RELIANCE ELECTRIC

# VZ3000 200-230 VAC Dedicated Type and 200-230 VAC/380-460 VAC Common Type Drive Hardware Reference, Installation, Start-up, and Troubleshooting

**Converter: Model UAZ3022(-A) to UAZ3037(-A)**
**Model UAZ3222(-A) to UAZ3275**
**Inverter: Model UVZC3001 to UVZC3007**
**Model UVZ3022 to UVZ3037**
**Model UVZC3201 to UVZC3207**
**Model UVZ3222 to UVZ3275**

Instruction Manual 32023-19E

**Reliance Electric Limited**

The information in this instruction manual is subject to change without notice.

Throughout this manual, the following notes are used to alert you to safety considerations:

**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

**Important:** Identifies information that is critical for successful application and understanding of the product.

**ATTENTION:** Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this instruction manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait for a while for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** The user is responsible for conforming to all applicable local, national and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

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# CHAPTER 1
# Receiving Drive

The products described in this instruction manual are manufactured and distributed by Reliance Electric Limited.

The VZ3000 drive provides vector regulation by means of sinusoidal pulse-width-modulated (PWM) waveform using intelligent power module (IPM) or insulated gate bipolar transistors (IGBTs). The VZ3000 is a flexible, multifunction drive for a wide range of applications.

The VZ3000 drive consists of inverter unit, converter unit and motor as hardware portion, and VZ3000/VZ3000G terminal software VZterm for Windows to be executed on a host computer, and/or an VZ3000/VZ3000G operator's terminal OPCU-2 as software portion.

This instruction manual covers 200-230 VAC dedicated type and 200-230 VAC/380-460 VAC common type hardware. Separate instruction manuals are provided for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027), the VZ3000/VZ3000G terminal software VZterm for Windows, Tuning Version (IM 32028), the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021), and 380-460 VAC dedicated type (larger models) hardware (IM 32022). Refer to these instruction manuals when necessary.

The following units are UL/IEC/C-UL listed:

UVZC3001, UVZC3003, UVZC3007, UVZ3022, UVZ3030, UVZ3037
UAZ3022, UAZ3030, UAZ3037, UAZ3022-A, UAZ3030-A and UAZ3037-A

## 1.1 Identify Drive by Model Number

Each VZ3000 drive can positively be identified by its model numbers provided for its drive and motor. These numbers appear on the shipping label and are stamped on the respective nameplates. The nameplates are located on the lower right side of the drive and on the frame of the motor. Refer to these numbers whenever discussing the drive with Reliance Electric personnel.

The drive's model number is described as "UVZC3007N-SF-HA001BB," for example. Its first half, "UVZC3007N," shows a model number for hardware, and the second half, "SF-HA001BB," for software as shown in Figures 1.1 and 1.2.

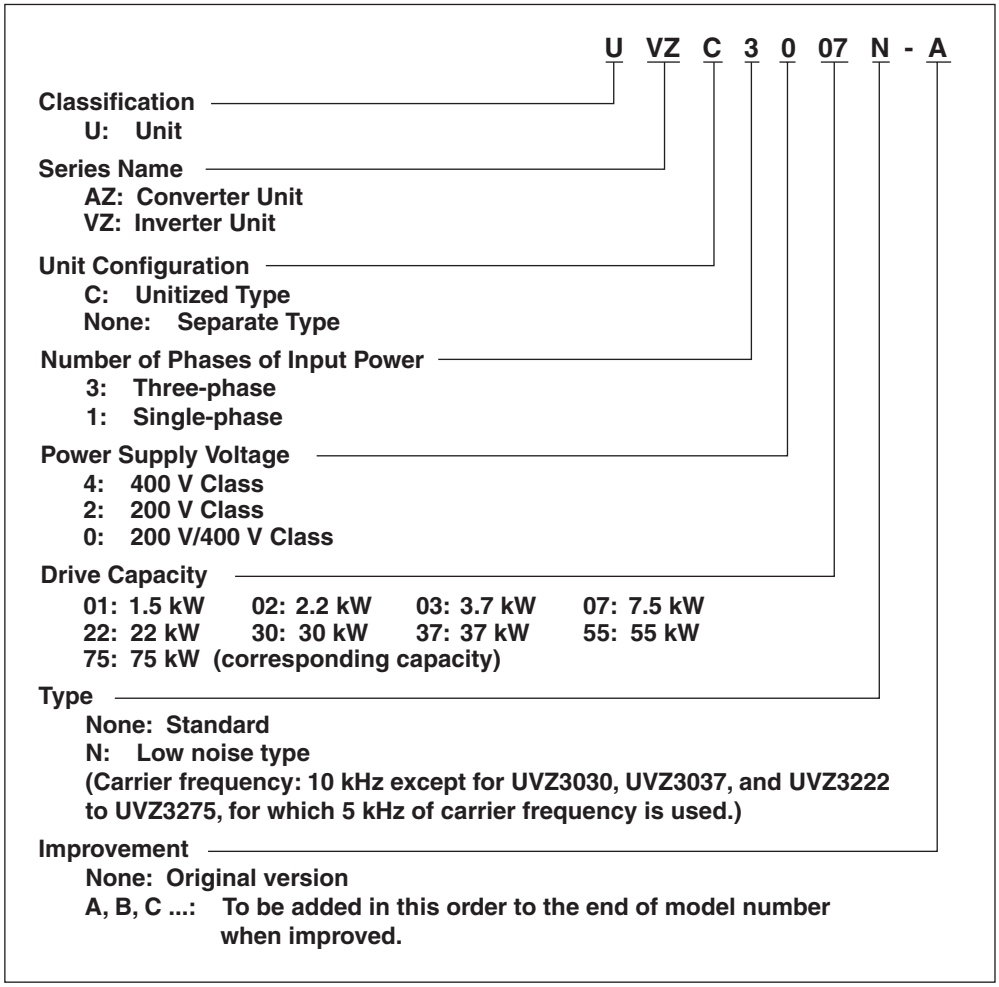



Figure 1.1 - Identifying VZ3000 Drive Hardware Model Number

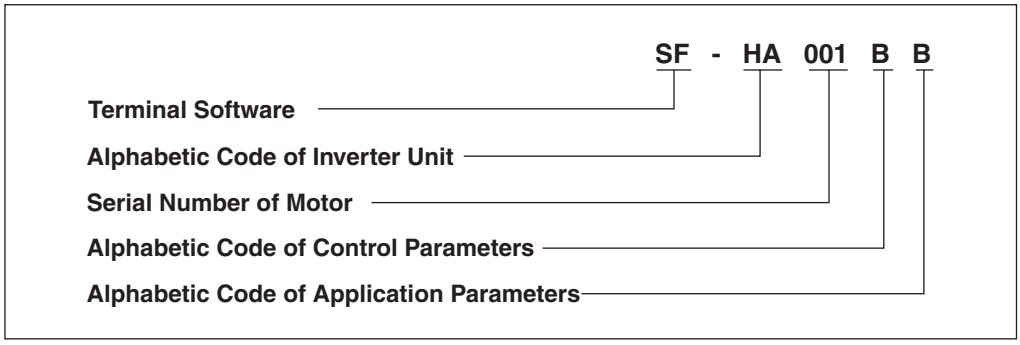



Figure 1.2 - Identifying VZ3000 Drive Software Model Number

For the details of the terminal software VZterm for Windows, refer to the separate instruction manual for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027).

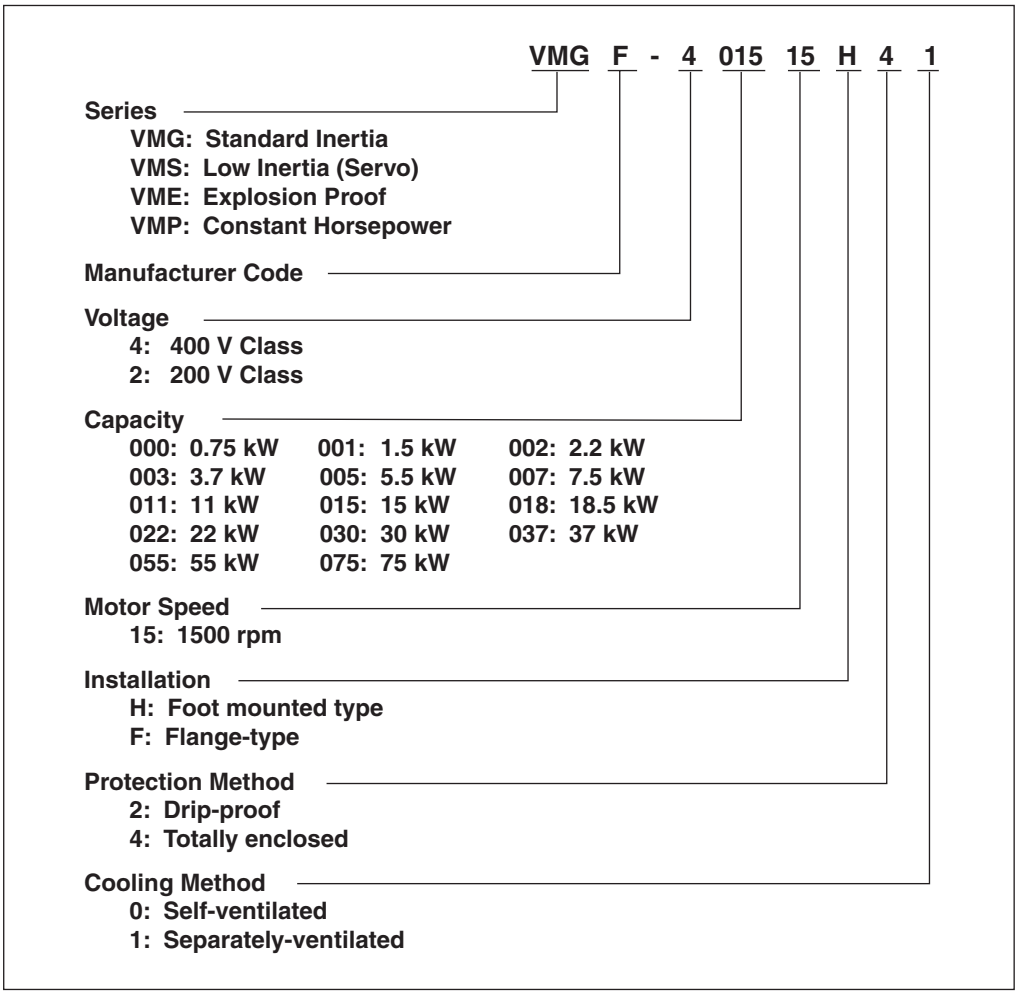



Figure 1.3 - Identifying VZ3000 Motor Model Number

## 1.2 Receive and Accept Shipment

Reliance Electric's terms of sale, in all instances, are FOB point of origin. The user is responsible for thoroughly inspecting the equipment before accepting shipment from the transportation company.

If any items called for on the bill of lading or on the express receipt are not included or if any items are obviously damaged, do not accept the shipment until the freight or express agent makes an appropriate notation on the freight bill or express receipt.

If any concealed loss or damage is discovered later, notify your freight or express agent within 15 days of receipt and request that he make an inspection of the shipment. Keep the entire shipment intact in its original shipping container.

The user is responsible for making claim against the transportation company for any shortage or damage occurring in transit. Claims for loss or damage in shipment must not be deducted from the Reliance Electric invoice, nor should payment of the Reliance Electric invoice be withheld while awaiting adjustment of such claims since the transportation company guarantees safe delivery.

If considerable damage has been incurred and the situation is urgent, contact the nearest Reliance Electric Sales Office for assistance.

## 1.3 File Return Request

To return the drive, send a written request to Reliance Electric within ten days of receipt. Do not return the drive without a numbered Equipment Return Authorization Form, available from your local Reliance Electric Sales Office. Reliance Electric reserves the right to inspect the drive on site.

## 1.4 Store Drive until Installation

After receipt inspection, repack the drive in its original shipping container until ready for installation. To ensure satisfactory drive operation at start-up and to maintain warranty coverage, store the drivet as follows if storage will be less than five months:

- Indoors
- In its original container with its internal packing in a clean, dry, safe place.
- Within an ambient temperature that does not exceed 65 degree C (149 degree F) or go below -40 degree C (-40 degree F).
- Within a relative humidity range of 5 to 95% without condensation.
- Away from a corrosive atmosphere. In harsh or dusty environment, cover the shipping/storage container.
- Away from construction areas.

If storage will be longer than five months, contact Reliance for long-term storage instructions.

# CHAPTER 2
# Knowing Drive

This chapter provides the description of various components and the specifications of the VZ3000 drives.

## 2.1 Drive Front Panel Components

Components on front panel of the VZ3000 drives are shown in Figures 2.1 to 2.3.

Figure 2.1 shows front panels for unitized type units UVZC3001 to UVZC3007 and UVZC3201 to UVZC3207, for separate type converter units UAZ3022(-A) to UAZ3037(-A) and UAZ3222(-A), and for separate type inverter units UVZ3022 to UVZ3037 and UVZ3222. Note that the overheat fault output terminals for built-in re-generative resistor shown in the figure are not provided on the original version of the units. For more information, refer to the notes in the figure.

