Varispeed-606PC3
INSTRUCTION MANUAL

ULTRA-COMPACT ALL-DIGITAL LOW-NOISE INVERTER (VS-606PC3)

MODEL : CIMR-PCA2, CIMR-PCE2 (230V 3-PHASE SERIES)
CIMR-PCAB, CIMR-PCEB (240V SINGLE-PHASE SERIES)
CIMR-PCA4, CIMR-PCE4 (460V 3-PHASE SERIES)

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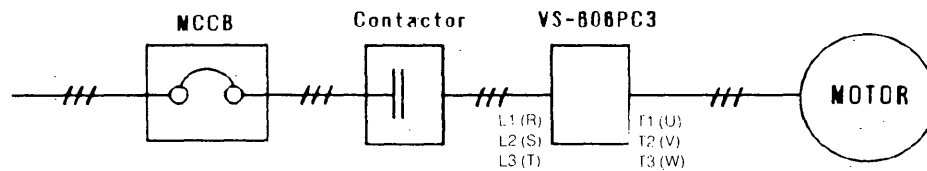
YASKAWA

MANUAL NO. TOE-S606-3D

What's an inverter?

In spite of its compact size, you will be impressed with the great number of control features available with the VS-606PC3 inverter. Installed between the power source and your motor, the VS-606PC3 will give you years of service that will increase performance and save you money.

```
        MCCB          Contactor      VS-606PC3
                                                              _____
                      ┌──┐          ┌──────┐                 /           \
───///──┌──o──o──┐───///──┤  ├───///──┤      ├──────///──(   MOTOR    )
        └────────┘      └──┘          └──────┘              \           /
                                  L1 (R)    T1 (U)            _____/
                                  L2 (S)    T2 (V)
                                  L3 (T)    T3 (W)
```

3-Phase 200~230V 50/60 Hz

The main feature of the VS-606PC3 is its efficient control of motor speed. Because the inverter can control motor speed this means you can now use one motor for conventional applications that until now required more than one motor. The inverter also smoothes motor operation and reduces motor noise.

The industrial applications of inverters are wide ranging, including air conditioners, fans, blowers, pumps, conveyers, cranes, and hoists. But the inverter also has a place in the home and office, in any location where saving energy and high performance of electrical appliances and equipment are required. Their noise-reduction capabilities make inverters ideal for motors that power elevators, automatic doors, and other electric equipment in the quiet environment demanded of intelligent buildings and hospitals.

☐ High torque at low speeds

The VS-606PC3 delivers tough performance, high torque at low speeds, with tripless operation. The inverter's automatic boost feature, made possible by originally developed vector control and sine wave drive achieves 150% (or greater) torque even at low 1/20 speed. Heat overload protection is also available for the inverter and motor, regardless of motor type.

☐ Eliminates noise

The VS-606PC3 eliminates motor noise that has plagued and continues to plague conventional inverters. This feature is made possible by YASKAWA's original asynchronous high-carrier technology for sine wave PWM control. Running noises have been reduced by 20 dB, compared to other PWM inverters. This reduction of motor noise assures you a more comfortable working and living environment.

☐ Guarantees continuous operation

The VS-606PC3 automatically resets itself after momentary power losses of up to 2 seconds (1 second for 0.75 kW or lower models). Its fault retry feature performs self-diagnosis and restarts automatically without stopping the motor.

☐ Compact size

A compact size and rugged, enclosed construction means the inverter can easily be installed even in a harsh environment. Two types of enclosures are available:

• Enclosed wall-mounted type

• Water and dust tight type

To meet a wide range of needs, two main series are available :

• From 0.13 to 5HP (0.1 to 3.7 kW) for the 200 V, 3-phase and single-phase series

• From 0.5 to 5HP (0.2 to 3.7 kW) for the 400 V, 3-phase series.

☐ Easy operation

The VS-606PC3 is available in two basic configurations with:

• A digital operator

• An indicating cover

The digital operator is a 10-key operation panel equipped with a 1- line digital display. With the keys and display, you can easily change constant settings for a variety of important features. The digital display also lets you visually monitor inverter output frequency or output current, and also displays a fault code as soon as a problem occurs. With the digital operator installed, remote operation through control terminals is also possible.

The indicating cover can be used to replace the digital operator. The indicating cover, with only two LEDs and no digital display, is used for applications where the digital operator is not needed for each inverter, such as for group drives. For details, contact your service representative.

PREFACE

This instruction manual describes installation, maintenance and inspection, troubleshooting, and specifications of the VS-606PC3. Read this instruction manual thoroughly before operation.
In this manual, "constant (No. ____)" indicates the item number of control constant set by digital operator.

YASKAWA ELECTRIC CORPORATION

General Precautions

• Some drawings or photos in this manual are shown with the protective cover or shields removed, in order to describe detail with more clarity. Make sure all covers and shields are replaced before operating this product.

• This manual may be modified when necessary because of improvement of the product, modification, or changes in specifications.
Such modifications are denoted by a revised manual No.

• To order a copy of this manual, if your copy has been damaged or lost, contact your YASKAWA representative.

• YASKAWA is not responsible for any modification of the product made by the user, since that will void your guarantee.

NOTES FOR SAFE OPERATION

Read this instruction manual thoroughly before installation, operation, maintenance or inspection of the VS-606PC3. In this manual, NOTES FOR SAFE OPERATION are classified as "WARNING" or "CAUTION".
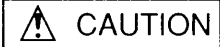
⚠ WARNING

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

⚠ CAUTION

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

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

Identifying the parts

⚠ CAUTION
(Ref. page)
• Do not install or operate any inverter which is damaged or has missing parts.   Failure to observe this caution may result in personal injury or equipment damage.··1-10

Handling/mounting the inverter

⚠ CAUTION
(Ref. page)
• Lift the cabinet by the die-cast case. When moving the unit, never lift by front cover or the terminal cover. Otherwise, the main unit may be dropped causing damage to the unit.· ·1-10
• Mount the inverter on nonflammable material (i.e. metal). Failure to observe this caution can result in a fire
• When mounting units of enclosed wall-mounted type (NEMA1) in an enclosure, remove the top and bottom covers and terminal cover of the inverter box, then install a fan or other cooling device to keep the intake air temperature below 113°F (45°C). Overheating may cause a fire or damage to the unit.· · · · · · · · · · · · ·2-9
• Never submerse the unit of water and dust tight type (NEMA4) in water. Failure to observe this caution can result in an electrical shock, personal injury or inverter damage.· 2-11

Wiring/grounding

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

(Ref. page)

- Make sure to ground the ground terminal ⏚ (E,G).
  (Ground resistance :
  200V class: 100Ω or less, 400V class: 10Ω or less)
  Failure to observe this warning can result in an electrical
  shock or a fire.· 2-3, 2-28

⚠ CAUTION

(Ref. page)

- Verify that the inverter rated voltage coincides with
  the AC power supply voltage.
  Failure to observe this caution can result in personal injury
  or a fire.

- Do not perform a withstand voltage test of the inverter.
  It may cause semi-conductor elements to be damaged.

- To connect a braking resistor, braking resistor unit
  or braking unit, follow the procedures described in
  this manual.
  Improper connection may cause a fire.· ·2-19

- Make sure to tighten terminal screws.
  (See page 2-3 for tightening torque.)
  Failure to observe this caution can result in a malfunction,
  damage or a fire. ·2-3, 2-32

- Never connect the AC main circuit power supply to
  output terminals T1, T2 and T3 (U, V and W).
  The inverter will be damaged and invalidate the
  guarantee.· 2-18, 2-32

Operation

⚠ WARNING

(Ref. page)

- For units of water and dust tight type (NAMA4),
  only turn ON the input power supply after replacing
  the front cover and the bottom cover. Do not remove
  the cover while current is flowing.

  Failure to observe this warning can result in an electrical shock.

- For units of enclosed wall-mounted type (NEMA1),
  never operate the digital operator or the switches
  when your hand is wet.

  Failure to observe this warning can result in an electrical shock.

- Never touch the terminals while current is flowing,
  even during stopping.

  Failure to observe this warning can result in an electrical shock.

- When the fault retry function is selected, stand
  clear of the inverter or the load, since it may restart
  suddenly after being stopped.
  (Construct machine system, so as to assure safety for
  personnel, even if the inverter should restart.)

  Failure to observe this warning can result in personal
  injury. · 6-48

- Since the digital operator stop button can be disabled
  by a function setting, install a separate emergency
  stop switch.

  Failure to observe this warning can result in personal injury.

- If the power supply is turned ON with the operation signal ON,
  the inverter restarts automatically. Only turn ON the power
  supply after verifying that the operation signal is OFF.

  Failure to observe this warning can result in personal injury.

⚠ CAUTION

- Never touch the die-cast case or braking resistor since the temperature is very high.

  Failure to observe this caution can result in harmful burns to the body.

- Since it is easy to change operation speed from low to high speed, verify the safe working range of the motor and machine before operation.

  Failure to observe this caution can result in personal injury and machine damage.

- Install a holding brake separately if necessary.

  Failure to observe this caution can result in personal injury.

- Do not check signals during operation.
  Never connect any meters, oscilloscopes or other test instruments while power is ON.

  The machine or the inverter may be damaged.

- All the constants of the inverter have been preset at the factory. Do not change the settings unnecessarily.

  The inverter may be damaged.

Maintenance

⚠ WARNING

(Ref. page)

- Disconnect electrical supply before servicing the electrical system.

  Failure to observe this warning can result in an electrical shock.

- Never touch high-voltage terminals in the inverter.

  Failure to observe this warning can result in an electrical shock.

- Disconnect all power before performing maintenance or inspection. Then wait at least one minute after the power supply is disconnected and CHARGE LED goes OFF.

  The capacitors are still charged and can be dangerous. · · · · · · · · · · · ·9-2

⚠ WARNING

• Only authorized personnel should be permitted to perform maintenance, inspections or parts replacement.

[Remove all metal objects (watches, bracelets, etc.) before operation.]
(Use tools which are insulated against electrical shock.)
Failure to observe this warning can result in an electrical shock.

⚠ CAUTION

(Ref. page)

• The control PC board employs CMOS ICs.
Do not touch the CMOS elements.

They are easily damaged by static electricity.

• Do not connect or disconnect wires or digital operator while power is applied to the circuit.

Failure to observe this caution can result in personal injury.·········3-2

Others

⚠ WARNING

• Never modify the product.

Failure to observe this warning can result in an electrical shock or personal injury and will invalidate the guarantee.

AVERTISSEMENT

Des tensions subsistent aux bornes des condensateurs pendant cinq minutes après l'ouverture de circuit d'entrée.
Couper l'alimentation avant d'entreprendre le depannage du système électrique.

ATTENTION

Une protection distincte contre les surintensités, la surcharge et la surchaufee de moteur doit être fournie conformément AU CODE CANADIAN DE L'ELECTRICITE, PREMIER PARTIE et LE NATIONAL DE L'ELECTRICITE.

WARNING LABEL

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

Example of Enclosed Wall-mounted Type (NEMA1)
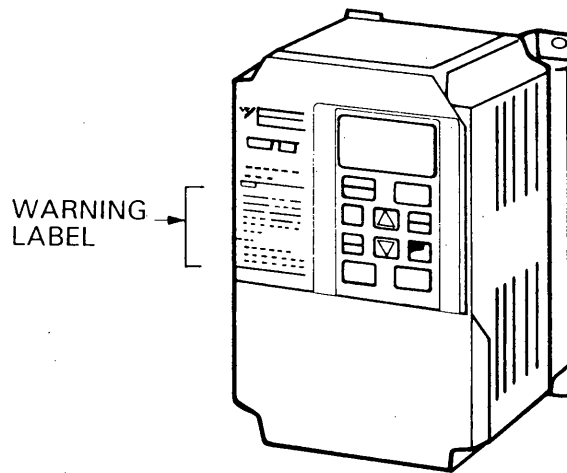
WARNING
LABEL →

Warning Label

⬦! 危　険
感電のおそれが あります。 ・通電中及び電源遮断後１分 　以内はターミナルカバーを 　開けないで下さい。
── YASKAWA

Japan Domestic Standard Model
CIMR-PCA [_____]

⚠ WARNING
May cause electric shock. ・Disconnect all power before opening terminal cover of unit. Wait 1 minute until DC Bus capacitors discharge.

European Standard Model
CIMR-PCE [_____]

Table of Contents

6. SELECTED APPLICATIONS 6-1

1. READ THIS FIRST...

Read this section first because it contains important information that helps you get started using your new VS-606PC3.

This section includes a quick start summary if you are in a hurry to get started. To work safely, be sure to read the cautions and warnings in this section before going on to other parts of this manual.

If you are in a hurry ...

If you have experience with this type of inverter, you may be in a hurry to get started. Below is a quick summary of the start-up procedures for units which include the optional digital operator.

If you have an indicating cover with no digital display installed, after you complete the main circuit wiring and control terminal wiring, go to section *4. USING THE INDICATING COVER.*

Hardware installation tips

1. Connect main circuit wiring. (2-18)
2. Connect control wiring. (2-29)
3. The inverter is properly grounded. (2-28)

   A list of peripherals and optional equipment is provided in the appendix.
4. Turn on the inverter.

   As soon as you turn the inverter on, you should see:

   ```
   F000.0
   ```

   Having problems? If you see any other code, or if *all* the digits in the display are blinking, refer to section *8. TROUBLESHOOTING.*
5. Do preliminary testing. If you are using the digital operator follow the procedure for the first operation test. (3-10)
6. If you are using the indicating cover, do the operation test for the indicating cover. (4-3)

Using the digital operator

> ```
> F ̈00.0
> ```

[DSPL] **1.** Press DSPL repeatedly to scroll the 1-line display:

    ⌐→ F000.0   Frequency value
    │   0.0   Output frequency
    │   0.0A   Output current
    └─ no-00   Constant display

The blinking digit in the display tells you that you can change this digit by pressing △ or ▽.

[PRGM DRIVE] **2.** Press PRGM DRIVE to change between the drive and program mode. Indicates that the inverter is in the program mode.

> ```
> no-01
> ```

[DATA ENTER] **3.** Press DATA ENTER to enter the next level.

> ```
> 0011
> ```

[▷ RESET] **4.** Press ▷ to move the blinking digit display to the right so you can select the digit you want to change.

[△] **5.** Press △ to increase the number.

[▽] **6.** Press ▽ to decrease the number.

[DATA ENTER] **7.** Press DATA ENTER to enter the number you've changed.

    • *After you change a constant, always press* DATA ENTER *to save the change in the inverter memory.*

[△] **8.** Press △ to select a higher constant number.

    -or-

[▽]   Press ▽ to select a lower constant number.

[PRGM DRIVE] **9.** When you are finished making changes, press PRGM DRIVE to leave the program mode and enter the drive mode. For a quick summary of all the constant settings, see section *7. QUICK REFERENCE.*

Before you try to set constants, be sure you know how to:

• Enter the program mode. (6-2)

• Initialize the inverter, with the password and release constants **no-20** to **no-59** from write protection. (6-4)

For a detailed description of inverter applications, see section *6. SELECTED APPLICATIONS.*

How to use this manual

For best results, read this manual in the order that it is presented. The manual is designed to take you from opening the box to programming the inverter for advanced applications.

The first 5 sections of the manual are designed to get you set up and operating the inverter as quickly as possible.

Do the procedures as they are described to test your installation and to also to learn how to set constants in the inverter program mode.

1. READ THIS FIRST
This section gets you started by telling you how to read the name plate on the side of the inverter. Check this information to be sure you have the type of inverter that you ordered.

2. INSTALLING THE INVERTER
Tells you what you need before you get started, and how to do the physical installation of the inverter. Carefully follow the instructions for main circuit and control terminal wiring in this section. Some optional peripheral devices such as MCs, MCCBs, and surge suppressors are also described.

3. BASICS: A HANDS ON INTRODUCTION
Work through this section of the manual by doing the procedures on the inverter. This section not only introduces how to use the digital operator, but also walks you step by step through initial testing of your inverter installation. After changing some constants, first, we'll show you how to restore the factory settings. Then we'll show you how to set up the inverter for remote control through the terminals. If your inverter has an indicating cover with no digital display, you can skip this section.

4. USING THE INVERTER WITH AN INDICATING COVER
Shows you how to remove the digital operator and mount the indicating cover. Follow the procedures in this section to perform initial testing of your inverter with the indicating cover installed.

5. SETTING UP APPLICATIONS
Guides you step by step through setting up more complicated applications. After you complete this section, you will be able to use any of the settings described *7. QUICK REFERENCE.*

6. SELECTED APPLICATIONS

Describes important applications that can be set up by changing constants with the digital operator in the inverter's program mode.

7. QUICK REFERENCE

Tables provide a concise summary of all features that can be set up by changing constants with the digital operator in the inverter's program mode. Factory settings, constants that remain in effect until they are set or changed, are also listed.

8. TROUBLESHOOTING

Provides information about how to solve problems when they occur. Fault tables listing digital fault messages on the digital operator and LED displays on the indicating cover are described and solutions are provided for operation problems. A separate table provides a list of possible motor and connection errors.

APPENDIXES

The appendixes provide information about daily maintenance, high voltage testing, lists of optional peripherals that are available, and VS-606PC3 series specifications.

Symbols and terms you should know

- *Text in italics describes helpful hints, restrictions, or how to avoid minor difficulties.*

60 Hz
Unless otherwise noted, the reference frequency in all examples is assumed to be 60 Hz.

indicating cover
With the digital operator installed, the inverter can be operated with the operator keys and constants can be set and saved to the inverter memory. With the digital operator removed and the indicating cover installed in its place, the inverter can be operated only with external signals. The digital operator and indicating cover can easily be exchanged.

display
The term *display* refers to the 5-digit display on the digital operator. The startup display looks like this:

```
┌─────────────┐
│  F00.0      │
└─────────────┘
```

You can scroll the display among the four possible selections by pressing the DSPL key.

digital operator JVOP-110
This is the digital operator. With its keys you can operate the motor from the inverter and set up constants for operation and save them to the inverter's memory. The digital operator can be removed and replaced with an indicating cover. With the indicating cover installed, the inverter can be controlled only by external signals.

factory setting
These are constants that are set up for the inverter before shipping. To adjust these settings for your load requirements, you have to use the digital operator JVOP-110. Factory settings are listed in the tables in section 7. *QUICK REFERENCE.*

LEDs These symbols are used in this manual to describe the status of the LEDs:

● OFF

⋆Ọ⋆ ON

⋆Ọ⋆ Blinking

MC Stands for *magnetic contactor.*

MCCB Stands for *molded case circuit breaker.*

mode *Mode* refers to a method of operation. For example, in the FWD (forward) mode (when viewed from the back) the motor turns counter-clockwise and in the reverse mode it turns clockwise. Switch between the forward and reverse modes by pressing the **FWD/REV** key. In the *program mode* you can set up operation constants and in the *drive mode* you can operate the motor with the inverter's digital display. Switch between these modes by pressing the **PRGM DRIVE** key.

no-00 This is what you see in the display after you press **PRGM DRIVE** to enter the program mode. Press △ to change the number upward or press ▽ to change it downward. Up to **no-59** selections can be displayed. For details, see section *7. QUICK REFERENCE.*

In timing charts, to save space this notation is abbreviated by enclosing the number in a box. For example, constant 8, which would normally appear in text as **no-08**, would be abbreviated in a timing chart as 8 .

terminals Depending on your area, there may be some difference in how you designate your input, output, and ground terminals. In this manual the following notations are used:

• Input terminals are L1, L2, L3 (R, S, T) where L1, L2, L3 correspond respectively to R, S, T.

• Output terminals T1, T2, T3 (U, V, W) where T1, T2, T3 correspond respectively to U, V, W.

• Ground terminal ⏚ (E, G) where ⏚ corresponds to E or G.

What's in the box?

After you open the box, be sure you have everything.

☐ VS-606PC3 Inverter

☐ User manual

Identifying the parts

Read this section and take a few moments to become familiar with the names of the parts.

Enclosed wall-mounted type (NEMA1)
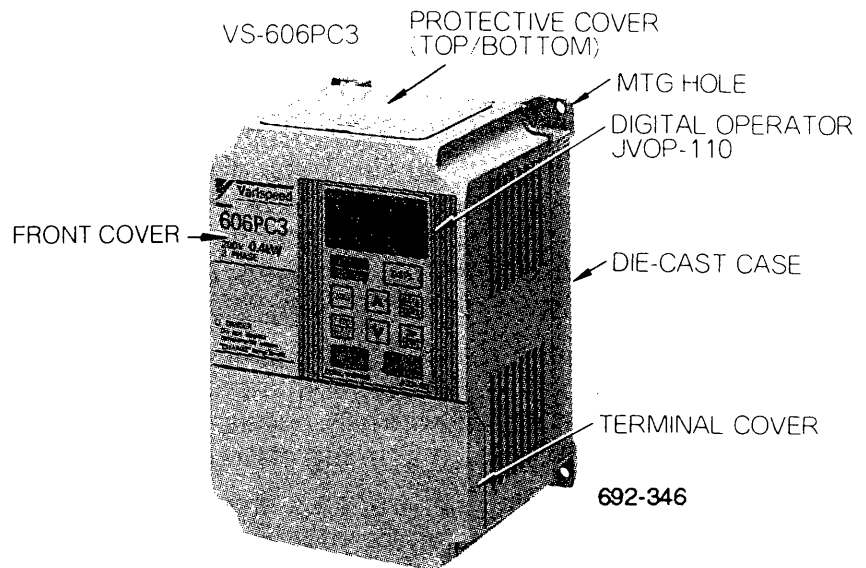
VS-606PC3 PROTECTIVE COVER (TOP/BOTTOM)

MTG HOLE

DIGITAL OPERATOR JVOP-110

FRONT COVER

DIE-CAST CASE

TERMINAL COVER

692-346

Water and dust tight type (NEMA4)

UNIT COVER

FRONT COVER

DIGITAL OPERATOR JVOP-110

DIE-CAST CASE

693-241

BOTTOM COVER
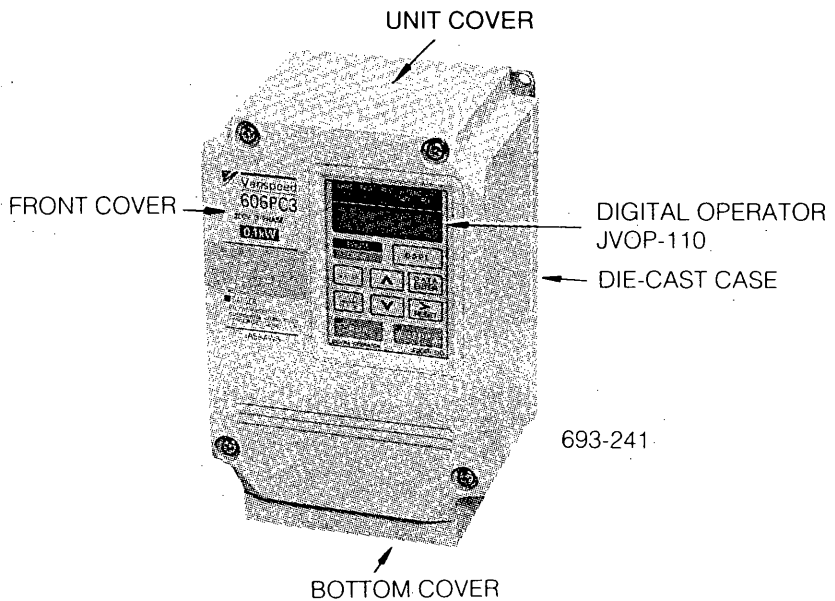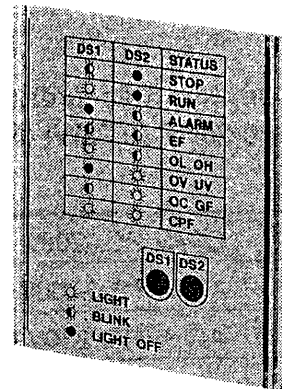
The indicating cover can be used to replace the digital operator after the inverter has been set up. The digital operator and the indicating cover can be easily removed and exchanged.

692-359

Indicating cover

After you unpack the VS-606PC3, immediately check the following.

☐ Verify that the part numbers you have received match your purchase order or packing slip.

☐ Check the unit for physical damage that may have occurred during shipping.

If any part of the VS-606PC3 is missing or damaged, call for service immediately.

Handling the inverter

The VS-606PC3 is a precision piece of equipment. To ensure long years of reliable service, handle it with care to avoid damage .

Caution!

• *Never pick up or hold the inverter unit by the front cover or the unit cover.*

• *Never submerse water and dust tight type (NEMA4) in water.*

Checking the name plate

Japan Domestic Standards for Types of 3-phase,
200VAC, 0.25HP (0.2kW) (NEMA1)

INVERTER MODEL →

INPUT SPEC. →

LOT NO. →

MODEL	: CIMR-PCA20P2 SPEC : 20P2D1
INPUT	: AC 3PH 200-230V 50Hz/60Hz 1.7A
OUTPUT	: AC 3PH 0-230V 0.6kVA 1.5A
LOT NO.	: MASS : 1.1kg
SER NO.	:

← OUTPUT SPEC.

← MASS

← SERIAL NO.

YASKAWA ELECTRIC CORPORATION MADE IN JAPAN

CIMR - PC A 2 0P2

Inverter ─────────────

VS-606PC3 series ───────

Specifications ─────────
A : Japan domestic standards
E : European standards

Voltage class ──────────
.2 : Three-phase, 230V
4 : Three-phase, 460V
B : Single-phase, 240V

Applicable maximum motor output
0P1 : 0.13HP (0.1kW)
0P2 : 0.25HP (0.2kW)
    to
3P7 : 5HP (3.7kW)
"P" indicates a decimal point.

Japan Domestic Standards for Types of 3-phase,
200VAC, 0.25HP (0.2kW) (NEMA1)

INVERTER MODEL ----►

INPUT SPEC. ----►

LOT NO. ----►

| MODEL : CIMR-PCA20P2 SPEC : 20P2D1 |
| INPUT : AC 3PH 200-230V 50Hz/60Hz 1.7A |
| OUTPUT : AC 3PH 0-230V 0.6kVA 1.5A |
| LOT NO. : MASS : 1.1kg |
| SER NO. : |
| ✔ YASKAWA ELECTRIC CORPORATION MADE IN JAPAN |

◄— OUTPUT SPEC.

◄— MASS

◄— SERIAL NO.

2 0P2 D 1 B

Voltage
2 : Three-phase, 230V
4 : Three-phase, 460V
B : Single-phase, 240V

Revision mark

Enclosures
1 : NEMA1
(Enclosed wall-mounted type)
8 : NEMA4
(Water and dust tight type)

Digital operator
D : Digital operator provided
N : Digital operator not provided
(Indicating cover provided)

Applicable maximum motor output
0P1 : 0.13HP (0.1kW)
0P2 : 0.25HP (0.2kW)
to
3P7 : 5HP (3.7kW)
"P" indicates a decimal point.

2. INSTALLING THE INVERTER

Follow the procedures in this section to install your inverter.
This section describes:

- What you need to install the inverter.
- Choosing a good location for mounting the inverter.
- Mounting the inverter.
- Doing main circuit and control terminal wiring.
- Optional peripheral equipment.

What you need for wiring

This is list of items you may need to install the inverter.

□ **Connectors**

You'll need UL Listed and CSA Certified closed-loop (ring) connectors, sized for the wire gauge to be used for wiring the terminals. Install the connectors with the correct crimp tool specified by the connector manufacturer.

□ **Cooling a common enclosure**

If you are going to install the VS-606PC3 in a common enclosure, you will need to install a fan or other cooling device to keep the air entering the inverter below 113°F (45°C).

□ **Wire size**

Determine wire size by the voltage drop. Use the following equation to select a wire size so the voltage drop will be within 2% of the normal rated voltage.

V = Phase-to-phase voltage drop

R = Wire resistance (Ω/km)

M = Wiring distance (meters)

C = Current (A)

$V = \sqrt{3} \times R \times M \times C \times 10^{-3}$ (volts)

□ **Power supply over 600 kVA?**

If the power supply capacity exceeds 600 kVA, then you should connect an AC reactor at the inverter input side to coordinate the power supply. The reactor will also improve the power factor of the power supply. For details, see *Appendix 3: Options and peripheral units*.

□ **Wire separating inverter and motor excessively long?**

If the length of wire between the inverter and the motor is excessively long and the inverter carrier frequency (main transistor switching frequency) is high, the effect of harmonic leakage current from the wire for the inverter or peripherals will increase. To avoid this problem when you have to use a long wire between the inverter and motor, reduce the inverter carrier frequency. To reduce the carrier frequency, follow the procedure on page 5-10.

□ **Ground (Earth) wires**

For large-current electrical equipment, ground wires should be run in a conduit separate from the wires. Use only ground wires that comply with AWG standards.

□ **Wiring**

Before you get started, be sure you have wiring that meets specifications for the inverter you want to install.

• *Use 600V vinyl-sheathed lead or equivalent.*
• *Use 75˚C copper wires only.*
• *Low voltage terminals shall be wired with Class I Wiring.*

• 230 V Class 3-phase Input Series

Circuit	VS-606PC3 Model CIMR-	Terminal			Wire Size	
		Symbol	Screw	Torque	AWG	mm²
Main Circuit	PC□20P1	L1(R), L2(S), L3(T), B1/ ⊕ (B1/P), B2, T1(U), T2(V),T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
	PC□20P2	L1(R), L2(S), L3(T), B1/ ⊕ (B1/P), B2, T1(U), T2(V),T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
	PC□20P4	L1(R), L2(S), L3(T), B1/ ⊕ (B1/P), B2, T1(U), T2(V),T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
	PC□20P7	L1(R), L2(S), L3(T), B1/ ⊕ (B1/P), B2, T1(U), T2(V),T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
	PC□21P5	L1(R), L2(S), L3(T), B1/ ⊕ (B1/P), B2, T1(U), T2(V),T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
	PC□22P2	L1(R), L2(S), L3(T), B1/ ⊕ (B1/P), B2, T1(U), T2(V),T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
	PC□23P7	L1(R), L2(S), L3(T), B1/ ⊕ (B1/P), B2, T1(U), T2(V),T3(W)	M4	1.43	12-10	3.5 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
Control Circuit	Common to All Models	① to ⑭ FLT-A, FLT-B, FLT-C	M3.5	0.95	28-14	0.1 to 2

Note : where □ is "A" or "E".

□ Wiring (cont.)

• 240 V Class Single-phase Input Series

Circuit	VS-606PC3 Model CIMR-	Terminal			Wire Size	
		Symbol	Screw	Torque	AWG	mm²
Main Circuit	PC B0PI	L1(R), L2(S), B1/⊕ (B1/P), B2,T1(U) T2(V),T3(W)	M4	1.43	14-10	2 to 5.5
		⏚(E,G)		1.43	14-10	2 to 5.5
	PC B0P2	L1(R), L2(S), B1/⊕ (B1/P), B2,T1(U), T2(V),T3(W)	M4	1.43	14-10	2 to 5.5
		⏚(E,G)		1.43	14-10	2 to 5.5
	PC B0P4	L1(R), L2(S), B1/⊕ (B1/P), B2,T1(U), T2(V),T3(W)	M4	1.43	14-10	2 to 5.5
		⏚(E,G)		1.43	14-10	2 to 5.5
	PC B0P7	L1(R), L2(S),B1/⊕ (B1/P), B2,T1(U), T2(V),T3(W)	M4	1.43	14-10	2 to 5.5
		⏚(E,G)		1.43	14-10	2 to 5.5
	PC B1P5	L1(R), L2(S),B1/⊕ (B1/P), B2,T1(U), T2(V),T3(W)	M4	1.43	14-10	2 to 5.5
		⏚(E,G)		1.43	14-10	2 to 5.5
	PC B2P2	L1(R), L2(S),B1/⊕ (B1/P), B2,T1(U), T2(V),T3(W)	M5	2.24	12-8	3.5 to 8
		⏚(E,G)	M4	1.43	14-8	2 to 8
	PC B3P7*	L1(R), L2(S),B1/⊕ (B1/P), B2,T1(U), T2(V),T3(W)	M5	2.24	10-8	5.5 to 8
		⏚(E,G)	M4	1.43	14-8	2 to 8
Control Circuit	Common to All Models	① to ⑭ FLT-A, FLT-B, FLT-C	M3.5	0.95	28-14	0.1 to 2

Note : where □ is "A" or "E".
*Water and dust tight type (NEMA4) not provided for this model.

□ Wiring (cont.)

- 460V Class 3-phase Input Series

Circuit	VC-606PC3 Model CIMR-	Terminal			Wire Size	
		Symbol	Screw	Torque	AWG	mm²
Main Circuit	PC.40P2	L1(R), L2(S), L3(T), B1/ ⊕, (B1/P), B2, T1(U), T2(V), T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
	PC.40P4	L1(R), L2(S), L3(T), B1/ ⊕, (B1/P), B2, T1(U), T2(V), T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
	PC.40P7	L1(R), L2(S), L3(T), B1/ ⊕, (B1/P), B2, T1(U), T2(V), T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
	PC.41P5	L1(R), L2(S), L3(T), B1/ ⊕, (B1/P), B2, T1(U), T2(V), T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
	PC.42P2	L1(R), L2(S), L3(T), B1/ ⊕, (B1/P), B2, T1(U), T2(V), T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
	PC.43P7	L1(R), L2(S), L3(T), B1/ ⊕, (B1/P), B2, T1(U), T2(V), T3(W)	M4	1.43	14-10	2 to 5.5
		⊕(E,G)		1.43	14-10	2 to 5.5
Control Circuit	Common to All Models	① to ⑭ FLT-A, FLT-B, FLT-C	M3.5	0.95	28-14	0.1 to 2

Note : where ⬚ is "A" or "E".

Choosing a location to mount the inverter

To ensure proper performance and long operating life, follow the recommendations below when you choose a location for installation of the VS-606PC3.

Checklist for site location

Be sure the inverter is protected from the following conditions:

☐ Extreme cold and heat. Use only within ambient temperature range : 14 to 104°F (-10 to + 40°C)

☐ Rain, moisture. (For enclosed wall-mounted type)

☐ Oil sprays, splashes

☐ Salt spray

☐ Direct sunlight. (Avoid using outdoors.)

☐ Corrosive gases or liquids.

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

☐ Physical shock, vibration.

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

☐ High humidity.

☐ Radioactive substances.

☐ Combustibles : thinner, solvents, etc.

Mounting the inverter

Refer to the figure on next page to provide sufficient space on the top, bottom, and sides to allow the VS-606PC3 to cool during operation.

