | 60                   | 125                    | 3     | 2     | 100                  | 3   |
|               | 4045                         | 72                   | 150                    | 3     | 2     | 125                  | 3   |

### 3.3 MAGNETIC CONTACTOR SPECIFICATIONS FOR WINDING SELECTION

(1) Specifications

Table A-14 Specifications

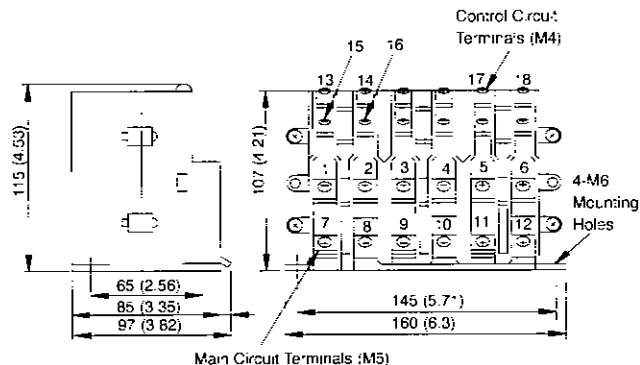
| Type <sup>*1</sup>           | Standard                                     | HV-75A4                          | HV-150AP4                        | HV-200AP4                      |
|------------------------------|--|----------------------------------|----------------------------------|--------------------------------|
|                              | IPM motor <sup>*2</sup>                      | HV-75BP4                         | HV-150BP4                        | HV-200BP4                      |
| Contact                      | Main contact: 3NO3NC, auxiliary contact: 1NO |                                  |                                  |                                |
| Rated Insulation Voltage     | 600V   |                                  |                                  |                                |
| Rated Applying Current       | Continuous                                   | 75A                              | 150A                             | 200A                           |
|                              | 30 minutes <sup>*3</sup>                     | 87A                              | 175A                             | 226A                           |
| Breaking Current Capacity    | 220V   | 200A                             | 400A                             | 400A                           |
|                              | 440V   | 150A                             | 300A                             | 300A                           |
| Open/Close Frequency         | 600 times/hr                                 |                                  |                                  |                                |
| Machanical Duration of Life  | 5 million times                              |                                  |                                  |                                |
| Control Magnetic Coil Rating | 200V 50/60Hz, 220V 50/60Hz, 230V 60Hz        |                                  |                                  |                                |
| Mass                         | lb (kg)                                      | 5.5 (2.5)                        | 11 (5.0)                         | 11 (5.0)                       |
| Ambient Temperature          | -10 to +55°C (+14 to 131°F)                  |                                  |                                  |                                |
| Humidity                     | 10 to 95% RH (non-condensing)                |                                  |                                  |                                |
| Applicable Inverter Capacity | 200V class                                   | 5HP to 20HP<br>(3.7kW to 15kW)   | 25HP to 40HP<br>(18.5kW to 30kW) | 50HP (37kW)                    |
|                              | 400V class                                   | 7.5HP to 20HP<br>(5.5kW to 15kW) | 25HP to 40HP<br>(18.5kW to 30kW) | 50HP to 60HP<br>(37kW to 45kW) |

\*1 HV-□ AP4S or HV-□ BP4S when a safety cover is mounted.

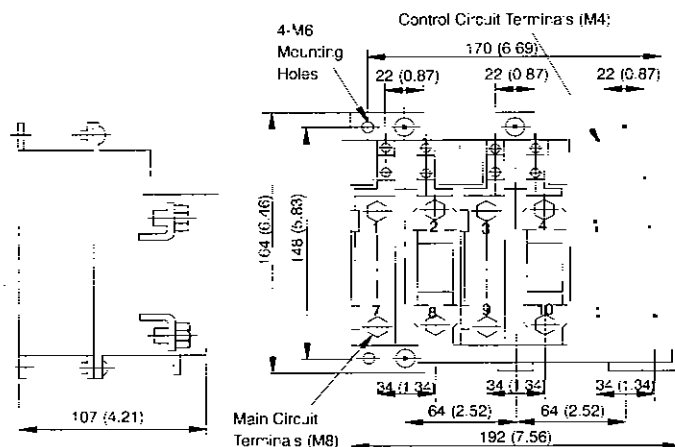
\*2 The magnetic contactor for IPM motors does not have a short-circuit bar.

\*3 1-hour or more dwell time is required after applying power supply for 30 minutes.

(2) Dimensions in mm (inches)



(a) Model HV-75AP3

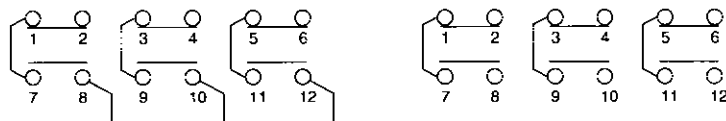


(b) Models HV-150AP3, HV-200AP3

(3) Terminal Descriptions

Table A-15 Terminal Name and Operation Status

| Terminal | Name                   | Operation Status            |                            |
|----------|------------------------|-----------------------------|----------------------------|
|          |                        | +24V<br>(Low-speed Winding) | 0V<br>(High-speed Winding) |
| 13-14    | Selection signal       |                             |                            |
| 1-2      | Main contact: 3NC      | Open (OFF)                  | Closed (ON)                |
| 3-4      |                        |                             |                            |
| 5-6      |                        |                             |                            |
| 7-8      | Main contact: 3NO      | Closed (ON)                 | Open (OFF)                 |
| 9-10     |                        |                             |                            |
| 11-12    |                        |                             |                            |
| 15-16    | Auxiliary contact: 1NO | Open (OFF)                  | Closed (ON)                |
| 17-18    | 200V power supply      | -                           | -                          |



