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)

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

YASKAWA

MANUAL NO. TOE-S626-7.2D

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.

YASKAWA ELECTRIC CORPORATION

General Precautions

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

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.

NOTE : 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. 13

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 pollusion 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 personal injury. 20
- Make sure to ground the ground terminal
  (200V class: Ground to 100 Ω or less, 400V class: Ground to 10 Ω or less)
  Failure to observe this warning can result in 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 electrostatic discharge. 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

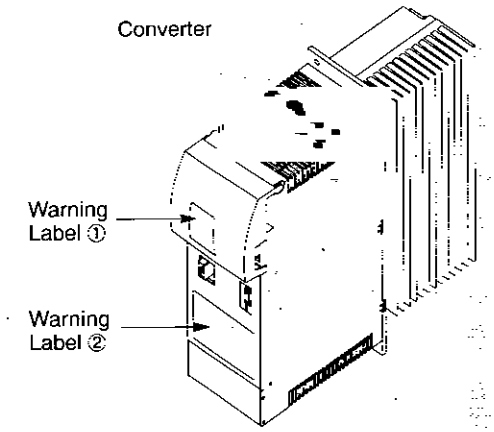
OTHERS

⚠ WARNING

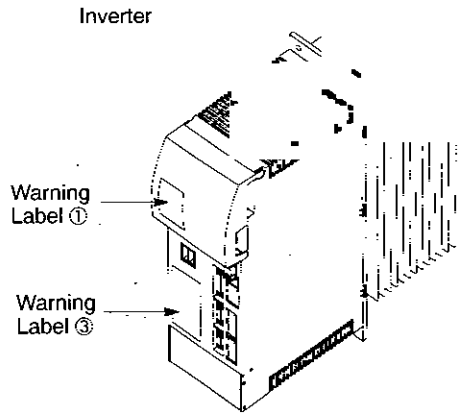
- Never modify the product.
  Failure to observe this warning can result in an electric shock or personal injury and will invalidate the guarantee.

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.



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



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

Warning Label ①

危　険
WARNING

感電の恐れがあります。

通電中及び電源
オフ後５分以内は、
端子部に触らない
でください。

May cause electric shock.

Disconnect all power and wait 5 min. before servicing.

Warning Label ②

危　険
WARNING

けが、感電の恐れがあります。

・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。

感電の恐れがあります。

・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。
・確実に接地を行ってください。

May cause injury or electric shock.

- Please follow the instructions in the manual before installation or operation.
- Disconnect all power before opening front cover of unit. Wait 5 minutes until DC Bus capacitors discharge.
- Use proper grounding techniques.
- Make sure to ground the supply neutral (TÜV approval).

Warning Label ③

危　険
WARNING

けが、感電の恐れがあります。

・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。

感電の恐れがあります。

・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。
・確実に接地を行ってください。

May cause injury or electric shock.

- Please follow the instructions in the manual before installation or operation.
- Disconnect all power before opening front cover of unit. Wait 5 minutes until DC Bus capacitors discharge.
- Use proper grounding techniques.

Related Manuals

Refer to the following manuals as necessary.

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

CONTENTS

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

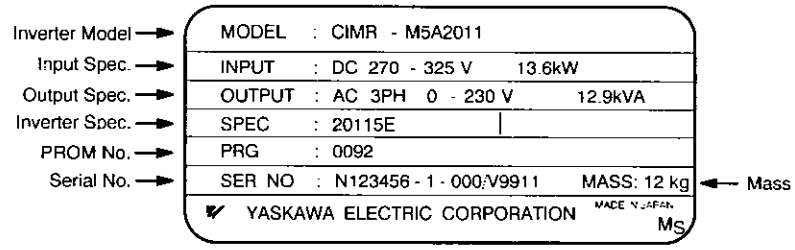
Checkpoints	Description
Does the inverter model number correspond with the purchase order?	Open the upper cover of the VS-626M5 and check the model number on the nameplate. (Refer to page 14.)
Are any parts damaged?	Visually check the exterior and verify that there was no damage during transport.
Are 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)



(b) Model Designation

CIMR - M5 A 2 7P5

Inverter

VS-626M5 Series

Symbol	Specifications
A	For stand alone system
N	For NC system

Symbol	Voltage
2	3-phase 200 V class
4	3-phase 400 V class

Symbol	Max. applicable motor output
3P7	5HP (3.7kW)
5P5 to 045	7.5HP (5.5kW) to 60HP (45kW)

("P" indicates a decimal point.)

(c) Specification Designation

2 7P5 5 E *

Revision symbol

Symbol	Voltage
2	3-phase 200 V class
4	3-phase 400 V class

Symbol	Max. applicable motor output
3P7	5HP (3.7kW)
5P5 to 045	7.5HP (5.5kW) to 60HP (45kW)

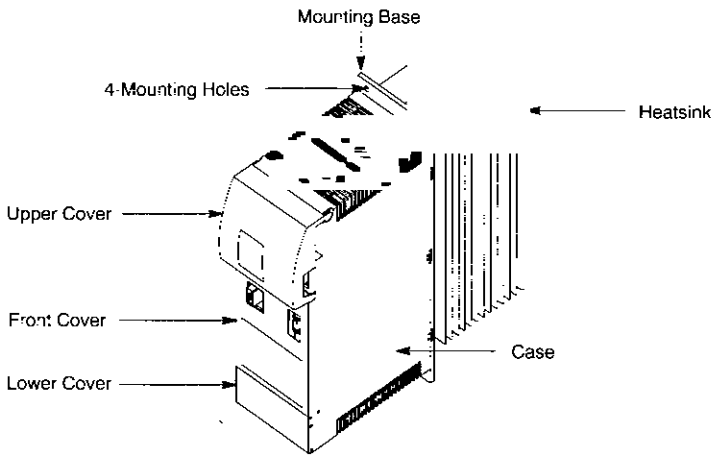
("P" indicates a decimal point.)

Symbol	Structure
0	Open chassis type
5	Heatsink externally cooling type

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

1.2 IDENTIFYING THE PARTS

(1) Converter



【Upper and Lower Covers Opened】

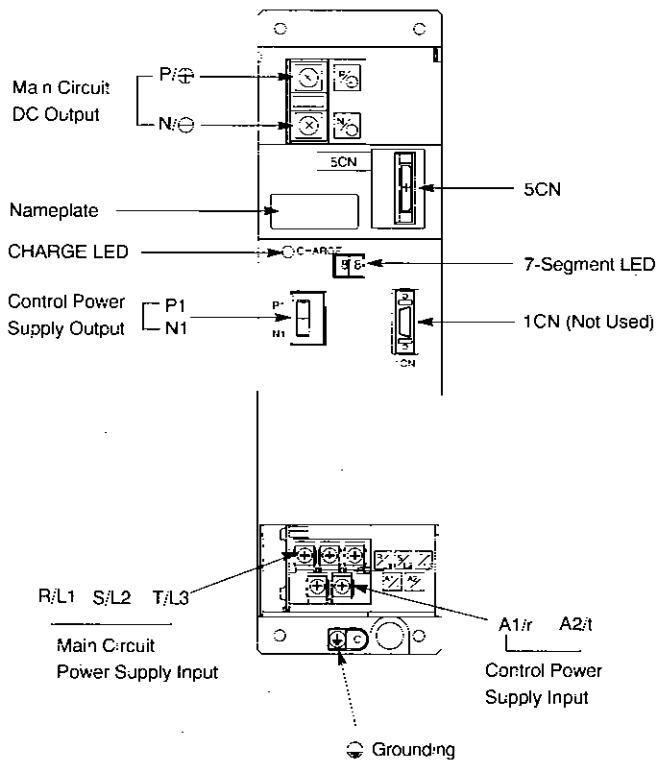


Fig. 1 Parts Name of VS-656MR5 (Model CIMR-MR5A27P5)

(2) Inverter

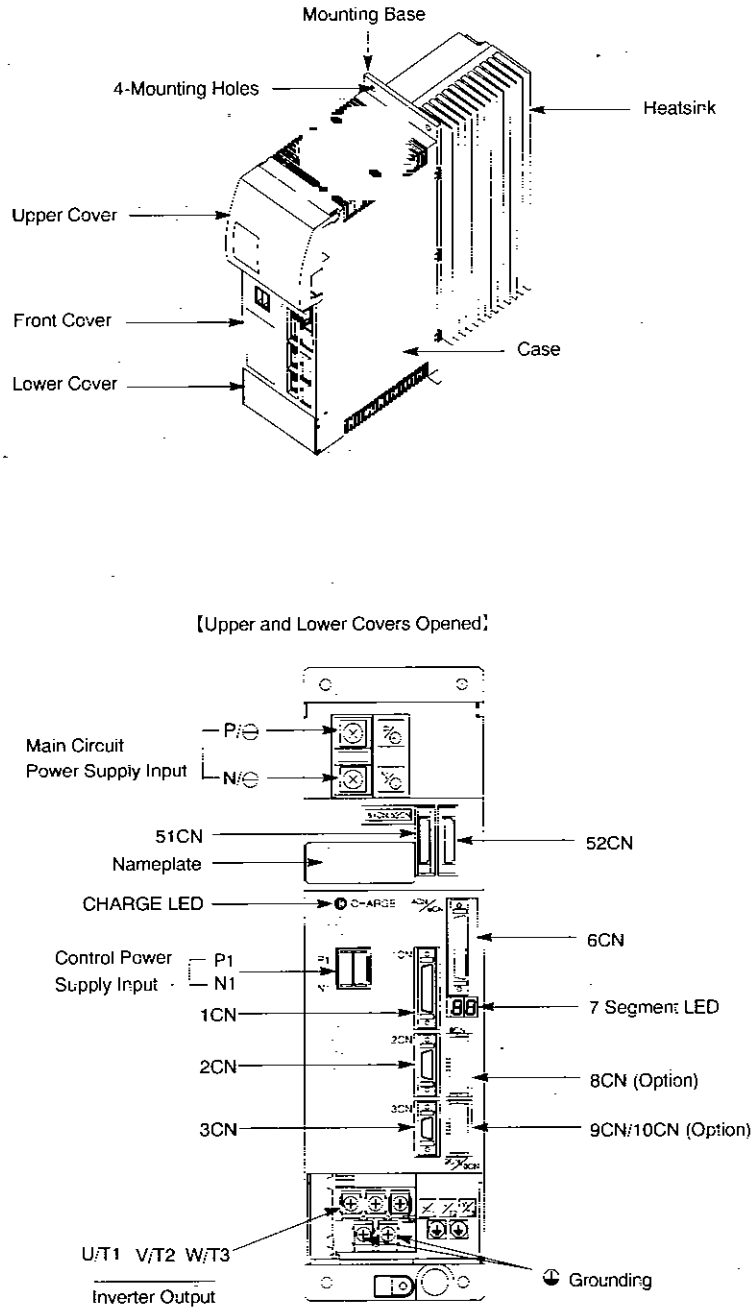


Fig. 2 Parts Name of VS-626M5 (Model CIMR-M5A27P5)

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 pollusion 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

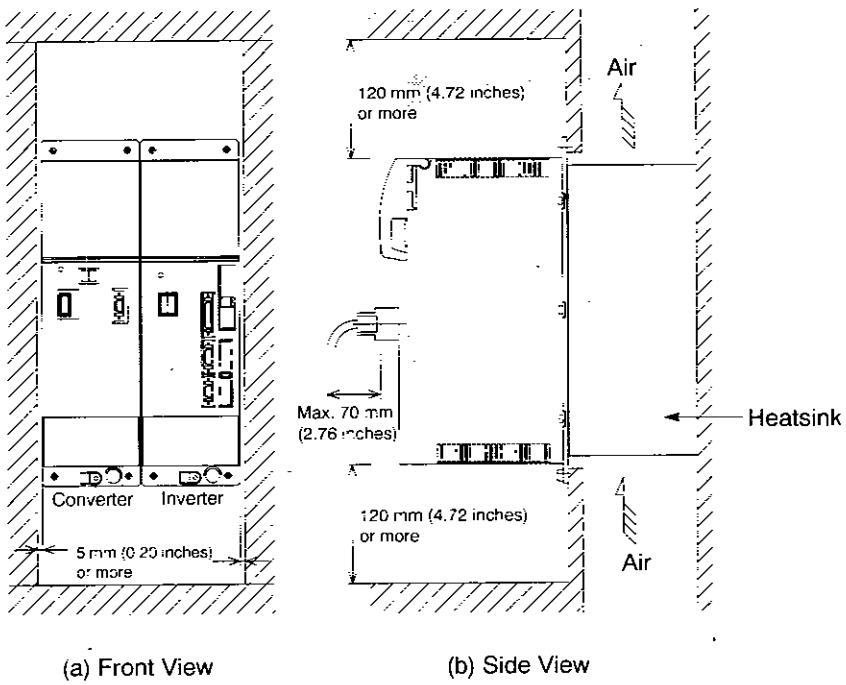


Fig. 3 Clearances (Heatsink externally cooling type)

(2) Open Chassis Type

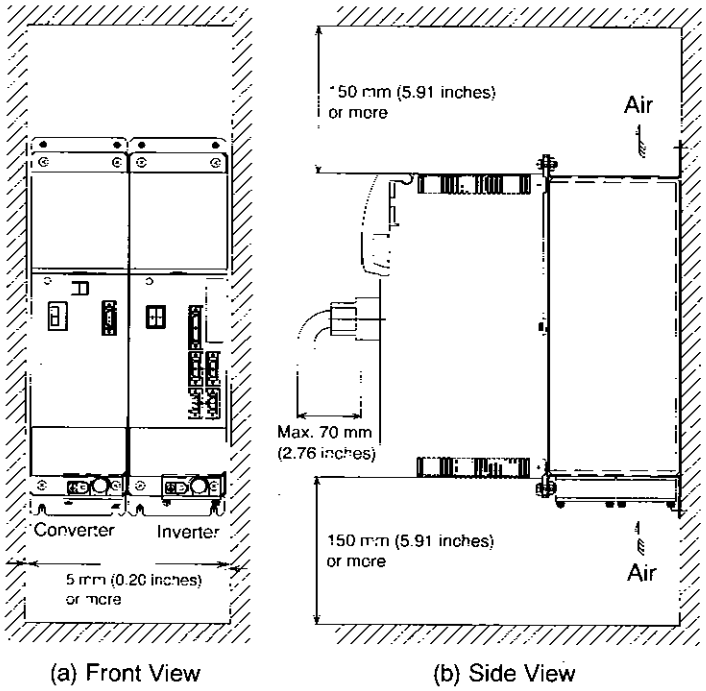


Fig. 4 Clearances (Open chassis type)

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.

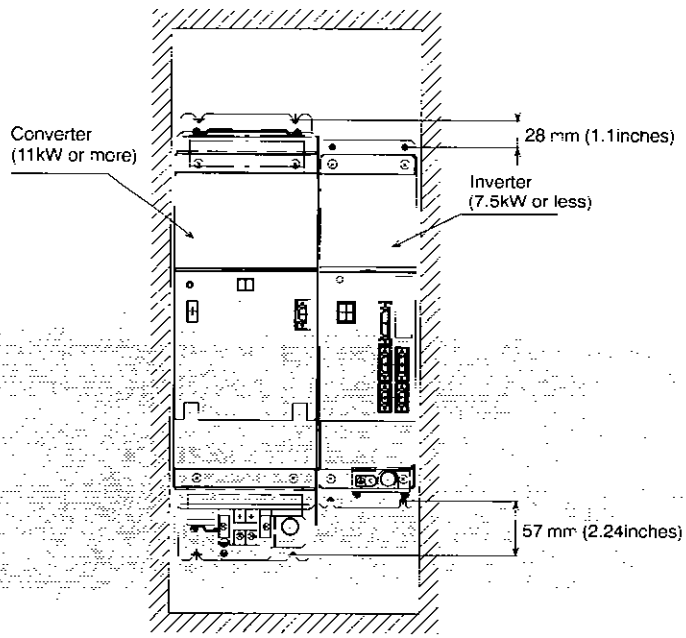


Fig. 5 Clearances when combining a converter (11kW or more) with an inverter (7.5kW or less)

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.

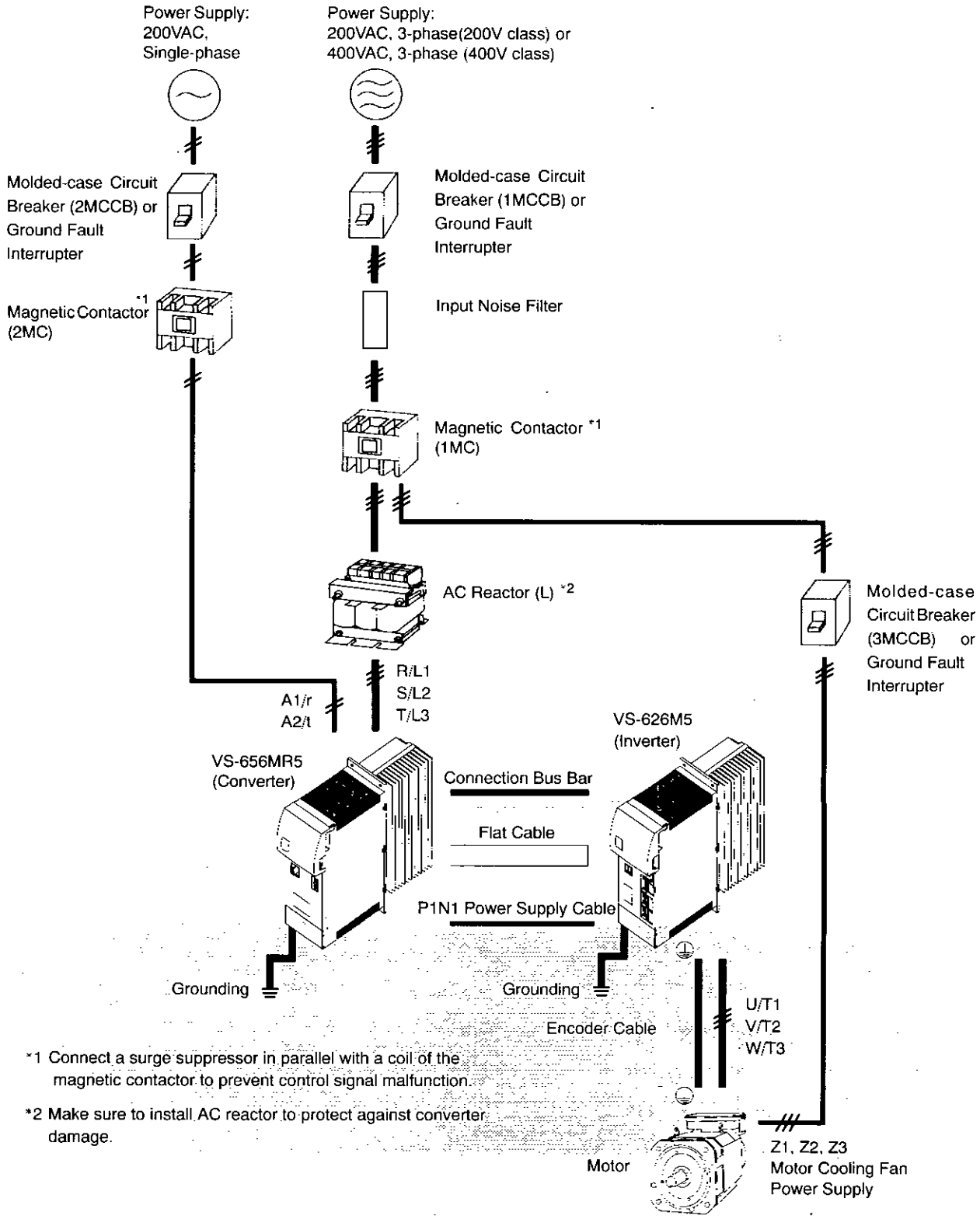


Fig. 6 Connection with Peripheral Units (Heatsink Externally Cooling Type)

