VS mini J7 Series
INSTRUCTION MANUAL

COMPACT GENERAL-PURPOSE INVERTER

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

YASKAWA

MANUAL NO. TOE-S606-12.1G

PREFACE

Yaskawa's VS mini J7 (hereinafter called VS mini) is a small and simple Inverter; as easy to use as a contactor. This instruction manual describes installation, maintenance, inspection, troubleshooting, and specifications of the VS mini. Read this instruction manual thoroughly before operation.

YASKAWA ELECTRIC CORPORATION

General Precautions

- Some drawings in this manual are shown with protective covers or shields removed in order to show detail with more clarity. Make sure all covers and shields are replaced before operating the product.
- This manual may be modified when necessary because of improvements to the product, modifications, or changes in specifications.
  Such modifications are indicated by revising the manual number.
- To order a copy of this manual, or 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 the guarantee.

NOTATION FOR SAFETY PRECAUTIONS

Read this instruction manual thoroughly before installation, operation, maintenance, or inspection of the VS mini. In this manual, safety precautions are classified as either warnings or cautions and are indicated as shown below.

⚠ WARNING

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

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or damage to equipment.
It may also be used to alert against unsafe practices.
Even items classified as cautions may result in serious accidents in some situations. Always follow these important precautions.

: Indicates information to insure proper operation.

PRECAUTIONS FOR UL/cUL MARKING

- Do not connect or disconnect wiring, or perform signal checks while the power supply is turned ON.
- The Inverter internal capacitor is still charged even after the power supply is turned OFF. To prevent electric shock, disconnect all power before servicing the Inverter, and then wait at least one minute after the power supply is disconnected. Confirm that all indicators are OFF before proceeding.
- Do not perform a withstand voltage test on any part of the Inverter. The Inverter is an electronic device that uses semiconductors, and is thus vulnerable to high voltage.
- Do not remove the Digital Operator or the blank cover unless the power supply is turned OFF. Never touch the printed circuit board (PCB) while the power supply is turned ON.
- This Inverter is not suitable for use on a circuit capable of delivering more than 18,000 RMS symmetrical amperes, 250 V maximum (200 V Class Inverters) or 18,000 RMS symmetrical amperes, 480 V maximum (400 V Class Inverters).

⚠ CAUTION
• Use 75°C copper wire or equivalent. Low voltage wires must be wired with Class I Wiring.

PRECAUTIONS FOR CE MARKINGS

- Only basic insulation to meet the requirements of protection class 1 and overvoltage category II is provided with control circuit terminals. Additional insulation may be necessary in the end product to conform to CE requirements.
- For 400 V class Inverters, make sure to ground the supply neutral to conform to CE requirements.
- For conformance to EMC directives, refer to the relevant manuals for the requirements.
  Document No. EZZ008389 for Japanese version,
  Document No. EZZ008390 for English version

RECEIVING THE PRODUCT

⚠ CAUTION	
	(Ref. page)
• Do not install or operate any Inverter that is damaged or has missing parts. Failure to observe this caution may result in injury or equipment damage.	19

MOUNTING

⚠ CAUTION	
	(Ref. page)
• Lift the Inverter by the heatsinks. When moving the Inverter, never lift it by the plastic case or the terminal cover. Otherwise, the main unit may fall and be damaged.	21
• Mount the Inverter on nonflammable material (i.e., metal). Failure to observe this caution may result in a fire.	21
• When mounting Inverters in an enclosure, install a fan or other cooling device to keep the intake air temperature below 50°C. Overheating may cause a fire or damage the Inverter.	21
• The VS mini generates heat. For effective cooling, mount it vertically. Refer to the figure in *Mounting Dimensions* on page 22.	22

WIRING

⚠ WARNING

	(Ref. page)
• Only begin wiring after verifying that the power supply is turned OFF. Failure to observe this warning may result in an electric shock or a fire.	24
• Wiring should be performed only by qualified personnel. Failure to observe this warning may result in an electric shock or a fire.	24
• When wiring the emergency stop circuit, check the wiring thoroughly before operation. Failure to observe this warning may result in injury.	24
• For 400 V class, make sure to ground the supply neutral. Failure to observe this warning can result in an electric shock or a fire.	29
• Always ground the ground terminal ⏚ according to the local grounding code. Failure to observe this warning may result in an electric shock or a fire.	29
• When the 3-wire sequence is set, do not make the wiring for the control circuit unless the multi-function input terminal parameter is set. Failure to observe this warning may result in injury.	70

⚠ CAUTION

(Ref. page)

- Verify that the Inverter rated voltage coincides with the AC power supply voltage.
  Failure to observe this caution may result in personal injury or a fire.
- Do not perform a withstand voltage test on the Inverter.
  Performing withstand voltage tests may damage semiconductor elements.
- Always tighten terminal screws of the main circuit and the control circuits. 24
  Failure to observe this caution may result in a malfunction, damage, or a fire.
- Never connect the AC main circuit power supply to output terminals U/T1, V/T2, or W/T3. 24
  The Inverter will be damaged and the guarantee will be voided.
- Do not connect or disconnect wires or connectors while power is applied to the circuits.
  Failure to observe this caution may result in injury.
- Do not perform signal checks during operation.
  The machine or the Inverter may be damaged.

OPERATION

⚠ WARNING

(Ref. page)

- Only turn ON the input power supply after confirming that the front cover, top cover, and bottom cover are in place. Do not remove the covers while current is flowing.
  Failure to observe this warning may result in an electric shock.
- Never operate the Digital Operator or DIP switches with wet hands.
  Failure to observe this warning may result in an electric shock.
- Never touch the terminals while current is flowing, even if the Inverter is stopping.
  Failure to observe this warning may result in an electric shock.
- When the fault retry function is selected, stand clear of the Inverter or the load. The Inverter may restart suddenly after stopping. 60
  (Construct the system to ensure safety, even if the Inverter should restart.) Failure to observe this warning may result in injury.
- When continuous operation after power recovery is selected, stand clear of the Inverter or the load. The Inverter may restart suddenly after stopping. 56
  (Construct the system to ensure safety, even if the Inverter should restart.) Failure to observe this warning may result in injury.
- The Digital Operator stop button can be disabled by a setting in the Inverter. Install a separate emergency stop switch.
  Failure to observe this warning may result in injury.

⚠ WARNING

(Ref. page)

- If an alarm is reset with the operation signal ON, the Inverter will restart automatically. Reset an alarm only after verifying that the operation signal is OFF. 32
  Failure to observe this warning may result in injury.
- When the 3-wire sequence is set, do not make the wiring for the control circuit unless the multi-function input terminal parameter is set. 70
  Failure to observe this warning may result in injury.

⚠ CAUTION

(Ref. page)

- Never touch the heatsinks, which can be extremely hot.
  Failure to observe this caution may result in harmful burns to the body.
- It is easy to change operation speed from low to high. Verify the safe working range of the motor and machine before operation.
  Failure to observe this caution may result in injury and machine damage.
- Install a holding brake separately if necessary.
  Failure to observe this caution may result in injury.
- If using an Inverter with an elevator, take safety measures on the elevator to prevent the elevator from dropping.
  Failure to observe this caution can result in personal injury.
- Do not perform signal checks during operation.
  The machine or the Inverter may be damaged.

⚠ CAUTION	
• All the constants set in the Inverter have been preset at the factory. Do not change the settings unnecessarily. The Inverter may be damaged.	33

MAINTENANCE AND INSPECTION

⚠ WARNING	(Ref. page)
• Never touch high-voltage terminals on the Inverter. Failure to observe this warning may result in an electric shock.	
• Disconnect all power before performing maintenance or inspection, and then wait at least one minute after the power supply is disconnected. Confirm that all indicators are OFF before proceeding. If the indicators are not OFF, the capacitors are still charged and can be dangerous.	
• Do not perform withstand voltage test on any part of the VS mini. The Inverter is an electronic device that uses semiconductors, and is thus vulnerable to high voltage.	
• Only authorized personnel should be permitted to perform maintenance, inspection, or parts replacement. (Remove all metal objects (watches, bracelets, etc.) before starting work.) (Use tools which are insulated against electric shock.) Failure to observe these warnings may result in an electric shock.	93

⚠ CAUTION

(Ref. page)

- The control PCB employs CMOS ICs.
  Do not touch the CMOS elements.
  They are easily damaged by static electricity.
- Do not connect or disconnect wires, connectors, or the cooling fan while power is applied to the circuit.
  Failure to observe this caution may result in injury. 93

OTHERS

⚠ WARNING

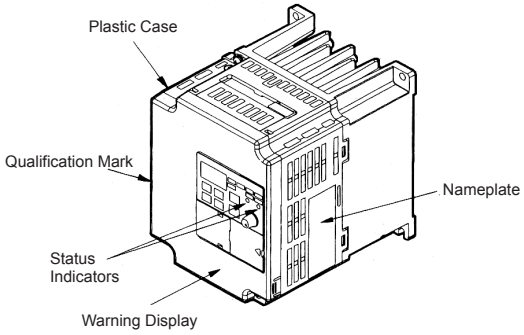
- Never modify the product.
  Failure to observe this warning may result in an electric shock or injury and will void the guarantee.

⚠ CAUTION

- Do not subject the Inverter to halogen gases, such as fluorine, chlorine, bromine, and iodine, at any time even during transportation or installation.
  Otherwise, the Inverter can be damaged or interior parts burnt.

WARNING LABEL

A warning label is provided on the front cover of the Inverter, as shown below. Follow the warnings when handling the Inverter.

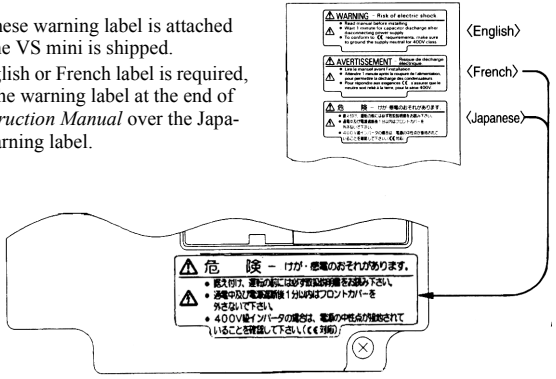


English and French Warning Labels

Warning Labels at End of Instruction Manual

A Japanese warning label is attached when the VS mini is shipped.

If a English or French label is required, attach the warning label at the end of the *Instruction Manual* over the Japanese warning label.



Example: 3-phase (200 V Class, 1.5 kW) Inverter

WARRANTY INFORMATION

■ Free Warranty Period and Scope

□ Warranty Period

This product is warranted for twelve months after being delivered to Yaskawa's customer or if applicable eighteen months from the date of shipment from Yaskawa's factory, whichever comes first.

□ Scope of Warranty

Inspections

Periodic inspections must be conducted by the customer. However, upon request, Yaskawa or one of Yaskawa's Service Centers can inspect the product for a fee. In this case, if after conferring with the customer, a Yaskawa product is found to be defective due to Yaskawa workmanship or materials and the defect occurs during the warranty period, then this fee will be waived and the problem remedied free of charge.

Repairs

If a Yaskawa product is found to be defective due to Yaskawa workmanship or materials and the defect occurs during the warranty period, Yaskawa will provide a replacement, repair the defective product, and provide shipping to and from the site free of charge.

However, if the Yaskawa Authorized Service Center determines that the problem with a Yaskawa product is not due to defects in Yaskawa's workmanship or materials, then the customer will be responsible for the cost of any necessary repairs. Some problems that are outside the scope of this warranty are:

- Problems due to improper maintenance or handling, carelessness, or other reasons where the customer is determined to be responsible.
- Problems due to additions or modifications made to a Yaskawa product without Yaskawa's understanding.
- Problems due to the use of a Yaskawa product under conditions that do not meet the recommended specifications.
- Problems caused by natural disaster or fire.
- Or other problems not due to defects in Yaskawa workmanship or materials.

Warranty service is only applicable within Japan.

However, after-sales service is available for customers outside of Japan for a reasonable fee. Contact your local Yaskawa representative for more information.

■ Exceptions

Any inconvenience to the customer or damage to non-Yaskawa products due to Yaskawa's defective products whether within or outside the warranty period are NOT covered by this warranty.

RESTRICTIONS

- The VS mini was not designed or manufactured for use in devices or systems that may directly affect or threaten human lives or health.
- Customers who intend to use the product described in this manual for devices or systems relating to transportation, health care, space aviation, atomic or electric power, or underwater use must contact their Yaskawa representatives or the nearest Yaskawa sales office beforehand.
- This product has been manufactured under strict quality-control guidelines. However, if this product is to be installed in any location where failure of this product could involve or result in a life-and-death situation or loss of human life or in a facility where failure may cause a serious accident or physical injury, safety devices must be installed to minimize the likelihood of any accident.

CONTENTS

1. Receiving the Product

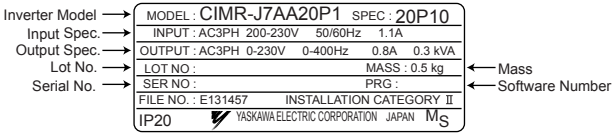
After unpacking the VS mini, check the following.

- Verify that the model number matches your purchase order or packing slip.
- Check the Inverter for physical damage that may have occurred during shipping.

If any part of VS mini is missing or damaged, call for service immediately.

■ Checking the Nameplate

Example for 3-phase, 200-VAC, 0.1-kW Inverter



Model

C I M R — J 7 A A 2 0 P 1

Inverter

VS mini J7 Series

No.	Type
A	With Digital Operator (with potentiometer)
B	Without Digital Operator
C	With Digital Operator (without potentiometer)

Note: Contact your Yaskawa representatives for models without heatsinks.

No.	Specifications
A	Japan domestic standards

No.	Applicable maximum motor output
0P1	0.1 kW
0P2	0.2 kW
0P4	0.4 kW
0P7	0.75 kW
1P5	1.5 kW
2P2	2.2 kW
3P0	3.0 kW
3P7	3.7 kW

No.	Voltage Class
B	Single-phase 200 VAC
2	Three-phase 200 VAC
4	Three-phase 400 VAC

Specifications

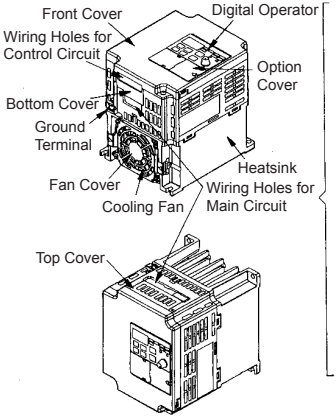
2 0 P 1 0

B	Single-phase 200 VAC
2	Three-phase 200 VAC
4	Three-phase 400 VAC

No.	Applicable maximum motor output
0P1	0.1 kW
0P2	0.2 kW
0P4	0.4 kW
0P7	0.75 kW
1P5	1.5 kW
2P2	2.2 kW
3P0	3.0 kW
3P7	3.7 kW

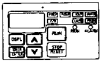
No.	Protective structure
0	Open chassis(IP20)

2. Identifying the Parts



Digital Operator (with potentiometer)

Used for setting or changing constants.
Frequency can be set using potentiometer.



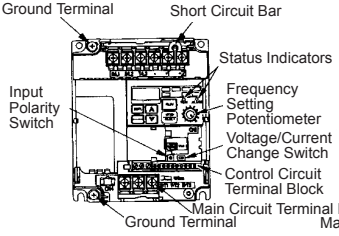
Digital Operator (without potentiometer)

Used for setting or changing constants.

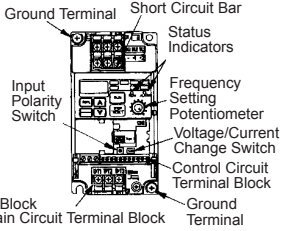
Without Digital Operator

In models without digital operator, only status can be displayed.

⇩ Opening the covers



CIMR-J7**21P5, 22P2, 23P7
B0P7, B1P5
40P2, 40P4, 40P7, 41P5
42P2, 43P0, 43P7



CIMR-J7**20P1, 20P2, 20P4, 20P7
B0P1, B0P2, B0P4

3. Mounting

■ Choosing a Location to Mount the Inverter

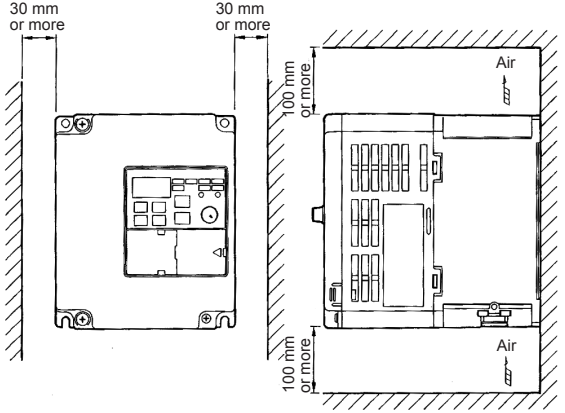
Be sure the Inverter is protected from the following conditions.

- Extreme cold and heat. Use only within the specified ambient temperature range:

  −10 to 50°C
- Rain and moisture
- Oil sprays and splashes
- Salt spray
- Direct sunlight (Avoid using outdoors.)
- Corrosive gases (e.g., sulfurized gas) or liquids
- Dust or metallic particles in the air
- Physical shock or vibration
- Magnetic noise (Examples: Welding machines, power devices, etc.)
- High humidity
- Radioactive substances
- Combustibles, such as thinner or solvents

■ Mounting Dimensions

To mount the VS mini, the dimensions shown below are required.

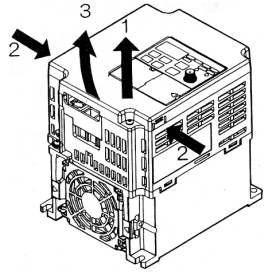


■ Mounting/Removing Components

Removing and Mounting the Digital Operator and Covers

- Removing the Front Cover

  Use a screwdriver to loosen the screw on the front cover and then remove it in direction 1. Then press the right and left sides in direction 2 and lift the front cover in direction 3.

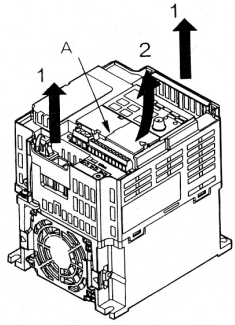


- Mounting the Front Cover

  Insert the tab of the upper part of the front cover into the groove of the Inverter, and press the lower part of the front cover onto the plastic case until the cover snaps shut. Then, tighten the screws.

- Removing the Option Cover

  After removing the front cover, remove the option cover in direction 2 with section A as a supporting point.



- Mounting the Option Cover

  Mount the terminal cover by reversing the order of the above procedure for removal.

- Removing the Upper/Bottom Covers

  After removing the front cover, lift the covers in direction 1.

- Mounting the Upper/Bottom Covers

  Mount the front cover by reversing the order of the above procedure for removal.

4. Wiring

■ Wiring Instructions

1. Always connect the power supply to the power input terminals R/L1, S/L2, and T/L3 (R/L1, S/L2 for single-phase power) via a molded-case circuit breaker (MCCB) or a fuse. Never connect the power supply to terminals U/T1, V/T2, W/T3, –, +1, or +2.
   Refer to page 119 for recommended peripheral devices. For single-phase Inverters, always use terminals R/L1 and S/L2. Never connect terminal T/L3.

Inverter Power Supply Connection Terminals

200-V 3-phase Input Power Supply Specification Inverters CIMR-J7□□2□□□	200-V Single Input Power Supply Specification Inverters CIMR-J7□□B□□□	400-V 3-phase Input Power Supply Specification Inverters CIMR-J7□□4□□□
Connect to R/L1, S/L2, and T/L3.	Connect to R/L1 and S/L2.	Connect to R/L1, S/L2, and T/L3.

2. Connect the motor wiring to terminals U/T1, V/T2 and W/T3 on the main circuit output side (bottom of the Inverter)
3. If the wiring distance between Inverter and motor is long, reduce the Inverter carrier frequency. For details, refer to *Reducing Motor Noise or Leakage Current Using Carrier Frequency Selection (n46)* on page 64.
4. Control wiring must be less than 50 m in length and must be separated from the power wiring. Use shielded twisted-pair cable when inputting the frequency signal externally.
5. Tighten the screws on the main circuit and control circuit terminals.
6. Do not connect or disconnect wiring, or perform signal check while the power supply is turned ON.
7. For 400 V Class Inverters, always ground the supply neutral to conform to CE requirements.
8. Only basic insulation to meet the requirements of protection class 1 and overvoltage category II is provided with control circuit terminals.
   Additional insulation may be necessary in the end product to conform to CE requirements.

9. Closed-loop connectors should be used when wiring to the main circuit terminals.
10. Voltage drop should be considered when determining the wire size.

Voltage drop can be calculated using the following equation:

Phase-to-phase voltage drop (V)

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

Select a wire size so that voltage drop will be less than 2% of the normal rated voltage.