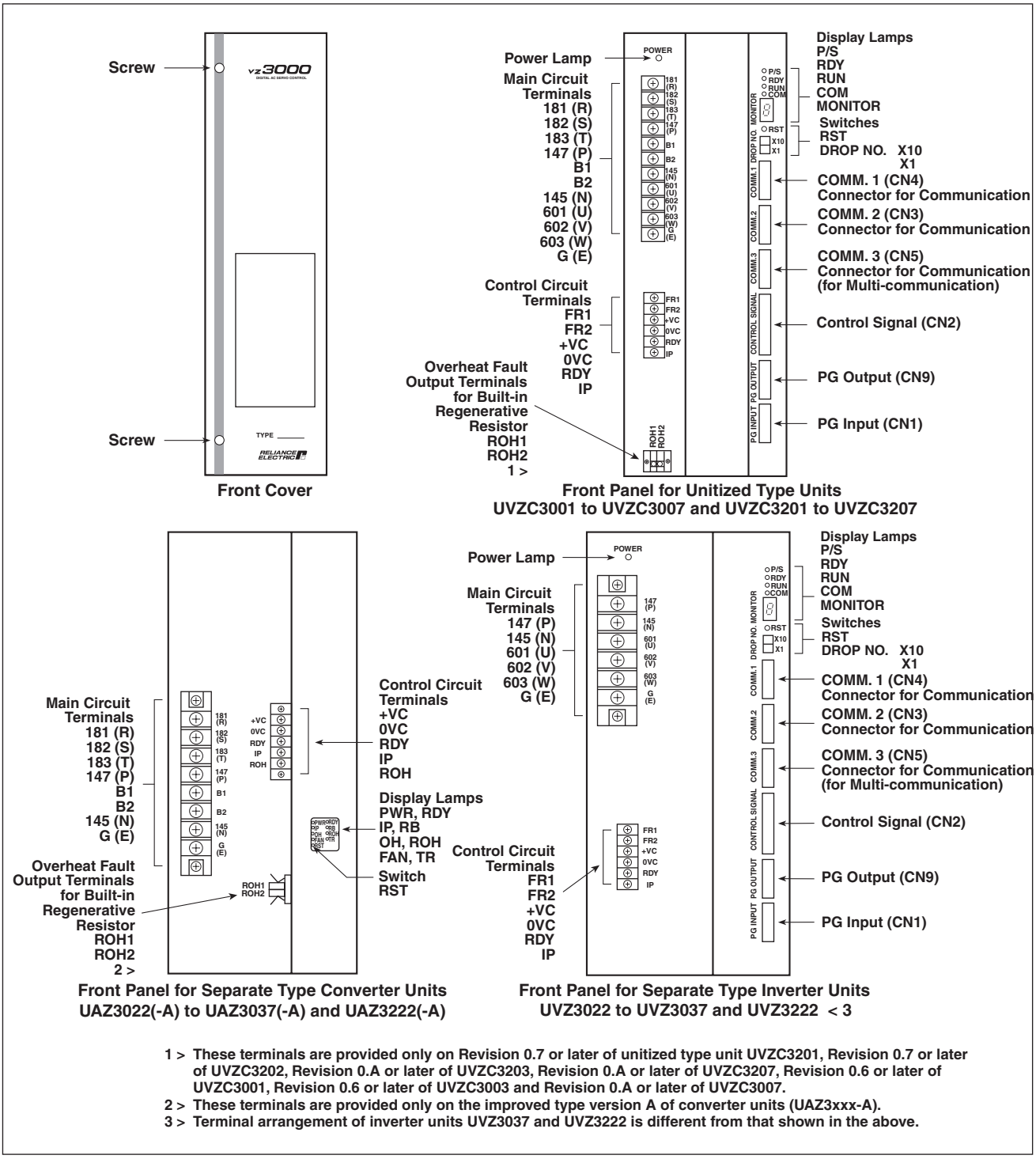
Power lamps and terminals of these units are behind front covers. To take off the cover, loosen two screws retaining front cover to body (except models UVZC3201 to UVZC3203 which have only one retaining screw) until screws will come off from body. Do not remove screws from front cover (except models UVZC3201 to UVZC3203 for which screw must be removed from front cover).

Figure 2.2 illustrates front panels for separate type converter units UAZ3237(-A) and UAZ3275. As shown in the figure, the improved type version A of converter unit UAZ3237-A is provided with the overheat fault output terminals for built-in regenerative resistor. Because these units have main circuit terminals at top and bottom of front panel, they have no front cover.

Figure 2.3 shows front panels for separate type inverter units UVZ3230 to UVZ3275. The main circuit terminals of these units are located at top and bottom of front panel, and therefore, these units have no front cover.

For detailed function of each component except connectors, refer to Tables 2.1 to 2.5. The connectors are described in Chapter 4.

**Important:** Inverter unit UVZ3275 is for a motor having two same windings.




**1 > These terminals are provided only on Revision 0.7 or later of unitized type unit UVZC3201, Revision 0.7 or later of UVZC3202, Revision 0.A or later of UVZC3203, Revision 0.A or later of UVZC3207, Revision 0.6 or later of UVZC3001, Revision 0.6 or later of UVZC3003 and Revision 0.A or later of UVZC3007.**

**2 > These terminals are provided only on the improved type version A of converter units (UAZ3xxx-A).**

**3 > Terminal arrangement of inverter units UVZ3037 and UVZ3222 is different from that shown in the above.**

Figure 2.1 - Front Panels and Components on Unitized Type Units, Separate Type Converter Units UAZ3022(-A) to UAZ3037(-A) and UAZ3222(-A), and Separate Type Inverter Units UVZ3022 to UVZ3037 and UVZ3222

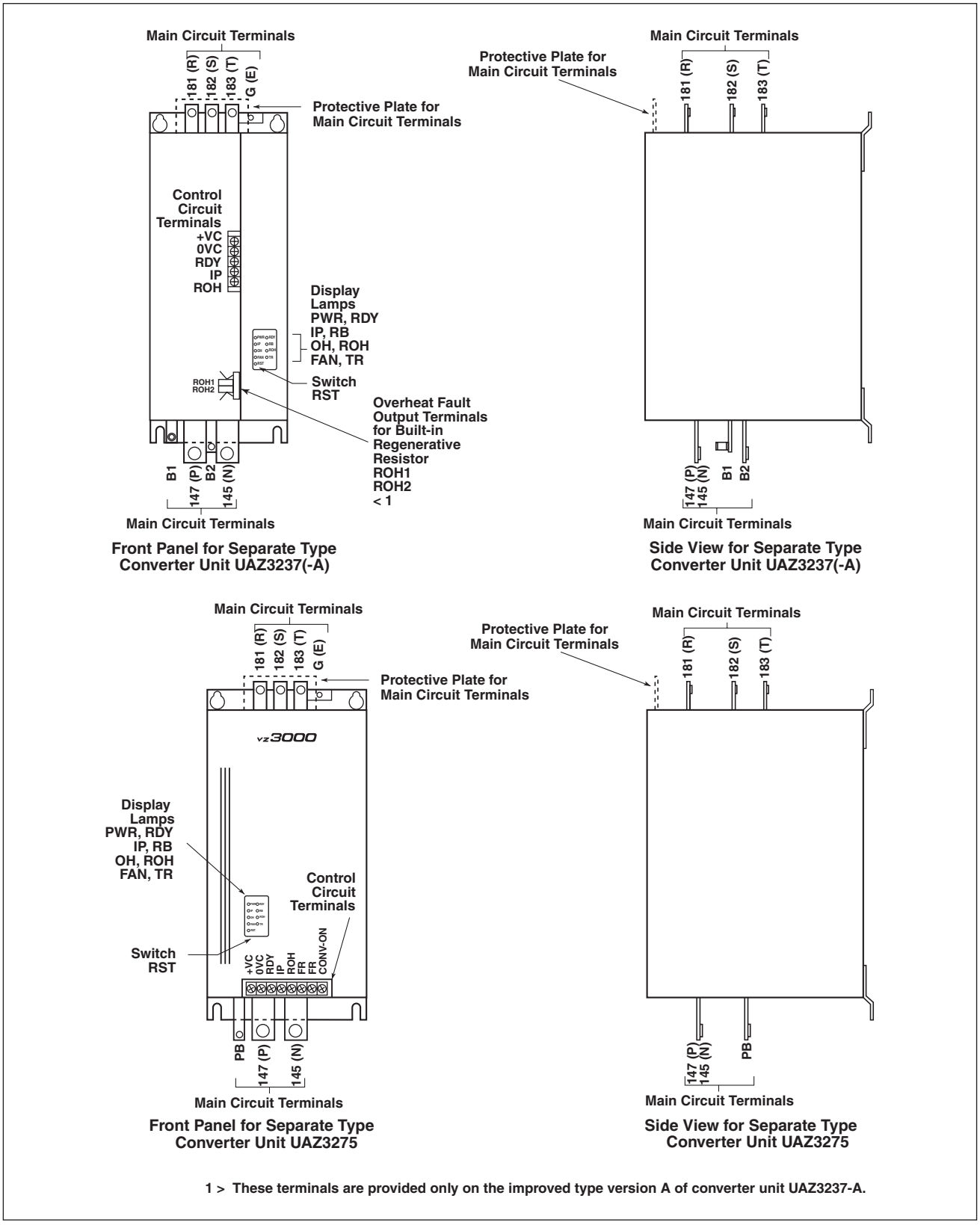



Figure 2.2 - Front Panels and Components on Separate Type Converter Units UAZ3237(-A) and UAZ3275

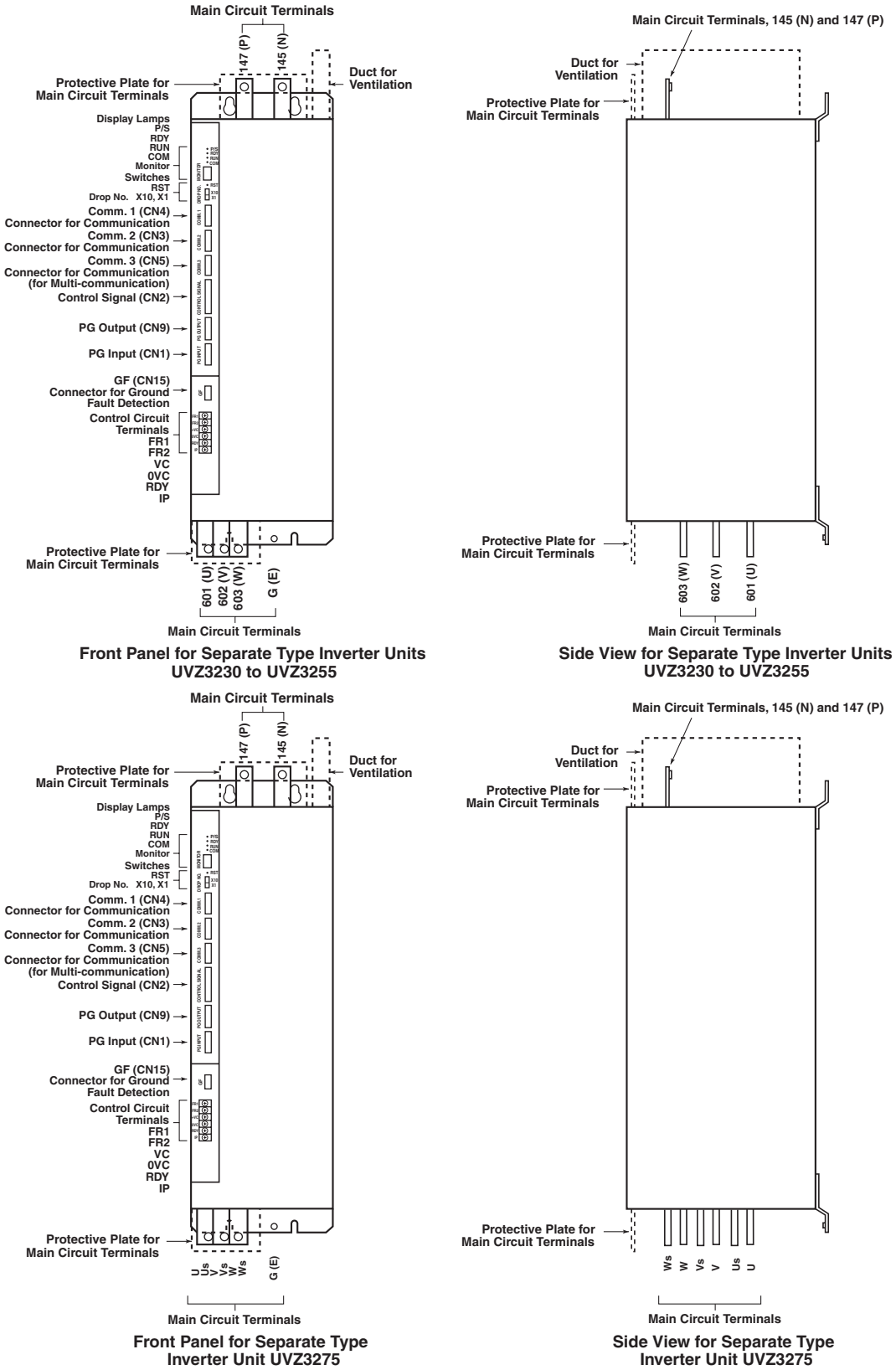



Figure 2.3 - Front Panels and Components on Separate Type Inverter Units UVZ3230 to UVZ3275

## 2.2 Terminals

### 2.2.1 Main Circuit Terminals

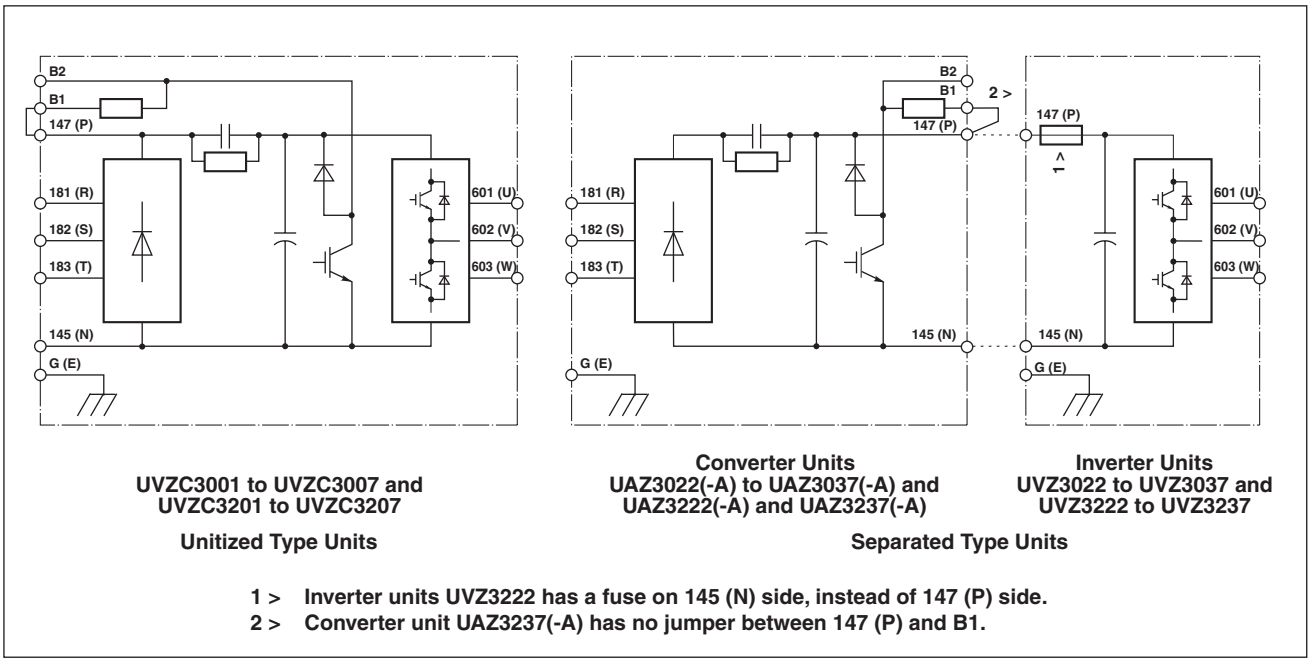
The functions of the main circuit terminals of drives are described in Table 2.1, and the arrangement of these main circuit terminals is illustrated in Figures 2.4 to 2.6. Note that inverter unit UVZ3275 has six output terminals, because this unit is for a motor having two same windings.