3.2 CONNECTION DIAGRAM

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

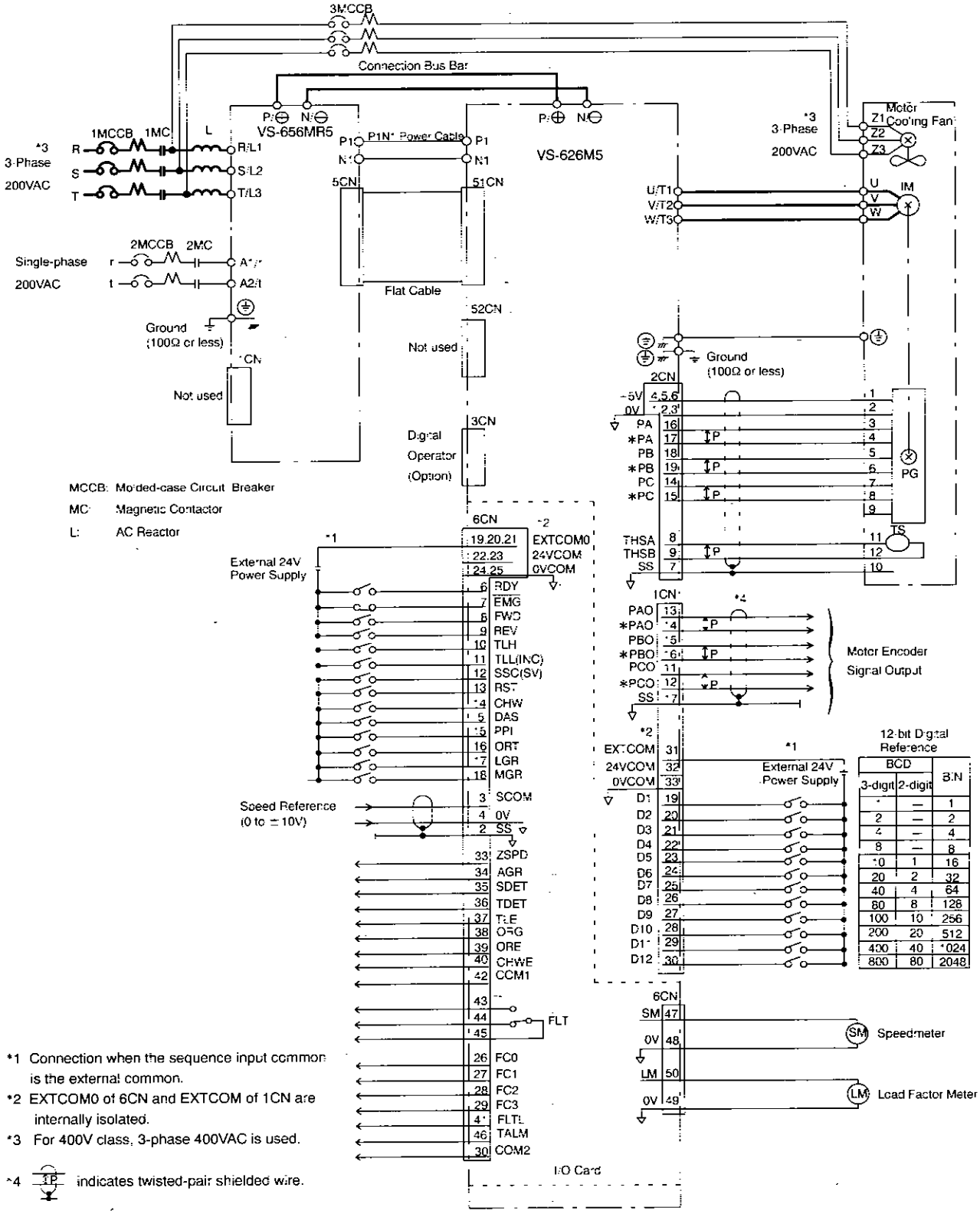


Fig. 7 Connection Diagram (200V class, Heatsink externally cooling type)

3.3 WIRING THE MAIN CIRCUIT

⚠ WARNING

- Make sure to ground the ground terminal ⏚.
  (200V class: Ground to 100Ω or less, 400V class: Ground to 10Ω 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 [illegible] breaker (MCCB). However, when a magnetic contactor is switched OFF [illegible] power supply input side, regenerative braking does not function and [illegible] stop. (At this time, protective function activates to display a fault.)

Frequent opening/closing of the [illegible] 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

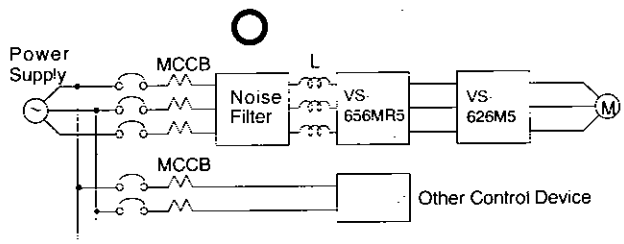
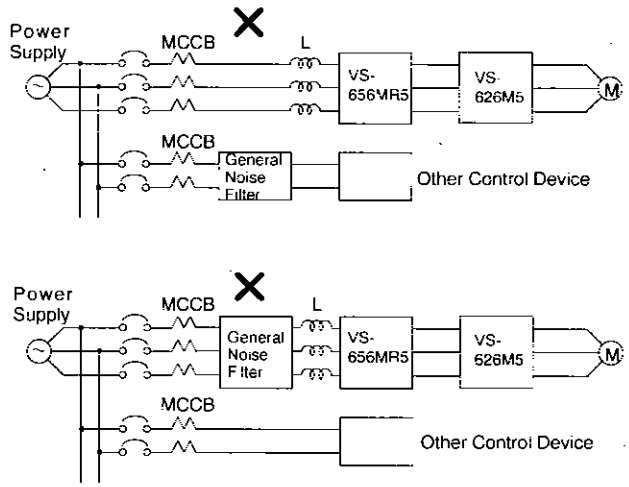


Fig. 8 Correct Input Noise Filter Installation

• Example 2



A general-purpose noise filter will not be effective.

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 onnected.

(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.

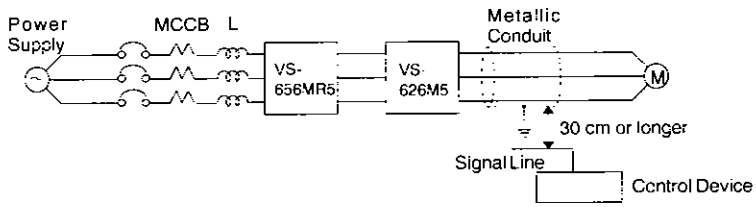


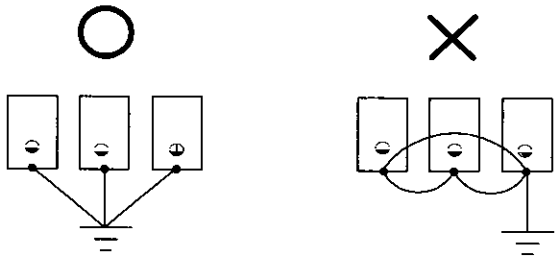
Fig. 10 Dealing with Emission Noise

(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).

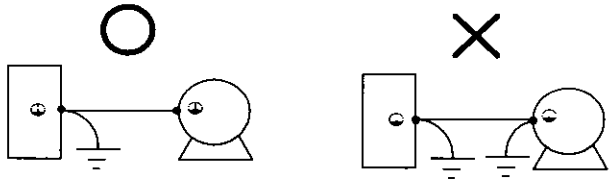
(5) Grounding

- Make sure to ground the ground terminal (⏚).
  200V class: Groung 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).



(a) Acceptable (b) Not Acceptable

Fig. 11 Grounding



(a) Acceptable (b) Not Acceptable

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

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

Table 3 Inverter Main Circuit Terminals

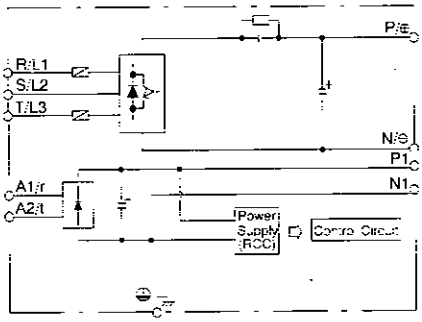
Voltage class	Symbol	Name	Functions
200V class	P/⊕ N/⊖	Main circuit power supply input	270 - 325VDC (Supplied from converter)
	P1 N1	Control power supply input	282 - 325VDC (Supplied from converter)
	A12/r2* A22/t2	Power supply input for heatsink cooling fan	Single-phase 200 - 220VAC 50Hz 200 - 230VAC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

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

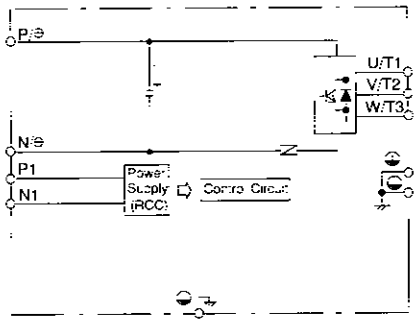
(7) Main Circuit Configuration

(a) 200V class Heatsink Externally Cooling Type

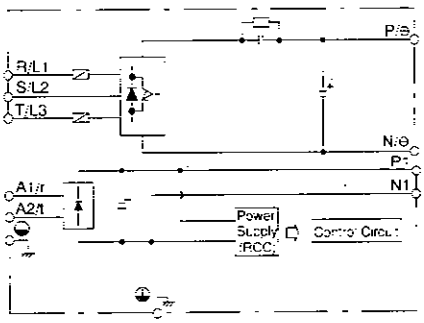
Converter (VS-656MR5)
CIMR-MR5A23P75 to 27P55



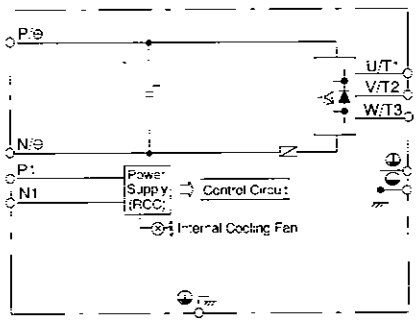
Inverter (VS-626M5)
CIMR-M5A23P75 to 27P55



CIMR-MR5A20115 to 20375

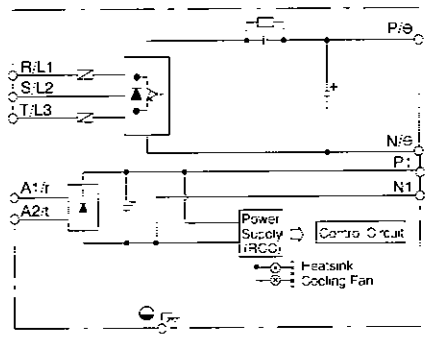


CIMR-M5A20115 to 20375

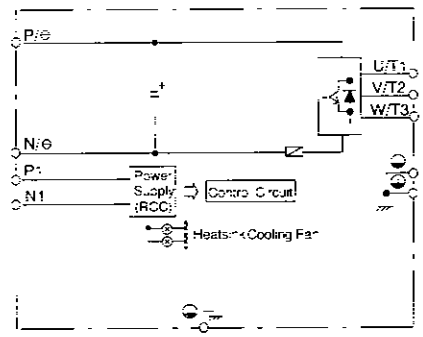


(b) 200V class Open Chassis Type

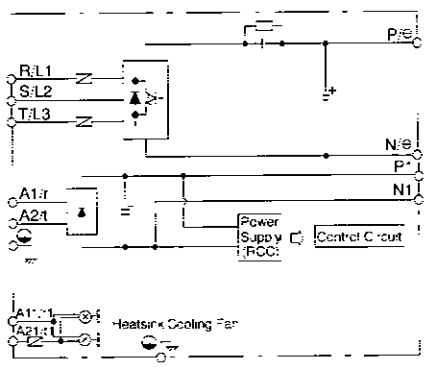
Converter (VS-656MR5)
CIMR-MR5A23P70 to 27P50



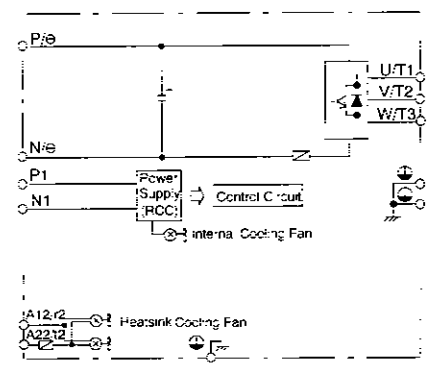
Inverter (VS-626M5)
CIMR-M5A23P70 to 27P50



CIMR-MR5A20110 to 20300

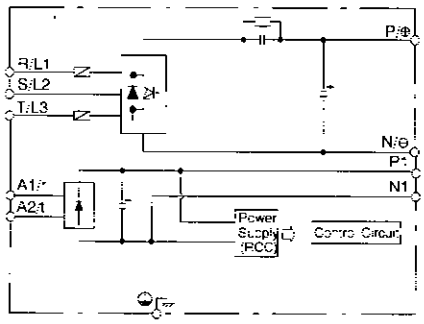


CIMR-M5A20110 to 20300

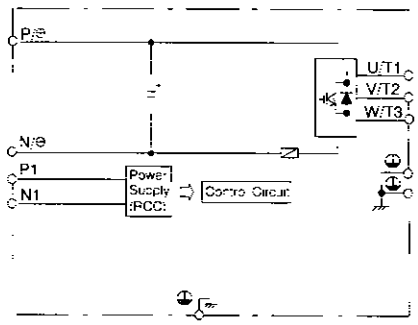


(c) 400V class Heatsink Externally Cooling Type

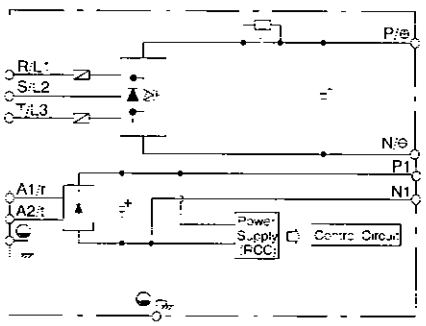
Converter (VS-656MR5)
CIMR-MR5A45P55 to 47P55



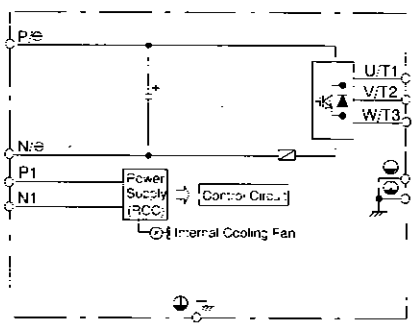
Inverter (VS-626M5)
CIMR-M5A45P55 to 47P55



CIMR-MR5A40115 to 40455

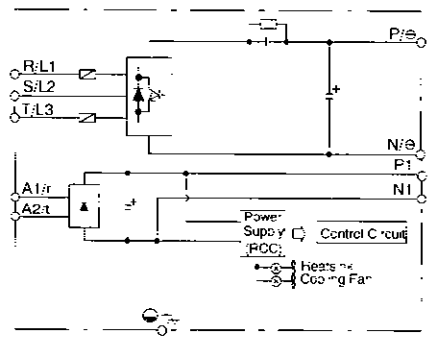


CIMR-M5A40115 to 40455

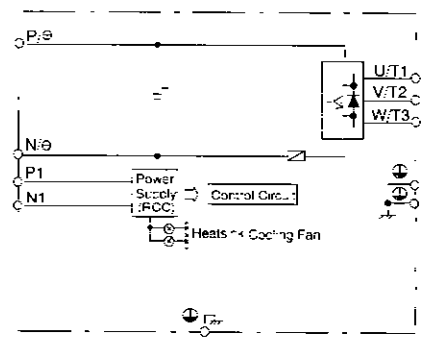


(d) 400V class Open Chassis Type

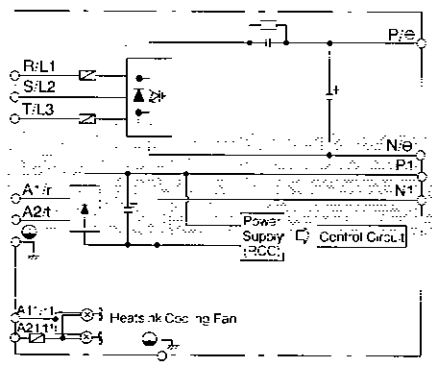
Converter (VS-656MR5)
CIMR-MR5A45P50 to 47P50



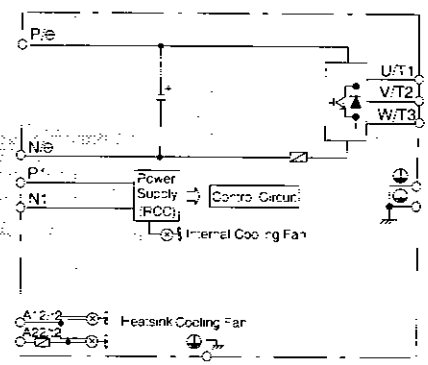
Inverter (VS-626M5)
CIMR-M5A45P50 to 47P50



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 CIMR-MR5A□	Terminal Symbol	Terminal Screw	Tightning Torque lb-in (N · m)	Wire Size			
				UL-approved 75 °C (167°F) temperature-rated copper wire [AWG (mm²)]	600V vinyl-sheath insulated wire (IV, VV) 60 °C (140°F) (mm²)	600V cross-linked polyethylene wire (IC) 90°C (194°F) (mm²)	600V rubber-insulated cabtyre cable (CT) 60°C (140°F) (mm²)
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 (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 CIMR-MR5A□	Terminal Symbol	Terminal Screw	Tightning Torque lb-in (N · m)	Wire Size			
				UL-approved 75 ℃ (167°F) temperature-rated copper wire [AWG (mm²)]	600V vinyl-sheath insulated wire (IV, VV) 60 ℃ (140°F) (mm²)	600V cross-linked polyethylene wire (IC) 90℃ (194°F) (mm²)	600V rubber-insulated cabtyre cable (CT) 60℃ (140°F) (mm²)
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/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
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/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
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/t	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/t	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/t	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/t	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/t	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/t	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/t	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/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. (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℃ (86°F).