■ Wire and Terminal Screw Sizes

1. Control Circuits

Model	Terminal Symbols	Screws	Tightening Torque N·m	Wires				
				Applicable Size		Recommended Size		Type
				mm^2	AWG	mm^2	AWG	
Common to all models	MA, MB, MC	M3	0.5 to 0.6	Twisted wires: 0.5 to 1.25, Single: 0.5 to 1.25	20 to 16, 20 to 16	0.75	18	Shielded or equivalent
	S1 to S5, SC, FS, FR, FC, AM, AC	M2	0.22 to 0.25	Twisted wires: 0.5 to 0.75, Single: 0.5 to 1.25	20 to 18, 20 to 16	0.75	18	

200 V Class 3-phase Input Inverters

Model	Terminal Symbols	Screws	Tightening Torque N·m	Wires				
				Applicable Size		Recommended Size		Type
				mm^2	AWG	mm^2	AWG	
CIMR-J7∗A 20P1	R/L1, S/L2, T/L3, -, +1, +2 ⏚ U/T1, V/T2, W/T3	M3.5	0.8 to 1.0 1.24 (10.97)	0.75 to 2	18 to 14	2	14	600 V vinyl-sheathed or equivalent
CIMR-J7∗A 20P2	R/L1, S/L2, T/L3, -, +1, +2 ⏚ U/T1, V/T2, W/T3	M3.5	0.8 to 1.0 1.24 (10.97)	0.75 to 2	18 to 14	2	14	
CIMR-J7∗A 20P4	R/L1, S/L2, T/L3, -, +1, +2 ⏚ U/T1, V/T2, W/T3	M3.5	0.8 to 1.0 1.24 (10.97)	0.75 to 2	18 to 14	2	14	
CIMR-J7∗A 20P7	R/L1, S/L2, T/L3, -, +1, +2 ⏚ U/T1, V/T2, W/T3	M3.5	0.8 to 1.0 1.24 (10.97)	0.75 to 2	18 to 14	2	14	
CIMR-J7∗A 21P5	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3 ⏚	M3.5	0.8 to 1.0	2 to 5.5	14 to 10	2	14	
CIMR-J7∗A 22P2	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3 ⏚	M3.5	0.8 to 1.0	2 to 5.5	14 to 10	3.5	12	
CIMR-J7∗A 23P7	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3 ⏚	M4	1.2 to 1.5	2 to 5.5	14 to 10	5.5	10	

Note: The wire size is given for copper wire at 75°C.

200 V Class Single-phase Input Inverters

Model	Terminal Symbols	Screws	Tightening Torque N·m	Wires				
				Applicable Size		Recommended Size		Type
				mm^2	AWG	mm^2	AWG	
CIMR-J7∗A B0P1	R/L1, S/L2, T/L3, -, +1, +2	M3.5	0.8 to 1.0	0.75 to 2	18 to 14	2	14	600 V vinyl-sheathed or equivalent
	⏚							
	U/T1, V/T2, W/T3		1.24 (10.97)					
CIMR-J7∗A B0P2	R/L1, S/L2, T/L3, -, +1, +2	M3.5	0.8 to 1.0	0.75 to 2	18 to 14	2	14	
	⏚							
	U/T1, V/T2, W/T3		1.24 (10.97)					
CIMR-J7∗A B0P4	R/L1, S/L2, T/L3, -, +1, +2	M3.5	0.8 to 1.0	0.75 to 2	18 to 14	2	14	
	⏚							
	U/T1, V/T2, W/T3		1.24 (10.97)					
CIMR-J7∗A B0P7	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	14 to 10	3.5	12	
	⏚					2	14	
CIMR-J7∗A B1P5	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	14 to 10	5.5	10	
	⏚					2	14	

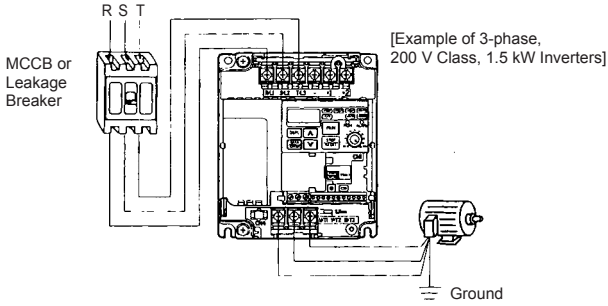
Note: 1. The wire size is given for copper wire at 75°C.
2. Do not use terminal T/L3 on Inverters with single-phase input.

400 V Class 3-phase Input Inverters

Model	Terminal Symbols	Screws	Tightening Torque N·m	Wires				
				Applicable Size		Recommended Size		Type
				mm^2	AWG	mm^2	AWG	
CIMR-J7∗A 40P2	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	14 to 10	2	14	600 V vinyl-sheathed or equivalent
	⏚							
CIMR-J7∗A 40P4	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	14 to 10	2	14	
	⏚							
CIMR-J7∗A 40P7	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	14 to 10	2	14	
	⏚							
CIMR-J7∗A 41P5	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3	M3.5	0.8 to 1.0	2 to 5.5	14 to 10	2	14	
	⏚							
CIMR-J7∗A 42P2	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3	M4	1.2 to 1.5	2 to 5.5	14 to 10	2	14	
	⏚							
CIMR-J7∗A 43P0	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3	M4	1.2 to 1.5	2 to 5.5	14 to 10	2	14	
	⏚					3.5	12	
CIMR-J7∗A 43P7	R/L1, S/L2, T/L3, -, +1, +2, U/T1, V/T2, W/T3	M4	1.2 to 1.5	2 to 5.5	14 to 10	2	14	
	⏚					3.5	12	

Note: The wire size is given for copper wire at 75°C.

■ Wiring the Main Circuits



• Main Circuit Input Power Supply

Always connect the power supply line to input terminals R/L1, S/L2, and T/L3 (R/L1, S/L2 for single-phase Inverters). Never connect them to terminals U/T1, V/T2, W/T3, B1, B2, –, +1, or +2. The Inverter may be damaged if the wrong terminals are connected.

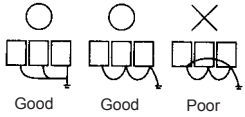
NOTE For single-phase Inverters, always use terminals R/L1 and S/L2. Never connect terminal T/L3.

• Grounding (Use ground terminal ⏚.)

Always ground the ground terminal ⏚ according to local grounding codes.

Never ground the VS mini to the same ground as welding machines, motors, or other electrical equipment.

When several VS mini Inverters are used side by side, ground each as shown in examples. Do not loop the ground wires.

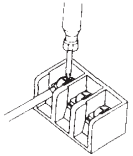


• Inverter Output

Connect the motor terminals to U/T1, V/T2, and W/T3.

• Wiring the Main Circuit Terminals

Pass the cables through wiring hole to connect them. Always mount the cover in its original position.



Connect with a Phillips screwdriver.

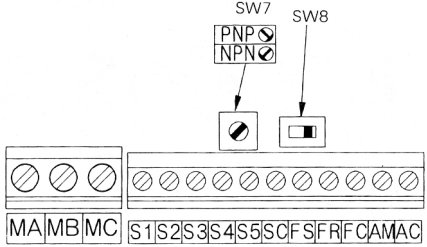
■ Wiring the Control Circuits

Only basic insulation is provided for the control circuit terminals.

Additional insulation may be necessary in the end product.

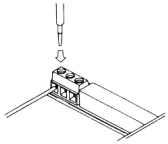
- Control Circuit Terminals

  Pass the cable through wiring hole to connect it. Always mount the cover in its original position.

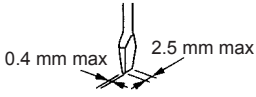


SW7 can be changed according to sequence input signal (S1 to S5) polarity.
0 V common: NPN side (Initial setting)
+24 V common: PNP side
Refer to page 115 for SW7.
Refer to page 75 for SW8.

Wiring the Control Circuit Terminals



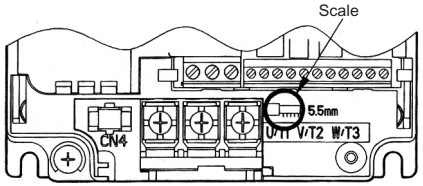
Screwdriver Blade Width



Insert the wire into the lower part of the terminal block and connect it tightly with a screwdriver.

The wire sheath strip length must be 5.5 mm.

Open the front cover and verify that the strip length is 5.5 mm.



■ Wiring Inspection

After completing wiring, check the following.

- Wiring is proper.
- Wire clippings or screws are not left in the Inverter.
- Screws are securely tightened.
- Bare wires in the terminals do not contact other terminals.

NOTE

If the FWD (or REV) RUN command is given when the RUN command from the control circuit terminal is selected (n02 = 1), the motor will start automatically after the main circuit input power supply is turned ON.

5. Operating the Inverter

■ Test Run

The Inverter operates when a frequency (speed) is set.

There are three operating modes for the VS mini:

1. RUN command from the Digital Operator (potentiometer/digital setting)
2. RUN command from the control circuit terminals
3. RUN command from MEMOBUS communications

Prior to shipping, the Inverter is set up to receive the RUN command and frequency reference from the Operator. Below are instructions for running the VS mini using the Digital Operator (with potentiometer). For instructions on operation, refer to page 41.

Operation reference or frequency reference constants can be selected separately as shown below.

Name	Constant	
RUN Command Selection	n02	= 0 --- Enables run, stop, and reset from Digital Operator. = 1 --- Enables run and stop from control circuit terminals. = 2 --- Enables MEMOBUS communications.
Frequency Reference Selection	n03	= 0 --- Enables the Digital Operator's potentiometer setting. = 1 --- Enables Frequency Reference 1 (constant n21). = 2 --- Enables a voltage reference (0 to 10 V) of control circuit terminal. = 3 --- Enables a current reference (4 to 20 mA) of control circuit terminal. = 4 --- Enables a current reference (0 to 20 mA) of control circuit terminal. = 6 --- Enables MEMOBUS communications.

Operation Steps	Operator Display	Function Indicators	Status Indicators
1. Turn the potentiometer fully counterclockwise, and then turn the power ON.	0.0	FREF	RUN ☼ ALARM ●
2. F/R will flash. Select FWD or REV RUN using the keys. NOTE Never select REV when reverse run is prohibited.	For (Forward) or rEv (Reverse)	F/R	RUN ☼ ALARM ●
3. Press DSPL to make FREF flash. Then press RUN.	0.0	FREF	RUN ☼ ALARM ●
4. Operate the motor by turning the potentiometer clockwise. (A frequency reference corresponding to the potentiometer position will be displayed.) NOTE If the potentiometer is switched rapidly, the motor also accelerates or decelerates rapidly in proportion to the potentiometer movement. Pay attention to load status and switch the potentiometer at a speed that will not adversely affect motor movement.	0.0 to 60.0 (min^{-1}) Minimum output frequency is 1.5 Hz.	FREF	RUN ☼ ALARM ●

Status indicators ☼: ON ☼: Flashing ●: OFF

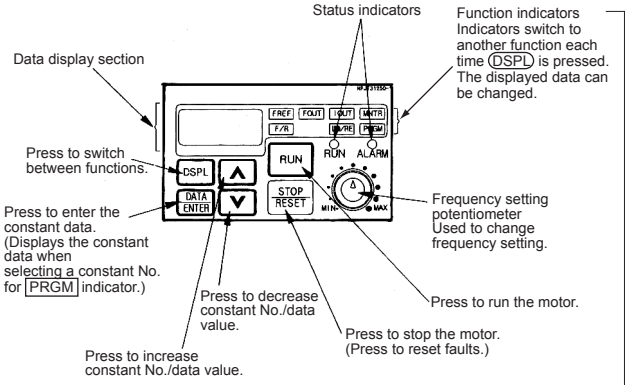
☐ Operation Check Points

- Motor rotates smoothly.
- Motor rotates in the correct direction.
- Motor does not have abnormal vibration or noise.
- Acceleration and deceleration are smooth.
- Current matching the load flows.
- Status indicators and Digital Operator display are correct.

■ Operating the Digital Operator

All functions of the VS mini are set using the Digital Operator. Below are descriptions of the display and keypad sections.

Digital Operator



Details of Indicators (Color in parenthesis indicates the color of indicator.)

FREF Frequency reference setting/monitoring (GREEN)	FOUT Output frequency monitoring (GREEN)	IOUT Output current monitoring (GREEN)	MNTR Multi-function monitoring (GREEN)
F/R Operator RUN command FWD/REV selection (GREEN)		LO/RE LOCAL/REMOTE Selection (RED)	PRGM Constant No./data (RED)

☐ Description of Status Indicators

There are two status indicators on the middle right section of the face of the VS mini. The combinations of these indicators indicate the status of the Inverter (ON, flashing, and OFF). RUN indicator and status indicator on RUN button have the same function.

☼ :ON ☼ :Flashing (long flashing) ☼ :Flashing ●:OFF

The following table shows the relationship between the Inverter conditions and the indicator on the RUN button of the Digital Operator as well as the RUN and ALARM indicators on the face of the VS mini.

The indicators are lit, unlit or flashing reflecting the order of priority.

Priority	Digital Operator (Optional)	Face of the VS mini		Conditions
	RUN	RUN	ALARM	
1	●	●	●	Power supply is shut down. Until the Inverter become ready after the power is turned ON.
2	●	●	☼	Fault
3	☼	☼	☼	Emergency stop (STOP command is sent from the Digital Operator when the control circuit terminals were used to operate the Inverter.) Eere emergency stop (Emergency stop alarm is sent from the control circuit terminal.) Note: Indicators will be the same as with alarm (stopped) occurring after the Inverter is stopped.
4	☼	☼	☼	Emergency stop (Emergency stop fault is sent from the control circuit terminal.) Note: Indicators will be the same as with fault occurring after the Inverter is stopped.
5	☼	☼	☼	Alarm (Stopped)
6	☼	☼	☼	Alarm (Operating) The RUN command is carried out when the External baseblock command using the multi-function contact input terminal is issued.
7	☼	☼	●	Stopped (During baseblock)
8	☼	☼	●	Operating (Including the status that the Inverter is operating at a frequency below the minimum output frequency.) During dynamic braking when starting.
9	☼	☼	●	During deceleration to a stop During dynamic braking when stopping.

For details on how the status indicators function for Inverter faults, refer to *Chapter 8. Fault Diagnosis*. If a fault occurs, the ALARM indicator will light.

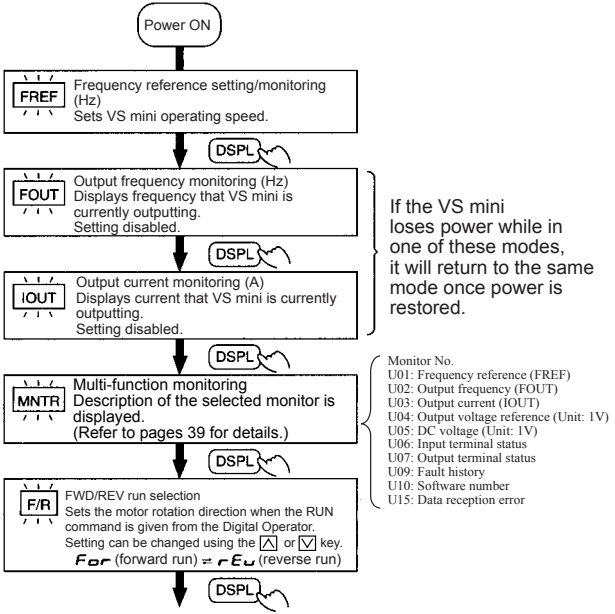
NOTE

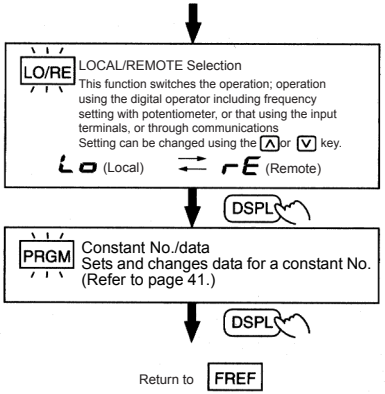
The fault can be reset by turning ON the FAULT RESET signal (or by pressing the STOP RESET key on the Digital Operator) with the operation signal OFF, or by turning OFF the power supply. If the operation signal is ON, the fault cannot be reset using the FAULT RESET signal.

■ Function Indicator Description

By pressing DSPL on the Digital Operator, each of the function indicators can be selected.

The following flowchart describes each function indicator.





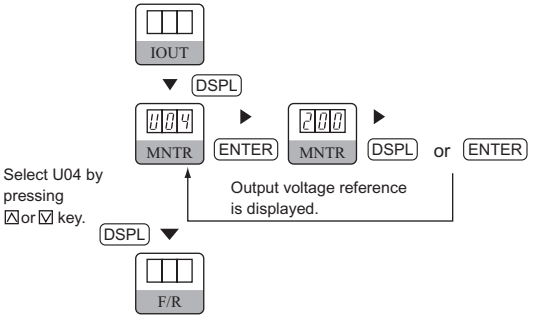
⚠WARNING If n01=5, a Run command can be received even while changing a constant. If sending a Run command while changing a constant, such as during a test run, be sure to observe all safety precautions.
Failure to observe this warning may result in injury.

☐ MNTR Multi-function Monitoring

Selecting the Monitor

Press the (DSPL) key. When (MNTR) is ON, data can be displayed by selecting the monitor number.

Example: Monitoring the Output Voltage Reference



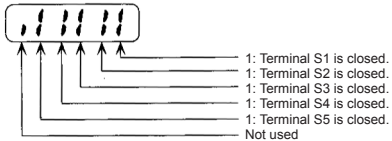
Monitoring

The following items can be monitored using U constants.

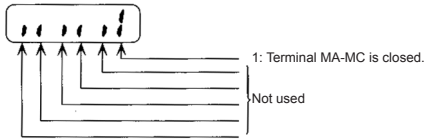
Constant No.	Name	Unit	Description
U01	Frequency Reference (FREF)	Hz	Frequency reference can be monitored. (Same as FREF)
U02	Output Frequency (FOUT)	Hz	Output frequency can be monitored. (Same as FOUT)
U03	Output Current (IOUT)	A	Output current can be monitored. (Same as IOUT)
U04	Output Voltage	V	Output voltage can be monitored.
U05	DC Voltage	V	Main circuit DC voltage can be monitored.
U06	Input Terminal Status	-	Input terminal status of control circuit terminals can be monitored.
U07	Output Terminal Status	-	Output terminal status of control circuit terminals can be monitored.
U09	Fault History	-	The last four fault history records are displayed.
U10	Software No.	-	Software number can be checked.
U15	Data Reception Error	-	Contents of MEMOBUS communication data reception error can be checked. (Contents of transmission register No. 003DH are the same.)

☐ Input/Output Terminal Status

Input terminal status



Output terminal status



Fault History Display Method

Fault description is displayed when U09 is selected.

(Example)

□□□: Fault description

"---" is displayed if there is no fault.

(Refer to page 97 for details.)

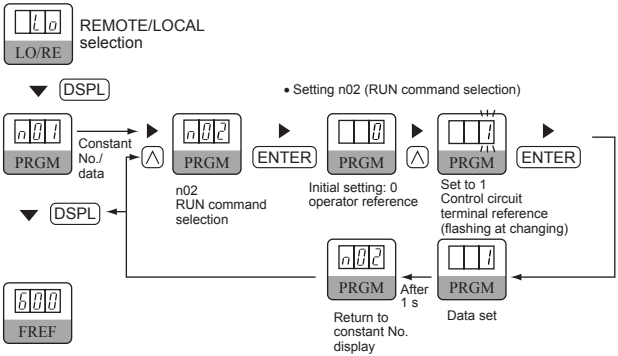
Clearing the Fault History

Set constant n01 to 6 to clear the fault history. Set data returns to its initial value after 6 is set.

Note: Initializing the constants (n01=8, 9) also clears the fault history.

Setting and Referencing Constants

The following diagram shows how to select and change constants.



■ Simple Data Setting

Digital setting (refer to *5. Operating the Inverter*) and potentiometer setting are both possible for simple acceleration/deceleration operation of the VS mini.

Frequency reference by potentiometer signal is set with initial setting (n03=0).

Factory setting of the model with operator (without potentiometer) is set by Digital Operator (n03=1).

Following is an example in which the function LEDs are used to set frequency reference, acceleration time, deceleration time, and motor direction.

Operation Steps	Operator Display	Function Indicators	Status Indicators
1. Turn ON the power supply.	0.0	FREF	RUN ☼ ALARM ●
2. Set constant n03 to 1.	1	PRGM	RUN ☼ ALARM ●
3. Set the following constants. n16: 15.0 (Acceleration Time) n17: 5.0 (Deceleration Time)	15.0 5.0	PRGM	RUN ☼ ALARM ●
4. Select forward or reverse run by pressing the ∧ or ∨ key. NOTE Examine the application. (Never select REV when reverse run is prohibited.)	For (Forward) or rEv (Reverse)	FR	RUN ☼ ALARM ●
5. Set the reference by pressing the ∧ or ∨ key.	60.0	FREF	RUN ☼ ALARM ●
6. Press RUN.	0.0 to 60.0	FOUT	RUN ☼ ALARM ●
7. Press STOP to stop.	60.0 to 0.0	FOUT	RUN ☼ ↓ RUN ☼ ALARM ●

Status indicators ☼:ON ☼:Flashing (long flashing) ☼:Flashing ●:OFF

6. Programming Features

Factory settings of the constants are shaded in the tables.

After wiring is complete, be sure to make the following settings before operation.

☐ Hardware

Make the following settings before the Inverter is turned ON.

Item	Ref.
Sequence input signal (S1 to S5) polarity selection	115
Voltage reference / current reference input selection of control circuit terminal FR	75

☐ Software (Constant)

Item		Ref.
Environment setting	Constant Selection / Initialization (n01)	44
	RUN Command Selection (n02)	49
	Frequency Reference Selection (n03)	50
	Stopping Method Selection (n04)	67
Basic characteristics and frequency reference setting	V/f pattern setting (n09 to n15)	45
	Acceleration Time 1 (n16), Deceleration Time 1 (n17)	55
	Frequency Reference 1 to 8 (n21 to n28)	51
Motor protection	Motor Rated Current (n32)	81
	Electric Thermal Motor Protection Selection (n33)	81
Countermeasure for noise and leakage current, Using an optional braking resistor	Carrier Frequency Reference (n46)	64

■ Constant Setup and Initialization

□ Constant Selection/Initialization (n01)

The following table lists the data that can be set or read when n01 is set. Unused constants between n01 and n79 are not displayed.

n01 Setting	Constant That Can Be Set	Constant That Can Be Referenced
0	n01	n01 to n79
1	n01 to n79*1	
5	n01 to n79*1 (Run command can be received in Program mode.)	
6	Fault history cleared	
7	Not used	
8	Initialize	
9	Initialize (3-wire sequence)*2	

* 1. Excluding setting-disabled constants.
* 2. Refer to page 70.