1. Use the 4 mounting holes at the four corners of the inverter case.

2. For effective cooling and easy access, install the VS-606PC3 vertically.
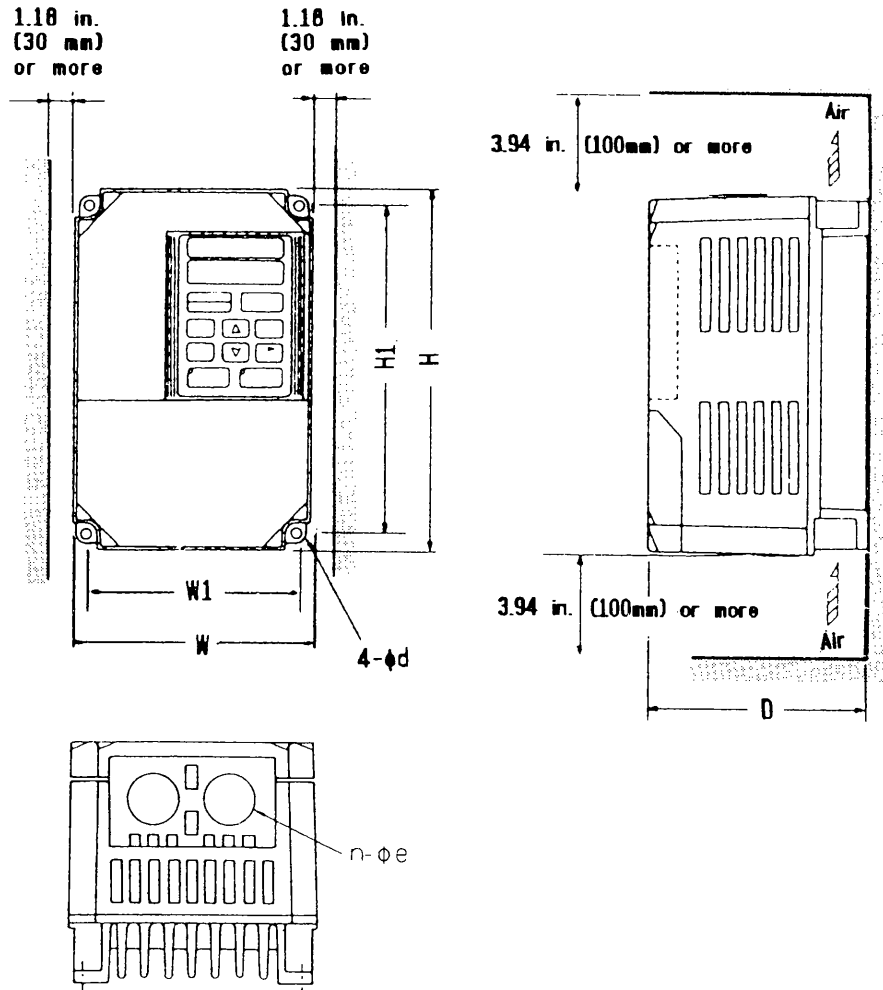
Enclosed wall-mounted type (NEMA1)

Table of dimensions for various models

VS-606PC3 Model CIMR-PC.	W	W1	H	H1	D	d	n-φe
20P1 20P2 20P4	4.13 (105)	3.66 (93)	5.91 (150)	5.43 (138)	3.94 (100)	0.20 (5)	2-φ0.87 (2-φ22)
20P7 21P5	5.51 (140)	5.04 (128)	5.91 (150)	5.43 (138)	5.45 (138.5)	0.20 (5)	3-φ0.87 (3-φ22)
22P2 23P7	5.51 (140)	4.96 (126)	7.87 (200)	7.32 (186)	6.69 (170)	0.22 (5.5)	1-φ0.87 2-φ1.10 $\left(\begin{array}{l}1\text{-}φ22\\2\text{-}φ28\end{array}\right)$
B0P1 B0P2 B0P4	5.51 (140)	5.04 (128)	5.91 (150)	5.43 (138)	5.45 (138.5)	0.20 (5)	3-φ0.87 (3-φ22)
B0P7 B1P5	5.51 (140)	4.96 (126)	7.87 (200)	7.32 (186)	6.69 (170)	0.22 (5.5)	1-φ0.87 2-φ1.10
B2P2 B3P7	7.48 (190)	6.89 (175)	7.87 (200)	7.28 (185)	7.48 (190)	0.23 (5.8)	$\left(\begin{array}{l}1\text{-}φ22\\2\text{-}φ28\end{array}\right)$
40P2 40P4	5.51 (140)	4.96 (126)	7.87 (200)	7.32 (186)	4.72 (120)	0.22 (5.5)	1-φ0.87
40P7 41P5	5.51 (140)	4.96 (126)	7.87 (200)	7.32 (186)	6.69 (170)	0.22 (5.5)	2-φ1.10 $\left(\begin{array}{l}1\text{-}φ22\\2\text{-}φ28\end{array}\right)$
42P2 43P7	7.48 (190)	6.89 (175)	7.87 (200)	7.28 (185)	7.48 (190)	0.23 (5.8)	

Caution!

• *When mounting units in an enclosure, remove the top and bottom covers and terminal cover of the inverter box, then install a fan or other cooling device to keep the air entering the inverter below 113°F (+45°C)*
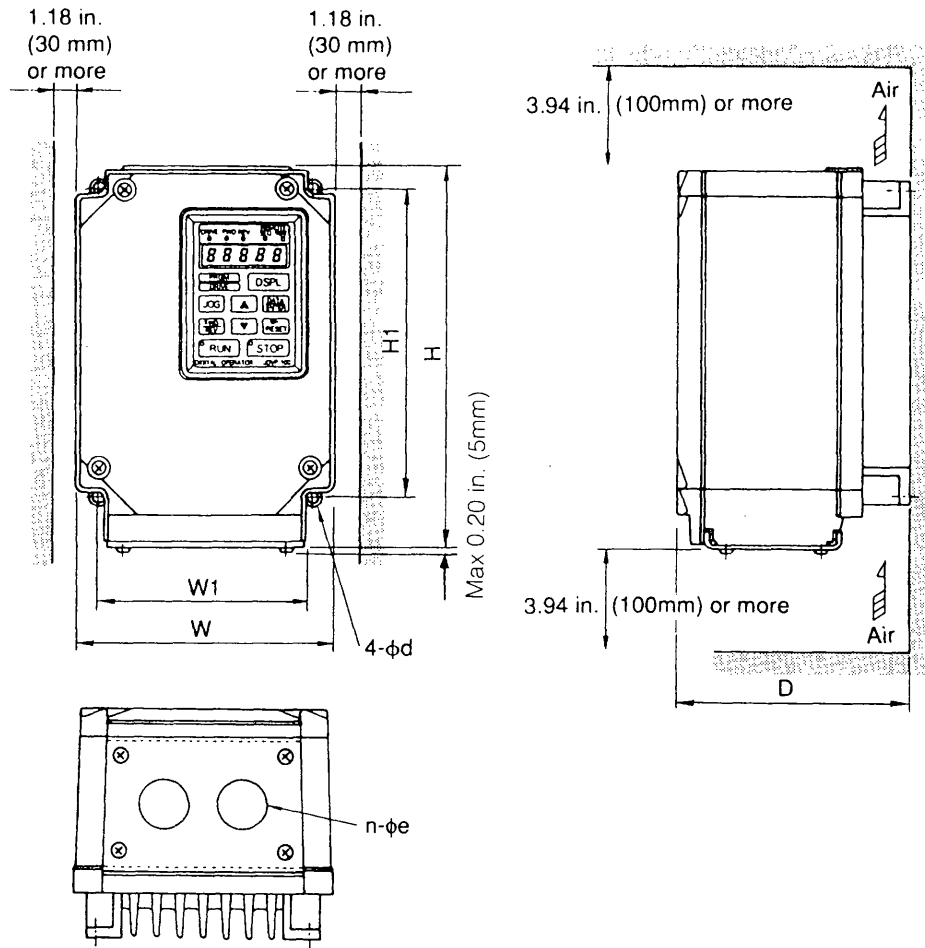
Water and dust tight type (NEMA4)

Table of dimensions for various models

VS-606PC3 Model CIMR-PC ▭	W	W1	H	H1	H2	D	d	n-φe
20P1 20P2	4.45 (113)	3.66 (93)	6.77 (172)	5.43 (138)	0.43 (11)	4.07 (103.5)	0.20 (5)	2-φ0.91 (2-φ23)
20P4 20P7	5.83 (148)	5.04 (128)	6.77 (172)	5.43 (138)	0.43 (11)	5.59 (142)	0.20 (5)	3-φ0.91 (3-φ23)
21P5 22P2	5.83 (148)	4.96 (126)	8.94 (227)	7.32 (186)	0.47 (12)	6.83 (173.5)	0.22 (5.5)	1-φ0.91 2-φ1.13
23P7	7.87 (200)	6.89 (175)	9.06 (230)	7.28 (185)	0.50 (12.8)	7.62 (193.5)	0.23 (5.8)	$\left(\begin{smallmatrix}1\text{-}\phi23\\2\text{-}\phi28.6\end{smallmatrix}\right)$
B0P1 B0P2 B0P4	5.83 (148)	5.04 (128)	6.77 (172)	5.43 (138)	0.43 (11)	5.59 (142)	0.20 (5)	3-φ0.91 (3-φ23)
B0P7 B1P5	5.83 (148)	4.96 (126)	8.94 (227)	7.32 (186)	0.47 (12)	6.83 (173.5)	0.22 (5.5)	1-φ0.91 2-φ1.13
B2P2	7.87 (200)	6.89 (175)	9.06 (230)	7.28 (185)	0.50 (12.8)	7.62 (193.5)	0.23 (5.8)	$\left(\begin{smallmatrix}1\text{-}\phi23\\2\text{-}\phi28.6\end{smallmatrix}\right)$
40P2 40P4	5.83 (148)	4.96 (126)	8.94 (227)	7.32 (186)	0.47 (12)	4.86 (123.5)	0.22 (5.5)	1-φ0.91 2-φ1.13 $\left(\begin{smallmatrix}1\text{-}\phi23\\2\text{-}\phi28.6\end{smallmatrix}\right)$
40P7 41P5	5.83 (148)	4.96 (126)	8.94 (227)	7.32 (186)	0.47 (12)	6.83 (173.5)	0.22 (5.5)	
42P2 43P7	7.87 (200)	6.89 (175)	9.06 (230)	7.28 (185)	0.50 (12.8)	7.62 (193.5)	0.23 (5.8)	

Caution!

• <u>*Never submerse this model in water.*</u>

• *The models of a forced-air-cooled type are provided with a cooling fan in the die-cast case.* <u>*Protect the cooling fan from moisture.   Excessive water splash may reduce the inverter operating life.*</u>

• *If water splashes on the cooling fan section, keep the cooling fan operating for approx. 30 minutes in order to dry it. (By conducting current to the inverter unit, the cooling fan rotates.)*

• *For the cable lead-in section (at the bottom cover), use a cable gland of a waterproof type. (Products described in pages 2-13 and 2-14 are available as options.)*

The attached rubber bushing is used in order to prevent foreign matter from entering during transport, etc. Mount a waterproof type cap on the unused cable lead-in holes or seal them with rubber bushing for water prevention.

• *After completion of wiring, mount the front cover and bottom cover with care. (<u>Pay attention so as not to damage the gasket.</u>) Since the inverter unit cover is sealed with the die-cast case, never remove it.*

• *The front cover mounting screws and bottom cover mounting screws are of stainless. Do not use any other screws than those attached. (In particular, screws of different length may cause damage.)*

• *When silicon rubber cement applied to the contacting section of the front cover and bottom cover for reinforcement of waterproof performance, use silicon rubber cement with less gas generated when hardening. (Recommended: KE-3494 made by SHIN-ETSU CHEMICAL CO., LTD.)*

Cable gland

When a cable gland is used for water and dust tight type (NEMA4) models, pay attention to the following items.

• *Use multi-core cable for cable gland. (If more than two cables are inserted into one cable gland, a gap is created and may cause leakage.)*

• *Seal the cable gland with a gasket without fail. (A gasket is attached to the recommended cable gland.)*

Cable gland mounting hole (Already drilled in bottom cover)	
VS-606PC3 Model CIMR-PC ⬚	Qty-Size
20P1 20P2	2-0.91 DIA (2-φ23)
20P4 20P7	3-0.91 DIA (3-φ23)
21P5 22P2 23P7	1-0.91 DIA 2-1.13 DIA (1-φ23) (2-φ28.6)
B0P1 B0P2 B0P4	3-0.91 DIA (3-φ23)
B0P7 B1P5 B2P2	1-0.91 DIA 2-1.13 DIA (1-φ23) (2-φ28.6)
40P2 ⋮ 43P7	1-0.91 DIA 2-1.13 DIA (1-φ23) (2-φ28.6)

Recommended cable gland

For cable gland for water and dust tight type (NEMA4) models, refer to the following YASKAWA code No. and quantity when you place an order.

VS-606PC3 Model CIMR-PC........	Cable gland	
	YASKAWA code No.	Qty
20P1 20P2	WSZT31002-A	2
20P4 20P7	WSZT31002-A	3
21P5 22P2 23P7	WSZT31002-A WSZT31002-B	1 2
B0P1 B0P2 B0P4	WSZT31002-A	3
B0P7 B1P5 B2P2	WSZT31002-A WSZT31002-B	1 2
40P2 40P4 40P7 41P5 42P2 43P7	WSZT31002-A WSZT31002-B	1 2

• *Lock nut, gasket and the like required for one-hole wiring with one cable gland are provided.*
• *The quantity shown in the above table is the number of cable glands required for one inverter unit.*

Cable gland

Dimensions in inches (mm)										
	A	B	SW1	Cmax	D	E	F	H	SW2	G
WSZT31002-A (Size PG 16)	1.16 (29.5)	0.57 (14.5)	1.06 (27)	1.42 (36)	0.73 (18.5)	0.24 (6)	0.08 (2)	0.26 (6.5)	1.18 (30)	1.30 (33)
WSZT31002-B (Size PG 21)	1.40 (35.5)	0.73 (18.5)	1.30 (33)	1.57 (40)	0.89 (22.5)	0.24 (6)	0.08 (2)	0.30 (7.5)	1.42 (36)	1.54 (39)

Gasket

Locknut
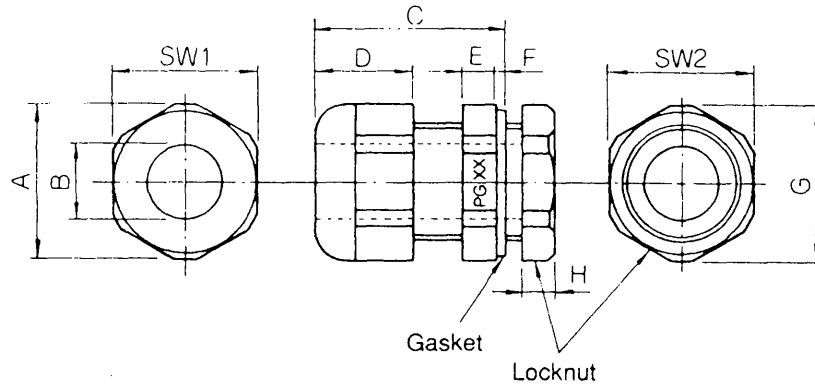
Specifications		
Cable gland	Applicable cable size	Tightening torque
WSZT31002-A	0.39DIA to 0.55DIA (φ10 to φ14)	5 to 9 (N • m)
WSZT31002-B	0.51DIA to 0.7DIA (φ13 to φ18)	7.5 to 9 (N • m)

Wiring the inverter

Follow the procedures in this section to remove the terminal cover, the front cover or the bottom cover and wire the main circuit and control circuits.

WARNING!

• **BEFORE YOU ATTEMPT TO WIRE THE INVERTER, BE SURE THE POWER ON THE MAIN POWER LINE IS SHUT DOWN.**

Removing the terminal cover of enclosed wall-mounted type (NEMA1)

1. On both sides, grasp the terminal cover at ① and ②, and then lift in the direction of ③.
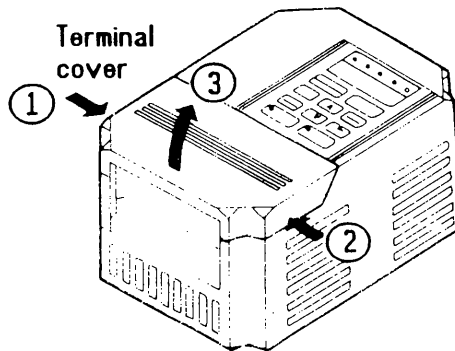
2. Set the terminal cover aside.

Removing the front cover or the bottom cover of water and dust tight type (NEMA4)

Remove the four mounting bolts and take off the cover in the direction of ①.

① →

FRONT COVER
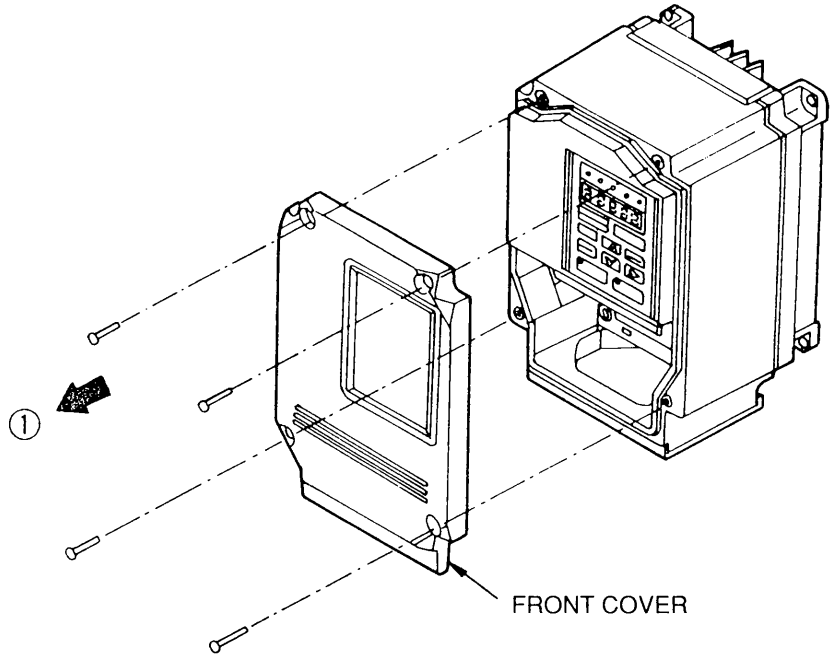
Remove the four mounting bolts when installing cable glands, etc. Install wiring after inserting cables through the cable glands and securing them to the bottom cover.

BOTTOM COVER
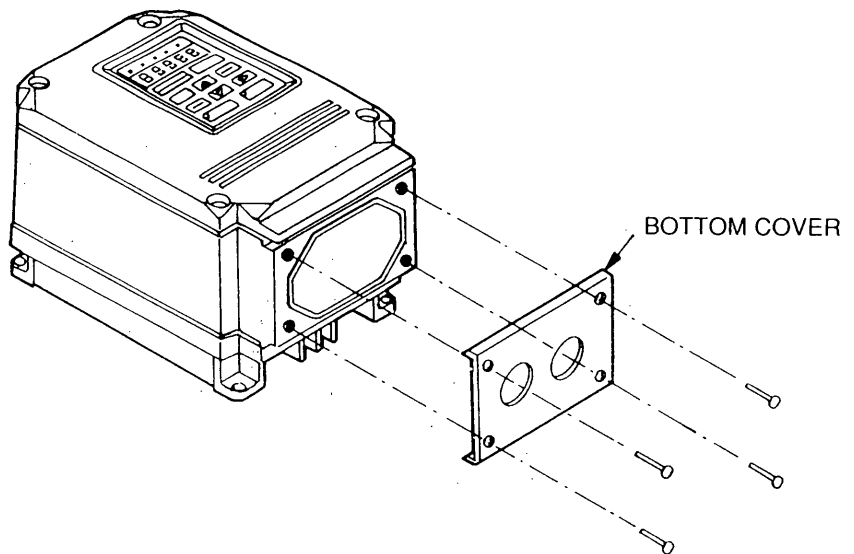
Standard wiring
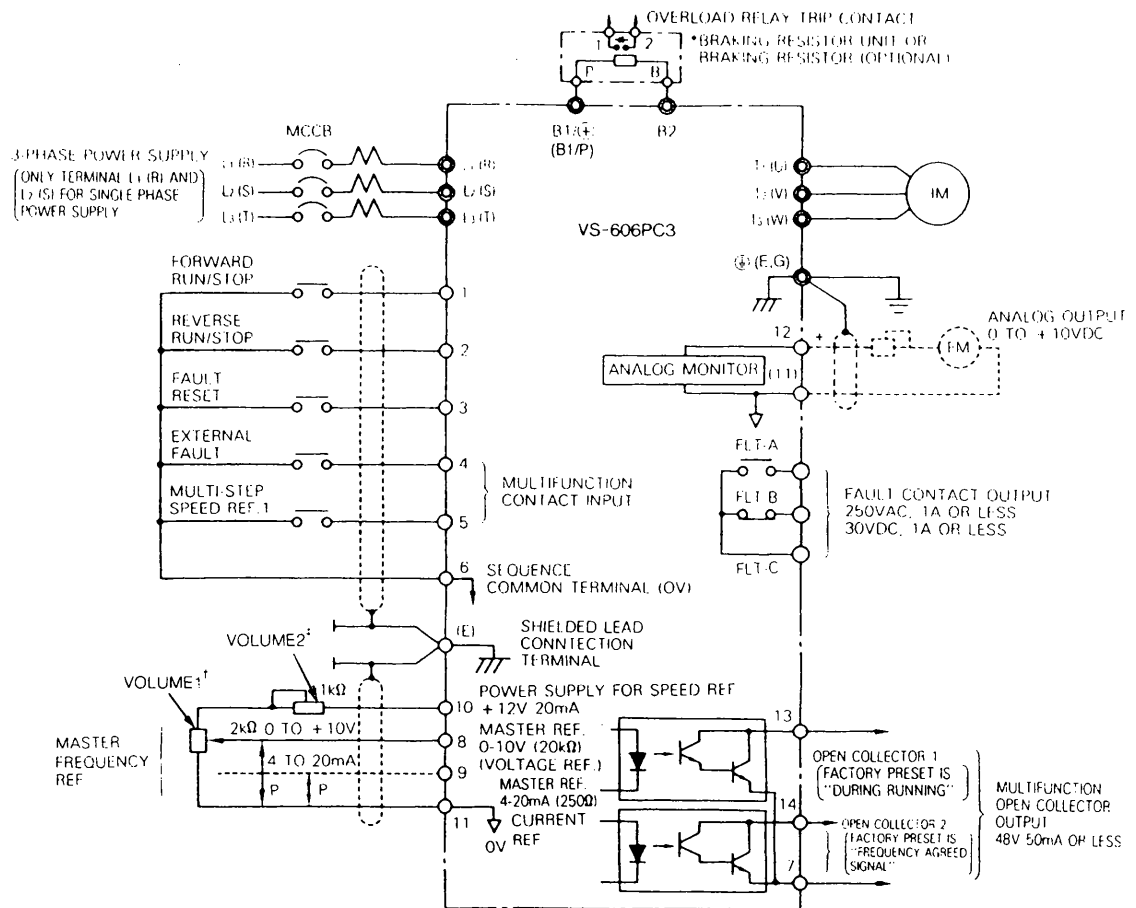
Notes: 1. ┆┆ indicates shielded leads and ┼┼ twisted-pair shielded leads.

2. External terminal (10) of +10V has maximum output current capacity of 20mA.
3. Terminal symbols: ◎ shows main circuit; ○ shows control circuit.

* Set thermal overload relay between braking resistor and inverter when using braking resistor without thermal overload relay (type ERF-150WJ, option) to protect it from overheating. Use sequencer to break power supply side on thermal overload relay trip contact when using braking resistor. Also, when using braking resistor unit with thermal overload relay (type LKEB, option), use sequencer to break power supply side on thermal overload relay trip contact.

† Volume 1 : for frequency setting

‡ Volume 2 : resistor to reduce the voltage from +12V to +10V. Considering the voltage drop by wiring impedance, power supply voltage is set to +12V.
    • When volume 2 is not provided:
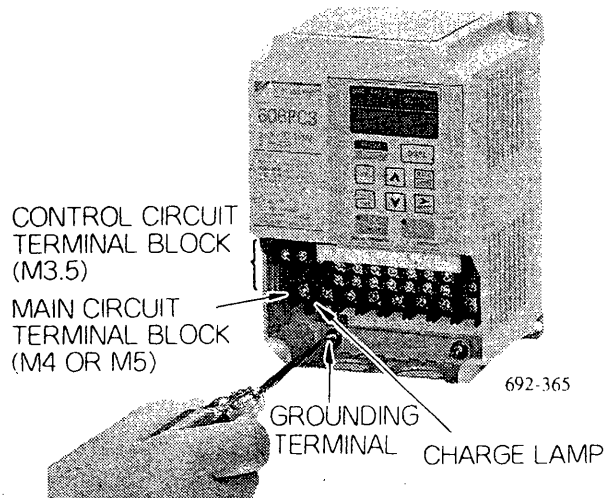   Max frequency when turning volume 1 to 80%.
    Even if turning more, frequency remains at the maximum. Even if +12V loads on terminal 8, it will not damage the inverter nor affect its operation.

10V (Max. frequency)
0V   12V
Volume 1
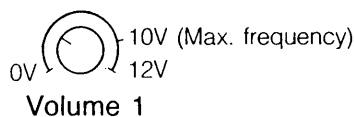
Wiring the main circuits

- "Suitable for use on a circuit capable of delivering not more than 1000 rms symmetrical amperes, 240V max." Models with 20P1, 20P2, 20P4, B0P1, B0P2 and B0P4 suffix only.
- "Suitable for use on a circuit capable of delivering not more than 1000 rms symmetrical amperes, 460V max." Models with 40P2, 40P4 suffix only.
- "Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 240V max." Models with 20P7, 21P5, 22P2, 23P7, B0P7, B1P5, B2P2 and B3P7 suffix only.
- "Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 460V max." Models with 40P7, 41P5, 42P2 and 43P7 suffix only.

The terminals and blocks are clearly labeled inside the inverter.

The location of terminal blocks for both enclosed wall-mounted type (NEMA1) and water and dust tight type (NEMA4) is the same. The photo shows enclosed wall-mounted type (NEMA1).

CONTROL CIRCUIT TERMINAL BLOCK (M3.5)

MAIN CIRCUIT TERMINAL BLOCK (M4 OR M5)
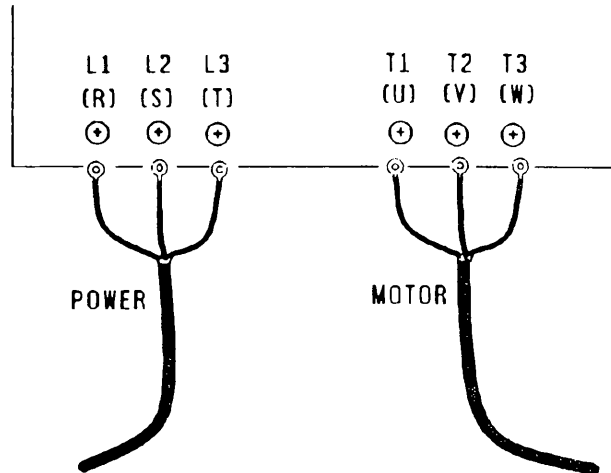
GROUNDING TERMINAL   CHARGE LAMP

692-365

1. Prepare and use UL Listed and CSA Certified closed-loop (ring) connectors, sized for the wire gauge that you are going to use to wire the terminals.

   - *Install connectors with the appropriate crimp tool specified by the connector manufacturer.*

2. Connect the wires from the power source to the power input terminals at L1, L2, L3 (R, S, T).
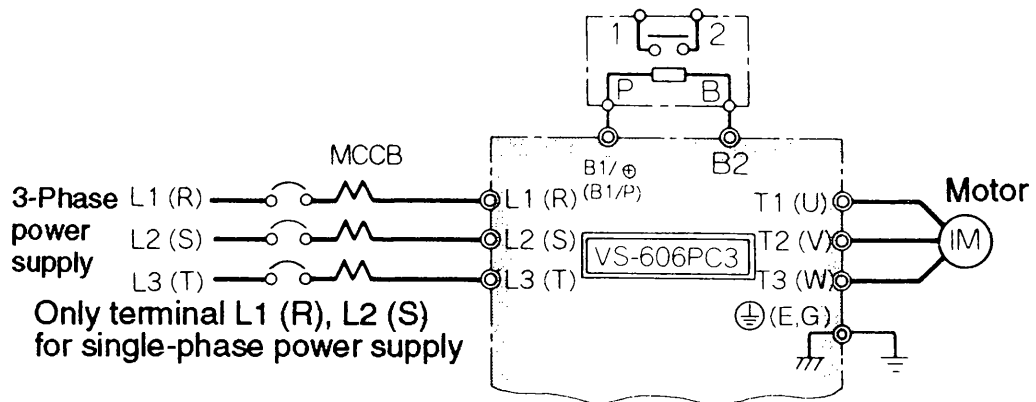
   | WARNING! |

   - **NEVER CONNECT AN AC POWER SOURCE TO INVERTER TERMINALS T1, T2, T3 (U, V, W). CONNECTING AN AC POWER SOURCE TO THESE TERMINALS CAN DESTROY THE INVERTER.**

3. Connect the wires from the motor to the output terminals at T1, T2, T3 (U, V, W) in order from left to right.

```
L1   L2   L3            T1   T2   T3
(R)  (S)  (T)           (U)  (V)  (W)
 ⊕    ⊕    ⊕             ⊕    ⊕    ⊕

        POWER                  MOTOR
```

Braking resistor unit or
braking resistor
(both optional)

```
3-Phase  L1 (R) ───o o─W───  ⊕L1 (R) (B1/P)      T1 (U)⊕     Motor
power    L2 (S) ───o o─W───  ⊕L2 (S)    VS-606PC3 T2 (V)⊕     (IM)
supply   L3 (T) ───o o─W───  ⊕L3 (T)             T3 (W)⊕
              MCCB            B1/⊕          B2    ⊕(E,G)
Only terminal L1 (R), L2 (S)
for single-phase power supply
```

VS-606PC3 main circuit terminal

Terminal	Description
L1 (R)	Main circuit power input.
L2 (S)	L3 cannot be used for signal-phase input
L3 (T)	Specifications.
T1 (U)	
T2 (V)	Inverter output
T3 (W)	
B1/⊕(B1/P)	Braking resistor or braking resistor unit
B2	connector (option)
⊕ (E,G)*	Grounding [ground resistance should be 100 Ω or less (200V class), 10 Ω or less (400V class)].

* Use screw for frame ground.

4. Double check your connections. To avoid malfunctions in peripherals, be sure the main circuit wiring is separate from the wiring for the control wiring for peripheral devices.

- *Be sure all connections are tight.*

- *You can connect an L-noise filter to the VS-606PC3 output, but never connect a power factor correction capacitor LC or RC to VS-606PC3 output.*

Main circuit terminals

Three-phase series (all models)							
L1 (R)	L2 (S)	L3 (T)	B1/⊕ (B1/P)	B2	T1 (U)	T2 (V)	T3 (W)

200 V single-phase series, 0.13 to 1.5 HP (0.1 to 1.5kW)							
L1 (R)	L2 (S)		B1/⊕ (B1/P)	B2	T1 (U)	T2 (V)	T3 (W)

Do not use.

200 V single-phase series, 3/5 HP (2.2/3.7 kW)						
L1 (R)	L2 (S)	B1/⊕ (B1/P)	B2	T1 (U)	T2 (V)	T3 (W)

MCCBs (Molded-case circuit breakers) and MCs (Magnetic contactors)

To protect the wiring, you should install MCCBs or fuses between the AC main circuit power supply and the VS-606PC3 input terminals L1, L2, L3 (R, S, T).

If you are going to use a fault interrupter, select one that is not affected by high frequencies. To prevent malfunctions, the current should be 200 mA or more and the operating time 0.1 sec. or more.

We recommend the following ground fault interrupters:

* NV series by Mitsubishi Electric Co., Ltd. (manufactured in and after 1988)

* EGSG series by Fuji Electric Co., Ltd. (manufactured in and after 1984).

* Recommended ratings of MCCB and Fuse are listed in the following tables. The fuses should be listed Class RK5.

• 230V Class 3-phase Input Series

	Model CIMR-	PC 20P1	PC 20P2	PC 20P4	PC 20P7	PC 21P5	PC 22P2	PC 23P7
VS-606PC3	Capacity HP (kW)	0.13 (0.1)	0.25 (0.2)	0.75 (0.4)	1 (0.75)	1.5 (1.5)	3 (2.2)	5 (3.7)
	Rated Output Current A	0.8	1.5	3	5	6.5	11	17.5
MCCB		5A	5A	5A	10A	20A	20A	30A

• 240V Class Single-phase Input Series

	Model CIMR-	PC B0P1	PC B0P2	PC B0P4	PC B0P7	PC B1P5	PC B2P2	PC B3P7*
VS-606PC3	Capacity HP (kW)	0.13 (0.1)	0.25 (0.2)	0.75 (0.4)	1 (0.75)	1.5 (1.5)	3 (2.2)	5 (3.7)
	Rated Output Current A	0.8	1.5	3	5	6.5	11	17.5
MCCB		5A	5A	10A	20A	20A	40A	50A

* Water and dust tight type (NEMA4) not provided for this model.

• 460V Class 3-phase Input Series

	Model CIMR-	PC 40P2	PC 40P4	PC 40P7	PC 41P5	PC 42P2	PC 43P7
VS-606PC3	Capacity HP (kW)	0.5 (0.2)	0.75 (0.4)	1.5 (0.75)	2 (1.5)	3 (2.2)	5 (3.7)
	Rated Output Current A	1	1.6	2.6	4	4.8	8
MCCB		5A	5A	5A	10A	10A	20A

Surge suppressors

When peripheral equipment such as control relays, magnetic contactors, magnetic valves, or magnetic brakes are used near the VS-606PC3, surge suppressors should be connected to their coils. Large voltage surges that occur during switching can cause malfunctions in the inverter. The recommended suppressors are shown below.

Surge suppressors

Coils of magnetic contactor and control relay		Surge suppressors*		
		Model DCR2-	Specifications	Code No.
200 V to 230 V units	Large size magnetic contactors	50 A 22E	250 VAC 0.5 μF 200Ω	C002417
	Control relays MY-2, -3 (OMRON) HH-22, -23 (Fuji) MM2-2, -4 (OMRON)	10 A 25C	250 VAC 0.1 μF 100Ω	C002482
380 V to 460 V units		50 D 100B	1000 VDC 0.5μF 220Ω	C002630

* Made by MARCON Electronics

Using input noise filters

Noise filters can eliminate noise that invades the inverter from the power line, and also reduce a higher harmonics noise leaking from the inverter to the power line.

Example 1
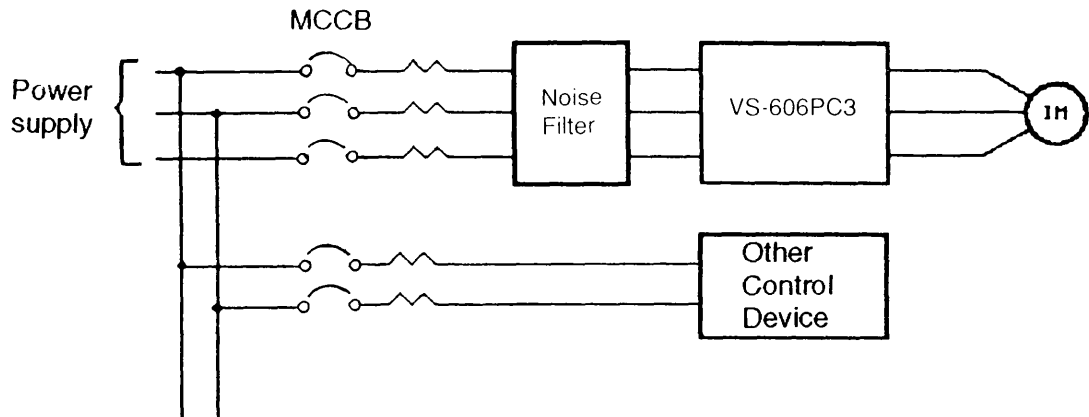
Use an exclusive noise filter specified for the inverter.