2. If ambient temperature exceeds 30℃ (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 CIMR-M5A ☐☐	Terminal Symbol	Terminal Screw	Tightning Torque lb-in (N · m)	Wire Size			
				UL-approved 75 °C (167°F) temperature-rated copper wire [AWG (mm²)]	600V vinyl-sheath insulated wire (IV, VV) 60 °C (140°F) (mm²)	600V cross-linked polyethylene wire (IC) 90°C (194°F) (mm²)	600V rubber-insulated cabtyre cable (CT) 60°C (140°F) (mm²)
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 (14.7 - 19.6)	3/0 (85)	100	50	100
	⏚	M8 × 2, M6	69.4 - 86.8 (7.8 - 9.8) 30.4 - 43.4 (3.4 - 4.9)	3 (26.7)	22	14	22
2011 to 2030	A12/r2, A22/r2 (* 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 CIMR-M5A ☐	Terminal Symbol	Terminal Screw	Tightning Torque lb-in (N · m)	Wire Size			
				UL-approved 75 ℃ (167°F) temperature-rated copper wire [AWG (mm²)]	600V vinyl-sheath insulated wire (IV, VV) 60 ℃ (140°F) (mm²)	600V cross-linked polyethylene wire (IC) 90℃ (194°F) (mm²)	600V rubber-insulated cabtyre cable (CT) 60℃ (140°F) (mm²)
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, M6	17.4 -21.7 (2.1 - 2.5) 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, M6	17.4 - 21.7 (2.1 - 2.5) 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, M6	17.4 - 21.7 (2.1 - 2.5) 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, M6	17.4 - 21.7 (2.1 - 2.5) 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, M6	30.4 - 43.4 (3.4 - 4.9) 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, M6	30.4 - 43.4 (3.4 - 4.9) 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, M6	30.4 - 43.4 (3.4 - 4.9) 30.4 - 43.4 (3.4 - 4.9)	6 (13.3)	14	8	14
4011 to 4022	A12/r2, A22/t2 (* 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℃ (86°F).

2. If ambient temperature exceeds 30℃ (86°F), the allowable current of wire may be lowered.

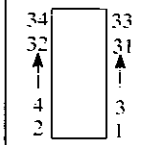
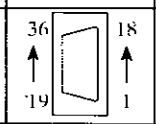
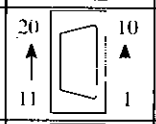
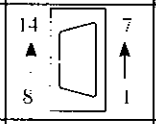
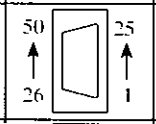
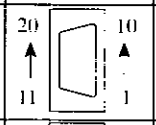
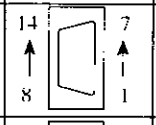
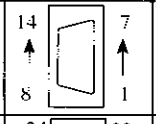
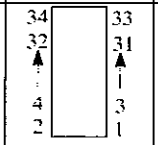
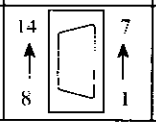
3. Temperature for each wire indicates maximum allowable conductor temperature.

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

Wire Size		Terminal Screw	Closed-Loop Connectors
mm^2	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
		M8	5.5 - 8
8	8	M5	8 - 5
		M6	8 - 6
		M8	8 - 8
14	6	M6	14 - 6
		M8	14 - 8
22	4	M6	22 - 6
		M8	22 - 8
30 - 38	3 - 2	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 (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 ·10336-52A0-008 (case)		0.2 mm²	Sumitomo 3M Ltd.
	2CN	Encoder signal input	10220-52A2JL	·10120-3000VE ·10320-52A0-008 (case)		0.2 mm²	Sumitomo 3M Ltd.
	3CN	Digital operator	10214-52A2JL	·10114-3000VE ·10314-52A0-008 (case)		Use a special cable.	Sumitomo 3M Ltd.
I/O Card (VS-626M5)	6CN	Control signals	10250-52A2JL	·10150-3000VE ·10350-52A0-008 (case)		0.2 mm²	Sumitomo 3M Ltd.
Encoder Method Orientation Card (VS-626M5)	8CN	Load shaft encoder signal input	10220-52A2JL	·10120-3000VE ·10320-52A0-008 (case)		0.2 mm²	Sumitomo 3M Ltd.
	9CN	Load shaft encoder signal output	10214-52A2JL	·10114-3000VE ·10314-52A0-008 (case)		0.2 mm²	Sumitomo 3M Ltd.
Magnetic Sensor Method Orientation Card (VS-626M5)	10CN	Control signals	10214-52A2JL	·10114-3000VE ·10314-52A0-008 (case)		0.2 mm²	Sumitomo 3M Ltd.
Control PC Board (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 ·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 Line driver +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 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 Load current: 350mA or less
	0V	1, 2, 3	Encoder power supply common	
	PA	16	Encoder phase A signal input	RS-422A specification Line receiver +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	+24V Load current: 10mA or less
	CA2	13		

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	
	SS	2	Shield (0V)	–	C1-26, 10, C1-38 bit 5
	SCOM	3	Analog speed reference input	0 to ±10V (Input impedance: 50kΩ)	C1-11, 12
	0V	4	Analog speed reference 0V	–	
	DAS	5	Digital/analog speed reference selection		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 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	24VDC	Selected when C1-36 bit 3=1
	RST	13	Fault reset	Current when closed: 5mA	–
	CHW	14	Winding selection		–
	PPI	15	P control/PI control selection		Selected when C1-36 bit 4=0
	ORT	16	Orientation		Selected when C1-40 bit 3=0 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		
	FC1	27	Fault code 1		
	FC2	28	Fault code 2	Open-collector output	
	FC3	29	Fault code 3	Exclusive-use for 24VDC	–
	FLTL	41	Fault (Open at fault)	Load current: 50mA or less	
	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	Open-collector output	C1-23
	TLE	37	Torque limit	Exclusive-use for 24VDC	–
	ORG	38	Load origin	Load current: 50mA or less	–
	ORE	39	Orientation completion		C2-09, 10 or C3-09, 10
	CHWE	40	Winding selection completion		–
	COM1	42	Sequence output signal common		–
	FLTNO	43	Fault contact output Closed between 43 and 45 at fault Open between 44 and 45 at fault	Relay contact output Exclusive-use for 24VDC Load current: 1A or less Minimum Permissible load: 10mA (as reference value)	–
	FLTNC	44			
	FLTCOM	45			
	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 C1-38 bit 1, 0
	0V	49	0V for load ratio meter	–	C1-38 bit 7

NOTE

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 (option)	+5V	4, 5, 6	+5V power supply for encoder	+5V Load current: 350mA or less
	0V	1, 2, 3	Encoder power supply 0V	
	CPA	9	—	RS-422A specification Line receiver +5V
	*CPA	11		
	CPB	12	—	
	*CPB	13		
	CPC	7	—	
	*CPC	8		
	SPA	16	Encoder phase A signal input	RS-422A specification Line receiver +5V
	*SPA	17		
	SPB	18	Encoder phase B signal input	
	*SPB	19		
	SPC	14	Encoder phase C signal input	
	*SPC	15		
	SS	20	Shield (0V)	—
9CN (option)	SPAO	4	Encoder phase A signal output	RS-422A specification Line driver +5V
	*SPAO	5		
	SPBO	6	Encoder phase B signal output	
	*SPBO	7		
	SPCO	2	Encoder phase C signal output	
	*SPCO	3		
	SS	1	Shield (0V)	—
10CN (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 52CN 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

51CN

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

5CN, 52CN

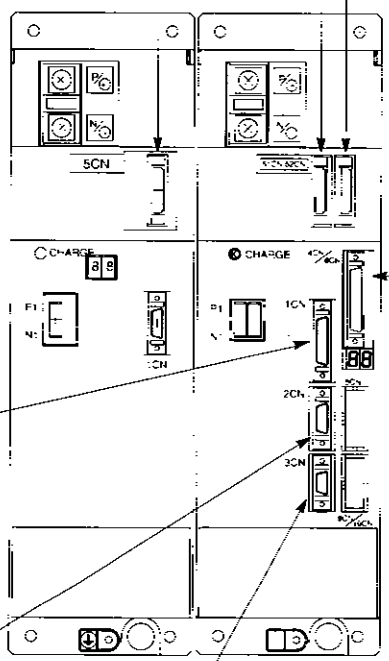
34	—	33	+24VIN
32	ESP0	31	/EXT1
30	ALM±	29	/EXT2
28	ALMC	27	ESP1
26	CONRDY	25	CONFLT
24	AXRUN	23	CONRST
22	+24V	21	+24V
20	+24V	19	+24V
18	+24V	17	+24V
16	+24V	15	+24V
14	0V	13	0V
12	0V	11	0V
10	0V	9	0V
8	0V	7	0V
6	BAT+	5	*S
4	BAT-	3	S
2	0V	1	0V

1CN

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

6CN

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	FLTNC	19	COM
43	FLTNO	18	MGR
42	COM1	17	LGR
41	FLTL	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



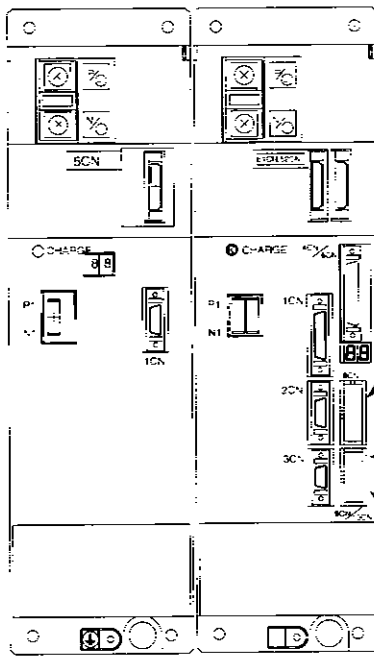
2CN

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

3CN (Option)

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	*SPAO
11	—	4	SPAO
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

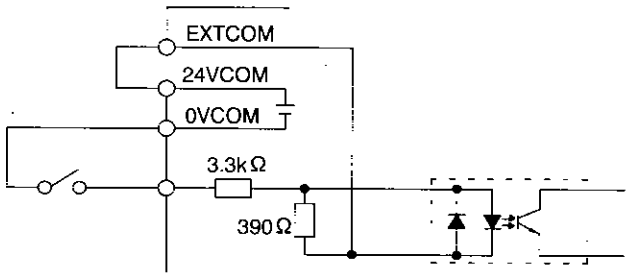
Note: Terminal arrangement is as when the connectors on the PC board are viewed from the engaged part (front of the unit).

(3) Input Method Selection

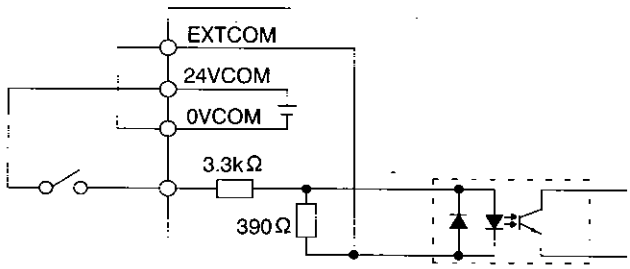
Inverter 1CN 12-bit digital reference and 6CN sequence input signal can be input with 0V common, +24V common or external common. Wiring differs according to input method used. Refer to Fig. 13 for correct wiring. For external common, use +24V (20 to 26V) power supply for input signal.

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

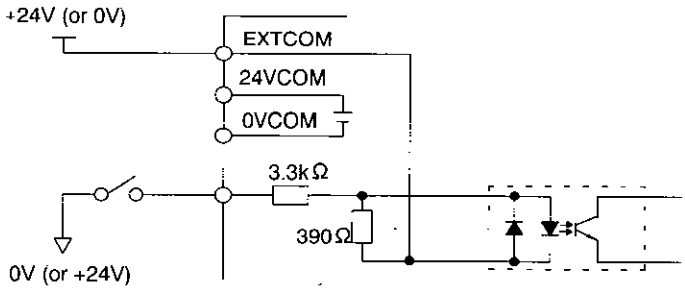
(a) 0V Common



(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 form 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.

NOTE

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.

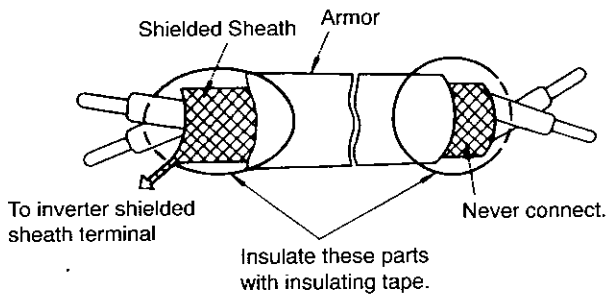


Fig. 14 Shielded Wire Termination

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

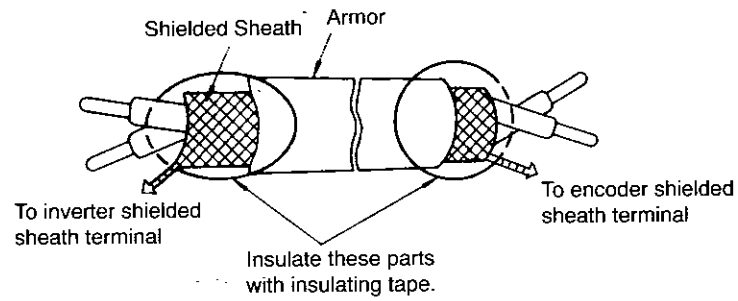


Fig. 15 Shielded Wire Termination (Shielded at Both Ends)

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.

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.

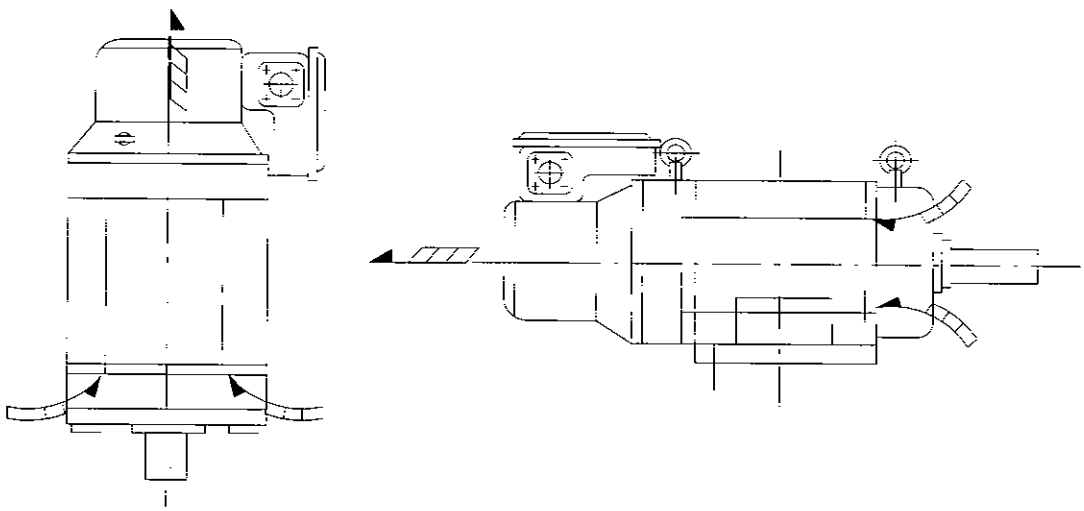
When " - U " is displayed continuously on the 7-segment LED of the converter, main circuit input voltage may be low or open-phase occurs. Check the input supply voltage.

(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.



(a) Flange-mounted Type (b) Foot-mounted Type

Fig. 16 Motor Cooing Air Passage

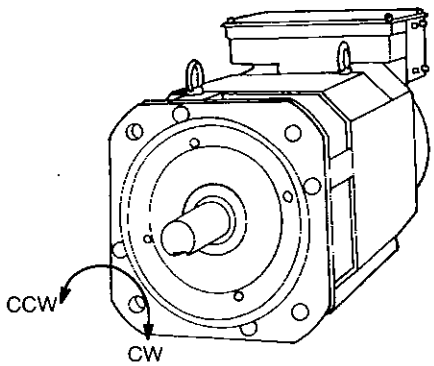
(4) Operation

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, of 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- (Fault occurrence No.) 01 (Fault contents)	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.) When the fault occurrence is only one, displays the fault contents only.

Inverter

Display	Description
- b	Indicates the status where run command is not input (base blocked).
- r	Indicates the converter is running.
2 - (Fault occurrence No.) 42 (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.) 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

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

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

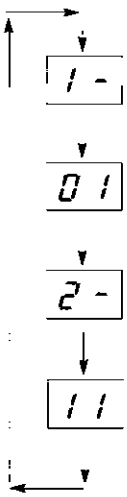
The last 2 letters of the software version are displayed for 2 sec.

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



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

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

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

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.

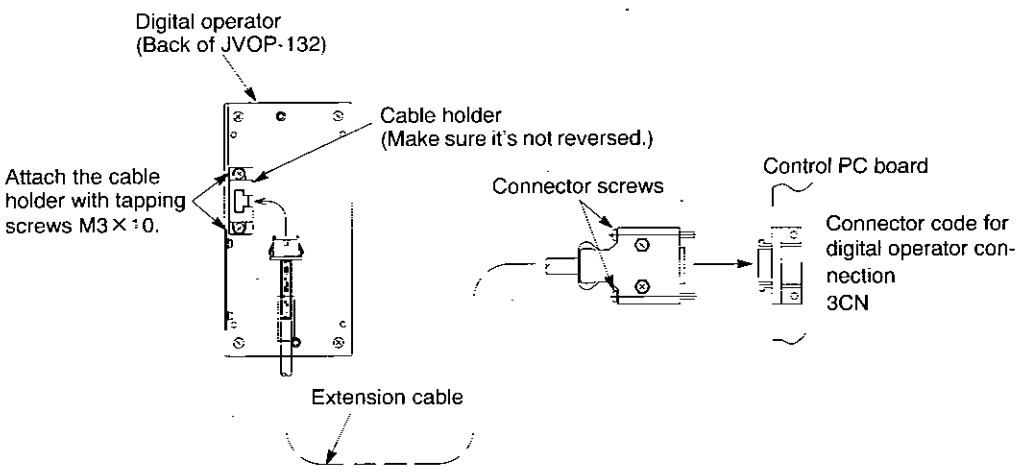


Fig. 18 Extension Cable Installation

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.