NOTE

Err appears on the display for one second and the set data returns to its initial values in the following cases.

1. If the set values of input terminal function selection 2 to 5 (n36 to n39) are the same.
2. If the following conditions are not satisfied in the V/f pattern setting:
   Max. Output Frequency (n09) ≥ Max. Voltage Output Frequency (n11) > Mid. Output Frequency (n12) ≥ Min. Output Frequency (n14)
   For details, refer to *Adjusting Torque According to Application* (V/f Pattern Setting) on page 45.
3. If the following conditions are not satisfied in the jump frequency settings:
   Jump Frequency 2 (n50) ≤ Jump Frequency 1 (n49)

4. If the Frequency Reference Lower Limit (n31) ≤ Frequency Reference Upper Limit (n30)
5. If the Motor Rated Current (n32) ≤ 120% of Inverter rated current

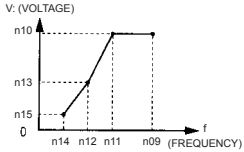
■ Selecting V/f Pattern

□ Adjusting Torque According to Application

Adjust motor torque by using the V/f pattern and full-range automatic torque boost settings.

V/f Pattern Setting

Set the V/f pattern in n09 to n15 as described below. Set each pattern when using a special motor (e.g., high-speed motor) or when requiring special torque adjustment of the machine.



Be sure to satisfy the following conditions for the settings of n09 to n15.
n14 ≤ n12 < n11 ≤ n09
If n14 = n12, the setting of n13 will be disabled.

Constant No.	Name	Unit	Setting Range	Initial Setting
n09	Max. Output Frequency	0.1 Hz	50.0 to 400 Hz	60.0 Hz
n10	Max. Voltage	1 V	1 to 255 V (1 to 510 V)	200 V (400 V)
n11	Max. Voltage Output Frequency (Base Frequency)	0.1 Hz	0.2 to 400 Hz	60.0 Hz
n12	Mid. Output Frequency	0.1 Hz	1 to 399 Hz	1.5 Hz
n13	Mid. Output Frequency Voltage	1 V	1 to 255 V (1 to 510 V)	12 V (24 V)
n14	Min. Output Frequency	0.1 Hz	0.1 to 10.0 Hz	1.5 Hz
n15	Min. Output Frequency Voltage	1 V	1 to 50 V (1 to 100 V)	12 V (24 V)

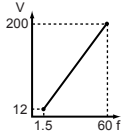
Typical Setting of the V/f Pattern

Set the V/f pattern according to the application as described below. For 400-V Class Inverters, the voltage values (n10, n13, and n15) should be doubled. When running at a frequency exceeding 50/60 Hz, change the Maximum Output Frequency (n09).

Note: Always set the maximum output frequency according to the motor characteristics.

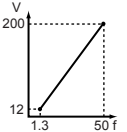
1. For General-purpose Applications

Motor Specification: 60 Hz (Factory setting)



Constant	Setting
n09	60.0
n10	200.0
n11	60.0
n12	1.5
n13	12
n14	1.5
n15	12

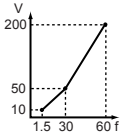
Motor Specification: 50 Hz



Constant	Setting
n09	50.0
n10	200.0
n11	50.0
n12	1.3
n13	12
n14	1.3
n15	12

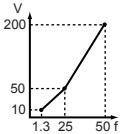
2. For Fans/Pumps

Motor Specification: 60 Hz



Constant	Setting
n09	60.0
n10	200.0
n11	60.0
n12	30.0
n13	50
n14	1.5
n15	10

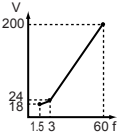
Motor Specification: 50 Hz



Constant	Setting
n09	50.0
n10	200.0
n11	50.0
n12	25.0
n13	50
n14	1.3
n15	10

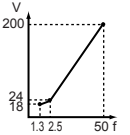
3. For Applications Requiring High Starting Torque

Motor Specification: 60 Hz



Constant	Setting
n09	60.0
n10	200.0
n11	60.0
n12	3.0
n13	24
n14	1.5
n15	18

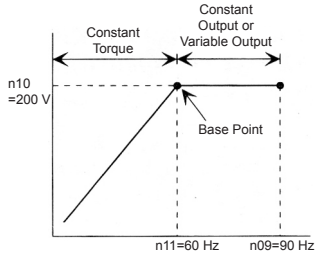
Motor Specification: 50 Hz



Constant	Setting
n09	50.0
n10	200.0
n11	50.0
n12	2.5
n13	24
n14	1.3
n15	18

Increasing the voltage of the V/f pattern increases motor torque, but an excessive increase may cause motor overexcitation, motor overheating, or vibration.

When operating with frequency larger than 60 Hz/50 Hz, change only max. output frequency (n09).



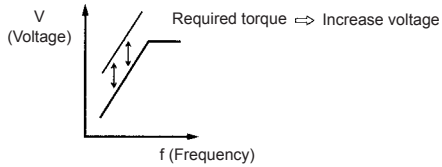
Full-range Automatic Torque Boost

The motor torque requirement changes according to load conditions. The full-range automatic torque boost adjusts the voltage of the V/f pattern according to requirements. The VS mini automatically adjusts the voltage during constant-speed operation, as well as during acceleration.

The required torque is calculated by the Inverter.
This ensures tripless operation and energy-saving effects.

Output voltage ∝ Torque compensation gain (n63) × Required torque

Operation



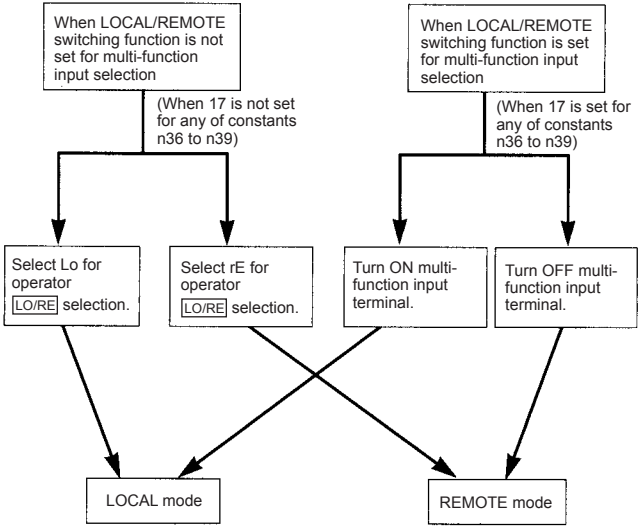
Normally, no adjustment is necessary for the Torque Compensation Gain (n63 factory setting: 1.0). When the wiring distance between the Inverter and the motor is long, or when the motor generates vibration, change the automatic torque compensation gain. In these cases, set the V/f pattern (n09 to n15).

■ Switching LOCAL/REMOTE Mode

The following functions can be selected by switching LOCAL or REMOTE mode. To select the RUN/STOP command or frequency reference, change the mode in advance depending on the following applications.

- LOCAL mode: Enables the Digital Operator for RUN/STOP commands and FWD/REV RUN commands. The frequency reference can be set using the potentiometer or FREF.
- REMOTE mode: Enables RUN Command Selection (n02). The frequency reference can be set by n03 (frequency reference selection) setting.

□ How to Select LOCAL/REMOTE Mode



■ Selecting RUN/STOP Commands

Refer to *Switching LOCAL/REMOTE Mode* (page 48) to select either the LOCAL mode or REMOTE mode.

The operation method (RUN/STOP commands, FWD/REV RUN commands) can be selected using the following method.

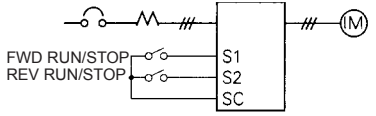
□ LOCAL Mode

When Lo (local mode) is selected for Digital Operator [LO/RE] ON mode, or when the LOCAL/REMOTE switching function is set and the input terminals are turned ON, run operation is enabled by the [STP] or [RUN] on the Digital Operator, and FWD/REV is enabled by the [F/R] ON mode (using ∧ or ∨ key).

[LO/RE] is not effective when local/remote switching function is selected for multi-function input selection.

□ REMOTE Mode

1. Select remote mode.
   There are following two methods to select remote mode.
   - Select rE (remote mode) for the [LO/RE] selection.
   - When the local/remote switching function is selected for the multi-function input selection, turn OFF the input terminal to select remote mode.
2. Select the operation method by setting constant n02.
   n02 =0: Enables the Digital Operator (same with local mode).
   =1: Enables the multi-function input terminal (see fig. below).
   =2: Enables communications (refer to page 83) (When option card is installed).
   - Example when using the multi-function input terminal as operation reference (two-wire sequence)



For an example of three-wire sequence, refer to page 70.

☐ Operating (RUN/STOP Commands) Using Communications (When Option Card is Installed)

Setting constant n02 to 2 in REMOTE mode enables using RUN/STOP commands via MEMOBUS communications. For commands using MEMOBUS communications, refer to page 83.

■ Selecting Frequency Reference

Frequency reference can be selected by the following methods.

☐ Setting by Operator

Select REMOTE or LOCAL mode in advance. For the method for selecting the mode, refer to page 48.

LOCAL Mode

Select command method using constant n07.

n07=0: Enables using the potentiometer on the Digital Operator (initial setting).
The factory setting for models with the Digital Operator (without a potentiometer) is n07=1.

=1: Enables digital setting on the Digital Operator, setting value is stored in constant n21 (frequency reference 1).

- Digital Setting Using the Digital Operator

Input the frequency while FREF is lit (press ENTER after setting the numeric value).

Frequency reference setting is effective when 1 is set for constant n08 instead of pressing ENTER.

n08 =0: Enables frequency reference setting using the ENTER key (initial setting).

=1: Disables frequency reference setting using the ENTER key.

REMOTE Mode

Select the command method in constant n03.

n03 =0: Enables frequency reference setting using the potentiometer on the Digital Operator (initial setting).
Factory setting of models with the Digital Operator (without a potentiometer) is n03=1.

=1: Enables using frequency reference 1 (n21)

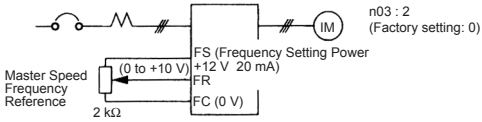
=2: Enables a voltage reference. (0 to 10 V) (See the following figure.)

=3: Enables current reference. (4 to 20 mA) (Refer to page 75.)

=4: Enables current reference. (0 to 20 mA) (Refer to page 75.)

=6: Enables communications. (Refer to page 83.)

Example of frequency reference by voltage signal



■ Setting Operation Conditions

☐ Reverse Run Prohibit (n05)

The Reverse Run Prohibit setting disables accepting a reverse RUN command from the control circuit terminal or Digital Operator. This setting is used for applications where a reverse RUN command can cause problems.

Setting	Description
0	Reverse run enabled.
1	Reverse run disabled.

☐ Multi-step Speed Selection

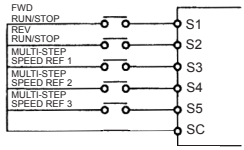
Up to 16 speed steps (including Jog frequency reference) can be set using the following combinations of frequency reference and input terminal selections.

8-step speed change

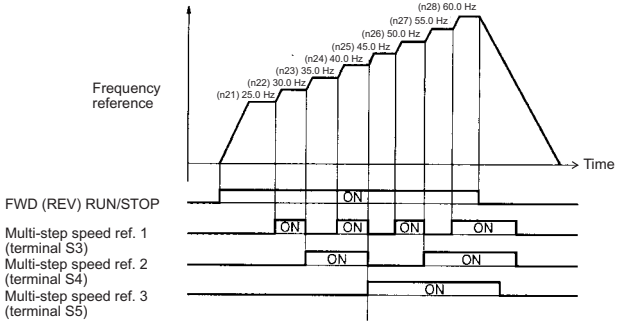
n02=1 (Operation mode selection)
n03=1 (Frequency reference selection)
n21=25.0 Hz (Frequency reference 1)
n22=30.0 Hz (Frequency reference 2)
n23=35.0 Hz (Frequency reference 3)
n24=40.0 Hz (Frequency reference 4)
n25=45.0 Hz (Frequency reference 5)
n26=50.0 Hz (Frequency reference 6)
n27=55.0 Hz (Frequency reference 7)
n28=60.0 Hz (Frequency reference 8)

NOTE When all multi-function reference inputs are OFF, the frequency reference selected by constant n03 (frequency reference selection) becomes effective.

n36=1
n37=6 (Multi-function contact input terminal S3)
n38=7 (Multi-function contact input terminal S4)
n39=8 (Multi-function contact input terminal S5)



n36=2 (Input terminal S2) Initial Setting
n37=6 (Input terminal S3) Change the setting to 6.
n38=7 (Input terminal S4) Change the setting to 7.
n39=8 (Input terminal S5) Change the setting to 8.



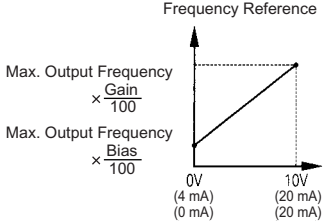
☐ Operating at Low Speed

By inputting a JOG command and then a FORWARD (REVERSE) RUN command, operation is enabled at the jog frequency set in n29. When multi-step speed references 1, 2, 3 or 4 are input simultaneously with the JOG command, the JOG command has priority.

Constant No.	Name	Setting
n29	Jog Frequency	Initial setting: 6.0 Hz
n36 to n39	Jog References	Set to 10 for any constant.

☐ Adjusting Speed Setting Signal

The relationship between the analog inputs and the frequency reference can be set to provide the frequency reference by analog input of control circuit terminal FR or FC.



( ) indicates the value when a current reference input is selected.

- Frequency reference gain (n41)

  The analog input voltage value for the max. output frequency (n09) can be set in units of 1% (max. output frequency n09=100%).

  * Factory setting: 100%

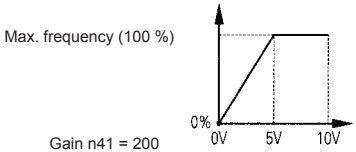
- Frequency reference bias (n42)

  The frequency reference provided when analog input is 0 V (4 mA or 0 mA) can be set in units of 1% (max. output frequency n09=100%).

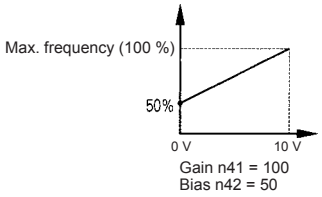
  * Factory setting: 0%

Typical Settings

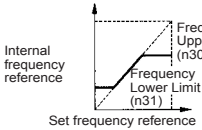
- To operate the Inverter with a frequency reference of 50% to 100% at an input voltage of 0 to 5 V



- To operate the Inverter with a frequency reference of 50% to 100% at an input voltage of 0 to 10 V



☐ Adjusitng Frequency Upper and Lower Limits



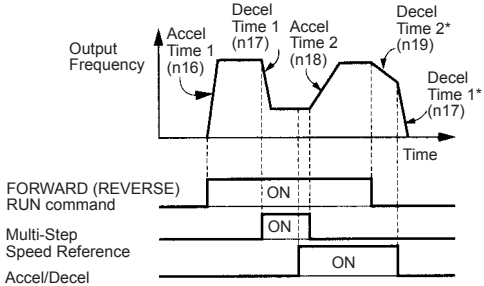
- Frequency Reference Upper Limit (n30)

  Sets the upper limit of the frequency reference in units of 1%.
  (n09: Max. Output Frequency = 100%)
  Factory setting: 100%

- Frequency Reference Lower Limit (n31)

  Sets the lower limit of the frequency reference in units of 1%.
  (n09: Max. Output Frequency = 100%)
  When operating at a frequency reference of 0, operation is continued at the frequency reference lower limit.
  However, if the frequency reference lower limit is set to less than the Minimum Output Frequency (n14), operation is not performed.
  Factory setting: 0%

☐ Using Two Acceleration/Deceleration Times



* When deceleration to a stop is selected (n04 = 0).

By setting input terminal function selection (either of n36 to 39) to 11 (acceleration/deceleration time select), the acceleration/deceleration time is selected by turning ON/OFF the acceleration/deceleration time selection terminals (terminals S2 to S5).

At OFF: n16 (Acceleration Time 1)
n17 (Deceleration Time 1)

At ON: n18 (Acceleration Time 2)
n19 (Deceleration Time 2)

- Acceleration time
  Set the time needed for the output frequency to reach 100% from 0%.
- Deceleration time
  Set the time needed for the output frequency to reach 0% from 100%.
  (Max. Output Frequency n09 = 100%)

☐ Momentary Power Loss Ridethrough Method (n47)

When constant n47 is set to 1 or 2, operation automatically restarts even if a momentary power loss occurs.

Setting	Description
0	Continuous operation after momentary power loss not enabled.
1*1	Continuous operation after power recovery within momentary power loss ridethrough time
2*1, *2	Continuous operation after power recovery (Fault output not produced.)

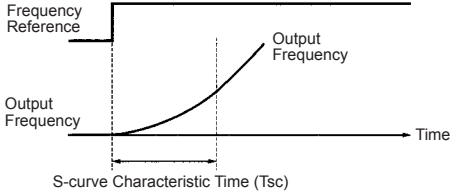
* 1. Hold the operation signal to continue operation after recovery from a momentary power loss.
* 2. When 2 is selected, the Inverter restarts if power supply voltage recovers while the control power supply is held.
No fault signal is output.

☐ S-curve Selection (n20)

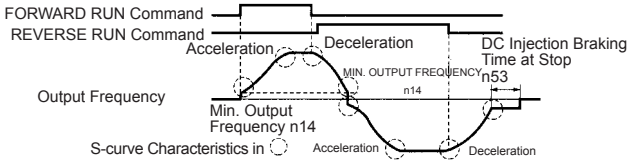
To prevent shock when starting and stopping the machine, acceleration/deceleration can be performed using an S-curve pattern.

Setting	S-curve Selection
0	S-curve characteristic not provided.
1	0.2 s
2	0.5 s
3	1.0 s

Note: The S-curve characteristic time is the time from acceleration/deceleration rate 0 to the normal acceleration/deceleration rate determined by the set acceleration/deceleration time.



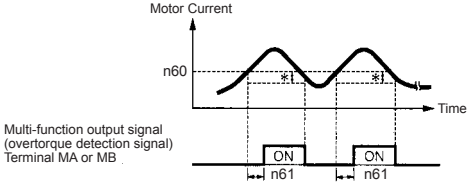
The following time chart shows switching between FWD/REV run when decelerating to a stop.



☐ Torque Detection

If an excessive load is applied to the machine, an increase in the output current can be detected to output an alarm signal to multi-function output terminal MA or MB.

To output an overtorque detection signal, set one of the output terminal function selection n40 for overtorque detection (Setting: 6 (NO contact) or 7 (NC contact)).



* The overtorque detection release width (hysteresis) is set at approx. 5% of the Inverter rated current.

Overtorque Detection Function Selection (n59)

Setting	Description
0	Overtorque detection not provided.
1	Detected during constant-speed running. Operation continues after detection.
2	Detected during constant-speed running. Operation stops during detection.
3	Detected during running. Operation continues after detection.
4	Detected during running. Operation stops during detection.

1. To detect overtorque during acceleration/deceleration, set n59 to 3 or 4.
2. To continue operation after overtorque detection, set n59 to 1 or 3. During detection, the operator will display an oL3 alarm (flashing).
3. To stop the Inverter and generate a fault at overtorque detection, set n59 to 2 or 4. At detection, the Digital Operator will display an oL3 fault (ON).

Overtorque Detection Level (n60)

Set the overtorque detection current level in units of 1%. (Inverter rated current = 100%)

Factory setting: 160%

Overtorque Detection Time (n61)

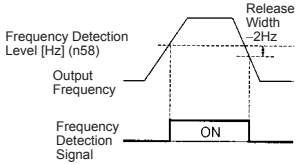
If the time that the motor current exceeds the Overtorque Detection Level (n60) is longer than Overtorque Detection Time (n61), the overtorque detection function will operate.
Factory setting: 0.1 s

☐ Frequency Detection Level (n58)

Effective when the Multi-function Output Selection n40 is set for frequency detection (setting: 4 or 5). Frequency detection turns ON when the output frequency is higher or lower than the setting for the Frequency Detection Level (n58).

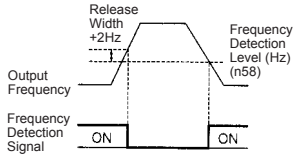
Frequency Detection 1

Output frequency ≥ Frequency Detection Level n58 (Set n40 to 4.)



Frequency Detection 2

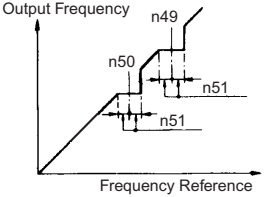
Output frequency ≤ Frequency Detection Level n58 (Set n40 to 5.)



☐ Jump Frequencies (n49 to n51)

This function allows the prohibition or "jumping" of critical frequencies so that the motor can operate without resonance caused by the machine system. This function is also used for dead band control. Setting the values to 0.00 Hz disables this function.

Set prohibited frequency 1 or 2 as follows:



n49 ≥ n50

If this condition is not satisfied, the Inverter will display Err for one second and restore the data to initial settings.

Operation is prohibited within the jump frequency ranges. However, the motor will operate without jumping during acceleration/deceleration.