Example 2

UNACCEPTABLE CONFIGURATIONS
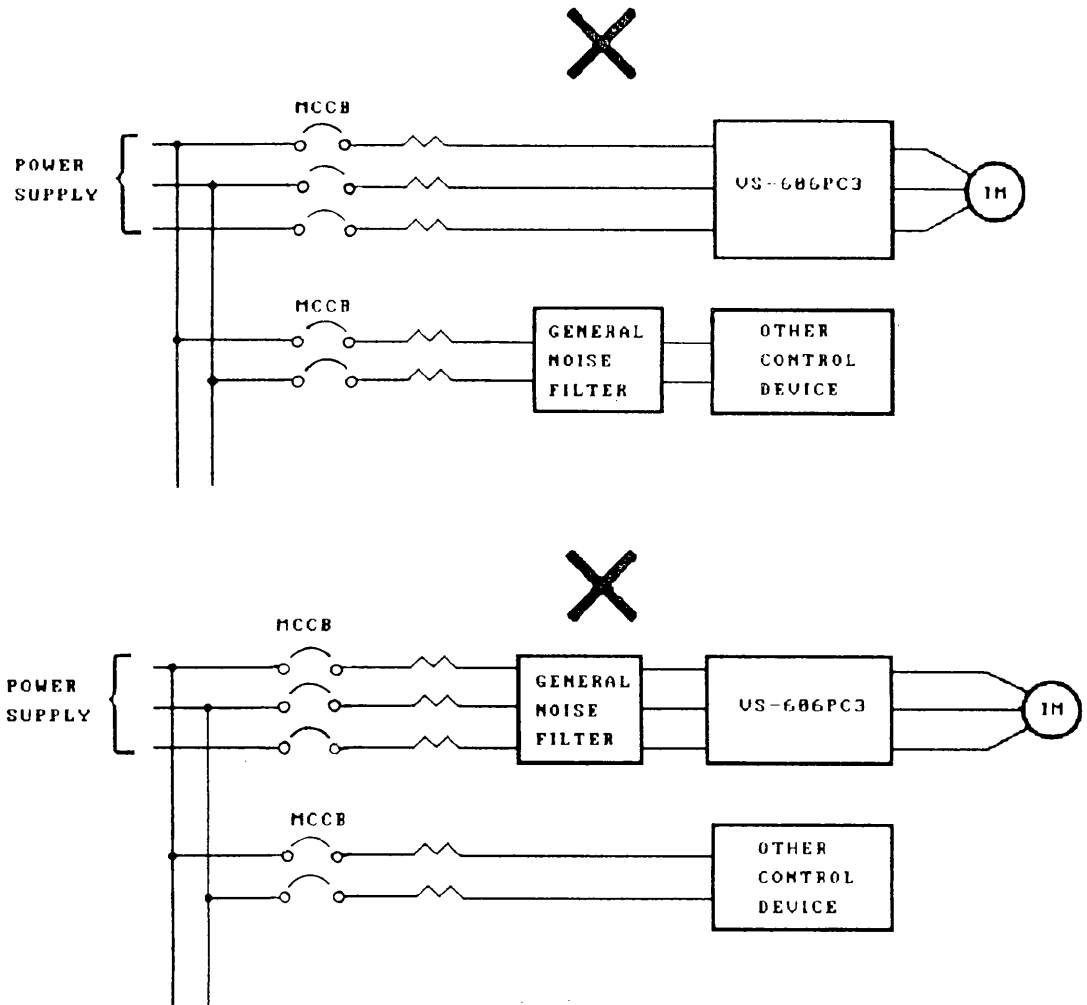
A general purpose noise filter will not be effective.

Example 3
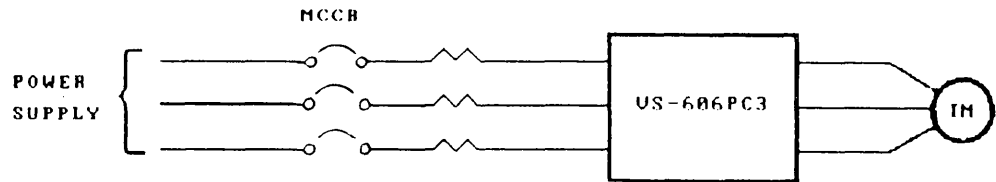
When one inverter is installed on one power line, a noise filter is not required.

Example 4
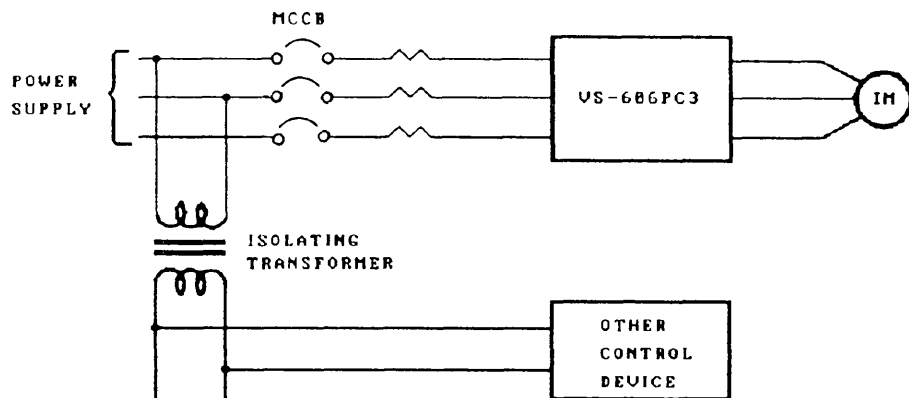
By installing an isolating transformer on the power side of another control device, you can achieve the same result as with installing a noise filter.

Using output noise filters

Using output noise filters on the output side

By installing a noise filter on the output side of the inverter, you can effectively reduce radio frequency interference (RFI) and inductive noise.
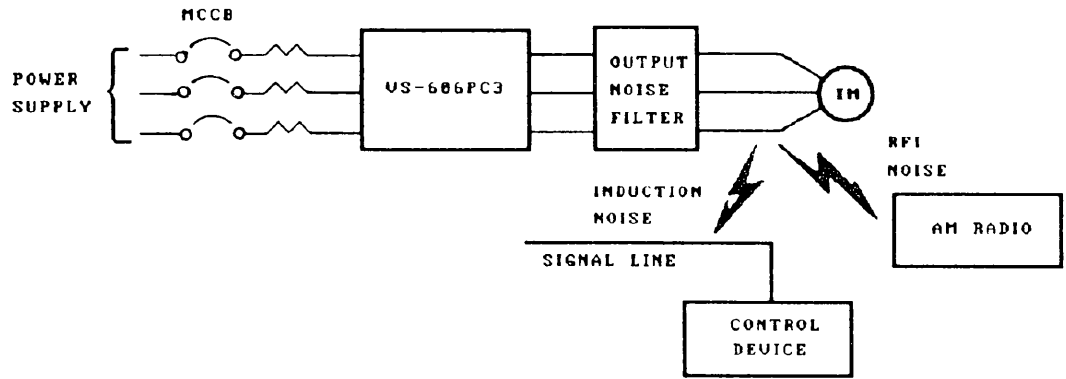
- **Inductive noise:** Noise coming on the signal line due to electromagnetic inductance can cause malfunctioning of a control device.

- **Radio frequency interference noise (RFI):** Higher harmonics waves from the inverter or cable can interfere with radio receiver.

Dealing with RFI noise

RFI noise can be caused by emissions from the inverter unit as well as the input/output lines, so by installing a noise filter on the input and output line and covering the inverter with a metallic shield, you can effectively reduce radio interference. Furthermore, try to make the wire length between the inverter and motor as short as possible.
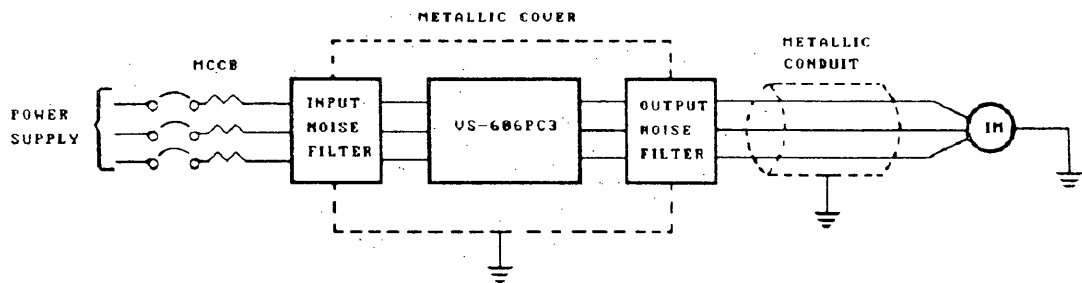
Grounding the inverter

WARNING!

- **NEVER GROUND THE VS-606PC3 IN COMMON WITH WELDING MACHINES, MOTORS, OR OTHER ELECTRICAL EQUIPMENT.**
- **RUN ALL GROUND WIRES IN A CONDUIT SEPARATE FROM WIRES FOR OTHER ELECTRICAL EQUIPMENT.**

To ground the inverter, we recommend:

☐ The ground resistance should be 100Ω or less (200V class), 10Ω or less (400V class).

☐ Ground wires should comply with AWG standards.

☐ To ground the casing of the VS-606PC3, use the ⏚ (E, G) ground terminal (screw terminal for frame ground).

☐ Make the ground wires as short as possible.

☐ When several VS-606PC3 units are to be used side by side, all the units should be grounded as shown in (a) or (b) of the illustration below. Do not loop the ground wires as shown in (c).

(a) Acceptable grounding (earth)

(b) Acceptable grounding (earth)

(c) Unacceptable

Wiring the control circuits

Caution!

• *Low voltage terminals shall be wired with Class I Wiring.*

Control signal wires are connected by screws. The figure in 2-17 shows the relation between the I/O signals (the values set at the factory) and the screw terminal numbers.

In addition to connecting the control terminals correctly, you must also set the operation mode for external control with the digital operator. This is called *operation mode selection*.

Control circuit terminal configuration

The control circuit terminal numbers are clearly written on the tab for your reference.

2. INSTALLING THE INVERTER
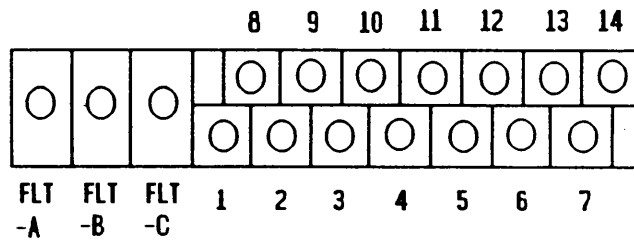
Factory settings of control circuit terminals

To avoid malfunctions, separate the control signal lines from power lines.

Control circuit terminal functions

| Classification	Terminal	Signal name	Function		Signal level
Sequence input signal	1	Forward run/stop	Runs at CLOSED, stops at OPEN		Photocoupler insulation input 24 VDC 8 mA
	2	Reverse run/stop	Runs reverse at CLOSED, stops at OPEN		
	3	Fault reset input	Resets at CLOSED		
	4	External fault	Fault at CLOSED	Multifunction contact input; two signals available to select.*	
	5	Multi-step speed ref. 1	Effective at CLOSED		
	6	Sequence control input common terminal	Common terminal for sequence input		
Analog input signal	10	Power supply terminal for frequency setting	Speed reference power supply		+12 V (Allowable current 20 mA max.)
	8	Frequency reference	0 to +10V/max. output frequency		0 to +10 V (20kΩ)
	9		4 to 20 mA max. output frequency		4 to 20 mA (250Ω)
	11	Common terminal for control circuit	0V		---
Sequence output signal	13	During running	L level at run	Multifunction photocoupler output; two signals available to select.†	Photocoupler output +48V 50 mA or less
	14	Frequency agreed signal	L level at set Frequency = output frequency		
	7	Photocoupler output common	Common terminal for sequence output		
	FLT-A	Fault signal contact output	At fault, CLOSED between A and C, and at fault OPEN between B and C.		Contact capacity 250 VAC: 1A or less 30 VDC: 1A or less
	FLT-B				
	FLT-C	Fault signal contact output common			
Analog output signal	12	Frequency meter	0 to 10 V/max. output frequency. Possible to select current meter output.‡		0 to 11 V max. 2 mA or less
	11	Common			

* : See *Multifunction contact input* on page 6-30.

† : See *Multifunction photocoupler output* on page 6-33.

‡ : See *Multifunction analog output monitor* on page 6-24.

Before you do the control circuit wiring ...

□ Separate the control signal line from power lines. Otherwise, it may cause a malfunction.

□ For analog signals, use a shielded wire and terminate correctly.
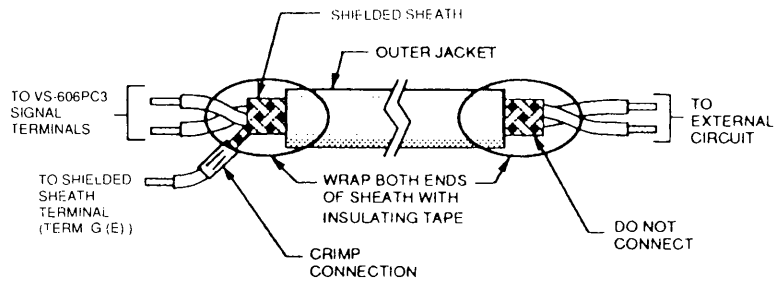
□ The control signal line should not be longer than 50 m.

□ To drive the contact input by transistor, use one rated 50V 50 mA or more.

□ Circuit leakage current at signal OFF must be 300μA or less.

Wiring example (open collector input)
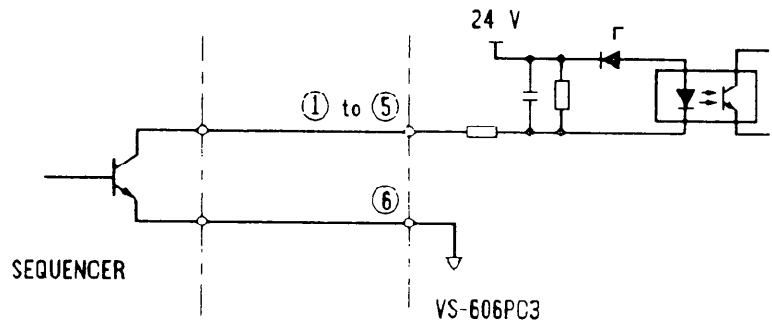
□ To drive an inductive load (a relay coil, for example) with a multifunction photocoupler output, be sure to insert a free- wheel diode.
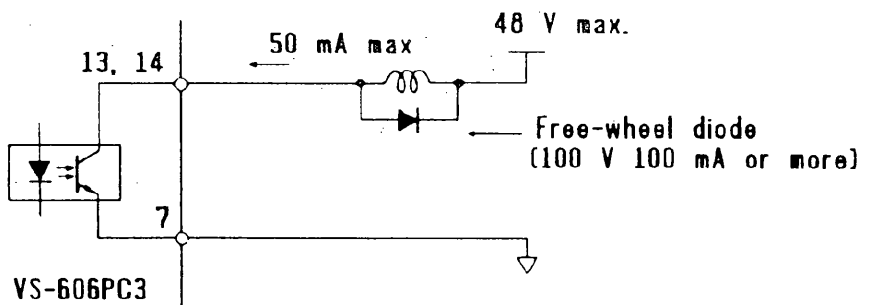
Replacing the terminal cover, the front cover or the bottom cover

Before you replace the terminal cover, perform this pre-operation check:

☐ Any faults in wiring? Be sure the power supply is connected correctly to terminals L1, L2, L3 (R, S, T).

☐ Wiring and all connections clean?

☐ All screws and terminal connections tight?

☐ Ground terminal connected and grounded properly?

Enclosed wall-mounted Type (NEMA1)
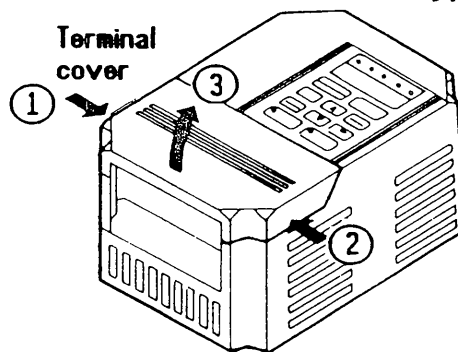
1. Hold the terminal cover by the sides at ① and ②, and slip the tabs under the bottom edge of the front cover.
2. Push down on the cover until it snaps into place at ③.
3. To set the inverter so you can operate it from the control terminals, follow the procedure on page 3-23.

Water and dust tight type (NEMA4)

Insert the four mounting bolts.

FRONT COVER
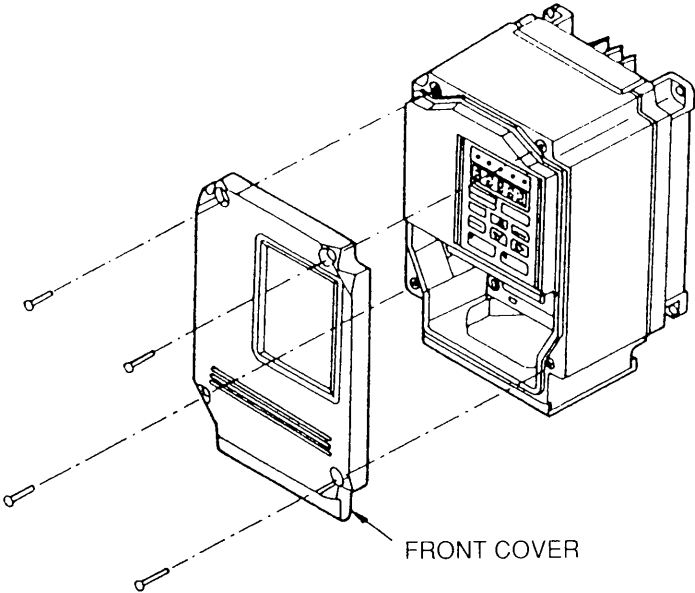
Install the bottom cover after inserting cables through the cable glands and securing them to the bottom cover.

BOTTOM COVER
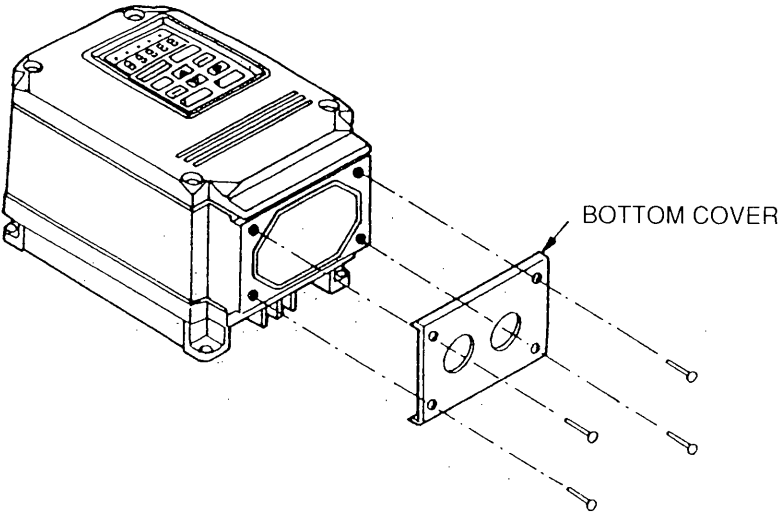
3. BASICS: A HANDS ON INTRODUCTION

This section is a hands-on introduction to using the inverter and the digital operator. Take a few minutes to read over this section and work through the explanations step by step. After you finish this section, you will know how to:

- Mount/remove the digital operator.
- Use the digital operator keys.
- Do initial testing for your inverter installation.
- Program the inverter.
- Run the inverter from the digital operator.
- Restore the factory settings.
- Set up the inverter with the digital display for operation with external signals.

Mounting and removing the digital operator

The digital operator JVOP-110, mounted directly on the inverter faceplate, performs three important functions:

- Operates the inverter

- Changes control constants

- Displays alarms when faults occur.

Caution!

- *Never mount or remove the inverter with the power supply on.*

- *To avoid malfunctions, turn the power supply off and wait a few minutes before you mount or remove the inverter.*

Mounting the digital operator

1. Turn the power supply off.
2. Insert the digital operator in the direction of the arrow.
3. Push down on the digital operator until it snaps into place.
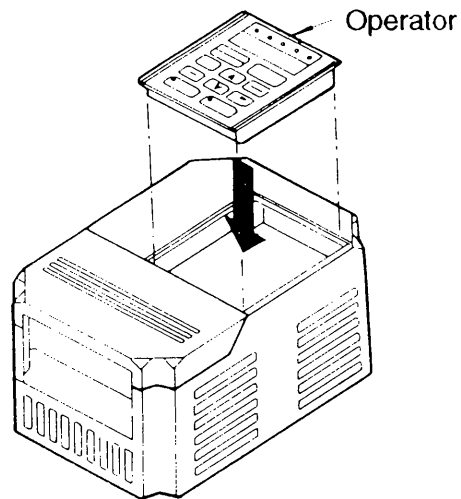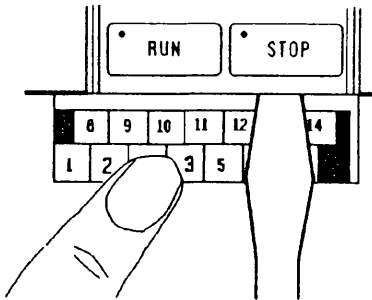
Operator

## Removing the digital operator

1. To remove the digital operator, first remove the terminal cover (enclosed wall-mounted type) or the front cover (water and dust tight type). Grasp the terminal cover of both sides at ① and ②, then lift it in the direction of the arrow ③.
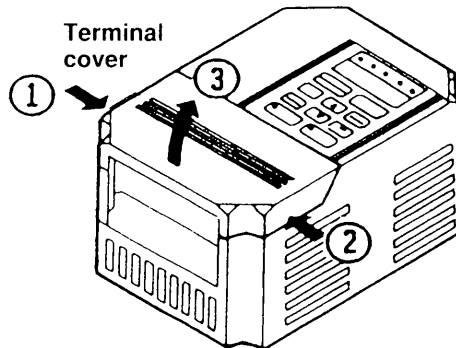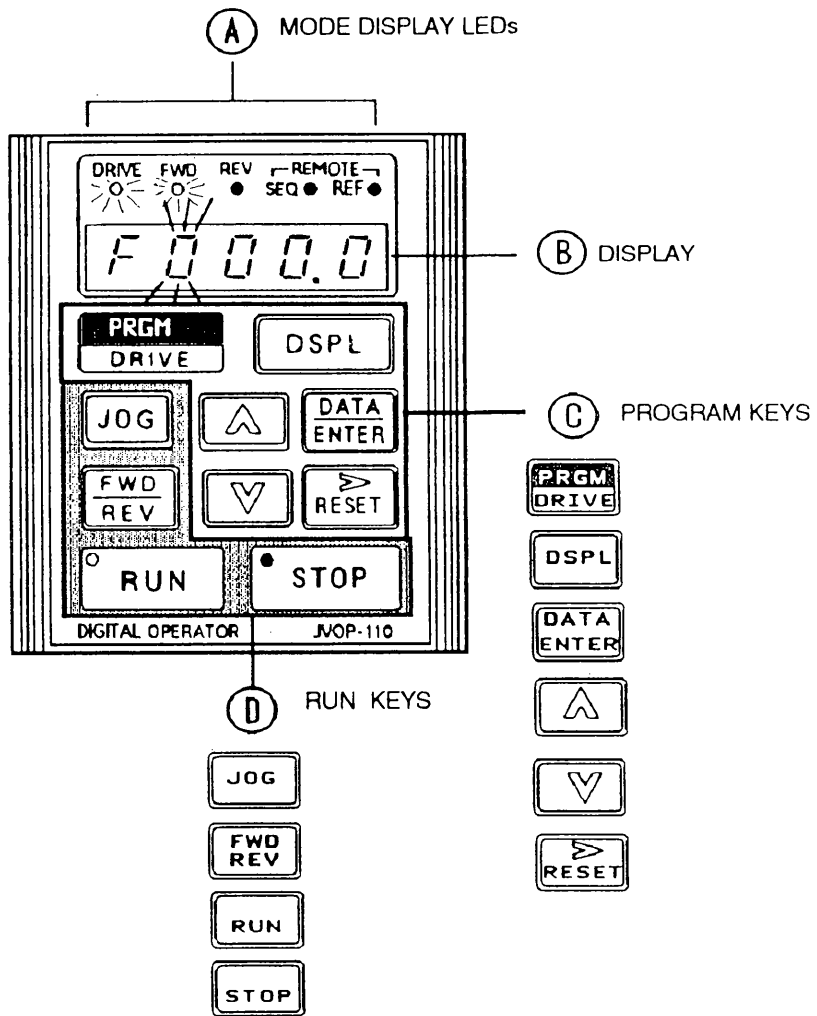
2. Push down on the lever and insert the flat edge of a screwdriver under the operator. (For water and dust tight type, it is not necessary to push down on the lever.) Gently pry the digital operator loose from its connector.

3. While pressing down on the lever at ①, lift the digital operator up at ② then remove it.
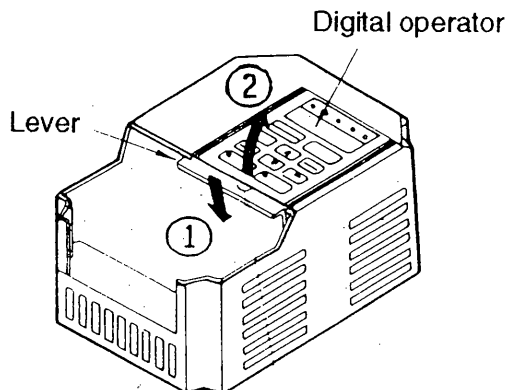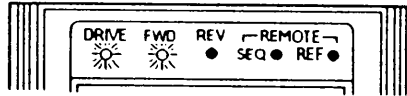
Digital operator key summary

[A] MODE DISPLAY LEDS
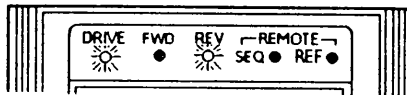
The mode LEDs tell you what operating mode you are in.

DRIVE mode LED
The DRIVE LED lights in the drive mode and goes off in the program mode. Press PRGM/DRIVE to change between the drive and program modes.

FWD LED
Lights when in the forward drive mode. In the drive mode, press FWD/REV to toggle between the forward and reverse drive modes.
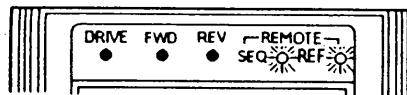
REV LED
Lights when in the reverse drive mode. In the drive mode, press FWD/REV to change between the forward and reverse drive modes.

REMOTE LEDs
These LEDs light when the inverter is controlled by external terminal commands. (When constant no-01 is set to 0000. See page 3-23)

SEQ LED
Lights when the RUN/STOP signals are through the control terminals. (When constant no-01 is set to 0000. See page 3-23)

REF LED
Lights when frequency reference is through terminals 8 and 9.

[B] DISPLAY

`DSPL` Press to change the display. There are 4 displays.

> `F00.0`   Frequency value
>
> `0.0`   Output frequency
>
> `0.0A`   Output current
>
> `no-00`   Constant selection

Displays settings and monitors operation frequency and output current.

A blinking single digit tells you that you can change that number by pressing △ or ▽:

> `03`
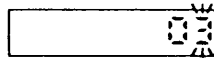
If all digits blink and then return to the original setting, this means you have tried to enter a number that is beyond the allowed range of settings:

> `25`
>
> `03`
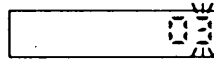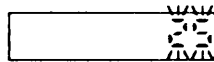
The 5-digit display also displays a variety of alarms. For details about what these alarms mean and how to solve problems see section *8. TROUBLESHOOTING*.

[C] PROGRAM KEYS

Switch to the program mode to change operation constants.

PRGM DRIVE — Press to turn off the **DRIVE** mode and enter the program mode. After you press **PRGM DRIVE** a program selection (**no-00** to **no-59**) is displayed.

DATA ENTER — Press to enter the next level below so you can start changing constants.

▷ RESET — Press to scroll the blinking digit from left to right. When the last digit on the right is blinking, after you press ▷ the first digit starts blinking again. The blinking digit can be changed by pressing △ and ▽.

△ — Press to increase the blinking digit or the **no-00** display by one. Press and hold to increase the value rapidly.

▽ — Press to decrease the blinking digit or the **no-00** display by one. Press and hold to increase the value rapidly.

DATA ENTER — Press to save the digit you have just changed.

[D] RUN COMMAND KEYS

Switch to the drive mode when you want to operate the motor with the run command keys.

PRGM DRIVE   Press to turn on the DRIVE LED and enter the drive mode.

DSPL   Press DSPL to scroll the 1-line display. In the drive mode you can view all the settings, but you cannot change a setting unless you enter the program mode by pressing **PRGM DRIVE**.

F000.0	Frequency value
0.0	Output frequency
0.0A	Output current
n0-00	Constant selection
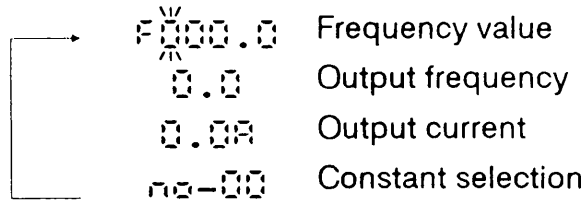
FWD REV   Press to change between forward (FWD) and reverse (REV) drive.

JOG   Viewed from the rear of the motor, jogs or inches the motor counterclockwise for normal rotation or clockwise for reverse rotation.

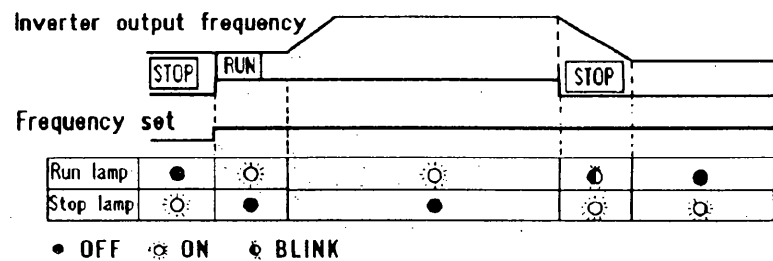**RUN**   Press to turn on the motor.

STOP   Press to stop running the motor.

The table below shows you the status of the RUN and STOP LEDs.

Inverter output frequency

	STOP	RUN		STOP

Frequency set

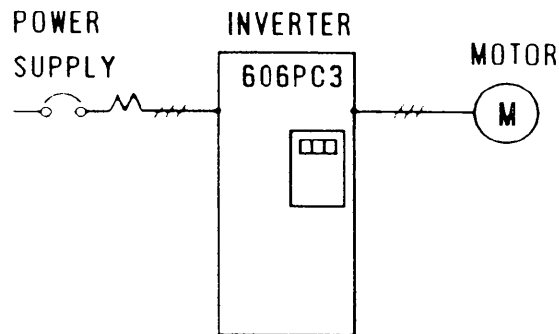|					
Run lamp	●	○	○	◐	●
Stop lamp	○	●	●	○	○

● OFF   ○ ON   ◐ BLINK

First operation test

The inverter has two modes of operation:

• With a digital operator.

• With an indicating cover (no digital operator).

This section describes operation testing with the digital operator JVOP-110. For information about testing with the indicating cover, see section *4. USING THE INVERTER WITH THE INDICATING COVER.*

Caution!

• *Before you turn on the power and do a test run, be sure to disconnect the motor coupling or belt from the machine.*

1. Turn on the power.

This is the frequency display. If you see any other code in the 1-line display, check the list of faults and alarms in section *8. TROUBLESHOOTING.*

-or-

If no message is displayed, turn the inverter off immediately and check the inverter wiring. If the wiring is correct, check the table of possible motor faults listed in the table on page 8-6.

Changing the program

Follow this procedure to learn the basic operation of the digital operator. Here we'll show you how to change the frequency to 60 Hz.

```
F000.0
```

- *When a digit is blinking, this means the digit can be set for another number.*

1. Check the name plate on your motor to read the frequency setting for the rated current of your motor. In this procedure, we'll show you how to set 60 Hz. If the setting for your motor is different, use that number.

RESET 2. To change the current digit, press ▷.

Every time you press ▷ the next digit to the right starts blinking. Press ▷ several times to change the current digit. The blinking digit will move from left to right until it reaches the last digit on the right. When you press ▷ when the last digit on the right is blinking, the first digit will start blinking again.

```
F000.0
```
```
F000.0
```

RESET 3. Press ▷ until you see the second zero start blinking.

```
F000.0
```

△ 4. To change a digit, press △ to increase the number, or press ▽ to decrease the number. Try this a few times. To increase or decrease a number rapidly, press and hold the key.

Press △ or ▽ until you see **6**.

```
F060.0
```

- *The setting has only been changed; you must save the setting before it becomes effective.*

DATA ENTER 5. To save the setting, press **DATA ENTER**. After you press this key, the digit stops blinking for a few moments and then resumes blinking again.

```
End
```
```
F060.0
```

Doing a forward/reverse check

Follow this procedure to test forward and reverse rotation of the motor.

DSPL   1. Press **DSPL** once to show the output frequency display.

```
┌─────────────────────┐
│              0.0    │
└─────────────────────┘
```

While the motor is turning during forward or reverse operation, check for the following:

☐ Smooth rotation

☐ Rotation in the correct direction.

☐ Excessive vibration or beat.

JOG   2. Press **JOG** and hold it.

```
┌─────────────────────┐
│              6.0    │
└─────────────────────┘
```

3. Release **JOG**.

```
┌─────────────────────┐
│              0.0    │
└─────────────────────┘
```

FWD/REV   4. Press **FWD/REV**. The **REV** LED lights.

JOG   5. Press and hold **JOG**.

```
┌─────────────────────┐
│  —           6.0    │
└─────────────────────┘
```
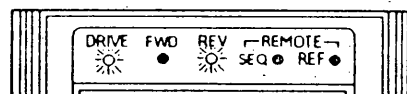
- *During reverse rotation (clockwise), a minus sign is displayed on the left side of the display.*

FWD/REV   6. Press **FWD/REV** again to switch to forward (FWD) rotation.

- *Every time you press* **FWD/REV** *an LED lights below* **FWD** *or* **REV** *to show you the current mode.*
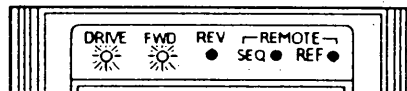
Forward mode

Reverse mode

Running and stopping

Follow this procedure to be sure the motor is starting, running, and stopping correctly. Check for the following:

☐ Smooth rotation

☐ Rotation in the correct direction.

☐ Excessive vibration or beat.

☐ Smooth acceleration/deceleration

☐ Current suitable for load

☐ LED display correct

FWD
REV

1. Check the LEDs above the display and be sure the LED below FWD is on. If it is not, press FWD/REV to turn it on.

2. If **0.0** (output frequency display) is not displayed, press DSPL until you see it.

$$\boxed{0.0}$$
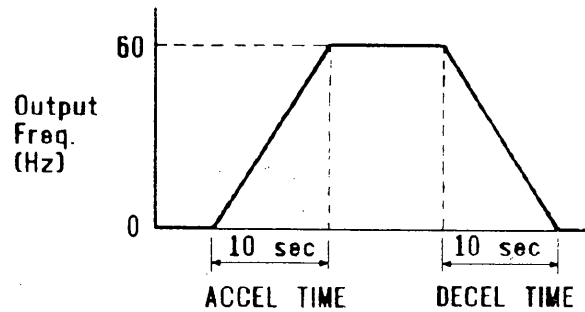
RUN

3. Press RUN to start the motor. Watch the display ramp to 60 Hz.

$$\boxed{60.0}$$

STOP

4. To stop the motor, press STOP. Watch the display ramp to **00** Hz.

$$\boxed{0.0}$$

Changing the acceleration/deceleration time

Follow this next procedure to practice setting constants for the inverter. Prior to shipping, the maximum output frequency is set to 60 Hz, and acceleration/deceleration time to 10 seconds.