(a) Model HV-□AP4

(b) Model HV-□BP4

Fig. A-5 Main Circuit Contacts Configuration

# APPENDIX 4 TYPICAL CONNECTION DIAGRAM

## 4.1 WINDING SELECTION TYPE

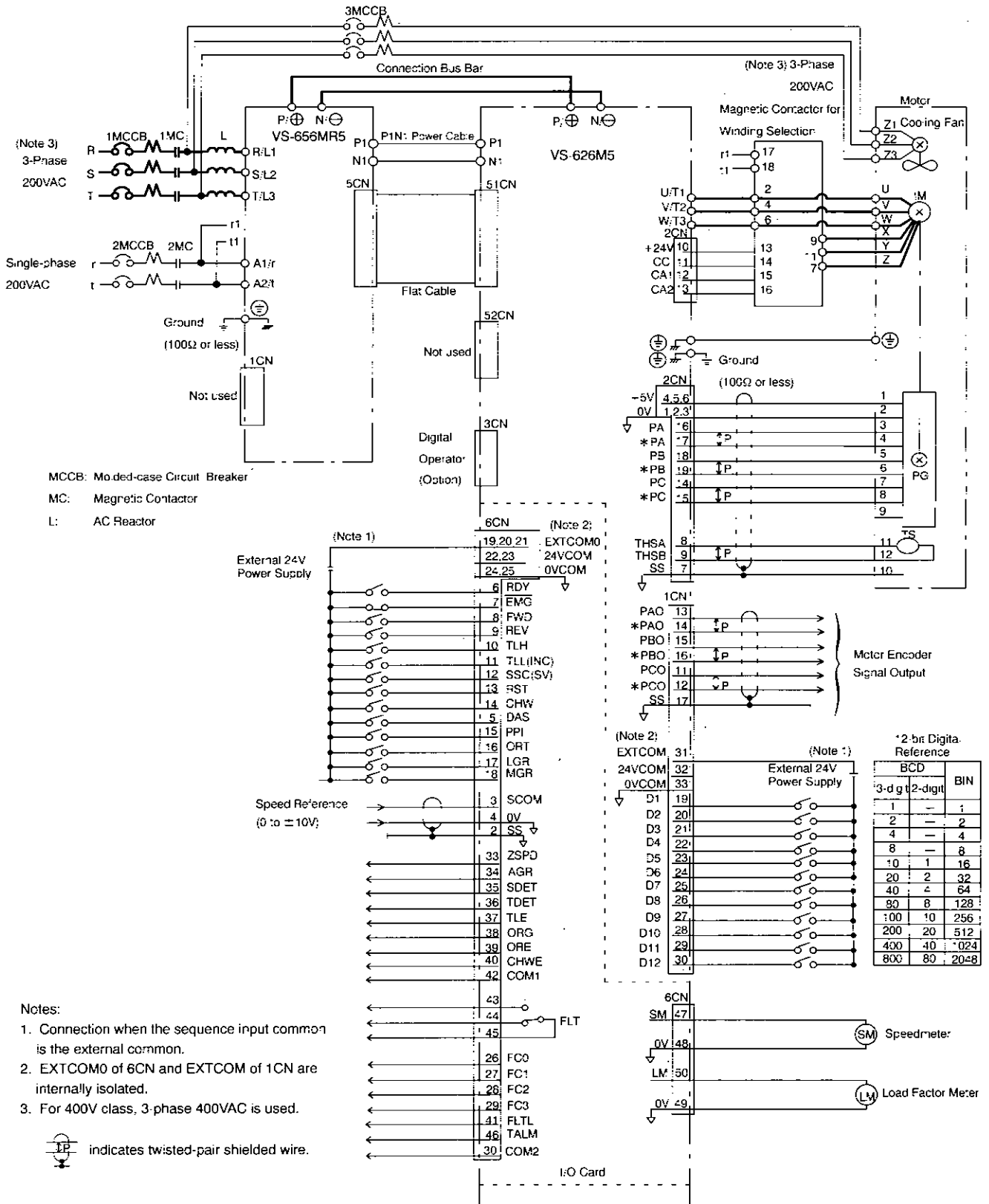


Fig. A-6 Winding Selection Type (200V class shown as example)

### 4.2 STOP AT ARBITRARY POSITION BY LOAD SHAFT ENCODER

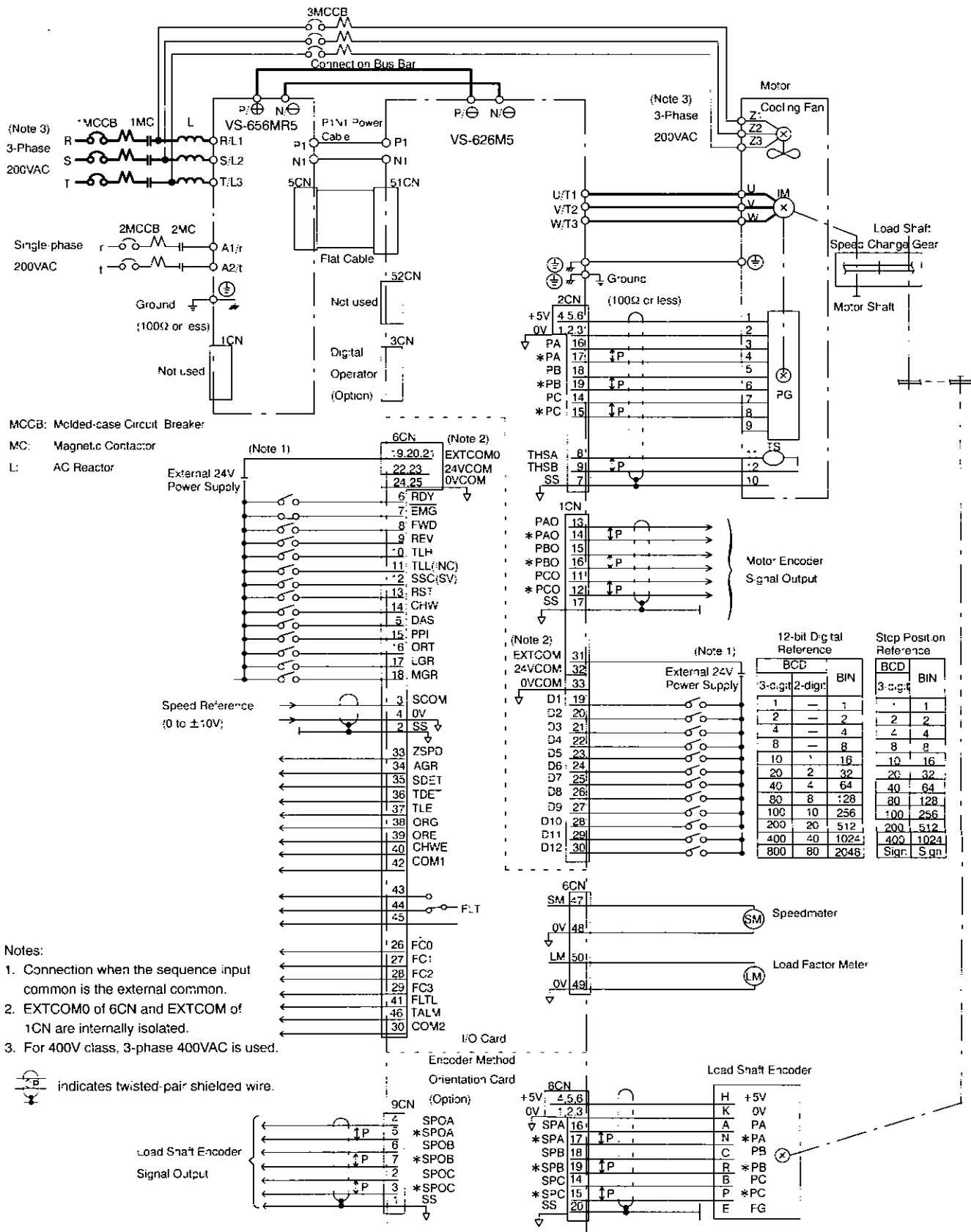


Fig. A-7 Stop at Arbitrary Position by Load Shaft Encoder (200V class shown as example)

### 4.3 STOP AT HOME/ARBITRARY POSITION BY MAGNETIC SENSOR

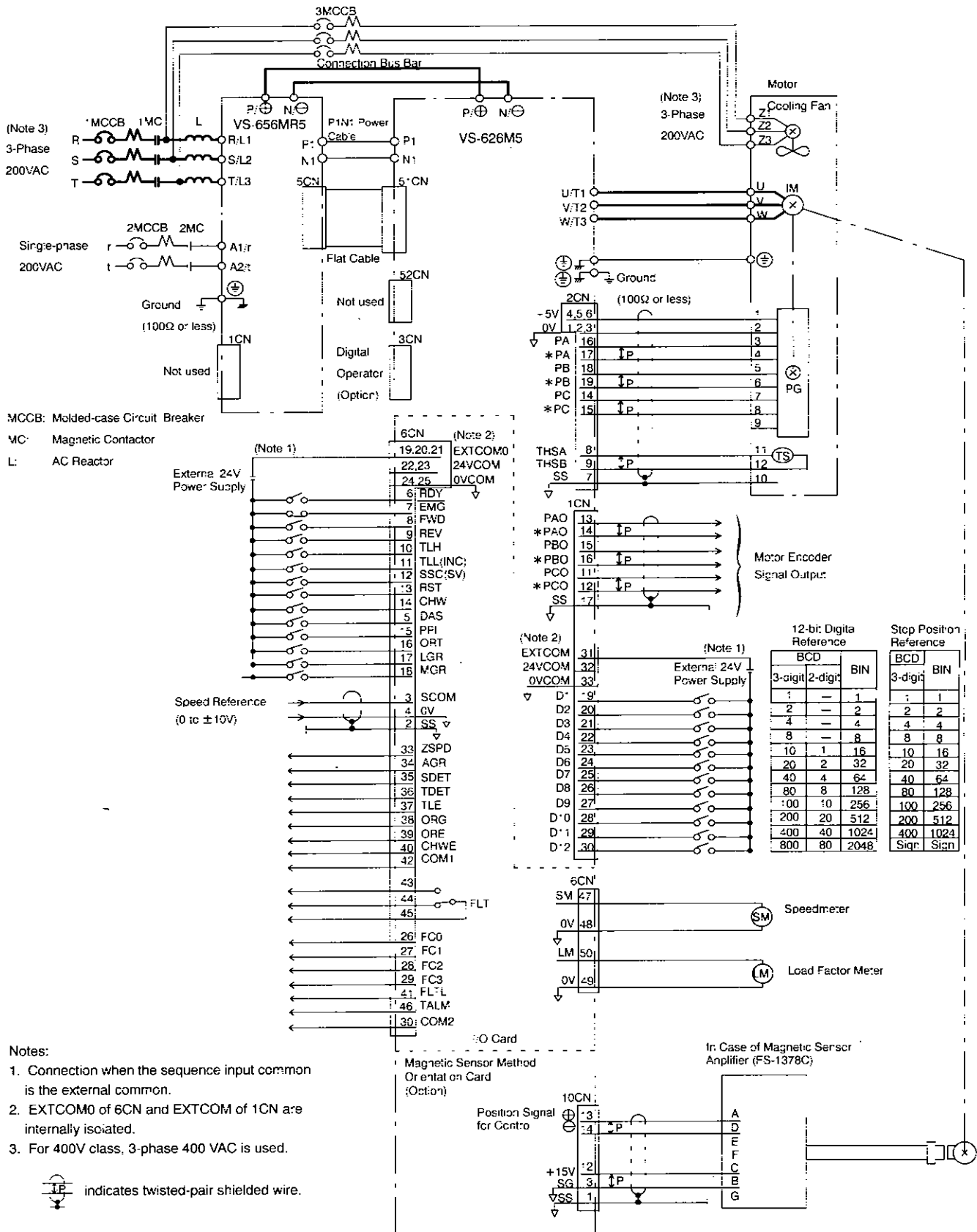
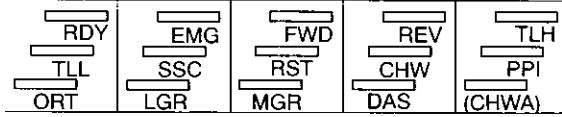
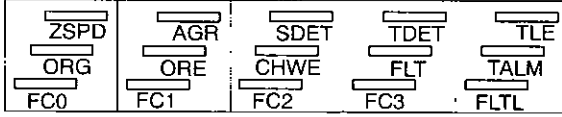
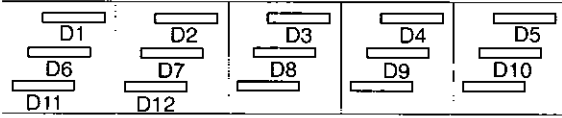