☐ Continuing Operation Using Automatic Retry Attempts (n48)

The Inverter can be set to restart and reset fault detection after a fault occurs. The number of self-diagnosis and retry attempts can be set to up to 10 in n48. The Inverter will automatically restart after the following faults occur:

OC (overcurrent)

GF (ground fault)

OV (overvoltage)

The number of retry attempts is cleared to 0 in the following cases:

1. If no other fault occurs within 10 minutes after retry
2. When the FAULT RESET signal is ON after the fault is detected
3. When the power supply is turned OFF

☐ Operating a Coasting Motor without Tripping

To operate a coasting motor without tripping, use the SPEED SEARCH command or DC injection braking at startup.

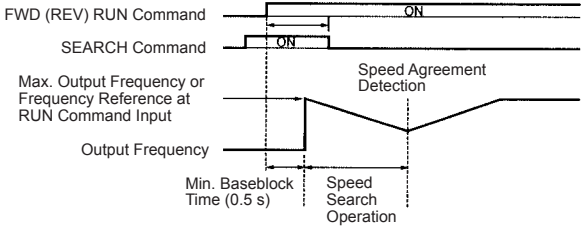
SPEED SEARCH Command

Restarts a coasting motor without stopping it. This function enables smooth switching between motor commercial power supply operation and Inverter operation.

Set a Multi-function Input Selection (n36 to n39) to 14 (SEARCH command from maximum output frequency) or 15 (SEARCH command from set frequency).

Build a sequence so that a FWD (REV) RUN command is input at the same time as the SEARCH command or after the SEARCH command. If the RUN command is input before the SEARCH command, the SEARCH command will be disabled.

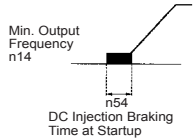
Time Chart at SEARCH Command Input



DC Injection Braking at Startup (n52, n54)

Restarts a coasting motor after stopping it. Set the DC injection braking time at startup in n54 in units of 0.1 second. Set the DC Injection Braking Current in n52 in units of 1% (Inverter rated current =100%). When the setting of n54 is 0, DC injection braking is not performed and acceleration starts from the minimum output frequency.

When n52 is set to 0, acceleration starts from the minimum output frequency after baseblocking for the time set in n54.



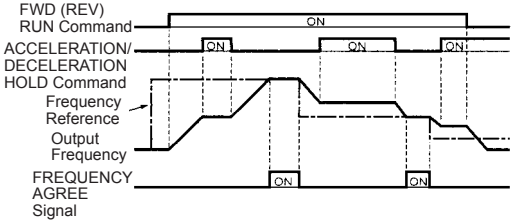
☐ Holding Acceleration/Deceleration Temporarily

To hold acceleration or deceleration, input an ACCELERATION/DECELERATION HOLD command. The output frequency is maintained when an ACCELERATION/DECELERATION HOLD command is input during acceleration or deceleration.

When the STOP command is input while an ACCELERATION/DECELERATION PROHIBITION command is being input, the acceleration/deceleration hold is released and operation ramps to a stop.

Set a Multi-function Input Selection (n36 to n39) to 16 (acceleration/deceleration prohibit).

Time Chart for ACCELERATION/DECELERATION HOLD Command Input



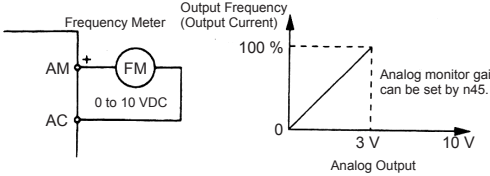
Note: If a FWD (REV) RUN command is input at the same time as an ACCELERATION/DECELERATION HOLD command, the motor will not operate. However, if the Frequency Reference Lower Limit (n31) is set to a value greater than or equal to the Min. Output Frequency (n14), the motor will operate at the Frequency Reference Lower Limit (n31).

☐ Using Frequency Meter or Ammeter (n44)

Select to output either output frequency or output current to analog output terminals AM-AC for monitoring.

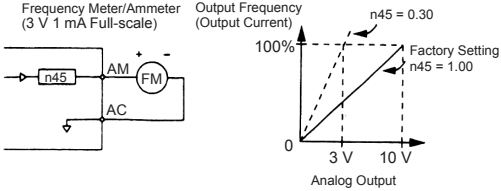
Setting	Description
0	Output frequency
1	Output current

In initial setting, analog voltage of approx. 10 V is output when output frequency (output current) is 100%.



☐ Calibrating Frequency Meter or Ammeter (n45)

Used to adjust analog output gain.



Set the analog output voltage at 100% of output frequency (output current).

Frequency meter displays 0 to 60 Hz at 0 to 3 V.

$$10\ \text{V} \times \boxed{\frac{\text{n45 setting}}{0.30}} = 3\ \text{V}$$

Output frequency becomes 100 % at this value.

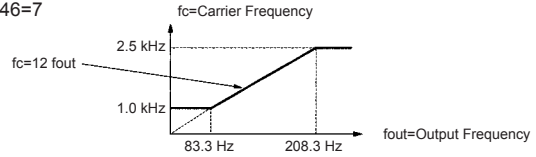
☐ Reducing Motor Noise or Leakage Current Using Carrier Frequency Selection (n46)

Set the Inverter output transistor switching frequency (carrier frequency).

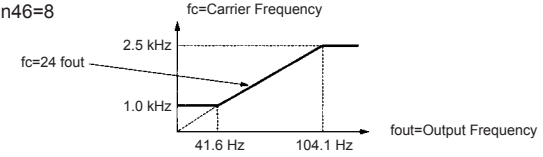
Setting	Carrier Frequency	Metallic Noise from Motor	Noise and Current Leakage
7	12 fout (Hz)	Higher ↑ ↓ Not audible	Smaller ↑ ↓ Larger
8	24 fout (Hz)		
9	36 fout (Hz)		
1	2.5 (kHz)		
2	5.0 (kHz)		
3	7.5 (kHz)		
4	10.0 (kHz)		

If the set value is 7, 8, or 9, the carrier frequency will be multiplied by the same factor as the output frequency.

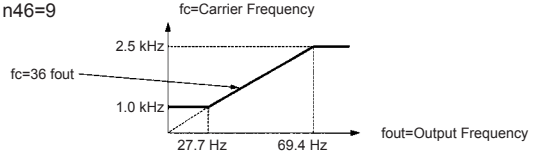
n46=7



n46=8



n46=9



The factory setting depends on the Inverter capacity (kVA).

Voltage Class (V)	Capacity (kW)	Initial Setting		Maximum Continuous Output Current (A)	Reduced Current (A)
		Setting	Carrier Frequency (kHz)		
200 V Single-phase or 3-phase	0.1	4	10	0.8	-
	0.2	4	10	1.6	
	0.4	4	10	3.0	
	0.75	4	10	5.0	
	1.5	3	7.5	8.0	7.0
	2.2	3	7.5	11.0	10.0
	3.7	3	7.5	17.5	16.5
400 V 3-phase	0.2	3	7.5	1.2	1.0
	0.4	3	7.5	1.8	1.6
	0.75	3	7.5	3.4	3.0
	1.5	3	7.5	4.8	4.0
	2.2	3	7.5	5.5	4.8
	3.0	3	7.5	7.2	6.3
	3.7	3	7.5	8.6	7.6

NOTE

1. Reduce the continuous output current when changing the carrier frequency to 4 (10 kHz) for 200 V Class (1.5 kW or more) and 400 V Class Inverters. Refer to the table above for the reduced current.
   Operation Condition
   - Input power supply voltage:
     3-phase 200 to 230 V (200 V Class)
     Single-phase 200 to 240 V (200 V Class)
     3-phase 380 to 460 V (400 V Class)
   - Ambient temperature:
     −10 to 50°C
     (Protection structure: open chassis type IP20)

2. If the wiring distance is long, reduce the Inverter carrier frequency as described below.

Wiring Distance between Inverter and Motor	Up to 50 m	Up to 100 m	More than 100 m
Carrier Frequency (n46 setting)	10 kHz or less (n46=1, 2, 3, 4, 7, 8, 9)	5 kHz or less (n46=1, 2, 7, 8, 9)	2.5 kHz or less (n46=1, 7, 8, 9)

3. The carrier frequency is automatically reduced to 2.5 kHz when the Reducing Carrier Frequency Selection at Low Speed (n75) is set to 1 and the following conditions are satisfied:

   Output frequency ≤ 5 Hz
   Output current ≥ 110%

   Factory setting: 0 (Disabled)

☐ Operator Stop Key Selection (n06)

Set the processing when the STOP key is "pressed" during operation either from a multi-function input terminal or communications.

Setting	Description
0	The STOP key is effective either from a multi-function input terminal or communications. When the STOP key is pressed, the Inverter stops according to the setting of constant n04. At this time, the Digital Operator displays a SrP alarm (flashing). This STOP command is held in the Inverter until both forward and reverse RUN commands are open, or until the RUN command from communications goes to zero.
1	The STOP key is ineffective either from multi-function input terminals or communications.

■ Selecting the Stopping Method

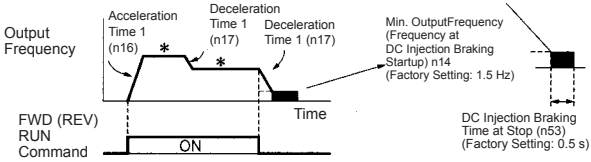
□ Stopping Method Selection (n04)

Select the stopping method suitable for the application.

Setting	Description
0	Deceleration to a stop
1	Coast to a stop

Deceleration to a Stop

Example when acceleration/deceleration time 1 is selected

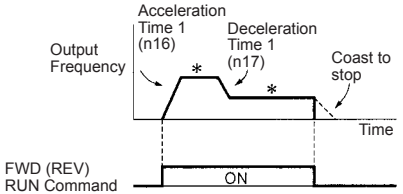


* Changing the Frequency Reference while Running

Upon termination of a FWD (REV) RUN command, the motor decelerates at the deceleration rate determined by the time set in Deceleration Time 1 (n17) and DC injection braking is applied immediately before stopping. DC injection braking is also applied when the motor decelerates because the frequency reference is set lower than the Min. Output Frequency (n14) when the FWD (REV) RUN command is ON. If the deceleration time is short or the load inertia is large, an overvoltage (OV) fault may occur at deceleration. In this case, increase the deceleration time.

Coast to a Stop

Example when Acceleration/deceleration Time 1 is selected



* Changing the Frequency Reference while Running

Upon termination of the FWD (REV) RUN command, the motor starts coasting.

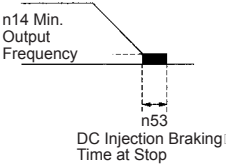
☐ Applying DC Injection Braking

DC Injection Braking Current (n52)

Sets the DC injection braking current in units of 1%. (Inverter rated current=100%)

DC Injection Braking Time at Stop (n53)

Sets the DC injection braking time at stopping in units of 0.1 second. When the setting of n53 is 0, DC injection braking is not performed, but the Inverter output is turned OFF when DC injection braking is started.



When coasting to a stop is specified in the Stopping Method Selection (n04), DC injection braking is not applied when stopping.

■ Building Interface Circuits with External Devices

□ Using Input Signals

The functions of multi-function input terminals S2 to S5 can be changed as necessary by setting constants n36 to n39. The same value cannot be set for more than one of these constants.

Setting	Name	Description	Ref.
0	FWD/REV RUN command (3-wire sequence selection)	Setting possible only for n37.	70
2	REVERSE RUN command (2-wire sequence selection)		49
3	External fault, NO contact input	Inverter stops for an external fault signal input. Digital Operator displays EF□*.	-
4	External fault, NC contact input		-
5	Fault reset	Resets a fault. Fault reset not effective when the RUN signal is ON.	-
6	Multi-step speed reference 1		51
7	Multi-step speed reference 2		51
8	Multi-step speed reference 3		51
10	JOG command		52
11	Acceleration/deceleration time selection		55
12	External baseblock, NO contact input	Motor coasts to a stop for this signal input. Digital Operator displays bb.	-
13	External baseblock, NC contact input		-
14	SEARCH command from maximum frequency	SPEED SEARCH command signal	61
15	SEARCH command from set frequency		61
16	ACCELERATION/ DECELERATION HOLD command		62
17	LOCAL/REMOTE selection		48
18	Communications/control circuit terminal selection		73

Setting	Name	Description	Ref.
19	Emergency stop fault, NO contact input	Inverter stops for an emergency stop signal input according to the Stopping Method Selection (n04). When frequency coasting to a stop (n04 is set to 1) is selected, the Inverter coasts to a stop according to Deceleration Time Setting 2 (n19). Digital Operator displays SrP. (Lit for fault, flashing for alarm.)	-
20	Emergency stop alarm, NO contact input		-
21	Emergency stop fault, NC contact input		-
22	Emergency stop alarm, NC contact input		-
34	UP/DOWN commands	Setting enabled only for n39 (terminal S5)	72
35	Self-test	Setting enabled only for n39 (terminal S5)	-
1, 9, 23 to 33	Not used	Set to one of 1, 9, 23 to 33 if a terminal is not used.	-

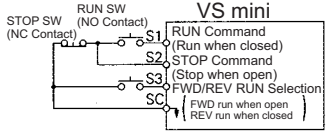
* Numbers 2 to 5 are displayed for □ to indicate the terminal numbers S2 to S5.

Initial Settings

No.	Terminal	Initial Setting	Function
n36	S2	2	REVERSE RUN command (2-wire sequence)
n37	S3	5	Fault reset
n38	S4	3	External fault (NO contact input)
n39	S5	6	Multi-step speed reference 1

Terminal Functions for 3-wire Sequence Selection

When 0 is set for terminal S3 (n37), terminal S1 is the RUN command, terminal S2 is the STOP command, and terminal S3 is the FWD/REV RUN command.



⚠WARNING To select the 3-wire sequence, set terminal S3 (n37) to 0.
Failure to observe this warning may result in injury.

LOCAL/REMOTE Selection (Setting: 17)

Select the operation reference from either the Digital Operator or from the settings of the RUN Command Selection (n02) and Frequency Reference Selection (n03). The LOCAL/REMOTE Selection can be used only when stopped.

Open: Run according to the setting of RUN Command Selection (n02) or Frequency Reference Selection (n03).

Closed: Run according to the frequency reference and RUN command from the Digital Operator.

Example: Set n02=1, n03=2, n07=0.

Open: Run according to the frequency reference from multi-function input terminal FR and RUN command from multi-function input terminals S1 to S5.

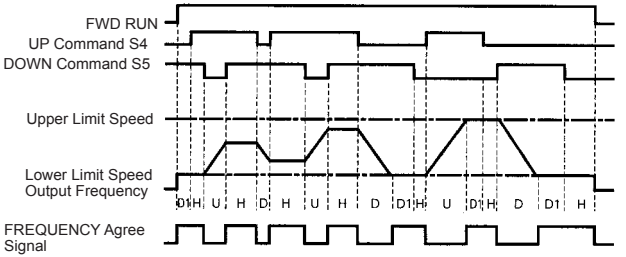
Closed: Run according to the potentiometer frequency reference and RUN command from the Digital Operator.

UP/DOWN Commands (Setting: n39 = 034)

When the FWD (REV) RUN command is ON, acceleration/deceleration is enabled by inputting the UP or DOWN signal from multi-function input terminals S4 and S5 without changing the frequency reference. Operation can thus be performed at the desired speed. When UP/DOWN commands are specified in n39, any function set in n38 is disabled, terminal S4 is the input terminal for the UP command, and terminal S5 is the input terminal for the DOWN command.

Multi-function Input Terminal S4 (UP command)	Closed	Open	Open	Closed
Multi-function Input Terminal S5 (DOWN command)	Open	Closed	Open	Closed
Operation Status	Acceleration	Deceleration	Hold	Hold

Time Chart for UP/DOWN Command Input



U = UP (accelerating) status
D = DOWN (decelerating) status
H = HOLD (constant speed) status
U1 = UP status, clamping at upper limit speed
D1 = DOWN status, clamping at lower limit speed

Note: 1. When UP/DOWN commands are selected, the upper limit speed is set regardless of frequency reference.
Upper limit speed =Maximum Output Frequency (n09) × Frequency Reference Upper Limit (n30)/100%
2. Lower limit value is either the Minimum Output Frequency (n14) or Maximum Output Frequency (n09) × Frequency Reference Lower Limit (n31)/100% (whichever is larger.).
3. When the FWD (REV) RUN command is input, operation starts at the lower limit speed without using the UP/DOWN commands.
4. If the JOG command is input while running for an UP/DOWN command, the JOG command has priority.
5. Multi-step speed references 1 to 3 are not effective when an UP/DOWN command is selected. Multi-step speed references are effective while running in hold status.
6. When 1 is set for the HOLD Output Frequency Memory Selection (n62), the output frequency can be recorded during HOLD.

Setting	Description
0	Output frequency is not recorded during HOLD.
1	When HOLD status is continued for 5 seconds or longer, the output frequency during HOLD is recorded and the Inverter restarts at the recorded frequency.

Communications/Multi-function Input Terminal Selection (Setting: 18)

(This function is effective when option card is installed.)

Operation can be changed from communications commands, or from multi-function input terminal or Digital Operator commands.

RUN commands from communications and the frequency reference are effective when the multi-function input terminal for this setting is closed.

RUN commands in LOCAL/REMOTE mode and the frequency reference are effective when the terminal is open.

☐ Using Output Signals (n40)

The functions of multi-function output terminals MA and MB can be changed as necessary by setting constants n40.

- Terminal MA and MB functions: Set to n40

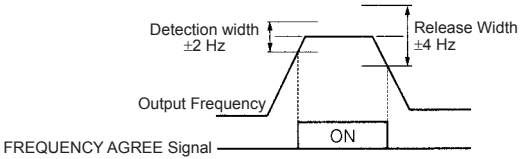
Setting	Name	Description	Ref.
0	Fault	Closed when Inverter fault occurs.	-
1	Operating	Closed when either FWD/REV command is input or voltage is output from the Inverter.	-
2	Frequency agree	Closed when the set frequency agrees with Inverter output frequency.	74
3	Zero speed	Closed when Inverter output frequency is less than minimum output frequency.	-
4	Frequency detection 1	Output frequency ≥ Frequency Detection Level (n58)	59
5	Frequency detection 2	Output frequency ≤ Frequency Detection Level (n58)	59
6	Overtorque detection, NO contact output	-	57
7	Overtorque detection, NC contact output	-	57
8, 9	Not used	Set to one of 8 or 9 if a terminal is not used.	-
10	Minor fault	Closed when an alarm has been detected.	-

Setting	Name	Description	Ref.
11	Base blocked	Closed when the Inverter output is OFF.	-
12	Operating mode	Closed when LOCAL is selected for the LOCAL/REMOTE selection.	-
13	Inverter operation ready	Closed when an Inverter fault is not detected, and operation is ready.	-
14	Fault restart	Closed during fault retries.	-
15	UV	Closed when undervoltage is detected.	-
16	Reverse run	Closed during reverse run.	-
17	Speed search	Closed when Inverter conducts a speed search.	-
18	Data output from communications	Operates multi-function output terminal independently from Inverter operation (by MEMOBUS communications)	83

Initial Settings

No.	Terminal	Initial Setting
n40	MA, MB	1 (operating)

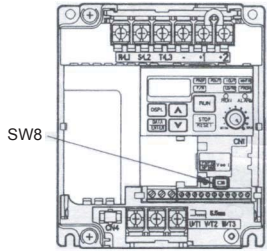
- FREQUENCY AGREE Signal (setting=2)

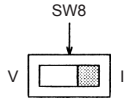


■ Setting Frequency by Current Reference Input

When setting frequency by inputting current reference (4-20 mA or 0-20 mA) from the control circuit terminal FR, switch the DIP switch SW8 on the control circuit board to “I” side.

SW8 is accessed by removing the option cover.





NOTE Never input voltage reference to control circuit terminal FR when DIP switch SW8 is switched to “I” side.

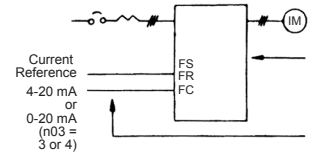
Current Reference Selection

After changing DIP switch (V/I switch of SW8) to the "I" side, press PRGM on the Digital Operator, then set the following constants.

4-20 mA.....n03=3

0-20 mA.....n03=4

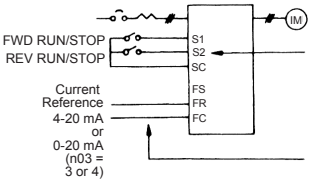
- Setting: n02=0, n03=3 or 4



Press the Digital Operator keys to run or stop the Inverter. Switch run and stop direction by setting F/R LED.

Set frequency by the analog current signal [0-100% (max. frequency)/4-20 mA or 0-20 mA] connected to the control circuit terminal.

- Setting: n02=1, n03=3 or 4



Switch run/stop and FWD/REV run with switching device connected to the control circuit terminal.
Multi-function input terminal S2 is set to Reverse run/stop (n36=2).

Set frequency by the analog current signal [0-100% (max. frequency)/4-20 mA or 0-20 mA] connected to the control circuit terminal.

Frequency reference gain (n41)/bias (n42) can be set even when current reference input is selected. For details, refer to *Adjusting Speed Setting Signal* on page 53.

■ Preventing the Motor from Stalling (Current Limit)

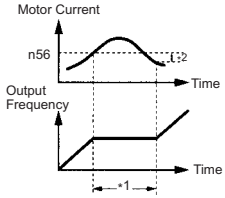
This function automatically adjusts the output frequency and output current according to the load to continue operation without stalling the motor.