This example shows you how to set the acceleration and deceleration with the digital operator for the motor.

DSPL

1. Press **DSPL** until **0.0** is displayed.

```
|        0.0 |
```

RUN

2. Press **RUN**. The display will take 10 seconds to accelerate to **60**.

```
|       60.0 |
```

STOP

3. Press **STOP**. The display will take 10 seconds to decelerate to **0.0**

```
|        0.0 |
```

- *The two settings (10 sec.) are the factory settings for acceleration and deceleration.*

Setting the acceleration time

PRGM
DRIVE

1. Press **PRGM DRIVE** to enter the program mode.

```
┌─────────────┐
│   no-01     │
└─────────────┘
```

- *After you press* **PRGM DRIVE**, *the* **DRIVE** *and* **FWD** *LEDs above the display will go out. When these LEDs are out, you are in the program mode where you can enter constants.*

△

2. Press and hold △ and watch the number selections change upward.

- *After you pass the last selection (19) by pressing △, the display re-starts from the first selection (00) and continues upward.*

▽

3. Press and hold ▽ and watch the number selections change downward.

- *After you pass the first selection (00) by pressing ▽, the display scrolls to the last selection (19) and continues downward.*

4. To start changing the acceleration time, press △ or ▽ until **no-09** is displayed.

```
┌─────────────┐
│   no-09     │
└─────────────┘
```

5. Press **DATA ENTER** to display the next level.

```
┌─────────────┐
│   010.0     │
└─────────────┘
```

The current acceleration speed is 10 seconds. Let's set the acceleration speed for 5 seconds.

RESET

6. Press ▷ twice to make the third digit from the left (0) blink.

```
┌─────────────┐
│   010.0     │
└─────────────┘
```

▽

7. Press ▽ 5 times to set the display for 5 seconds.

```
┌─────────────┐
│   005.0     │
└─────────────┘
```

8. Press **DATA ENTER** to enter the change. For a few seconds, you will see **End** and then you will return to the original display (005.0).

```
┌─────────────┐
│        End  │
└─────────────┘
```

```
┌─────────────┐
│      005.0  │
└─────────────┘
```

9. Now press **DSPL**.

```
┌─────────────┐
│      no-09  │
└─────────────┘
```

Setting deceleration time

Now set the deceleration time for 15 seconds. To set the deceleration time, you must select **no-10**.

[△]   **1.** Press △ once to set the display for **no-10**.

> no-10

[DATA ENTER]   **2.** Press DATA ENTER to go to the next level.

> 010.0

[▷ RESET]   **3.** Press ▷ twice.

> 010.0

[△]   **4.** Press △ 5 times to change the display to 15.

> 015.0

[DATA ENTER]   **5.** Press DATA ENTER to enter the constant.

> End

> 015.0

[PRGM DRIVE]   **6.** Press PRGM DRIVE to return to the starting display.

> F060.0

The DRIVE and FWD LEDs come on again. This means the inverter is in the drive mode and the motor is ready to operate. You've just set acceleration for 5 seconds and deceleration for 15 seconds.

| DSPL |

7. Press **DSPL** once so you can watch the output current after your turn the motor off and on.
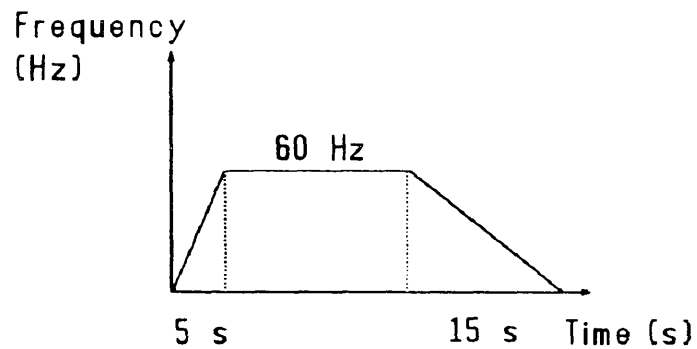
```
       0.0
```

| RUN |

8. Press **RUN**. The display will show acceleration to 60 Hz within 5 seconds.

```
      60.0
```

| STOP |

9. Press **STOP**. This display will show deceleration from 60 Hz to **0.0** within 15 seconds.
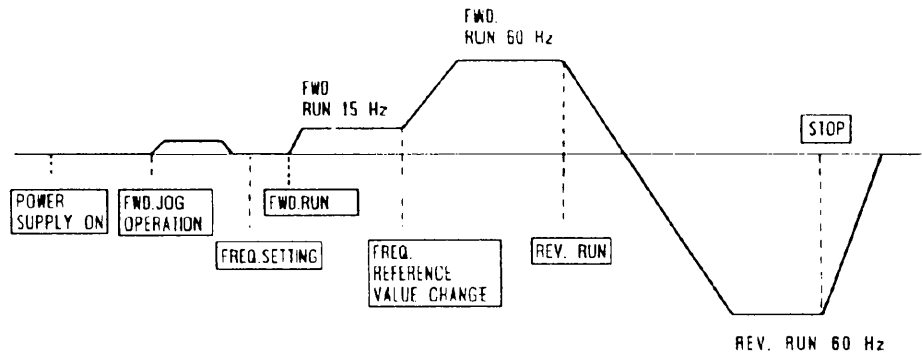
```
       60
```

```
       00
```

Frequency
(Hz)

● *For details about faults and what to do about them, see section 8. TROUBLESHOOTING.*

Driving the motor from the digital operator

Here we will show you an example of how to drive the motor with the digital operator keys.

1. Turn on the power.

   ```
   F 60.0
   ```

   -or-

   Press **DSPL** until you see:

   ```
   F 60.0
   ```

DSPL 2. Press **DSPL**

   ```
   0.0
   ```

JOG 3. Press and hold **JOG** for a few seconds and then release it so you can check the rotation of the motor.

   ```
   6.0
   ```

   ```
   0.0
   ```

DSPL 4. Press **DSPL** 3 times to return to the frequency display.

   ```
   F 60.0
   ```

RESET 5. Set the frequency reference for **15**. First, press ▷.

   ```
   F 60.0
   ```

Λ 6. Press ▽ until you see **1**.

   ```
   F 10.0
   ```

RESET ▷ **7.** Press ▷ to move the blinking digit right.

| F010.0 |

△ **8.** Press △ until you see **5**.

| F015.0 |

DATA ENTER **9.** Press **DATA ENTER** to save the new entry. The display stops blinking for about 3 seconds, then starts blinking again with the value you just entered.

| F015.0 |

DSPL **10.** Press **DSPL** so you can monitor the output frequency.

| 0.0 |

RUN **11.** Press **RUN** to start the motor.

● *You can change the frequency even while the motor is running.*

The frequency monitor display shows an output of 15 Hz.

| 15.0 |

DSPL **12.** Now change the frequency from **15** to **60**. Press **DSPL** 3 times.

| F015.0 |

RESET ▷ **13.** Press ▷.

| F015.0 |

△ **14.** Press △ until you see **6**.

RESET ▷ **15.** Press ▷.

| F065.0 |

▽ **16.** Press ▽ until you see **0**.

| F060.0 |

DATA ENTER **17.** Press **DATA ENTER** to save the new frequency setting. As soon as you press **DATA ENTER** the motor ramps to 60 Hz.

DSPL   **18.** Press **DSPL** to show the output frequency.

> ```
> 60.0
> ```

FWD
REV   **19.** To reverse the rotation of the motor, press **FWD/REV**. The **REV** LED above the display lights. The motor decelerates to **0** then starts rotation up to **- 60**.

> ```
> −    60.0
> ```

     • *The minus prefix means reverse rotation is operating.*
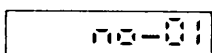
STOP   **20.** Press **STOP** to ramp to stop.

> ```
> 0.0
> ```

Restoring the factory settings

Follow this procedure to restore the factory settings.

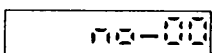* *To avoid difficulties, always initialize the inverter before you set up new constants.*

PRGM DRIVE   **1.** Press **PRGM DRIVE** to enter the program mode.

> ```
>      no-01
> ```

* *The display will show the last constant you set.*

∇   **2.** Press ∇ or ∆ to display 00.

> ```
>      no-00
> ```

DATA ENTER   **3.** Press **DATA ENTER**.

> ```
>           01
> ```
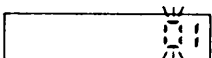
▷ RESET   **4.** Press ▷. The digit on the right should be blinking.

> ```
>           01
> ```

∆   **5.** Press ∆ until you see **08**.

> ```
>           08
> ```

DATA ENTER   **6.** Press **DATA ENTER**.

> ```
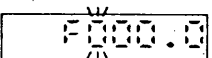>   End
> ```
> ```
>   01
> ```
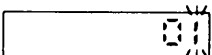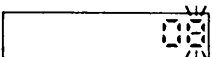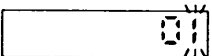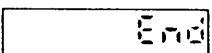
PRGM DRIVE   **7.** Press **PRGM DRIVE** to return to the starting display and the drive mode.

* *All values have been reset to the factory settings, including the frequency reference. Factory settings are listed in the tables of section 7. QUICK REFERENCE.*
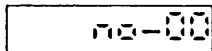
> ```
>      F00.0
> ```

Setting for operation from the control circuits

Follow this procedure if you have a digital operator and you want to set the inverter up to be controlled by external circuits.
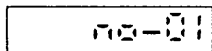
1. Turn on the power.

   ```
   F000.0
   ```

PRGM DRIVE 2. Press **PRGM DRIVE** to enter the program mode.

   ```
   no-00
   ```

Δ 3. Press Δ to display **01**.

   -or-

   If the display shows another number, press ∇ or Δ to display **01**.

   ```
   no-01
   ```

DATA ENTER 4. Press **DATA ENTER**.

   ```
   0011
   ```

▷ RESET 5. Press ▷ twice to set the third digit from the left blinking.

   ```
   0011
   ```
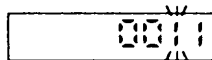
∇ 6. Press ∇ to change the digit to 0.

   ```
   0001
   ```
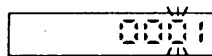
▷ RESET 7. Press ▷ once to select the last digit.

   ```
   0001
   ```

[▽] **8.** Press ▽ once to change the digit to 0.

0000

[DATA ENTER] **9.** Press **DATA ENTER** to save the setting.

End

0000
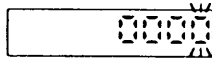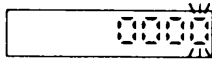
[PRGM DRIVE] **10.** Press **PRGM DRIVE** to leave the program mode.

- *The display changes and the* SEQ *and* REF *LEDs come on to tell you that the inverter is now in the control terminal mode.*

DRIVE	FWD	REV	┌─REMOTE─┐
☀	●	●	SEQ☀ REF☀
F		0.0	
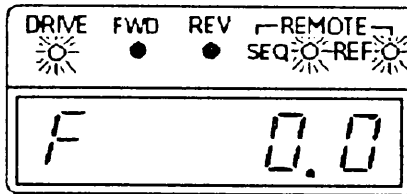
The inverter can now be operated from the external control circuits connected on page 2-29.

4. USING THE INDICATING COVER

With the indicating cover, the inverter does not have a digital operator. The inverter is operated by a frequency setter or operation switches connected to control circuit terminals.
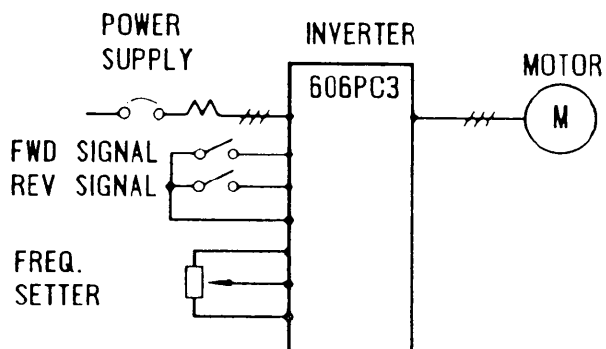
Before you try to do the testing described in this manual, be sure you have followed the instructions for:

• Wiring the main circuits (2-18)

• Wiring the control circuits (2-29)

Mounting the indicating cover

Follow this procedure if you want to remove the digital operator and replace it with the indicating cover.

1. Turn off the power source. The display won't change for a few seconds, then you will see flashing:
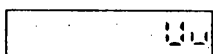
2. Grasp the terminal cover on both sides at ① and ②, and then lift in the direction of ③.
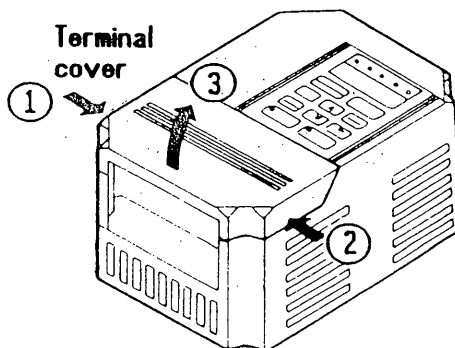
3. Press and hold down the tab, then slip the flat edge of a screwdriver under the digital operator and gently pry it up until it snaps loose.
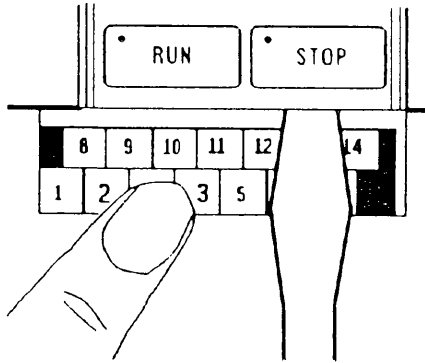
4. Store the digital operator in a dry, safe place.

5. Fit the indicating cover over the opening and snap it into place.
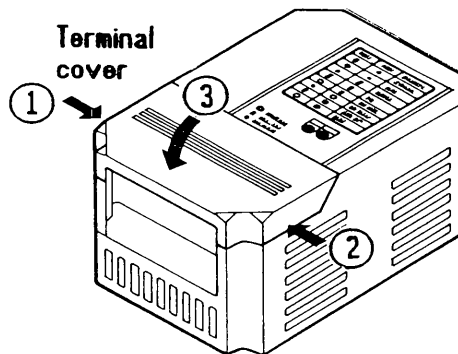
6. Hold the terminal cover by the sides at ① and ②, and slip the tabs under the bottom edge of the front cover.

7. Push down on the cover at ③ until it snaps into place.

Doing a test run

Follow this procedure to test the operation of the inverter with an indicating cover attached.

1. Turn on the power.
2. Look through the front of the indicating cover. You should see two LEDs:
   - Green (DS1)
   - Red (DS2)

   The green LED should be blinking, and the red LED should be off. If your LED display is different, see section *8. TROUBLESHOOTING.*
3. Turn the frequency setting knob all the way to the left to decrease the frequency value to 0.
4. Turn on the forward or reverse run signal.
   - *The green LED on the indicating cover will stop blinking and stay on with a steady light.*
5. Turn the frequency setter knob slowly to the right to increase the frequency value to its largest value.
6. Turn the frequency setter knob slowly to the left to lower the frequency until it reads 0 and the motor stops.
7. Turn off the forward or reverse run signal.
   - *If the forward and reverse signals are turned on simultaneously, the red LED blinks and the motor will not start.*
   - *While the motor is running, if the forward and reverse signals are turned on simultaneously, the red LED will start blinking and the motor will stop.*

LED displays

When you are using the indicating cover without the digital operator, LEDs tell you about the inverter's operation status. Two LEDs can be seen through the front of the inverter:

- Green (DS1)
- Red (DS2)

The table below shows you how the LEDs light and what the LED displays mean.

LED display and contents

Inverter status	LED display		Display contents	Remarks
	DS1 (Green)	DS2 (Red)		
Normal	blinking	off	Operation ready (during STOP)	----
	on	off	During normal RUN	
Alarm	off	blinking	Power supply voltage reduction, external BB inputting, etc. in STOP status.	Automatic recovery by protective operation release.
Protective operation	blinking	blinking	Inverter external fault (EF is input).	Can be reset by removing the factor. (Hardware fault if not recovered.)
	on	blinking	Overload protection such as inverter overload (OL) fin overheat, etc.	
	off	on	Voltage protection such as overvoltage (OV), undervoltage (UV)	
	blinking	on	Overcurrent protection (OC)	Cannot reset. (Replace the inverter.)
Inverter fault	on	on	Digital hardware memory fault (CPF)	
	off	off	Hardware fault such as control power supply fault, CPU runaway, etc.	Cannot reset. (Replace the inverter.)

● : LED off   ☀: LED on   ☀: LED blinking

By initializing control constants with the digital operator, faults can be released. For details, see page 5-2.

5. SETTING UP APPLICATIONS

This section guides you step by step through more complicated procedures for setting constants with the digital operator. Some of these functions were selected from section *6. SELECTED APPLICATIONS* to illustrate in detail how to set up more complicated applications. After you work through this section, you will be able to:

- Use the password to release write protection so you can use all 60 constants (**no-00** to **no-59**).
- Adjust the frequency setting gain and bias.
- Calibrate a frequency/current meter.
- Set a lower frequency for long-distance wiring between the inverter and motor.
- Set up the inverter for remote operation with the external control circuits. Three examples are provided.

By the time you work through this chapter, you will be able to set up any of the applications described in section *6. SELECTED APPLICATIONS*.

Using the password

The password function enables groups of functions and applications or can write-protect them after their constants have been set.

Using its many functions, you can set up the VS-606PC3 for optimum operation of your motor. In total there are 59 constants you can set and save to the inverter's memory. You can enable the inverter to use 19, 29, or 59 of these functions for basic and advanced applications.

00-19
1st functions. Standard functions for drive motors.

20-29
2nd functions. Basic features.
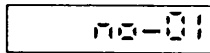
30-59
3rd functions. Advanced features.
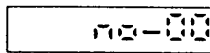
For a detailed description of these functions and applications, see section *7. QUICK REFERENCE.*

| F060.0 |

PRGM DRIVE

1. At the starting display, press **PRGM DRIVE** to enter the program mode.

| no-01 |

∇
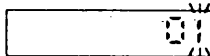
2. Press ∇ or △ until you see **00** in the display.

| no-00 |

DATA ENTER

3. Press **DATA ENTER**.

| 01 |

▷ RESET
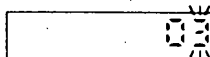
4. Press ▷ to start the right digit blinking.

| 01 |

∇

5. Press ∇ or △ to change the number to 1, 2, or 3.

| 03 |

Here's a summary of what these settings do:

01 (00-19) (The default)
Enables basic motor functions. You can set and use basic functions 00 to 19 for a total of 20 features. Features 20-59 are write-protected.

02 (00-29)
Enables basic applications. You can set and use basic functions 00 to 19 and basic applications 20 to 29 for a total of 30 features. Features 30-59 are write-protected.

03 (00-59)
Enables advanced applications. You can set and use basic functions 00 to 19, basic applications 20 to 29, and advanced applications 30 to 59 for a total of 60 features. No features are write-protected.

00
All functions and applications are write-protected. You can view the settings, but you cannot change them. You can only select and re-set **no-00** to release write protection.

6. Press **DATA ENTER** to save the new setting.

| DATA ENTER |

```
┌─────────────┐
│       End   │
└─────────────┘
```
```
┌─────────────┐
│         03  │
└─────────────┘
```

7. Now press **DSPL**.

| DSPL |

```
┌─────────────┐
│   no-00     │
└─────────────┘
```
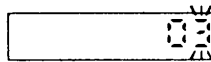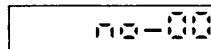
8. Now press and hold **△**.

| △ |

If you set **01**, the display will run up to **19** and then repeat from **00**. This is the default setting.

```
┌─────────────┐
│   no-00     │
└─────────────┘
```
```
┌─────────────┐
│   no-19     │
└─────────────┘
```
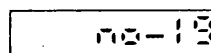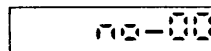
You can now use the basic functions (00 to 19).

-or-

If you set **02**, the display will run up to **29** and then repeat from **00**.

```
┌─────────────┐
│   no-00     │
└─────────────┘
```
```
┌─────────────┐
│   no-29     │
└─────────────┘
```

5. SETTING UP APPLICATIONS
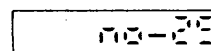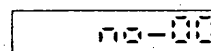
You can now use the basic functions and basic applications (00 to 29)

-or-

If you set **03**, the display will run up to **59** and then repeat from **00**.

```
┌─────────────┐
│   no-00     │
└─────────────┘
```

```
┌─────────────┐
│   no-59     │
└─────────────┘
```

You can now use the basic functions, basic applications, and advance applications (00 to 59).

- *Set 03 so you can work through the other examples in this section.*

PRGM DRIVE

9. Press **PRGM DRIVE** to return to the drive mode.

```
┌─────────────┐
│   F060.0    │
└─────────────┘
```

Constants that can be set in the drive mode

The following constants can be set by using the digital operator in the drive mode when setting the 2nd digit of constant no-46 to "1".

Constant	Name	Constant	Name
no-09	Accel time 1	no-16	Frequency reference 4
no-10	Decel time 1	no-17	Jog frequency reference
no-11	Accel time 2	no-22	Frequency reference gain
no-12	Decel time 2	no-23	Frequency reference bias
no-13	Frequency reference 1	no-29	Automatic torque boost gain
no-14	Frequency reference 2	no-45	Analog monitor gain
no-15	Frequency reference 3	no-57	Slip compensation gain

Note: For some units, constant no-46 cannot be set in the drive mode according to PROM No. version of the VS-606PC3.

PROM No. (no-49)

NSP6 04001 to 6 04005 : Setting disabled.

NSP6 04100 and after : Setting enabled.

Adjusting the frequency setting

This procedure shows you how to obtain 10% speed (6 Hz) at a frequency voltage setting of 0V and 100% speed (60 Hz) at 8V. To do this, you have to set:

- no-23 to 0.10

- no-22 to 1.23.

Setting the bias

First, set the bias by setting **no-23** to **0.10**

FREQ SETTING VOLTAGE (V)

1. Press **PRGM DRIVE** to enter the program mode.

```
no-01
```
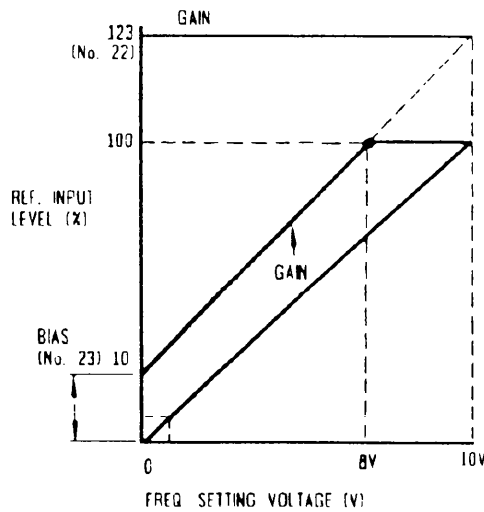
2. Press △ or ▽ until you see **23**.

```
no-23
```

[DATA ENTER] **3.** Press **DATA ENTER**

```
 ┌──────────┐
 │  ᵜ       │
 │ 00.00    │
 │ ◿◺       │
 └──────────┘
```

[▷ RESET] **4.** Press ▷ to start the second digit blinking.

```
 ┌──────────┐
 │     ᵜ    │
 │ 00.00    │
 │     ◿◺   │
 └──────────┘
```

[△] **5.** Press △ to enter **1**.

```
 ┌──────────┐
 │     ᵜ    │
 │ 00.10    │
 │     ◿◺   │
 └──────────┘
```
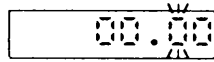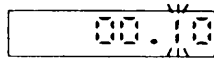
If the display shows **0.10**, go on to the next step.

-or-

If the last digit is not zero, press ▷ then use ▽ or △ to set the last digit to zero.

[DATA ENTER] **6.** Press **DATA ENTER**.

```
 ┌──────────┐
 │      End │
 └──────────┘
```

```
 ┌──────────┐
 │     ᵜ    │
 │  0.10    │
 │     ◿◺   │
 └──────────┘
```
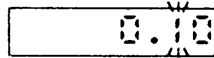
Setting the gain

The value for gain was determined by using the calculation shown below.

How to calculate GAIN

$$(1)\quad x = \frac{100-b}{a}$$

$$(2)\quad G = \frac{10x+b}{100}$$

Use equation (1) to obtain x.

$$x = \frac{100-10}{8}$$

$$x = 11.25$$

By substituting the value for x in equation (2), we have:

$$G = \frac{10 \times 11.25 + 10}{100}$$

$$G = 1.23$$

Values in the equations

a:	Setting voltage at 100% frequency (V). In this example, since 100% speed (60Hz) is obtained at 8V, then $a = 8$.
b:	Bias level (%). In this example, since 10% speed (6 Hz) is obtained at frequency voltage 0V, the $b = 10$.
G:	Gain set value.

DSPL **1.** Press **DSPL**.

no-23

▽ **2.** Press ▽.

no-22

DATA ENTER **3.** Press **DATA ENTER**.

1.00

⊵ RESET	**4.** Press ▷ select the digit to change.
△	**5.** Press △ or ▽ to set **1.23**.

$$\boxed{\quad 1.23 \quad}$$

DATA ENTER	**6.** Press DATA ENTER.

$$\boxed{\quad 1.23 \quad}$$
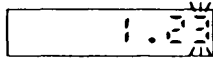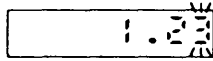
Calibrating a frequency/current meter

Follow this procedure to calibrate a frequency/current meter. The meter can be calibrated without a calibration resistor. This example assumes the frequency meter specifications are 3V at the full output for **no-02**. Let's set **no-45** to **0.30**.

PRGM DRIVE

1. Press **PRGM DRIVE** to enter the program mode.

       | no-01 |

△

2. Press and hold △ to select **45**.

       | no-45 |

DATA ENTER

3. Press **DATA ENTER**.

       | 1.00 |

▽

4. Press ▽ to set 0 at the first digit.

       | 0.00 |

▷ RESET

5. Press ▷.

       | 0.00 |

△

6. Press △ three times to enter **3**.

       | 0.30 |

DATA ENTER

7. Press **DATA ENTER**.

       | End |

       | 0.30 |

Since analog monitor gain is set to 1.00 prior to shipping, 10V is output at the maximum output frequency set for **no-02**.

By displaying the value for no-45 in the program mode, the voltage at the 100% level according to the value set for **no-45** is unconditionally output by the meter calibrating function.

Assuming **no-45** is **0.30**, then

10V x 0.30 = 3V

is output unconditionally.

5. SETTING UP APPLICATIONS

Setting a lower frequency for long wiring

Follow this procedure if you have to separate the inverter and motor with a very long wire. The effect of harmonic leakage current from the cable on the inverter or peripherals will increase as the cable becomes longer. To avoid this problem, lower the inverter carrier frequency.

1. Measure the distance between the inverter and the motor.
2. Check the table below to find the setting you need.

    *   *The factory setting is 4. If the wire between the inverter and motor is between 30 and 50 meters long, you won't have to change this setting.*

Wiring distance between inverter and motor	**Up to 30 m**	**Up to 50 m**	**Up to 100 m**	**100 m or more**
Allowable Carrier Frequency (Value for no-40)	15 kHz or less (6)	10 kHz or less (4)	5 kHz or less (2)	2.5 kHz or less (1)

If the 4 setting is satisfactory, press **PRGM DRIVE** to return to the drive mode and initial display.

-or-

If you need a setting other than 4, go on to the next step.

PRGM DRIVE   3. Press **PRGM DRIVE** to enter the program mode.

> ⌐◌−◌◌
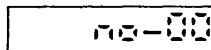
▽   4. Press ▽ or △ until you see **40**.

> ⌐◌−�╵◌

DATA ENTER   5. Press **DATA ENTER**.

> ◌╵╵
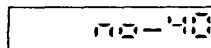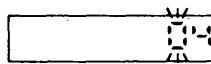
▷ RESET   6. Press ▷.

> ◌╵╵

[∇]   **7.** Press △ or ∇ until you see the number you want.

┌─────────────────┐
│   0̃2̃   │
└─────────────────┘

[DATA ENTER]   **8.** Press **DATA ENTER** to save the setting.

┌─────────────────┐
│   End   │
└─────────────────┘

┌─────────────────┐
│   0̃2̃   │
└─────────────────┘
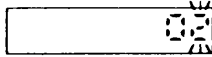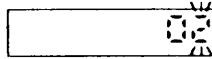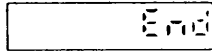
[PRGM DRIVE]   **9.** Press **PRGM DRIVE** to return to the drive mode.

Remote operation examples

The following example shows you how to set up the inverter for remote control using external signals through the control circuits.

A heavy-duty motor of non-standard voltage, frequency

Let's assume that you have a piece of heavy equipment, such as a lathe, for example, with a heavy-duty motor rated to run at 160 V, 300 Hz with external signal input.

To set up the inverter, you will need to:

⌐o–00	Initialize the inverter
⌐o–0 !	Set the operation mode for remote operation
⌐o–02	Set the maximum output frequency 300 Hz
⌐o–03	Set the maximum voltage 160 V
⌐o–04	Set the maximum voltage output frequency 300 Hz
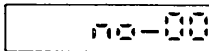
Initializing the inverter

Follow this procedure to initialize the inverter. After you initialize the inverter, all constants are returned to the factory settings.

- *Always initialize the inverter before you set up new constants.*

```
F000.0
```
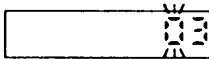
[PRGM DRIVE] 1. At the initial display, press **PRGM DRIVE**.

```
no-00
```
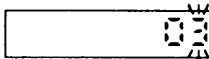
If **no-00** is not displayed, press Δ or ∇ until you see **no-00**.

[DATA ENTER] 2. Press **DATA ENTER** to enter the next level.

```
03
```

[⊳ RESET] 3. Press ⊳.

```
03
```
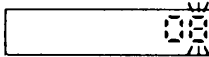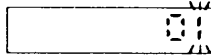
[Δ] 4. Press Δ until you see **08**.

```
08
```

5. SETTING UP APPLICATIONS

DATA ENTER   **5.** Press **DATA ENTER**.

> ```
>                    01
> ```

After you restore all the factory settings, remove write protection from constants **no-20** to **no-59**. Enter **03** so all the constants (00-59) are available for setting.
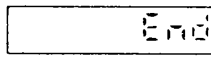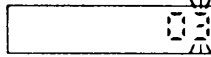
△   **6.** Press △ until you see **03**.

> ```
>                    03
> ```

DATA ENTER   **7.** Press **DATA ENTER**

> ```
>                   End
> ```
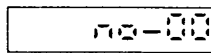
> ```
>                    03
> ```

DSPL   **8.** Press **DSPL**.

> ```
>                 no-00
> ```

Setting the operation mode

Set the operation for remote operation (operating the inverter with external signals through the control terminals.)

Λ

1. Press Λ to display **no-01**.

| no-01 |

DATA ENTER

2. Press DATA ENTER.

| 0011 |

▷ RESET
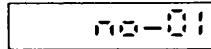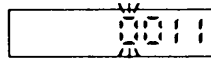
3. Press ▷ to move the blinking digit.

∇

4. Press ∇ to change the blinking digit.
   Set all digits to **0**.

| 0000 |

DATA ENTER

5. Press DATA ENTER.

| End |

| 0000 |
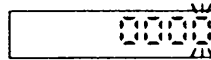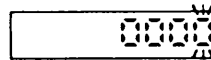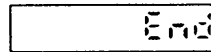
Setting the maximum output frequency

Set the maximum output frequency to 300 Hz.

| DSPL | **1.** Press **DSPL**. |

```
┌─────────────────┐
│     no-01       │
└─────────────────┘
```

| △ | **2.** Press △. |

```
┌─────────────────┐
│     no-02       │
└─────────────────┘
```

| DATA ENTER | **3.** Press **DATA ENTER**. |

```
┌─────────────────┐
│     060.0       │
└─────────────────┘
```

| ▷ RESET | **4.** Set the display for **300.0** |

- *Press △ or ▽ to change the blinking digit.*
- *Press ▷ to move the blinking digit to the right.*

```
┌─────────────────┐
│     300.0       │
└─────────────────┘
```

| DATA ENTER | **5.** Press **DATA ENTER**. |

```
┌─────────────────┐
│      End        │
└─────────────────┘
```

```
┌─────────────────┐
│     300.0       │
└─────────────────┘
```

Setting the maximum voltage

|DSPL| **1.** Press DSPL

```
┌─────────────┐
│   no-02     │
└─────────────┘
```

|Δ| **2.** Press Δ.

```
┌─────────────┐
│   no-03     │
└─────────────┘
```

|DATA ENTER| **3.** Press DATA ENTER.

```
┌─────────────┐
│    200.0    │
└─────────────┘
```

|▷ RESET| **4.** Set the display for **160.0**.

- *Press Δ or ∇ to change the blinking digit.*
- *Press ▷ to move the blinking digit to the right.*

```
┌─────────────┐
│    160.0    │
└─────────────┘
```

|DATA ENTER| **5.** Press DATA ENTER.

```
┌─────────────┐
│     End     │
└─────────────┘
┌─────────────┐
│    160.0    │
└─────────────┘
```

Setting the maximum voltage output frequency

DSPL **1.** Press DSPL.

```
 ┌──────────────┐
 │   no-03      │
 └──────────────┘
```

2. Press △.

```
 ┌──────────────┐
 │   no-04      │
 └──────────────┘
```

DATA ENTER **3.** Press DATA ENTER.

```
 ┌──────────────┐
 │     060.0    │
 └──────────────┘
```

▷ RESET **4.** Set the display for **300.0**.

- *Press △ or ▽ to change the blinking digit.*
- *Press ▷ to move the blinking digit to the right.*

```
 ┌──────────────┐
 │     300.0    │
 └──────────────┘
```

DATA ENTER **5.** Press DATA ENTER.

```
 ┌──────────────┐
 │      End     │
 └──────────────┘
```

```
 ┌──────────────┐
 │     300.0    │
 └──────────────┘
```

PRGM DRIVE **6.** Press PRGM DRIVE to end the settings and leave the program.

```
 ┌──────────────┐
 │  F    0.0    │
 └──────────────┘
```

- *The inverter is now set for operation from the control terminals.*

Running the motor

1. Turn on the forward run signal.
2. Turn the frequency knob to the right to run and increase the output frequency.

Voltage
200 V

0   60 Hz
              Frequency

Voltage
160 V

no-2 300

no-3 160

no-4 300

0   300 Hz
              Frequency
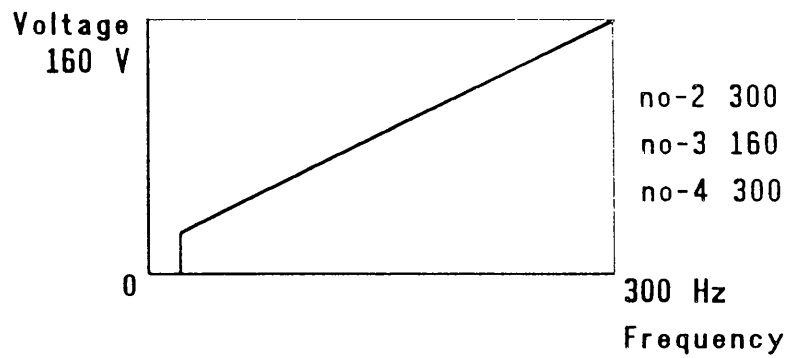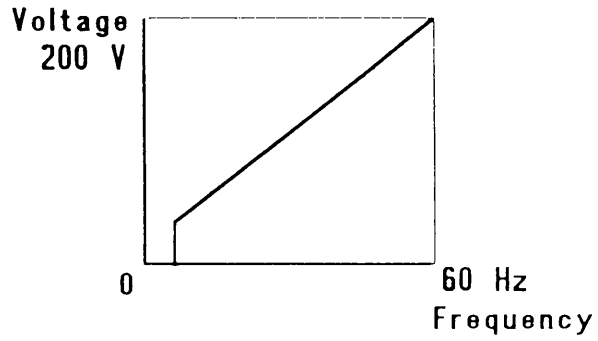
Motor rated current setting

The inverter is provided with electronic thermal overload protection to protect your motor from overheating. To take advantage of this feature, you must set the inverter for the rated current value described on your motor name plate.