Table 2.1 - Main Circuit Terminals

| Terminal Name | | Symbol | Description |
|---|---|---|---|
| AC Power Input Terminals | | 181 (R)<br>182 (S)<br>183 (T) | To be used to supply AC power to converter unit.<br>200 V Class: 200/220/230 VAC (+/-10%), 50/60 Hz<br>400 V Class: 380/400/440/460 VAC (+/-10%), 50/60 Hz<br>In case of single-phase input, use terminals R and S. (In this case, derating is required.) |
| DC Bus Terminals | | 147 (P)<br>145 (N) | To connect converter unit to inverter unit when using converter unit.<br>200 V Class: 240 (minimum) to 350 VDC (maximum)<br>400 V Class: 460 (minimum) to 715 VDC (maximum) |
| Regenerative Resistor Connection Terminals | For drives having converter portion except Model UAZ3275 | B1<br>B2 | To connect a regenerative resistor.<br>When a built-in regenerative resistor is used:<br>Jumper the two terminals 147 (P) and B1, and open B2.<br>When an external regenerative resistor is used:<br>Connect a resistor between 147 (P) and B2, and open B1. |
| | For converter unit UAZ3275 | B1<br>PB | To connect a regenerative resistor.<br>When a built-in regenerative resistor is used:<br>Connect three white leads of the built-in regenerative resistor to the terminal PB.<br>When an external regenerative resistor is used:<br>Remove the three white leads of the built-in regenerative resistor from terminal PB, apply insulation tape to the ends of the leads, and connect an external regenerative resistor between 147 (P) and PB. |
| Output Terminals | For inverter units except Model UVZ3275 | 601 (U)<br>602 (V)<br>603 (W) | To connect motor terminals U, V and W.<br>Motor terminals U, V and W must be connected to controller terminals U (601), V (602) and W (603), respectively.<br>Motor "U" lead to terminal 601 (U)<br>Motor "V" lead to terminal 602 (V)<br>Motor "W" lead to terminal 603 (W) |
| | For inverter unit UVZ3275 [1] | U<br>Us<br>V<br>Vs<br>W<br>Ws | To connect motor terminals $U_1$, $U_2$, $V_1$, $V_2$ $W_1$ and $W_2$.<br>Motor terminals $U_1$, $U_2$, $V_1$, $V_2$ $W_1$ and $W_2$ [2] must be connected to controller terminals U, Us, V, Vs, W and Ws, respectively. |
| Ground Terminal | | G (E) | Grounding terminal. |

[1] Inverter unit UVZ3275 is a unit for a motor having two same windings, and has six output terminals. For wiring, refer to Figure 2.6.

[2] Motor terminal names shown here may be different from those of your motor.




**UVZC3001 to UVZC3007 and UVZC3201 to UVZC3207**

**Converter Units UAZ3022(-A) to UAZ3037(-A) and UAZ3222(-A) and UAZ3237(-A)**

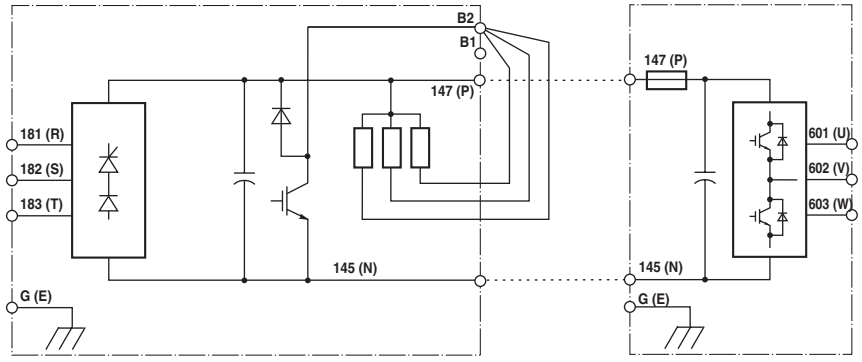
**Inverter Units UVZ3022 to UVZ3037 and UVZ3222 to UVZ3237**

**Unitized Type Units**

**Separated Type Units**

**1 > Inverter units UVZ3222 has a fuse on 145 (N) side, instead of 147 (P) side.**
**2 > Converter unit UAZ3237(-A) has no jumper between 147 (P) and B1.**

Figure 2.4 - Block Diagram of Main Circuit of Unitized Type Units and Separate Type Units Except Converter Unit UAZ3275 and Inverter Units UVZ3255 and UVZ3275




**Converter Unit UAZ3275**

**Inverter Unit UVZ3255**

**Note: Converter unit UAZ3275 is of a three-phase full wave mixing bridge type.**

Figure 2.5 - Block Diagram of Main Circuit of Separate Type Unit Consisting of Converter Unit UAZ3275 and Inverter Unit UVZ3255

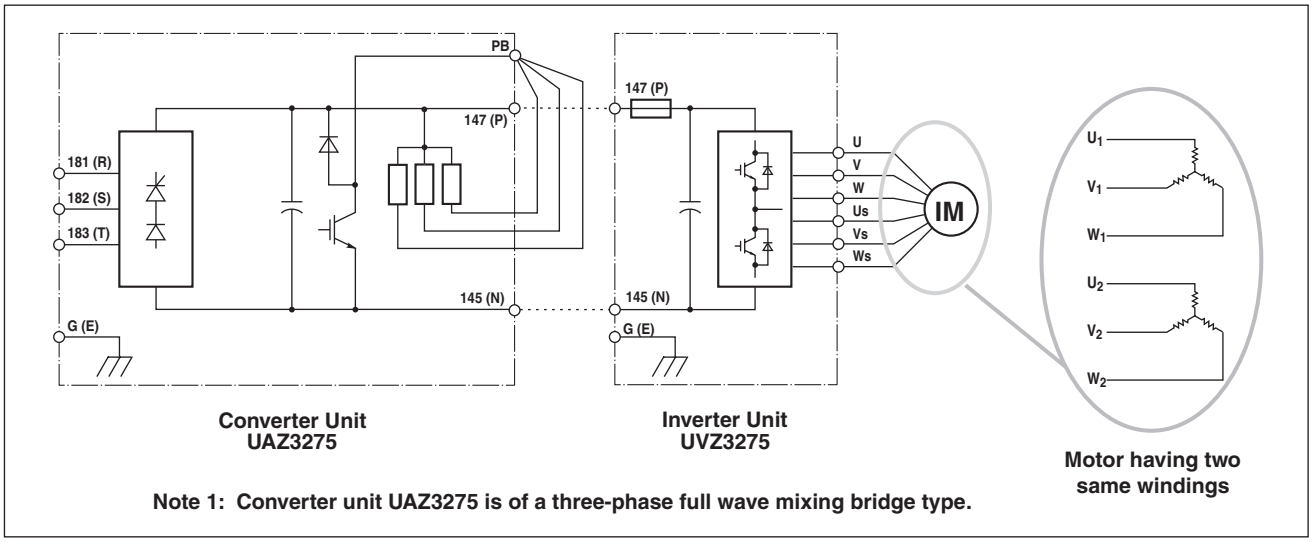



Figure 2.6 - Block Diagram of Main Circuit of Separate Type Unit Consisting of Converter Unit UAZ3275 and Inverter Unit UVZ3275

### 2.2.2 Control Circuit Terminals

As shown in Figures 2.1 to 2.3, the VZ3000 drive has control circuit terminals on its front panel. The functions of these control circuit terminals are described in Table 2.2. Converter unit's terminals +VC, RDY, IP and 0VC should be connected to inverter unit's terminals of same names, respectively (see Figure 7.18).

Table 2.2 - Control Circuit Terminals

| Unit | Symbol of Terminal | Name of Signal | Description |
|---|---|---|---|
| Converter Units except UAZ3275 (1) | +VC | 12 V Control Power Supply | 12 V, maximum 90 mA. |
| | RDY | Converter Unit Ready for Operation Signal | This signal will become ON after VZ3000 drive is powered up if no fault exists in the converter unit. It is an open collector output (allowable range 15 V, 40 mA). |
| | IP | Instantaneous Power Loss Detection Signal | This signal will be ON when AC input power becomes lower than the specified level. It is an open collector output (allowable range 15 V, 40 mA). |
| | 0VC | Common | Common for the above-mentioned power output. |
| | ROH | Protection Input for External Regenerative Resistor | This signal is not usually used. (Opening voltage 12 VDC, closing current 4.5 mA) |
| | ROH1/ ROH2 (2) | Overheat Fault Output for Built-in Resistor | This is a contact output signal that is opened when the built-in resistor is overheated. (110 VAC, 0.3 A or 30 VDC, 0.1 A.) |

Table 2.2 - Control Circuit Terminals (continued)

| Unit | Symbol of Terminal | Name of Signal | Description |
|---|---|---|---|
| Converter Unit UAZ3275 | +VC | 12 V Control Power Supply | 12 V, maximum 90 mA. |
| | RDY | Converter Unit Ready for Operation Signal | This signal will become ON after VZ3000 controller is powered up if no fault exists in the converter unit. It is an open collector output (allowable range 15 V, 40 mA). |
| | IP | Instantaneous Power Loss Detection Signal | This signal will be ON when AC input power becomes lower than the specified level. It is an open collector output (allowable range 15 V, 40 mA). |
| | ROH [3] | Protection Input for External Regenerative Resistor | Connect thermal switch contact signal of resistor overheat protection kit to be attached to external regenerative resistor, between this terminal and terminal 0VC. (Opening voltage 24 VDC, closing current 11 mA.) |
| | CONV ON | Converter ON Signal | Converter unit ON/OFF signal enters to this terminal. To start the converter unit, connect the contact signal between this terminal and terminal 0VC. (Opening voltage 12 VDC, closing current 5 mA.) |
| | 0VC | Common | Common for the above-mentioned power output. |
| | FR/FR | Fault Output | This signal will become close after VZ3000 drive is powered up if no fault exists in the converter unit. It is a contact output (250 VAC, 1 A or 30 VDC, 1A). |
| Inverter Unit | +VC | 12 V Control Power Input | Control power input (load current 7 mA). |
| | RDY | Converter Portion Ready for Operation Signal | Connect the ready for operation signal from the converter potion, to this terminal. |
| | IP | Detection Signal of Instantaneous Power Loss of Converter Portion | Connect the detection signal of instantaneous power loss from the converter portion to this terminal. |
| | 0VC | Common | Common for the above-mentioned power output. |
| | FR1/FR2 | Fault Output | This signal will become close after VZ3000 drive is powered up if no fault exists in both the inverter unit and the converter unit. It is a contact output (250 VAC, 1 A or 30 VDC, 1A). |
| | ROH1/ ROH2 [4] | Overheat Fault Output for Built-in Resistor | This is a contact output signal that is opened when the built-in resistor is overheated. (110 VAC, 0.3 A or 30 VDC, 0.1 A.) |

[1] When AC input power is entered, the converter unit will automatically start. Fault information of the converter unit is provided as fault output signal FR1/FR2 of the inverter unit.

[2] This terminal was added to the improved type version A of the converter unit (UAZ3xxx-A).

[3] This terminal does not exist when Control Board ACDC-2 is used.

[4] This terminal was added to Revision 0.6 or later of unitized type unit UVZC3201, Revision 0.7 or later of UVZC3202, Revision 0.A or later of UVZC3203, Revision 0.A or later of UVZC3207, Revision 0.6 or later of UVZC3001, Revision 0.6 or later of UVZC3003 and Revision 0.A or later of UVZC3007. Separate type inverter units are not provided with this terminal.

## 2.3 Display Lamps

The VZ3000 drive has several lamps to indicate drive status or fault status as shown in Table 2.3.