Stall Prevention (Current Limit) Level during Acceleration (n56)

Sets the stall prevention (current limit) level during acceleration in units of 1%. (Inverter rated current = 100%)

Factory setting: 170%

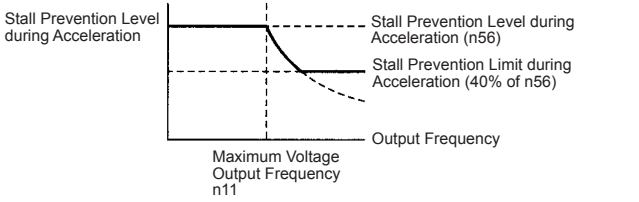
A setting of 200% disables the stall prevention (current limit) during acceleration. If the output current exceeds the value set for n56 during acceleration, acceleration stops and the frequency is maintained. When the output current goes to the value set for n56, acceleration starts.



*1: Stops the acceleration to prevent the motor from stalling.
*2: Release width (hysteresis) of stall prevention during accel is approx. 5% of inverter rated current

In the constant output area (output frequency > Max. Voltage Output Frequency (n11)), the stall prevention (current limit) level during acceleration is automatically decreased using the following equation.

$$\text{Stall prevention (current limit) level during acceleration in constant output area} = \text{Stall prevention (current limit) level during acceleration (n56)} \times \frac{\text{Max. voltage output frequency (n11)}}{\text{Output frequency}}$$



Stall Prevention (Current Limit) Level while Running (n57)

Sets the stall prevention (current limit) level while running in units of 1%. (Inverter rated current = 100%)

Factory setting: 160%

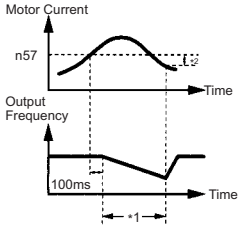
A setting of 200% disables stall prevention (current limit) while running.

If the stall prevention action current at speed agreement exceeds the value set for n57 for longer than 100 ms, deceleration starts.

If the output current exceeds the value set for n57, deceleration continues. If the output current goes to the value set for n57, acceleration to the set frequency starts.

Stall prevention acceleration/deceleration settings during operation are set either for the currently selected Acceleration Time, i.e., for Acceler-

ation Time 1 (n16) and Deceleration Time 1 (n17), or for Acceleration Time 2 (n18) and Deceleration Time 2 (n19).

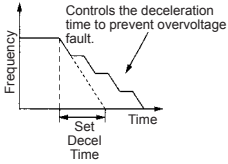


*1: Decreases frequency to prevent the motor from stalling.
*2: At start of acceleration, the output current hysterisis is approx. 5% of Inverter rated current.

- Stall Prevention (Current Limit) during Deceleration (n55)

  To prevent overvoltage during deceleration, the Inverter automatically extends the deceleration time according to the value of main circuit DC voltage.

Setting	Stall Prevention (Current Limit) during Deceleration
0	Provided
1	Not provided



■ Decreasing Motor Speed Fluctuation

□ Slip Compensation

As the load becomes larger, the motor speed is reduced and the motor slip value is increased. The slip compensating function controls the motor speed at a constant value even if the load varies.

When the Inverter output current is equal to the Motor Rated Current (n32), the compensation frequency is added to the output frequency.

$$\text{Compensation frequency} = \text{Motor rated slip (n64)} \times \frac{\text{Output current} - \text{Motor no-load current (n65)}}{\text{Motor rated current (n32)} - \text{Motor no-load current (n65)}} \times \text{Slip compensation gain (n66)}$$

Related Constants

Constant No.	Name	Unit	Setting Range	Initial Setting
n32	Motor Rated Current	0.1 A	0% to 120% of Inverter rated current	*
n64	Motor Rated Slip	0.1 Hz	0.0 to 20 Hz	*
n65	Motor No-load Current	1%	0% to 99% (100%=Motor Rated Current n32)	*
n66	Slip Compensation Gain	0.1	0.0 to 2.5	0.0
n67	Slip Compensation Time Constant	0.1 s	0.0 to 25.5 s When 0.0 s is set, delay time is 2.0 s.	2.0 s

* Depends on Inverter capacity.

Note: 1. Slip compensation is not performed under the following condition: Output frequency < Minimum Output Frequency (n14)
2. Slip compensation is not performed during regeneration.
3. Slip compensation is not performed when the Motor Rated Current (n32) is set to 0.0 A.

■ Motor Protection

□ Motor Overload Detection

The VS mini protects against motor overload with a built-in electronic thermal overload relay.

Motor Rated Current (Electronic Thermal Reference Current, n32)

Set the rated current value shown on the motor nameplate.

Note: Setting n32 to 0.0 A disables the motor overload protective function.

Motor Overload Protection Selection (n33, n34)

n33 Setting	Electronic Thermal Characteristics
0	For general-purpose motor
1	For Inverter motor
2	Electronic thermal overload protection not provided.

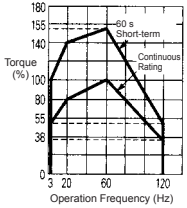
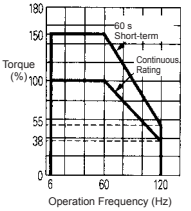
Constant No.	Name	Unit	Setting Range	Initial Setting
n34	Protection Constant Selection	1 min	1 to 60 min	8 min

The electronic thermal overload function monitors the motor temperature based on Inverter output current and time to protect the motor from overheating. When the electronic thermal overload relay is enabled, an oL 1 error occurs, and the Inverter output is turned OFF to prevent excessive overheating in the motor. When operating with one Inverter connected to one motor, an external thermal relay is not needed. When operating more than one motor with one Inverter, install a thermal relay on each motor.

General-purpose Motors and Inverter Motors

Induction motors are classified as general-purpose motors or Inverter motors based on their cooling capabilities. The motor overload function operates differently for these two motor types.

Example for 200 V-Class Motors

	Cooling Effect	Torque Characteristics	Electronic Thermal Overload
General-purpose Motor	Effective when operated at 50/60 Hz from commercial power supply.	 Base Frequency 60 Hz (V/f for 60-Hz, 220-V Input Voltage) For low-speed operation, torque must be limited in order to stop motor temperature rise.	An oL 1 error (motor overload protection) occurs when continuously operated at 50/60 Hz or less at 100% load.
Inverter Motor	Effective even when operated at low speed (approx. 6 Hz)	 Base Frequency 60 Hz (V/f for 60-Hz, 220-V Input Voltage) Use an Inverter motor for continuous operation at low speed.	Electronic thermal overload protection is not activated even for continuous operation at 50/60 Hz or less at 100% load.

■ Selecting Cooling Fan Operation

In order to increase the life of the cooling fan, the fan can be set to operate only when Inverter is running

n35	= 0 (Initial setting):	Operates only when Inverter is running (Continues operation for 1 minute after Inverter is stopped.)
	=1:	Operates with power ON

■ Using MEMOBUS (MODBUS) Communications

Serial communication is available with VS mini using programmable controller (MEMOCON series) and MEMOBUS. In order to perform serial communications, RS-485/422 interface card (optional) must be installed.

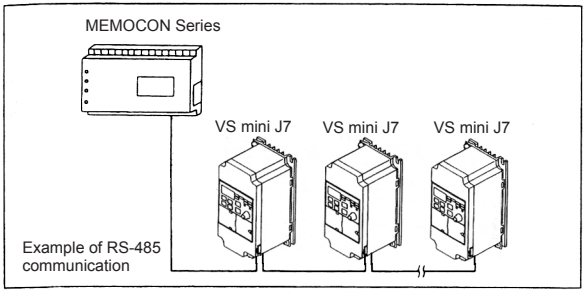
Refer to MEMOBUS Instruction Manual (Manual No.: TOEZ-C736-70.1) for details of communications.

MEMOBUS (MODBUS) Communications

MEMOBUS system is composed of a single master (PLC) and slaves (1 to 31 VS-mini units).

Communication between master and slave (serial communication) is controlled according to the master program with the master initiating communication and the slave responding.

The master sends a signal to one slave at a time. Each slave has a pre-registered address No., and the master specifies the number and conduct signal communications. The slave receives the communication to carry out designated functions and reply to the master.



Communications Specifications

Interface	RS-422, RS-485
Synchronization	Asynchronous (Start-stop synchronization)
Communication Parameters	Baud rate: Selected from 2400/4800/9600/19200 bps Data length: 8 bits fixed Parity: Selected from even/odd/none Stop bits: 1 bit fixed
Communication Protocol	MEMOBUS (MODBUS) (RTU mode only)
Max. Number of Inverters that can be Connected	31 units (When using RS-485)

■ Using Constant Copy Function

□ Constant Copy Function

The Digital Operator for remote operation (Model JVOP-146, Optional) can store constants for one Inverter. A backup power supply is not necessary because EEPROM is used.

Note: When using a Digital Operator for remote operation, use with a remote interface unit for remote operation (optional) and the cable for remote operation (optional). Refer to the VS mini J7 catalog (Literature No. KAE-S606-12) for details.

The constant copy function is possible only for the Inverters with the same product series and power supply specifications. However, some constants may not be copied. It is also impossible to copy constants between VS mini and VS-606V7 Inverters.

Prohibiting reading constants from the Inverter can be set in n77. The constant data cannot be changed when this constant is set.

If an alarm occurs when copying constants, PRGM will flash and copying will continue.

Constant Copy Function Selection (n76)

Depending on the setting of n76 (Constant Copy Function Selection), the following functions can be used.

1. Reading all the constants from the Inverter (READ) and storing them in EEPROM in the Digital Operator
2. Copying the constants stored in the Digital Operator to the Inverter (COPY)

3. Verifying that the constants in the Digital Operator and the constants in the Inverter are the same (VERIFY)
4. Displaying the maximum applicable motor capacity and the voltage class of the Inverter for which constants are stored in the Digital Operator
5. Displaying the software number of the Inverter for which constants are stored in the Digital Operator

Constant No.	Name	Unit	Setting Range	Initial Setting
n76	Constant Copy Function Selection	-	rdy: READY rEd: READ CPy: COPY vFy: VERIFY vA: Inverter capacity display Sno: Software No. display	rdy

Prohibiting Constant Read Selection (n77)

Select this function to prevent accidentally overwriting the constants stored in EEPROM or in the Digital Operator. Reading is not possible when this constant is set to 0.

The constant data stored in the Digital Operator are safe from accidental overwriting.

If reading is attempted while this constant is set to 0, PrE will flash. Press DSPL or ENTER and return to the constant No. display.

Constant No.	Name	Unit	Setting Range	Initial Setting
n77	Constant Read Selection Prohibit	1	0: READ prohibited 1: READ allowed	0

☐ READ Function

Reads out the constants in batch from the Inverter and stores them in EEPROM inside the Digital Operator. When the read-out is executed, the previously stored constants data in the EEPROM are cleared and replaced with the newly entered constants.

Example: Storing Constants from Inverter in EEPROM in Operator.

Explanation		Operator Display
• Enable the setting of constants n01 to n79.	• Press DSPL to light [PRGM].	n01 (May be a different constant No.)
	• Press ENTER to display the set value.	0 (Lit) (May be a different set value.)
	• Change the set value to 4 by pressing the ▲ or ▼ key.	1 (Flashes)
	• Press ENTER.	1 (Lit for one second.) ↓ n01 (The constant No. is displayed.)
• Set Constant Read Prohibited Selection (n77) to read-enabled. *1	• Change the constant No. to n77 by pressing the ▲ or ▼ key.	n77
	• Press ENTER to display the set value.	0 (Lit)
	• Change the set value to 1 by pressing the ▲ or ▼ key.	1 (Flashes)
	• Press ENTER.	1 (Lit for one second.) ↓ n77 (The constant No. is displayed.)
• Execute read-out (READ) using the Constant Copy Function Selection (n76).	• Change the constant No. by pressing the ▲ or ▼ key.	n76
	• Press ENTER to display the set value.	rdy (Lit)
	• Change the set value to rEd by pressing the ▲ or ▼ key.	rEd (Lit)
	• Press ENTER.	rEd (Flashes while executing the read) ↓ End (End is displayed after the read has been completed.)
	• Press DSPL or ENTER.	n76 (The constant No. is displayed.)

Explanation		Operator Display
• Set Constant Read Prohibited Selection (n77) to read-disabled.*2	• Change the constant No. to n77 by pressing the ▲ or ▼ key. • Press ENTER to display the set value. • Change the set value to 0 by pressing the ▲ or ▼ key. • Press ENTER.	n77 1 (Lit) 0 (Flashes) 0 (Lit for one second.) ↓ n77 (The constant No. is displayed.)

Note: 1. When reading is enabled (n77=1), this setting is not necessary.
2. This setting is not necessary unless read-prohibition is selected.

☐ COPY Function

This function writes the constants stored inside the Digital Operator in batch to the Inverter. Write-in is possible only for Inverters with the same product series and power supply specifications.

Therefore, writing from 200 V Class to 400 V Class Inverters (or vice versa), from V/f control mode to vector control mode Inverters (or vice versa), or from VS mini to VS-606V7 Inverters are not possible.

The Constant Copy Function Selection (n76), Constant Read Selection Prohibit (n77), Fault History (n78), Software Version No. (n79), and hold output frequency are not written. vAE will appear (flashing) if the capacities of the Inverters differ.
Press ENTER to continue writing (the COPY function).
Press STOP/RESET to stop the COPY function.
The following constants are not written if the Inverter capacities differ.

Constant No.	Name	Constant No.	Name
n09 to n15	V/f Settings	n64	Motor Rated Slip
n32	Motor Rated Current	n65	Motor No-load Current
n46	Carrier Frequency Selection		

Example: Writing Constants from EEPROM in Operator to Inverter

Explanation		Operator Display
• Enable the settings for constants n01 to n79.	• Press DSPL to light [PRGM].	n01 (May be a different constant No.)
	• Press ENTER to display the set value.	0 (Lit) (May be a different set value.)
	• Change the set value to 4 by pressing the ▲ or ▼ key.	1 (Flashes)
	• Press ENTER.	1 (Lit for one second.) ↓ n01 (The constant No. is displayed.)
• Execute write-in (COPY) using the Constant Copy Function Selection (n76).	• Change the constant No. to n76 by pressing the ▲ or ▼ key.	n76
	• Press ENTER to display the set value.	rdY (Lit)
	• Change the set value to CPy by pressing the ▲ or ▼ key.	CPY (Lit)
	• Press ENTER.	CPY (Flashes while executing the copy.) ↓ End (End is displayed after the copy has been completed.)
	• Press DSPL or ENTER.	n76 (The constant No. is displayed.)

A setting range check and matching check for the written constants are executed after the constants are written from the Digital Operator to the Inverter. If a constant error is found, the written constants are discarded and the constants stored before writing are restored.

When a setting range error is found, the constant No. where an error occurs is indicated by flashing.

When an inconsistency in the settings is found, oP □ (□: a number) is indicated by flashing.

☐ VERIFY Function

This function compares the constants stored in the Digital Operator with the constant in the Inverter. Verification is possible only for the Inverters with same product series and power supply specifications.

When the constants stored in the Digital Operator are the same as those in the Inverter, vFy will flash, and then End will be displayed.

Example: Comparing Constants Stored in EEPROM in Operator with Constants in Inverter

Explanation		Operator Display
• Enable the settings for constants n01 to n79.	• Press DSPL to light [PRGM]. • Press ENTER to display the set value. • Change the set value to 4 by pressing the ⊠ or ⊡ key. • Press ENTER.	n01 (May be a different constant No.) 0 (Lit) (May be a different constant No.) 1 (Flashes) 1 (Lit for one second.) ↓ n01 (The constant No. is displayed.)
• Execute VERIFY by Constant Copy Function Selection (n76).	• Change the constant No. to n76 by pressing the ⊠ or ⊡ key. • Press ENTER to display the set value. • Change the set value to vFy by pressing the ⊠ or ⊡ key. • Press ENTER.	n76 rdY (Lit) vFY (Lit) vFY (Flashes while executing VERIFY)
• Display the unmatched constant No.		n11 (Flashes) (When n011 is different.)
• Display the constant value in the Inverter.	• Press ENTER.	60.0 (Flashes)
• Display the constant value in the Digital Operator.	• Press ENTER.	50.0 (Flashes)
• Continue the execution of VERIFY.	• Press the ⊠ key. • Press DSPL or ENTER.	vFY (Flashes while executing the verification) ↓ End (End is displayed when the verification has been completed.) n76 (The constant No. is displayed.)

While a constant No. that is not the same is displayed or a constant value is displayed, press STOP/RESET to interrupt the execution of the verification. End will be displayed. Press DSPL or ENTER to return to the constant No.

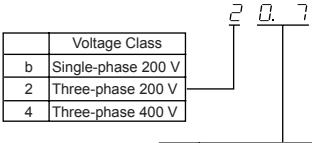
☐ Inverter Capacity Display

The voltage class and maximum applicable motor capacity for which constants are stored in the Digital Operator are displayed.

Example: Displaying Voltage Class and Maximum Applicable Motor Capacity for Inverter whose Constants are in EEPROM in Operator

Explanation		Operator Display
• Enable the setting for constants n01 to n79.	• Press DSPL to light [PRGM].	n01 (May be a different constant No.)
	• Press ENTER to display the set value.	0 (Lit) (May be a different constant No.)
	• Change the set value to 4 by pressing the ⊠ or ⊠ key. • Press ENTER.	1 (Flashes) 1 (Lit for one second.) ↓ n01 (The constant No. is displayed.)
• Execute Inverter Capacity Display (vA) using the Constant Copy Function Selection (n76).	• Change the constant No. to n76 by pressing the ⊠ or ⊠ key. • Press ENTER to display the set value. • Change the set value to vA fy by pressing the ⊠ or ⊠ key. • Press ENTER.	n76 rdY (Lit) vA (Lit) 20.7 (Lit) (For 20P7)*
	• Press DSPL or ENTER.	n76 (The constant No. is displayed.)

* The following figure shows the Inverter Capacity Display



	Voltage Class
b	Single-phase 200 V
2	Three-phase 200 V
4	Three-phase 400 V

No.	Max. Applicable Motor Capacity
0.1	0.1 kW
0.2	0.2 kW
0.4	0.4 kW
0.7	0.75 kW
1.5	1.5 kW
2.2	2.2 kW
3.0	3.0 kW
3.7	3.7 kW

☐ Software No. Display

The software number of the Inverter for which constants are stored in the Digital Operator is displayed.

Example: Displaying Software No. of Inverter for which Constants are Stored in EEPROM in Operator

Explanation		Operator Display
• Enable the setting for constants n01 to n79.	• Press DSPL to light [PRGM]. • Press ENTER to display the set value. • Change the set value to 4 by pressing the ⌃ or ⌄ key. • Press ENTER.	n01 (May be a different constant No.) 0 (Lit) (May be a different constant No.) 1 (Flashes) 1 (Lit for one second.) ↓ n01 (The constant No. is displayed.)
• Execute Software No. Display (Sno)* using the Constant Copy Function Selection (n76).	• Change the constant No. to n76 by pressing the ⌃ or ⌄ key. • Press ENTER to display the set value. • Change the set value to Sno by pressing the ⌃ or ⌄ key. • Press ENTER. • Press DSPL or ENTER.	n76 rdy (Lit) Sno (Lit) 011 (Lit) (Software version: VSP020011) n76 (The constant No. is displayed.)

* Displays the lower 3 digits of the software version.

☐ Display List

Operator Display	Description	Corrective Action
rdy	Lit: Constant copy function selection enabled.	-
rEd	Lit: READ selected. Flashes: READ under execution.	-
CPy	Lit: Writing (COPY) selected. Flashes: Writing (COPY) under execution.	-
vFy	Lit: VERIFY selected. Flashes: VERIFY under execution.	-
vA	Lit: Inverter capacity display selected.	-
Sno	Lit: Software No. display selected.	-
End	Lit: READ, COPY (writing), VERIFY completed.	-

Operator Display	Description	Corrective Action
PrE	Flashes: Attempt made to execute READ while Constant Read Selection Prohibit (n77) is set to 0.	Confirm the necessity to execute READ, then set Constant Read Selection Prohibit (n77) to 1 to execute READ.
rdE	Flashes: The constant could not be read properly for READ operation. Or, a main circuit low voltage is detected during READ operation.	Confirm that the main circuit power supply voltage is correct, then re-execute READ.
CSE	Flashes: A checksum error occurred in the constant data stored in the Digital Operator.	The constants stored in the Digital Operator cannot be used. Re-execute READ to store the constants in the Digital Operator.
dPS	Flashes: The password for the connected Inverter and that for the constant data stored in the Digital Operator disagree. Example: Writing (COPY) from VS mini to VS-606V7	Check if the Inverters are the same product series.
ndT	Flashes: No constant data stored in the Digital Operator.	Execute READ.
CPE	Flashes: Attempt made to execute writing (COPY) or VERIFY between different voltage classes or different control modes.	Check each voltage class and control mode.
CYE	Flashes: A main circuit low voltage was detected during writing (COPY) operation.	Confirm that the main circuit power supply voltage is correct, then re-execute writing (COPY).
F04	Lit: A checksum error occurred in the constant data stored in the Inverter.	Initialize the constants. If an error occurs again, replace the Inverter due to a failure of constant memory element (EEPROM) in the Inverter.
vAE	Flashes: Attempt made to execute COPY or VERIFY between different Inverters of different capacities.	Press ENTER to continue the execution of COPY or VERIFY. Press STOP to interrupt the execution of COPY or VERIFY.
iFE	Flashes: A communications error occurred between the Inverter and the Digital Operator.	Check the connection between the Inverter and Digital Operator. If a communications error occurs during the READ operation or writing (COPY) operation, always re-execute the READ or COPY.

Note: While rEd, CPy, or vFy is flashing, key input on the Digital Operator is disabled. While rEd, CPy and vFy are not flashing, pressing DSPL or ENTER redisplays the constant No.

7. Maintenance and Inspection

■ Periodic Inspection

Periodically inspect the Inverter as described in the following table to prevent accidents and to ensure high performance with high reliability.