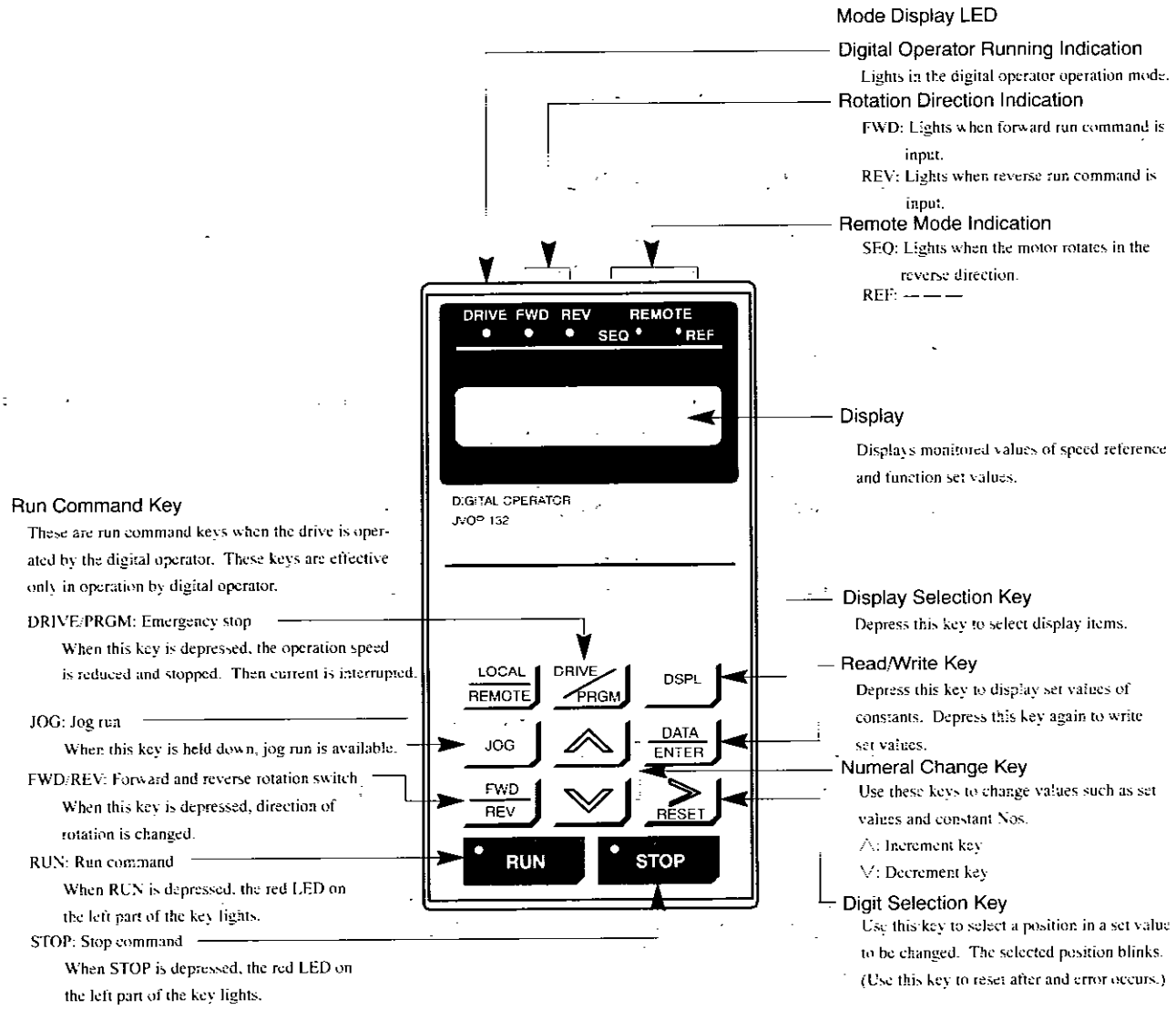


Fig. 19 Display Unit and Operation Keys of the Digital Operator

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

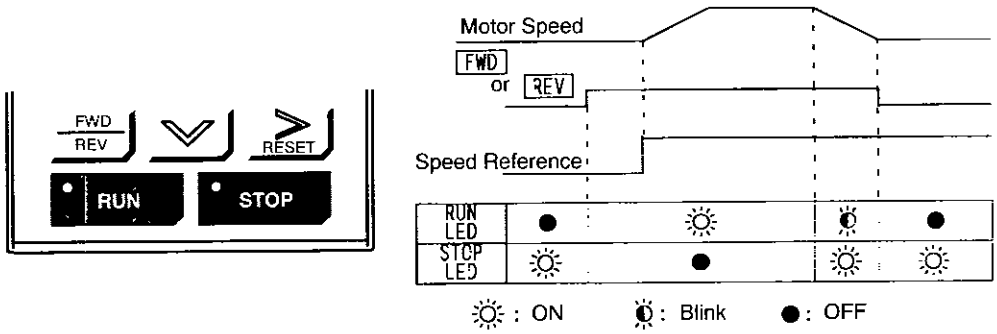


Fig. 20 LED Display of RUN and STOP Keys

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

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

Note: "—" is not displayed.

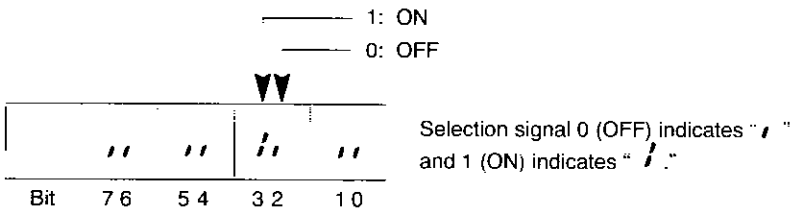


Fig. 21 Display of Bit Selection Signal

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
· Turn ON control power supply. · All LEDs light.	8.8.8.8.8	Displayed for 1.5 sec.
· PROM No. is displayed.	00040	Displayed for 0.5 sec. The lower 5 digits of PROM No. are displayed. The example uses PROM No. "VSM200040."
· U1-01 (motor speed) data is displayed.	0	Because the motor does not rotate when power supply is turned ON, "0" is displayed.
· The fault No. is displayed. (Displayed when a protective function is activated.)	(AL-42)	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
· Motor speed (U1-01) data is displayed.		0	
· Motor speed data No. is displayed. (Operation status display has been selected.)	DSPL	U1-01	Control signal status of each unit can be monitored.
· Control constants display is selected.	DSPL	C1-01	Control constants are displayed/set.
· Digital operator run command display is selected. (Displayed when bits 0 and 1 of control constant C1-37 are set ON.)	DSPL	(d1-01)	Use when operating by digital operator.
· The fault No. display is selected. (Displayed when a protective function is activated.)	DSPL	(AL-42)	Contents of currently occuring fault are displayed. AL-42 indicates motor thermistor disconnection is detected.
· Fault record display is selected.	DSPL	1AL30	Contents of past faults are displayed. 1AL30 indicates the last fault is encoder signal disconnection.
· Returns to operation status display.	DSPL	U1-01	

(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.		U1-01	
· Move blinking cursor to the data No.	RESET	U1-01	Depress [>] key once more to return the blinking cursor.
· Select U1-09.	∧ ∨	U1-09	
· Display U1-09 data contents.	DATA ENTER	- -	The display example is the status when [RDY] and [EMG] signals are closed.
· Return to operation status No. display	DSPL	U1-09	

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.		C1-01	
· Move blinking cursor to the data No.	RESET	C1-01	Depress [>] key once more to return the blinking cursor.
· Select C1-10.	∧ ∨	C1-10	
· Display C1-10 data contents.	DATA ENTER	000.1	
· Select data line to be changed.	RESET	000.1	
· Change set value. (1→5)	∧ ∨	000.5	
· Write-in set value.	DATA ENTER	End	Displayed for 0.5 sec. *
		000.5	Returns to previous display before write-in.
· Return to control constant No. display.	DSPL	C1-10	

* 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.

NOTE

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 "0 0" to "1 1" to turn ON the operation mode.

Description	Key Sequence	Digital Operator Display	Remarks
· C1-37 is selected.		C 1-37	
· Display C1-37 data contents.	DATA ENTER	0 0 0 0 0 0 0 0	
· Select the digit of bit 1 (second place from the right).	RESET	0 0 0 0 0 0 0 0	
· Change set value. (Turn ON lower two bits.)	^ RESET	0 0 0 0 0 0 1 1	
· Write-in set value.	DATA ENTER	End	Displayed for 0.5 sec.
		0 0 0 0 0 0 1 1	Returns to previous display before write-in.
· Return to control constants display.	DSPL	C 1-37	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	Bit 9 8 7 6 5 4 3 2 1 0 TLH TLL SSC - - - CHW PPI ORT LGR MGR - - -
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.	DSPL	d1-01	
· Select d1-02.	∧	d1-02	
· Display d1-02 data contents.	DATA ENTER	000.00	
· Set speed reference (25%).	> RESET ∧ ∨	025.00	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.	DATA ENTER	End	Displayed for 0.5 sec.
		025.00	Returns to previous display before write-in.

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

Table 17 Key Operations in Digital Operator Operation Mode

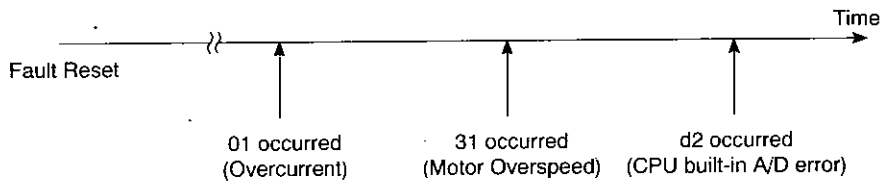
Key	Name	Function
DRIVE/PRGM	Emergency stop key	When the key is depressed, current is shut off after deceleration to stop.
JOG	Jog run key	Jog run can be performed when the key is held down. [Runs at 5% reference of rated speed setting (C1-26).]
FWD/REV	FWD/REV run key	FWD/REV run is switched when the key is depressed. (FWD/REV LED lights alternately.)
RUN	Run command key	Depress the key to start operation. (Red LED on the left lights during run.)
STOP	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 "01."

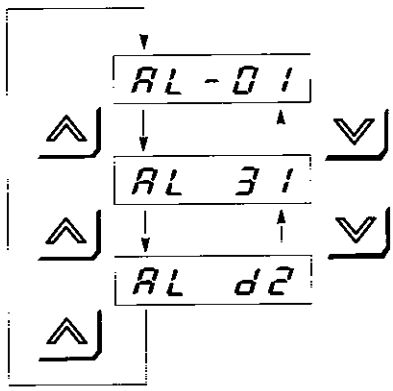
(6) Fault Display Mode

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.



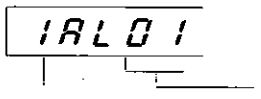
NOTE

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.

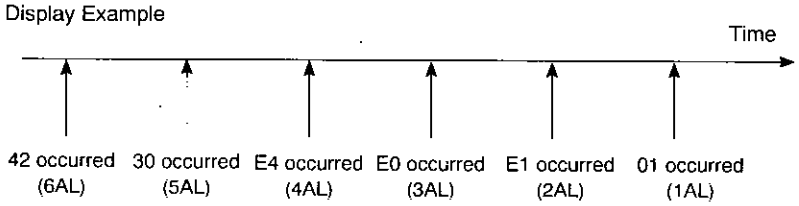
(7) Fault Record Display Mode

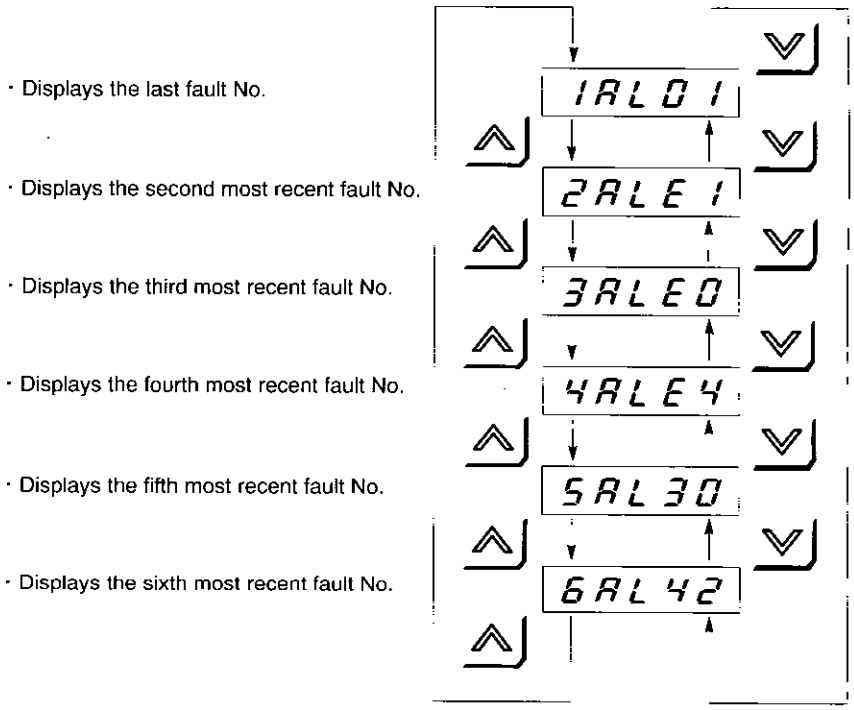
Up to six faults can be displayed in order from most recent to oldest.



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

Display Example





NOTE

- 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 39.2×10^4 to 58.8×10^4 Pa (4 to 6kg·cm^{-2}) pressure.
	Printed Circuit Board	Accumulation of conductive dust or oil	Blow with dry compressed air of 39.2×10^4 to 58.8×10^4 Pa (4 to 6kg·cm^{-2}) pressure. If dust and oil cannot be removed, replace the board.
	Cooling Fan	· For abnormal noise and vibration · Whether the cumulative operation time exceeds 20,000 hours or not.	Replace the cooling fan.
	Power Elements	Accumulation of dust and dirt	Blow with dry compressed air of 39.2×10^4 to 58.8×10^4 Pa (4 to 6kg·cm^{-2}) pressure.
	Smoothing Capacitor	Discoloration or odor	Replace the capacitor or 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 tha 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

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

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.	· Check the wiring. · Check the input supply voltage. · Check the AC reactor. · Check the load shaft (inverter, servo) capacity.
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.	· Reduce the load. · Check the load shaft (inverter, servo) capacity.
11	Output overvoltage	Output voltage exceeded overvoltage level. Detection level: 200V class: Approx. 400V 400V class: Approx. 800V	· Check the input supply voltage. · Check the load shaft (inverter, servo) capacity.
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 ± 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.

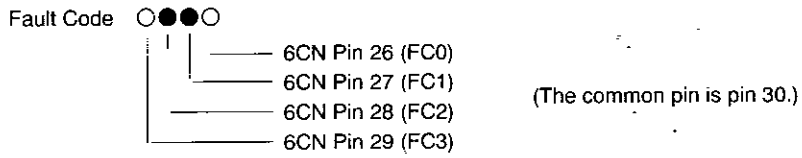


Fig. 22 Fault Code Output

Table 21 Inverter Fault Diagnosis and Corrective Actions

Fault No.	Name	Contents	Corrective Actions	Fault Code
AL-01	Overcurrent	Output current exceeded overcurrent detection value, or inverter output (load) was short-circuited.	Check the wiring for looseness, etc.	●●●●
AL-02	Ground fault	Inverter output side ground current exceeded grounding detection level.	· Check the motor for deterioration of insulation. · Check the wiring between inverter and motor.	●●●●
AL-04	Main circuit fuse blown	DC circuit fuse was blown.	· Check for damage to transistor, short-circuits on load side, ground fault, etc. · Check the inverter output wiring.	●●●●
AL-05	Inverter output overload	Output current of 120% of 30-minute rating runs for over one minute.	· Reduce the load. · Check the load shaft (inverter, servo) capacity.	●●●●
AL-06	Motor overload	Motor overload capacity exceeded.	Reduce the load.	●●●●
AL-07	Motor Overload (When the motor is locked) (IPM motor only)	The motor exceeded the overload level at low speed (30 r/min or less).	· Check that the load is heavy or a tool is jammed. · 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.)	●●●●
AL-10	Converter fault	A fault occurred in converter unit.	Check fault contents by using converter LED.	●●●○
AL-11	Main circuit overvoltage	Main circuit DC bus voltage exceeded the overvoltage set value.	· Check the input supply voltage. · Check the load shaft (inverter, servo) capacity. · Check the control constants.	●●●○
AL-12	Main circuit undervoltage	Main circuit DC bus voltage became lower than undervoltage detection level during run.	Check the input supply voltage.	●●●○
AL-13	Control circuit undervoltage	Control circuit power supply became lower than undervoltage detection level.	Check the control supply voltage.	●●●○
AL-20	Winding selection fault	Winding selection was not completed within set time.	· Check the control constant C1-25. · Check magnetic contactor wiring for winding selection.	●●○●

(Cont'd)

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

Fault No.	Name	Contents	Corrective Actions	Fault Code
AL-21	Emergency stop fault	Inverter did not stop within 10 seconds after emergency stop command.	· Check control constant C1-25. · Check the setting of control constant C1-24 and whether external torque limit signals TLL and TLH are input.	●●○●
AL-30	Encoder signal cable disconnection	Motor encoder signal was disconnected or connected improperly.	Check the wiring of encoder signal lines.	●●○○
AL-31	Motor overspeed	Motor speed exceeded 120% of set rated speed.	· Check that encoder signal lines are separated from main circuit or other power lines. · Check the control constants.	●●○○
AL-32	Excessive speed deviation	Speed falls to less than 50% of reference value.	· Check that the load is heavy or a tool is jammed. · Check whether external torque limit signals TLL and TLH are input. · Check the control constants. · Check the wiring of encoder signal lines.	●●○○
AL-33	Load fault	Inverter output (U/T1, V/T2, W/T3) was disconnected.	Check inverter output wiring.	●●○○
AL-34	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.)	· Check that the load is heavy or a tool is jammed. · Check the wiring between inverter and motor. · Check the wiring of encoder signal lines. · Make sure that the motor shaft rotates. · Check if a motor fault or a contact between rotor and stator occurs, or if a bearing is damaged.	●●○○
AL-40	Motor overheat 1	Motor temperature exceeded upper limit (minor fault).	· Check the wiring. · Check that motor cooling air is normal with power ON. · Check that the fan is not clogged with dust or oil. · Check the wiring of motor thermistor signal lines.	●○●●
AL-41	Motor overheat 2	Motor temperature over upper limit continued for over one minute.		●○●●
AL-42	Motor thermistor disconnection	Motor temperature detection thermistor was disconnected.	· Check the motor thermistor signal wiring. · Check the motor ambient temperature. [Raise the temperature to above -10°C (14°F) or more.]	●○●●
AL-43	Heatsink overheat 1	Heatsink temperature exceeded upper limit (minor fault).	Check the ambient temperature for effective cooling.	●○●●
AL-44	Heatsink overheat 2	Heatsink temperature over upper limit continued for one minute or longer.		●○●●
AL-45	Heatsink thermistor disconnection	Thermistor for heatsink temperature detection was disconnected. The ambient temperature is low [-20°C (-4°F) or below].	· Replace the unit. · Raise the ambient temperature to above -20°C (-4°F).	●○●●
AL-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.	●○●●
AL-47	Control PC board temperature fault 2	Control PC board temperature exceeded +85°C (185°F).	Check the ambient temperature for effective cooling.	●○●●
AL-48	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
AL-60	Tune-up incomplete (Encoder method orientation)	Orientation command was input before tuning up (minor fault).	Perform orientation tune-up.	●○○●
AL-61	Phase C signal detection error	Phase C signal could not be detected during tuning up.	· Check the wiring of encoder signal lines. · Check that encoder signal lines are separated from main circuit or other power lines. · Verify that motor and inverter are grounded. · Replace the orientation card. · Replace the encoder.	●○○●
AL-62	Phase C signal width error	Phase C signal width exceeded 100 pulses.		●○○●
AL-63	Fault of number of pulses per rotation (Encoder method orientation)	Number of pulses per rotation exceeded 4096 ± 1 during tuning up.		●○○●
AL-64	Position detection signal cable disconnection	Position detection encoder signal cable was disconnected or connected improperly.	· Check the wiring of load shaft encoder signal lines. · Replace the load shaft encoder. · Replace the orientation card.	●○○●
AL-65	INC signal error (Encoder method orientation)	INC signal input timing error (minor fault)	After carrying out absolute positioning, change circuit to command INC signal.	●○○●
AL-70	Tune-up incomplete (magnetic sensor method orientation)	Orientation command was input before tuning up (minor fault).	Perform orientation tune-up.	●○○○
AL-71	Magnetic sensor signal detection error	Incorrect magnetic sensor signal voltage level during tuning up.	· Check the wiring of magnetic sensor signal lines. · Replace the magnetic sensor or magnetizer.	●○○○
AL-73	Fault of number of pulses per rotation (magnetic sensor method orientation)	Number of motor pulses per spindle rotation (4096 ÷ speed gear ratio) exceeded ±6% during tuning up.	· Check control constants C1-27, 28, 29. · Check the wiring of motor encoder signal lines.	●○○○
AL-74	Magnetic sensor signal disconnection	Magnetic sensor signal cable was disconnected or connected improperly.	· Check the wiring of magnetic sensor signal lines. · Replace the magnetic sensor or magnetizer. · Perform tune-up again.	●○○○
AL-75	INC signal error (Magnetic sensor method orientation)	INC signal input timing error (minor fault)	After carrying out absolute positioning, change circuit to command INC signal.	●○○○
AL-60	Initial Orgin Detection Error (For IPM motors only)	When the power is turned ON, a phase-C signal cannot be detected while detecting the initial origin.	· Check the wiring of the C-phase signal of the encoder. · Replace the encoder or motor. · Replace the control card.	○●○○
AL-61	Encoder Pulse Number Error (For IPM motor only)	The encoder pulse number per rotation exceeded the correct value by ±10 pulses.	· Check the wiring of the encoder signal lines. · Check if the encoder signal line is separated from the main circuit wiring and other power cables. · Check if the motor and the inverter are properly grounded. · Check the encoder cable specifications. (Check if a twisted-pair shielded wire is used.) · Replace the encoder.	○●○○