Table 2.3 - Display Lamps

| Unit | Lamp | Description |
|---|---|---|
| Inverter Unit [1] | POWER | This lamp is turned ON while DC bus voltage is charged. |
| | P/S | This lamp is turned ON when control power supply is established. But it is not turned ON if built-in fuse was blown. [3] |
| | RDY | This lamp is turned ON when the VZ3000 becomes ready for operation, and turned OFF when any fault occurs or when a parameter is changed. |
| | RUN | This is a monitoring lamp that is turned ON when an external RUN signal is received while the "RDY" lamp above is turned ON. Note, however, that this lamp is instantaneously turned ON due to base block condition for self-diagnostic when the VZ3000 is powered up, even though no external RUN signal is received. |
| | COM | This lamp is turned ON while the VZ3000 is communicating. |
| | MONITOR | Alarm/error code flashes when error(s) and/or alarm condition occurs. For detailed contents of codes, refer to Tables 6.1 to 6.3. Note that when DC bus voltage is lost, held faults will be cleared. |
| Converter Unit [2] | PWR | This lamp is turned ON while AC input voltage or DC bus voltage is charged. |
| | RDY | This lamp is turned ON when charging of DC bus voltage is completed and converter unit is normal. |
| | IP [4] | This lamp is turned ON and holds turned ON when AC input voltage drops (even for an instant). |
| | RB | This lamp is turned ON while regenerative transistor is in operation. But this lamp of converter unit UAZ3275 is turned ON at AC input overvoltage. |
| | OH | This lamp is turned ON at overheat of converter unit. |
| | ROH [4] | This lamp is turned ON when built-in regenerative resistor is overheated or when precharge relay for converter unit other than UAZ3275 is not turned ON. |
| | FAN | This lamp is turned ON when cooling fan of converter unit becomes defective. |
| | TR | This lamp is turned ON when overcurrent of regenerative transistor is detected or when transistor becomes defective. But this lamp of converter unit UAZ3275 is turned ON when overcurrent of regenerative transistor is detected or when short-circuit of the DC bus is detected. |

[1] These display lamps are provided on unitized type units UVZC3001 to UVZC3007 and UVZC3201 to UVZC3207 and on inverter units UVZ3022 to UVZ3037 and UVZ3222 to UVZ3275; not on converter units UAZ3022(-A) to UAZ3037(-A) and UAZ3222(-A) to UAZ3275.

[2] These display lamps are provided on converter units UAZ3022(-A) to UAZ3037(-A) and UAZ3222(-A) to UAZ3275; not on unitized type units UVZC3001 to UVZC3007 and UVZC3201 to UVZC3207 and on inverter units UVZ3022 to UVZ3037 and UVZ3222 to UVZ3275.

[3] This is not applicable to unitized units UVZC3001 to UVZC3007 and UVZC3201 to UVZC3207.

[4] These lamps are turned ON when power supply is turned OFF. If the power is re-applied at this time, the unit is kept as fault. To prevent such situation from occurring when the power was turned OFF, turn ON the power again after these display lamps have been turned OFF.

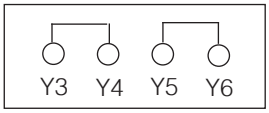
## 2.4 Switches and Jumpers

The controllers have switches and jumpers that can be set by the user, as described in Table 2.4. For the names of boards used in the VZ3000, refer to Chapter 8.

Table 2.4 - Switches and Jumpers

<table>
<tr><th>Unit</th><th colspan="2">Switches and Jumpers</th><th>Description</th></tr>
<tr><td rowspan="8">Inverter Unit [1]</td><td colspan="2">DROP No. x 10 (Higher digit)<br>DROP No. x 1 (Lower digit)</td><td>To set Drop Number (user selectable unit number) for inverter unit when a host computer or a VZ3000/VZ3000G operator's terminal OPCU-2 is used for communication. Setting range: 1 to 99 (00 is not acceptable).<br>The setting is read at power up only.</td></tr>
<tr><td colspan="2">RST Switch</td><td>To reset a fault/alarm of inverter unit or to reset system.</td></tr>
<tr><td colspan="2">Dip Switches on Control Board DASR-1</td><td>Dip switches 1 and 2 are used for selecting communication baud rate as shown below. Dip switches 3 and 4 are used for internal purpose in system.
<table>
<tr><th colspan="2">Dip Switch</th><th rowspan="2">Communication Baud Rate for COMM. 2</th></tr>
<tr><th>1</th><th>2</th></tr>
<tr><td>OFF</td><td>OFF</td><td>1200 BPS</td></tr>
<tr><td>ON</td><td>OFF</td><td>2400 BPS</td></tr>
<tr><td>OFF</td><td>ON</td><td>4800 BPS</td></tr>
<tr><td>ON</td><td>ON</td><td>9600 BPS</td></tr>
</table>
<table>
<tr><th colspan="2">Dip Switch</th></tr>
<tr><th>3</th><th>4</th></tr>
<tr><td>OFF</td><td>OFF</td></tr>
</table>
Factory setting: Dip switches 1 and 2: ON<br>Dip switches 3 and 4: OFF</td></tr>
<tr><td>Jumpers on Driver Board PWCC-4</td><td>JP1 and JP2</td><td>Setting of the jumpers JP1 and JP2 depends on inverter unit as follows:<br>UVZ3022: OPEN<br>UVZ3030: SHORT</td></tr>
<tr><td>Jumpers on Driver Board PWCC-6</td><td>JP1 and JP2</td><td>Short the jumpers JP1 and JP2.<br>The Driver Board PWCC-6 is used for the following inverter units:<br>UVZ3222, UVZ3230, UVZ3237 and UVZ3037.</td></tr>
<tr><td>Jumpers on Driver Board PWCC-10</td><td>JP1 and JP2</td><td>Set the jumpers JP1 and JP2 to "A".<br>The Driver Board PWCC-10 is used for the following unitized type controllers:<br>UVZC3201 and UVZC3202.</td></tr>
<tr><td>Jumpers on Driver Board PWCC-11</td><td>JP1 and JP2</td><td>Set the jumpers JP1 and JP2 to "B".<br>The Driver Board PWCC-11 is used for the unitized type controller UVZC3203.</td></tr>
<tr><td>Jumpers on Driver Board PWCC-17</td><td>JP1 and JP2</td><td>Setting of the jumpers JP1 and JP2 depends on inverter unit as follows:<br>UVZ3255: OPEN<br>UVZ3275: SHORT</td></tr>
<tr><td rowspan="2">Converter Unit [2]</td><td colspan="2">RST Switch</td><td>To reset an error/alarm of converter unit.</td></tr>
<tr><td>SW2 Switches on Control Board DCVR-5 [3]</td><td>SW2-1<br>SW2-2</td><td>To set overheat detection temperature.
<table>
<tr><th>SW2-1</th><th>SW2-2</th><th>Set Temperature</th></tr>
<tr><td>OFF</td><td>OFF</td><td>The "OH" LED lights ON.</td></tr>
<tr><td>ON</td><td>OFF</td><td>80 degree C (176 degree F)</td></tr>
<tr><td>OFF</td><td>ON</td><td>90 degree C (194 degree F)</td></tr>
<tr><td>ON</td><td>ON</td><td>Do not use this setting because the element might be damaged.</td></tr>
</table>
Factory setting: SW2-1: OFF<br>SW2-2: ON</td></tr>
</table>

Table 2.4 - Switches and Jumpers (continued)

<table>
<tr><th>Unit</th><th colspan="2">Switches and Jumpers</th><th>Description</th></tr>
<tr><td rowspan="15">Converter Unit [2] (cont'ed)</td><td rowspan="2">SW2 Switches on Control Board DCVR-5 [3] (cont'ed)</td><td>SW2-3</td><td>At single-phase operation, turn ON this switch to disable open-phase detection of T-phase. (In case of single-phase input, use terminals R and S for connection of power.)<br>Factory setting: OFF</td></tr>
<tr><td>SW2-4</td><td>When an optional SS4000 Power Regeneration Unit is used, turn ON to disable detection of transistor fault. In this case, disconnect built-in regenerative resistor.<br>Factory setting: OFF</td></tr>
<tr><td rowspan="6">Switches and Jumpers on Control Board ACDC-3 [4]</td><td>SW2</td><td>To test IGBT.</td></tr>
<tr><td>SW3</td><td>To set thermal overload (continuous discharge capacity) of regenerative resistor.Select a regenerative resistor capacity near actually used permissible capacity instead of rated capacity.
<table>
<tr><td>Setting</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Continuous Discharge Capacity (kW)</td><td>0.5</td><td>1.8</td><td>3.4</td><td>4.7</td><td>6.4</td><td>7.6</td><td>9.0</td><td>10.1</td></tr>
</table>
When using built-in resistor, set switch SW3 to 0.<br>Factory setting: 0</td></tr>
<tr><td>Y1 and Y2</td><td>Short these terminals (for 200 V class).</td></tr>
<tr><td>Y3, Y4, Y5 and Y6</td><td>Short these terminals as follows (for 200 V class).<br> 
</td></tr>
<tr><td>JP5 and JP6</td><td>Open these jumpers.</td></tr>
<tr><td>JP9</td><td>Regenerative operation is disabled by shorting this jumper.<br>When using an optional regenerative converter, short this jumper.<br>Factory setting: OPEN</td></tr>
<tr><td>JP10 [5]</td><td>This jumper is used to inhibit forced discharge of voltage accumulated in DC capacitors, when power supply is disconnected.<br>A: Not inhibit (usually)<br>B: Inhibit.<br>When forced discharge is inhibited by selecting "B", be careful that DC bus voltage is maintained for a long time. In such a case, provide a discharge circuit or similar, outside of the VZ3000.</td></tr>
<tr><td rowspan="5">(Jumpers on Control Board ACDC-2) [4]</td><td>JP1 and JP4</td><td>Short these jumpers.</td></tr>
<tr><td>JP2 and JP3</td><td>Open these jumpers.</td></tr>
<tr><td>JP5 and JP6</td><td>Open these jumpers.</td></tr>
<tr><td>JP7</td><td>Short this jumper.</td></tr>
<tr><td>JP8</td><td>Shorting this jumper extends precharge time.<br>When impedance of power supply is high, short this jumper.</td></tr>
<tr><td>JP9</td><td>Regenerative operation is disabled by shorting this jumper.<br>When using an optional regenerative converter, short this jumper.</td></tr>
</table>

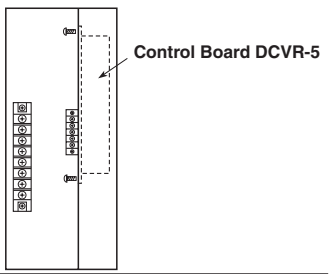
[1] These switches are provided on unitized type units UVZC3001 to UVZC3007 and UVZC3201 to UVZC3207 and on inverter units UVZ3022 to UVZ3037 and UVZ3222 to UVZ3275; not on converter units UAZ3022(-A) to UAZ3037(-A) and UAZ3222(-A) to UAZ3275.

[2] These switches are provided on converter units UAZ3022(-A) to UAZ3037(-A) and UAZ3222(-A) to UAZ3275; not on unitized type units UVZC3001 to UVZC3015 and UVZC3201 to UVZC3207 and on inverter units UVZ3022 to UVZ3037 and UVZ3222 to UVZ3275.

[3] The Control Board DCVR-5 is used for converter units UAZ3022(-A) to UAZ3037(-A) and UAZ3222(-A) to UAZ3237(-A). It can be taken out by removing two screws as shown in the right figure.

[4] These switches and jumpers are on converter unit UAZ3275.

[5] The Control Board ACDC-3 earlier than Revision 0.2 does not have this function.



## 2.5 Technical Specifications

Two types of VZ3000 are provided, unitized type unit in which converter portion and inverter portion are arranged as a unit, and separate type unit which has separate converter unit and inverter unit, and each has 200-230 VAC dedicated type and 200-230 VAC/380-460 VAC common type. Since converter portion of unitized type unit is contained in inverter portion, model numbers for unitized type units are provided only for inverter portions, which are UVZC3001 to UVZC3007 and UVZC3201 to UVZC3207.

The inverter model numbers of separate type are UVZ3022 to UVZ3037 and UVZ3222 to UVZ3275. The converter model numbers are UAZ3022(-A) to UAZ3037(-A) and UAZ3222(-A) to UAZ3275.

The following 12 units have been UL/C-UL listed, provided that UL-listed fuses as shown in Table 9.10 should be installed in the AC input power line.

| | |
|---|---|
| Converter/Inverter Unitized Type Unit: | UVZC3001, UVZC3003, and UVZC3007 |
| Converter Unit: | UAZ3022, UAZ3022-A, UAZ3030, UAZ3030-A, UAZ3037 and UAZ3037-A |
| Inverter Unit: | UVZ3022, UVZ3030, and UVZ3037 |

In the following sections, technical specifications of the VZ3000 controllers are described.

**Important:** When a VZ3000 drive is used for your motor, rated output current and instantaneous maximum output current of the controller must be larger than rated current and overload current of the motor.

### 2.5.1 Common Specifications

Table 2.5 shows common specifications of unitized type units, separate type inverter units and separate type converter units.

Table 2.5 - Common Specifications of Unitized Type Units, Separate Type Inverter Units and Separate Type Converter Units

| | | |
|---|---|---|
| Environment | Place of Installation | In a control cabinet (free from oil mist, metal powder, dust, other airborne materials, inflammable gas, corrosive gas and other dangerous gas) |
| | Ambient Temperature | In use: -10 to 55 degree C (14 to 131 degree F)<br>Stored: -40 to 65 degree C (-40 to 140 degree F). |
| | Ambient Humidity | 5 to 95% (no condensation). |
| | Elevation | Less than 1000 meters above see level. |
| | Vibration | Less than 1 G (25 Hz) |
| | Shock | Less than 2 G. |

## 2.5.2 Specifications of 200-230 VAC Dedicated Type Inverter Units

Table 2.6 shows specifications of 200-230 VAC dedicated type inverter units.