Location to Check	Check for	Solution
Terminals, Inverter mounting screws, etc.	Improper seating or loose connections in hardware.	Properly seat and tighten hardware.
Heatsinks	Buildup of dust, dirt, and debris	Blow with dry compressed air at a pressure of 39.2×10^4 to 58.8×10^4 Pa, 57 to 85 psi (4 to 6kg/cm^2).
Printed circuit boards	Accumulation of conductive material or oil mist	Blow with dry compressed air at a pressure of 39.2×10^4 to 58.8×10^4 Pa, 57 to 85 psi (4 to 6kg/cm^2). If dust or oil cannot be removed, replace the Inverter.
Power elements and smoothing capacitor	Abnormal odor or discoloration	Replace the Inverter.
Cooling fan	Abnormal noise or vibration Cumulative operation time exceeding 20,000 hours	Replace the cooling fan.

■ Part Replacement

Inverter's maintenance periods are given below. Keep them as guidelines.

Part Replacement Guidelines

Part	Standard Replacement Period	Replacement Method
Cooling fan	2 to 3 years	Replace with new part.
Smoothing capacitor	5 years	Replace with new part. (Determine need by inspection.)
Breaker relays	-	Determine need by inspection.
Fuses	10 years	Replace with new part.
Aluminum capacitors on PCBs	5 years	Replace board. (Determine need by inspection.)

Note: Usage conditions are as follows:

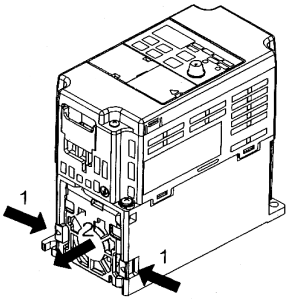
- Ambient temperature: Yearly average of 30°C
- Load factor: 80% max.
- Operating rate: 12 hours max. per day

☐ Replacement of Cooling Fan

Inverters with Width of 68 mm or 140 mm

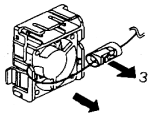
1. Removal

1. Press the right and left catches on the fan cover in direction 1, and then pull them in direction 2 to remove the fan cover from the Inverter.
2. Pull the wiring in direction 3 from the fan cover rear face, and remove the protective tube and connector.
3. Open the left and right sides of the fan cover to remove the cooling fan from the cover.



2. Mounting

1. Mount the cooling fan on the fan cover. The arrow mark to indicate the airflow direction of the cooling fan must be on the opposite side to the cover.
2. Connect the connector and mount the protective tube firmly. Mount the connector joint section on the fan cover rear face.
3. Mount the fan cover on the Inverter. Always mount the right and left catches on the fan cover on the heatsinks.

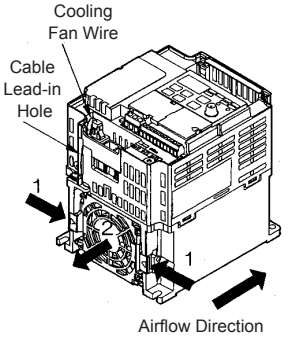


Airflow Direction

Inverters with Width of 108 mm

1. Removal

1. Remove the front cover, and then remove the cooling fan connector (CN4).
2. Press the right and left catches on the fan cover in direction 1, and pull the fan cover in direction 2 to remove it from the Inverter. Pull out the wiring from the cable lead-in hole at the bottom of the plastic case.
3. Open the right and left sides of the fan cover to remove the cover from the cooling fan.



2. Mounting

1. Mount the cooling fan on the fan cover. The arrow mark to indicate the airflow direction must be opposite to the cover.
2. Mount the fan cover on the Inverter. Always mount the right and left catches on the fan cover on the heatsinks. Thread in the wiring from the cable lead-in hole at the bottom of the plastic case to the inside of the Inverter.
3. Connect the wiring to the cooling fan connector (CN4) and mount the front cover and the terminal cover.

8. Fault Diagnosis

■ Protective and Diagnostic Functions

This section describes the alarm and fault displays, the fault conditions, and the corrective actions to be taken if the VS mini malfunctions.

Corrective Actions of Models without Digital Operator

1. Input fault reset or cycle the power supply OFF and ON.
2. When a fault cannot be corrected:
   Turn the power supply OFF and check the wiring and control logic.

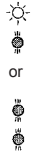
Corrective Actions of Models with Digital Operator

☼ : ON ◍ : Flashing ● : OFF

Alarm Displays and Meanings

Alarm Display		Inverter Status	Description	Causes and Corrective Actions
Digital Operator	RUN (Green) ALARM (Red)			
Uv Flashing	◍ ◍	Detected as an alarm only. Fault contact output is not activated.	UV (Main circuit low voltage) Main circuit DC voltage dropped below the low-voltage detection level while the Inverter output is OFF. 200 V: Main circuit DC voltage drops below approx. 200 V (160 V for single-phase) 400 V: Main circuit DC voltage dropped below approx. 400 V.	Check the following: • Power supply voltage • Main circuit power supply connection. • Terminal screws: Loose?
ov Flashing			OV (Main circuit overvoltage) Main circuit DC voltage exceeded the overvoltage detection level while the Inverter output is OFF. Detection level 200 V Class: approx. 410 V or more 400 V Class: approx. 820 V or more	Check the power supply voltage.
oH Flashing			OH (Heatsink overheat) Intake air temperature increased while the Inverter output is OFF.	Check the intake air temperature.

Alarm Display		Inverter Status	Description	Causes and Corrective Actions
Digital Operator	RUN (Green) ALARM (Red)			
CAL Flashing		Detected as an alarm only. Fault contact output is not activated.	CAL (MEMOBUS communications waiting) Correct data has not been received from the PLC when the constants n02 (RUN Command Selection) is 2 or n03 (Frequency Reference Selection) is 6, and power is turned ON.	Check communications devices and transmission signals.
oP□ Flashing			OP□ (Constant setting error when constants are set through MEMOBUS communications) OP1: Two or more values are set for multi-function input selection. (constants n36 to n39) OP2: Relationship among V/f constants is not correct. (constants n09, n11, n12, n14) OP3: Setting value of motor rated current exceeds 120% of Inverter Rated Current. (constant n32) OP4: Upper/lower limit of frequency reference is reversed. (constants n30, n31) OP5: Setting values of jump frequencies 1 and 2 are not appropriate. (constants n49, n50)	Check the setting values.
oL3 Flashing			OL3 (Overtorque detection) Motor current exceeded the preset value in constant n60.	Reduce the load, and increase the acceleration/deceleration time.
SEr Flashing			SER (Sequence error) Inverter received LOCAL/REMOTE command or communications/control circuit terminal changing signals from the multi-function terminal while the Inverter output is ON.	Check the external circuit (sequence).

Alarm Display		Inverter Status	Description	Causes and Corrective Actions
Digital Operator	RUN (Green) ALARM (Red)			
bb Flashing		Detected as an alarm only. Fault contact output is not activated.	BB (External baseblock) BASEBLOCK command at multi-function terminal is ON and the Inverter output is OFF (motor coasting). Condition is cleared when input command is removed.	Check the external circuit (sequence).
EF Flashing			EF (Simultaneous FWD/REV RUN commands) When FWD and REV RUN commands are simultaneously input for over 500 ms, the Inverter stops according to constant n04.	Check the external circuit (sequence).
SrP Flashing			STP (Operator function stop) STOP RESET was pressed during running via a control circuit terminal FWD/REV command, or by a RUN command from communications. The Inverter stops according to constant n04. STP (Emergency stop) Inverter received emergency stop alarm signal. Inverter stops according to constant n04.	Open FWD/REV command of control circuit terminals. Check the external circuit (sequence).
FAn Flashing			FAN (Cooling fan fault) Cooling fan is locked.	Check the following: • Cooling fan • Cooling fan connection
CE Flashing			CE (MEMOBUS communications fault)	Check the communication devices or signals.

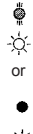
Fault Displays and Meanings

Fault Display		Inverter Status	Description	Causes and Corrective Actions
Digital Operator	RUN (Green) ALARM (Red)			
oC	● ☼	Protective Operation Output is turned OFF and motor coasts to a stop.	**OC (Overcurrent)** Inverter output current momentarily exceeded approx. 200% of rated current. (Control power supply fault) Voltage fault of control power supply is detected.	• Short circuit or grounding at Inverter output side • Excessive load GD^2 • Extremely rapid Acceleration/ Deceleration Time (constants n16 to n19) • Special motor used • Starting motor during coasting • Motor of a capacity greater than the Inverter rating has been started. • Magnetic contactor opened/closed at the Inverter output side ⇓ Check the cause, and restore the operation. • Cycle power. If the fault remains, replace the Inverter. Note) Before turning the power ON again, make sure that no short-circuit or ground fault occurs at the Inverter output.
GF			**GF (Ground fault)*** Ground fault current at the Inverter output exceeded Inverter rated current.	• Check that motor insulation has not deteriorated. • Check the connection between Inverter and motor. Note) Before turning the power ON again, make sure that no short-circuit or ground fault occurs at the Inverter output.
ov			**OV (Main circuit overvoltage)** Main circuit DC voltage exceeded the overvoltage detection level because of excessive regenerative energy from the motor. Detection level: 200 V: Stop at main circuit DC voltage below approx. 410 V 400 V: Stops at main circuit DC voltage of approx. 820 V or more	• Insufficient Deceleration Time (constants n17 and n19) • Lowering of negative load (e.g., elevator) ⇓ • Increase deceleration time.

* The ground fault here is one which occurs in the motor wiring while the motor is running. A ground fault may not be detected in the following cases.
  - A ground fault with low resistance which occurs in motor cables or terminals.
  - A ground fault occurs when the power is turned ON.

Fault Display		Inverter Status	Description	Causes and Corrective Actions
Digital Operator	RUN (Green) ALARM (Red)			
Uu 1	☼	Protective Operation Output is turned OFF and motor coasts to a stop.	UV1 (Main circuit low voltage) Main circuit DC voltage dropped below the low-voltage detection level while the Inverter output is ON. 200 V: Stops at main circuit DC voltage below approx. 200 V (160 V for single-phase) 400 V: Stops at main circuit DC voltage of approx. 400 V or more	• Reduction of input power supply voltage • Open phase of input supply • Momentary power loss ⇓ Check the following: • Power supply voltage • Main circuit power supply connections • Terminal screws: Loose?
oH	● ☼		OH (Heatsink overheat) Temperature increased because of Inverter overload operation or intake air temperature rise.	• Excessive load • Improper V/f pattern setting • Insufficient acceleration time if the fault occurs during acceleration • Intake air temperature exceeding 50°C • Cooling fan stops. ⇓ Check the following: • Load size • V/f pattern setting (constants n09 to n15) • Intake air temperature.
oL 1			OL1 (Motor overload) Motor overload protection operated by built-in electronic thermal overload relay.	• Check the load size or V/f pattern setting (constants n09 to n15). • Set the motor rated current shown on the nameplate in constant n32.
oL2			OL2 (Inverter overload) Inverter overload protection operated by built-in electronic thermal overload relay.	• Check the load size or V/f pattern setting (constants n09 to n15). • Check the Inverter capacity.
oL3			OL3 (Overtorque detection) Inverter output current exceeded the preset value in constant n60. When overtorque is detected, Inverter performs operation according to the preset setting of constant n59.	Check the driven machine and correct the cause of the fault, or increase the value of constant n60 up to the highest value allowed for the machine.

Fault Display		Inverter Status	Description	Causes and Corrective Actions
Digital Operator	RUN (Green) ALARM (Red)			
EF□	● ☼	Protective Operation Output is turned OFF and motor coasts to a stop.	EF□ (External fault) Inverter receives an external fault input from control circuit terminal. EF0: External fault reference through MEMOBUS communications EF2: External fault input command from control circuit terminal S2 EF3: External fault input command from control circuit terminal S3 EF4: External fault input command from control circuit terminal S4 EF5: External fault input command from control circuit terminal S5	Check the external circuit (sequence).
F00			CPF-00 Initial memory fault has detected.	Cycle power. If the fault remains, replace the Inverter.
F01			CPF-01 ROM error has detected.	Cycle power. If the fault remains, replace the Inverter.
F04			CPF-04 EEPROM fault of Inverter control circuit was detected.	• Record all constant data and initialize the constants. (Refer to page 44 for constant initialization.) • Cycle power. If the fault remains, replace the Inverter.
F05			CPF-05 AD converter fault was detected.	Cycle power. If the fault remains, replace the Inverter.
F06			CPF-06 • Option card connection fault • A non-corresponding option card is connected.	Remove power to the Inverter. Check the connection of the Digital Operator. Verify Software Version No.
F07			CPF-07 Operator control circuit (EEPROM or A/D converter) fault	Cycle power. If the fault remains, replace the Inverter.
CE			CE (MEMOBUS communications fault) Normal reception of communication data is not possible.	Check the communication devices or communication signals.

Fault Display		Inverter Status	Description	Causes and Corrective Actions
Digital Operator	RUN (Green) ALARM (Red)			
STP		Stops according to constant	STP (Emergency stop) The Inverter stopped according to constant n04 after receiving the emergency stop fault signal.	Check the external circuit (sequence).
— (OFF)			• Insufficient power supply voltage • Control power supply fault • Hardware fault	Check the following: • Power supply voltage • Main circuit power supply connections • Terminal screws: Loose? • Control sequence. Replace the Inverter.

Note: To display or clear the fault history, refer to page 41.

■ Troubleshooting

Trouble	Cause	Corrective Actions
The motor does not operate when an external operation signal is input.	**The operation method selection is wrong.** The run command (n02) is not set to Control Circuit Terminal.	Set the run command (n02) to Control Circuit Terminal.
	A 3-wire sequence is in effect. The multi-function input method (n37) is set to 3-wire sequence, and the S2 control terminal is not closed.	To use a 3-wire sequence, make the wiring so that the S2 control terminal is closed. To use a 2-wire sequence, set the multi-function input (n37) to a value other than 3-wire sequence.
	The frequency reference is too low. The input frequency reference is lower than the setting for the min.output frequency (n14).	Input a frequency reference greater than the min. output frequency (n14).
	Local mode is in effect.	Set the LO/RE selection of the digital operator to RE.
	The SW setting for the reference selection is wrong. Example: The reference 4-20 mA is input, but the SW is set to "V."	For analog input, make sure that the frequency reference (n03) and SW8 settings are correct.
	The setting of NPN/PNP switch (SW7) is not correct.	Set SW7 correctly.
The motor stops. The torque is not output.	**The stall prevention level during acceleration is too low.** Because the stall prevention level during acceleration (n56) is set too low, the output current reaches the set level, the output frequency is stopped, and the acceleration time is lengthened.	Check if the stall prevention level during acceleration (n56) is set to an appropriate value.
	The stall prevention level during running is too low. Because the stall prevention level during running (n57) is set too low, the output current reaches the set level, and the speed drops.	Check if the stall prevention level during running (n57) is set to an appropriate value.
	The load is too heavy. If the load is too heavy, stall prevention is activated, the output frequency is stopped, and the acceleration time is lengthened.	• Lengthen the set acceleration time (n16). • Reduce the load.
	When the maximum frequency was changed, the maximum voltage frequency was also changed.	To increase the speed of a general-purpose motor, only change the maximum frequency.
	The V/f set value is too low.	Set the V/f (n09 to n15) according to the load characteristics.

Trouble	Cause	Corrective Actions
The motor speed is unstable. The motor speed fluctuates when operating with a light load.	**The stall prevention level during running is too low.** Because the stall prevention level during running (n57) is too low, the output current reaches the set level and the speed drops.	Check if the stall prevention level during running (n57) is set to an appropriate value.
	The load is too heavy. If the load is too heavy, stall prevention is activated, the output frequency is stopped, and the acceleration time is lengthened.	Reduce the load.
	The carrier frequency is too high. If operating the motor with a light load, a high carrier frequency may cause the motor speed to fluctuate.	Decrease the carrier frequency (n46).
	The V/f set value is too high for a low speed operation. Because the set value for the V/f is too high, over-excitation occurs at low speeds.	Set the V/f (n09 to n15) according to the load characteristics.
	The maximum frequency and base frequency were incorrectly adjusted. Example: To operate a 60 Hz motor at 40 Hz or less, the maximum frequency and base frequency are set to 40 Hz.	Set the maximum frequency and the base frequency according to the motor specifications.
	The Inverter is used for an operation at 1.5 Hz or less.	Do not use the J7 Inverter for an operation that runs at 1.5 Hz or less. For an operation at 1.5 Hz or less, use a different Inverter model.
	The analog reference input is unstable and has noise interference.	Increase the set value for the filter time constant.
The Digital Operator does not turn ON.	**The power is not being supplied.** The breaker or other component on the power input side is not turned ON, and the power is not being supplied.	Check if the power is being supplied.
The LED of the Digital Operator is unlit.	**Short-circuit bar for terminals +1 and +2 is not connected.**	Confirm that the short-circuit bar is connected properly.

9. Specifications

■ Standard Specifications (200 V Class)

Voltage Class			200 V single-/3-phase						
Model CIMR-J7∗A□□□□		3-phase	20P1	20P2	20P4	20P7	21P5	22P2	23P7
		Single-phase	B0P1	B0P2	B0P4	B0P7	B1P5	-	-
Max. Applicable Motor Output kW *1			0.1	0.2	0.4	0.75	1.5	2.2	3.7
Output Characteristics	Inverter Capacity (kVA)		0.3	0.6	1.1	1.9	3.0	4.2	6.7
	Rated Output Current (A)		0.8	1.6	3	5	8	11	17.5
	Max. Output Voltage (V)		3-phase, 200 to 230 V (proportional to input voltage) 3-phase, 200 to 240 V (proportional to input voltage)						
	Max. Output Frequency (Hz)		400 Hz (Programmable)						
Power Supply	Rated Input Voltage and Frequency		3-phase, 200 to 230 V, 50/60 Hz Single-phase, 200 to 240 V, 50/60 Hz						
	Allowable Voltage Fluctuation		–15% to +10%						
	Allowable Frequency Fluctuation		±5%						
Control Characteristics	Control Method		Sine wave PWM (V/f control)						
	Frequency Control Range		0.1 to 400 Hz						
	Frequency Accuracy (Temperature Change)		Digital reference: ±0.01% (–10 to 50°C) Analog reference: ±0.5% (25 ±10°C)						
	Frequency Setting Resolution		Digital reference: 0.1 Hz (less than 100 Hz)/1 Hz (100 Hz or more) Analog reference: 1/1000 of max. output frequency						
	Output Frequency Resolution		0.01 Hz						
	Overload Capacity		150% rated output current for one minute						
	Frequency Reference Signal		0 to 10 VDC (20 kΩ), 4 to 20 mA (250 Ω), 0 to 20 mA (250 Ω), frequency setting potentiometer (Selectable)						
	Acceleration/ Deceleration Time		0.0 to 999 s (Acceleration/deceleration time are independently programmed.)						

Voltage Class		200 V single-/3-phase						
Model CIMR-J7∗A□□□□	3-phase	20P1	20P2	20P4	20P7	21P5	22P2	23P7
	Single-phase	B0P1	B0P2	B0P4	B0P7	B1P5	-	-

Control Characteristics	Braking Torque	Short-term average deceleration torque*2 0.1, 0.2 kW: 150% 0.4, 0.75 kW: 100% 1.5 kW: 50% 2.2 kW or more: 20% Continuous regenerative torque: Approx. 20%
	V/f Characteristics	Possible to program any V/f pattern
Protective Functions	Motor Overload Protection	Electronic thermal overload relay
	Instantaneous Overcurrent	Motor coasts to a stop at approx. 200% of Inverter rated current
	Overload	Motor coasts to a stop after 1 minute at 150% of Inverter rated output current
	Overvoltage	Motor coasts to a stop if DC bus voltage exceed 410 V
	Undervoltage	Stops when DC bus voltage is approx. 200 V or less (approx. 160 V or less for single-phase series).
	Momentary Power Loss	Following items are selectable: Not provided (stops if power loss is 15 ms or longer), continuous operation if power loss is approx. 0.5 s or shorter, continuous operation.
	Heatsink Overheat	Protected by electronic circuit.
	Stall Prevention Level	Can be set individual level during acceleration/deceleration, provided/not provided available during coast to a stop.
	Cooling Fan Fault	Protected by electronic circuit (fan lock detection).
	Ground Fault*6	Protected by electronic circuit (rated output current level).
	Power Charge Indication	RUN indicator stays ON or Digital Operator indicator stays ON. (Charge LED is provided for 400 V.) ON until the DC bus voltage becomes 50 V or less.