(Cont'd)

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

Fault No.	Name	Contents	Corrective Actions	Fault Code
AL-b2	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.	○●○○
AL-d1	Speed reference A/D converter error	I/O card speed reference A/D converter error	Replace the I/O card.	○○●○
AL-d2	CPU built-in A/D converter error	CPU built-in A/D converter error	Replace the control PC board.	○○●○
AL-d3	Phase U A/D converter error	Phase U current detection A/D converter error		○○●○
AL-d4	Phase W A/D converter error	Phase W current detection A/D converter error	Replace the control PC board.	○○●○
AL-d5	Control circuit I/O fault 1	Data transmission error between CPUs.	Replace the control PC board.	○○●○
AL-d6	Control circuit I/O fault 2			○○●○
AL-d7	Control circuit I/O fault 3			○○●○
AL-E0	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).	○○○●
AL-E1	Motor code unrecorded	Motor code set in C1-25 is not recorded.	· Check motor model and motor code (C1-25). · Check setting list for correct PROM version of motor code (C1-25).	○○○●
AL-E2	Constant setting range error	Memory (EEPROM) data exceeded upper/lower limit.	· Check that rated speed (C1-26) is within setting range. · Check control constants. · Replace the control PC board.	○○○●
AL-E3	Orientation card mismatch	Selected orientation bit does not match orientation card.	· Check orientation card model and orientation selection signal (bit 0 of C1-39). · Replace the orientation card.	○○○●
AL-E4	Inverter capacity selection error	Selected inverter capacity (C1-56) does not match the unit.	Check inverter model and inverter capacity selection (C1-56).	○○○●
AL-F0	ROM error	Memory (PROM) error	Replace the control PC board.	○○○○
AL-F1	EEPROM error 1	Memory (EEPROM) error		○○○○
AL-F2	EEPROM error 2			○○○○
AL-F3	EEPROM error 3			○○○○
AL-F4	EEPROM error 4			○○○○
CPF00	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.	· Insert the digital operator connector again. · Check the wiring of power supply signal line of 1CN. · Replace the control PC board.	—
CPF01	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 contines 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.	· Turn ON power supply. · Check supply voltage.
	Inverter output disconnection, improper connecion	Check the wiring between inverter and motor.
	Control signal does not function.	· Check sequence input signal on operation status display (U1-09) (RDY, EMG, FWD and REV). · Check if speed reference is input or not on operation status display (U1-02).
	Torque limiting	Check whether external torque limit signals TLL or TLH is input on operation status display (U1-09).
	Motor winding wire disconnection	· Check resistance between motor terminals (a circuit tester necessary). · Replace the motor.
	Motor fault (rotor and stator rub together, broken bearing)	· Check motor shaft rotation manually. · Replace the motor.
	Control PC board fault	Replace the control PC board.
Motor rotates slowly or vibrates with no rotation.	Inverter output disconnection, improper connecion	Check the wiring between inverter and motor.
	Encoder signal line disconnection, improper connecion, loose connector	Check the wiring of encoder signal line.
	Motor encoder fault	· Check for abnormal changes in motor speed on speedometer or operation status display (U1-01). · Replace the encoder or the motor.
	Speed reference signal disconnection, improper connecion	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 connecion of inverter output or motor encoder signal line	Check the wiring according to the connecion 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	· Check speed reference on operation status display (U1-02). · Readjust master speed reference function.
	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	· Check load status on the load factor meter for loss and inertia moment of the load machine. · Increase the capacity of inverter and motor.
	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)	· Check that encoder signal lines are separated from inverter output wiring or other power lines. · Check encoder cable specifications (whether the cable is a twisted pair shielded wire).
	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	· Check if rotor is balanced. · Replace the motor.
	Motor fault (Motor bearing fault, rotor fault)	· Run a motor alone to check if noise and vibration are within specifications. · Replace the motor.
	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. (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 connecion, loose connector	Check the wiring of encoder signal lines.
	Encoder fault	· Check for abnormal changes in motor speed on the speedometer or operation status display (U1-01). · Replace the encoder or the motor.
	Fault of orientation card or control PC board	Replace the orientation card or the control PC board.
Motor does not stop at orientation. (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. (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	· Perform positioning at zero-point to measure position accuracy. · Perform tune-up again to set the load shaft zero-point.
	Encoder signal line disconnection. improper connection. loose connector	Check the wiring of encoder signal lines.
	Malfunction due to noise (Poor encoder characteristics)	· Check that encoder signal lines are separated from inverter output wiring or other power lines. · Check encoder cable specifications (whether the cable is a twisted pair shielded wire).
	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. (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 (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.	· Check that no vibration occurs in the forward and reverse directions near the stop position. · Lower position control proportional gain to reduce vibration.
	Position control proportional gain is low.	· Check that the load shaft has reached the stop position on operation status display (U2-03 or U3-03). · Increase position control proportional gain to reach the commanded position.
	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

Motor	Model UAASK□FZ		A-04	A-06	A-08	A-11	A-15	A-19	A-22	J-30	J-37
	Rated Output *1 HP (kW)	30-minute Rating (50%ED)	5 *2 (3.7)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)
		Continuous Rating	3 (2.2)	5 (3.7)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (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 (1.43)	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)
	Rotor Inertia ($GD^2/4$)	lb·ft^2 (kg·m^2)	0.209 (0.0088)	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)
	Rotor GD^2	lb·ft^2 (kgf·m^2)	0.831 (0.035)	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)
	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)	71 (32)	119 (54)	130 (59)	150 (68)	207 (94)	238 (108)	269 (122)	481 (218)	580 (263)
Controller	Model CIMR-M5A□		23P7	25P5	27P5	2011	2015	2018	2022	2030	2037
Inverter	Continous Rating Input Current (A)		17.6	17.6	26.2	35.7	52.4	71.4	88.1	104.8	142.8
	Continous 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) *3	Width	3.94 (100)			5.91 (150)				7.84 (200)	11.82 (300)
		Height	13.78 (350)								
		Depth	12.60 (320)								
Converter *4	Model CIMR-MR5A□		23P7	25P5	27P5	2011	2015	2018	2022	2030	2037
	Required Power Capacity (kVA)		7	9	12	19	24	30	36	48	60
	Continous Rating Input Current (A)		13.3	13.3	19.7	26.8	39.3	53.6	66.1	78.6	107.2
	Continous 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) (Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%. Line-to-line voltage unbalance: 5% or less)								
	Control Power Supply		Single-phase, 200VAC (50/60Hz); 220VAC (50/60Hz); 230VAC (60Hz) (Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%) 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) *3	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)

	Model CIMR-M5A ☐ / CIMR-MR5A ☐	23P7	25P5	27P5	2011	2015	2018	2022	2030	2037
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 *5	-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^2 (1G) at 10 to less than 20 Hz, up to 2 m / s^2 (0.2G) at 20 to 50 Hz								
	Protective Structure	IEC IP00 (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

Motor	Model UAASK□FZ***E		A-06	A-08	A-11	A-15	A-19	A-22	J-30	J-37	J-45
	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)	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 ($GD^2/4$)	$lb·ft^2$ ($kg·m^2$)	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^2	$lb·ft^2$ ($kgf·m^2$)	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	(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)	119 (54)	130 (59)	150 (68)	207 (94)	238 (108)	269 (122)	481 (218)	580 (263)	783 (355)
Controller — Inverter	Model CIMR-M5A□		45P5	47P5	4011	4015	4018	4022	4030	4037	4045
	Continous Rating Input Current (A)		8.8	13.1	17.9	26.2	35.7	44.1	52.4	71.4	88.2
	Continous 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 *5		120%, 1 minute of 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)				9.84 (250)		
		Height	13.78 (350)								
		Depth	12.60 (320)								
Controller — Converter *3	Model CIMR-MR5A□		45P5	47P5	4011	4015	4018	4022	4030	4037	4045
	Required Power Capacity (kVA)		9	12	19	24	30	36	48	60	70
	Continous Rating Input Current (A)		6.7	9.85	13.4	19.7	26.8	33.1	39.3	53.6	66.2
	Continous 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) (Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%. Line-to-line voltage unbalance: 5% or less)								
	Control Power Supply		Single-phase, 200VAC (50/60Hz); 220VAC (50/60Hz); 230VAC (60Hz) (Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%) 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) *2	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 □ / CIMR-MR5A □	45P5	47P5	4011	4015	4018	4022	4030	4037	4045
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^2 (1G) at 10 to less than 20 Hz, up to 2 m/s^2 (0.2G) at 20 to 50 Hz								
	Protective Structure	IEC IP00 (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.

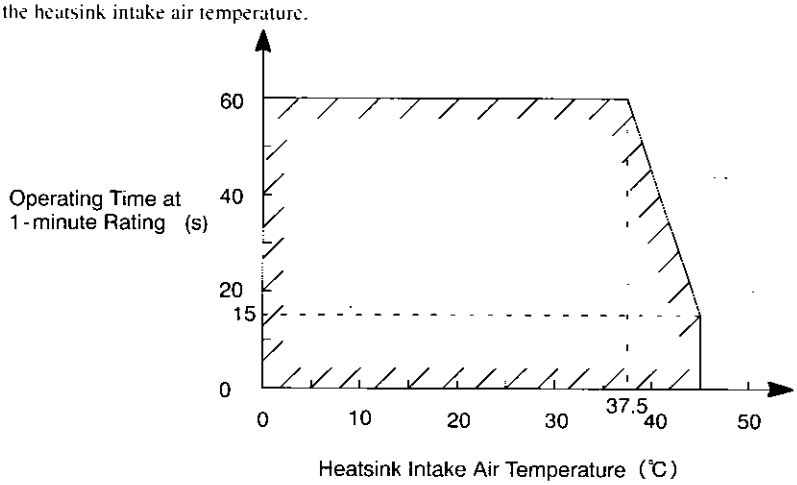


Table A-3 Winding Selection 200V Series

Motor	Model UAASK□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 ($GD^2/4$)	lb·ft^2 (kg·m^2)	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)
	Rotor GD^2	lb·ft^2 (kgf·m^2)	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	(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)	207 (94)	238 (108)	291 (132)	481 (218)	783 (355)	893 (405)	948 (430)
Controller / Inverter	Model CIMR-M5A□		25P5	27P5	2011	2015	2018	2022	2030
	Continous Rating Input Current (A)		17.6	26.2	35.7	52.4	71.4	88.1	104.8
	Continous 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)						
Converter *3	Model CIMR-MR5A□		25P5	27P5	2011	2015	2018	2022	2030
	Required Power Capacity (kVA)		9	12	19	24	30	36	48
	Continous Rating Input Current (A)		13.3	19.7	26.8	39.3	53.6	66.1	78.6
	Continous 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) (Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%. Line-to-line voltage unbalance: 5% or less)						
	Control Power Supply		Single-phase, 200VAC (50/60Hz); 220VAC (50/60Hz); 230VAC (60Hz) (Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%) 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)

		Model CIMR-M5A ☐ CIMR-MR5A ☐	25P5	27P5	2011	2015	2018	2022	2030
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^2 (1G) at 10 to less than 20 Hz, up to 2 m/s^2 (0.2G) at 20 to 50 Hz						
		Protective Structure	IEC IP(00) (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 UAASK□ FZ***E		B-06	B-08	B-11	B-15	B-19	B-22	B-30*1
	Rated Output *2	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 ($GD^2/4$)	lb·ft² (kg·m²)	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)
	Rotor GD^2	lb·ft² (kgf·m²)	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	(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)	207 (94)	238 (108)	291 (132)	481 (218)	783 (355)	893 (405)	948 (430)
Controller	Model CIMR-M5A □		45P5	47P5	4011	4015	4018	4022	4030
Inverter	Continous Rating Input Current (A)		8.8	13.1	17.9	26.2	35.7	44.1	52.4
	Continous 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 (mm) *3	Width	3.94 (100)			5.91 (150)			9.84 (250)
		Height	13.78 (350)						
		Depth	12.60 (320)						
Converter *4	Model CIMR-MR5A □		45P5	47P5	4011	4015	4018	4022	4030
	Required Power Capacity (kVA)		9	12	19	24	30	36	48
	Continous Rating Input Current (A)		6.7	9.85	13.4	19.7	26.8	33.1	39.3
	Continous 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) (Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%, Line-to-line voltage unbalance: 5% or less)						
	Control Power Supply		Single-phase, 200VAC (50/60Hz); 220VAC (50/60Hz); 230VAC (60Hz) (Allowable voltage fluctuation: +10% to -15%, allowable frequency fluctuation: ±5%) 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) *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)

	Model CIMR-M5A □ CIMR-MR5A □	45P5	47P5	4011	4015	4018	4022	4030
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 *5	-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^2 (1G) at 10 to less than 20 Hz, up to 2 m / s^2 (0.2G) at 20 to 50 Hz						
	Protective Structure	IEC IP00 (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.

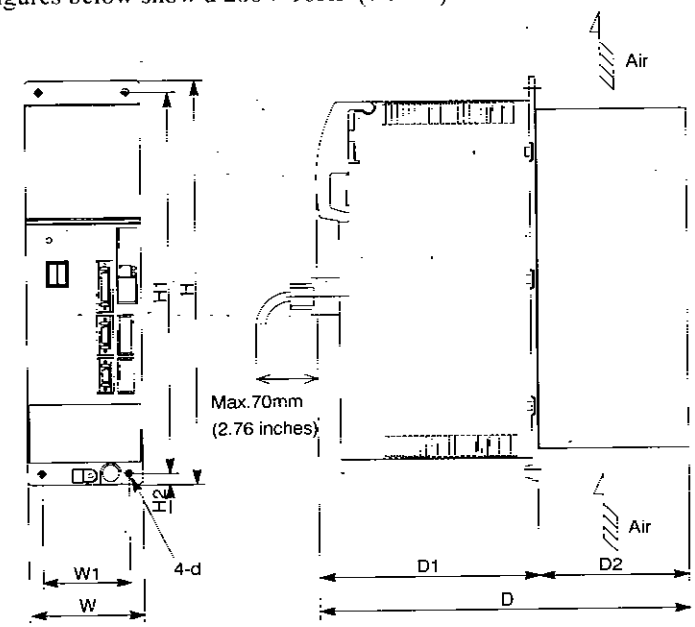


Fig. A-1 Dimensions of VS-626M5

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

Voltage Class	Model CIMR-M5A□	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 (3.94)	350 (13.78)	320 (12.6)	75 (2.95)	330 (12.99)	10 (0.39)	190 (7.48)	130 (5.12)	5 (11)	M5
	25P5										
	27P5										
	2011	150 (5.91)	350 (13.78)	320 (12.6)	100 (3.94)	330 (12.99)	10 (0.39)	190 (7.48)	130 (5.12)	12 (26)	M5
	2015										
	2018										
	2022										
	2030	200 (7.87)	350 (13.78)	320 (12.6)	150 (5.91)	330 (12.99)	10 (0.39)	190 (7.48)	130 (5.12)	16 (35)	M5
	2037	300 (11.81)	350 (13.78)	320 (12.6)	250 (9.84)	330 (12.99)	10 (0.39)	190 (7.48)	130 (5.12)	26 (57)	M6
400V class	45P5	100 (3.94)	350 (13.78)	320 (12.6)	75 (2.95)	330 (12.99)	10 (0.39)	190 (7.48)	130 (5.12)	6 (13)	M5
	47P5										
	4011										
	4015	150 (5.91)	350 (13.78)	320 (12.6)	100 (3.94)	330 (12.99)	10 (0.39)	190 (7.48)	130 (5.12)	12 (26)	M5
	4018										
	4022										
	4030	250 (9.84)	350 (13.78)	320 (12.6)	200 (7.87)	330 (12.99)	10 (0.39)	190 (7.48)	130 (5.12)	16 (35)	M5
	4037										
	4045										

2.2 INVERTER (VS-626M5) Open Chassis Type

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

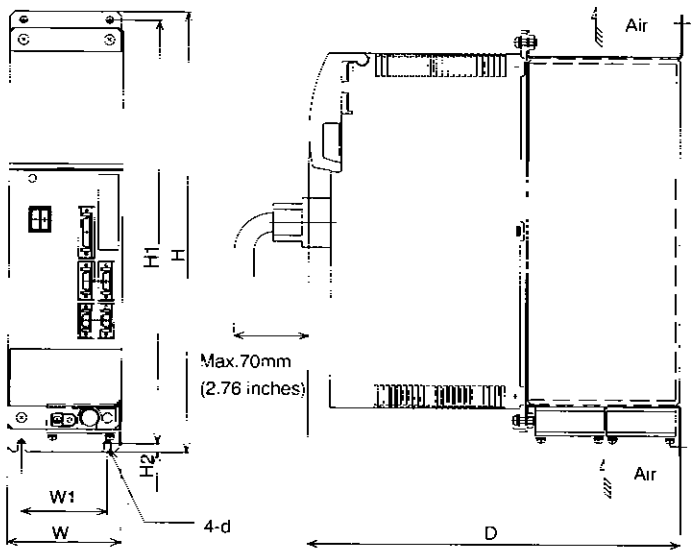


Fig. A-2 Dimensions of VS-626M5

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

Voltage Class	Model CIMR-M5A□	Open Chassis Type Dimensions in mm (inches)							
		W	H	D	W1	H1	H2	Approx. Mass kg (lb)	d
200V class	23P7	100 (3.94)	385 (15.16)	324 (12.76)	75 (2.95)	370 (14.57)	7.5 (0.30)	6 (13)	M5
	25P5								
	27P5								
	2011	150 (5.91)	470 (18.5)	324 (12.76)	100 (3.94)	455 (17.91)	6.5 (0.26)	16 (35)	M5
	2015								
	2018								
	2022							16.5 (36)	
	2030	200 (7.87)	470 (18.5)	324 (12.76)	150 (5.91)	455 (17.91)	6.5 (0.26)	21.5 (47)	M5
400V class	45P5	100 (3.94)	385 (15.16)	324 (12.76)	75 (2.95)	370 (14.57)	7.5 (0.30)	7 (15)	M5
	47P5								
	4011	150 (5.91)	470 (18.5)	324 (12.76)	100 (3.94)	455 (17.91)	6.5 (0.26)	16 (35)	M5
	4015								
	4018								
	4022							16.5 (36)	