Table 2.6 - Specifications of 200-230 VAC Dedicated Type Inverter Units

| Description / Model Number | | | UVZC-3201 | UVZC-3202 | UVZC-3203 | UVZC-3207 | UVZ-3222 | UVZ-3230 | UVZ-3237 | UVZ-3255 | UVZ-3275 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of Unit | | | Unitized Type | | | | Separate Type | | | | |
| Input | Input Power Voltage (1) | 200 V Class | Three-phase 200/220/230 VAC (+/-10%) 50/60 Hz or 230 to 357 VDC | | | | 230 to 357 VDC | | | | |
| Output | Standard Type (2) | Rated Current (Arms) | 10 | 14 | 20 | 35 | 94 | 145 | 185 | 265 | 350 |
| | | Maximum Current (1 min.) (Arms) | 15 | 21 | 30 | 52 | 141 | 218 | 278 | 397 | 525 |
| | | PWM Carrier Frequency (kHz) | 5.0 | | | | 3.0 | | | | |
| | Low Noise Type (2) | Rated Current (Arms) | 9 | 13 | 18 | 32 | 85 | 131 | 167 | 239 | 315 |
| | | Maximum Current (1 min.) (Arms) | 14 | 19 | 27 | 48 | 127 | 196 | 250 | 357 | 473 |
| | | PWM Carrier Frequency (kHz) | 10.0 | | | | 5.0 | | | | |
| Regen-erative Power | Built-in Resistor Capacity (W) | | (220) | (220) | (220) | (440) | - | - | - | - | - |
| | Minimum Resistance (Ohms) | 200 V Class | 38 | 38 | 27.2 | 13.6 | - | - | - | - | - |
| Control Method | | | All-digital vector regulation by means of sinusoidal pulse-width-modulated (PWM) waveform using intelligent power module (IPM). | | | | | | | | |
| Speed Control | Speed Control Range | | 1 : 2000 (with standard pulse encoder of 2048 PPR) / 1 : 4000 (with pulse encoder of 4096 PPR) | | | | | | | | |
| | Speed Fluctuation (%) | Due to Load Fluctuation | +/-0.025 (for load fluctuation from 0 to 100%) | | | | | | | | |
| | | Due to Input Voltage Fluctuation | +/-0.025 | | | | | | | | |
| | | Due to Ambient Temperature Fluctuation | In case of digital command: +/-0.025, in case of analog command: +/-0.1 | | | | | | | | |
| | Speed Control Response (radians/second) | | 628 (motor only) | | | | | | | | |
| | Acceleration/Deceleration Functions | | 0.01 to 500 seconds (accel/decel time for linear accel/decel curve and S-curve accel/decel). | | | | | | | | |
| Signal Input | Command Input | | 5 analog command inputs (input voltage: 0 to +/- 10 VDC, input resistance: 10 kilo-ohms) | | | | | | | | |
| | Sequence Input | | 9 contact signal inputs (allowable voltage: 12 to 24 VDC, input resistance: 2.3 kilo-ohms) | | | | | | | | |
| | Pulse Encoder (PG) Input (kHz) | | Maximum 204.8 at motor rated speed. A, B and Z-phase signals are equivalent to line driver signals. | | | | | | | | |
| | Motor Temperature Sensor Input | | NTC thermistor with B constant of 3570 (100 degree C, 3 kilo-ohms) | | | | | | | | |
| Signal Output | Signal Output | | 2 analog monitor outputs (allowable voltage: +/-3 V, output resistance: 940 ohms) | | | | | | | | |
| | Sequence Output | | 8 open collector outputs (alowable voltage: 12 to 50 VDC, allowable current: 50 mA) | | | | | | | | |

Table 2.6 - Specifications of 200-230 VAC Dedicated Type Inverter Units (continued)

| Description \ Model Number | UVZC-3201 | UVZC-3202 | UVZC-3203 | UVZC-3207 | UVZ-3222 | UVZ-3230 | UVZ-3237 | UVZ-3255 | UVZ-3275 |
|---|---|---|---|---|---|---|---|---|---|
| Communication Function | 2 channels of RS232C port (Modbus protocol) (to be used for various command, sequence signals, monitor, error, etc.) | | | | | | | | |
| Response to Instantaneous Power Loss | 5 selectable methods (operation stop, speed reference stop, free-run during power loss, etc.) | | | | | | | | |
| Protection Function | Overcurrent, overheat (electronic thermal relay), overspeed, overvoltage, low voltage, control power supply failure, unit overheat, motor overheat, PG failure, communication link failure, ground fault (4), etc. | | | | | | | | |
| Cooling Method | Forced cooled type (with DC brushless fan). | | | | | | | | |
| Weight (kg) | 7 | 7 | 7 | 11 | 16 | 30 | 30 | 40 | 50 |

(1) This is the input voltage range within which no fault is detected. When the input voltage is low, derating would be required. For input power capacity, refer to Table 9.6.

(2) For other PWM carrier frequency, select a reduction rate of rated current from the characteristics shown in Figure 7.14 or 7.15.

(3) The built-in resistor cannot be used for usual operation. It must be used only for start-up adjustment by electrical personnel who are familiar with the VZ3000 drive, provided that the drive is immediately shut down when any fault is detected. However, if the revision of drive to be used can output overheat detection signal of the regenerative resistor and AC input power can be cut off with this overheat detection signal, the built-in regenerative resistor of this revision can be used for usual operation. (See Section 7.18.2.)

(4) Power supply source for AC input must be grounded. In addition, in case of inverter units UVZ3255 and UVZ3275, an external ground fault detecting element connected to unit is required . Note that units UVZC3201 to UVZC3203, UVZ3230 and UVZ3237 are not provided with the ground fault detecting function.

### 2.5.3 Specifications of 200-230 VAC/380-460 VAC Common Type Inverter Units

Table 2.7 shows specifications of 200-230 VAC/380-460 VAC common type inverter units.

Table 2.7 - Specifications of 200-230 VAC/380-460 VAC Common Type Inverter Units

| Description \ Model Number | | | UVZC3001 | UVZC3003 | UVZC3007 | UVZ3022 | UVZ3030 | UVZ3037 |
|---|---|---|---|---|---|---|---|---|
| Type of Unit | | | Unitized Type | | | Separate Type | | |
| Input | Input Power Voltage (1) | 200 V Class | Three-phase 200/220/230 VAC (+/-10%) 50/60 Hz or 230 to 357 VDC | | | 230 to 357 VDC | | |
| | | 400 V Class | Three-phase 380/400/440/460 VAC (+/-10%) 50/60 Hz or 460 to 715 VDC | | | 460 to 715 VDC | | |
| Output | Standard Type (2) | Rated Current (Arms) | 6 | 12 | 22 | 60 | 80 | 92 |
| | | Maximum Current (1 min.) (Arms) | 9 | 18 | 33 | 90 | 120 | 138 |
| | | PWM Carrier Frequency (kHz) | 5.0 | | | 3.0 | | |
| | Low Noise Type (2) | Rated Current (Arms) | 5 | 11 | 20 | 54 | 72 | 85 |
| | | Maximum Current (1 min.) (Arms) | 7 | 16 | 30 | 81 | 108 | 127 |
| | | PWM Carrier Frequency (kHz) | 10.0 | | | 5.0 | | |

Table 2.7 - Specifications of 200-230 VAC/380-460 VAC Common Type Inverter Units (continued)

| Description / Model Number | | | UVZC3001 | UVZC3003 | UVZC3007 | UVZ3022 | UVZ3030 | UVZ3037 |
|---|---|---|---|---|---|---|---|---|
| Regen-erative Power | Built-in Resistor Capacity (W) | | (220) | (220) | (440) | - | - | - |
| | Minimum Resistance (ohms) | 200 V Class | 33 | 33 | 33 | - | - | - |
| | | 400 V Class | 58 | 58 | 58 | - | - | - |
| Control Method | | | All-digital vector regulation by means of sinusoidal pulse-width-modulated (PWM) waveform using intelligent power module (IPM). | | | | | |
| Speed Control | Speed Control Range | | 1 : 2000 (with standard pulse encoder of 2048 PPR) / 1 : 4000 (with pulse encoder of 4096 PPR) | | | | | |
| | Speed Fluctuation (%) | Due to Load Fluctuation | +/-0.025 (for load fluctuation from 0 to 100%) | | | | | |
| | | Due to Input Voltage Fluctuation | +/-0.025 | | | | | |
| | | Due to Ambient Temperature Fluctuation | In case of digital command: +/-0.025, in case of analog command: +/-0.1. | | | | | |
| | Speed Control Response (radians/second) | | 628 (motor only) | | | | | |
| | Acceleration/Deceleration Functions | | 0.01 to 500 seconds (accel/decel time for linear accel/decel curve and S-curve accel/decel). | | | | | |
| Signal Input | Command Input | | 5 analog command inputs (input voltage: 0 to +/-10 VDC, input resistance: 10 kilo-ohms) | | | | | |
| | Sequence Input | | 9 contact signal inputs (allowable voltage: 12 to 24 VDC, input resistance: 2.3 kilo-ohms) | | | | | |
| | Pulse Encoder (PG) Input (kHz) | | Maximum 204.8 at motor rated speed. A, B and Z-phase signals are equivalent to line driver signals. | | | | | |
| | Motor Temperature Sensor Input | | NTC thermistor with B constant of 3570 (100 degree C, 3 kilo-ohms) | | | | | |
| Signal Output | Signal Output | | 2 analog monitor outputs (allowable voltage: +/-3 V, output resistance: 940 ohms) | | | | | |
| | Sequence Output | | 8 open collector outputs (alowable voltage: 12 to 50 VDC, allowable current: 50 mA) | | | | | |
| Communication Function | | | 2 channels of RS232C port (Modbus protocol) (to be used for various command, sequence signals, monitor, error, etc.) | | | | | |
| Response to Instantaneous Power Loss | | | 5 selectable methods (operation stop, speed reference stop, free-run during power loss, etc.) | | | | | |
| Protection Function | | | Overcurrent, overheat (electronic thermal relay), overspeed, overvoltage, low voltage, control power supply failure, unit overheat, motor overheat, PG failure, communication link failure, ground fault [4], etc. | | | | | |
| Cooling Method | | | Forced cooled type (with DC brushless fan). | | | | | |
| Weight (kg) | | | 11 | 11 | 11 | 15 | 16 | 18 |

[1] This is the input voltage range within which no fault is detected. When the input voltage is low, derating would be required. For input power capacity, refer to Table 9-5 or 9-6.

[2] For other PWM carrier frequency, select a reduction rate of rated current from the characteristics shown in Figure 7.14 or 7.15.

[3] The built-in resistor cannot be used for usual operation. It must be used only for start-up adjustment by electrical personnel who are familiar with the VZ3000 drive, provided that the drive is immediately shut down when any fault is detected. However, if the revision of drive to be used can output overheat detection signal of the regenerative resistor and AC input power can be cut off with this overheat detection signal, the built-in regenerative resistor of this revision can be used for usual operation. (See Section 7.18.2.)

[4] Power supply source for AC input must be grounded.

## 2.5.4 Specifications of Converter Units

Table 2.8 shows specifications of converter units.

Table 2.8 - Specifications of Converter Unit

| Description \ Model No. | | | | UAZ-3022(-A) | UAZ-3030(-A) | UAZ-3037(-A) | UAZ-3222(-A) | UAZ-3237(-A) | UAZ-3275 |
|---|---|---|---|---|---|---|---|---|---|
| Type of Unit | | | | 200-230 VAC/380-460 VAC Common Type | | | 200-230 VAC Dedicated Type | | |
| Input | Input Power Voltage [1] | | 200 V Class | Three-phase 200/220/230 VAC (+/-10%) 50/60 Hz | | | | | |
| | | | 400 V Class | Three-phase 380/400/440/460 VAC (+/-10%) 50/60 Hz | | | - | | |
| Output | Rated Output (kW) [2] | | 200 V Class | 11 | 15 | 18.5 | 22 | 37 | 75 |
| | | | 400 V Class | 22 | 30 | 37 | - | - | - |
| | Overload Capacity | | | 150%, 60 seconds | | | | | |
| Regen-erative Power | (When built-in resistor is used) [4] | | Capacity (W) | (200) [3] | | | | | 900 |
| | When external resistor is used | Minimum Resistance (ohms) [4] | 200 V Class | 8 | 5.1 | 3.9 | 3.75 | 2.0 | 1.5 |
| | | | 400 V Class | 15 | 10 | 7.5 | - | - | - |
| | | Continuous Capacity (kW) [5] | 200 V Class | 11 | 15 | 18.5 | 22 | 37 | [6] |
| | | | 400 V Class | 22 | 30 | 37 | - | - | - |
| Protection Function | | | | Unit overheat, built-in resistor overheat, overvoltage, low voltage, regenerative trip | | | | | |
| Cooling Method | | | | Forced cooled type (with DC brushless fan). | | | | | |
| Weight (kg) | | | | 15 | 15 | 17 | 15 | 20 | 25 |

[1] For input power capacity, refer to Table 9.5 or 9.6.

[2] The rated output values are shown as rated output of motor.

[3] The built-in resistor cannot be used for usual operation. It must be used only for start-up adjustment by electrical personnel who are familiar with the VZ3000 drive, provided that the drive should immediately be shut down when any fault is detected. However, if the revision of drive to be used can output overheat detection signal of the regenerative resistor and AC input power can be cut off with this overheat detection signal, the built-in regenerative resistor of this revision can be used for usual operation. (See Section 7.18.2.)

[4] The instantaneous rated capacities including motor loss are for 200% overload capacity except for converter unit UAZ3275. The instantaneous rated capacity for converter unit UAZ3275 is for 150% overload capacity.

[5] The continuous capacity is limited by the regenerative resistor installed outside of the drive. Refer to Section 7.18.

[6] When Control Board ACDC-3 is used, the continuous capacity depends on the setting of switch SW-3 on ACDC-3 shown in Table 2.4. Note, however, that the maximum value is for the above-mentioned resistance and is up to 10.1 KW.