Fig. A-8 Stop at Home/Arbitrary Position by Magnetic Sensor (200V class shown as example)

## APPENDIX 5 OPERATION STATUS DISPLAY

The operation status of the VS-626M5 can be monitored by the digital operator (option). The operation status display includes inverter operation (U1), optional encoder method orientation control (U2) and magnetic sensor method orientation control (U3). (Data marked with \* are operation status display data for preset.)

Table A-16 Operation Status Display Functions (For Inverter Operation)

| No.     | Signal Name                            | Explanation  | Unit  |
|---------|--|--|-------|
| U1-01   | Motor speed                            | Speed detected by the motor encoder  | r/min |
| U1-02   | Speed reference                        | Speed control reference. Ratio to the rated speed (C1-26)  | %     |
| U1-03   | Load shaft speed                       | Product of motor speed and gear transmission ratio   | r/min |
| U1-04   | Torque reference                       | Percentage of 30-minute rating (100%)  | %     |
| U1-05   | ---                                    | -----  |       |
| U1-06   | Inverter output current                | Detected inverter output current converted to amperes.<br>Accuracy: $\pm 3\%$  | A     |
| U1-07   | Output frequency                       | Inverter output current frequency  | Hz    |
| * U1-08 | Internal status                        | Operation status signal (at logical level)   |       |
| U1-09   | Input signal status                    | Sequence input signal ON/OFF status (Note)<br>            |       |
| U1-10   | Output signal status                   | Sequence output signal ON/OFF status (Note)<br>          |       |
| U1-11   | Inverter capacity                      | Inverter unit 30-minute rated capacity   | kW    |
| U1-12   | Inverter internal temperature          | Detected inverter internal temperature (control PC board)  | °C    |
| U1-13   | Heatsink temperature                   | Detected heatsink temperature of inverter. Accuracy: $\pm 5^{\circ}\text{C}$   | °C    |
| * U1-14 | DC bus voltage                         | Main circuit capacitor voltage   | V     |
| U1-15   | Analog speed reference A/D converter   | Analog reference conversion values for adjusting speed reference offset  |       |
| U1-16   | ---                                    | -----  |       |
| * U1-17 | Phase-U current                        | Detected phase-U current converted from analog to digital  |       |
| * U1-18 | Phase-W current                        | Detected phase-W current converted from analog to digital  |       |
| U1-19   | 12-bit digital reference signal status | 12-bit digital reference signal ON/OFF status (Note)<br> |       |
| U1-20   | LED check                              | All LEDs on the digital operator lights when U1-20 is selected.  |       |
| U1-21   | PROM No.                               | PROM software version No. is displayed (lower 5 digits).   |       |

Note: The lamps of I/O signals in the ON state light.

**Table A-17 Operation Status Display Functions (Encoder Method Orientation Control)**

| No.   | Signal Name             | Explanation   | Unit     |
|-------|-------------------------|---|----------|
| U2-01 | I/O signal status       | Orientation I/O signal status (Note)<br>  |          |
| U2-02 | ---                     | -----   |          |
| U2-03 | Position monitor        | Actual position expressed by dividing one rotation by 4096 in reference to a set origin         | Pulses   |
| U2-04 | Commanded stop position | Commanded stop position expressed by dividing one rotation by 4096 in reference to a set origin | Pulses   |
| U2-05 | Position deviation      | Difference between commanded stop position and current position in pulses                       | Pulses   |
| U2-06 | Positioning time        | Time from input of orientation command to output of completion of signal                        | × 2 msec |

Note: The lamps of I/O signals in the ON state light.

**Table A-18 Operation Status Display Functions (Magnetic Sensor Method Orientation Control)**

| No.     | Signal Name                  | Explanation   | Unit     |
|---------|------------------------------|---|----------|
| U3-01   | I/O signal status            | Orientation I/O signal status (Note)<br>  |          |
| * U3-02 | Magnetic sensor signal level | AD converted value of magnetic sensor signal  |          |
| U3-03   | Position monitor             | Actual position expressed by dividing one rotation by 4096 in reference to a set origin | Pulses   |
| U3-04   | Commanded stop position      | Commanded stop position expressed in reference to a set origin                          | Pulses   |
| U3-05   | Speed deviation              | Difference between commanded stop position and current position in pulses               | Pulses   |
| U3-06   | Positioning time             | Time from input of orientation command to output of completion of signal                | × 2 msec |

Note: The lamps of I/O signals in the ON state light.

**Table A-19 Operation Status Display Functions (Others)**

| No.     | Signal Name       | Explanation  | Unit |
|---------|-------------------|--|------|
| U7-01   | Motor temperature | Detected temperature for motor overheat protection | °C   |
| * U7-02 | Slip frequency    | Slip frequency to be applied to the motor          | Hz   |



## APPENDIX 6 CONTROL CONSTANTS

The control constants of the VS-626M5 can be changed by the digital operator (option). The control constants includes user constants (C1), optional encoder method orientation constants (C2) and magnetic sensor method orientation constants (C3).