Voltage Class			200 V single-/3-phase						
Model CIMR-J7∗A□□□□		3-phase	20P1	20P2	20P4	20P7	21P5	22P2	23P7
		Single-phase	B0P1	B0P2	B0P4	B0P7	B1P5	-	-
Output Functions	Input Signals	Multi-function Input	Four of the following input signals are selectable: Reverse run (3-wire sequence), fault reset, external fault (NO/NC contact input), multi-step speed operation, JOG command, acceleration/deceleration time select, external baseblock (NO/NC contact input), SPEED SEARCH command, ACCELERATION/DECELERATION HOLD command, LOCAL/REMOTE selection, communication/control circuit terminal selection, emergency stop fault, emergency stop alarm						
	Output Signals	Multi-function Output[*3]	Following output signals are selectable (1 NO/NC contact output): Fault, running, zero speed, frequency agree, frequency detection (output frequency ≤ or ≥ set value), overtorque detection, minor error, baseblock, operating mode, Inverter run ready, fault retry, UV, speed search, data output through communication						
	Standard Functions		Full-range automatic torque boost, slip compensation, DC injection braking current/time at startup/stop, frequency reference bias/gain, frequency reference with built-in potentiometer, [MEMOBUS communications (RS-485/422, max. 19.2K bps) (optional)]						
Other Functions	Indications	Status Indicators	RUN and ALARM provided as standard indicators						
		Digital Operator	Provided for monitor frequency reference, output frequency, output current						
	Terminals		Main circuit: screw terminals Control circuit: plug-in screw terminal						
	Wiring Distance between Inverter and Motor		100 m or less[*5]						
Enclosure			Open chassis IP20						
Cooling Method			Cooling fan is provided for the following models: 200 V, 0.75 kW or larger Inverters (3-phase) 200 V, 1.5 kW or larger Inverters (single-phase) Other models are self-cooling.						
Environmental Conditions	Ambient Temperature		Open chassis: –10 to 50°C (not frozen)						
	Humidity		95% or less (non-condensing)						
	Storage Temperature[*4]		–20 to 60 °C						
	Location		Indoor (free from corrosive gases or dust)						
	Elevation		1,000 m or less						
	Vibration		Up to 9.8 m/s^2 (1G) at less than 20 Hz, up to 2 m/s^2 (0.2G) at 20 to 50 Hz						

* 1. Based on a standard 4-pole motor for max. applicable motor output.
* 2. Shows deceleration torque for uncoupled motor decelerating from 60 Hz with the shortest possible deceleration time.
* 3. Minimum permissible load: 5 VDC, 10 mA (as reference value)
* 4. Temperature during shipping (for short period).
* 5. If the wiring distance between Inverter and motor is long, reduce the Inverter carrier frequency. For details, refer to *Reducing Motor Noise or Leakage Current Using Carrier Frequency Selection (n46)* on page 64.
* 6. The ground fault here is one which occurs in the motor wiring while the motor is running. A ground fault may not be detected in the following cases.
  - A ground fault with low resistance which occurs in motor cables or terminals.
  - A ground fault occurs when the power is turned ON.

■ Standard Specifications (400 V Class)

Voltage Class		400 V 3-phase						
Model CIMR-J7∗A□□□□ 3-phase		40P2	40P4	40P7	41P5	42P2	43P0	43P7
Max. Applicable Motor Output kW *1		0.2	0.4	0.75	1.5	2.2	3.0	3.7
Output Characteristics	Inverter Capacity (kVA)	0.9	1.4	2.6	3.7	4.2	5.5	6.6
	Rated Output Current (A)	1.2	1.8	3.4	4.8	5.5	7.2	8.6
	Max. Output Voltage (V)	3-phase, 380 to 460 V (proportional to input voltage)						
	Max. Output Frequency (Hz)	400 Hz (Programmable)						
Power Supply	Rated Input Voltage and Frequency	3-phase, 380 to 460 V, 50/60 Hz						
	Allowable Voltage Fluctuation	−15% to +10%						
	Allowable Frequency Fluctuation	±5%						

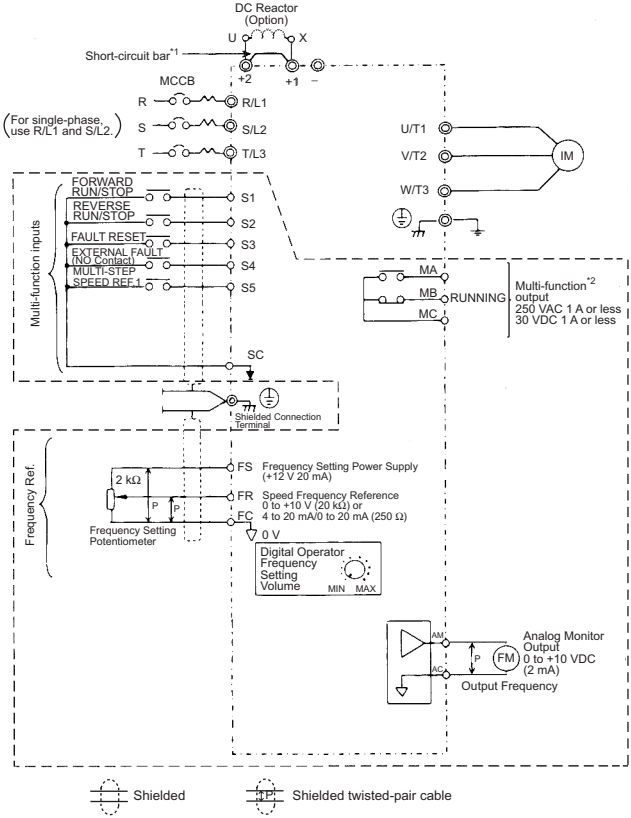
Voltage Class		400 V 3-phase						
Model CIMR-J7∗A□□□□ 3-phase		40P2	40P4	40P7	41P5	42P2	43P0	43P7
Control Characteristics	Control Method	Sine wave PWM (V/f control)						
	Frequency Control Range	0.1 to 400 Hz						
	Frequency Accuracy (Temperature Change)	Digital reference: ±0.01%, −10 to 50°C Analog reference: ±0.5%, 25±10°C						
	Frequency Setting Resolution	Digital reference: 0.1 Hz (less than 100 Hz)/1 Hz (100 Hz or more) Analog reference: 1/1000 of max. output frequency						
	Output Frequency Resolution	0.01 Hz						
	Overload Capacity	150% rated output current for one minute						
	Frequency Reference Signal	0 to 10 VDC (20 kΩ), 4 to 20 mA (250 Ω), 0 to 20 mA (250 Ω), frequency setting potentiometer (Selectable)						
	Acceleration/ Deceleration Time	0.0 to 999 s (Acceleration/deceleration time are independently programmed.)						
	Braking Torque	Short-term average deceleration torque*2 0.2 kW: 150% 0.4/0.75 kW: 100% 1.5 kW: 50% 2.2 kW or more: 20% Continuous regenerative torque: Pyrex. 20%						
	V/f Characteristics	Possible to program any V/f pattern						
Protective Functions	Motor Overload Protection	Electronic thermal overload relay						
	Instantaneous Overcurrent	Motor coasts to a stop at approx. 200% of Inverter rated current						
	Overload	Motor coasts to a stop after 1 minute at 150% of Inverter rated output current						
	Overvoltage	Motor coasts to a stop if DC bus voltage exceed 820 V						
	Undervoltage	Stops when DC bus voltage is approx. 400 V or less						

Voltage Class			400 V 3-phase						
Model CIMR-J7∗A□□□□		3-phase	40P2	40P4	40P7	41P5	42P2	43P0	43P7
Protective Functions	Momentary Power Loss		Following items are selectable: Not provided (stops if power loss is 15 ms or longer), continuous operation if power loss is approx. 0.5 s or shorter, continuous operation.						
	Heatsink Overheat		Protected by electronic circuit.						
	Stall Prevention Level		Can be set individual levels during acceleration/deceleration, provided/not provided available during coast to a stop.						
	Cooling Fan Fault		Protected by electronic circuit (fan lock detection).						
	Ground Fault*6		Protected by electronic circuit (rated output current level).						
	Power Charge Indication		Charge LED is provided. ON until the DC bus voltage becomes 50 V or less.						
Output Functions	Input Signals	Multi-function Input	Four of the following input signals are selectable: Reverse run (3-wire sequence), fault reset, external fault (NO/NC contact input), multi-step speed operation, JOG command, acceleration/deceleration time select, external baseblock (NO/NC contact input), SPEED SEARCH command, ACCELERATION/DECELERATION HOLD command, LOCAL/REMOTE selection, communication/control circuit terminal selection, emergency stop fault, emergency stop alarm						
	Output Signals	Multi-function Output*3	Following output signals are selectable (1 NO/NC contact output): Fault, running, zero speed, frequency agree, frequency detection (output frequency ≤ or ≥ set value), overtorque detection, minor error, baseblock, operating mode, Inverter run ready, fault retry, UV, speed search, data output through communication						
	Standard Functions		Full-range automatic torque boost, slip compensation, DC injection braking current/time at startup/stop frequency reference bias/gain, frequency reference with built-in potentiometer, constant copy, [MEMOBUS communications (RS-485/422, max.19.2K bps) (optional)]						
Other Functions	Indications	Status Indicators	RUN and ALARM provided as standard indicators						
		Digital Operator	Provided for monitor frequency reference, output frequency, output current						
	Terminals		Main circuit: screw terminals Control circuit: plug-in screw terminal						
	Wiring Distance between Inverter and Motor		100 m or less*5						
Enclosure			Open chassis IP20						
Cooling Method			Cooling fan is provided for the following models: 400 V, 1.5 kW or larger Inverters (3-phase) Other models are self-cooling.						

Voltage Class		400 V 3-phase						
Model CIMR-J7∗A□□□□	3-phase	40P2	40P4	40P7	41P5	42P2	43P0	43P7
Environmental Conditions	Ambient Temperature	Open chassis: –10 to 50°C (not frozen)						
	Humidity	95% or less (non-condensing)						
	Storage Temperature*4	–20 to 60°C						
	Location	Indoor (free from corrosive gases or dust)						
	Elevation	1,000 m or less						
	Vibration	Up to 9.8 m/s^2 (1G) at less than 20 Hz, up to 2 m/s^2 (0.2G) at 20 to 50 Hz						

* 1. Based on a standard 4-pole motor for max. applicable motor output.
* 2. Shows deceleration torque for uncoupled motor decelerating from 60 Hz with the shortest possible deceleration time.
* 3. Minimum permissible load: 5 VDC, 10 mA (as reference value)
* 4. Temperature during shipping (for short period).
* 5. If the wiring distance between Inverter and motor is long, reduce the Inverter carrier frequency. For details, refer to *Reducing Motor Noise or Leakage Current Using Carrier Frequency Selection (n46)* on page 64.
* 6. The ground fault here is one which occurs in the motor wiring while the motor is running. A ground fault may not be detected in the following cases.
  - A ground fault with low resistance which occurs in motor cables or terminals.
  - A ground fault occurs when the power is turned ON.

■ Standard Wiring



: Only basic insulation (Protective class 1, overvoltage categoly II) is provided for the control circuit terminals. Additional insulation may be necessary in the end product to conform to CE requirements.

*1. Shorting bar must be removed when connecting DC reactor.

*2. Minimum permissible load: 5 VDC, 10 mA (as reference value)

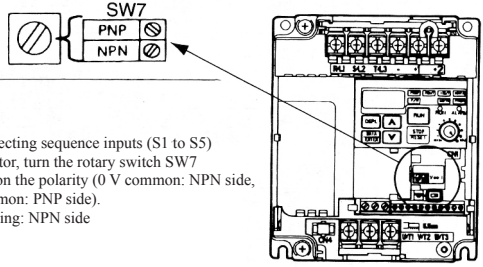
Terminal Descriptions

Type		Terminal		Name	Function (Signal Level)	
Main Circuit		R/L1, S/L2, T/L3		AC power supply input	Use main circuit power input. (Use terminals R/L1 and S/L2 for single-phase Inverters. Never use terminal T/L3.)	
		U/T1, V/T2, W/T3		Inverter output	Inverter output	
		+2, +1		DC reactor connection	When connecting optional DC reactor, remove the main circuit short-circuit bar between +2 and +1.	
		+1, -		DC power supply input	DC power supply input (+1: positive –: negative)*1	
		⏚		Grounding	For grounding (according to the local grounding codes)	
Control Circuit	Input	Sequence	S1	Forward run input	Closed: FWD run, open: REV run	Photocoupler insulation, 24 VDC, 8 mA
			S2	Multi-function input selection 2	Factory setting closed:REV run open: FWD run	
			S3	Multi-function input selection 3	Factory setting: Fault reset	
			S4	Multi-function input selection 4	Factory setting: External fault (NO contact)	
			S5	Multi-function input selection 5	Factory setting: Multi-step speed reference 1	
			SC	Multi-function input selection common	For control signal	
		Frequency reference	FS	Power for frequency setting	+12 V (permissible current 20 mA max.)	
			FR	Master speed frequency reference	0 to +10 VDC (20 kΩ) or 4 to 20 mA (250 Ω) or 0 to 20 mA (250 Ω) (1/1000 resolution)	
			FC	Frequency reference common	0 V	
	Output	Multi-function contact output	MA	NO contact output	Factory setting: running	Contact capacity 250 VAC 1 A or less, 30 VDC 1 A or less
			MB	NC contact output		
			MC	Contact output common		
		AM		Analog monitor output	Factory setting: Output frequency 0 to +10 VDC	0 to +10 VDC, 2 mA or less, 8-bit resolution
		AC		Analog monitor common	0 V	

* 1. DC power supply input terminal is not applied to CE/UL standard.

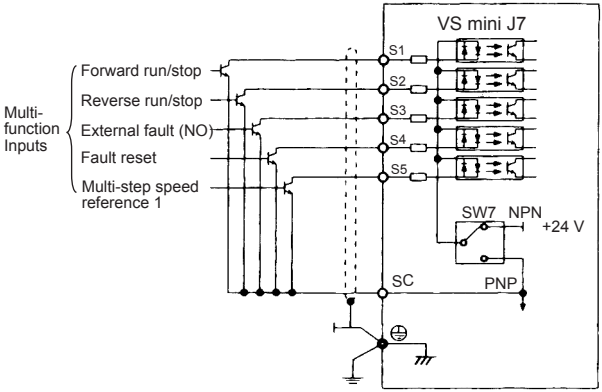
* 2. Minimum permissible load: 5 VDC, 10 mA (as reference value)

■ Sequence Input Connection with NPN/PNP Transistor

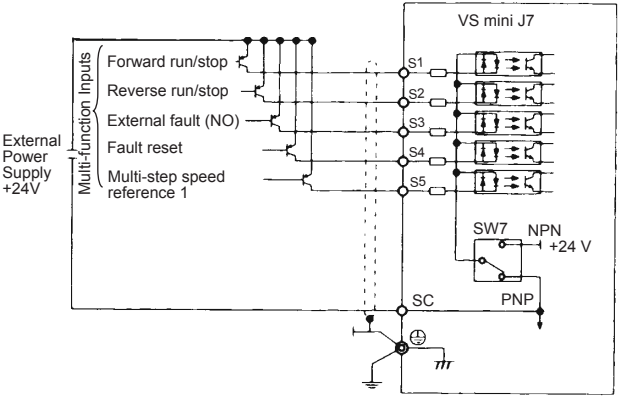


When connecting sequence inputs (S1 to S5) with transistor, turn the rotary switch SW7 depending on the polarity (0 V common: NPN side, +24 V common: PNP side).
Factory setting: NPN side

Sequence Connection with NPN Transistor (0 V Common)



Sequence Connection with PNP Transistor (+24 V Common)



■ Dimensions/Heat Loss (Unit: mm)

The following diagram shows the external dimensions and heat loss of the open-chassis type (IP20).

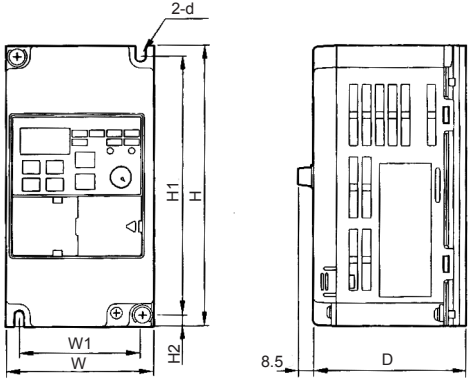


Fig. 1

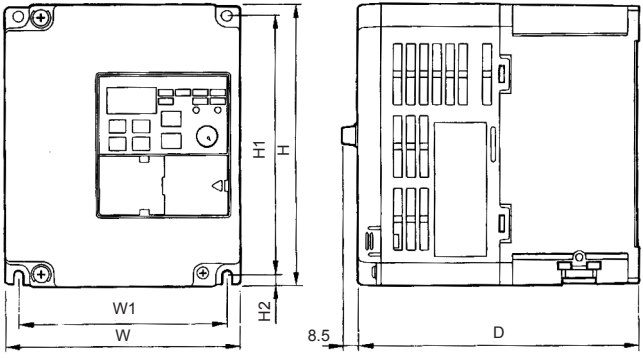


Fig. 2

Dimensions in mm/Mass in kg/Heat Loss (W)

Voltage class	Capacity (kW)	W	H	D	W1	H1	H2	d	Mass	Heat Loss (W)			Fig.
										Heat-sink	Unit	Total	
200 V 3-phase	0.1	68	128	70	56	118	5	M4	0.5	3.7	9.3	13.0	1
	0.2	68	128	70	56	118	5	M4	0.5	7.7	10.3	18.0	1
	0.4	68	128	102	56	118	5	M4	0.8	15.8	12.3	28.1	1
	0.75	68	128	122	56	118	5	M4	0.9	28.4	16.7	45.1	1
	1.5	108	128	129	96	118	5	M4	1.3	53.7	19.1	72.8	2
	2.2	108	128	154	96	118	5	M4	1.5	60.4	34.4	94.8	2
	3.7	140	128	161	128	118	5	M4	2.1	96.7	52.4	149.1	2
200 V single-phase	0.1	68	128	70	56	118	5	M4	0.5	3.7	10.4	14.1	1
	0.2	68	128	70	56	118	5	M4	0.5	7.7	12.3	20.0	1
	0.4	68	128	112	56	118	5	M4	0.9	15.8	16.1	31.9	1
	0.75	108	128	129	96	118	5	M4	1.5	28.4	23.0	51.4	2
	1.5	108	128	154	96	118	5	M4	1.5	53.7	29.1	82.8	2
400 V 3-phase	0.2	108	128	81	96	118	5	M4	1.0	9.4	13.7	23.1	2
	0.4	108	128	99	96	118	5	M4	1.1	15.1	15.0	30.1	2
	0.75	108	128	129	96	118	5	M4	1.5	30.3	24.6	54.9	2
	1.5	108	128	154	96	118	5	M4	1.5	45.8	29.9	75.7	2
	2.2	108	128	154	96	118	5	M4	1.5	50.5	32.5	83.0	2
	3.0	140	128	161	128	118	5	M4	2.1	58.2	37.6	95.8	2
	3.7	140	128	161	128	118	5	M4	2.1	73.4	44.5	117.9	2

■ Recommended Peripheral Devices

It is recommended that the following peripheral devices be mounted between the AC main circuit power supply and VS mini input terminals R/L1, S/L2, and T/L3.

- MCCB (Molded-case Circuit Breaker)/Fuse:

  Always connect for wiring protection.

- Magnetic Contactor:

  Mount a surge suppressor on the coil. (Refer to the table shown below.) When using a magnetic contactor to start and stop the Inverter, do not exceed one start per hour.

Recommended MCCB, Magnetic Contactors and Fuses

- 200 V 3-phase

VS mini Model		J7*A 20P1	J7*A 20P2	J7*A 20P4	J7*A 20P7	J7*A 21P5	J7*A 22P2	J7*A 23P7
Capacity (kVA)		0.3	0.6	1.1	1.9	3.0	4.2	6.7
Rated Output Current (A)		0.8	1.6	3	5	8	11	17.5
MCCB type NF30 (MITSUBISHI)		5 A	5 A	5 A	10 A	20 A	20 A	30 A
Magnetic contactor (Fuji Electric FA Components & Systems)	Without reactor	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-4-0 (18A)	SC-N1 (26A)	SC-N2 (35A)
	With reactor	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-4-0 (18A)	SC-N1 (26A)
Fuse (UL Class RK5)		5 A	5 A	5 A	10 A	20 A	20 A	30 A

- 200 V Single-phase

VS mini Model		J7*A B0P1	J7*A B0P2	J7*A B0P4	J7*A B0P7	J7*A B1P5
Capacity (kVA)		0.3	0.6	1.1	1.9	3.0
Rated Output Current (A)		0.8	1.5	3	5	8
MCCB type NF30, NF50 (MITSUBISHI)		5 A	5 A	10 A	20 A	30 A
Magnetic contactor (Fuji Electric FA Components & Systems)	Without reactor	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-4-0 (18A)	SC-N2 (35A)
	With reactor	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-4-0 (18A)	SC-N1 (26A)
Fuse (UL Class RK5)		5 A	5 A	10 A	20 A	20 A

- 400 A 3-phase

VS mini Model		J7*A 40P2	J7*A 40P4	J7*A 40P7	J7*A 41P5	J7*A 42P2	J7*A 43P0	J7*A 43P7
Capacity (kVA)		0.9	1.4	2.6	3.7	4.2	5.5	6.6
Rated Output Current (A)		1.2	1.8	3.4	4.8	5.5	7.2	8.6
MCCB type NF30, NF50 (MITSUBISHI)		5 A	5 A	5 A	10 A	15 A	20 A	20 A
Magnetic contactor (Fuji Electric FA Components & Systems)	Without reactor	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-4-0 (18A)	SC-4-0 (18A)	SC-N1 (26A)
	With reactor	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-03 (11A)	SC-4-0 (18A)
Fuse (UL Class RK5)		5 A	5 A	5 A	10 A	10 A	20 A	20 A

Surge Suppressors

Coils and Relays \ Surge Suppressors		Model DCR2-	Specifications	Code No.
200 V to 230 V	Large size magnetic contactors	50A22E	250 VAC 0.5 µF 200 Ω	C002417
	Control relays MY-2, -3 (OMRON) HH-22, -23 (FUJI) MM-2, -4 (OMRON)	10A25C	250 VAC 0.1 µF 100 Ω	C002482

- Ground Fault Interrupter:

  Select a ground fault interrupter not affected by high frequencies. To prevent malfunctions, the current should be 200 mA or higher and the operating time 0.1 s or longer.

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

- AC and DC Reactor:

  Install an AC reactor to connect to a power supply transformer of large capacity (600 kVA or more) or to improve power factor on the power supply side.

- Noise Filter:

  Use a noise filter exclusively for Inverter if radio noise generated from the Inverter causes other control devices to malfunction.