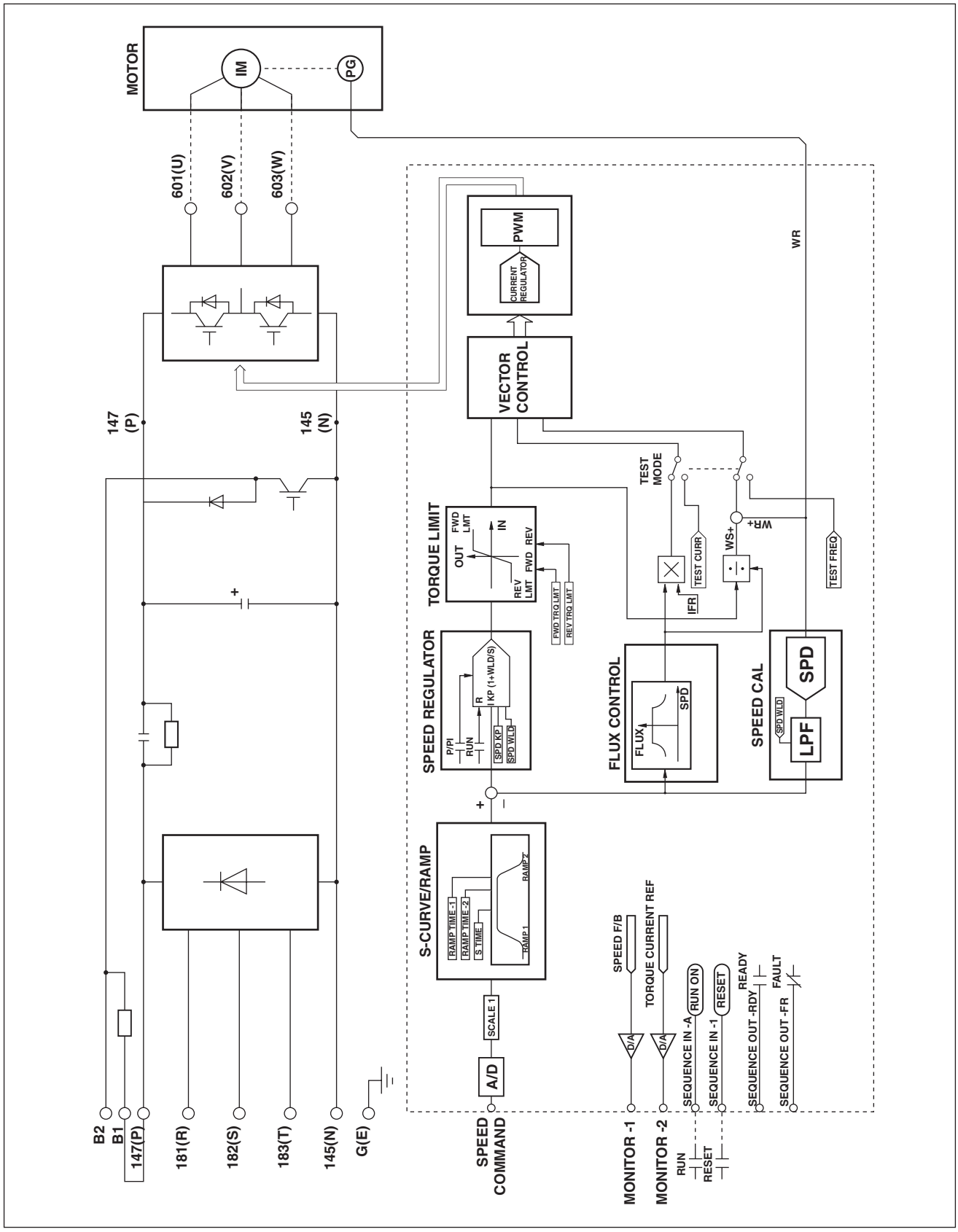



Figure 2.7 - Block Diagram of VZ3000

# CHAPTER 3

# Installing Drive

This chapter provides the procedures that are to be followed to properly install the VZ3000 drive.

**ATTENTION:** Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, and service the equipment. Read and understand this manual and other applicable instruction manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** User is responsible for conforming to the applicable local, national and international codes. Wiring practices, grounding, disconnects, and overcurrent protection are of particular importance. Failure to observe these precaution could result in severe bodily injury or loss of life.

**Important:** The equipment generates, uses, and can radiate radio frequency energy. If installation is not performed according to this instruction manual, interference with radio communication could be caused.

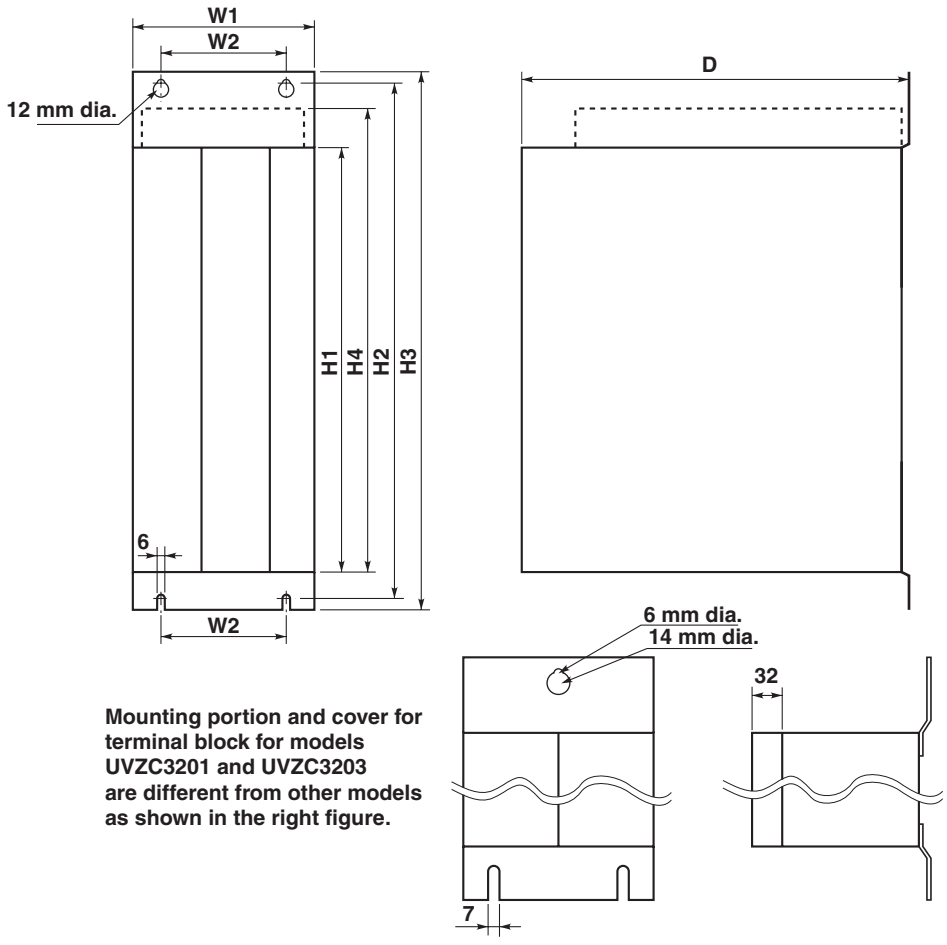
## 3.1 Planning and Location

It is important to properly plan before installing a VZ3000 drive to ensure that the drive's environment and operating conditions are satisfactory. Read and follow the recommendations advised in this chapter before proceeding with installation.

1. Verify that the VZ3000 drive can be kept clean, cool, and dry.
2. Make sure the selected location is away from oil mist, coolant, metal powder, dust, other airborne contaminants, corrosive gas, inflammable gas, other dangerous gas, and direct sunlight.
3. Check that the controller will not be exposed to excessive vibration and noise, nor will be close to instruments very sensitive to electrical noise.
4. Check that temperatures within the vicinity of the controller are between -10 to 55 degree C (14 to 131 degree F). The ambient temperature of motor in use must be 0 to 40 degree C (32 to 104 degree F). If the temperature is higher than this range, derating is required.
5. Check that relative humidity is between 5 and 95% without condensation.
6. Do not install above 3300 feet (1000 meters) without derating. For every 1000 feet (300 meters) above 3300 feet (1000 meters), derate the current rating by 4%. Consult Reliance Electric Sales Office for operation above 5000 feet (1500 meters).

## 3.2 Mounting Dimensions

See Figures 3.1 and 3.2 for dimensions of unitized type units and separate type inverter units, and Figures 3.3 and 3.4 for dimensions of separate type converter units.

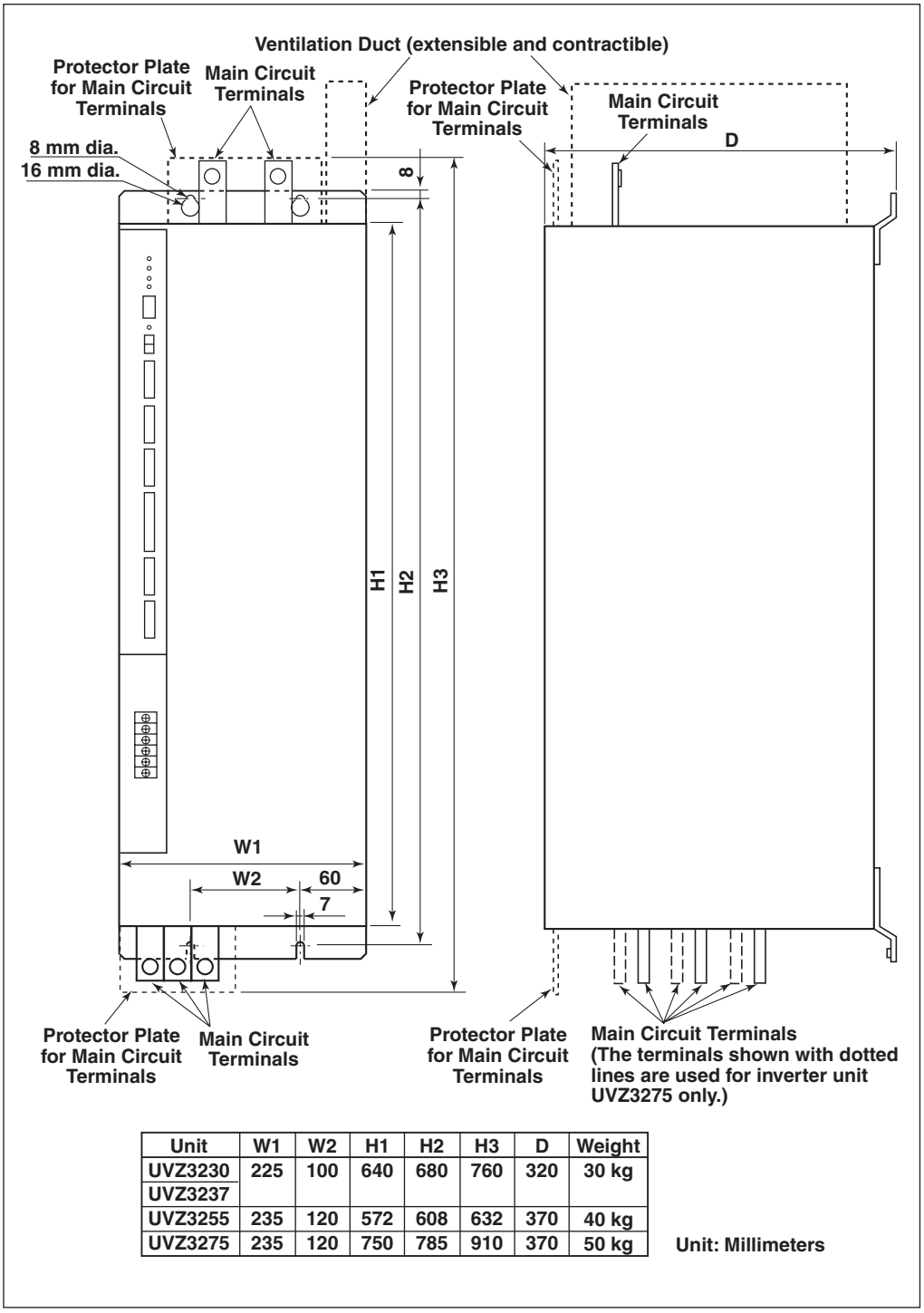



| Unit | W1 | W2 | H1 | H2 | H3 | H4 <1 | D | Weight |
|---|---|---|---|---|---|---|---|---|
| UVZC3201 | 120 | 70 | 352 | 380 | 392 | - | 270 | 7 kg |
| UVZC3202 | | | | | | | | |
| UVZC3203 | | | | | | | | |
| UVZC3001 | 145 | 100 | 382 | 415 | 430 | - | 303 | 11 kg |
| UVZC3003 | | | | | | | | |
| UVZC3207 | | | | | | | | |
| UVZC3007 | | | | | | | | |
| UVZ3022 | 176 | 127 | 382 | 415 | 430 | - | 303 | 15 kg |
| UVZ3030 | 176 | 127 | 413 | 445 | 460 | - | 312 | 16 kg |
| UVZ3037 | 190 | 140 | 514 | 550 | 565 | - | 320 | 18 kg |
| UVZ3222 | 175 | 127 | 413 | 500 | 518 | 475 | 312 | 16 kg |