Table A-20 User Constants List

| Constant No. | Name  | Explanation  | Unit | Standard Setting | Upper Limit<br>Lower Limit |
|--------------|---|--|------|------------------|----------------------------|
| C1-01        | Speed Control Proportional Gain (H)<br>K <sub>VHN</sub>         | Speed control proportional gain when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF). Raising K <sub>VHN</sub> increases rigidity.<br>Torque Reference P = K <sub>VHN</sub> × Speed Tolerance                    | %/Hz | 30               | 255<br>1                   |
| C1-02        | Speed Control Integral Time (H)<br>τ <sub>VHN</sub>             | Speed control integral time constant when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF). Reducing τ <sub>VHN</sub> quickens response.<br>Torque Reference I = Torque Reference P × Time / τ <sub>VHN</sub>     | ms   | 600              | 1000<br>5                  |
| C1-03        | Speed Control Proportional Gain (M, L)<br>K <sub>VLN</sub>      | Speed control proportional gain when low-speed is selected (MGR or LGR is ON) or when low-speed winding is selected (CHW is ON). Raising K <sub>VLN</sub> increases rigidity.<br>Torque Reference P = K <sub>VLN</sub> × Speed Tolerance                               | %/Hz | 30               | 255<br>1                   |
| C1-04        | Speed Control Integral Time Constant (M, L)<br>τ <sub>VLN</sub> | Speed control integral time constant when low-speed gear is selected (MGR or LGR is ON) or when low-speed winding is selected (CHW is ON). Reducing τ <sub>VLN</sub> quickens response.<br>Torque Reference I = Torque Reference P × Time / τ <sub>VLN</sub>           | ms   | 600              | 1000<br>5                  |
| C1-05        | Speed Control Proportional Gain (H)<br>K <sub>VHS</sub>         | Speed proportional gain when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF) in servo mode (SV is ON).<br>Torque Reference P = K <sub>VHS</sub> × Speed Tolerance  | %/Hz | 40               | 255<br>1                   |
| C1-06        | Speed Control Integral Time Constant (H)<br>τ <sub>VHS</sub>    | Speed control integral time constant when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF) in servo mode (SV is ON).<br>Torque Reference I = Torque Reference P × Time / τ <sub>VHS</sub>                         | ms   | 100              | 1000<br>5                  |
| C1-07        | Speed Control Proportional Gain (M, L)<br>K <sub>VLS</sub>      | Speed control proportional gain when low-speed gear is selected (MGR or LGR is ON) or when low-speed winding is selected (CHW is ON) in servo mode (SV is ON).<br>Torque Reference P = K <sub>VLS</sub> × Speed Tolerance  | %/Hz | 40               | 255<br>1                   |
| C1-08        | Speed Control Integral Time Constant (M, L)<br>τ <sub>VLS</sub> | Speed control integral time constant when low-speed gear is selected (MGR or LGR is ON) or when low-speed winding is selected (CHW is ON) in servo mode (SV is ON).<br>Torque Reference I = Torque Reference P × Time / τ <sub>VLS</sub>                               | ms   | 100              | 1000<br>5                  |
| C1-09        | Torque Reference Filter Time Constant<br>τ <sub>T</sub>         | Time constant of low-pass filter of torque references to be used in measures against gear chattering noise. Increasing the time constant may cause runaway depending on conditions.  | ms   | 1.0              | 5.0<br>0.0                 |
| C1-10        | Soft Start Time<br>T <sub>SFS</sub>                             | Setting of required time for soft starter. Variations in speed references are suppressed according to the speed change ratio of the set time. Starting time from at rest state is obtained as follows:<br>Starting Time = T <sub>SFS</sub> × Speed Reference (%) / 100 | sec  | 0.1              | 180.0<br>0.1               |
| C1-11        | Speed Reference Offset Adjustment Value<br>SC <sub>OFFS</sub>   | Offset adjustment value for analog speed reference. Set the values of U1-15 when operating at speed reference 0 for C1-11.   |      | 0                | 80<br>-80                  |

(Cont'd)

Table A-20 User Constants List (Cont'd)

| Constant No.         | Name  | Explanation   | Unit  | Standard Setting | Upper Limit<br>Lower Limit |
|----------------------|---|---|-------|------------------|----------------------------|
| C1-12                | Motor Speed Adjustment Value<br>S <sub>ADJ</sub>              | Constant for adjusting motor speed when analog speed reference is used. Speed is increased in proportion to S <sub>ADJ</sub> . This constant is disabled when digital speed reference is used.  |       | 1.0000           | 1.1000<br>0.9000           |
| C1-13<br>to<br>C1-15 | ---   | -----   |       | ---              | ---                        |
| C1-16                | Speedometer Signal Adjustment Value<br>SM <sub>ADJ</sub>      | Constant for fine control to match the actual speed and indication on the speedometer. Increasing SM <sub>ADJ</sub> makes the meter indicator travel farther. Standard value is 10V output at rated speed (C1-26).  |       | 1.00             | 1.50<br>0.90               |
| C1-17                | Load Ratio Meter Signal Adjustment Value<br>LM <sub>ADJ</sub> | Constant for fine control to match the torque reference and indication on the load ratio meter. Increasing LM <sub>ADJ</sub> makes the meter indicator travel farther. Standard value is 10V output at 120% of the 30-minute rating.  |       | 1.00             | 1.50<br>0.90               |
| C1-18                | Load Ratio Meter Signal Adjustment Value<br>LM <sub>FS</sub>  | Setting of full-scale value of the load ratio meter expressed as a percent of continuous rating. Note that the full-scale value depends on specifications of the load machine.  | %     | 200              | 500<br>120                 |
| C1-19                | Zero-speed Detection Level<br>ZS <sub>LVL</sub>               | Detection level of zero-speed signal (ZSPD). Standard setting is 30 r/min.  | r/min | 30               | 60<br>3                    |
| C1-20                | Speed-agree Signal Detection Width<br>AGR <sub>BD</sub>       | Detection width of speed-agree signal at rated speed. Standard setting is 15%.  | %     | 15               | 50<br>10                   |
| C1-21                | Speed Detection Signal Level<br>SD <sub>LVL</sub>             | Speed detection signal (SDET) activation level used for winding selection. Expressed as a percent of the motor rated speed (C1-26).   | %     | 10               | 100<br>0                   |
| C1-22                | Speed Detection Signal Detection Width<br>SD <sub>HYS</sub>   | Hysteresis width adjustment level of speed signal detection. During acceleration, SD <sub>LVL</sub> +SD <sub>HYS</sub> is detected. During deceleration, SD <sub>LVL</sub> -SD <sub>HYS</sub> is detected. Expressed as a percent of the motor rated speed (C1-26).         | %     | 1.00             | 10.00<br>0.00              |
| C1-23                | Torque Detection Signal Operation Level<br>TD <sub>LVL</sub>  | Torque detection signal (TDET) activation level used to detect abnormal loads. Expressed as a percent of the 30-minute rated torque. Hysteresis width is limited to ±10%.   | %     | 10               | 120<br>5                   |
| C1-24                | External Control Torque Limiting Level<br>T <sub>EXT</sub>    | Torque limit using external torque limiting signals (TLL and TLH). Expressed as a percent of the 30-minute rated torque.  | %     | 10               | 120<br>5                   |
| C1-25                | Motor Code Selection<br>MTR                                   | Select applicable motor from the motor codes stored in inverter memory. Expressed in 3-digit hexadecimals 0 to F. When the motor code is changed, be sure to turn OFF the power once; and then turn it ON again after verifying that the digital operator display has gone. |       |                  | 1FF<br>001                 |
| C1-26                | Rated Speed Setting<br>S <sub>100</sub>                       | Rated speed set according to load machine specifications. Must not be greater than the motor maximum speed. When commanded speed is 100%, this speed is applied.  | r/min | Max. Speed       | Max. Speed<br>100          |
| C1-27                | Transmission Ratio 1 (H)<br>RHGR                              | Transmission ratio determined by mechanical specifications. This parameter is valid when H gear is selected (MGR and LGR are OFF).<br>Transmission Ratio = Load Shaft Speed ÷ Motor Speed   |       | 1.0000           | 2.5000<br>0.0±00           |
| C1-28                | Transmission Ratio 2 (M)<br>RMGR                              | Transmission ratio determined by mechanical specifications. This parameter is valid when M gear is selected (MGR is ON).<br>Transmission Ratio = Load Shaft Speed ÷ Motor Speed   |       | 1.0000           | 2.5000<br>0.0±00           |

(Cont'd)