- *A YASKAWA standard 4-pole motor current is set as the initial value before shipping.*

Read the name plate on your motor, then do these settings.

no-18   Motor protection.

no-19   Thermal overload reference current.

- *For more details about these settings, see section 7. QUICK REFERENCE.*

6. SELECTED APPLICATIONS

This section provides a detailed summary of the most important application features of the inverter. Function and application constants are set and changed in the program mode. At the beginning of this section you will see a brief overview of these important procedures:
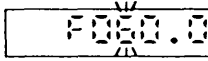
- Entering the program mode.
- Initializing the inverter constants (restoring the constants to the factory settings).
- Password setting
- Operation mode selection

Before doing selected applications ...
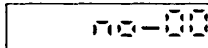
Before doing selected applications, read over this short introduction of basic functions and be sure you understand them and know how to set them up.

Entering the program mode

1. Turn on the inverter.

   [F060.0]

PRGM DRIVE

2. Press **PRGM DRIVE** to enter the program mode.

   [no-00]

A
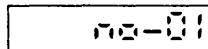
3. Press A to increase the number selection.

   • *Press and hold to rapidly display higher numbers.*

   • *After you reach no-59 (the highest selection) if you press A the display scrolls back to no-00 (the lowest selection).*

V
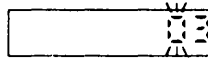
4. Press V to decrease the number selection.
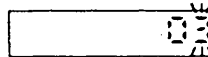
   • *Press and hold to rapidly display lower numbers.*

   • *After you reach no-00 (the lowest selection) if you press V, the display scrolls up to no-59 (the highest selection).*

   [no-01]
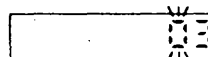
DATA ENTER

5. At any selection, press **DATA ENTER** so you can display the next level and enter changes. At this level, you will see one digit blinking. When a digit is blinking this means this is the digit you can change.

   [03]

⟩ RESET

6. Press ⟩ to move the blinking digit right.

   [03]

⟩ RESET

7. When the last digit on the right is blinking, press ⟩ again. The first digit starts blinking again.

   [03]

⊳ RESET **8.** You have to continuously press ▷ to set blinking the digit you want to change.

```
┌─────────────┐
│          03 │
└─────────────┘
```

△ **9.** To increase the blinking number, press △.

  • *Press and hold to rapidly increase the number.*

```
┌─────────────┐
│          08 │
└─────────────┘
```
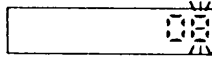
▽ **10.** To decrease the blinking number, press ▽.

  • *Press and hold to rapidly decrease the number.*

```
┌─────────────┐
│          03 │
└─────────────┘
```
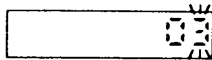
DATA ENTER **11.** After you have displayed the number you want to enter, press DATA ENTER.

  • *You must press* DATA ENTER. *If you fail to press this key, the change will not be saved in the inverter memory.*

```
┌─────────────┐
│       End   │
└─────────────┘
```

```
┌─────────────┐
│          03 │
└─────────────┘
```
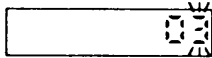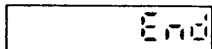
End is displayed for a few seconds, then you see the setting you just entered displayed again.

If you see both digits blinking for about 3 seconds:

```
┌─────────────┐
│          03 │
└─────────────┘
```
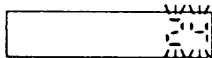
this means you have entered a number that is out of range for the setting. See section *7. QUICK REFERENCE* for a summary of allowed entries for each setting.

```
┌─────────────┐
│          03 │
└─────────────┘
```
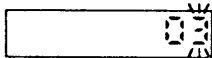
DSPL **12.** When you are finished making a setting for the current selection, press DSPL to return to the previous level. Now you can repeat this procedure and make other settings.

-or-

PRGM DRIVE Press PRGM DRIVE to leave the program mode and return to the drive mode.

```
┌─────────────┐
│     F060.0  │
└─────────────┘
```
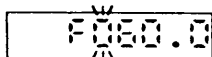
Initializing before new settings

To avoid conflicting configurations, be sure to re-initialize the inverter before trying to set up new settings.

PRGM
DRIVE

1. Enter the program mode.

```
┌────────────────────┐
│      no-00         │
└────────────────────┘
```

-or-

Press △ or ▽ until you see **no-00**.

DATA
ENTER

2. Select **no-00**.

```
┌────────────────────┐
│                03  │
└────────────────────┘
```

▷
RESET

3. Select the first digit.

```
┌────────────────────┐
│                03  │
└────────────────────┘
```

△

4. Change the first digit to **8** (initialize).

```
┌────────────────────┐
│                08  │
└────────────────────┘
```

DATA
ENTER

5. Save the new setting.

```
┌────────────────────┐
│      End           │
└────────────────────┘
```

```
┌────────────────────┐
│                01  │
└────────────────────┘
```

△

6. Enter **3** so you can use all the constants (00-59).

```
┌────────────────────┐
│                03  │
└────────────────────┘
```

Re-set for the maximum number of constants that can be set (00- 59).

DATA
ENTER

7. Save the new setting.

```
┌────────────────────┐
│      End           │
└────────────────────┘
```

```
┌────────────────────┐
│      no-00         │
└────────────────────┘
```

Now make your new settings.

-or-
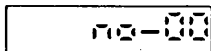
PRGM
DRIVE

Press **PRGM DRIVE** to return to the drive mode.

Selecting the operation mode
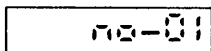
Always be sure the operation mode is set correctly before you try to set up applications. There are two operation modes: (1) operating from the inverter digital display (2) operating with external signals through the control circuits.

```
F000.0
```

PRGM DRIVE 1. Press **PRGM DRIVE** to enter the program mode.

```
no-00
```

∇ 2. Press Δ or ∇ until you see **no-01**.

```
no-01
```

DATA ENTER 3. Press **DATA ENTER**.

```
0011
```

4. The default setting is **0011**, the constant for operation from the digital operator keys.
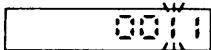
If you want to operate the inverter from the digital operator, press **PRGM DRIVE** to leave the program mode and return to the drive mode.

-or-
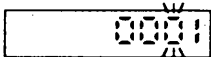
If you want to operate the inverter with external signals through the control terminals, go on to the next step.
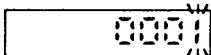
▷ RESET 5. Press ▷ until the first **1** starts blinking.

```
0011
```

∇ 6. Press ∇ to change the **1** to **0**.

```
0001
```

▷ RESET 7. Press ▷ to start the last **1** blinking.

```
0001
```

| ▽ |

8. Press ▽ to change the **1** to **0**.
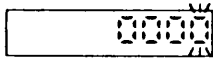
| 0000 |

| DATA ENTER |

9. Press **DATA ENTER**.

| End |

| 0000 |

| PRGM DRIVE |

10. Press **PRGM DRIVE** to leave the program mode and enter the drive mode.

| F   0.0 |
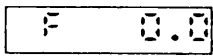
The inverter is now set for remote operation through the control terminals.

Quick reference table for selected applications

For a quick reference, use this alphabetical listing of applications.

Application	Page
Accel / decel hold	6-50
Accel / decel time and patterns	6-19
Automatic reset and restart	6-48
Carrier frequency	6-39
DC injection braking	6-34
Electronic thermal overload	6-22
4-step speed change	6-11
Frequency / current meter calibration	6-35
Full-range automatic torque boost	6-29
Jog operation	6-18
Local / remote selection	6-52
Motor stall prevention	6-27
Moter torque adjustment	6-15
Multifunction analog output monitor	6-24
Multifunction contact input	6-30
Multifunction photocoupler output	6-33
Operation during momentary power loss	6-46
Operation mode selection	6-9
Output frequency control (gain / bias)	6-20
Output frequency limit	6-26
Overtorque detection	6-37
Prohibited frequency control	6-41
Password.	6-8
Reduction of machine vibration and shock	6-43
S-curve pattern accel / decel	6-13
Slip compensation	6-51
Speed agreed signal output	6-40
Speed search	6-44
UP / DOWN command	6-53

Password

Name	Constant	Factory setting
Constant group	ⲛⲟ-００	1

Main Feature

Sets and releases write protection on constants. To be able to read and change all constants, set to **03**. To write-protect all constants from accidental erasure, set to **00**.

The password function enables and disables the selection of the 2nd (no-20 to 29) and 3rd (no-30 to 59) groups of functions. Enable the functions when you want to set and display them in the 1-line display. Disable them after you have set them up and you want to protect them from accidental resetting or canceling.

Settings

００	First functions 00 to 19 can only be read.
０ⵏ	First functions 00 to 19 can be set and read.
０ⴺ	First (00 to 19) and second (20-29) functions can be set and read.
０ⴺ	First (00 to 19), second (20-29), and third functions (30-59) can be set and read.
０Ϭ	All fault records are cleared.
０ⴺ	Initializes the inverter by restoring all settings and terminal functions to the factory settings.
０ⵟ	Initializes all control constants. Terminal functions are all set to 3-wire sequence. Refer to *Multifunction contact input* on page 6-30.

Operation mode selection

Name	Constant	Factory setting
Start/stop procedure	no-01	0011*
Reverse rotation prevention	no-20	0000

* : 0000 is the factory setting for the model shipped with the indicating cover.

Main Feature

Sets the inverter for local operation with the digital operator (0011) or for remote operation (0000) with external signals through the control terminals.

Start procedure

Operation performed from the digital operator or the control circuits.

1   X X 0 0

         1st digit

         0: Frequency ref. from control circuit

         1: Frequency ref. from digital operator

         2nd digit

         0: Start/stop control from control circuit terminal

         1: Start/stop from digital operator
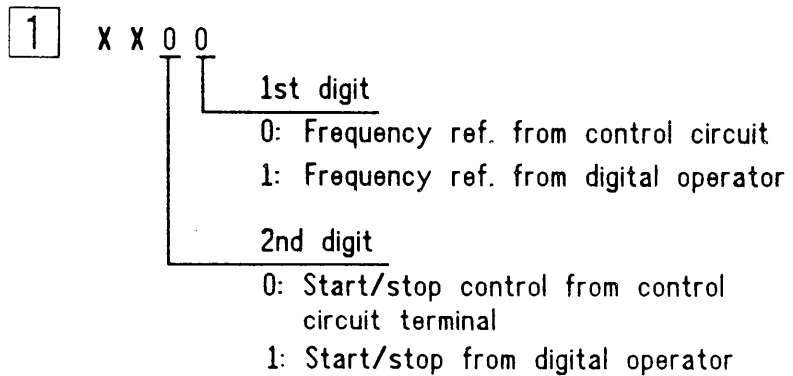
- *In this timing chart, and in the timing charts that follow in this section, the constants are abbreviated by enclosing them in a box. For example, the constant **no-20** in the timing chart above appears as* 20 .

Stop procedure

The stop mode can be selected according to your application.

    [1]   X 0 X X
              └─ 3rd digit
                  0 : Deceleration to a stop
                  1 : Coast to a stop
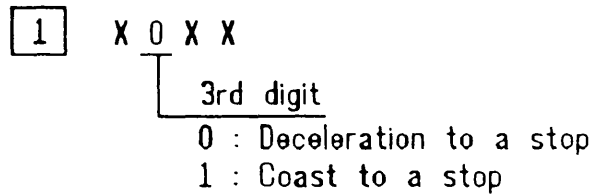
Reverse rotation prevention

Prevents accidental selection of reverse rotation by ignoring the REV even if it is input.

    [20]   X X X 1
                  └─ 1st digit

                      0 : Reverse rotation possible
                      1 : Reverse rotation impossible
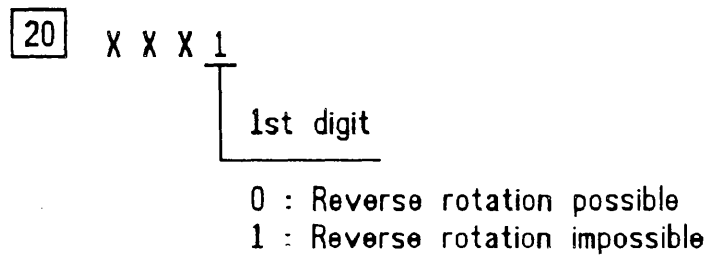
4-step speed change

Name	Constant	Factory setting
Multi-speed frequency reference	ᴨᴏ-13 to 16	0.0 Hz
Multi-speed operation	ᴨᴏ32, 33	1, 3

Main Feature

Sets up to 4 steps of speed using contact input by setting terminals 4 and 5 as multifunction contact terminals.
When an analog signal is not used, operation even at low speed without the adverse effects of noise can be performed.

The frequency reference can be changed only if it is selected by the multispeed reference functions by closing and opening terminals 4 and 5.
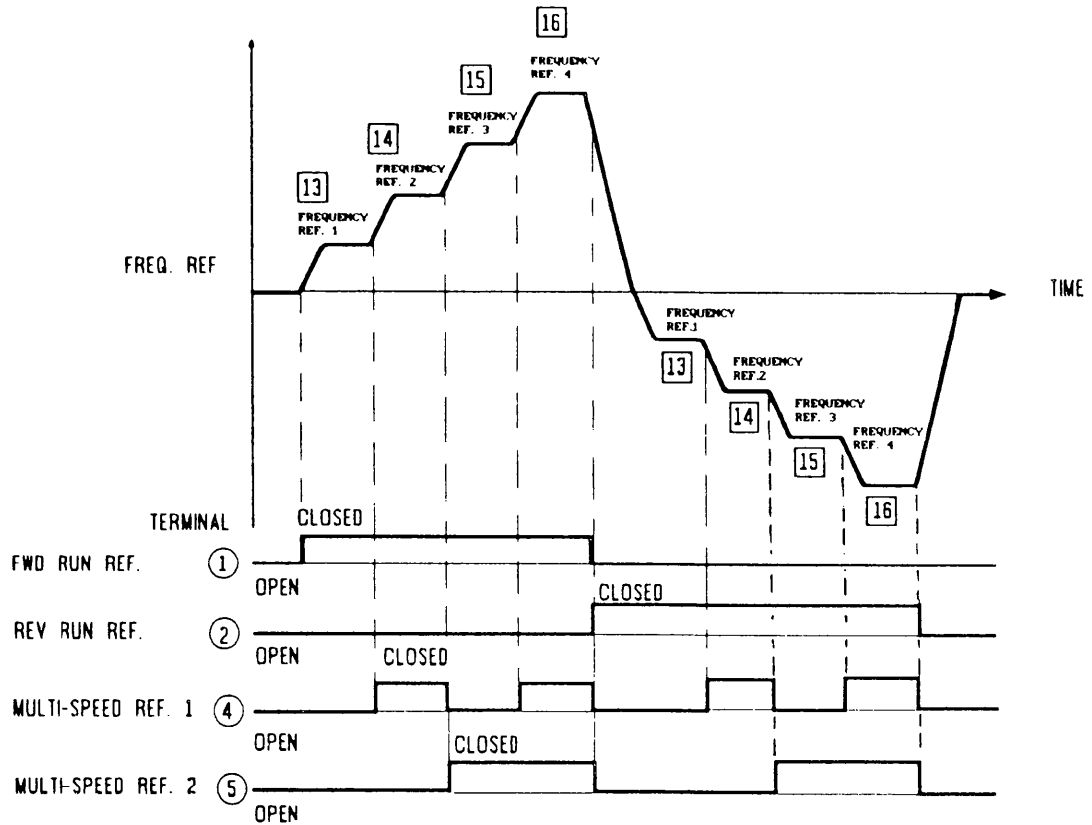
Terminal 4	Terminal 5	Constant
OPEN	OPEN	no-13
CLOSED	OPEN	no-14
OPEN	CLOSED	no-15
CLOSED	CLOSED	no-16

For frequency reference change during running, only frequency reference selected by multi-step speed reference during frequency reference value display can be changed. Additionally, when either multi-step speed reference 1 or 2 is used, the other multi-step speed reference that is not set is regarded to be always "open".

When no-01 is set to "× × × 1", no-13 (frequency reference 1) becomes the master frequency reference and the frequency reference is displayed on the operator. When the frequency reference value is changed, the changed value is stored in no-13 (frequency reference 1).

When no-01 is set to "× × ×0", the control circuit terminal analog frequency reference becomes the master frequency reference. In this case, the contents of no-13 (frequency reference 1) are invalidated.

S-curve pattern accel/decel

Name	Constant	Factory setting
S-Curve pattern	no-21	0000

Main Feature

Prevents shock at start/stop. Obtain the S-curve pattern by setting **no-21**.

```
21    0 0 X X
            ┐
            └─  3rd, 4th  digits

            00 : S-curve  section  not  provided
                 (linear  accel/decel)
            01 : S-curve  section  0.2  sec.
            10 : S-curve  section  0.5  sec.
            11 : S-curve  section  1.0  sec.
```

FREQUENCY
REFERENCE

OUTPUT FREQUENCY

TIME

S-CURVE CHARACTERISTIC TIME (T_{sc})
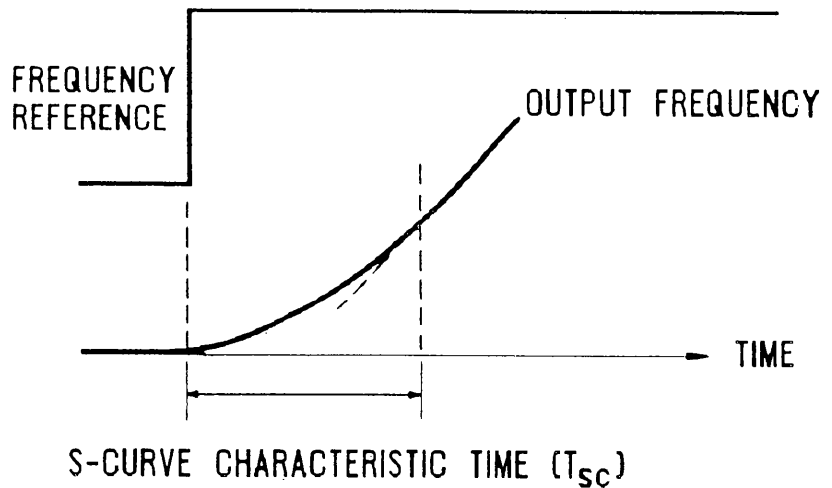
• *The S-curve characteristic time refers to the time from acceleration rate 0 to the regular acceleration rate determined by the set acceleration time.*

The following time chart shows FWD/REV run switching at deceleration to a stop.

FWD RUN COMMAND

REV RUN COMMAND

ACCELERATION

DECELERATION

MINIMUM OUTPUT FREQUENCY [7]

DC INJECTION BRAKING TIME AT STOP [27]

OUTPUT FREQUENCY

MINIMUM OUTPUT FREQUENCY [7]

MINIMUM OUTPUT FREQUENCY [7]

[7]

S-CURVE CHARACTERISTICS

ACCELERATION

DECELERATION

IN
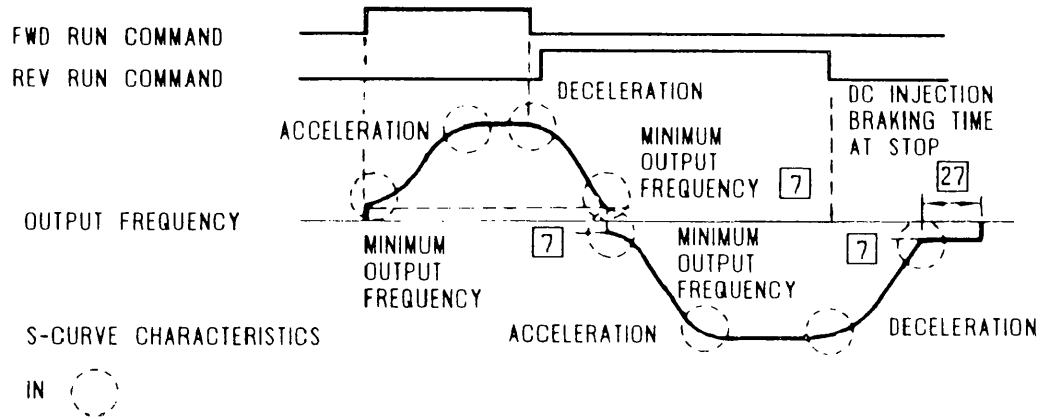
Motor torque adjustment

Main Feature

Motor torque is adjusted by V/f pattern and full-range automatic torque boost.

V/f pattern setting

Set V/f pattern as follows according to the load characteristics. For 400V class, voltage is twice that of the following values. When operating at more than 60Hz/50Hz, change the max frequency (no-02).

For general-purpose machines

[Motor specification : 60Hz]
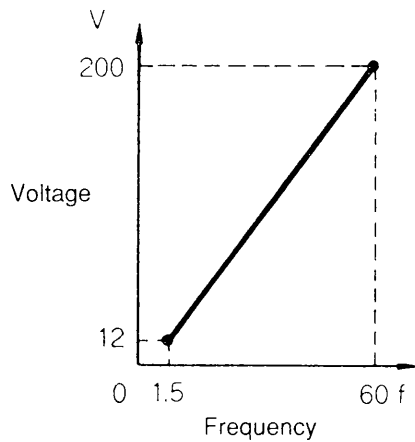
Factory setting

Constant	Set value
no-02	60.0
no-03	200.0
no-04	60.0
no-05	1.5
no-06	12.0
no-07	1.5
no-08	12.0

[Motor specification : 50Hz]
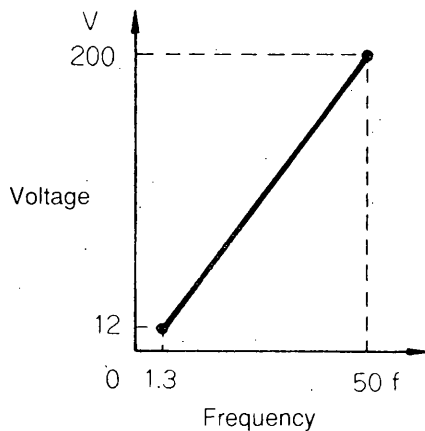
Constant	Set value
no-02	50.0
no-03	200.0
no-04	50.0
no-05	1.3
no-06	12.0
no-07	1.3
no-08	12.0

For fans/pumps

[Motor specification : 60Hz]   [Motor specification : 50Hz]

Constant	Set value
no-02	60.0
no-03	200.0
no-04	60.0
no-05	30.0
no-06	50.0
no-07	1.5
no-08	10.0

Constant	Set value
no-02	50.0
no-03	200.0
no-04	50.0
no-05	25.0
no-06	50.0
no-07	1.3
no-08	10.0
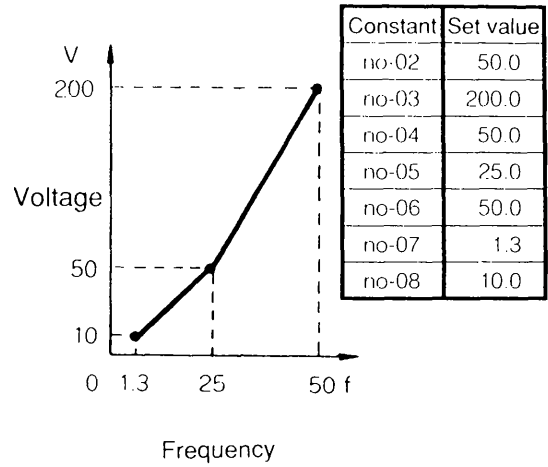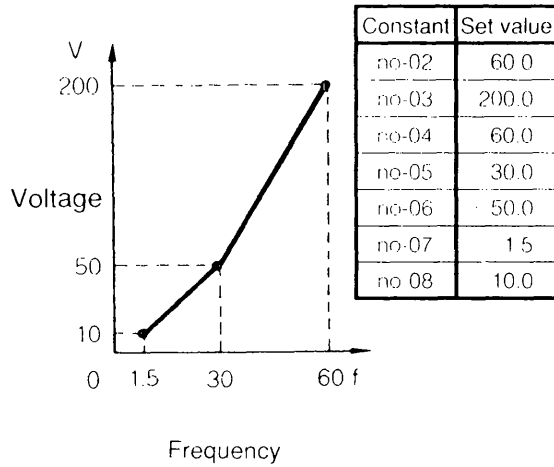
For machines requiring high starting torque

[Motor specification : 60Hz]   [Motor specification : 50Hz]

Constant	Set value
no-02	60.0
no-03	200.0
no-04	60.0
no-05	3.0
no-06	23.0
no-07	1.5
no-08	18.0

Constant	Set value
no-02	50.0
no-03	200.0
no-04	50.0
no-05	2.2
no-06	23.0
no-07	1.3
no-08	14.0
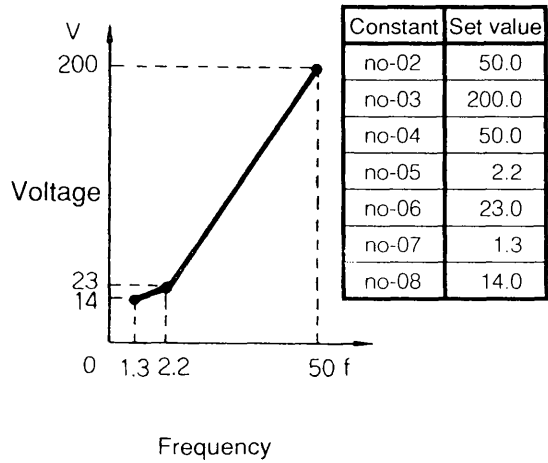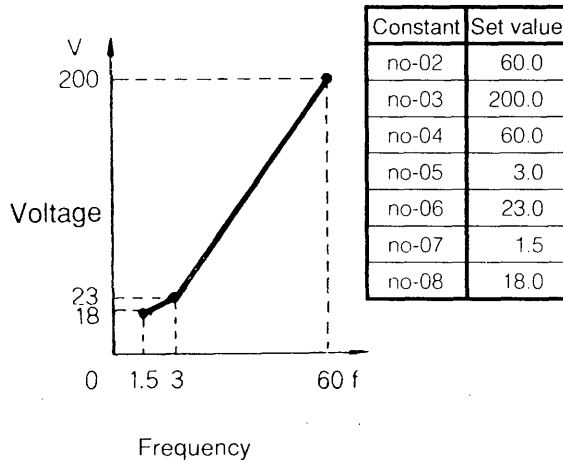
Caution!

• *Increasing voltage of V/f pattern, increases motor torque, but excessive increase may cause motor current overflow, motor overheat or vibration.*

Output limiter selection

When V/f is set to an excessively larger value, an inverter fault can occur. Therefore, in order to prevent a malfunction, an upper limit is provided for the output voltage. However, the setting is not necessary for normal operation.


```
OUTPUT      250 V
VOLTAGE                         OUTPUT VOLTAGE
                                LIMIT PATTERN
             40 V
              5 V

              0   [4]/40    [4]    OUTPUT FREQUENCY
                 (MAX. VOLTAGE OUTPUT FREQUENCY)
```
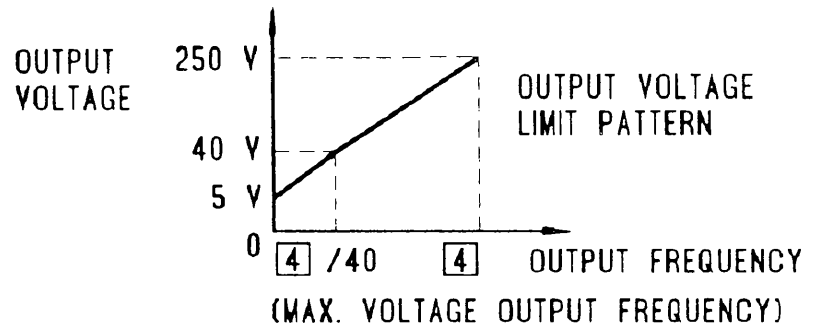
```
[1]  0 X X X
            |___ 4th digit
```

0 : Desired V/f with output voltage limiter

1 : Desired V/f without output voltage limiter

For 400 V Class, the value is twice that of the 200 V Class.

If 1 is set, a V/f setting matching the motor characteristics must be selected.

Jog operation

Name	Constant	Factory setting
Jog frequency reference setting	no-17	6.0 Hz
Jog reference selection	no-32, 33	1, 3

Main Feature

When the jog command is input and then the FWD (REV) run command is input, jog operation is enabled at the jog frequency set to no-17. The jog command is input from multifunction contact input terminals 4 and 5. The function value 5 of terminal 4 or 5 is set to no-32 or no-33 as follows:

Terminal 4 function : Set 5 to no-32.

Terminal 5 function : Set 5 to no-33.

The digital operator JOG key can perform the same operation. Operation by the JOG key is equivalent to when operation from the control circuit terminal input is selected (no-01=$\times \times \times$0), and the run command and the jog command are input simultaneously.
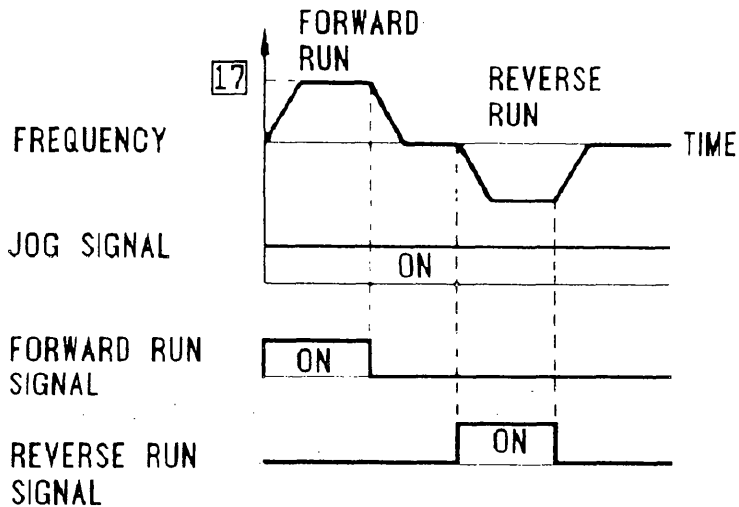
• *When multi-step speed reference 1 or 2 (refer to 6-12) and the jog command are input simultaneously, the jog command has priority.*

When you press **JOG** or input an external jog signal, the motor ramps to the output level set by this constant.

When you use the digital operator, you can press **JOG** and ramp to this setting only when the motor is stopped. This feature is disabled when the motor is running.

However, when an external jog signal is input it will override the current operation mode and the inverter will ramp to the level set for this constant.

Accel/decel time and patterns

Name	Constant	Factory setting
Acceleration time 1	no-09	10.0 s
Deceleration time 1	no-10	10.0 s
Acceleration time 2	no-11	10.0 s
Deceleration time 2	no-12	10.0 s
Accel/decel time select	no-32, 33	1, 3

Main Feature

Allows you to use two sets of individually programmed acceleration and deceleration times set from **0.0 sec** to **600 sec**.

The set time indicates the interval required before reaching the maximum output frequency setting (**no-02**). The accel/decel time can be set for two-step switching with multifunction contact input, even during running.
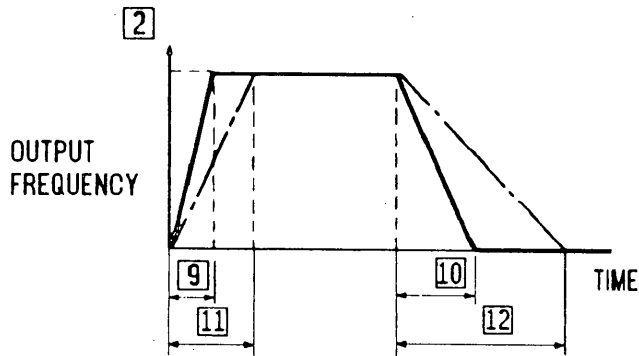
Example

When no-33 is 6 :

Terminals 5,6	Selects
OPEN	no-09, no-10
CLOSED	no-11, no-12

Shock reduction at motor start by the S-curve is also enabled. When S-curve accel/decel is required, refer to S-curve pattern selection on page 6-13.

Output frequency control (gain/bias)

Name	Constant	Factory setting
Frequency reference Gain	no-22	1.00
Frequency reference Bias	no-23	0.00

Main Feature

Allows you to set Gain/Bias according the frequency setting (0 to 10 V or 4 to 20 mA).
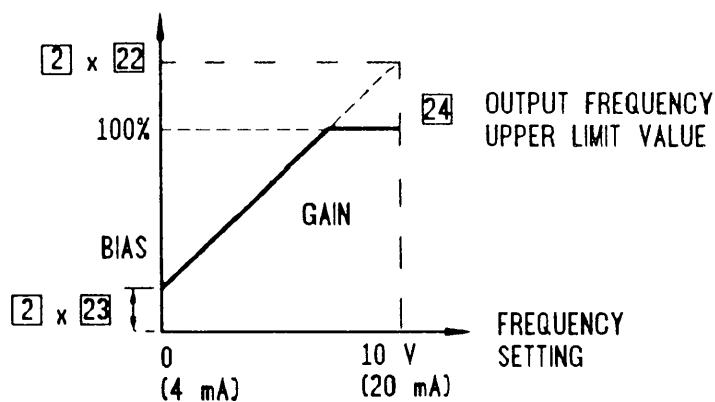
For details about the setting method, see page 5-5 .

Frequency reference Gain (no-22) sets the automatic speed reference Gain in increments of 0.1%. Frequency reference Bias (no-23) sets automatic speed reference Bias in increments of 1% .

0-10V

1. With no input, adjust Bias (no-23) until an output of 0.00 Hz is obtained.

2. With full input, adjust Gain (no-22) until an output of 60.0Hz (or other desired max. output frequency) is obtained.

4-20 mA

3. With 4 mA input adjust Bias (no-23) until an output of 0.00 is obtained.

4. With 20 mA input, adjust Gain (no-22) until an output of 60.00 Hz (or other desired max. output frequency) is obtained.

Relation between analog input voltage/current and frequency

Frequency
reference

100%

0

0   10 V
(4)   (20 mA)
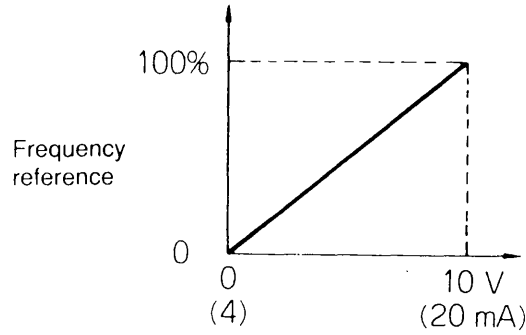
The figure shows the relation preset at the factory. The relation between analog input and frequency can be changed by resetting of gain (no-22) and bias (no-23).