**1 > The dotted line portion shows the cooling fan of Model UVZ3222.**

**Unit: Millimeters**

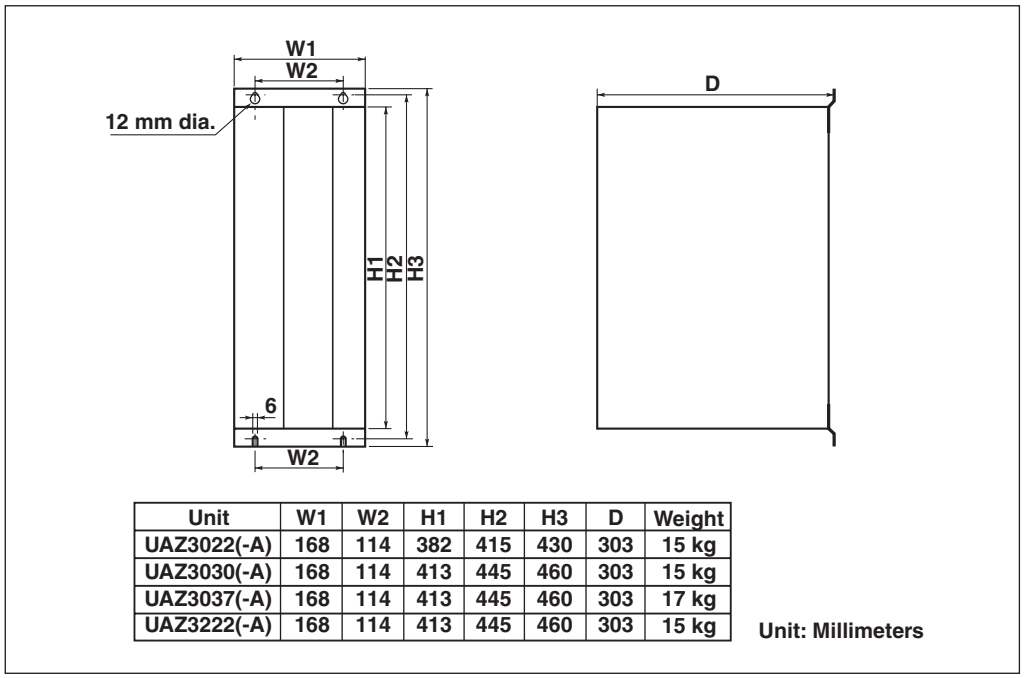
Figure 3.1 - Dimensions of Unitized Type Units and Separate Type Inverter Units Except Models UVZ3230 to UVZ3275




| Unit | W1 | W2 | H1 | H2 | H3 | D | Weight |
|---|---|---|---|---|---|---|---|
| UVZ3230 | 225 | 100 | 640 | 680 | 760 | 320 | 30 kg |
| UVZ3237 | | | | | | | |
| UVZ3255 | 235 | 120 | 572 | 608 | 632 | 370 | 40 kg |
| UVZ3275 | 235 | 120 | 750 | 785 | 910 | 370 | 50 kg |

Unit: Millimeters

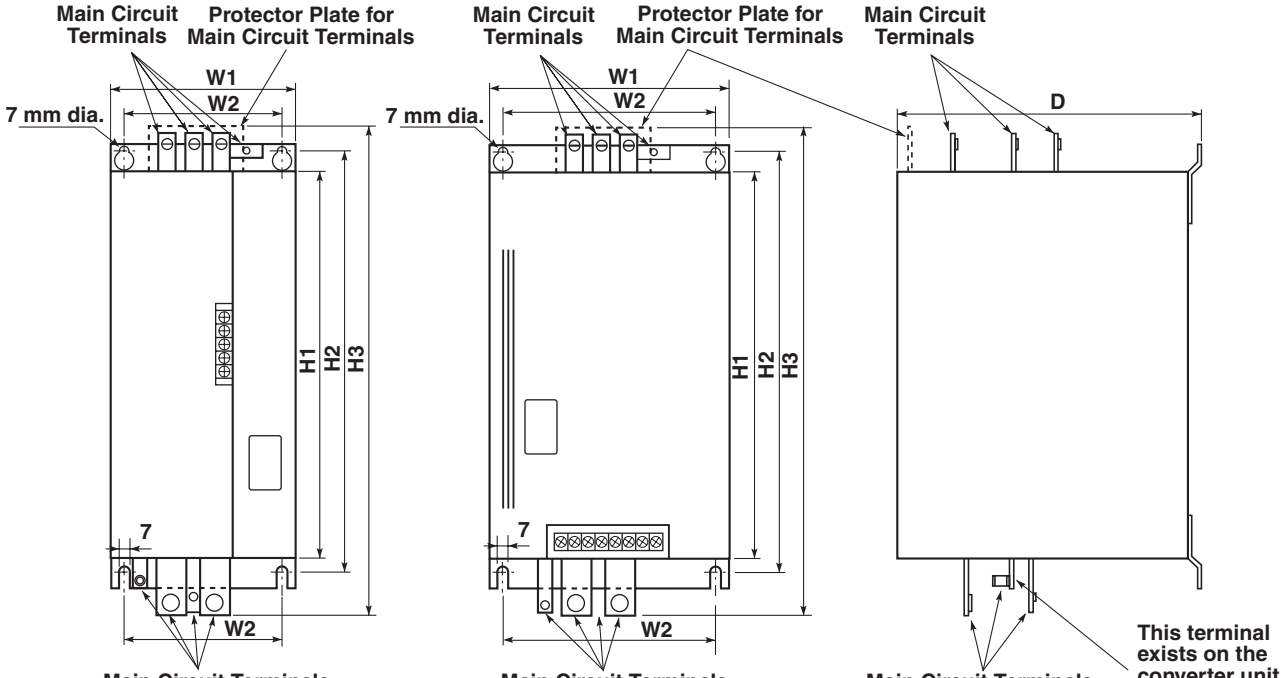
Figure 3.2 - Dimensions of Separate Type Inverter Units UVZ3230 to UVZ3275




| Unit | W1 | W2 | H1 | H2 | H3 | D | Weight |
|---|---|---|---|---|---|---|---|
| UAZ3022(-A) | 168 | 114 | 382 | 415 | 430 | 303 | 15 kg |
| UAZ3030(-A) | 168 | 114 | 413 | 445 | 460 | 303 | 15 kg |
| UAZ3037(-A) | 168 | 114 | 413 | 445 | 460 | 303 | 17 kg |
| UAZ3222(-A) | 168 | 114 | 413 | 445 | 460 | 303 | 15 kg |

Unit: Millimeters

Figure 3.3 - Dimensions of Converter Units except Models UAZ3237(-A) and UAZ3275




| Unit | W1 | W2 | H1 | H2 | H3 | D | Weight |
|---|---|---|---|---|---|---|---|
| UAZ3237(-A) | 202 | 160 | 422 | 456 | 533 | 332 | 20 kg |
| UAZ3275 | 230 | 140 | 370 | 400 | 470 | 370 | 25 kg |

Unit: Millimeters

Figure 3.4 - Dimensions of Converter Units UAZ3237(-A) and UAZ3275

## 3.3 Notes on Installation

1. In the location selected, mount both inverter unit and converter unit vertically. See Figures 3.1 through 3.4 for mounting dimensions of controllers.
2. Provide adequate clearance for air ventilation as shown in Figure 3.5.

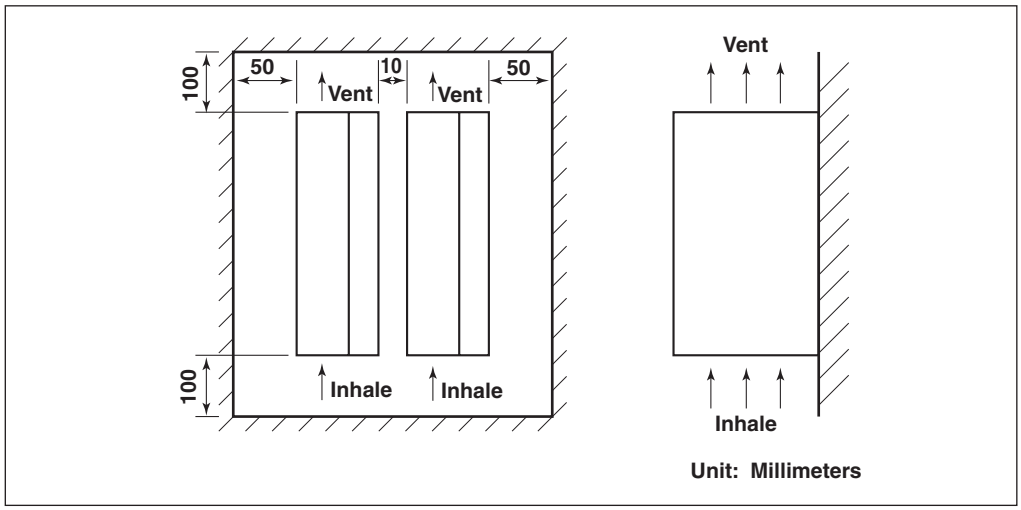



Figure 3.5 - Clearance

3. For converter unit UAZ3275, provide a duct and prepare an opening for duct at upper end of cabinet as shown in Figure 3.6, so that air in the unit can be exhausted directly to outside of cabinet and the specified ambient temperature can be maintained. The dimensions of the duct and opening are shown in Figure 3.6.

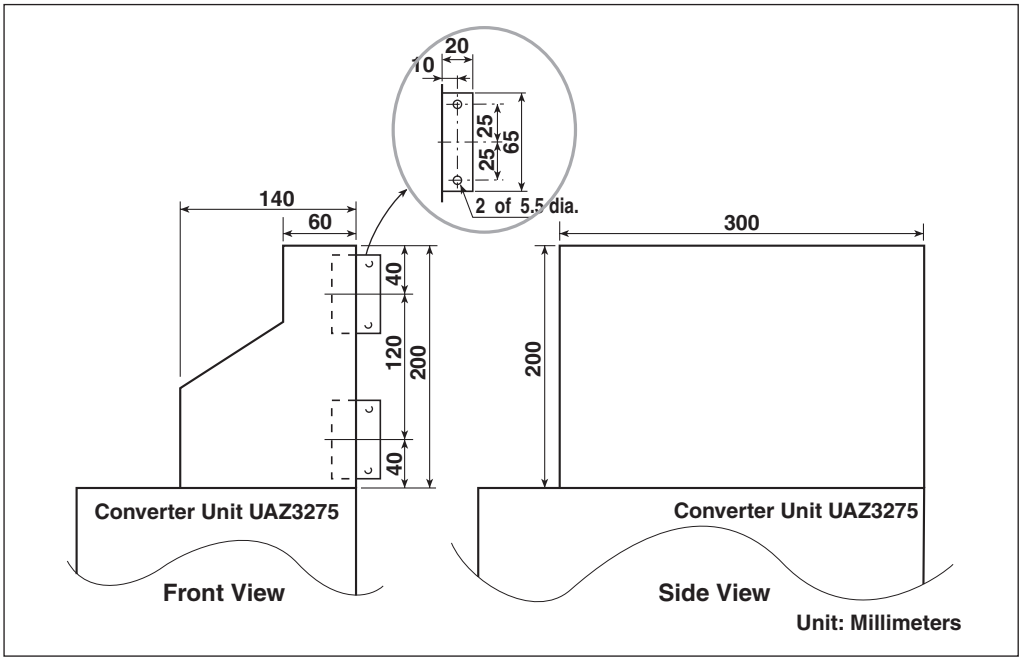



Figure 3.6 - Dimensions of Duct for Converter Unit UAZ3275

4. Be sure that ambient temperatures of inverter unit and converter unit are maintained between -10 to 55 degree C (14 to 131 degree F). To cool down the temperatures in the cabinet, provide enough spaces to exhaust air and also mount enough large capacities of cooling fans.

   Heat generated by each of 200-230 VAC/380-460 VAC common type units at its rated output (using standard carrier frequency of 5 kHz, except for the units UVZ3030 and UVZ3037 for which standard carrier frequency of 3 kHz is used) is shown in Table 3.1. Heat generated by each of 200-230 VAC dedicated type units at its rated output (using standard carrier frequency of 5 kHz, except for the units UVZ3222 to UVZ3275 for which standard carrier frequency of 3 kHz is used) is shown in Table 3.2.

Table 3.1 - Heat Generated by 200-230 VAC/380-460 VAC Common Type Units at Rated Output Using Standard Carrier Frequency of 5 kHz

| Unit | | Inverter | | | | | | Converter | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | UVZC-3001 | UVZC-3003 | UVZC-3007 | UVZ-3022 | UVZ-3030 (1) | UVZ-3037 (1) | UAZ-3022(-A) | UAZ-3030(-A) (1) | UAZ-3037(-A) (1) |
| **Heat Generated (Watts)** | 200 V Class | 150 +$P_1$ (2) | 150 +$P_1$ (2) | 250 +$P_2$ (2) | 400 | 600 | 750 | 120 +$P_4$ (2) | 150 +$P_5$ (2) | 180 +$P_6$ (2) |
| | 400 V Class | 350 +$P_1$ (2) | 350 +$P_1$ (2) | 500 +$P_2$ (2) | 750 | 1200 | 1580 | 250 +$P_4$ (2) | 300 +$P_5$ (2) | 360 +$P_6$ (2) |

(1) The heat values for inverter units UVZ3030 and UVZ3037 and for converter units UAZ3030(-A) and UAZ3037(-A) are the values at rated output in case standard carrier frequency of 3 kHz is used. The remaining heat values are those at rated output in case standard carrier frequency of 5 kHz is used.

(2) $P_1$ to $P_6$ are heat values generated by regenerative resistors.