Table A-20 User Constants List (Cont'd)

| Constant No.                                    | Name  | Explanation   | Unit                              | Standard Setting | Upper Limit<br>Lower Limit         |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
|---|---|---|-----------------------------------|------------------|------------------------------------|----------|---------|----------|------------------|--------|--------------------|----------|-----------------------------|--|---|--|--|----------|-----|
| CI-29   | Transmission Ratio 3 (L)<br>RLGR              | Transmission ratio determined by mechanical specifications. This parameter is valid when L gear is selected (LGR is ON).<br>$\text{Transmission Ratio} = \text{Load Shaft Speed} \div \text{Motor Speed}$   |                                   | 1.0000           | 2.5000<br>0.0400                   |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| CI-30   | Motor Flux Lower Limit Level<br>$\phi_{WL}$   | Set value of motor flux lower limit level at reduction control  | %                                 | 15               | 100<br>15                          |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| CI-31   | Servo Mode Flux Level (H)<br>$\phi_{SVH}$     | Motor flux level when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF) in servo mode (SV is OFF).  | %                                 | 70               | 100<br>30                          |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| CI-32   | Servo Mode Base Speed Ratio (H)<br>RBSH       | Base speed ratio when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF) in servo mode (SV is ON).<br>$\text{Base Speed (Servo)} = RBSH \times \text{Base Speed (Motor)}$  |                                   | 1.00             | 5.00<br>1.00                       |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| CI-33   | Servo Mode Flux Level (M. L.)<br>$\phi_{SVL}$ | Motor flux level when low-speed gear is selected (MGR or LGR is ON) or when low-speed winding is selected (CHW is ON) in servo mode (SV is ON).   | %                                 | 70               | 100<br>30                          |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| CI-34   | Servo Mode Base Speed Ratio (M. L.)<br>RBSL   | Base speed ratio when low-speed gear is selected (MGR or LGR is ON) or when low-speed winding is selected (CHW is ON) in servo mode (SV is ON).<br>$\text{Base Speed (Servo)} = RBSL \times \text{Base Speed (Motor)}$  |                                   | 1.00             | 5.00<br>1.00                       |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| CI-35   | Zero-speed Braking Time<br>T <sub>BLK</sub>   | Time for generating braking force after deceleration and zero-speed is reached to stop.   | sec                               | 0                | 100<br>0                           |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| CI-36   | Select Signal 1<br>SEL1 *                     | Setting signal for multi-functional selection.<br><ul style="list-style-type: none"> <li>• Bits 1 and 0: 6CN pin 11<br/> <table style="margin-left: 20px;"> <tr><td>00 : TLL</td><td>01 : ---</td></tr> <tr><td>10 : INC</td><td>11 : ---</td></tr> </table> </li> <li>• Bit 2: 6CN pin 10<br/> <table style="margin-left: 20px;"> <tr><td>0 : TLH</td><td>1 : ---</td></tr> </table> </li> <li>• Bit 3: 6CN pin 12<br/> <table style="margin-left: 20px;"> <tr><td>0 : SSC</td><td>1 : SV</td></tr> </table> </li> <li>• Bit 4: 6CN pin 15<br/> <table style="margin-left: 20px;"> <tr><td>0 : PPI</td><td>1 : LM10</td></tr> </table> </li> <li>• Bit 7: 1CN, 12-bit digital reference<br/> <table style="margin-left: 20px;"> <tr><td>0 : Digital speed reference</td><td></td></tr> <tr><td>1 : Orientation control stop position reference</td><td></td></tr> </table> </li> </ul> | 00 : TLL                          | 01 : ---         | 10 : INC                           | 11 : --- | 0 : TLH | 1 : ---  | 0 : SSC          | 1 : SV | 0 : PPI            | 1 : LM10 | 0 : Digital speed reference |  | 1 : Orientation control stop position reference |  |  | 00000000 | --- |
| 00 : TLL  | 01 : ---                                      |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 10 : INC  | 11 : ---                                      |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 0 : TLH   | 1 : ---                                       |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 0 : SSC   | 1 : SV  |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 0 : PPI   | 1 : LM10                                      |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 0 : Digital speed reference                     |   |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 1 : Orientation control stop position reference |   |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| CI-37   | Select Signal 2<br>SEL2 *                     | Setting signal for multi-functional selection.<br><ul style="list-style-type: none"> <li>• Bits 1 and 0: Operation mode<br/> <table style="margin-left: 20px;"> <tr><td>00 : Operation by speed reference</td><td></td></tr> <tr><td>11 : Operation by digital operator</td><td></td></tr> </table> </li> <li>• Bit 2: 6CN pin 6<br/> <table style="margin-left: 20px;"> <tr><td>0 : RDY</td><td>1 : EMG2</td></tr> </table> </li> <li>• Bits 7 and 6: Digital speed reference selection<br/> <table style="margin-left: 20px;"> <tr><td>00 : 2-digit BCD</td><td></td></tr> <tr><td>01 : 12-bit binary</td><td></td></tr> <tr><td>10 : 3-digit BCD</td><td></td></tr> <tr><td>11 : Internal speed setting</td><td></td></tr> </table> </li> </ul>  | 00 : Operation by speed reference |                  | 11 : Operation by digital operator |          | 0 : RDY | 1 : EMG2 | 00 : 2-digit BCD |        | 01 : 12-bit binary |          | 10 : 3-digit BCD            |  | 11 : Internal speed setting                     |  |  | 01000000 | --- |
| 00 : Operation by speed reference               |   |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 11 : Operation by digital operator              |   |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 0 : RDY   | 1 : EMG2                                      |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 00 : 2-digit BCD                                |   |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 01 : 12-bit binary                              |   |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 10 : 3-digit BCD                                |   |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |
| 11 : Internal speed setting                     |   |   |                                   |                  |                                    |          |         |          |                  |        |                    |          |                             |  |   |  |  |          |     |

\* In explanation of select signals, 0 stands for " / " and 1 for " / " .

(Cont'd)

Table A-20 User Constants List (Cont'd)

| Constant No. | Name                      | Explanation   | Unit | Standard Setting | Upper Limit<br>Lower Limit |
|--------------|---------------------------|---|------|------------------|----------------------------|
| C1-38        | Select Signal 3<br>SEL3 * | <p>Select signal for control mode and level</p> <ul style="list-style-type: none"> <li>• Bits 1 and 0: Load ratio meter filter                             <ul style="list-style-type: none"> <li>00 : 2ms filter</li> <li>01 : 10ms filter</li> <li>10 : 100ms filter</li> <li>11 : 500ms filter</li> </ul> </li> <li>• Bit 2: Torque limiting auto judgement                             <ul style="list-style-type: none"> <li>0 : Not judged</li> <li>1 : Judged</li> </ul> </li> <li>• Bit 3: Servo mode sensitivity                             <ul style="list-style-type: none"> <li>0 : Speed reference gain selection disabled</li> <li>1 : Speed reference gain selection enabled<br/>(Set by C1-40 bit 5)</li> </ul> </li> <li>• Bit 4: Excessive speed deviation protection (AL-32) operation threshold                             <ul style="list-style-type: none"> <li>0 : 1/2 or less of speed reference</li> <li>1 : 1/4 or less of speed reference</li> </ul> </li> <li>• Bit 5: Speed limiting level                             <ul style="list-style-type: none"> <li>0 : 105% of rated reference</li> <li>1 : 110% of rated reference</li> </ul> </li> <li>• Bit 6: Speed agree signal (AGR) output at zero speed                             <ul style="list-style-type: none"> <li>0 : Output (AGR: closed)</li> <li>1 : Not output (AGR: open)</li> </ul> </li> <li>• Bit 7: Load ratio meter adjustment                             <ul style="list-style-type: none"> <li>0 : 120% signal of 30-minute rating output</li> <li>1 : 100% signal of continuous rating output</li> </ul> </li> </ul> |      | 00000000         | ---                        |
| C1-39        | Select Signal 4<br>SEL4 * | <p>Select signal for control mode and level</p> <ul style="list-style-type: none"> <li>• Bit 0: Orientation method                             <ul style="list-style-type: none"> <li>0 : Encoder method</li> <li>1 : Magnetic sensor method</li> </ul> </li> </ul> <p>When the setting has changed, turn the control power supply off then on again.</p>   |      | 00000000         | ---                        |
| C1-40        | Select Signal 5<br>SEL5 * | <p>Control mode select signal</p> <ul style="list-style-type: none"> <li>• Bit 1 and 0: Operation delay time of excessive speed deviation protection (AL-32)                             <ul style="list-style-type: none"> <li>00 : 0 sec    01 : 0.3 sec</li> <li>10 : 0.4 sec    11 : 0.5 sec</li> </ul> </li> <li>• Bit 2: Torque detection signal (TDET) output                             <ul style="list-style-type: none"> <li>0 : Standard output</li> <li>1 : Closed at accel/decel</li> </ul> </li> <li>• Bit 3: NC orientation                             <ul style="list-style-type: none"> <li>0 : Disabled.</li> <li>1 : Enabled. Even if orientation signal (ORT) is input, the inverter will not perform orientation. The rotating direction of motor is determined according to the polarity of speed reference.</li> </ul> </li> <li>• Bit 4: Load ratio meter output reference                             <ul style="list-style-type: none"> <li>0 : Continuous rating output</li> <li>1 : 30-minute rating output</li> </ul> </li> <li>• Bit 5: Speed reference gain selection in servo mode (Enabled when C1-38 bit 3 = 1)                             <ul style="list-style-type: none"> <li>0 : Analog speed reference 10V/5000r/min</li> <li>1 : Sets analog speed reference read-in gain by C1-49 or C1-50.</li> </ul> </li> <li>• Bit 7: Load fault detection (AL-33)                             <ul style="list-style-type: none"> <li>0 : Disabled.</li> <li>1 : Enabled.</li> </ul> </li> </ul>   |      | 00000000         | ---                        |