Example: 0 to 5V analog input

100%

0   5 V   10 V
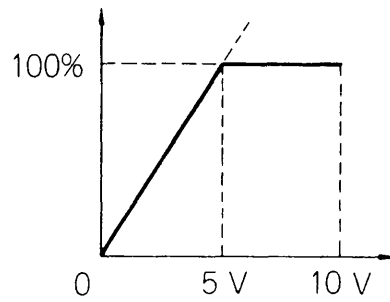
Setting:
Gain (no-22)=2.00%
Bias (no-23)=0.00%

Electronic thermal overload

Name	Constant	Factory setting
Motor type	⌐⌐-18	0000
Motor rated current	⌐⌐-19	1.9A*

* : For a YASKAWA 0.75 HP (0.4kW), 200 V, 4-pole standard motor.
The YASKAWA motor standard values are set before shipping.
For details, see tables on page 7-11.

Main Feature

Prevents standard and exclusive-use motors from overloading. The inverter electronic thermal overload function monitors motor current and detects overload.

You are not required to mount external thermal overload relays. However, if you want to connect several motors to one inverter, you should install a thermal relay for each motor. In this case, you must reduce the carrier frequency by following the instructions for adjusting the frequency according to the wiring distance between the inverter and motor. For details, see page 5-10.

19   Motor rated current
Set the motor rated current value according to the rated value on the motor name plate.

18   X X 0 X
       2nd digit
        0 : Standard motor
        1 : Exclusive-use motor

18   X X X 1   Can disable electronic thermal overload protection
      1st digit
       0 : Electronic thermal overload protection provided
       1 : No electronic thermal overload protection

18   X 0 X X
      3rd digit
       0 : Electronic thermal overload time constant used for standard or exclusive-use motors (standard ratings)
       1 : Electronic thermal overload time constant used for motors not described above (short-term ratings)

Standard motors and exclusive-use motors

Induction motors are classified into standard motors and inverter exclusive-use motors.

Therefore, protection characteristics for temperature simulation of inverter electronic thermal overload is different in the two motor types.

	Cooling effect	Torque characteristics	Electronic thermal overload
Standard motor	Effective when operated at 50/60Hz due to using commercial power supply.	Base Frequency 60 Hz (V/f for 60Hz, 220V Input Voltage) For low-speed operation, torque must be limited in order to stop temperature rise in motor.	"OL1" error (motor overload protection) occurs when continuously operated at 50/60Hz or less at 100% load.
Inverter exclusive-use motor	Effective even when operated at low speed (approx. 6Hz).	Base Frequency 60 Hz (V/f for 60Hz, 220V Input Voltage) Use an exclusive-use motor for continuous operation at low speed.	Electronic thermal overload protection not activated even when continuously operated at 50/60Hz or less at 100% load.

Multifunction analog output monitor

Name	Constant	Factory setting
Output monitor select	no-21	0000
Analog monitor gain	no-45	1.00

Main Feature

Allows you to monitor output frequency or output current by analog output between control terminals 12 and 11 (0 to 10 V output).

```
21    X X 0 X
            └─ Not used

          Output contents between control
          circuit terminals  12-11

          2nd digit

          0 : Output frequency monitor
          1 : Output current monitor
```
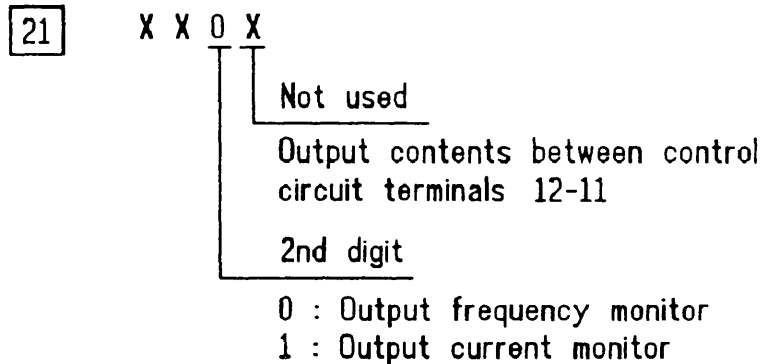
You can set analog monitor gain with **no-45**. Analog output monitor voltage is output as shown by the equations below.

Output frequency monitor

$$\text{Output voltage (V)} = \text{Output frequency} \times \frac{10\ V}{\text{Max. output frequency}\ \boxed{2}} \times \boxed{45}$$

Output current monitor

$$\text{Output voltage (V)} = \text{Output current} \times \frac{10\ V}{\text{Inverter rated current}} \times \boxed{45}$$

Because the output current may occasionally reach approximately 200% of the rated current for the inverter, the output voltage is clamped at approximately 11 V when:

- **no-45** is set at **1.00**
- The rated current for the inverter is exceeded.

To preserve linearity, be sure **no-45** is set to **0.5**

Output frequency limit

Name	Constant	Factory setting
Output frequency (speed) upper limit	no-24	100%
Output frequency (speed) lower limit	no-25	0

Main Feature

Allows you to set the range for the output frequency.

When the lower limit is *not* **0**, acceleration to the set lower limit begins and continues until the frequency reference reaches the lower limit value, and then the start command is input.
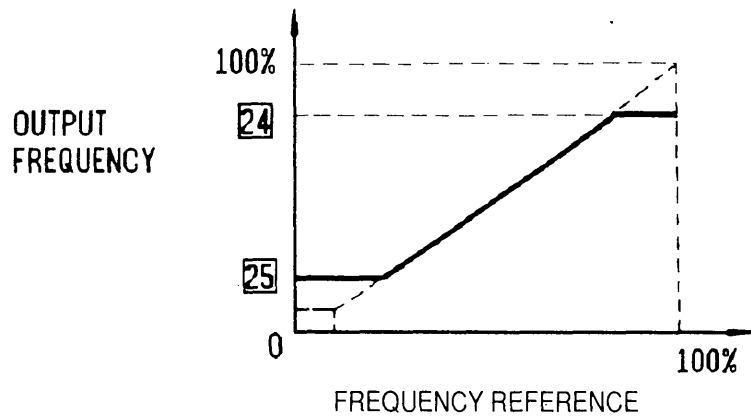
By setting **no-24** to **110%**, frequencies up to the setting for **no-02** x 1.1 can be output. For example, assume:

- no-02 = 60 (Hz)
- no-24 = 1.1

then 60 x 1.1 = 66 Hz, up to 66 Hz can be output. However, when voltage exceeds 400 Hz, the voltage is clamped at 400 Hz.

Motor stall prevention

Name	Constant	Factory setting
Operation level for stall prevention during acceleration	no-30	170%
Automatic decrease of stall prevention level during accel in constant HP(kW) area	no-46	0000
Operation level for stall prevention during run	no-31	160%
Stall prevention function during deceleration	no-20	0000

Main Feature

Determines whether stall prevention is enabled or disabled during:

- Acceleration
- Running
- Deceleration

Stall prevention automatically adjusts output frequency according to the load to allow continuous operation without stalling the motor.

Stall prevention during acceleration

During acceleration if the motor current exceeds the value set for **no-30**, acceleration stops until the motor current goes down to the value set for **no-30** or less.

MOTOR CURRENT
[30]

TIME

OUTPUT FREQ.

TIME

6. SELECTED APPLICATIONS
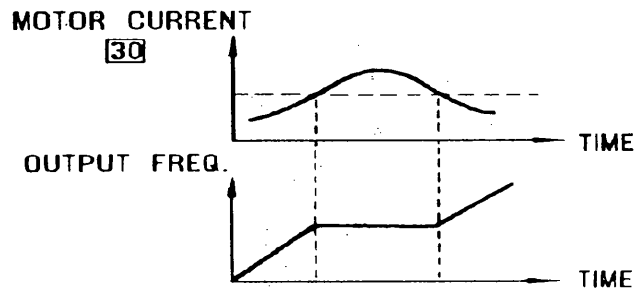
Stall prevention level during accel can be lowered automatically in constant HP(kW) area.

$\boxed{46}$ = × 0 × ×

3rd digit

0 : Automatic lowering disabled

1 : Automatic lowering enabled

Stall prevention level during accel in constant HP(kW) area
=Stall prevention level during accel $\boxed{30}$ ×

$$\frac{\text{Max. voltage output freq. } \boxed{04}}{\text{output freq.}}$$

Lower limit of stall prevention level during accel in constant HP(kW) area is 40% of stall prevention level during accel (no-30).

Stall prevention during running

During running if the motor current exceeds the value set for **no- 31** as a result of excessive load, the output frequency is automatically lowered. When the motor current goes down to the value set for **no-31** or lower, the motor starts acceleration again and operation continues.

MOTOR CURRENT

$\boxed{31}$

TIME

OUTPUT FREQ.

TIME
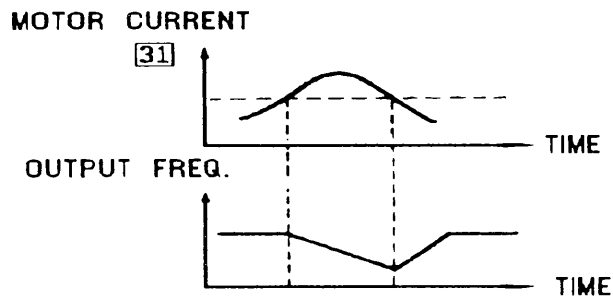
Stall prevention during deceleration

To prevent overvoltage during deceleration, the inverter automatically adjusts the deceleration rate by monitoring the DC voltage.

• *If you are connecting a braking resistor, set 1.*

$\boxed{20}$ 0 X X X

4th digit

0 : Stall prevention during deceleration

1 : No stall prevention during deceleration

• *When the motor load is large, or when the accel/decel time is short, the stall prevention function allows the accel/decel time to be longer than the set value.*

Full-range automatic torque boost

Name	Constant	Factory setting
Torque compensation	*no-29*	1.0

Main Feature

Allows tripless operation for energy saving.

This means the inverter automatically controls the V/f ratio according to the load torque. This ensures tripless operation and optimum output current.

When the wiring distance between the inverter and motor is long, (about 100 m), and when the motor torque is short, you may need to increase torque compensation gradually while checking the motor current. Normally, no adjustment is necessary.

Full-range automatic torque boost

Motor torque requirement changes according to load conditions. Full-range automatic torque boost adjusts voltage of V/f pattern according to the requirement. The VS-606PC3 automatically adjusts the voltage not only during constant-speed operation but also during acceleration. Torque requirement is calculated by the inverter.

| Output voltage | $\propto$ | Automatic torque boost gain (no-29) | $\times$ | Required torque |

Operation

V (Voltage)

Torque requirement $\Rightarrow$ Increase voltage

f (Frequency)
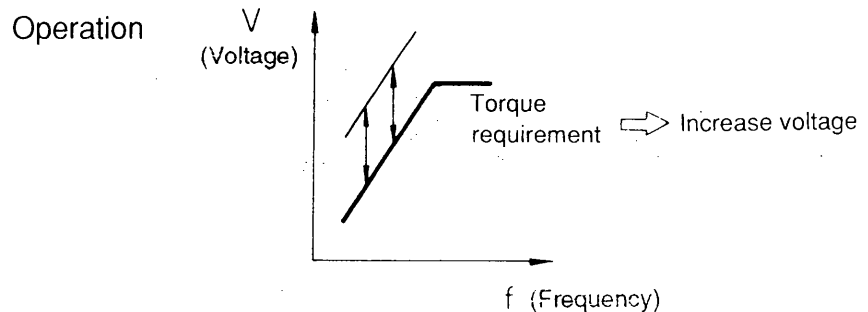
Multifunction contact input

Name	Constant	Factory setting
Multifunction contact input function	no-32, 33	1, 3

Main Feature

Selects the input signal functions for terminals 4 and 5.

If you make a mistake when setting these constants, a constant set failure will occur. Value failures are indicated in the display when all the digits blink and then the display returns to the setting before you changed it.

05
03
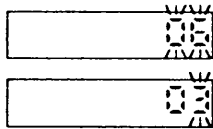
Rules for setting multifunction contact input constants

To avoid constant setting failures, follow these rules when you set constants for no-32 and no-33:

1. Set the values arranged in sequence with the smaller value for no-32 and the larger value for no-33.
2. Set no-33 first, then set no-32.
3. Set the constant for terminal 4 at no-32.
4. Set the constant for terminal 5 at no-33.

First, set no-33 : Larger value for
Terminal 5

Second, set no-32 : Smaller value for
Terminal 4

no-32

Setting	Function
00	FWD/REV run command (3-wire sequence selection)
01	External fault (NO contact input)
02	External fault (NC contact input)
03	Multi-step speed reference 1
04	Multi-step speed reference 2
05	JOG command
06	Accel/decel time select
07	External baseblock (NO contact input)
08	External baseblock (NC contact input)
09	Search command from maximum frequency
10	Search command from set frequency
11	Accel/decel hold command
12*	Local/remote selection
13*	option/inverter selection

* Cannot be set according to PROM No. version of the VS-606PC3.
PROM No. (no-49)

NSP6 [04001] to 6 [04005] : Setting disabled.

NSP6 [04100] and after : Setting enabled.

Terminal function at 3-wire sequence selection

VS-606PC3

1	RUN COMMAND (Run when CLOSED)
2	STOP COMMAND (Stop when OPEN)
4	FWD/REV RUN SELECTION (FWD RUN OPEN REV RUN CLOSED)
6	
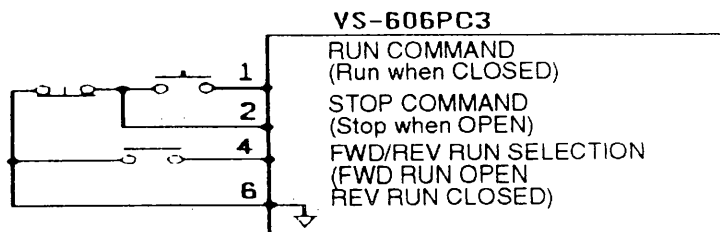
no-33

Setting	Function
01	External fault (NO contact input)
02	External fault (NC contact input)
03	Multi-step speed reference 1
04	Multi-step speed reference 2
05	JOG command
06	Accel/decel time select
07	External baseblock (NO contact input)
08	External baseblock (NC contact input)
09	Search command from maximum frequency
10	Search command from set frequency
11	Accel/decel hold command
12*	Local/remote selection
13*	option/inverter selection
14*	UP/DOWN command

* Cannot be set according to PROM No. version of the VS-606PC3.
PROM No. (no-49)

NSP6 04001 to 6 04005 : Setting disabled.

NSP6 04100 and after : Setting enabled.

Option / inverter selection

This command is effective when using a digital reference module (JVOP-117). Master frequency reference can be selected by this command.

Open : Master frequency reference from digital reference module
Closed : Master ferquency reference from control circuit terminal
(analog reference)

Multifunction photocoupler output

Name	Constant	Factory setting
Multifunction photocoupler output function	no-34, 35	0, 1

Main Feature

Enables and controls the functions of control circuits 13-7 and 14-7.

- *For terminals 13-7 (operation time: L), set at no-34.*
- *For terminals 14-7 (operation time: L), set at no-35.*

Setting	Function
0*	In operation
1†	Agreed frequency
2	Zero speed
3	Frequency detection (output frequency ≥) frequency detection level
4	Overtorque detected
5‡	Operation mode

* Factory setting of **no-34**

† Factory setting of **no-35**

‡ Cannot be set according to PROM No. version of the VS-606PC3.
   PROM No. (no-49)
   NSP6 04001 to 6 04005 : Setting disabled.
   NSP6 04100 and after : Setting enabled.

- *The maximum output capacity is 48 VDC 50 mA.*
- *To drive an inductive load, be sure to insert a free-wheel diode to control surge voltage.*
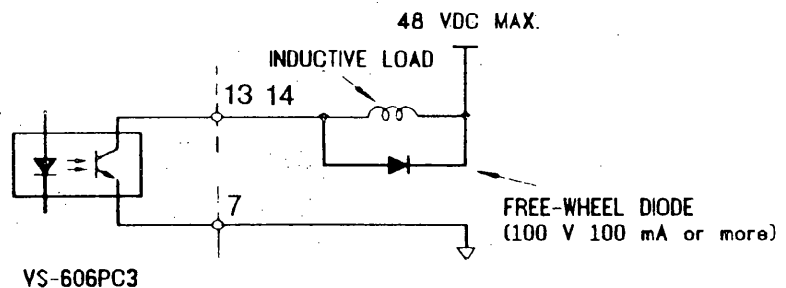
DC injection braking

Name	Constant	Factory setting
DC injection braking during stop	no-27	0.5 s
DC injection braking at start	no-28	0.0 s
DC injection braking current	no-26	50%

Main Feature

Allows you to accomplish the following without braking resistors:

- Prevent overrun at stop
- Start a coasting motor without tripping
- Set the braking current

Preventing overruns

Prevents overrun at stop with DC injection braking. If output frequency drops to the minimum output frequency (**no-07**) or less, the DC injection brake is applied for the time set at **no-27** to stop the motor. To disable injection braking, set **no-27** to **0.0** seconds.
When braking is disabled, the motor coasts to a stop when the output frequency is less than the minimum output frequency set for **no- 07**.
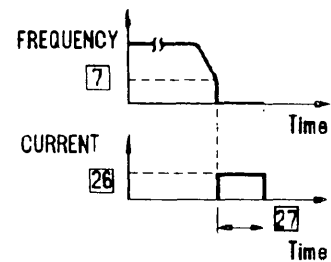
Starting a coasting motor without tripping

Starts a coasting motor without tripping even when the direction of rotation is not known. When the run command is input, the DC injection brake is applied for the time set at **no-28** and the motor stops. The motor then starts to operate.
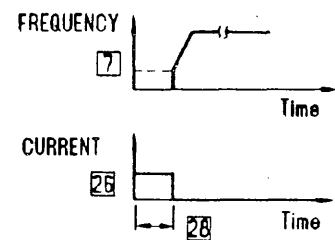
Setting the braking current

The braking current is set at **no-26**. The factory setting is 50% and at 100% equals the rated current of the inverter.

Frequency/current meter calibration

Name	Constant	Factory setting
Analog monitor gain	no-45	1.00
Output monitor selection	no-21	0000

Main Feature

Allows you to calibrate the frequency/current meter connected to the inverter with **no-45** without using a resistor for calibration.

For details, see *Calibrating a frequency meter* on page 5-9 and *Multifunction Analog Output Monitor* on page 6-24.

Output between control circuit terminals 12-11

```
21  X X 0 X
          └─ 2nd digit

        0 : Output frequency
        1 : Output current
```

Analog monitor scale calibration (no-45)

Use for adjusting analog output gain.

**FREQUENCY/CURRENT METER
(3 V FULL SCALE)**

6. SELECTED APPLICATIONS
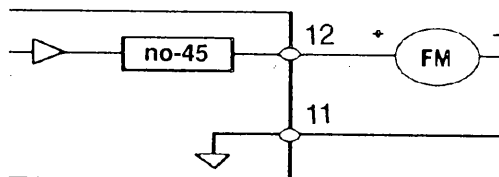
Set the voltage at 100% of analog output.

Frequency meter displaying 0 to 60Hz at 0 to 3V

$$10V \times \boxed{\frac{\text{no-45 setting}}{0.3}} = 3V$$

Output frequency becomes
100% at this value.

Analog output
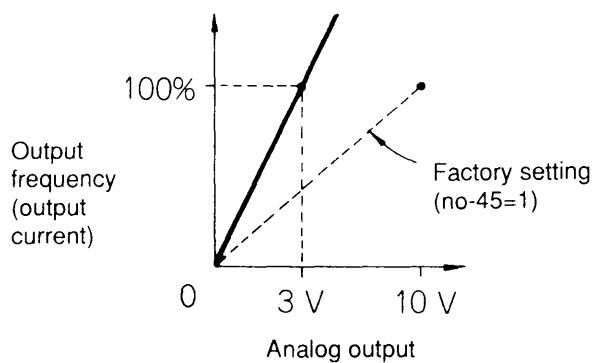
Overtorque detection

Name	Constant	Factory setting
Overtorque detection level	no-38	160%
Overtorque detection time	no-39	0.1 s
Overtorque detection signal	no-34, 35	0, 1
Overtorque detection selection	no-37	0000

Main Feature

Compares inverter rated output with the overtorque detection level. Detects overtorque when output current is equal to or greater than the defined level.

When an excess load is placed on the machine, the increase in motor current is detected. If the detected current exceeds the value set at **no-38** and lasts longer than the time set at **no-39**, the overtorque detection signal is output to control terminal 13 or 14 until the current is reduced equal to or below the value set for **no-38**.

- *To output the signal to control circuit terminal 13, set* **no-34** *to* **4.**

- *To output the signal to control circuit terminal 14, set* **no-35** *to* **4.**

MOTOR CURRENT

HYSTERESIS 5%

MULTI-FUNCTION
OUTPUT SIGNAL
(OVERTORQUE
DETECTION SIGNAL)

ON   ON

TIME
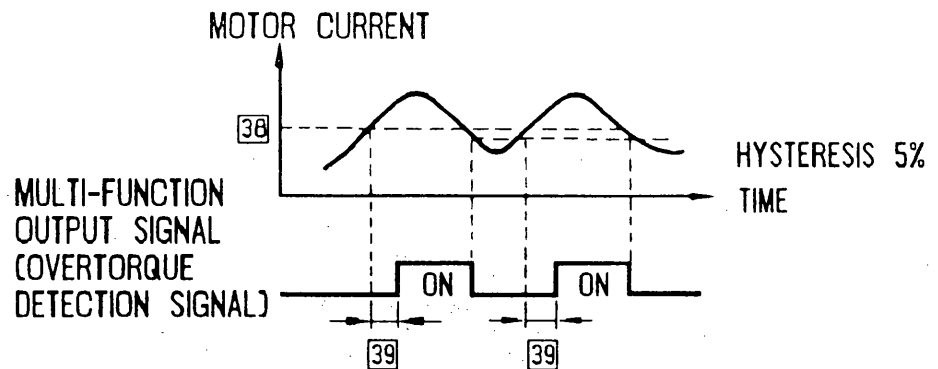
The setting for **no-37** can select overtorque detection only at an agreed speed or during running. It can also select continuous operation or output shut-off at overtorque detection.

```
[37]  × 0 0 0
              └── 1st digit
                  0 : No overtorque detection
                  1 : Overtorque detection

              2nd digit
                  0 : Detected only during agreed speed
                  1 : Detected during running

              3rd digit
                  0 : Continuous operation after
                      overtorque detection
                  1 : Output shut off at overtorque
                      detection

              Not used
```
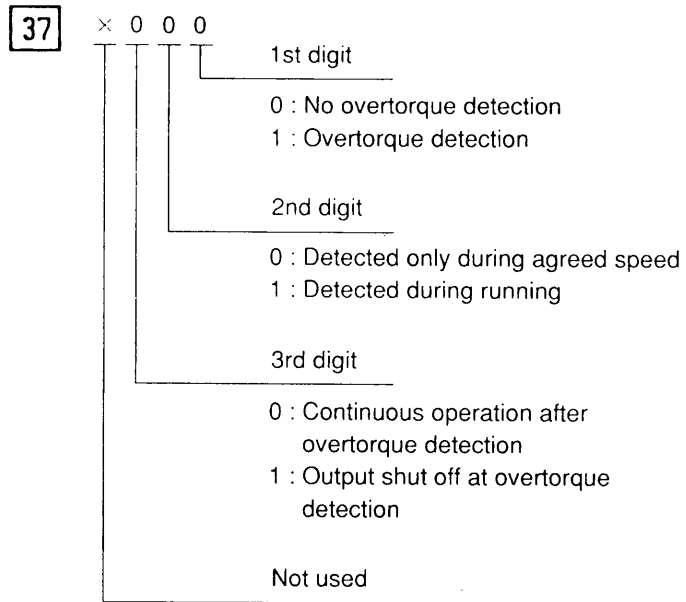
Carrier frequency

Name	Constant	Factory setting
Carrier frequency	⌐¤–⅏	4

Main Feature

Lets you change the carrier frequency to reduce RFI noise and current leakage without increasing motor noise.

Carrier frequency (kHz) = 2.5 kHz x [40] set value

1	2	3	4*	5	6

```
←─────── CARRIER FREQUENCY ───────→

 (LOW)                              (HIGH)
                 METALLIC NOISE
                 FROM MOTOR
   (HIGH)                           (NOT
                                    AUDIBLE)
```
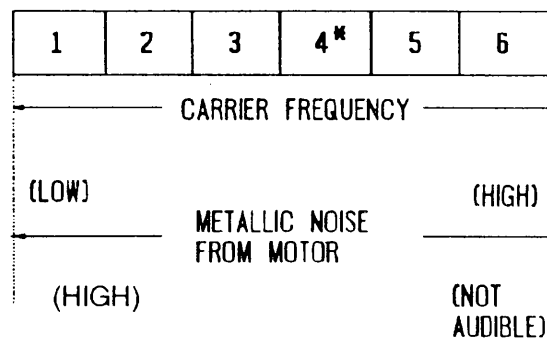
*Factory preset value

To set the frequency to 5 or 6, reduce the continuous output current.

Carrier Frequency Setting	Maximum Continuous Output Current
1 to 4	Up to 100% of inverter rated output current
5	Up to 90% of inverter rated output current
6	Up to 80% of inverter rated output current

If the wiring distance between the inverter and motor is long, reduce the carrier frequency. For details, see page 5-10.

6. SELECTED APPLICATIONS

Speed agreed signal output

Name	Constant	Factory setting
Frequency detection level	no-36	0.0 Hz
Multifunction photocoupler output function	no-34, 35	0, 1

Main Feature

Allows you to set operate the motor at an arbitrary speed as required.

If you set either constant (no-34 or no-35), you can enable control terminal 13 or 14.

- Set 1 for no-34 when the signal is to be output to terminal 13.

- Set 3 for no-35 when the signal is to be output to terminal 14.

Set value = 1 : Agreed frequency

Set value = 3 : frequency detection level
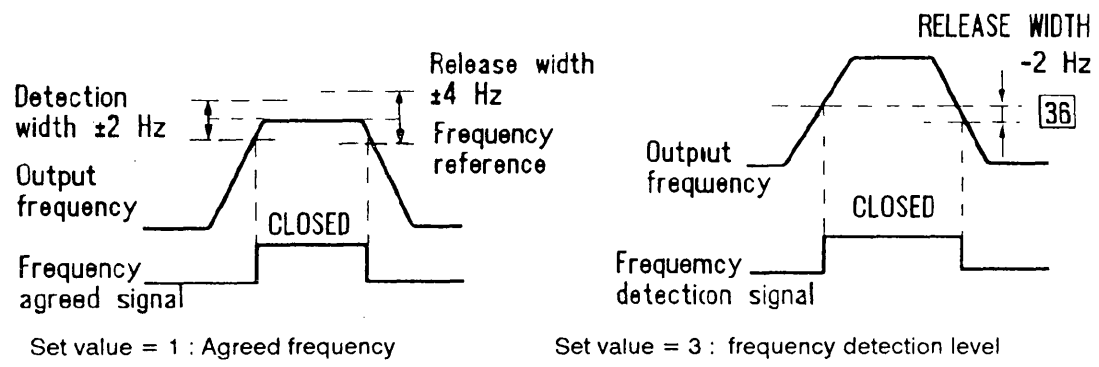
However, when agreed frequency is selected, the frequency agreed signal is turned OFF immediately to stop signal output.
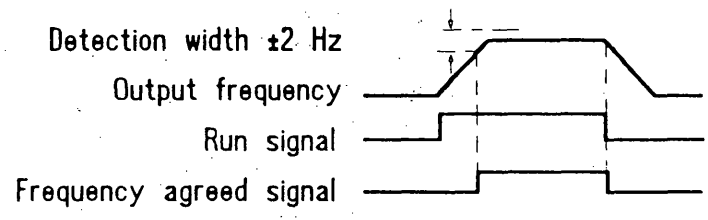
Prohibited frequency control

Name	Constant	Factory setting
Prohibited frequency 1	no-50	0.0 Hz
Prohibited frequency 2	no-51	0.0 Hz
Prohibited frequency 3	no-52	0.0 Hz
Probhibited width	no-53	1.0 Hz

Main Feature

Allows jumping the frequency so the motor can be operated without resonance caused by characteristic frequency of machine systems. This feature can also be used for dead band control.
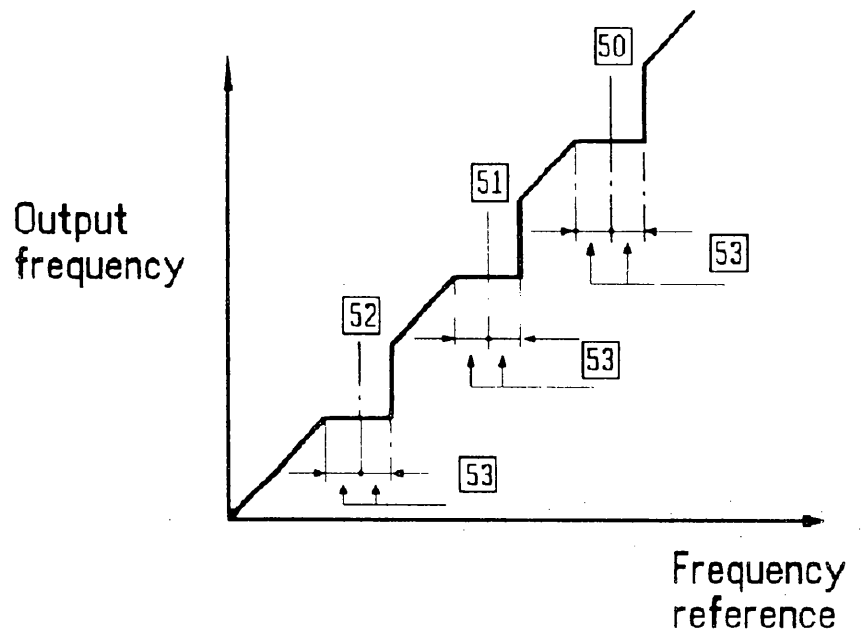
Constant speed operation is prohibited within the prohibited range. However, output frequency is not prohibited during acceleration or deceleration resulting in smooth acceleration and deceleration.

Prohibited frequency 1 to 3 (**no-50** *to* **no-52**)

By setting the value to 0.0 Hz, this function is disabled. Set the prohibited frequency 1 to 3 as described below:

$no-52$		$no-51$		$no-50$
Prohibited frequency 3	$\leq$	Prohibited frequency 2	$\leq$	Prohibited frequency 1

Prohibited width (**no-53**)

To disable this function, set the value to 0.0 Hz. The prohibited range is:

$$\begin{matrix} no-50 \\ \text{to} \\ no-52 \end{matrix} - no-53 \; < \; \text{Prohibited range} \; < \; \begin{matrix} no-50 \\ \text{to} \\ no-52 \end{matrix} + no-53$$

Example

When prohibited frequency 1 (no-50) is 45 Hz and the prohibited width 53 is 2.0 Hz, the prohibited range = 43 to 47 Hz.

Reduction of machine vibration and shock

Main Feature

Allows you to reduce vibration or shock by using the constants listed below.

Reduce Shock

Method	Constant	Factory setting	Adjustment
• To decrease generating torque	02 to 08	See V/f pattern setting in 7. QUICK REFERENCE	Decrease or increase V/f
• To increase generating torque	29	1.0	Decrease or increase torque boost
• To reduce shock at acceleration	21	0000	Set S-curve accel/decel
	09, 11	10.0 s	Increase accel time
	30	170%	Increase stall prevention level during accel
• To reduce shock at deceleration	01	0000	Set coasting to a stop
	21	0000	Set S-curve accel/decel
	10, 12	10.0 s	Increase decel time
	07	1.5 Hz	Decrease or increase minimum output frequency
	26	50%	Decrease DC injection braking current

Reduce Vibration

Method	Setting	Factory setting	Adjustment
• To decrease carrier frequency	40	4	----

Speed search

Name	Constant	Factory setting
Multifunction input selection	no-32, 33	1.3
Speed search operation level	no-54	150%
Min. baseblock time	no-55	0.5s
V/f during speed search	no-56	100%

Main Feature

Uses a multifunction input terminal to activate speed search and allows you to operate the motor without tripping when the motor is coasting during commercial power/inverter switching.

The speed search command is input from the multifunction contact input terminals 4 and 5. For terminals 4 and 5, **9** or **10** is set to **no-32** or **no-33**.

Constants no-32 and no-33 cannot be set in combination:

- When no-32 is set for 09, the speed search begins with the maximum frequency.
- When no-33 is set for 10, the speed search start from the set frequency.

By closing the search command during baseblock and inputting the run command, the speed search is started after the inverter output is shut off for the minimum baseblock time for **no-55**.

When the output inverter current is larger than the set value of the speed search **(no-54)**, the speed search operation starts.

The frequency at which the inverter output current becomes smaller than the speed search operation level **(no-54)** is judged to be the speed agreed point. The motor then starts re-acceleration or re-deceleration up or down to the set frequency for the set accel/decel time.

For V/f during speed search (no-56), see page 6-49.

The following time chart shows speed search command input.

FWD (REV) run command

ON

0.5 sec. or more

Search command — ON

Maximum frequency or frequency reference at run command input

Agreed speed detection

Output frequency

Minimum baseblock time

Voltage at speed search

Output voltage

Return to voltage at normal operation

Speed search operation
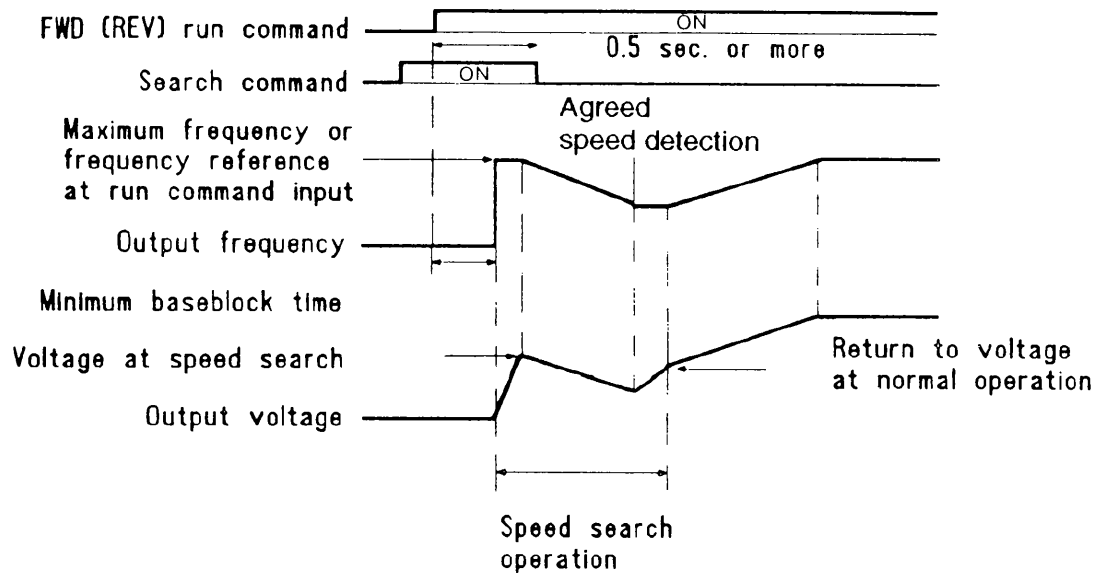
- *When the search commands are input from maximum frequency and set frequency simultaneously, the search command from maximum frequency has priority.*

- *Be sure the sequence for the FWD (REV) run command is input with or immediately after the search command.*

  If run command is input before search command, search command becomes ineffective.