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

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

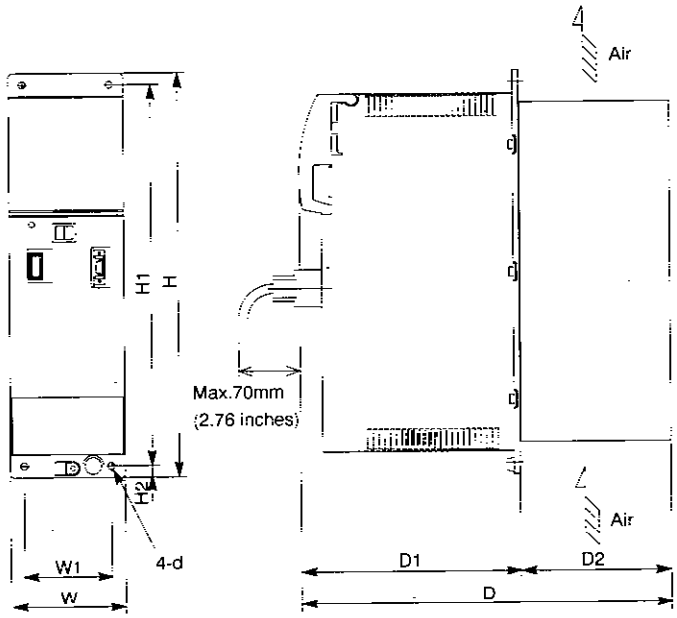


Fig. A-3 Dimensions of VS-656MR5

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

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

2.4 CONVERTER (VS-656MR5) Open Chassis Type

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

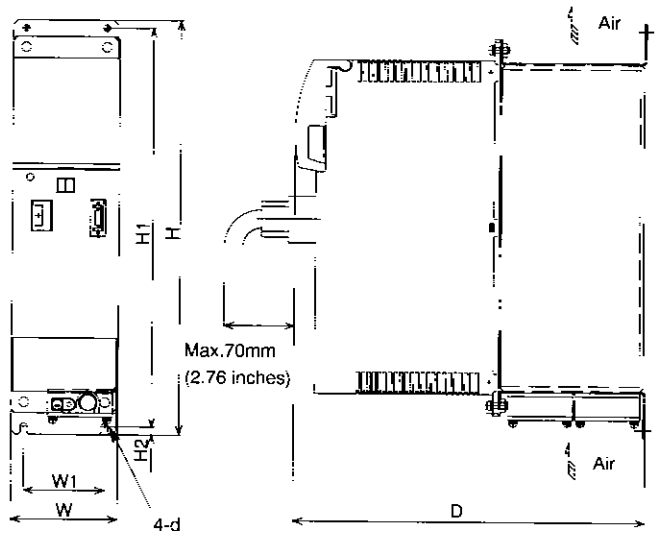


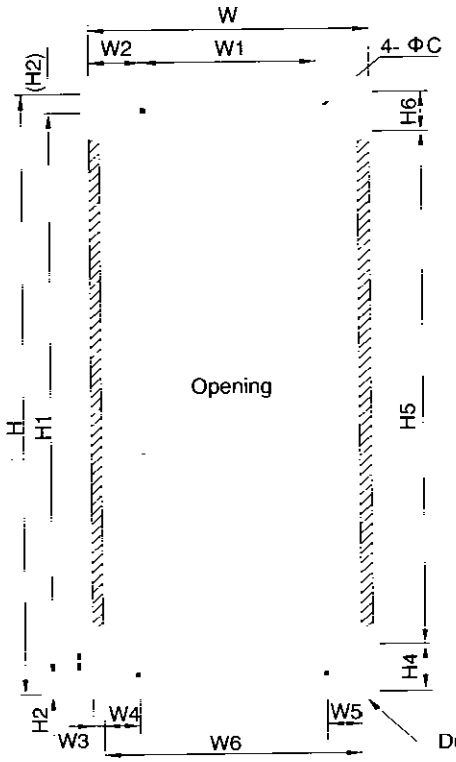
Fig. A-4 Dimensions of VS-656MR5

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

Voltage Class	Model CIMR-MR5A□	Heatsink Externally Cooling Type Dimensions in mm (inches)							
		W	H	D	W1	H1	H2	Approx. Mass kg (lb)	d
200V class	23P7	100 (3.94)	385 (15.16)	324 (12.76)	75 (2.95)	370 (14.57)	7.5 (0.30)	6 (13)	M5
	25P5								
	27P5								
	2011	150 (5.91)	470 (18.5)	324 (12.76)	100 (3.94)	455 (17.91)	6.5 (0.26)	16 (35)	M5
	2015								
	2018							16.5 (36)	
	2022								
	2030	200 (7.87)	470 (18.5)	324 (12.76)	150 (5.91)	455 (17.91)	6.5 (0.26)	21.5 (47)	M5
400V class	45P5	100 (3.94)	385 (15.16)	324 (12.76)	75 (2.95)	370 (14.57)	7.5 (0.30)	8 (18)	M5
	47P5								
	4011	150 (5.91)	470 (18.5)	324 (12.76)	100 (3.94)	455 (17.91)	6.5 (0.26)	16 (35)	M5
	4015								
	4018							16.5 (36)	
	4022								

2.5 PANEL CUTOUT DIMENSIONS (Heatsink Externally Cooling Type)

Refer to Table A-9 for panel cutout.



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□ CIMR-MR5A□	W	W1	W2	W3	W4	W5	W6	H	H1	H2	H3	H4	H5	H6	C
200V class	23P7 25P5 27P5	99 (3.90)	75 (2.95)	12 (0.47)	3.5 (0.14)	8.5 (0.33)	5.5 (0.22)	89 (3.50)	350 (13.8)	330 (13.0)	10 (0.39)	18 (0.71)	28 (1.10)	300 (11.8)	22 (0.87)	Φ6 (0.24 dia)
	2011 2015 2018 2022	149 (5.87)	100 (3.94)	24.5 (0.96)	4.5 (0.18)	20 (0.79)	20 (0.79)	140 (5.51)	350 (13.8)	330 (13.0)	10 (0.39)	18 (0.71)	28 (1.10)	300 (11.8)	22 (0.87)	Φ6 (0.24 dia)
	2030	199 (7.83)	150 (5.91)	24.5 (0.96)	4.5 (0.18)	20 (0.79)	20 (0.79)	190 (7.48)	350 (13.8)	330 (13.0)	10 (0.39)	18 (0.71)	28 (1.10)	300 (11.8)	22 (0.87)	Φ6 (0.24 dia)
	2037	299 (11.78)	250 (9.84)	24.5 (0.96)	4.5 (0.18)	20 (0.79)	20 (0.79)	290 (11.42)	350 (13.8)	330 (13.0)	10 (0.39)	18 (0.71)	28 (1.10)	300 (11.8)	22 (0.87)	Φ7 (0.28 dia)
400V class	45P5 47P5	99 (3.90)	75 (2.95)	12 (0.47)	3.5 (0.14)	8.5 (0.33)	5.5 (0.22)	89 (3.50)	350 (13.8)	330 (13.0)	10 (0.39)	18 (0.71)	28 (1.10)	300 (11.8)	22 (0.87)	Φ6 (0.24 dia)
	4011 4015 4018 4022	149 (5.87)	100 (3.94)	24.5 (0.96)	4.5 (0.18)	20 (0.79)	20 (0.79)	140 (5.51)	350 (13.8)	330 (13.0)	10 (0.39)	18 (0.71)	28 (1.10)	300 (11.8)	22 (0.87)	Φ6 (0.24 dia)
	2030 4037 4045	249 (9.80)	200 (7.87)	24.5 (0.96)	4.5 (0.18)	20 (0.79)	20 (0.79)	240 (9.45)	350 (13.8)	330 (13.0)	10 (0.39)	18 (0.71)	28 (1.10)	300 (11.8)	22 (0.87)	Φ6 (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 CIMR-M5A		23P7		25P5		27P5		2011		2015		2018		2022		2030		2030	
Output		Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute
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 externally 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 CIMR-M5A		45P5		47P5		4011		4015		4018		4022		4030		4037		4045	
Output		Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute
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 externally 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)

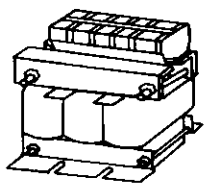
Converter Model CIMR-MR5A		23P7		25P5		27P5		2011		2015		2018		2022		2030		2037	
Output		Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute
Open chassis type Total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

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

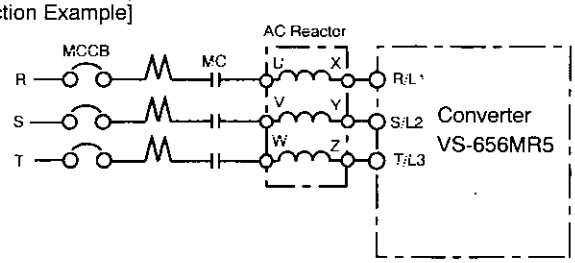
Converter Model CIMR-MR5A		45P5		47P5		4011		4015		4018		4022		4030		4037		4045	
Output		Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute	Continuous	30-minute
Open chassis type Total calorific value (W)		58	73	76	88	117	138	185	209	193	210	233	250	310	356	365	398	435	477
Heatsink externally cooling type	Outside of heatsink (W)	20	32	29	39	40	58	59	79	79	93	100	115	118	157	158	186	200	236
	Inside of heatsink (W)	38	41	47	49	77	80	126	130	114	117	133	135	192	199	207	212	235	241
Cooling air speed near 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 CIMR-MRBA	Current A	Inductance mH	Code No	Fig No	Dimensions in mm (inches) A (Max)	A1	B	B1 (Max)	B2	C1	C2	D	E	F	I	J	K	L	M	Approx Mass kg (lb)	Heat Loss W
23P7	20	0.53	X010057	1	130 (5.12)	—	86 (3.46)	60 (2.36)	44 (1.73)	105±5 (4.13±0.2)	25 (0.98)	50 (1.97)	70 (2.76)	130 (5.12)	3.2 (0.13)	M6	9 (0.35)	7 (0.28)	M4	3 (6.6)	35
25P5	30	0.35	X010058	1	130 (5.12)	—	86 (3.46)	60 (2.36)	44 (1.73)	105±5 (4.13±0.2)	40 (1.57)	50 (1.97)	70 (2.76)	130 (5.12)	3.2 (0.13)	M6	9 (0.35)	7 (0.28)	M5	3 (6.6)	45
27P5	40	0.265	X010059	2	130 (5.12)	150 (5.91)	98 (3.86)	65 (2.56)	49 (1.93)	105±5 (4.13±0.2)	40 (1.57)	50 (1.97)	80 (3.15)	130 (5.12)	3.2 (0.13)	M6	9 (0.35)	7 (0.28)	M6	4 (8.8)	50
2011	60	0.18	X010060	1	160 (6.3)	—	105 (4.13)	75 (2.95)	52.5 (2.07)	130±5 (5.12±0.2)	40 (1.57)	75 (2.95)	85 (3.35)	160 (6.3)	2.3 (0.09)	M6	10 (0.39)	7 (0.28)	M6	6 (13.2)	65
2015	80	0.13	X010061	1	180 (7.09)	—	100 (3.94)	85 (3.35)	50 (1.97)	150±5 (5.91±0.2)	42 (1.65)	75 (2.95)	80 (3.15)	180 (7.09)	2.3 (0.09)	M6	10 (0.39)	7 (0.28)	M6	8 (17.6)	75
2018	90	0.12	X010062	2	180 (7.09)	190 (7.48)	100 (3.94)	90 (3.54)	50 (1.97)	150±5 (5.91±0.2)	45 (1.77)	75 (2.95)	80 (3.15)	180 (7.09)	2.3 (0.09)	M6	10 (0.39)	7 (0.28)	M8	8 (17.6)	90
2022	120	0.09	X010063	2	180 (7.09)	190 (7.48)	100 (3.94)	95 (3.74)	50 (1.97)	150±5 (5.91±0.2)	45 (1.77)	75 (2.95)	80 (3.15)	180 (7.09)	2.3 (0.09)	M6	10 (0.39)	7 (0.28)	M8	8 (17.6)	90
2030	160	0.07	X010064	3	210 (8.27)	—	100 (3.94)	215 (8.27)	—	175±5 (6.89±0.2)	110 (4.33)	75 (2.95)	80 (3.15)	205 (8.07)	2.3 (0.09)	M6	10 (0.39)	7 (0.28)	M10	12 (26.5)	100
2037	200	0.05	X010120	3	210 (8.27)	—	116 (4.57)	230 (9.05)	—	175±5 (6.89±0.2)	130 (5.12)	75 (2.95)	95 (3.74)	205 (8.07)	2.3 (0.09)	M6	10 (0.39)	7 (0.28)	M10	15 (33.1)	110

(2) 400V Class

Model CIMR-MRBA	Current A	Inductance mH	Code No.	Fig. No	Dimensions in mm (inches) A (Max)	A1	B	B1 (Max)	B2	C1	C2	D	E	F	I	J	K	L	M	Approx Mass kg (lb)	Heat Loss W
45P5	15	1.42	X010058	1	130 (5.12)	—	98 (3.86)	—	49 (1.93)	105±5 (4.13±0.2)	25 (0.98)	50 (1.97)	80 (3.15)	130 (5.12)	3.2 (0.13)	M6	9 (0.35)	7 (0.28)	M4	4 (8.8)	50
47P5	20	1.06	X010099	1	160 (6.3)	—	90 (3.54)	50 (1.97)	45 (1.77)	130±5 (5.12±0.2)	25 (0.98)	75 (2.95)	70 (2.76)	160 (6.3)	2.3 (0.09)	M6	10 (0.39)	7 (0.28)	M4	5 (11)	50
4011	30	0.7	X010100	1	160 (6.3)	—	105 (4.13)	95 (3.74)	52.5 (2.07)	130±5 (5.12±0.2)	40 (1.57)	75 (2.95)	85 (3.35)	160 (6.3)	2.3 (0.09)	M6	10 (0.39)	7 (0.28)	M5	6 (13.2)	65
4015	40	0.53	X010101	1	180 (7.09)	—	100 (3.94)	85 (3.35)	50 (1.97)	150±5 (5.91±0.2)	40 (1.57)	75 (2.95)	80 (3.15)	180 (7.09)	2.3 (0.09)	M6	10 (0.39)	7 (0.28)	M6	8 (17.6)	90
4018	50	0.42	X010102	1	180 (7.09)	—	100 (3.94)	85 (3.35)	50 (1.97)	150±5 (5.91±0.2)	40 (1.57)	75 (2.95)	80 (3.15)	180 (7.09)	2.3 (0.09)	M6	10 (0.39)	7 (0.28)	M6	8 (17.6)	90
4022	60	0.36	X010103	1	180 (7.09)	—	100 (3.94)	85 (3.35)	50 (1.97)	150±5 (5.91±0.2)	40 (1.57)	75 (2.95)	80 (3.15)	180 (7.09)	2.3 (0.09)	M6	10 (0.39)	7 (0.28)	M6	8 (17.6)	90
4030	80	0.26	X010104	1	210 (8.23)	—	100 (3.94)	90 (3.54)	50 (1.97)	175±5 (6.89±0.2)	45 (1.77)	75 (2.95)	90 (3.15)	205 (8.07)	3.2 (0.13)	M6	10 (0.39)	7 (0.28)	M6	12 (26.5)	95
4037	90	0.24	X010105	1	210 (8.23)	—	116 (4.57)	110 (4.33)	58 (2.28)	175±5 (6.89±0.2)	48 (1.89)	75 (2.95)	95 (3.74)	205 (8.07)	3.2 (0.13)	M6	10 (0.39)	7 (0.28)	M8	15 (33.1)	110
4045	120	0.18	X010106	1	240 (9.45)	—	126 (4.96)	120 (4.72)	63 (2.48)	205±5 (8.07±0.2)	48 (1.89)	150 (5.90)	110 (4.33)	240 (9.45)	3.2 (0.13)	M8	8 (0.31)	10 (0.39)	M8	23 (50.7)	130

Fig. 1

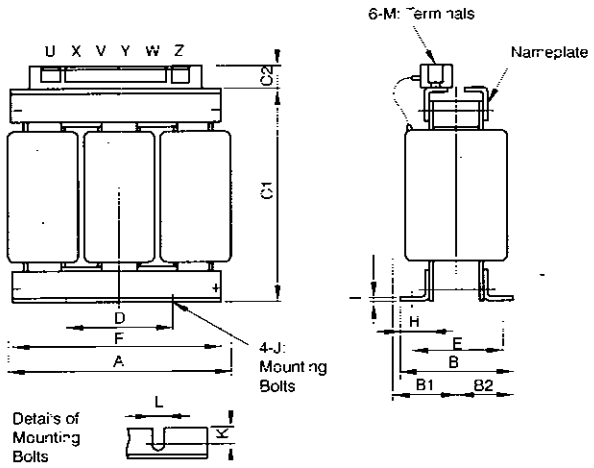


Fig. 2

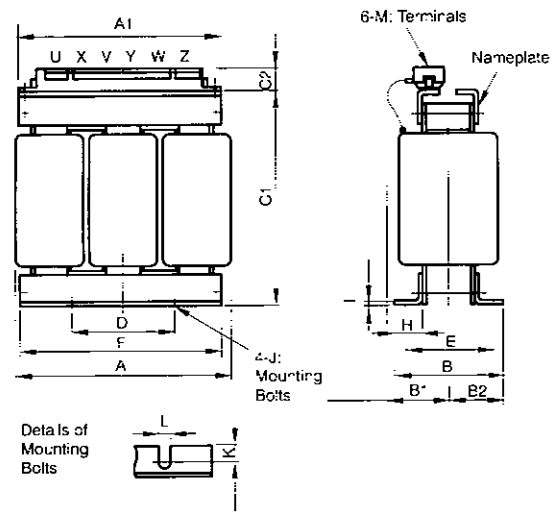
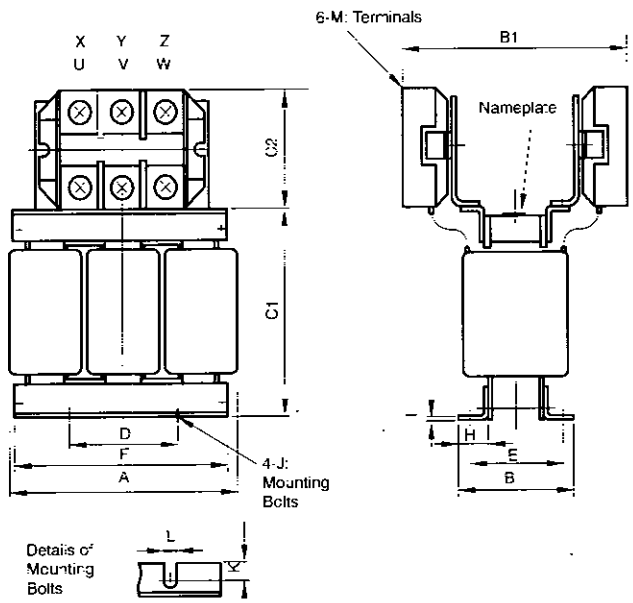
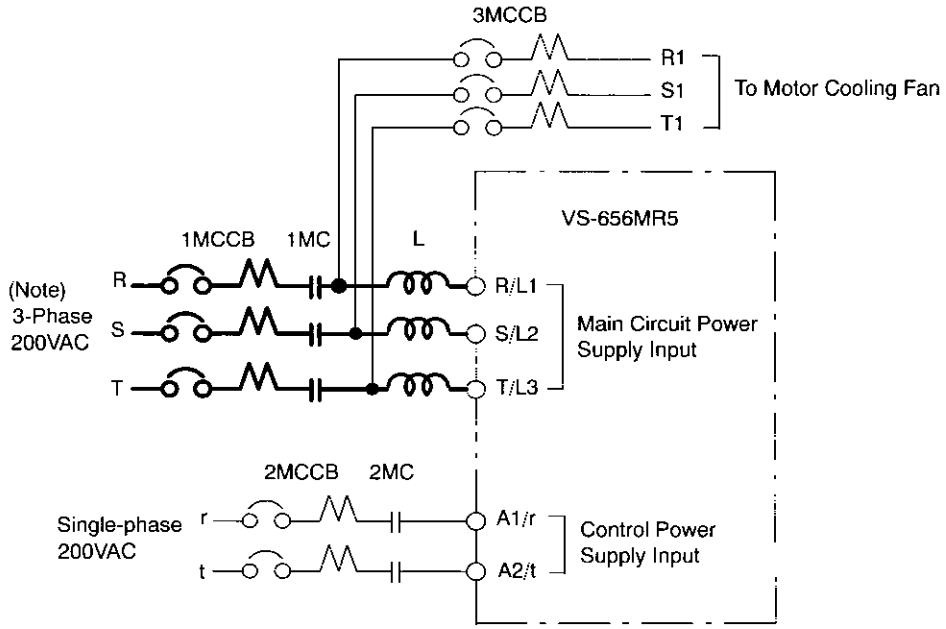