\* In explanation of select signals, 0 stands for "0" and 1 for "1".

(Cont'd)

Table A-20 User Constants List (Cont'd)

| Constant No.   | Name  | Explanation   | Unit   | Standard Setting | Upper Limit<br>Lower Limit |
|----------------|---|---|--------|------------------|----------------------------|
| C1-41 to C1-48 | Internal Speed Reference Set Value SPD1 to SPD8       | Internal speed setting for digital speed reference. The values correspond to reference input (from ICN) as follows. Expressed as a percent of the rated speed (C1-26).<br>Pin 19: SPD1                      Pin 23: SPD5<br>Pin 20: SPD2                      Pin 24: SPD6<br>Pin 21: SPD3                      Pin 25: SPD7<br>Pin 22: SPD4                      Pin 26: SPD8  | %      | 0.00             | 100.00<br>0.00             |
| C1-49 C1-50    | Servo Mode Speed Reference Gain SVGAIN1, 2            | Read-in gain settings for analog speed reference in servo mode. (Enabled when C1-38 bit 3 = 1 and C1-40 bit 5 = 1) r/min at analog speed reference of 10V is set as a ratio to rated speed (C1-26).<br>Analog speed reference 10V / (S100 * SVGAIN / 100) r/min<br>C1-49 or C1-50 is selected by DAS signal (6CN-5).<br>DAS is OFF: C1-49 (SVGAIN1)<br>DAS is ON: C1-50 (SVGAIN2)   | %      | 100.00           | 100.00<br>0.00             |
| C1-51 to C1-53 | ---   | -----   |        | -                | ---<br>---                 |
| C1-54          | Speedometer Signal Offset Adjustment Value SMOfS      | Offset adjustment value for speedometer signal.<br>The inverter subtracts the value and outputs speedometer signal.   | 5.4 mV | 0                | 200<br>-200                |
| C1-55          | Load Ratio Meter Signal Offset Adjustment Value LMOFS | Offset adjustment value for load ratio meter signal.<br>The inverter subtracts the value and outputs load ratio meter signal.   | 5.4 mV | 0                | 200<br>-200                |
| C1-56          | Inverter Capacity Selection UNITNO                    | Inverter capacity is set. (The setting is already made at factory prior to shipment.)<br>200V class<br>CIMR-M5A   23P7   25P5   27P5   2011   2015   2018   2022   2030   2037  <br>Set value   04   05   06   07   08   09   0A   0B   0C  <br>400V class<br>CIMR-M5A   45P5   47P5   4011   4015   4018   4022   4030   4037   4045<br>Set value   25   26   27   28   29   2A   2B   2C   2D  <br>When the setting has changed, turn the control power supply off then on again. |        |                  | ---                        |
| C1-57          | Select Signal 6 SEL6 *1                               | Control mode select signal<br>• Bit 0: Fault record clear selection<br>0 : Disabled<br>1 : Clears next time control power is turned ON.<br>(This bit automatically becomes 0.)  |        | 00000000         | ---<br>---                 |
| C1-58 C1-59    | ---   | -----   |        | -                | ---<br>---                 |
| C1-60          | Magnetic Pole Positioning Value *2                    | Adjusts the position of the magnetic pole. Sets the difference between a magnetic position and an encoder origin signal by the electrical angle (360 el = 8192). Set the C1-60 value on the terminal box.<br>When the setting has changed, turn the control power supply off then on again.   |        | 4096             | 8191<br>-8192              |
| C1-61          | C-phase Pulse Width *2                                | Sets the pulse width of the motor encoder origin signal (C-phase). Set the C1-61 value listed on the terminal box.<br>When the setting has changed, turn the control power supply off then on again.  | pulse  | 7                | 100<br>0                   |

\*1 In explanation of select signals, 0 stands for " 0 " and 1 for " 1 ".

\*2 Constants only for IPM motors. C1-60 and C1-61 are not displayed when the software for controlling an induction motor is used. Set C1-60 and C1-61 again when replacing a motor or an encoder.

Table A-21 Encoder Method Orientation Constants List

| Constant No. | Name  | Explanation   | Unit   | Standard Setting | Upper Limit<br>Lower Limit |
|--------------|---|---|--------|------------------|----------------------------|
| C2-01        | Load Shaft Positioning Origin<br>PORG                           | Mechanical origin of the load shaft. Set difference from encoder origin signal (phase C) pulses.  | Pulses | 0                | 4095<br>0                  |
| C2-02        | Position Control Proportional Gain (H)<br>K <sub>PH</sub>       | Position control porportional gain when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF). Raising K <sub>PH</sub> increases rigidity.<br>Speed Reference (pps) = K <sub>PH</sub> × Position Tolerance (pulses) | 1/s    | 15               | 99<br>1                    |
| C2-03        | Position Control Proportional Gain (M)<br>K <sub>PM</sub>       | Position control proportional gain when medium-speed gear is selected (MGR is ON). Raising K <sub>PM</sub> increases rigidity.<br>Speed Reference (pps) = K <sub>PM</sub> × Position Tolerance (pulses)   | 1/s    | 15               | 99<br>1                    |
| C2-04        | Position Control Proportional Gain (L)<br>K <sub>PL</sub>       | Position control proportional gain when low-speed gear is selected (LGR is ON) or when low-speed winding is selected (CHW is ON). Raising K <sub>PL</sub> increases rigidity.<br>Speed Reference (pps) = K <sub>PL</sub> × Position Tolerance (pulses)              | 1/s    | 15               | 99<br>1                    |
| C2-05        | Speed Control Proportional Gain (H)<br>K <sub>VHO</sub>         | Speed control proportional gain when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF) in orientation control (ORT is ON).<br>Torque Reference P = K <sub>VHO</sub> × Speed Tolerance                           | %/Hz   | 40               | 255<br>1                   |
| C2-06        | Speed Control Integral Time Constant (H)<br>τ <sub>VHO</sub>    | Speed control integral time constant when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF) in orientation control (ORT is ON).<br>Torque Reference I = Torque Reference P × Time / τ <sub>VHO</sub>            | ms     | 100              | 1000<br>5                  |
| C2-07        | Speed Control Proportional Gain (M, L)<br>K <sub>VLO</sub>      | Speed control proportional gain when low-speed gear is selected (MGR or LGR is ON) or when high-speed winding is selected (CHW is ON) in orientation control (ORT is ON).<br>Torque Reference P = K <sub>VLO</sub> × Speed Tolerance                                | %/Hz   | 40               | 255<br>1                   |
| C2-08        | Speed Control Integral Time Constant (M, L)<br>τ <sub>VLO</sub> | Speed control integral time constant when low-speed gear is selected (MGR or LGR is ON) or when low-speed winding is selected (CHW is ON) in orientation control (ORT is ON).<br>Torque Reference I = Torque Reference P × Time / τ <sub>VLO</sub>                  | ms     | 100              | 1000<br>5                  |
| C2-09        | Positioning Completion Detection Width<br>Z <sub>FIN</sub>      | Detection width for outputting completion signal when the load shaft reaches near the commanded stop position. Detection width is commanded stop position ± Z <sub>FIN</sub> .  | Pulses | 5                | 200<br>0                   |
| C2-10        | Positioning Completion Cancel Width<br>Z <sub>CAN</sub>         | Set value for canceling completion signal when the load shaft is moved after completion signal is output. Cancel width is commanded stop position ± Z <sub>CAN</sub> .  | Pulses | 10               | 200<br>Z <sub>FIN</sub>    |
| C2-11        | Orientation Speed<br>S <sub>ORT</sub>                           | Speed applied (after detecting encoder origin) until changing to the servo loop during orientation.   | r/min  | 400              | 600<br>40                  |
| C2-12        | BCD Stop Position Reference Resolution<br>P <sub>BCD</sub>      | Angle set value per minimum increment of stop position BCD command.   |        | 1.0              | 180.0<br>0.5               |
| C2-13        | Arbitrary Stop Position Offset<br>P <sub>IMG</sub>              | Stop position offset for smoothing stop operation when the servo loop is used. When Z <sub>FIN</sub> is reached, offset becomes 0.  | Pulses | 0                | 100<br>0                   |
| C2-14        | Orientation Speed Changing Ratio<br>R <sub>SOR</sub>            | Speed changing ratio for gradually reducing orientation speed to reduce gear noise when switching from orientation speed to servo loop speed.   |        | 0                | 100<br>0                   |