TYPICAL SEQUENCE

RELAY 1

RELAY 1   RELAY 2

SEARCH COMMAND

FWD (REV) RUN COMMAND
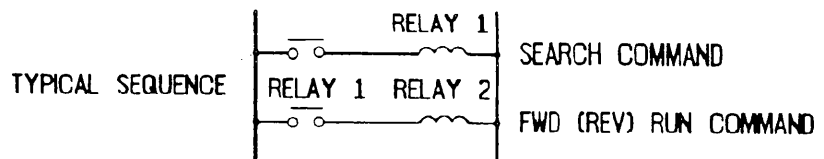
- *The minimum baseblock time is the time when the inverter output is shut off when there is motor voltage remaining. Setting this time shorter can reduce the time until the speed search starts, but the remaining voltage may activate an inverter protective feature, such as overcurrent (OC) for example. Therefore, do not reduce the time needlessly.*

Operation during momentary power loss

Name	Constant	Factory setting
Operation after momentary power loss	no-46	0000
Speed search operation level	no-54	150%
Min. baseblock time	no-55	0.5s
V/f during speed search	no-56	100%

Main Feature

Enables or disables power ride-thru. If disabled, the unit will stop when a power loss occurs. If enabled, the inverter will continue to operate during a momentary power loss for the length of time determined by the model of the inverter you are using.

$$\boxed{46} \quad X\ X\ X\ \underset{\text{1st digit}}{0}$$
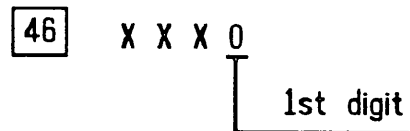
0 : No continuous operation after momentary power loss

1 : Continuous operation after momentary power loss

The amount of time within which operation can be assured varies to the capacity of the model you are using.

1 sec.	0.13 to 1 HP (0.1 to 0.75 kW)
2 sec.	2 to 5HP (1.5 to 3.7 kW)

For V/f during speed search (no-56), see page 6-49.

If a power loss exceeds the momentary power loss ride-thru time, the motor coasts to a stop.

Here is how this feature works:

① When undervoltage (UV) is detected, the inverter output is shut off and a frequency reference value and run command are given and held for the duration of the ride-thru time.
During the undervoltage, a blinking *Uu* appears on the display. If an undervoltage is detected, the inverter output is shut off for the minimum baseblock time (**no-55**).

② After recovery from the momentary power loss, the speed search operation starts after the inverter checks that DC voltage has recovered sufficiently.

③ The speed search operation starts when the inverter output current exceeds the speed search operation level (**no-54**). At this time, the new frequency reference value and run command are read in. The frequency at which the inverter output current is smaller than the speed search operation level (**no-54**) is judged to be the speed agreed point. Then re-acceleration or re- deceleration starts up or down to the set frequency for accel/decel time.
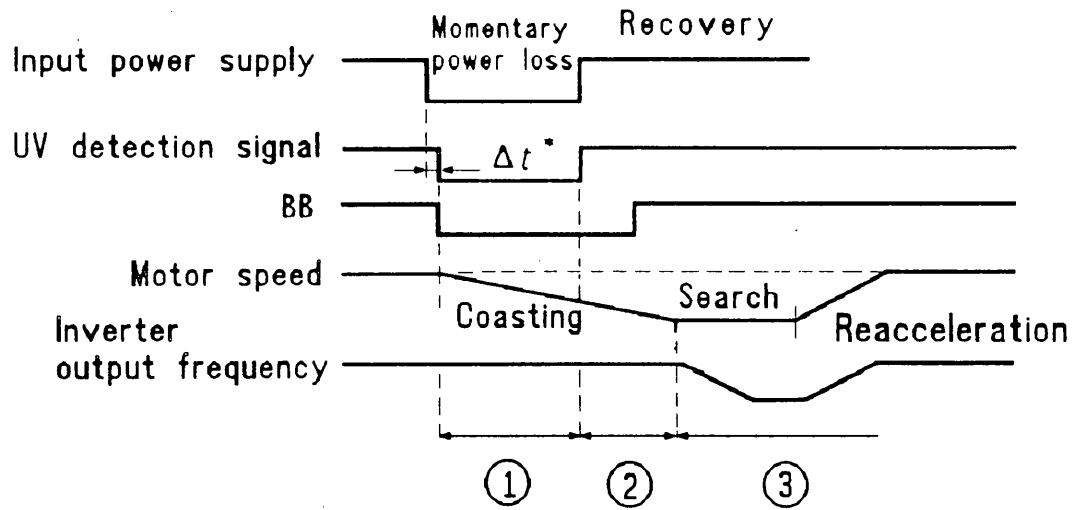
* Δt *varies according to the inverter size, but a minimum of 15 ms is assured. Operation automatically continues if recovery from momentary power loss is Δt or less.*

• *Do not set an excessively small value for the minimum baseblock time* **(no-55)**. *Otherwise, the inverter protection function may activate when the search operation starts.*

Automatic reset and restart

Name	Constant	Factory setting
Fault retry selection	no-47	0
Speed search operation level	no-54	150%
Min. baseblock time	no-55	0.5 s
V/f during speed search	no-56	100%

Main Feature

Sets the inverter to re-start and re-set fault detection after a fault occurs.

The number of the self-diagnosis and restarting times can be set at **no-47** up to **10**.

Set **0** to disable to this feature. The inverter automatically restarts after the following faults occur:

- oC Overcurrent protection
- ou Overvoltage protection
- oH Cooling fin overheat

The number of retries is cleared to **0** in the following cases:

- If no fault occurs longer than 10 minutes.
- After the fault is checked if the fault reset signal is on, or if **RESET** is pressed on the digital operator.
- Power supply is turned off.

Description of fault retry

① When a fault is detected, the inverter output is shut off for the minimum baseblock time **(no-55)**. While the inverter output is shut off, the alarm is displayed on the digital operator display.

② After the minimum baseblock time **(no-55)** has elapsed, the fault is automatically reset, and the speed search operation starts at the occurrence of the fault.

③ If the inverter output current is larger than the speed search operation level **(no-54)**, the speed search operation starts. The frequency at which the inverter output current is smaller than the speed search operation level **(no-54)** is judged to be the speed agreed point. Then re-acceleration or re-deceleration starts up or down to the set frequency at the set time for accel/decel.

---

④ If the number of faults exceeds the number of retry times (**47**), automatic resetting does not occur, and the inverter output is kept off. Then fault contact is output. Fault contact is not output during fault retry.
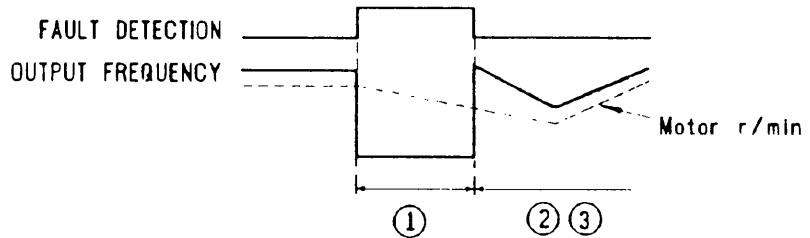
V/f during speed search (**no-56**)

The V/f during speed search can be set with **no-56** as shown in the figure so one of the protection functions, such as OC will not occur during the speed search. However, this setting is not needed for normal operation.

V/f during speed search = V/f under normal operation x value for **no-56**.

Minimum baseblock time

Do not set an excessively small value for the minimum baseblock time setting (no-55). Otherwise, an inverter protection function may operate when the search operation starts. See section *8. TROUBLESHOOTING.*

Accel/decel hold

Name	Constant	Factory setting
Accel/decel hold	no-32, 33	1, 3

Main Feature

Holds acceleration or deceleration.

The output frequency is maintained when the accel/decel hold command is input during acceleration or deceleration. The stop command releases the accel/decel hold and the operation stops.

The accel/decel hold command is input from the multifunction contact input terminal 4 or 5.

- *To use terminal 4, set 8 for no-32.*

- *To use terminal 5, set 8 for no-33.*

The following time chart shows the accel/decel hold command in operation.
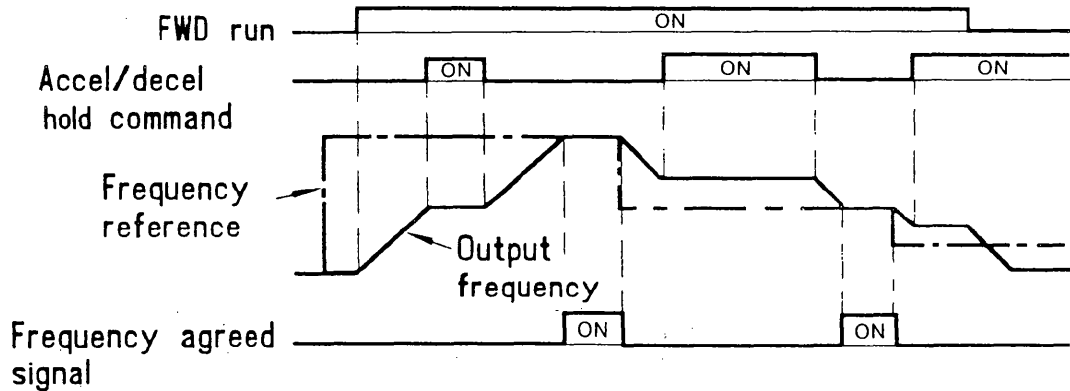
When the FWD (REV) run command is input with the accel/decel hold command, the baseblock status continues and the motor does not operate. However, when a frequency reference lower limit (**no- 25**) is set greater than or equal to the minimum output frequency (**no- 07**), the motor operates at the frequency reference lower limit (**no-25**).

Slip compensation

Name	Constant	Factory setting
Max. output frequency	no-02	60.0Hz
Max. voltage output frequency	no-04	60.0Hz
Motor rated current	no-19	*
Slip compensation gain	no-57	0.0%
Motor no-load current	no-58	30%
Slip compensation primary delay time	no-59	2.0s

* Differs depending on inverter capacity.

Main Feature

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

When inverter output current is equal to the motor rated current, the compensation frequency is added to the output frequency.

Compensation frequency = Motor rated slip value

$$\times \frac{\text{Output current} - \text{Motor no-load current } \boxed{58}}{\text{Motor rated current } \boxed{19} - \text{Motor no-load current } \boxed{58}}$$

Motor rated slip value = Max. voltage output frequency $\boxed{04}$
$\times$ Slip compensation gain $\boxed{57}$

Set the motor rated current (no-58) in units of 1% of inverter rated current.

$$\boxed{58} = \frac{\text{Motor no-load current (A)}}{\text{Inverter rated current (A)}} \times 100$$

- Slip compensation is not performed in the following conditions:
  - Setting slip compensation gain (no-57) to 0.0%
  - Output frequency < minimum output frequency (no-07)
  - During regeneration.
- In the constant HP(kW) area [output frequency $\geq$ max. voltage output frequency (no-04)], compensation frequency is increased automatically as below.
  The following shows the compensation frequency when the inverter output current is the motor rated current.
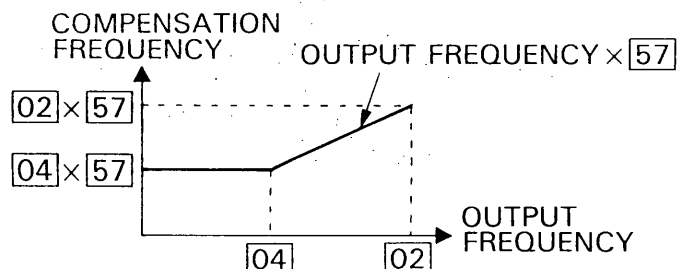
Local/remote selection

Name	Constant	Factory setting
Multifunction input selection	no - 32, 33	1, 3
Multifunction output selection	no - 34, 35	0, 1
Run signal selection	no - 01	0011 (0000)*

* The value for models with the indicating cover (without the digital operator).

Main Feature

Selects operation reference by the digital operator or by the control circuit terminal.
Local/ remote selection command can be input from multifuction contact input terminal 4 or 5. Set "12" for no-32 or no-33 to select terminal 4 or 5 function.

Terminal 4 or 5   Open: Remote mode

The inverter operates according to the setting of 1st and 2nd digits of run signal selection (no-01).

Terminal 4 or 5   Closed: Local mode

The inverter operates by frequency reference and run command from the digital operator.

Local/remote selection is effective only during stop. If it is performed during running, the command will be disregarded and the digital operator displays "SErr" (blinking).

Monitoring current mode

The current mode can be monitored by multifunction photocoupler output (control circuit terminal 13 or 14). Set "5" for no-34 to output to terminal 13 and for no-35 to terminal 14.
Terminal 13 or 14   Open   : Remote mode
                       Closed: Local mode

Precautions for use of analog operator (model JVOP-111)

In local mode, master frequency reference using the volume on the analog operator is selected.
When local/remote selection is set for multifunction input selection, the local/remote selection switch on the analog operator is disabled.

Precautions for use of digital reference module (model JVOP-117)

When using digital reference module, master frequency reference from digital reference module and run command from control circuit terminal are selected regardless of local/remote selection command.

UP/DOWN command

Name	Constant	Factory setting
Multifunction input selection	no-32, 33	1, 3
Max. output frequency	no-02	60.0Hz
Min. output frequency	no-07	1.5Hz
Output frequency upper limit	no-24	100%
Output frequency lower limit	no-25	0%

Main Feature

With the forward or reverse run command entered, accel/decel is enabled by inputting the UP or DOWN signals to control circuit terminals 4 and 5 without changing the frequency reference, so that operation can be performed at the desired speed. When UP/DOWN commands are specified by no-33, any function set to no-32 becomes disabled; terminal 4 becomes an input terminal for the UP command and terminal 5 for the DOWN command.

Control Circuit Terminal 4 (UP command)	Closed	Open	Open	Closed
Control Circuit Terminal 5 (DOWN command)	Open	Closed	Open	Closed
Operation Status	Accel	Decel	Hold	Hold

Time Chart at UP/DOWN Command Input
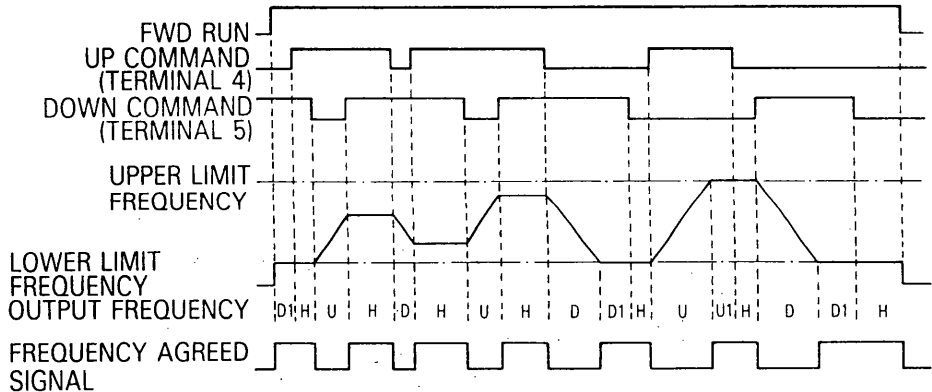
U = UP (accelerating) status
D = DOWN (decelerating) status
H = HOLD (constant speed) status
U1 = UP status, clamping at upper limit frequency
D1 = DOWN status, clamping at lower limit frequency

Notes:
1. When UP/DOWN command is selected, the upper limit frequency is set regardless of frequency.
   Upper limit frequency = Maximum output frequency (no-02)
   ×Frequency reference upper limit (no-24)/100
2. Lower limit frequency is either minimum output frequency (no-07) or frequency referece lower limit (no-25) (whichever is larger).
3. When the FWD (REV) run command is input, operation starts at the lower limit frequency without an UP/DOWN command.

6. SELECTED APPLICATIONS

7. QUICK REFERENCE

Three tables are included in this section for quick reference to all the constants that can be set for the inverter.

- First functions: no-00 to no-19
- Second functions: no-20 to no-29
- Third functions: no-30 to no-59

Before you try to set these constants, be sure you know how to set the password to enable all of these constants for changing and setting. For details, see page 5-2.

The tables in this section refer to the first to fourth digits. The digits are named as shown in the table below.

```
0  0  0  0
|  |  |  └── 1st digit
|  |  └───── 2nd digit
|  └──────── 3rd digit
└─────────── 4th digit
```
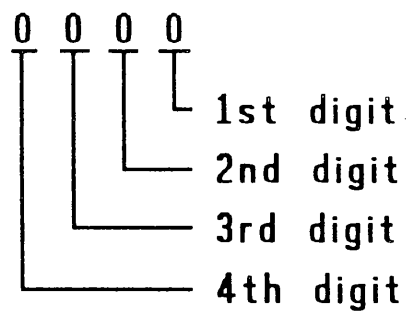
First functions: no-00 to no-19

First functions: no-00 to no-19

Function	No.	Name	Description	Initial setting	Note	Ref.
Constant group selection	00	Password	0: Password setting/reading and First Functions (no-01 to 19) reading possible.	1		6-8
			1: 1st function (no-00 to no-19) setting/reading possible.			
			2: 1st and 2nd functions (no-00 to no-29) setting/reading possible.			
Fault contents clear			3: 1st, 2nd, and 3rd functions (no-00 to no-59) setting/reading possible.			
			6: Fault record clear.			
Constant initial -ization			8: Initialize (multifunction terminal: initial value setting).			
			9: Initialize (3-wire sequence)			
Operation method	01*	Run signal selection 1	1st digit=0: Master frequency reference : control circuit terminals 8, 11 or 9, 11 inputs	0011† (0000)		6-9
			=1: Master frequency reference: operator F× × × ×			
			2nd digit=0: Run by command circuit terminal run command			
Stopping method			=1: Run by operator run command			
			3rd digit=0: Deceleration to stop			
			=1: Coasting to stop			
V/f pattern setting		Output voltage limiter selection	4th digit=0: Free choice V/f with output voltage limiter			
			=1: Free choice V/f without output voltage limiter			

* The 1st to 4th digits described above are read from right to left. This applies to other descriptions as well.

† The value in parentheses is the factory value for models with the indicating cover (without the digital operator.)

First functions: no-00 to no-19 (cont.)

Function	No.	Name	Description	Initial setting	Note	Ref.
V/f pattern setting	02	Maximum output frequency	Setting unit: 0.1 Hz Setting unit: 50.0 to 400.0 Hz	60.0 Hz		6-15
	03	Maximum voltage	Setting unit: 0.1 V* Setting range: 0.1 V to 255 V*	200.0 V*		
	04	Maximum voltage output frequency (base frequency)	Setting unit: 0.1 Hz Setting range: 0.2 to 400 Hz	60.0 Hz		
	05	Mid. output frequency	Setting unit: 0.1 Hz Setting range: 0.1 to 399.9 V	1.5 Hz		
	06	Mid. output frequency voltage	Setting unit: 0.1 V* Setting range: 0.1 V to 255 V*	12.0 V*		
	07	Minimum output frequency	Setting unit: 0.1 Hz Setting range: 0.1 to 10 Hz	1.5 Hz		
	08	Minimum output frequency voltage	Setting unit: 0.1 V* Setting range: 0.1 to 50 V*	12 .0V*		
1st accel, decel time setting	09	Acceleration time 1	Setting unit: 0.1 s Setting range: 0.0 to 600 s	10.0 s		6-19
	10	Deceleration time 1	Setting unit: 0.1 s Setting range: 0.0 to 600 s	10.0 s		
2nd accel, decel time setting	11	Acceleration time 2	Setting unit: 0.1 s Setting range: 0.0 to 600 s	10.0 s		
	12	Deceleration time 2	Setting unit: 0.1 s Setting range: 0.0 to 600 s	10.0 s		

* For 400 V class, the values are double those for 200 V class.

First functions: no-00 to no-19 (cont.)

Function	No.	Name	Description	Initial setting	Note	Ref.
Frequency reference*	13	Frequency reference 1 (Master frequency reference)	Setting unit: 0.1 Hz Setting range: 0.0 to 400 Hz	0.0 Hz		6-11
	14	Frequency reference 2	Setting unit: 0.1 Hz Setting range: 0.0 to 400 Hz	0.0 Hz		
	15	Frequency reference 3	Setting unit: 0.1 Hz Setting range: 0.0 to 400 Hz	0.0 Hz		
	16	Frequency reference 4	Setting unit: 0.1 Hz Setting range: 0.0 to 400 Hz	0.0 Hz		
	17	Jog frequency reference	Setting unit: 0.1 Hz Setting range: 0.0 to 400 Hz	6.0 Hz		
Electronic thermal overload motor. protection	18	Motor protection selection	1st digit=0: Electronic thermal overload motor protection provided =1: Electronic thermal overload motor protection not provided 2nd digit=0: Electronic thermal overload characteristics for standard motor =1: Electronic thermal overload characteristics for constant torque motor 3rd digit=0: Electronic thermal overload time constant for standard rating =1: Electronic thermal overload time constant for short term rating 4th digit=0: Not used	0000		6-22
Electron thermal overload reference current	19	Motor rated current	Setting units: 0.1A Setting range: 10 to 120% of inverter rated current	1.9A†		

* Can be changed even during run. The frequency reference selected by multi-step speed reference during frequency reference value display can be changed.
The maximum set frequency that can be set here is determined by no-02 (Maximum output frequency).

† Initial setting differs according to inverter capacity. The values in the list above are provided when Model CIMR-PC 20P4D1 [0.75HP (0.4kW)] and a YASKAWA standard motor of 200 V 60Hz 0.75 HP (0.4kW) are combined.

Second functions: no-20 to no-29

Second functions: no-20 to no-29

Function	No.	Name	Description					Initial setting	Note	Ref.
REV run prohibit	20	Run signal selection 2	1st digit=0: REV run enabled					0000		6-9
			=1: REV run disabled							
Operator stop key prece-dence			2nd digit=0: STOP key effective from control circuit terminals during run							----
			=1: STOP key ineffective from control circuit terminals during run							
			3rd digit=0: Not used							
Stall preven-tion during deceler-ation			4th digit=0: Stall prevention during deceleration provided							6-27
			=1: Stall prevention during deceleration not provided (when braking resistor connected)							
	21	Output monitor selection	1st digit: Not used					0000		6-24
Analog monitor selection			2nd digit=0: Analog monitor for output frequency							
			=1: Analog monitor for output current							
			Analog monitor gain is set by no-45							
		S-curve accel/ decel selection	3rd, 4th digit							6-13
			S-curve accel/decel selection	Not provided	0.2 s	0.5 s	1.0 s			
			3rd digit	0	1	0	1			
			4th digit	0	0	1	1			

7. QUICK REFERENCE

Second functions: no-20 to no-29 (cont.)

Function	No.	Name	Description	Initial setting	Note	Ref.
	22	Frequency reference Gain	Setting unit: 0.01 Setting range: 0.01 to 2.00	1.00		6-20
	23	Frequency reference Bias	Setting unit: 0.01 Setting range: -1.00 to 1.00	0.00		6-20
Frequency limit control	24	Frequency upper limit	Setting unit: 1% Setting range: 0 to 110%	100%		6-26
	25	Frequency lower limit	Setting unit: 1% Setting range: 0 to 110%	0%		
DC injection braking	26	DC injection braking current	Setting unit: 1% Setting range: 0 to 100% of inverter rated current	50%		6-34
	27	DC injection braking time of STOP	Setting unit: 0.1 s Setting range: 0.0 to 25.5s *	0.5s		
	28	DC injection braking time at START	Setting unit: 0.1 s Setting range: 0.0 to 25.5s *	0.0 s		
Torque compen-sation	29	Automatic torque boost gain	Setting unit: 0.1 Setting range: 0.0 to 3.0	1.0		6-29

* Setting range differs according to PROM No. version of the VS-606PC3.
 PROM No. (no-49)
  NSP6 ⌐04001⌐ to 6 ⌐04005⌐ : 0.0 to 5.0 s
  NSP6 ⌐04100⌐ and after   : 0.0 to 25.5 s

Third functions: no-30 to no-59

Function	No.	Name	Description	Initial setting	Note	Ref.
Stall prevention	30	Stall prevention level during accel	Setting unit: 1% Setting range: 30 to 200% of rated inverter current Note: Stall prevention during accel does not operate at 200%.	170%		6-27
	31	Stall prevention level during run	Setting unit: 1% Setting range: 30 to 200% of rated inverter current Note: Stall prevention during run does not operate at 200%.	160%		
Contact input signal	32	Multifunction input select 1 (terminal 4)	0: FWD/REV run command (3-wire sequence selection) 1: External fault (NO contact input) 2: External fault (NC contact input) 3: Multi-step speed reference 1 4: Multi-step speed reference 2 5: JOG command 6: Accel/decel time select 7: External baseblock (NO contact input) 8: External baseblock (NC contact input) 9: Search command from maximum frequency 10: Search command from set frequency 11: Accel/decel hold 12: Local/remote selection * 13: Option/inverter selection *	1		6-30

* Cannot be set according to PROM No. version of the VS-606PC3.
PROM No. (no-49)
     NSP6 $\boxed{04001}$ to 6 $\boxed{04005}$: setting disabled.
     NSP6 $\boxed{04100}$ and after : setting enabled.

Do not set 12 or above for PROM No. NSP6 $\boxed{04001}$ to 6 $\boxed{04005}$.

7. QUICK REFERENCE

Third functions: no-30 to no-59 (cont.)

Function	No.	Name	Description	Initial setting	Note	Ref.
Contact input signal	33	Multifunction input select 2 (terminal 5)	1: External fault (NO contact input) 2: External fault (NC contact input) 3: Multi-step speed reference 1 4: Multi-step speed reference 2 5: JOG command 6: Accel/decel time select 7: External baseblock (NO contact input) 8: External baseblock (NC contact input) 9: Search command from maximum frequency 10: Search command from set frequency 11: Accel/decel hold 12: Local/remote selection * 13: Option/inverter selection * 14: UP/DOWN command *	3		6-30
Phono-coupler output signal	34	Multifunction output select 1 (terminal 3)	0: Running 1: Agreed frequency 2: Zero speed 3: Frequency detection (output frequency ≥ frequency detection level) 4: Overtorque detection 5: Operation mode *	0		6-33
	35	Multifunction output select 2 (terminal 14)	0: Running 1: Agreed frequency 2: Zero speed 3: Frequency detection (output frequency ≥ frequency detection level) 4: Overtorque detection 5: Operation mode *	1		
Desired speed detection	36	Frequency detection level	Setting unit: 0.1 Hz Setting range: 0.0 to 400 Hz	0.0 Hz		6-40

* Cannot be set according to PROM No. version of the VS-606PC3.
   PROM No. (no-49)
         NSP6 $\boxed{04001}$ to 6 $\boxed{04005}$: setting disabled.
         NSP6 $\boxed{04100}$ and after   : setting enabled.

   Do not set 12 or above in no-33 for PROM No. NSP6 $\boxed{04001}$ to 6 $\boxed{04005}$.

Third functions: no-30 to no-59 (cont.)

Function	No.	Name	Description	Initial setting	Note	Ref.
Over torque detection	37	Overtorque detection	1st digit=0: Overtorque detection not provided =1: Overtorque detection provided	0000		6-37
			2nd digit=0: Detect only during agreed frequency =1: Detect during running			
			3rd digit=0: Operation continues after overtorque detection =1: Output shutoff at overtorque detection			
			4th digit: Not used			
	38	Overtorque detection level	Setting unit: 1% Setting range: 30 to 200% of inverter rated current	160%		
	39	Overtorque detection time	Setting unit: 0.1 s Setting range: 0.1 to 10.0 s	0.1 s		
Carrier frequency adjustment	40	Carrier frequency	Setting unit: 1 (2.5 kHz) Setting range: 1 to 6 (2.5 to 15 kHz)	4 (10 kHz)		6-39
----	41 to 44	Not used	Disabled		----	----
Analog monitor scale calibration	45	Analog monitor Gain	Setting unit: 0.01 Setting range: 0.01 to 2.00	1.00		6-35
Momentary power loss protection	46	Operation after momentary power loss	1st digit=0: No continuous operation after power loss =1: Continuous operation after power loss	0000 (0110)[†]		6-46
Constant setting change in drive mode		Constant setting change in drive mode *	2nd digit=0: Constant setting change disabled =1: Constant setting change enabled			5-4
Stall prevention during accel		Automatic lowering of stall prevention level during accel in constant output area *	3rd digit=0: Automatic decrease disabled =1: Automatic decrease enabled			6-28
			4th digit: Not used		—	—

* "1" Cannot be set according to PROM No. version of the VS-606PC3.
  PROM No. (no-49)
    NSP6 [04001] to 6 [04005] : Setting disabled.
    NSP6 [04100] and after   : Setting enabled.

† Initial setting differs between Japan domestic standard models
  (CIMR-PCA) and European standard models (CIMR-PCE).
      CIMR-PCA [_____] : no-46=0000
      CIMR-PCE [_____] : no-46=0110

Third functions: no-30 to no-59 (cont.)

Function	No.	Name	Description	Initial setting	Note	Ref.
Fault retry	47	Fault retry	Setting unit: 1 time Setting range: 0 to 10 times Note: Setting 0 disables fault retry.	0		6-48
Fault trace	48	Fault record	Stores, displays most recent alarm	----	----	----
Software version	49	PROM no.	Displays PROM number *	----	----	----
Prohibited frequency control	50	Prohibited frequency 1	Setting unit: 0.1 Hz Setting range: 0.0 to 400 Hz	0.0 Hz		6-41
	51	Prohibited frequency 2	Setting unit: 0.1 Hz Setting range: 0.0 to 400 Hz	0.0 Hz		
	52	Prohibited frequency 3	Setting unit: 0.1 Hz Setting range: 0.0 to 400 Hz	0.0 Hz		
	53	Prohibited width	Setting unit: 0.1 Hz Setting range: 0 to 25.5 Hz	1.0 Hz		
Speed search control	54	Speed search operation level	Setting unit: 1% Setting range: 0 to 200% of rated inverter current	150%		6-44
	55	Minimum baseblock time	Setting unit: 0.1 s Setting range: 0.5 to 5.0 s	0.5 s		
	56	V/f during speed search	Setting unit: 1% Setting range: 0 to 100%	100%		
Slip compen-sation†	57	Slip compensation gain	Setting unit: 0.1% Setting range: 0.0 to 9.9% of max. voltage output frequency Note: Setting 0.0% disables slip compensation.	0.0%		6-51
	58	Motor no-load current	Setting unit: 1% Setting range: 0 to 99% of motor rated current.	30%		
	59	Slip compensation primary delay time	Setting unit: 0.1 s Setting range: 0.1 to 25.5 s	2.0 s		

* Example: when PROM number is NSP6 $\boxed{04005}$, the number in $\boxed{}$ is displayed.

† Cannot be set according to PROM No. version of the VS-606PC3.
PROM No. (no-49)
NSP6 $\boxed{04001}$ to 6 $\boxed{04005}$: setting disabled.
NSP6 $\boxed{04100}$ and after   : setting enabled.

Initial settings for motor rated current

The following tables show the standard set values for each capacity. If the rated current value for the general purpose motor is different from the standard, change the setting.

200V Class, common to 3-phase and single-phase series

VS-606PC3 Model CIMR-PC		20P1 B0P1	20P2 B0P2	20P4 B0P4	20P7 B0P7	21P5 B1P5	22P2 B2P2	23P7 B3P7*
Max. applicable Motor capacity	HP (kW)	0.13 (0.1)	0.25 (0.2)	0.75 (0.4)	1 (0.75)	1.5 (1.5)	3 (2.2)	5 (3.7)
Motor current value at factory setting	(A)	0.6	1.1	1.9	3.3	6.2	8.5	14.1

* Water and dust tight type (NEMA4) not provided for this model.

400 V Class 3-phase series

VS-606PC3 Model CIMR-PC		40P2	40P4	40P7	41P5	42P2	43P7
Max. applicable Motor capacity	HP (kW)	0.5 (0.2)	0.75 (0.4)	1.5 (0.75)	2 (1.5)	3 (2.2)	5 (3.7)
Motor current value at factory setting	(A)	0.6	1.0	1.6	3.1	4.2	7.0

8. TROUBLESHOOTING

How to avoid faults

If you set a number that is out of the range of allowed settings for a function or application, for example, the display will blink for about 3 seconds then the original data will be displayed again.
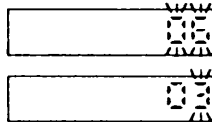
The display will blink and refuse your entry by returning the original setting before you changed it in the following cases:

- If the value you enter exceeds the range of allowed settings.

- If the following condition is not satisfied in the multifunction input selection constant setting:

Required:

no−32 < no−33	Multifunction input selection 1 is less than multifunction input selection 2.

- If the following conditions are not satisfied for the V/f constants.

Required:

no−02   ≥   no−04   >   no−05   ≥   no−07
02: Maximum output frequency 04: Maximum voltage output frequency 05: Mid. voltage output frequency 07: Miniimum voltage output frequency

- If the Mid. output frequency equals the minimum output frequency, then the mid. output frequency voltage no-06 is ignored. For details, see *Motor torque adjustment* on page 6-15.

- If the following conditions are not met for the frequency reference constant setting (F000.0) in the initial display. For details, see *Motor torque adjustment* on page 6-15, and *Output frequency limit* on page 6-26.

Required:

no-13 to no-17 ≤ no-02 X no-24
13 to 17: Frequency reference
02: Maximum output frequency
24: Output frequency upper limit

- If the following conditions are not met for the frequency upper and lower limit.

Required:

no-25 ≤ no-24
25: Frequency lower limit.
24: Frequency upper limit.

Resetting the inverter

To reset the inverter:

If the digital operator is in use of correcting the fault, then press ▷ RESET, with operation signal OFF.

-or-

If the indicating cover is in use without the digital operator, turn on the fault reset input signal with operation signal OFF.

-or-

In either case, after correcting the problem the inverter can be reset by turning the power supply OFF then ON.

Monitoring faults

When a problems occurs, an alarm is displayed in the 1- line display. The previous fault data is stored in the inverter so you can look at it, even after the power supply is turned off and turned on again. The previous fault message is stored by **no-48**. Follow this procedure to display the most recent fault generated.

DSPL   **1.** In the drive mode, press DSPL to display the constant selections.

> no-00

∇   **2.** Press ∇ to display no-48.

> no-48

DATA ENTER   **3.** Press DATA ENTER to show the most recent alarm displayed.

> U EF4

DSPL   **4.** Press DSPL twice to return to the initial display.

> F060.0

The following messages are always stored, even after the power is turned off and turned on again.

Alarms (fault type) stored after they occur

Fault	What it means
oC	Overcurrent
oU	Overvoltage
oH	Cooling fin overheating
oL 1	Motor overload
oL 2	Inverter overload
oL 3	Overtorque detection
EF4	External fault
EF5	External fault
CPF05	AD converter fault

Clearing faults

The fault contents can be cleared by setting **no-00** to **6**.

-or-

Faults can be cleared by initialization which means you have to set **no-00** to 8 or 9.

Please remember that initialization, also resets all constants to their factory settings.

When to call for service

Use the following tables to troubleshoot and correct problems with the inverter. When a problem occurs with the digital operator in use, the inverter will display a fault message in the digital operator display. When a problem occurs with the indicating cover installed in place of the digital operator, the LEDs warn you about problems.

Call for service in the following circumstances:

- If you cannot solve the problem by following the instructions in the tables below.
- If the inverter is malfunctioning in any way not identified in the table.
- If the inverter is obviously damaged.

The troubleshooting table contains three types of faults and alarms:

- **General Faults.** After a problem occurs, these faults shut down the system and must be reset after correction.
- **Control Function Faults.** These alarms are prefixed with **CPF** followed by 2 numbers, and indicate problems in the control circuit.
- **Alarms.** Alarms blink and do not generate fault output. They are restored to original operation without resetting after the cause of the problem is removed.