NOTE

1. Never connect a general LC/RC noise filter to the Inverter output circuit.
2. Do not connect a phase-advancing capacitor to the I/O sides and/or a surge suppressor to the output side.
3. When a magnetic contactor is installed between the Inverter and the motor, do not turn it ON/OFF during operation.

For the details of the peripheral devices, refer to the catalog.

■ Constants List

- Addition of Constants Accompanied by the Upgraded Software Version

  The constants marked with #1 are applicable for the upgraded software version No. VSP 020011 or later.

No.	Register No. for Transmission	Name	Setting Range	Setting Unit	Initial Setting	Change during Operation	User Setting	Ref. Page
01	0101H	Password	0, 1, 6, 8, 9	1	1	Yes		44
02	0102H	RUN Command Selection	0 to 2	1	0	Yes		49
03	0103H	Frequency Reference Selection	0 to 4, 6	1	0 *4	Yes		50
04	0104H	Stopping Method Selection	0, 1	1	0	Yes		67
05	0105H	Reverse Run Prohibit	0, 1	1	0	Yes		51
06	0106H	Stop Key Selection	0, 1	1	0	Yes		66
07	0107H	Frequency Reference Selection in Local Mode	0, 1	1	0 *4	Yes		49
08	0108H	Frequency Reference Setting Method From Digital Operator	0, 1	1	0	Yes		50
09	0109H	Max. Output Frequency	50.0 to 400 Hz	0.1 Hz (less than 100 Hz)	60.0 Hz	Yes		45
10	010AH	Max. Voltage	1 to 255 V *1	1 V	200 V*1	Yes		45
11	010BH	Max. Voltage Output Frequency	0.2 to 400 Hz	1 Hz (100 Hz or more)	60.0 Hz	Yes		45
12	010CH	Mid. Output Frequency	0.1 to 399 Hz	1 Hz (100 Hz or more)	1.5 Hz	Yes		45
13	010DH	Mid. Output Frequency Voltage	1 to 255 V *1	1 V	12 V *1	Yes		45

No.	Register No. for Transmission	Name	Setting Range	Setting Unit	Initial Setting	Change during Operation	User Setting	Ref. Page
14	010EH	Min. Output Frequency	0.1 to 10.0 Hz	0.1 Hz	1.5 Hz	Yes		45
15	010FH	Min. Output Frequency Voltage	1 to 50 V *1	1 V	12 V *1	Yes		45
16	0110H	Acceleration Time 1	0.0 to 999 s	0.1 s (less than 100 s) 1 s (100 s or more)	10.0 s	No		55
17	0111H	Deceleration Time 1	0.0 to 999 s	0.1 s (less than 100 s) 1 s (100 s or more)	10.0 s	No		55
18	0112H	Acceleration Time 2	0.0 to 999 s	0.1 s (less than 100 s) 1 s (100 s or more)	10.0 s	No		55
19	0113H	Deceleration Time 2	0.0 to 999 s	0.1 s (less than 100 s) 1 s (100 s or more)	10.0 s	No		55
20	0114H	S-curve Selection	0 to 3	1	0	Yes		56
21	0115H	Frequency Reference 1 (Master Speed Frequency Reference)	0.0 to 400 Hz	0.1 Hz (less than 100 Hz) 1Hz (100 Hz or more)	6.0 Hz	No		51
22	0116H	Frequency Reference 2	0.0 to 400 Hz	0.1 Hz (less than 100 Hz) 1Hz (100 Hz or more)	0.0 Hz	No		51
23	0117H	Frequency Reference 3	0.0 to 400 Hz	0.1 Hz (less than 100 Hz) 1Hz (100 Hz or more)	0.0 Hz	No		51

No.	Register No. for Transmission	Name	Setting Range	Setting Unit	Initial Setting	Change during Operation	User Setting	Ref. Page
24	0118H	Frequency Reference 4	0.0 to 400 Hz	0.1 Hz (less than 100 Hz) 1Hz (100 Hz or more)	0.0 Hz	No		51
25	0119H	Frequency Reference 5	0.0 to 400 Hz	0.1 Hz (less than 100 Hz) 1Hz (100 Hz or more)	0.0 Hz	No		51
26	011AH	Frequency Reference 6	0.0 to 400 Hz	0.1 Hz (less than 100 Hz) 1Hz (100 Hz or more)	0.0 Hz	No		51
27	011BH	Frequency Reference 7	0.0 to 400 Hz	0.1 Hz (less than 100 Hz) 1Hz (100 Hz or more)	0.0 Hz	No		51
28	011CH	Frequency Reference 8	0.0 to 400 Hz	0.1 Hz (less than 100 Hz) 1Hz (100 Hz or more)	0.0 Hz	No		51
29	011DH	Jog Frequency	0.0 to 400 Hz	0.1 Hz (less than 100 Hz) 1Hz (100 Hz or more)	6.0 Hz	No		52
30	011EH	Frequency Reference Upper Limit	0% to 110%	1%	100%	Yes		54
31	011FH	Frequency Reference Lower Limit	0% to 110%	1%	0%	Yes		54
32	0120H	Motor Rated Current	0% to 120% of Inverter rated current	0.1 A	*2	Yes		81

No.	Register No. for Transmission	Name	Setting Range	Setting Unit	Initial Setting	Change during Operation	User Setting	Ref. Page
33	0121H	Electronic Thermal Motor Protection Selection	0 to 2	1	0	Yes		81
34	0122H	Electronic Thermal Motor Protection Time Constant Setting	1 to 60 min	1 min	8 min	Yes		81
35	0123H	Selecting Cooling Fan Operation	0, 1	1	0	Yes		83
36	0124H	Multi-function Input Selection 2	2 to 8, 10 to 22	1	2	Yes		69
37	0125H	Multi-function Input Selection 3	0, 2 to 8, 10 to 22	1	5	Yes		69
38	0126H	Multi-function Input Selection 4	2 to 8, 10 to 22	1	3	Yes		69
39	0127H	Multi-function Input Selection 5	2 to 8, 10 to 22, 34, 35	1	6	Yes		69
40	0128H	Multi-function Output Selection	0 to 7, 10 to 18	1	1	Yes		73
41	0129H	Analog Frequency Reference Gain	0% to 255%	1%	100%	No		53
42	012AH	Analog Frequency Reference Bias	–99% to 99%	1%	0%	No		53
43	012BH	Analog Frequency Reference Filter Time Constant	0.00 to 2.00 s	0.01 s	0.10 s	Yes		---
44	012CH	Multi-function Analog Output (terminal AM-AC)	0, 1	1	0	Yes		63
45	012DH	Analog Monitor Gain	0.00 to 2.00	0.01	1.00	No		63
46	012EH	Carrier Frequency Selection	1 to 4, 7 to 9	1	*3	Yes		64
47	012FH	Momentary Power Loss Ridethrough Method	0 to 2	1	0	Yes		56
48	0130H	Automatic Retry Attempts	0 to 10 times	1	0 time	Yes		60

No.	Register No. for Transmission	Name	Setting Range	Setting Unit	Initial Setting	Change during Operation	User Setting	Ref. Page
49	0131H	Jump Frequency 1	0.0 to 400 Hz	0.1 Hz (less than 100 Hz)/ 1 Hz (100 Hz or more)	0.0 Hz	Yes		60
50	0132H	Jump Frequency 2	0.0 to 400 Hz	0.1 Hz (less than 100 Hz) 1 Hz (100 Hz or more)	0.0 Hz	Yes		60
51	0133H	Jump Frequency Range	0.0 to 25.5 Hz	0.1 Hz	0.0 Hz	Yes		60
52	0134H	DC Injection Braking Current	0% to 100%	1%	50%	Yes		61
53	0135H	DC Injection Braking Time at Stop	0.0% to 25.5%	0.1s	0.5 s	Yes		68
54	0136H	DC Injection Braking Time at Startup	0.0% to 25.5%	0.1s	0.0 s	Yes		61
55	0137H	Stall Prevention During Deceleration	0, 1	1	0	Yes		79
56	0138H	Stall Prevention Level During Acceleration	30% to 200%	1%	170%	Yes		77
57	0139H	Stall Prevention while Running	30% to 200%	1%	160%	Yes		78
58	013AH	Frequency Detection Level	0.0 to 400 Hz	0.1 Hz (less than 100 Hz)/1 Hz (100 Hz or more)	0.0 Hz	Yes		59
59	013BH	Overtorque Detection Function	0 to 4	1	0	Yes		58
60	013CH	Overtorque Detection Level	30% to 200%	1%	160%	Yes		58
61	013DH	Overtorque Detection Time	0.1 to 10.0 s	0.1 s	0.1 s	Yes		58
62	013EH	Hold Output	0, 1	1	0	Yes		72
63	013FH	Torque Compensation Gain	0.0 to 2.5	0.1	1.0	No		47

No.	Register No. for Transmission	Name	Setting Range	Setting Unit	Initial Setting	Change during Operation	User Setting	Ref. Page
64	0140H	Motor Rated Slip	0.0 to 20.0 Hz	0.1 Hz	*2	No		80
65	0141H	Motor No-load Current	0% to 99%	1%	*2	Yes		80
66	0142H	Slip Compensation Gain	0.0 to 2.5	0.1	0.0	No		80
67	0143H	Slip Compensation Time Constant	0.0 to 25.5 s	0.1 s	2.0 s	Yes		80
68	0144H	MEMOBUS Timeover Detection Selection	0 to 4	1	0	Yes		---
69	0145H	Baud Rate Setting	0 to 3	1	0	Yes		---
70	0146H	MEMOBUS Slave Address	0 to 32	1	0	Yes		---
71	0147H	MEMOBUS BPS Selection	0 to 3	1	2	Yes		---
72	0148H	MEMOBUS Parity Selection	0 to 2	1	0	Yes		---
73	0149H	Transmission Waiting Time	10 to 65 ms	1 ms	10 ms	Yes		---
74	014AH	RTS Control	0, 1	1	0	Yes		---
75 #1	014BH	Reducing Carrier Frequency Selection At Low Speed	0, 1	1	0	Yes		66
76 #1	014CH	Constant Copy Function Selection	rdy, rEd, Cpy, vFy, vA, Sno		rdy	Yes		84
77 #1	014DH	Constant Read Selection Prohibit	0, 1	1	0	Yes		85
78	014EH	Fault History	Stores, displays most recent alarm	Setting disabled	-	Yes		41
79	014FH	Software Version No.	Displays lower-place 3 digits of software No.	Setting disabled	-	Yes		---

* 1. Upper limit of setting range and initial setting are doubled for 400 V Class.
* 2. Depends on Inverter capacity. Refer to the next page.
* 3. Depends on Inverter capacity. Refer to page 65.
* 4. Initial setting of the model with Digital Operator (without potentiometer) is 1. Setting can be set to 0 by constant initialization.

- 200 V Class 3-phase

No.	Name	Unit	Initial Setting							
-	Inverter Capacity	kW	0.1	0.2	0.4	0.75	1.5	2.2	-	3.7
n32	Motor Rated Current	A	0.6	1.1	1.9	3.3	6.2	8.5	-	14.1
n64	Motor Rated Slip	Hz	2.5	2.6	2.9	2.5	2.6	2.9	-	3.3
n65	Motor No-load Current	%	72	73	62	55	45	35	-	32

- 200 V Class Single-phase

No.	Name	Unit	Initial Setting				
-	Inverter Capacity	kW	0.1	0.2	0.4	0.75	1.5
n32	Motor Rated Current	A	0.6	1.1	1.9	3.3	6.2
n64	Motor Rated Slip	Hz	2.5	2.6	2.9	2.5	2.6
n65	Motor No-load Current	%	72	73	62	55	45

- 400 V Class 3-phase

No.	Name	Unit	Initial Setting							
-	Inverter Capacity	kW	-	0.2	0.4	0.75	1.5	2.2	3.0	3.7
n32	Motor Rated Current	A	-	0.6	1.0	1.6	3.1	4.2	7.0	7.0
n64	Motor Rated Slip	Hz	-	2.5	2.7	2.6	2.5	3.0	3.2	3.2
n65	Motor No-load Current	%	-	73	63	52	45	35	33	33

10 Conformance to CE Markings

Points regarding conformance to CE markings are given below.

■ CE Markings

CE markings indicate conformance to safety and environmental standards that apply to business transactions (including production, imports, and sales) in Europe. There are unified European standards for mechanical products (Machine Directive), electrical products (Low Voltage Directive), and electrical noise (EMC Directive). CE markings are required for business transactions in Europe (including production, imports, and sales).

The VS mini Series Inverters bear CE markings indicating conformance to the Low Voltage Directive and the EMC Directive.

- Low Voltage Directive: 73/23/EEC
  93/68/EEC
- EMC Directive: 89/336/EEC
  92/31/EEC
  93/68/EEC

Machinery and installations that incorporate the Inverter are also subject to CE markings. It is ultimately the responsibility of customers making products incorporating the Inverter to attach CE markings to the finished products. The customer must confirm that the finished products (machines or installations) conform to the European Standards.

■ Requirements for Conformance to CE Markings

□ Low Voltage Directive

VS mini Series Inverters satisfy testing for conformance to the Low Voltage Directive under the conditions described in European Standard EN50178.

Requirements for Conformance to the Low Voltage Directive

VS mini Series Inverters must satisfy the following conditions in order to conform to the Low Voltage Directive.

- Only basic insulation to meet the requirements of protection class 1 and overvoltage category II is provided with control circuit terminals. Additional insulation may be necessary in the end product to conform to CE requirements.

- For 400 V Class Inverters, always ground the supply neutral to conform to CE requirements.

☐ EMC Directive

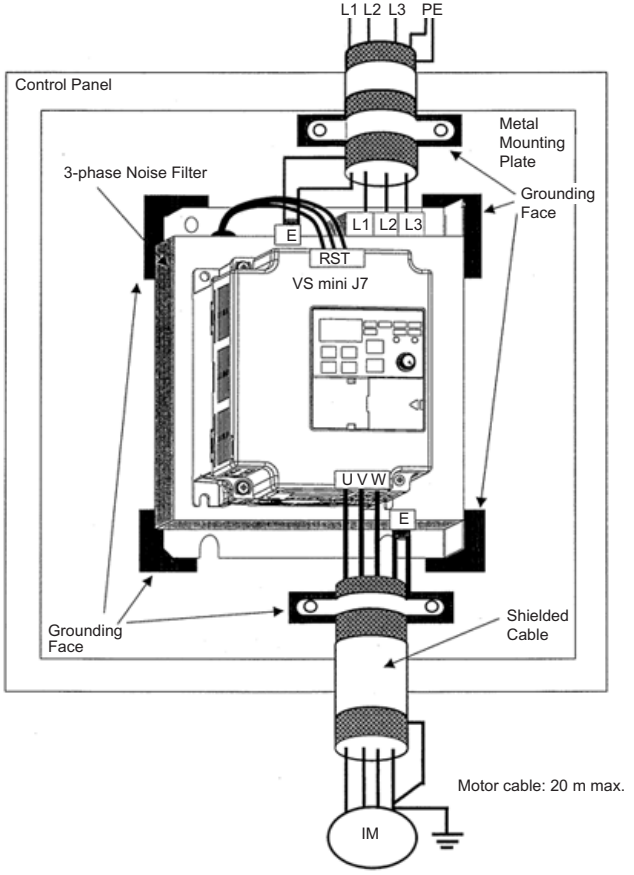
VS mini Series Inverters satisfy testing for conformance to the EMC Directive under the conditions described in European Standard EN61800-3.

Installation Method

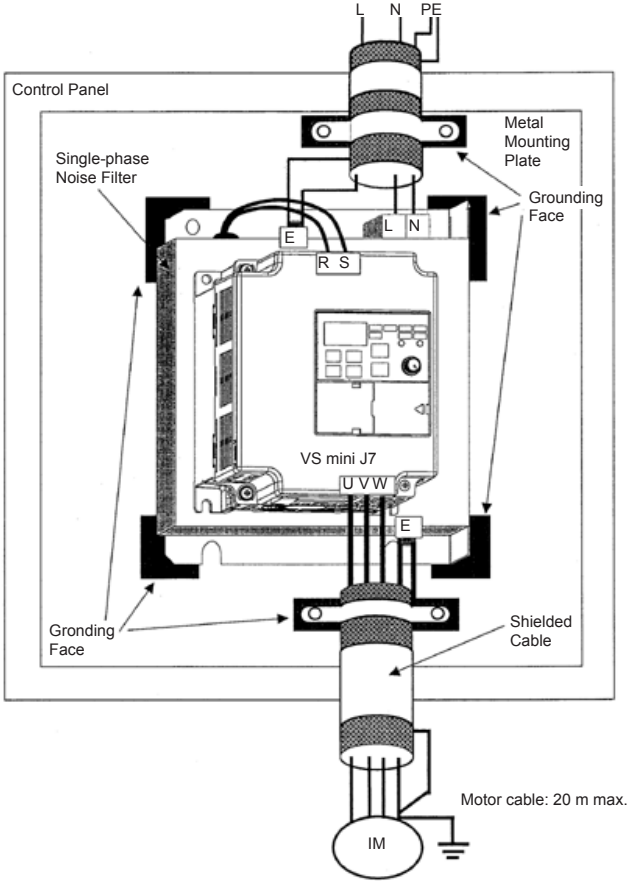
In order to ensure that the machinery or installation incorporating the Inverter conforms to the EMC Directive, perform installation according to the method below.

- Install a noise filter that conforms to European Standards on the input side. (Refer to *EMC Noise Filter* on page 133.)
- Use a shielded line or metal piping for wiring between the Inverter and Motor. Make the wiring as short as possible.
- For details of installation method, refer to Installation Manual (document No. EZZ008390.)

Installation and Wiring of Inverter and Noise Filter
(Model: CIMR-J7□□20P1 to 24P0),
(Model: CIMR-J7□□40P2 to 44P0)



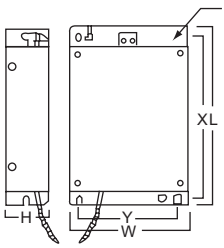
Installation and Wiring of Inverter and Noise Filter
(Model: CIMR-J7□□B0P1 to B1P5)



EMC Noise Filter

Voltage Class	Inverter Model CIMR-J7*□□	Noise Filter (Manufacturer: RASMI)						
		Model No.	Number of Phases	Rated Current (A)	Mass (kg)	Dimensions W×L×H	Y×X	ϕd
200 V	B0P1	RS1010-J7	1	10	0.6	71 × 169 × 45	51 × 156	5.0
	B0P2							
	B0P4							
	B0P7	RS1020-J7	1	20	1.0	111 × 169 × 50	91 × 156	5.0
	B1P5							
	20P1	RS2010-J7	3	10	0.8	82 × 194 × 50	62 × 181	5.0
	20P2							
	20P4							
	20P7							
	21P5	RS2020-J7	3	16	1.0	111 × 169 × 50	91 × 156	5.0
	22P2							
	23P7	RS2030-J7	3	26	1.1	144 × 174 × 50	120 × 161	5.0
	24P0							
400 V	40P2	RS3005-J7	3	5	1.0	111 × 169 × 45	91 × 156	5.0
	40P4							
	40P7	RS3010-J7	3	10	1.0	111 × 169 × 45	91 × 156	5.0
	41P5							
	42P2							
	43P0	RS3020-J7	3	15	1.1	144 × 174 × 50	120 × 161	5.0
	43P7							
	44P0							

The EMC-compliant J7 Series noise filter is footprint type.



CIMR-J7☐☐

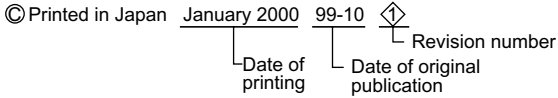
A to Z : Specifications

A to Z : Type

Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.

MANUAL NO. TOE-S606-12.1



Date of Printing	Rev. No.	Section	Revised Content
October 1999	–	–	First edition
January 2000	1	End of a book	Revision: Contents of sticker
June 2001	2	Notation for safety precautions	Revision: Warning/Caution mark
			Partly deleted
March 2002	3	Chapter 9	Addition: Minimum permissible load
April 2002	4	Notation for safety precautions	Addition: Warnings for CE Markings
July 2002	5	Chapter 8	Addition: Troubleshooting
August 2002	6	Front cover	Deletion: CE and UL marks
May 2003	7	Back cover	Revision: Address
July 2003	8	Chapter 5 Chapter 9	Partly revised
November 2003	9	Chapter 6	Revision: Inverter diagrams
October 2005	10	Notation for safety precautions	Addition: • WIRING Precaution when the 3-wire sequence is selected • Warranty Information
		Chapter 4	Revision: Descriptions of terminal symbols and tightening torque of the main circuits.

Date of Printing	Rev. No.	Section	Revised Content
October 2005	◇10◇	Chapter 5	Addition: • Table in the Description of Status Indicators • Flowchart in the Function Indicator Description Additional information for when LOCAL/REMOTE Selection and Constant No./data are selected
		Chapter 6	Addition: • Settings needed before operation after wiring • Setting 5 of Constant Selection/Initialization (n01) • *3 in the n081 Setting table • Settings 1, 9, 23 to 33 for multi-function input selection • Settings 8 and 9 for multi-function output selection.
		Chapter 8	Addition: • Descriptions of short circuit and grounding. • Description of setting for NPN/PNP switch. • Description of short-circuit bar.
		Chapter 9	Revision: • Descriptions of recommended magnetic contactor in the Recommended Peripheral Devices section. • A Change during Operation column has been inserted in the Constants list.
		Chapter 10	Added
		Back cover	Revision: Address
February 2006	◇11◇	Chapter 9	Revision: Max. output voltage in the Standard Specifications (200 V Class)

VS mini J7 Series
INSTRUCTION MANUAL

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