Fig. 3



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 CIMR-MR5A □	Power Capacity (kVA)	MCCB Rated Current (A)			MC Rated Current (A)	
		1MCCB	1MCCB	2MCCB	3MCCB	1MC	2MC
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

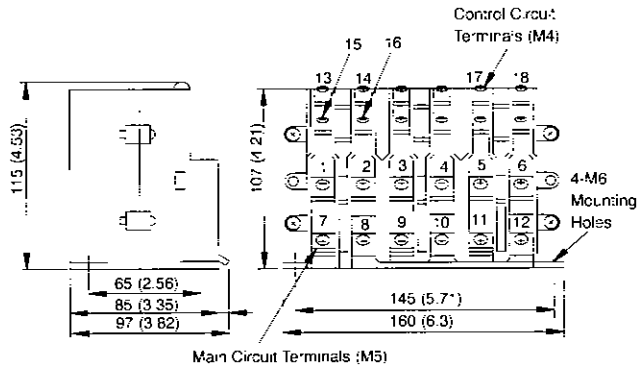
Type*1	Standard	HV-75A4	HV-150AP4	HV-200AP4
	IPM motor*2	HV-75BP4	HV-150BP4	HV-200BP4
Contact		Main contact: 3NO3NC, auxiliary contact: 1NO		
Rated Insulation Voltage		600V		
Rated Applying Current	Continuous	75A	150A	200A
	30 minutes *3	87A	175A	226A
Breaking Current Capacity	220V	200A	400A	400A
	440V	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 (3.7kW to 15kW)	25HP to 40HP (18.5kW to 30kW)	50HP (37kW)
	400V class	7.5HP to 20HP (5.5kW to 15kW)	25HP to 40HP (18.5kW to 30kW)	50HP to 60HP (37kW to 45kW)

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

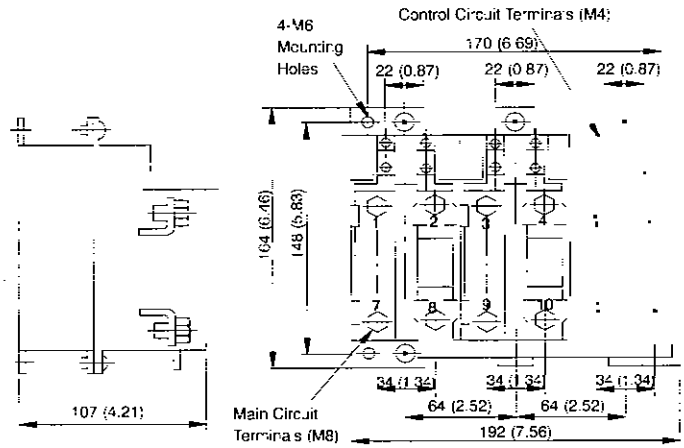
*2 The magnetic contactor for IPM motors does not have a short-circuit bar.

*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

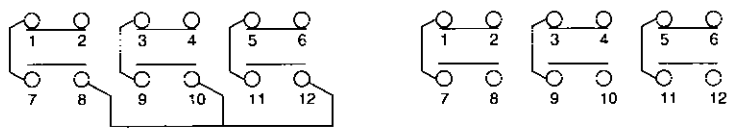


(b) Models HV-150AP3, HV-200AP3

(3) Terminal Descriptions

Table A-15 Terminal Name and Operation Status

Terminal	Name	Operation Status	
13 – 14	Selection signal	+24V (Low-speed Winding)	0V (High-speed Winding)
1 – 2 3 – 4 5 – 6	Main contact: 3NC	Open (OFF)	Closed (ON)
7 – 8 9 – 10 11 – 12	Main contact: 3NO	Closed (ON)	Open (OFF)
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

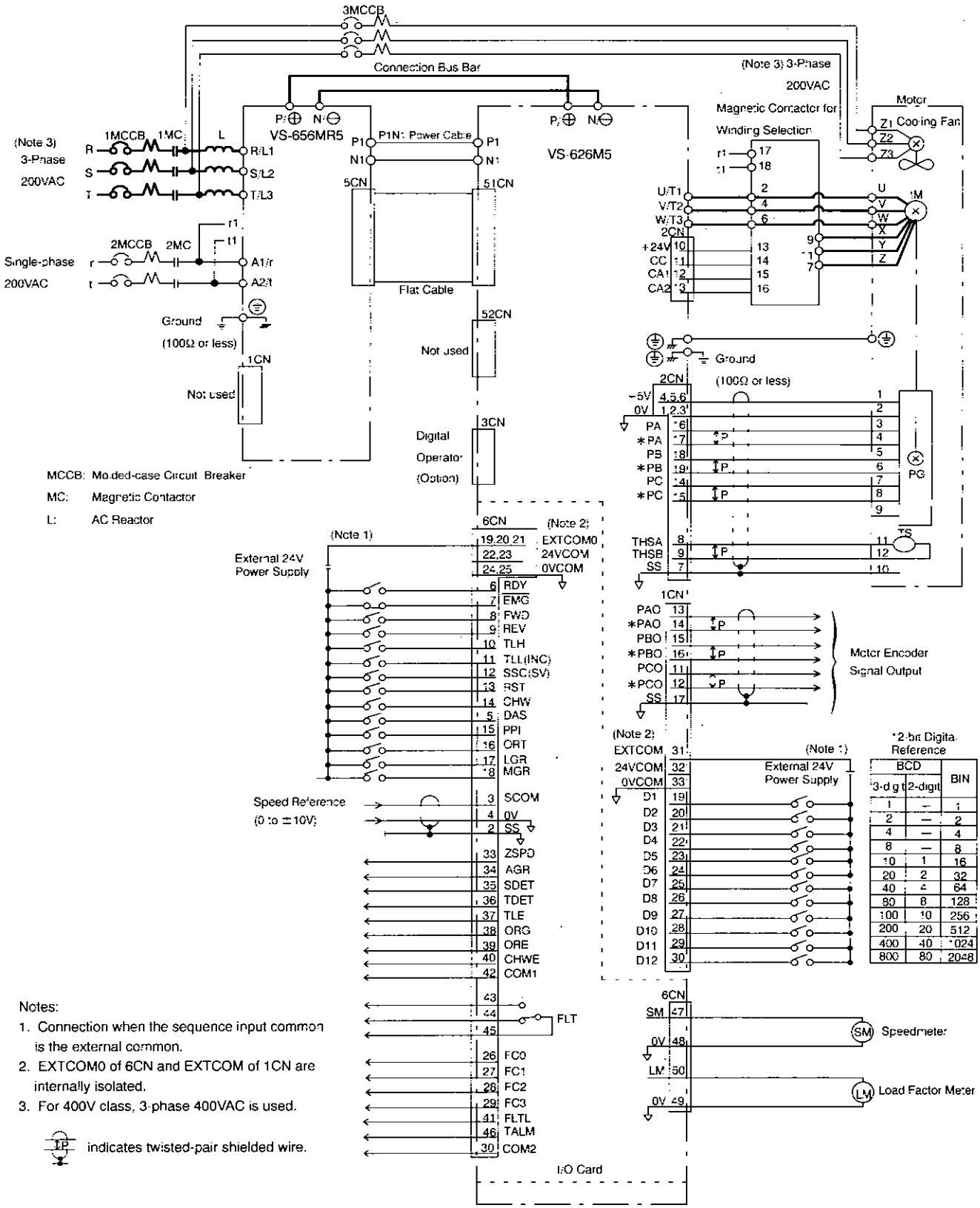


Fig. A-6 Winding Selection Type (200V class shown as example)

4.2 STOP AT ARBITRARY POSITION BY LOAD SHAFT ENCODER

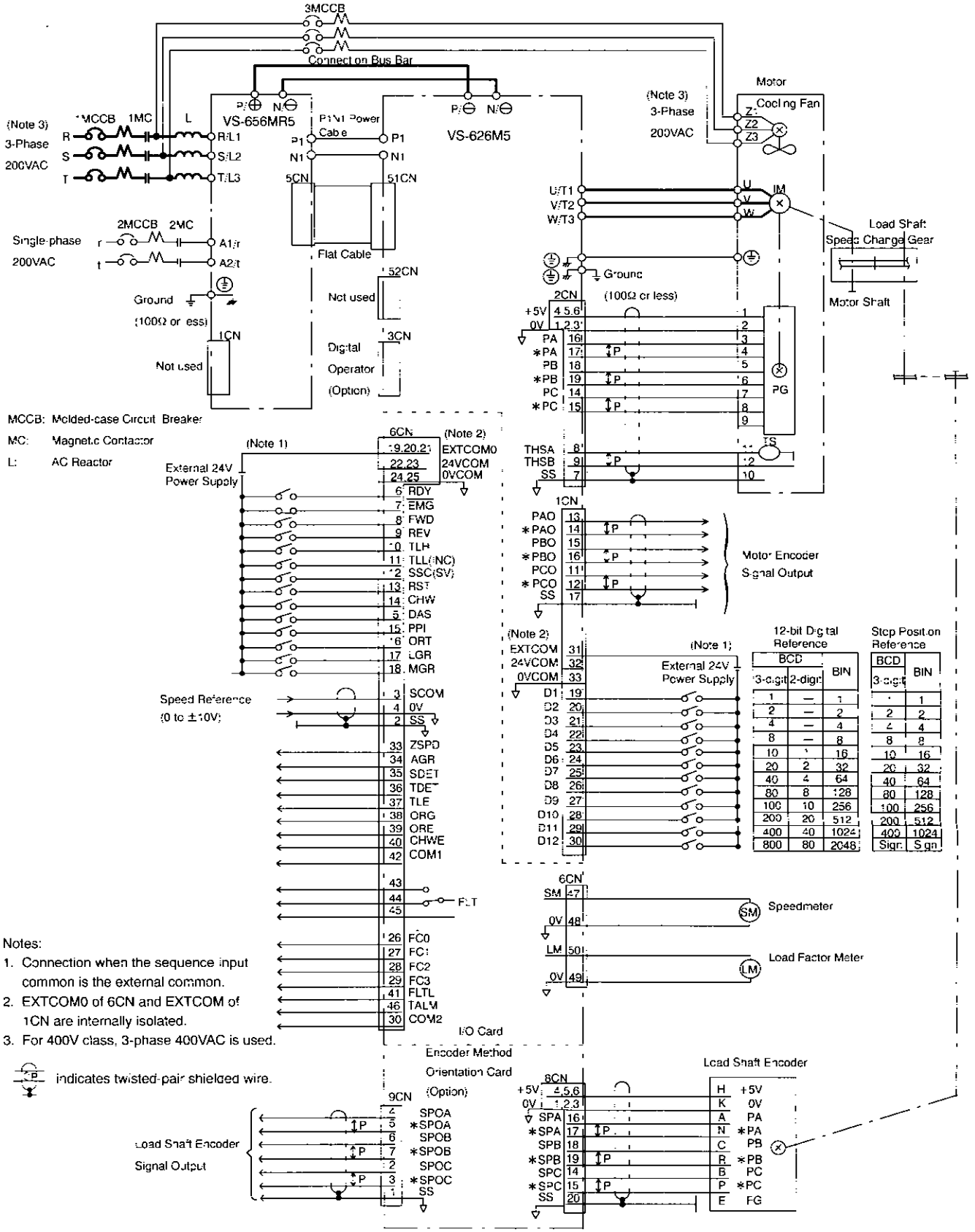
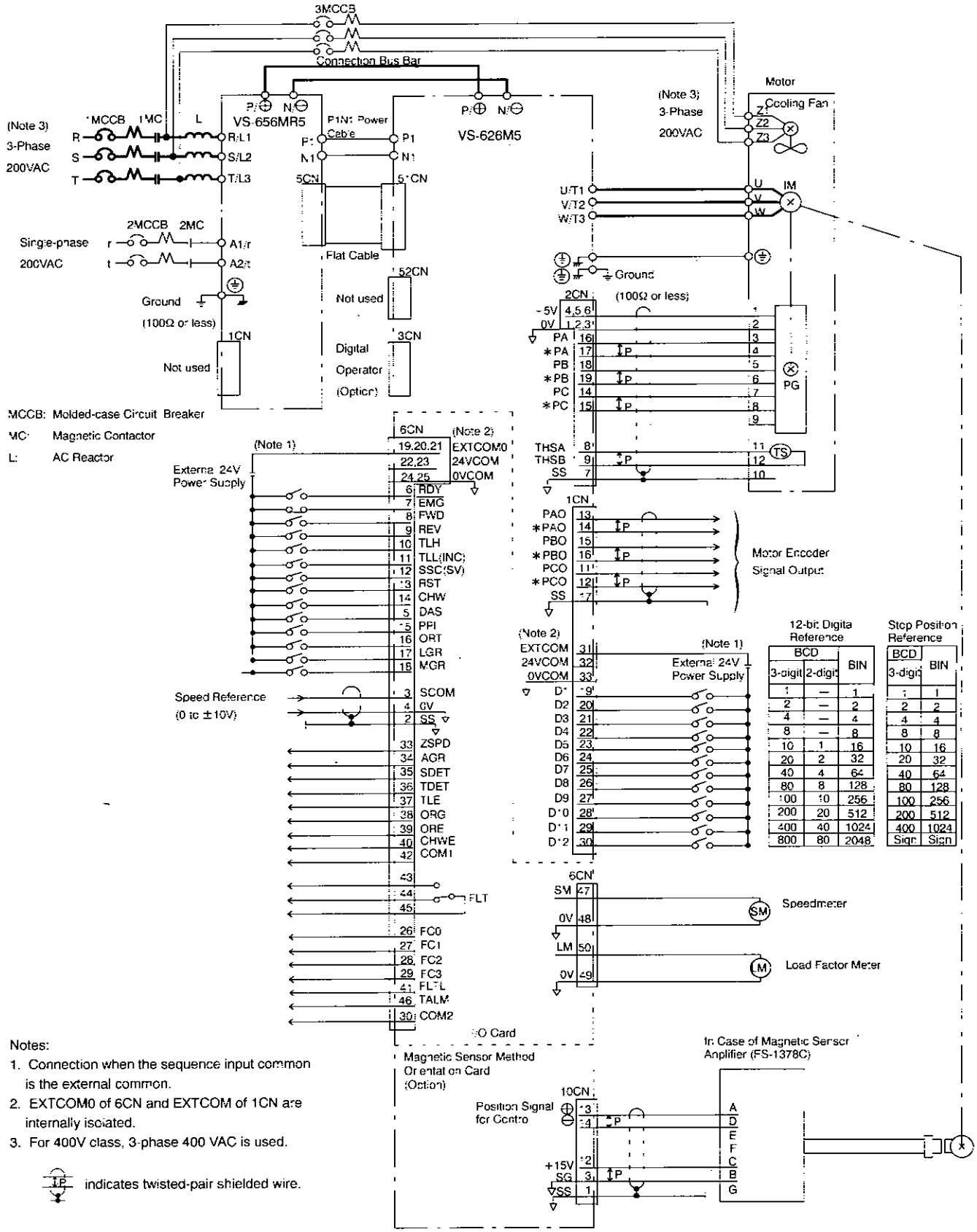


Fig. A-7 Stop at Arbitrary Position by Load Shaft Encoder (200V class shown as example)

4.3 STOP AT HOME/ARBITRARY POSITION BY MAGNETIC SENSOR



Notes:

1. Connection when the sequence input common is the external common.
2. EXTCOM0 of 6CN and EXTCOM of 1CN are internally isolated.
3. For 400V class, 3-phase 400 VAC is used.

indicates twisted-pair shielded wire.

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

APPENDIX 5 OPERATION STATUS DISPLAY

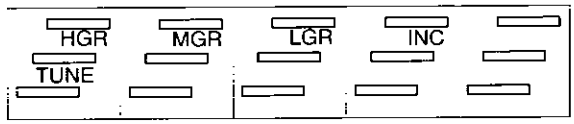
The operation status of the VS-626M5 can be monitored by the digital operator (option). The operation status display includes inverter operation (U1), optional encoder method orientation control (U2) and magnetic sensor method orientation control (U3). (Data marked with * are operation status display 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. Accuracy: ±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) RDY TLL ORT / EMG SSC LGR / FWD RST MGR / REV CHW DAS / TLH PPI (CHWA)	
U1-10	Output signal status	Sequence output signal ON/OFF status (Note) ZSPD ORG FC0 / AGR ORE FC1 / SDET CHWE FC2 / TDET FLT FC3 / TLE TALM FLTL	
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: ±5°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) D1 D6 D11 / D2 D7 D12 / D3 D8 / D4 D9 / D5 D10	
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).	

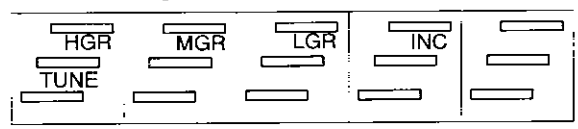
Note: The lamps of I/O signals in the ON state light.