(Cont'd)

Table A-21 Encoder Method Orientation Constants List (Cont'd)

| Constant No.   | Name  | Explanation  | Unit | Standard Setting | Upper Limit<br>Lower Limit |
|----------------|---|--|------|------------------|----------------------------|
| C2-15          | Starting Soft Start Time<br>T <sub>SFO</sub>                | Soft start time for accelerating from at rest state to orientation speed. Use this parameter to reduce gear noise at starting. Acceleration rate is (500 r/min)/sec.   | ms   | 0                | 50<br>0                    |
| C2-16          | Flux Level<br>φ <sub>ORT</sub>                              | Flux level at completion of orientation. Motor noise and torque changes in proportion to flux level.   |      | 60               | 100<br>15                  |
| C2-17          | Orientation Speed Reduction Coefficient<br>K <sub>SOR</sub> | Reduction coefficient to set orientation speed in proportion to the traveling angle for incremental positioning.   |      | 0                | 32767<br>0                 |
| C2-18 to C2-21 | ---   | -----  |      |                  |                            |
| C2-22          | Orientation Control Select Signal 1<br>SEL-E1 *             | <p>Control mode setting signal for specifying the direction of rotation in orientation control.</p> <ul style="list-style-type: none"> <li>• Bits 1 and 0: Positioning rotation direction                             <ul style="list-style-type: none"> <li>00 : Automatically selected rotation direction</li> <li>01 : Same direction as the forward/reverse run signal</li> <li>10 : Fixed rotation direction</li> <li>11 : Automatically selected rotation direction</li> </ul> </li> <li>• Bit 2: Selection for fixed rotation direction                             <ul style="list-style-type: none"> <li>0 : Forward rotation of the load shaft</li> <li>1 : Reverse rotation of the load shaft</li> </ul> </li> <li>• Bit 3: Stop position reference code                             <ul style="list-style-type: none"> <li>0 : 12-bit binary</li> <li>1 : 3-digit BCD</li> </ul> </li> <li>• Bit 4: Tune-up operation                             <ul style="list-style-type: none"> <li>0 : Tune-up enabled</li> <li>1 : Tune-up disabled</li> </ul> </li> <li>• Bit 5: Incremental positioning reference point                             <ul style="list-style-type: none"> <li>0 : Formerly commanded stop position</li> <li>1 : Current stop position</li> </ul> </li> <li>• Bit 6: Encoder selection                             <ul style="list-style-type: none"> <li>0 : Load shaft encoder</li> <li>1 : Motor encoder</li> </ul> </li> <li>• Bit 7: Rotation direction of motor and load shaft (automatically set at tune-up)                             <ul style="list-style-type: none"> <li>0 : Reverse</li> <li>1 : The same</li> </ul> </li> </ul> |      | 11000000         | ---                        |

\* In explanation of select signals, 0 stands for " 0 " and 1 for " 1 "

(Cont'd)

Table A-21 Encoder Method Orientation Constants List (Cont'd)

| Constant No. | Name  | Explanation   | Unit | Standard Setting | Upper Limit<br>Lower Limit |
|--------------|---|---|------|------------------|----------------------------|
| C2-23        | Orientation Control Select Signal 2<br>SEL-E2*  | <p>Dither signal pattern and gain</p> <ul style="list-style-type: none"> <li>• Bit 0: DB selection upon orientation completion<br/>0 : Disabled<br/>1 : Stops by braking torque at orientation completion</li> <li>• Bit 1: Dither signal pattern<br/>0 : 6 steps (83Hz)<br/>1 : 2 steps (250Hz)</li> <li>• Bits 4, 3 and 2: Dither signal level (H)<br/>(MGR and LGR are OFF.)<br/>000 : 0.0%    011 : 7.5 %    110 : 15.0 %<br/>001 : 2.5%    100 : 10.0%    111 : 17.5 %<br/>010 : 5.0%    101 : 12.5 %</li> <li>• Bits 7, 6 and 5: Dither signal level (L)<br/>(MGR or LGR is ON)<br/>000 : 0%    011 : 3%    110 : 6%<br/>001 : 1%    100 : 4%    111 : 7%<br/>010 : 2%    101 : 5%</li> </ul> |      | 00000000         | ---                        |
| C2-24        | Orientation Control Select Signal 3<br>SEL-E3** | <p>Orientation control parameters</p> <ul style="list-style-type: none"> <li>• Bits 3: Speed control mode selection in positioning operation **<br/>0 : P control<br/>1 : PI control</li> <li>• Bits 5 and 4: Speed reference differential compensation gain<br/>00 : 10<br/>01 : 15<br/>10 : 20<br/>11 : 30</li> <li>• Bits 7 and 6: Flux level for positioning servo loop control<br/>00 : 100 %<br/>01 : 80 %<br/>10 : 60 %<br/>11 : 40 %</li> </ul>   |      | 10000000         | ---                        |

\* 1 In explanation of select signals, 0 stands for " 0 " and 1 for " 1 " .

\*\* 2 Speed control mode selection (bit 3 of C2-24) is valid when the following softwares are used.  
VSM200XXX from VSM200095 onward  
VSM2051XX from VSM205120 onward  
VSM207XXX from VSM207051 onward