A separate table is provided for **Motor faults**. These problems are generated by faulty wiring, excessive loads, etc. and corrected by adjusting hardware connections, load reductions, etc.

The inverter has many protective functions to protect it from malfunctions such as overcurrent or overvoltage. When a problem occurs, the inverter shuts down the motor and displays an alarm, or lights the LEDs when the indicating cover is used.

When an alarm occurs, look up the alarm code or LED display in the table, then follow instructions to correct the problem. Depending on the type of fault, you may need to reset the inverter.

Motor faults table

Fault	Check Point	Solution
Motor does not rotate.	Power supply voltage applied to power supply terminals L1, L2, L3 (R, S, T)? CHARGE LED is ON?	Turn ON power supply. Turn OFF power supply, and then ON again. Check power supply voltage. Be sure terminal screws are tight.
	Use rectifier type voltmeter to test. Voltage output to output terminals T1, T2, T3 (U, V, W) correct?	Turn OFF power supply, then turn ON again.
	Motor locks due to excessive load?	Reduce the load and release the lock.
	Fault displayed in digital operator display?	Check troubleshooting table.
	FWD or REV run command entered?	Check the wiring.
	Frequency setting voltage entered?	Correct the wiring. Check frequency setting voltage.
	Operation mode setting correct?	With the digital operator, check the operation method selection at no-01.
Motor rotation reverses.	Wiring of terminals T1, T2, T3 (U, V, W) correct?	Match wiring to the phase order of the motor T1, T2, T3 (U, V, W)
	FWD and REV wiring run signals entered?	Correct the wiring.
Motor rotates, but variable speed not available.	Wiring of frequency setting circuit correct?	Correct the wiring.
	Operation mode setting correct?	With the digital operator, check the operation mode selection at no-01.
	Load excessively large?	Reduce the load.
Motor r/min too high or too low.	Motor ratings (number of poles, voltage) correct?	Check motor name plate specifications.
	Accel/decel speed change ratio for gears, etc. correct?	Check speed changer (gears, etc.)
	Maximum frequency set value correct?	Check the maximum frequency set value no-02.
	Use rectifier voltmeter. Voltage between motor terminals not excessively reduced?	Check V/f characteristic values (no-02 to 08)
Motor r/min not stable during operation. *	Load not excessively large?	Reduce the load.
	Load variation not excessively large?	Reduce the load variation. Increase inverter motor capacity.
	3-phase power supply used?	Connect AC reactor to the power supply if single-phase power supply is used.

* Due to motor and load (geared machines) characteristics, motor r/min. become unstable or the motor current ripples. To correct these problems, change the control constants.
See *Reduction of machine vibration or shock* on page 6-43.

Troubleshooting

This section outlines all the protection features provided with the inverter. Pay attention to the fault numbers when they appear in the display.

General and control function faults are shown with a steady light in the one-line display of the digital operator:

```
┌─────────────────┐
│           EF4   │        :Ọ:     :Ọ:
└─────────────────┘
```

The symbols on the right tell you what the LEDs look like on the indicating cover when it replaces the digital operator.

Alarms blink in the one-line display:

```
┌─────────────────┐
│            EF    │         ●       :Ọ:
└─────────────────┘
```

Both types of messages are explained below, listed in alphabetical order.

The symbols on the right tell you what the LEDs look like on the indicating cover when it replaces the digital operator.

The three symbols are used to show when the LEDs are on, off, or blinking.

●   OFF

:Ọ: ON

:Ọ: BLINKING

Stalling

No messages or warning LEDs are provided for stalling. Here is an explanation of what stall prevention does and how it works.

The three main causes for stalling during acceleration, running, or deceleration are:

- Insufficient power for accel/decel
- Overload
- Open phase

During acceleration

Inverter acceleration stops when 170% or more of the inverter rated current is required by the load. This prevents overload protection (□L 1, □L 2) or overcurrent □C. When current is reduced to less than 170%, acceleration is enabled.

During running

Output frequency decreases when 160% of the inverter rated current or greater is required by the load. This prevents motor and inverter overload (□L 1, □L 2). When the current is reduced below 160%, inverter acceleration is enabled.

During deceleration

Deceleration stops when the DC voltage rises due to motor regenerative energy. This prevents overvoltage trips. When the DC voltage decreases, deceleration to the set value resumes.

Remedies for stalling

☐ Set the proper accel/decel time with constants **no-09** to **no-12** for smooth operation.

☐ To prevent stalls during running, reduce the load or increase the inverter capacity.

List of protection features

⌷⌷⌷⌷⌷⌷   ●   ●
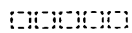
Blown fuse, no display   (For 400V class only)

Cause: Blown fuse

- Repeated overcurrent (⌷⌷)
- Repeated overload (⌷⌷⌷) power reset.
- Rapid deceleration in excess excitation (improper V/f characteristic setting)

Explanation:

The fuse blows to prevent wiring from being damaged by the short-circuit current when the main circuit transistor fails.

Remedy:

☐ Turn OFF the main power supply once and turn it on again.

☐ If the fault occurs again, replace the inverter.

☐ Do not replace the fuse.

| ⌷⌷ | ●   ☼
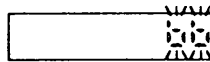
Cause

An external baseblock signal has been received. The inverter has ceased output.

Explanation:

When an external baseblock signal is input, the motor coasts to a stop. When the external baseblock signal is removed, the inverter output is immediately turned on at the preset frequency.

Remedy

☐ Release the enternal baseblock signal, then re-start operation.

☐ Check the sequence circuit.

> ```
> [ CPF00 ]          ●     ●
> ```

Cause: Initial memory fault

Initial memory fault has been detected.

Remedy

☐ Turn OFF the power supply and turn it ON again.

☐ If the fault still exists, replace the inverter.

> ```
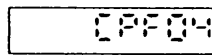> [CPF01]   ●   ●
> ```

Cause: ROM fault

A ROM fault has been detected.
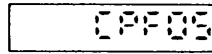
Remedy

☐ Turn OFF the power supply and turn it ON again.

☐ If the fault still exists, replace the inverter.

```
  ┌─────────────────┐          ☀      ☀
  │     CPF04       │
  └─────────────────┘
```

Cause: Constant fault

A constant fault has been detected.

```
  ┌─────────────────┐          ☀      ☀
  │     CPF05       │
  └─────────────────┘
```
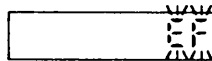
Cause: AD converter fault

A fault in the AD converter has occurred.

Remedy

☐ Make a note of all settings.

☐ Initialize the inverter (no-00).

☐ Turn OFF the power supply, then turn it ON again.

☐ If the fault still exists, replace the inverter.

```
  ┌─────────────────┐          ●      ☀
  │             EF  │
  └─────────────────┘
```

Cause: Simultaneous FWD/REV run commands

• Operation sequence fault.

• 3-wire/2-wire selection fault.

Explanation:

When forward and reverse run commands are simultaneously closed for over 500 ms, the inverter is stopped according to the stop method preset at constant **no-01**.

Remedy:

☐ Recheck the control sequence.

☐ Recheck the constant settings for constants **no-32** and **no-33**. For details, see page 8-1.

EF4	☀	☀
EF5	☀	☀

Cause: External fault signal input
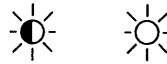
• External fault condition occurred.

Explanation:

When an external fault signal is input, the inverter output is shut off.

Remedy:

☐ Check the external circuitry sequence.
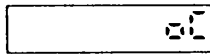☐ Correct the cause of the fault input.

GF	☀	☀

Cause : Ground fault

Inverter output side is grounded.

Explanation :

This fault is displayed only for European standard models CIMR-PCE ⌐‾‾‾⌐.

Remedy :

Check that the motor or load side wiring is not grounded.

oC

☀ ☼

Cause: Overcurrent protection

- Extremely short accel/decel time setting (no-09 to no-12).
- Motor ON/OFF switching at the inverter output side.
- Motor of capacity greater than the inverter rating has been started.
- High-speed motor or pulse motor has been started.

Explanation:

The inverter output is shut off when the inverter output current becomes approximately 200% or above the inverter rated current.

Remedy:

Transistor fault may have occurred. Investigate the fault cause, correct it, then restart.

oH

● ☀
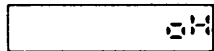
Cause: Overheated cooling fin.

- Defective cooling fan (low r/min)
- Rise in intake temperature.
- Clogged filter.
- Load is too large (V/f characterstics are not set correctly)

Explanation:

The inverter is shut off when the overheated cooling fin is detected by the thermistor. Check for a defective cooling fan or clogged filter.

- *This overheating can occur only with models using forced cooling.*

Remedy:

☐ Wash the filter.

☐ Replace the inverter when the inverter cooling fan is defective.

☐ Intake air temperature should be 104°F (+40°) or less.

☐ Check V/f constants no-02 to no-08.

```
┌──────────────────────┐          ●        ☀
│                  ₂H  │
└──────────────────────┘
```
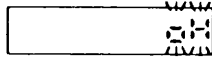
Cause: Overheated cooling fin

- Defective cooling fan.
- Rise in intake temperature.
- Clogged filter.

Explanation:

Monitor display appears when the cooling fin overheats due to a temperature rise of the intake air.

- *This overheating can occur only with models using forced cooling.*

Remedy:

☐ Replace the cooling fan and clean the filter.

☐ Intake air temperature should not be above 104°F (+40°C).

```
┌─────────────────────┐          '¦'      '¦'
│          ⊐L !        │         ;Ö;     ;●;
└─────────────────────┘         ´¦'      '¦'
```

## Cause: Motor thermal overload protection

- Overload due to long operation at low speed.
- Incorrect V/f characteristic setting.
- Motor rated current setting (**no-19**) is incorrect.

## Explanation:

The inverter output is stopped when output current to the motor is detected by the electronic thermal overload function in the inverter. Either an inverter constant-torque motor or a general purpose motor can be selected. If more than two motors are being driven, overload detection should be disabled. Instead, use a thermal relay or thermal protector for each motor.

## Remedy:

☐ Investigate the cause of the overload and review the operation pattern, V/f characteristics, and motor/inverter capacities.

☐ If the inverter is repeatedly reset after an overload occurs, the inverter may fault. Before restarting the motor, investigate and correct the cause of the overload.

☐ Set the rated current value printed on the motor name plate to constant **no-19**.

☐ If the above measures do not solve the problem, lower the carrier frequency at constant **no-40**.

| $\circ \llcorner 2$ | | $\dot{\bigcirc}$ | $\dot{\bullet}$ |
|---|---|---|---|
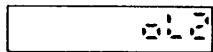
## Cause: Inverter overload protection

- Overload due to long operation at low speed.
- Incorrect V/f characteristic setting.
- Motor rated current setting (**no-19**) is incorrect.

### Explanation:

Electronic thermal overload protection activated by the inverse time limit and the inverter output is shut off at 112% or more of the inverter rated current. Overload capacity: 150% 1 min.

### Remedy:

☐ Investigate the cause of the overload and review the operation pattern, V/f characteristics, and motor/inverter capacities.

☐ If the inverter is repeatedly reset after an overload occurs, the inverter may fault. Before restarting the motor, investigate and correct the cause of the overload.

☐ Set the rated current value printed on the motor name plate to constant **no-19**.

☐ If the above measures do not solve the problem, lower the carrier frequency at constant **no-40**.

| $\circ \llcorner 3$ | | $\dot{\bigcirc}$ | $\dot{\bullet}$ |
|---|---|---|---|
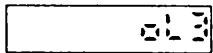
## Cause: Overtorque protection

Motor current exceeded the constant setting due to a machine fault or overload.

### Explanation:

The function protects the machine and monitors the inverter output torque. The motor operates according to selection of constant **no-37** when the inverter output exceeds the overtorque detection level. The monitor blinks when *operation continues* is preset.

### Remedy:

☐ Check the driven machine and correct the cause of the fault, or increase the value of constant setting **no-38** up to the highest value allowed for the machine.

| ⌐Ĺ_| ● ☼

## Cause: Overtorque protection

Motor current exceeds the preset value because of machinery fault or overload.

## Explanation:

The motor operates according to operation selection of constant **no-37** when the inverter output current exceeds the overtorque detection level. This function is used to protect the machine or to monitor the output torque. Use constant **no-37** to turn overtorque detection on and off.

## Remedy:

☐ Check the driven machine and correct the cause of the fault, or increase the value of constant setting **no-38** up to the highest value allowed for the machine.

| ⌐∪ | ● ☼

## Cause : Main circuit overvoltage protection

- Insufficient deceleration time.
- Negative load (motor is turned by the load).
- High input voltage compared to rated motor voltage.

## Explanation:

The inverter output is shut off when the main circuit DC voltage rises excessively due to regeneration energy caused by motor deceleration and negative load.

| Detection level | |
| --- | --- |
| Class | Level |
| 200 V | 410 V or more |
| 400 V | 820 V or more |

## Remedy:

☐ If braking torque is not correct, extend the decel time or connect a braking resistor unit. For details about available braking resistors, see page 9-5.

☐ Check the load. Be sure it is not a negative load.

☐ Check the power supply voltage.

```
┌─────────────────┐
│            ꒦꒦    │      ●      ☀
│           ꒦꒦     │
└─────────────────┘
```

Cause : Main circuit overvoltage protection

Motor current exceeds the preset value because of machine fault or overload.

Explanation:

Monitor display appears when the main circuit DC voltage rises above the detection level while the inverter output is off.

Detection level	
Class	Level
200 V	410 V or more
400 V	820 V or more

Remedy:

☐ Check the use of the machine.

☐ Correct the overload cause or set a higher detection level constant **no-38** within the allowed range.

```
┌─────────────────┐
│     5Err         │      ☀      ●
└─────────────────┘
```

Cause :

Local / remote selection is performed while the inverter output is ON.

Explanation :

Local / Remote selection is effective onlyduring stop.
If it is performed during running,the command will be disregarded and the above display appears.

Remedy :

☐ Check the sequence circuit.

| LU | ● | ☼ |

Cause: Main circuit low-voltage protection

- Input voltage drop.

Explanation:

Monitor display appears when the main circuit DC voltage drops under the detection level while the inverter output is off.

Detection level	
Class	Level
230V, 3-phase	210 V or less
240V, single-phase	170 V or less
460V, 3-phase	420 V or less

Remedy:

☐ Check the main circuit DC voltage.

☐ Check the power supply capacity and power system.

| U u 1 | ● | ☼ |
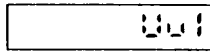
Cause: Main circuit low-voltage protection

- Inverter capacity too small.
- Voltage drop due to wiring.
- Large capacity motor connected to the same power system has been started.
- Rapid acceleration with generator power supply.
- Operation sequence with power off.
- Defective electromagnetic contactor.

Explanation:

When the inverter power supply drops, torque becomes insufficient and the motor overheats. Inverter output stops when the main circuit DC voltage drops below than the low-voltage detection level.

Detection level	
Class	Level
230V, 3-phase	210 V or less
240V, single-phase	170 V or less
460V, 3-phase	420 V or less

Remedy:

- ☐ Check the power supply voltage.
- ☐ Check the power capacity and power system.

APPENDIXES

Appendix 1: Maintenance

After the inverter is mounted, set up, and in operation, it requires very few routine checks. The inverter will deliver safe maximum service if you observe the precautions in choosing a location site for the inverter described on page 2- 6.

Follow this procedure to avoid or correct problems listed in the inspection table below.

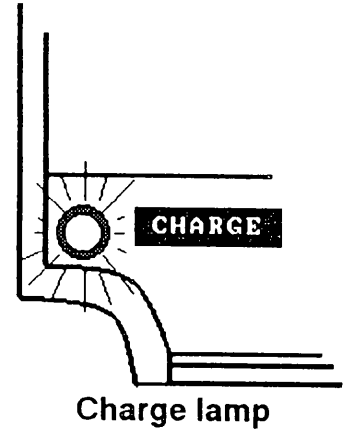1. Turn off the power supply. You will see **Uv** flash for a few seconds, then the display will go off.

```
     Uv
```
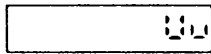
2. Grasp the terminal cover on both sides at ① and ②, and then lift in the direction of ③.
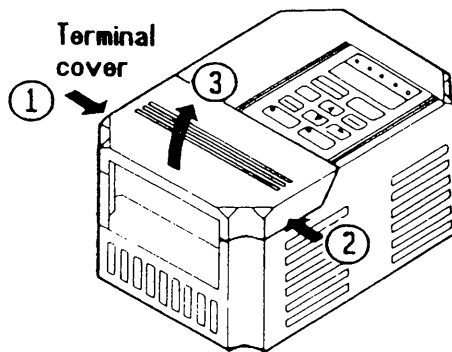
3. Check the CHARGE lamp in the lower left corner of the inverter case.

WARNING!

• **NEVER ATTEMPT TO MAKE ADJUSTMENTS INSIDE THE INVERTER WHEN THIS RED LED IS ON. THE CAPACITORS CONTAIN ENOUGH RESIDUAL VOLTAGE TO CAUSE SHOCK OR INJURY UNTIL THEY FULLY DISCHARGE AND THE LED GOES OFF. WAIT A FEW MOMENTS FOR THE CHARGE LED TO GO OFF.**

Charge lamp

Location to Check	Check For	Solution
External terminals, unit mounting bolts, connectors, etc.	Loose screws	Tighten
	Loose connectors	Tighten
Cooling fins	Built up dust, dirt	Blow with dry compressed air: 39.2×10^4 to 58.8×10^4 Pa, 57 to 85 psi (4 to 6 kg/cm^2) pressure
Printed circuit board	Accumulation of conductive dust or oil mist	Blow with dry compressed air : 39.2×10^4 to 58.8×10^4 Pa, 57 to 85 psi (4 to 6kg/cm^2) pressure If dust or oil cannot be removed, replace the inverter unit.
Cooling fan	Abnormal noise or vibration, even if cumulative operation does not exceed 20,000 hours.	Replace the inverter unit.
Power elements Smoothing capacitor	Abnormal odor	Replace the inverter unit.

Caution!

* **Do not remove the front cover of enclosed wall-mounted type (NEMA1) or the unit cover of water and dust tight type (NEMA4), or a failure may occur.**

Appendix 2: High voltage test

Follow this procedure to conduct an insulation resistance test (high voltage test) on the main control circuit.

1. Replace the terminal cover.
2. Disconnect the main circuit terminal wiring L1, L2, L3 (R, S, T).
3. Disconnect the circuit terminal wiring T1, T2, T3 (U, V, W).

   - *Conduct testing only between the main circuit terminals and the ground terminal.*
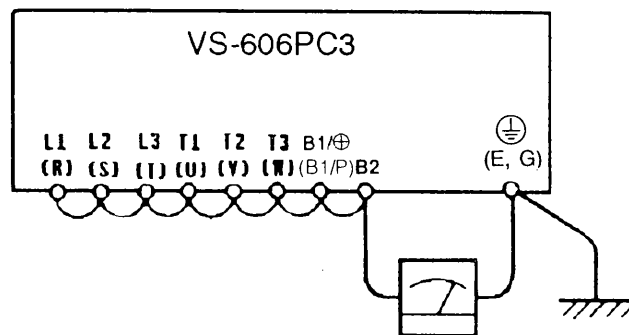
Caution!

- **Never conduct a high voltage test on the control circuit terminals.**

4. After you disconnect the test equipment, re-connect the power supply to L1, L2, L3 (R, S, T).

WARNING!

- **TO AVOID DESTRUCTION OF THE INVERTER, NEVER RE-CONNECT THE POWER SUPPLY TO THE INVERTER OUTPUT TERMINALS T1, T2, T3 (U, V, W).**

5. Re-connect the control circuit wires to the inverter output terminals T1, T2, T3 (U, V, W).
6. Replace the terminal cover.
7. See maintenance on page 9-1.

Appendix 3: Options and peripheral units

Optional Units

Name	Model (Code No.)	Function	Installing Position
VS Operator (Small plastic version)	JVOP-95-□* (73041-0905X-□)	An exclusive control panel for set frequency remotely and for turning the unit ON/OFF with analog commands (distance up to 50 m) Frequency meter scale: 60/120 Hz, 90/180 Hz	Separately installed.
VS Operator (Standard version)	JVOP-96-□* (73041-0906X-□)	An exclusive control panel for set frequency remotely and for turning the unit ON/OFF using analog commands (distance up to 50 m) Frequency meter scale: 75 Hz, 150 Hz, 220 Hz	Separately installed.
Braking Resistor Unit [†]	LKEB-□ (72600K □□□□0)	Shortens the motor deceleration time by causing the regenerative energy to be consumed through the resistor. Available at 100% deceleration torque at 10% ED. Thermal overload relay to protect resistor overheating is built in.	Separately installed.

* Types of frequency indicators are to be shown in the box after the model name and the number.

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

†Reference: TOE-C736-50.5

When using VS operator connected with +12V power supply for frequency setting (control circuit terminal 10), set constant no-22 to 1.25.
The frequency reference voltage becomes 100% of 18.0V output frequency.

OPTION UNITS (cont.)

Name	Model (Code No.)	Function	Installing Position
Braking Resistor	ERF-150WJ	Shortens the motor deceleration time by causing the regenerative energy to be consumed through the resistor. Available at 100% deceleration torque at 3% ED for resistor unit only.	Separately installed.
Digital Operator	JVOP-110 (73606-V1100)	Performs operation sequence, all function selections and constant setting. Also displays frequency setting, output frequency, output current and fault. However, it cannot be used remote operation.	Inverter front cover.
Analog Operator *†	JVOP-111 (73606-V1110)	Performs operation sequence, frequency setting, output frequency, output current and fault display.	Inverter front cover.

* Cannot be used for water and dust tight type (NEMA4).

† Cannot be mounted on the VS-606 PC3 due to PROM No. version.

PROM No. (no-49)

NSP6 04001 to 6 04004 : The analog operator not applicable.

NSP6 04005 and after : The analog operator applicable.

OPTION UNITS (cont.)

Name	Model (Code No.)	Function	Installing Position
Digital Operator *	JVOP-100 (73041-09100)	Has the same functions as type JVOP-110 and used for remote operation in combination with remote interface.	Separately installed.
Remote Interface for Digital Operator *	JVOP-112 (73606-V1120)	For remote operation of digital operator (type JVOP-100), used in combination with remote interface (RS-232C interface).	Inverter front cover.
Digital Reference Module *‡	JVOP-117 (73606-V1170)	Allows 8-bits digital speed ref. setting. • Input signal: binary 8 bits/ BCD 2 digits + code • Input voltage: +24V (isolated) • Input current: 8mA	Inverter front cover.

* Cannot be used for water and dust tight type (NEMA4).

‡ Cannot be mounted on the VS-606PC3 due to PROM No. version.

    PROM No. (no-49)

        NSP6 &boxed;04001&boxed; to 6 &boxed;04005&boxed;   : The digital reference module not applicable.

        NSP6 &boxed;04100&boxed; and after   : The digital reference module applicable.

Peripheral units

Name	Model (Code No.)	Function
Frequency meter	DCF-6A	
Frequency setter Frequency meter adjusting potentiometer Frequency setting knob	—	Provided with VS operator as standard. Available as separate components for remote control from several locations.
Potentiometer	—	Install at control circuit terminal for the calibration of frequency meter or ammeter and frequency reference.
AC reactor	UZBA-□	Used for power supply coordination when power supply capacity exceeds 600 kVA, or for improvement of inverter input.power factor.
Radio noise protection filter	LNFB□ (single-phase) LNFD□ (three-phase)	Use a radio noise filter to eliminate radio wave interference. It is provided at input terminals of the inverter main circuit.
VS system module	JGSM-□	Enables optimum system configuration by combining required VS system modules according to automatic control system.
Molded case circuit breaker (MCCB)	NF-□	Installing an MCCB at power supply will protect braking function.
Magnetic contactor (MC)	H1-□E	MC is required on inverters using the dynamic braking function.
Surge suppressor	DCR2-□	Absorbs surge currents by opening and closing magnetic contactors and control relays. Must be installed on magnetic contactor or control relays near the inverter.
Output voltmeter	SCF-12NH	Voltmeter or PWM inverter.
Isolator	DGP□	Isolates the inverter input and output signals to reduce induced noise.

Specifications for 230V 3-phase and 240V single-phase

Voltage Class	230V 3-phase							240V single-phase						
Inverter Model CIMR-PCA	20P1	20P2	20P4	20P7	21P5	22P2	23P7	B0P1	B0P2	B0P4	B0P7	B1P5	B2P2	B3P7 *
Max. Applicable Motor Output HP (kW) †	0.13 (0.1)	0.25 (0.2)	0.75 (0.4)	1 (0.75)	1.5 (1.5)	3 (2.2)	5 (3.7)	0.13 (0.1)	0.25 (0.2)	0.75 (0.4)	1 (0.75)	1.5 (1.5)	3 (2.2)	5 (3.7)
Output characteristics														
Inverter capacity kVA	0.3	0.6	1.1	1.9	2.5	4.2	6.7	0.3	0.6	1.1	1.9	2.5	4.2	6.7
Rated output current A	0.8	1.5	3	5	6.5	11	17.5	0.8	1.5	3	5	6.5	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 (available with constant setting)													
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	±10%													
Allowable frequency fluctuation	±5%													
Control characteristics														
Control method	Sine wave PWM													
Frequency control range	0.1 to 400 Hz													
Frequency accuracy (temperature change)	Digital command: 0.01% (14 to 104°F, -10 to +40°C), Analog command: 0.1% (77±50°F, 25±10°C)													
Frequency setting resolution	Digital operator reference: 0.1 Hz, Analog reference: 0.06/60 Hz													
Output frequency resolution	0.1 Hz													
Overload capacity	150% rated output current for one minute													
Frequency setting signal	0 to 10 VDC (20 kΩ), 4 to 20 mA (250Ω)													
Accel/decel time	0.1 to 600 sec (accel/decel time setting independently)													
Approx. braking torque ‡	150%		100%		50%		20%	150%		100%		50%		20%
V/f characteristic	Possible to set any program of V/f pattern													
Stall prevention level	Possible to set operating current													
Protective functions														
Instantaneous overcurrent	Motor coasts to a stop at approx. 200% of inverter rated current													
Ground fault#	Motor coasts to a stop when the inverter output side is grounded.													
Overload	Motor coasts to a stop for 1 minute at 150% of inverter rated output current													
Motor overload protection	Electronic thermal overload relay													
Overvoltage	Motor coasts to a stop if main circuit DC voltage exceeds 410 V													
Undervoltage	Stops when main circuit DC voltage is approx. 210 V or less							Stops when main circuit DC voltage is approx. 170 V or less						
Momentary power loss	Stops if power loss is 15 ms or longer (preset prior to shipping) (operation automatically restarts at recovery from momentary power loss of approx. 2 seconds or less by selection of operation mode)**													
Cooling fin overheat	Protected by thermoswitch (only for forced cooling method)													
Power charge indication	Charge lamp stays ON until main circuit DC voltage drops below 50 V.													

* Water and dust tight type is not provided for model B3P7.
† Our standard 4-pole motor is used for max. applicable motor output.
‡ The values show a short-term average deceleration torque when the motor single-uint decelerates from 60Hz at the shortest distance. It is not a continuous regenerative torque. Average deceleration torque is changed by the motor loss. If the motor operates exceeding the base frequency, this value is reduced. When a large regenerative torque is needed, use an optional braking resistor.
# Only for European standard specifications (models CIMR-PCE□□□).
** To select "Automatic restart after a power loss", set the 1st digit of **no-46** to 1. Automatic restart is available within approx. 1 sec for models 1HP (0.75kW) or less or within approx. 2 sec for models 1.5HP (1.5kW) or more.

Specifications for 230V 3-phase and 240V single-phase (cont.)

Voltage Class		230V 3-phase							240V single-phase						
Inverter Model CIMR-PCA		20P1	20P2	20P4	20P7	21P5	22P2	23P7	B0P1	B0P2	B0P4	B0P7	B1P5	B2P2	B3P7
Operating conditions															
Input signals															
Operation signal		Forward run/reverse run by individual command													
Fault reset		Releases protection while the function is operating													
Multifunction input selection		Multifunction contact input: Two of the following signals available to select. External fault, multispeed command, jog operation, accel/decel time select, 3-wire sequence, external base block, speed search command.													
Output signals															
Operation state (photocoupler output)		Multifunction contact output: Two of the following signals available to select. (48 V DC, 50 mA or less). During running output, zero speed, agreed frequency, output frequency ≥ set value, during overtorque detection.													
Fault contact		1 NO/NC contact output (250 VAC 1 A, 30 VDC 1 A or less)													
Built-in function		The following setup is available : Frequency reference bias/gain, upper/lower frequency limit. DC injection braking current/time at start/stop, full automatic torque boost, frequency meter calibrating gain, fault retry, prohibited frequency, S-curve accel/decel.													
Monitor Display Function															
LED status display		Displays contents at RUN/STOP and protective function operation.													
Digital operator		Displays set frequency, output frequency, output current, rotating direction, and the contents at protective function operation.													
Analog output monitor		Analog output (0 to 10 VDC). Possible to select output frequency or output current.													
Protective configuration		Enclosed wall-mounted type (NEMA1) and water and dust tight type (NEMA4)													
Cooling method	NEMA1	Self-cooling						Forced-cooling	Self-cooling					Forced-cooling	
	NEMA4	Self-cooling					Forced-cooling		Self-cooling				Forced-cooling		–
Mass lb. (kg)	NEMA1	2.4 (1 1)			4.4 (2)		7.3 (3.3)		4.9 (2.2)				6.6 (3)	10.6 (4.8)	11.0 (5)
	NEMA4	4.4 (2)		6.6 (3)		8.8 (4)		13.2 (6)	6.6 (3)				8.8 (4)		12.4 (5.6)
Environmental conditions															
Ambient temperature		14 to 104°F (-10 to 40°C) (not frozen)													
Storage temperature *		-4 to 140°F (-20 to 60°C)													
Humidity		90% RH or less (non-condensing)													
Vibration		Up to 9.8 m/s^2 (1G) at less than 20 Hz, up to 2 m/s^2 (0.2 G) at 20 to 50 Hz.													

* Temperature during shipping (for short periods)

Specifications for 460V 3-phase

Voltage Class	460V 3-phase					
Inverter Model CIMR-PCA	40P2	40P4	40P7	41P5	42P2	43P7
Max. Applicable Motor Output HP (kW)*	0.5 (0.2)	0.75 (0.4)	1.5 (0.75)	2 (1.5)	3 (2.2)	5 (3.7)
Output characteristics						
Inverter capacity kVA	0.8	1.2	2	3	3.7	6.1
Rated output current A	1	1.6	2.6	4	4.8	8
Max. output voltage V	3-phase, 380 to 460 V (proportional to input voltage)					
Max. output frequency Hz	400 Hz (available with constant setting)					
Power supply						
Rated input voltage and frequency	3-phase 380 to 460 V, 50/60 Hz					
Allowable voltage fluctuation	±10%					
Allowable frequency fluctuation	±5%					
Control characteristics						
Control method	Sine wave PWM					
Frequency control range	0.1 to 400 Hz					
Frequency accuracy (temperature change)	Digital command : 0.01% (14 to 104°F, -10 to + 40°C), Analog command : 0.1% (77 ± 50°F, 25 ± 10°C)					
Frequency setting resolution	Digital operator reference: 0.1 Hz, Analog reference: 0.06/60 Hz					
Output frequency resolution	0.1 Hz					
Overload capacity	150% rated output current for one minute					
Frequency setting signal	0 to 10 VDC (20 kΩ), 4 to 20 mA (250Ω)					
Accel/decel time	0.1 to 600 sec (accel/decel time setting independently)					
Approx braking torque [†]	150%		100%		50%	20%
V/f characteristic	Possible to set any program of V/f pattern					
Stall prevention level	Possible to set operating current					
Protective functions						
Instantaneous overcurrent	Motor coasts to a stop at approx. 200% of inverter rated current					
Ground fault [‡]	Motor coasts to a stop when the inverter output side is grounded.					
Overload	Motor coasts to a stop for 1 minute at 150% of inverter rated output current					
Motor overload protection	Electronic thermal overload relay					
Overvoltage	Motor coasts to a stop if main circuit DC voltage exceeds 820 V					
Undervoltage	Stops when main circuit DC voltage is approx. 420 V or less					
Momentary power loss	Stops if power loss is 15 ms or longer (preset prior to shipping) (operation automatically restarts at recovery from momentary power loss of approx. 2 seconds or less by selection of operation mode)					
Cooling fin overheat	Protected by thermoswitch (only for forced cooling method)					
Power charge indication	Charge lamp stays ON until main circuit DC voltage drops below 50 V.					

* Our standard 4-pole motor is used for max. applicable motor output.
† The values show a short-term average deceleration torque when the motor single-uint decelerates from 60Hz at the shortest distance. It is not a continuous regenerative torque.
  Average deceleration torque is changed by the motor loss. If the motor operates exceeding the base frequency, this value is reduced. When a large regenerative torque is needed, use an optional braking resistor.
‡ Only for European standard specifications (models CIMR-PCE[▢▢▢]).
″ To select "Automatic restart after a power loss", set the 1st digit of **no-46** to 1.
  Automatic restart is available within approx. 1 sec for models 1.5HP (0.75kW) or less or within approx. 2 sec for models 2HP (1.5kW) or more.

Specifications for 460V 3-phase (cont.)

Voltage Class		460V 3-phase					
Inverter Model CIMR-PCA		40P2	40P4	40P7	41P5	42P2	43P7
Operating conditions							
Input signals							
Operation signal		Forward run/reverse run by individual command					
Fault reset		Releases protection while the function is operating					
Multifunction input selection		Multifunction contact input : Two of the following signals available to select. External fault, multispeed command, jog operation, accel/decel time select, 3-wire sequence, external baseblock, speed search command.					
Output signals							
Operation state (photocoupler output)		Multifunction contact output : Two of the following signals available to select. (48VDC, 50mA or less) During running output, zero speed, agreed frequency, output frequency ≥ set value, during overtorque detection.					
Fault contact		1 NO/NC contact output (250 VAC 1 A, 30 VDC 1 A or less)					
Built-in function		The following setup is available : Frequency reference bias/gain, upper/lower frequency limit. DC injection braking current/time at start/stop, full automatic torque boost, frequency meter calibrating gain, fault retry, prohibited frequency, S-curce accel/decel.					
Monitor Display Function							
LED status display		Displays contents at RUN/STOP and protective function operation.					
Digital operator (option)		Displays set frequency, output frequency, output current, rotating direction, and the contents at protective function operation.					
Analog output monitor		Analog output (0 to 10 VDC). Possible to select output frequency or output current.					
Protective configuration		Enclosed wall-mounted type (NEMA 1) and water and dust tight type (NEMA 4)					
Cooling method	NEMA1	Self-cooling					Forced cooling
	NEMA4	Self-cooling			Forced cooling		
Mass lb. (kg)	NEMA1	4.4 (2)		6.6 (3)		9.7 (4.4)	10.2 (4.6)
	NEMA4	5.7 (2.6)		8.8 (4)		12.4 (5.6)	
Environmental conditions							
Ambient temperature		14 to 104°F (-10 to 40°C) (not frozen)					
Storage temperature*		-4 to 140°F (-20 to 60°C)					
Humidity		90% RH or less (non-condensing)					
Vibration		Up to 9.8 m/s^2 (1G) at less than 20 Hz, up to 2 m/s^2 (0.2 G) at 20 to 50 Hz.					

* Temperature during shipping (for short periods)

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