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) 	
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) 	
* 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	℃
* 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 / Lower Limit
C1-01	Speed Control Proportional Gain (H) K_{VHN}	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_{VHN} increases rigidity. Torque Reference P = K_{VHN} × Speed Tolerance	%/Hz	30	255 / 1
C1-02	Speed Control Integral Time (H) τ_{VHN}	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_{VHN} quickens response. Torque Reference I = Torque Reference P × Time/ τ_{VHN}	ms	600	1000 / 5
C1-03	Speed Control Proportional Gain (M, L) K_{VLN}	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_{VLN} increases rigidity. Torque Reference P = K_{VLN} × Speed Tolerance	%/Hz	30	255 / 1
C1-04	Speed Control Integral Time Constant (M, L) τ_{VLN}	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_{VLN} quickens response. Torque Reference I = Torque Reference P × Time/ τ_{VLN}	ms	600	1000 / 5
C1-05	Speed Control Proportional Gain (H) K_{VHS}	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). Torque Reference P = K_{VHS} × Speed Tolerance	%/Hz	40	255 / 1
C1-06	Speed Control Integral Time Constant (H) τ_{VHS}	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). Torque Reference I = Torque Reference P × Time/ τ_{VHS}	ms	100	1000 / 5
C1-07	Speed Control Proportional Gain (M, L) K_{VLS}	Speed control propotional 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). Torque Reference P = K_{VLS} × Speed Tolerance	%/Hz	40	255 / 1
C1-08	Speed Control Integral Time Constant (M, L) τ_{VLS}	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). Torque Reference I = Torque Reference P × Time/ τ_{VLS}	ms	100	1000 / 5
C1-09	Torque Reference Filter Time Constant τ_T	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 / 0.0
C1-10	Soft Start Time T_{SFS}	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: Starting Time = T_{SFS} × Speed Reference (%)/100	sec	0.1	180.0 / 0.1
C1-11	Speed Reference Offset Adjustment Value SC_{OFS}	Offset adjustment value for analog speed reference. Set the values of U1-15 when operating at speed reference 0 for C1-11.		0	80 / -80

(Cont'd)

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

Constant No.	Name	Explanation	Unit	Standard Setting	Upper Limit / Lower Limit
C1-12	Motor Speed Adjustment Value S_{ADJ}	Constant for adjusting motor speed when analog speed reference is used. Speed is increased in proportion to S_{ADJ}. This constant is disabled when digital speed reference is used.		1.0000	1.1000 / 0.9000
C1-13 to C1-15	– – –	– – – – – – – –		–	– – – / – – –
C1-16	Speedometer Signal Adjustment Value SM_{ADJ}	Constant for fine control to match the actual speed and indication on the speedometer. Increasing SM_{ADJ} makes the meter indicator travel farther. Standard value is 10V output at rated speed (C1-26).		1.00	1.50 / 0.90
C1-17	Load Ratio Meter Signal Adjustment Value LM_{ADJ}	Constant for fine control to match the torque reference and indication on the load ratio meter. Increasing LM_{ADJ} makes the meter indicator travel farther. Standard value is 10V output at 120% of the 30-minute rating.		1.00	1.50 / 0.90
C1-18	Load Ratio Meter Signal Adjustment Value LM_{FS}	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 / 120
C1-19	Zero-speed Detection Level ZS_{LVL}	Detection level of zero-speed signal (ZSPD). Standard setting is 30 r/min.	r/min	30	60 / 3
C1-20	Speed-agree Signal Detection Width AGR_{BD}	Detection width of speed-agree signal at rated speed. Standard setting is 15%.	%	15	50 / 10
C1-21	Speed Detection Signal Level SD_{LVL}	Speed detection signal (SDET) activation level used for winding selection. Expressed as a percent of the motor rated speed (C1-26).	%	10	100 / 0
C1-22	Speed Detection Signal Detection Width SD_{HYS}	Hysteresis width adjustment level of speed signal detection. During acceleration, SDLVL+SDHYS is detected. During deceleration, SDLVL-SDHYS is detected. Expressed as a percent of the motor rated speed (C1-26).	%	1.00	10.00 / 0.00
C1-23	Torque Detection Signal Operation Level TD_{LVL}	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 / 5
C1-24	External Control Torque Limiting Level TL_{EXT}	Torque limit using external torque limiting signals (TLL and TLH). Expressed as a percent of the 30-minute rated torque.	%	10	120 / 5
C1-25	Motor Code Selection 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 / 001
C1-26	Rated Speed Setting S_{100}	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 / 100
C1-27	Transmission Ratio 1 (H) R_{HGR}	Transmission ratio determined by mechanical specifications. This parameter is valid when H gear is selected (MGR and LGR are OFF). Transmission Ratio = Load Shaft Speed ÷ Motor Speed		1.0000	2.5000 / 0.0400
C1-28	Transmission Ratio 2 (M) R_{MGR}	Transmission ratio determined by mechanical specifications. This parameter is valid when M gear is selected (MGR is ON). Transmission Ratio= Load Shaft Speed ÷ Motor Speed		1.0000	2.5000 / 0.0400

(Cont'd)

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

Constant No.	Name	Explanation	Unit	Standard Setting	Upper Limit / Lower Limit
C1-29	Transmission Ratio 3 (L) R_{LGR}	Transmission ratio determined by mechanical specifications. This parameter is valid when L gear is selected (LGR is ON). Transmission Ratio = Load Shaft Speed ÷ Motor Speed		1.0000	2.5000 0.0400
C1-30	Motor Flux Lower Limit Level ϕ_{WL}	Set value of motor flux lower limit level at reduction control	%	15	100 15
C1-31	Servo Mode Flux Level (H) ϕ_{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 30
C1-32	Servo Mode Base Speed Ratio (H) R_{BSH}	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). Base Speed (Servo) = R_{BSH} × Base Speed (Motor)		1.00	5.00 1.00
C1-33	Servo Mode Flux Level (M, L) ϕ_{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 30
C1-34	Servo Mode Base Speed Ratio (M, L) R_{BSL}	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). Base Speed (Servo) = R_{BSL} × Base Speed (Motor)		1.00	5.00 1.00
C1-35	Zero-speed Braking Time T_{BLK}	Time for generating braking force after deceleration and zero-speed is reached to stop.	sec	0	100 0
C1-36	Select Signal 1 SEL1 *	Setting signal for multi-functional selection. · Bits 1 and 0: 6CN pin 11 00 : TLL 01 : — — — 10 : INC 11 : — — — · Bit 2: 6CN pin 10 0 : TLH 1 : — — — · Bit 3: 6CN pin 12 0 : SSC 1 : SV · Bit 4: 6CN pin 15 0 : PPI 1 : LM10 · Bit 7: 1CN, 12-bit digital reference 0 : Digital speed reference 1 : Orientation control stop position reference		00000000	- - -
C1-37	Select Signal 2 SEL2 *	Setting signal for multi-functional selection. · Bits 1 and 0: Operation mode 00 : Operation by speed reference 11 : Operation by digital operator · Bit 2: 6CN pin 6 0 : RDY 1 : EMG2 · Bits 7 and 6: Digital speed reference selection 00 : 2-digit BCD 01 : 12-bit binary 10 : 3-digit BCD 11 : Internal speed setting		01000000	- - -

* 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 / Lower Limit
C1-38	Select Signal 3 SEL3 *	Select signal for control mode and level · Bits 1 and 0: Load ratio meter filter 00 : 2ms filter 01 : 10ms filter 10 : 100ms filter 11 : 500ms filter · Bit 2: Torque limiting auto judgement 0 : Not judged 1 : Judged · Bit 3: Servo mode sensitivity 0 : Speed reference gain selection disabled 1 : Speed reference gain selection enabled (Set by C1-40 bit 5) · Bit 4: Excessive speed deviation protection (AL-32) operation threshold 0 : 1/2 or less of speed reference 1 : 1/4 or less of speed reference · Bit 5: Speed limiting level 0 : 105% of rated reference 1 : 110% of rated reference · Bit 6: Speed agree signal (AGR) output at zero speed 0 : Output (AGR: closed) 1 : Not output (AGR: open) · Bit 7: Load ratio meter adjustment 0 : 120% signal of 30-minute rating output 1 : 100% signal of continuous rating output		00000000	- - -
C1-39	Select Signal 4 SEL4 *	Select signal for control mode and level · Bit 0: Orientation method 0 : Encoder method 1 : Magnetic sensor method When the setting has changed, turn the control power supply off then on again.		00000000	- - - - - -
C1-40	Select Signal 5 SEL5 *	Control mode select signal · Bit 1 and 0: Operation delay time of excessive speed deviation protection (AL-32) 00 : 0 sec 01 : 0.3 sec 10 : 0.4 sec 11 : 0.5 sec · Bit 2: Torque detection signal (TDET) output 0 : Standard output 1 : Closed at accel/decel · Bit 3: NC orientation 0 : Disabled. 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. · Bit 4: Load ratio meter output reference 0 : Continuous rating output 1 : 30-minute rating output · Bit 5: Speed reference gain selection in servo mode (Enabled when C1-38 bit 3 = 1) 0 : Analog speed reference 10V/5000r/min 1 : Sets analog speed reference read-in gain by C1-49 or C1-50. · Bit 7: Load fault detection (AL-33) 0 : Disabled. 1 : Enabled.		00000000	- - - - - -

* 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 / 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). Pin 19: SPD1 Pin 23: SPD5 Pin 20: SPD2 Pin 24: SPD6 Pin 21: SPD3 Pin 25: SPD7 Pin 22: SPD4 Pin 26: SPD8	%	0.00	100.00 / 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). Analog speed reference 10V / (S100 * SVGAIN /100) r/min C1-49 or C1-50 is selected by DAS signal (6CN-5). DAS is OFF: C1-49 (SVGAIN1) DAS is ON: C1-50 (SVGAIN2)	%	100.00	100.00 / 0.00
C1-51 to C1-53	– – –	– – – – – – – –		–	– – – / – – –
C1-54	Speedometer Signal Offset Adjustment Value SM_{OFS}	Offset adjustment value for speedometer signal. The inverter subtracts the value and outputs speedometer signal.	5.4 mV	0	200 / -200
C1-55	Load Ratio Meter Signal Offset Adjustment Value LM_{OFS}	Offset adjustment value for load ratio meter signal. The inverter subtracts the value and outputs load ratio meter signal.	5.4 mV	0	200 / -200
C1-56	Inverter Capacity Selection UNITNO	Inverter capacity is set. (The setting is already made at factory prior to shipment.) 200V class CIMR-M5A□: 23P7 25P5 27P5 2011 2015 2018 2022 2030 2037 Set value: 04 05 06 07 08 09 0A 0B 0C 400V class CIMR-M5A□: 45P5 47P5 4011 4015 4018 4022 4030 4037 4045 Set value: 25 26 27 28 29 2A 2B 2C 2D 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 • Bit 0: Fault record clear selection 0 : Disabled 1 : Clears next time control power is turned ON. (This bit automatically becomes 0.)		00000000	– – – / – – –
C1-58 C1-59	– – –	– – – – – – – –		–	– – – / – – –
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. When the setting has changed, turn the control power supply off then on again.		4096	8191 / -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. When the setting has changed, turn the control power supply off then on again.	pulse	7	100 / 0

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

*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 / Lower Limit
C2-01	Load Shaft Positioning Origin P_{ORG}	Mechanical origin of the load shaft. Set difference from encoder origin signal (phase C) pulses.	Pulses	0	4095 / 0
C2-02	Position Control Proportional Gain (H) K_{PH}	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_{PH} increases rigidity. Speed Reference (pps) = K_{PH} × Position Tolerance (pulses)	1/s	15	99 / 1
C2-03	Position Control Proportional Gain (M) K_{PM}	Position control proportional gain when medium-speed gear is selected (MGR is ON). Raising K_{PM} increases rigidity. Speed Reference (pps) = K_{PM} × Position Tolerance (pulses)	1/s	15	99 / 1
C2-04	Position Control Proportional Gain (L) K_{PL}	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_{PL} increases rigidity. Speed Reference (pps) = K_{PL} × Position Tolerance (pulses)	1/s	15	99 / 1
C2-05	Speed Control Proportional Gain (H) K_{VHO}	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). Torque Reference P = K_{VHO} × Speed Tolerance	%/Hz	40	255 / 1
C2-06	Speed Control Integral Time Constant (H) τ_{VHO}	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). Torque Reference I = Torque Reference P × Time/ τ_{VHO}	ms	100	1000 / 5
C2-07	Speed Control Proportional Gain (M, L) K_{VLO}	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). Torque Reference P = K_{VLO} × Speed Tolerance	%/Hz	40	255 / 1
C2-08	Speed Control Integral Time Constant (M, L) τ_{VLO}	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). Torque Reference I = Torque Reference P × Time/ τ_{VLO}	ms	100	1000 / 5
C2-09	Positioning Completion Detection Width Z_{FIN}	Detection width for outputting completion signal when the load shaft reaches near the commanded stop position. Detection width is commanded stop position ± Z_{FIN}.	Pulses	5	200 / 0
C2-10	Positioning Completion Cancel Width Z_{CAN}	Set value for canceling completion signal when the load shaft is moved after completion signal is output. Cancel width is commanded stop position ± Z_{CAN}.	Pulses	10	200 / Z_{FIN}
C2-11	Orientation Speed S_{ORT}	Speed applied (after detecting encoder origin) until changing to the servo loop during orientation.	r/min	400	600 / 40
C2-12	BCD Stop Position Reference Resolution P_{BCD}	Angle set value per minimum increment of stop position BCD command.	°	1.0	180.0 / 0.5
C2-13	Arbitrary Stop Position Offset P_{IMG}	Stop position offset for smoothing stop operation when the servo loop is used. When Z_{FIN} is reached, offset becomes 0.	Pulses	0	100 / 0
C2-14	Orientation Speed Changing Ratio R_{SOR}	Speed changing ratio for gradually reducing orientation speed to reduce gear noise when switching from orientation speed to servo loop speed.		0	100 / 0

(Cont'd)

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

Constant No.	Name	Explanation	Unit	Standard Setting	Upper Limit / Lower Limit
C2-15	Starting Soft Start Time T_{SFO}	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 / 0
C2-16	Flux Level ϕ_{ORT}	Flux level at completion of orientation. Motor noise and torque changes in proportion to flux level.		60	100 / 15
C2-17	Orientation Speed Reduction Coefficient K_{SOR}	Reduction coefficient to set orientation speed in proportion to the traveling angle for incremental positioning.		0	32767 / 0
C2-18 to C2-21	— — —	— — — — — — — —			
C2-22	Orientation Control Select Signal 1 SEL-E1 *	Control mode setting signal for specifying the direction of rotation in orientation control. · Bits 1 and 0: Positioning rotation direction 00 : Automatically selected rotation direction 01 : Same direction as the forward/reverse run signal 10 : Fixed rotation direction 11 : Automatically selected rotation direction · Bit 2: Selection for fixed rotation direction 0 : Forward rotation of the load shaft 1 : Reverse rotation of the load shaft · Bit 3: Stop position reference code 0 : 12-bit binary 1 : 3-digit BCD · Bit 4: Tune-up operation 0 : Tune-up enabled 1 : Tune-up disabled · Bit 5: Incremental positioning reference point 0 : Formerly commanded stop position 1 : Current stop position · Bit 6: Encoder selection 0 : Load shaft encoder 1 : Motor encoder · Bit 7: Rotation direction of motor and load shaft (automatically set at tune-up) 0 : Reverse 1 : The same		11000000	— — — / — — —

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

(Cont'd)

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

Constant No.	Name	Explanation	Unit	Standard Setting	Upper Limit / Lower Limit
C2-23	Orientation Control Select Signal 2 SEL-E2*1	Dither signal pattern and gain • Bit 0: DB selection upon orientation completion 0 : Disabled 1 : Stops by braking torque at orientaion completion • Bit 1: Dither signal pattern 0 : 6 steps (83Hz) 1 : 2 steps (250Hz) • Bits 4, 3 and 2: Dither signal level (H) (MGR and LGR are OFF.) 000 : 0.0% 011 : 7.5 % 110 : 15.0 % 001 : 2.5% 100 : 10.0% 111 : 17.5 % 010 : 5.0% 101 : 12.5 % • Bits 7, 6 and 5: Dither signal level (L) (MGR or LGR is ON) 000 : 0% 011 : 3% 110 : 6% 001 : 1% 100 : 4% 111 : 7% 010 : 2% 101 : 5%		00000000	--- ---
C2-24	Orientation Control Select Signal 3 SEL-E3*1	Orientation control parameters • Bits 3: Speed control mode selection in positioning operation *2 0 : P control 1 : PI control • Bits 5 and 4: Speed reference differential compensation gain 00 : 10 01 : 15 10 : 20 11 : 30 • Bits 7 and 6: Flux level for positioning servo loop control 00 : 100 % 01 : 80 % 10 : 60 % 11 : 40 %		10000000	---

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

*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 Orientaion Constants List

Constant No.	Name	Explanation	Unit	Standard Setting	Upper Limit / Lower Limit
C3-01	Load Shaft Positioning Origin P_{ORG}	Mechanical origin of the load shaft. Set difference from magnetic sensor signal in degrees.	°	0.00	2.00 / -2.00
C3-02	Position Control Proportional Gain (H) K_{PH}	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). Raising K_{PH} increases rigidity. Speed Reference (pps) = K_{PH} × Position Tolerance (pulses)	1/sec	15	99 / 1
C3-03	Position Control Proportional Gain (M) K_{PM}	Position control proportional gain when medium-speed gear is selected (MGR is ON). Raising K_{PM} increases rigidity. Speed Reference (pps) = K_{PM} × Position Tolerance (pulses)	1/sec	15	99 / 1
C3-04	Position Control Proportional Gain (L) K_{PL}	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_{PL} increases rigidity. Speed Reference (pps) = K_{PL} × Position Tolerance (pulses)	1/sec	15	99 / 1
C3-05	Speed Control Proportional Gain (H) K_{VHO}	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). Torque Reference P = K_{VHO} × Speed Tolerance	%/Hz	40	255 / 1
C3-06	Speed Control Integral Time Constant (H) τ_{VHO}	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). Torque Reference I = Torque Reference P × Time / τ_{VHO}	msec	100	1000 / 5
C3-07	Speed Control Proportional Gain (M, L) K_{VLO}	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). Torque Reference P = K_{VLO} × Speed Tolerance	%/Hz	40	255 / 1
C3-08	Speed Control Integral Time Constant (M, L) τ_{VLO}	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). Torque Reference I = Torque Reference P × Time / τ_{VLO}	msec	100	1000 / 5
C3-09	Positioning Completion Detection Width Z_{FIN}	Detection width for outputting completion signal when the load shaft reaches near the commanded stop position. Detection width is commanded stop position ± Z_{FIN}.	°	0.5	20.0 / 0.0
C3-10	Positioning Completion Cancel Width Z_{CAN}	Set value for canceling completion signal when the load shaft is moved after completion signal is output. Cancel width is commanded at stop position ± Z_{CAN}.	°	1.0	20.0 / Z_{FIN}
C3-11	Orientation Speed S_{ORT}	Speed applied (after detecting magnetic sensor signal) until changing to the servo loop during orientation.	r/min	400	600 / 40
C3-12	BCD Stop Position Reference Resolution P_{BCD}	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 / 0.5
C3-13	Arbitrary Stop Position Offset P_{IMG}	Stop position offset for smoothing stop operation when the servo loop is used. When Z_{FIN} is reached, offset becomes 0.	°	0.0	10.0 / 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 / 0

(Cont'd)

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

Constant No.	Name	Explanation	Unit	Standard Setting	Upper Limit / Lower Limit
C3-15	Starting Soft Start Time T_{SFO}	Soft start time for accelerating from stop to orientation speed. Use this parameter to reduce gear noise at starting. Acceleration rate is (500 r/min)/sec.	msec	0	50 / 0
C3-16	Flux Level ϕ_{ORT}	Flux level at completion of orientation. Motor noise and torque change in proportion to flux level.		60	100 / 15
C3-17	Orientation Speed Reduction Coefficient K_{SOR}	Reduction coefficient to set orientation speed in proportion to the traveling angle for incremental positioning.		0	32767 / 0
C3-18	———				
C3-19	———				
C3-20	Sensor Signal Standardization Angle θ_{SEN}	Angle for standardizing magnetic sensor signal detection sensitivity $\theta_{SEN} = 180^{\circ} \times$ Detection Range (mm) ÷ Mounting Radius ÷ π Set 20.0 to θ_{SEN} when $\theta_{SEN} > 20.0$. For detection range, check the specifications of the magnetizer and apply the values below: MG-1378BS (15 mm) MG-1444S (7 mm)		5.0	20.0 / 5.0
C3-21	———				
C3-22	Orientation Control Select Signal 1 SEL-M1 *	Control mode setting signal for specifying the direction of rotation in orientation control · Bits 1 and 0: Positioning rotation direction 00 : Automatically selected rotation direction 01 : Same direction as the forward/reverse run signal 10 : Fixed rotation direction 11 : Automatically selected rotation direction · Bit 2: Selection for fixed rotation direction 0 : Forward rotation of the load shaft 1 : Reverse rotation of the load shaft · Bit 3: Stop position reference code 0 : 12-bit binary 1 : 3-digit BCD · Bit 4: Tune-up operation 0 : Tune-up enabled 1 : Tune-up disabled · Bit 5: Incremental positioning reference point 0 : Formerly commanded stop position 1 : Current stop position · Bit 6: Encoder selection 0 : Load shaft encoder 1 : Motor encoder · Bit 7: Rotation direction of motor and load shaft 0 : Reverse 1 : The same		11000000	--- / ---

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

(Cont'd)

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

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

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

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