Table A-22 Magnetic Sensor Method Orientation Constants List

| Constant No. | Name  | Explanation  | Unit  | Standard Setting | Upper Limit<br>Lower Limit |
|--------------|---|--|-------|------------------|----------------------------|
| C3-01        | Load Shaft Positioning Origin<br>PORG                           | Mechanical origin of the load shaft.<br>Set difference from magnetic sensor signal in degrees.   | °     | 0.00             | 2.00<br>-2.00              |
| C3-02        | Position Control Proportional Gain (H)<br>K <sub>PH</sub>       | Position control proportional gain when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF).<br>Raising K <sub>PH</sub> increases rigidity.<br>Speed Reference (pps) = K <sub>PH</sub> × Position Tolerance (pulses) | 1/sec | 15               | 99<br>1                    |
| C3-03        | Position Control Proportional Gain (M)<br>K <sub>PM</sub>       | Position control proportional gain when medium-speed gear is selected (MGR is ON). Raising K <sub>PM</sub> increases rigidity.<br>Speed Reference (pps) = K <sub>PM</sub> × Position Tolerance (pulses)  | 1/sec | 15               | 99<br>1                    |
| C3-04        | Position Control Proportional Gain (L)<br>K <sub>PL</sub>       | Position control proportional gain when low-speed gear is selected (LGR is ON) or when low-speed winding is selected (CHW is ON).<br>Raising K <sub>PL</sub> increases rigidity.<br>Speed Reference (pps) = K <sub>PL</sub> × Position Tolerance (pulses)              | 1/sec | 15               | 99<br>1                    |
| C3-05        | Speed Control Proportional Gain (H)<br>K <sub>VHO</sub>         | Speed control proportional gain when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF) in orientation control (ORT is ON).<br>Torque Reference P = K <sub>VHO</sub> × Speed Tolerance                              | %/Hz  | 40               | 255<br>1                   |
| C3-06        | Speed Control Integral Time Constant (H)<br>τ <sub>VHO</sub>    | Speed control integral time constant when high-speed gear is selected (MGR and LGR are OFF) or when high-speed winding is selected (CHW is OFF) in orientation control (ORT is ON).<br>Torque Reference I = Torque Reference P × Time / τ <sub>VHO</sub>               | msec  | 100              | 1000<br>5                  |
| C3-07        | Speed Control Proportional Gain (M, L)<br>K <sub>VLO</sub>      | Speed control proportional gain when low-speed gear is selected (MGR or LGR is ON) or when low-speed winding is selected (CHW is ON) in orientation control (ORT is ON).<br>Torque Reference P = K <sub>VLO</sub> × Speed Tolerance                                    | %/Hz  | 40               | 255<br>1                   |
| C3-08        | Speed Control Integral Time Constant (M, L)<br>τ <sub>VLO</sub> | Speed control integral time constant when low-speed gear is selected (MGR or LGR is ON) or when low-speed winding is selected (CHW is ON) in orientation control (ORT is ON).<br>Torque Reference I = Torque Reference P × Time / τ <sub>VLO</sub>                     | msec  | 100              | 1000<br>5                  |
| C3-09        | Positioning Completion Detection Width<br>Z <sub>FIN</sub>      | Detection width for outputting completion signal when the load shaft reaches near the commanded stop position.<br>Detection width is commanded stop position ± Z <sub>FIN</sub> .  | °     | 0.5              | 20.0<br>0.0                |
| C3-10        | Positioning Completion Cancel Width<br>Z <sub>CAN</sub>         | Set value for canceling completion signal when the load shaft is moved after completion signal is output.<br>Cancel width is commanded at stop position ± Z <sub>CAN</sub> .   | °     | 1.0              | 20.0<br>Z <sub>FIN</sub>   |
| C3-11        | Orientation Speed<br>SORT                                       | Speed applied (after detecting magnetic sensor signal) until changing to the servo loop during orientation.  | r/min | 400              | 600<br>40                  |
| C3-12        | BCD Stop Position Reference Resolution<br>PBCD                  | Completion signal cancel angle per minimum increment for determining stop position for incremental positioning with BCD command after stopping at home position.   | °     | 1.0              | 180.0<br>0.5               |
| C3-13        | Arbitrary Stop Position Offset<br>PIMG                          | Stop position offset for smoothing stop operation when the servo loop is used.<br>When Z <sub>FIN</sub> is reached, offset becomes 0.  | °     | 0.0              | 10.0<br>0                  |
| C3-14        | Orientation Speed Changing Ratio                                | Speed changing ratio for gradually reducing orientation speed to reduce gear noise when switching from orientation speed to servo loop speed   |       | 0                | 100<br>0                   |

(Cont'd)

Table A-22 Magnetic Sensor Method Orientation Constants List (Cont'd)

| Constant No. | Name  | Explanation  | Unit | Standard Setting | Upper Limit<br>Lower Limit |
|--------------|---|--|------|------------------|----------------------------|
| C3-15        | Starting Soft Start Time<br>T <sub>SFO</sub>                | Soft start time for accelerating from stop to orientation speed. Use this parameter to reduce gear noise at starting.<br>Acceleration rate is (500 r/min)/sec.   | msec | 0                | 50<br>0                    |
| C3-16        | Flux Level<br>φ <sub>ORT</sub>                              | Flux level at completion of orientation. Motor noise and torque change in proportion to flux level.  |      | 60               | 100<br>15                  |
| C3-17        | Orientation Speed Reduction Coefficient<br>K <sub>SOR</sub> | Reduction coefficient to set orientation speed in proportion to the traveling angle for incremental positioning.   |      | 0                | 32767<br>0                 |
| C3-18        | -----   |  |      |                  |                            |
| C3-19        | -----   |  |      |                  |                            |
| C3-20        | Sensor Signal Standardization Angle<br>θ <sub>SEN</sub>     | Angle for standardizing magnetic sensor signal detection sensitivity<br>$\theta_{SEN} = 180^\circ \times \text{Detection Range (mm)} \div \text{Mounting Radius} \div \pi$<br>Set 20.0 to θ <sub>SEN</sub> when θ <sub>SEN</sub> > 20.0.<br>For detection range, check the specifications of the magnetizer and apply the values below:<br>MG-1378BS (15 mm)<br>MG-1444S (7 mm)  |      | 5.0              | 20.0<br>5.0                |
| C3-21        | -----   |  |      |                  |                            |
| C3-22        | Orientation Control Select Signal 1<br>SEL-M1 *             | Control mode setting signal for specifying the direction of rotation in orientation control<br><ul style="list-style-type: none"> <li>• Bits 1 and 0: Positioning rotation direction <ul style="list-style-type: none"> <li>00 : Automatically selected rotation direction</li> <li>01 : Same direction as the forward/reverse run signal</li> <li>10 : Fixed rotation direction</li> <li>11 : Automatically selected rotation direction</li> </ul> </li> <li>• Bit 2: Selection for fixed rotation direction <ul style="list-style-type: none"> <li>0 : Forward rotation of the load shaft</li> <li>1 : Reverse rotation of the load shaft</li> </ul> </li> <li>• Bit 3: Stop position reference code <ul style="list-style-type: none"> <li>0 : 12-bit binary</li> <li>1 : 3-digit BCD</li> </ul> </li> <li>• Bit 4: Tune-up operation <ul style="list-style-type: none"> <li>0 : Tune-up enabled</li> <li>1 : Tune-up disabled</li> </ul> </li> <li>• Bit 5: Incremental positioning reference point <ul style="list-style-type: none"> <li>0 : Formerly commanded stop position</li> <li>1 : Current stop position</li> </ul> </li> <li>• Bit 6: Encoder selection <ul style="list-style-type: none"> <li>0 : Load shaft encoder</li> <li>1 : Motor encoder</li> </ul> </li> <li>• Bit 7: Rotation direction of motor and load shaft <ul style="list-style-type: none"> <li>0 : Reverse</li> <li>1 : The same</li> </ul> </li> </ul> |      | 11000000         | ---                        |

\* In explanation of select signals, 0 stands for " 0 " and 1 for " 1 ".

(Cont'd)

Table A-22 Magnetic Sensor Method Orientation Constants List (Cont'd)

| Constant No. | Name  | Explanation  | Unit | Standard Setting | Upper Limit | Lower Limit |
|--------------|---|--|------|------------------|-------------|-------------|
| C3-23        | Orientation Control Select Signal 2<br>SEL-M2 * | Dither signal pattern and gain<br>• Bit 1: Dither signal pattern<br>0 : 6 steps (83Hz)<br>1 : 2 steps (250Hz)<br>• Bits 4, 3, and 2: Dither signal level (H) (MGR, LGR: OFF)<br>000 : 0.0 %   011 : 7.5 %   110 : 15.0%<br>001 : 2.5 %   100 : 10.0 %   111 : 17.5%<br>010 : 5.0 %   101 : 12.5 %<br>• Bit 7, 6, and 5: Dither signal level (L) (MGR or LGR: ON)<br>000 : 0 %      011 : 3 %      110 : 6 %<br>001 : 1 %      100 : 4 %      111 : 7 %<br>010 : 2 %      101 : 5 % |      | 00000000         |             |             |
| C3-24        | Orientation Control Select Signal 3<br>SEL-M3 * | Orientation control parameters<br>• Bits 5 and 4: Speed reference differential compensation gain<br>00 : 10<br>01 : 15<br>10 : 20<br>11 : 30<br>• Bits 7 and 6: Flux level for positioning servo loop control<br>00 : 100 %<br>01 : 80 %<br>10 : 60 %<br>11 : 40 %   |      | 10000000         |             |             |

\* In explanation of select signals, 0 stands for " / " and 1 for " / . "

# VARISPEED-626M5 INSTRUCTION MANUAL

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