Table 3.2 - Heat Generated by 200-230 VAC Dedicated Type Units at Rated Output Using Standard Carrier Frequency of 5 kHz

| Unit | | Inverter | | | | | | | | Converter | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | UVZC-3201 | UVZC-3202 | UVZC-3203 | UVZC-3207 | UVZ-3222 (1) | UVZ-3230 (1) | UVZ-3237 (1) | UVZ-3255 (1) | UVZ-3275 (1) | UAZ-3222(-A) (1) | UAZ-3237(-A) (1) | UAZ-3275 (1) |
| **Heat Generated (Watts)** | 200 V Class | 350 +$P_1$ (2) | 350 +$P_1$ (2) | 350 +$P_1$ (2) | 500 +$P_2$ (2) | 750 | 1200 | 1500 | 2200 | 3000 | 250 +$P_4$ (2) | 360 +$P_5$ (2) | 750 +$P_6$ (2) |

(1) The heat values for inverters UVZ3222 to UVZ3275 and for converters UAZ3222(-A) to UAZ3275 are the values at rated output in case standard carrier frequency of 3 kHz is used. The remaining heat values are those at rated output in case standard carrier frequency of 5 kHz is used.

(2) $P_1$, $P_2$, $P_4$, $P_5$ and $P_6$ are heat values generated by regenerative resistors.

5. If it is not avoidable to install a unit close to a noise source or to use a unit in environment where noise trouble is expected, take sufficient measures against noise.

6. When a combination of converter unit UAZ3237(-A) and inverter unit UVZ3230 or UVZ3237 is used, or when a combination of converter unit UAZ3275 and inverter unit UVA3255 or UVZ3275 is used, it is possible to install the converter unit above the inverter unit. In this case, if the right side surfaces of the two units are lined up, main connection between the two units can be made directly.

## 3.4 Installing Motor

**Important:** If the motor has been in storage for a longer time or subjected to adverse moisture conditions, dry it thoroughly before installation.

**ATTENTION:** To prevent damage to encoder mounted on motor, do not hammer on motor shaft or allow excessive vibration at motor. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

1. Verify the motor is of the appropriate size to use with the controller.
2. Turn the motor shaft by hand to ensure free rotation. A slight resistance may be felt due to rotor magnetic force.
3. Make sure the motor's foundation is sufficiently rigid to minimize vibration.
4. Connect the machine to the motor.
5. Make sure the motor is properly aligned with the driven machine to minimize unnecessary motor loading from shaft misalignment. After carefully aligned, bolt the motor securely in place.
6. If the motor will be accessible while it is running, install appropriate protective guard around all exposed rotating parts.

# CHAPTER 4
# Wiring Drive

This chapter describes various inputs and outputs and provides instructions how to wire the VZ3000 drive.

**ATTENTION:** Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service the equipment. Read and understand this instruction manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** The user is responsible for conforming with all the applicable local, national and international codes such as NEC. Wiring practices, grounding, disconnects, and overcurrent protection are of particular importance. Failure to observe this precaution could result in severe bodily injury or loss of life.

## 4.1 Know Connectors before Wiring

On the front panel of the VZ3000 drive, there are seven connectors (see Figure 2.1). The following sections describe the function of each connector pin of these connectors.

### 4.1.1 Connector of Control Signals (CN2)

The connector CN2 is used for connecting sequence input and output signals for controlling the VZ3000 drive, analog inputs to be used as analog commands, analog outputs for monitoring, and input/output signals from/to option board. Table 4.1 shows the role of each connector pin of the connector CN2, and Figure 4.1 illustrates the pin arrangement.

Table 4.1 - Connector Pins for Control Signals (CN2)

| Kind | Pin No. | Mark | Name of Signal | Description |
|---|---|---|---|---|
| Sequence Input Signals | CN2-14 | SQI-R | RUN Signal Sequence Input R | Input signal for operation. When it is turned ON, the drive starts operation, and when turned OFF, the drive will be in base block condition and the motor will go to coast to rest. When signals are entered via communication, this signal is required for a hardware interlock. |

Table 4.1 - Connector Pins for Control Signals (CN2) (continued)

| Kind | Pin No. | Mark | Name of Signal | Description |
|---|---|---|---|---|
| Sequence Input Signals (continued) | CN2-15 | SQI-1 | Sequence Input Signals | Sequence input signals. The function of each pin is specified by setting parameters.<br>Range of power voltage to be used: 12 to 24 V |
| | CN2-40 | SQI-2 | | |
| | CN2-16 | SQI-3 | | |
| | CN2-41 | SQI-4 | | |
| | CN2-17 | SQI-5 | | |
| | CN2-42 | SQI-6 | | |
| | CN2-18 | SQI-7 | | |
| | CN2-43 | SQI-8 | | |
| | CN2-19 | MOH | Motor Thermal Switch Signal | To connect motor thermal switch contact signal (T1 and T4). |
| | CN2-44 | SQ0V | Sequence Signal Common | |
| Sequence Output Signals | CN2-45 | RDY/ | Ready-for-Operation Signal | This signal is turned ON when the controller is ready for operation. |
| | CN2-20 | FR | Controller Fault Signal | This signal becomes open when the controller is faulty. |
| | CN2-21 | SQO-1 | Sequence Output Signals | Sequence outputs signals. The function of each pin is specified by setting parameters. Open collector outputs. (Allowable range: 50 V, 50 mA) |
| | CN2-46 | SQO-2 | | |
| | CN2-22 | SQO-3 | | |
| | CN2-47 | SQO-4 | | |
| | CN2-23 | SQO-5 | | |
| | CN2-48 | SQO-6 | | |
| | CN2-39 | SQ0V | Sequence Signal Common | Common of sequence inputs and outputs. |
| Power Input | CN2-25 | SQ+V | External Sequence Power Input | To supply power for sequence (12 V or 24 V).<br>When internal 12 V power is used: Jumper between CN2-25 and CN2-50 and between CN2-24 and CN2-49.<br>When external power is used: Connect the external power to CN2-25 and the external power common to CN2-24. |
| | CN2-24 | SQ0V | Sequence Signal Common | |
| Power Output | CN2-50 | +12VI | 12 V Sequence Power Output | To use as power for sequence. +12 V (Allowable current: 50 mA) |
| | CN2-49 | 0VI | | |

Table 4.1 - Connector Pins for Control Signals (CN2) (continued)

| Kind | Pin No. | Mark | Name of Signal | Description |
|---|---|---|---|---|
| Analog Inputs | CN2-2 | IN1 | Analog Command 1 (1) | To connect analog commands. The function of each pin is specified by setting parameters. Standard: 4 V/100% (Impedance: 10 kilo-ohms) It is possible to set within a range 2 to 10 V/100% by changing the Application Parameters. Refer to Section 5.3.1 to change the parameters. (100% shows rated value, except torque reference for which 100% shows maximum torque value.) |
| | CN2-27 | 0V | Common (1) | |
| | CN2-3 | IN2 | Analog Command 2 | |
| | CN2-28 | 0V | Common | |
| | CN2-4 | IN3 | Analog Command 3 | |
| | CN2-29 | 0V | Common | |
| | CN2-5 | IN4 | Analog Command 4 | |
| | CN2-30 | 0V | Common | |
| | CN2-6 | IN5 | Analog Command 5 | |
| | CN2-31 | 0V | Common | |
| Analog Outputs | CN2-7 | MON1 | Monitor Output 1 | Analog outputs for monitoring. The items to be monitored are specified by setting parameters. Signal level: +/-3 V (Allowable current: 1 mA, Output Resistance: 940 Ohms) (3 V shows rated value, except torque reference for which 3 V shows maximum torque value.) |
| | CN2-32 | 0V | Common | |
| | CN2-8 | MON2 | Monitor Output 2 | |
| | CN2-33 | 0V | Common | |
| Power for Analog Signals | CN2-1 | +V | +5 V Power | To be used as power for analog commands. (Allowable current: +/-20 mA. Output Resistance: 10 Ohms) |
| | CN2-26 | -V | -5 V Power | |
| Input/Output from Option Board | CN2-9 | OP1 | | Input/output signals from/to option board. See instruction manual of the option board. |
| | CN2-34 | OP2 | | |
| | CN2-10 | OP3 | | |
| | CN2-35 | OP4 | | |
| | CN2-11 | OP5 | | |
| | CN2-36 | OP6 | | |
| | CN2-12 | OP7 | | |
| | CH2-37 | OP8 | | |

(1) Be careful that CN2-2 (IN1) and CN2-27 (0V) are connected to CN9-10 (IN1) and CN9-20 (0V), respectively.

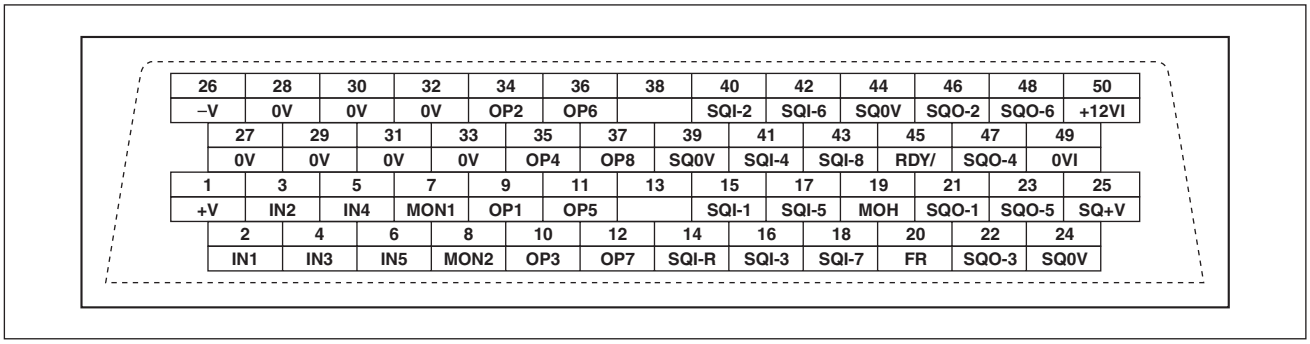



Figure 4.1 - Pin Arrangement of Connector of Control Signals (CN2)
(Viewed from the Connection Cable Side)

### 4.1.2 Connector of PG Inputs (CN1)

A pulse encoder (PG) is mounted on motor to feed speed back to the VZ3000 drive for closed loop regulation, and the connector CN1 is used for receiving PG input signals. Table 4.2 shows the functions of the connector pins, and Figure 4.2 shows the pin arrangement of the connector.

Table 4.2 - Connector Pins of PG Inputs (CN1)

| Kind | Pin No. | Mark | Name of Signal | Description |
|---|---|---|---|---|
| PG Inputs | CN1-1 | PA | PG A-phase Signal | To enter phase signals of pulse encoder (PG), equivalent to line driver signals (SN75113).<br>Note that the PG Z-phase signal is not used in the VZ3000 drive. |
| | CN1-11 | PA/ | | |
| | CN1-3 | PB | PG B-phase Signal | |
| | CN1-13 | PB/ | | |
| | CN1-5 | PZ | PG Z-phase signal | |
| | CN1-15 | PZ/ | | |
| Temperature Input | CN1-9 | MT1 | Motor Temperature Signal | To connect thermistor for measuring motor temperature. |
| | CN1-19 | MT2 | | |
| PG Power | CN1-2<br>CN1-4<br>CN1-6 | PG5 | 5 V Power | To connect positive side of power in case of pulse encoder (PG) for 5 V power (variable power from 5 to 8 V, 250 mA).<br>The sense signal is connected to the PG power terminal near the pulse encoder, and is used as feedback signal of the power voltage. |
| | CN1-8 | S+ | Sense Signal | |
| | CN1-12<br>CN1-14<br>CN1-16 | 0VI | Common | Common for 5 V or 12 V power. To connect to ground (0V) of the pulse encoder. |
| | CN1-10<br>CN1-18<br>CN1-20 | +12VI | 12 V Power | To connect positive side of power in case of pulse encoder (PG) for 12 V power (250 mA). |

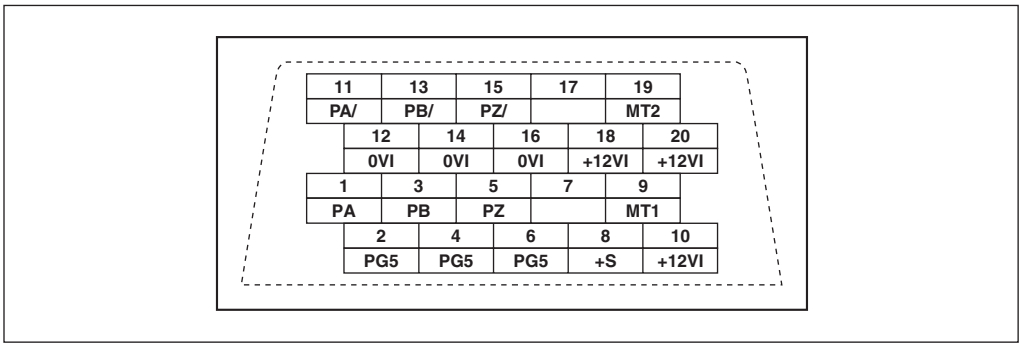



Figure 4.2 - Pin Arrangement of Connector of PG Inputs (CN1)
(Viewed from Connection Cable Side)

### 4.1.3 Connector of PG Outputs (PG Frequency Divider Outputs ) (CN9)

The pulse encoder (PG) frequency divider outputs are available as line driver outputs or totem pole outputs from the connector CN9. Table 4.3 describes the function of each connector pin of the connector (CN9) and the pin arrangement of the connector is shown in Figure 4.3.

Table 4.3 - Connector Pins for PG Frequency Divider Outputs (CN9)

| Kind | Pin No. | Mark | Name of Signal | Description | |
|---|---|---|---|---|---|
| Line Driver Outputs | CN9-1 | LDA | PG Frequency Divider Output A-phase Signal | PG frequency divider output signals, equivalent to line driver signals. (AM26C31) | The dividing ratio of the pulse encoder (PG) output pulses and the lead phase of the pulse encoder (PG) divider output are set by using the Application Parameters. The settings are common for the line divider outputs and the totem pole outputs. |
| | CN9-11 | LDA/ | | | |
| | CN9-3 | LDB | PG Frequency Divider Outpt B-phase Signal | | |
| | CN9-13 | LDB/ | | | |
| | CN9-15 | LDZ | PG Z-phase Signal Output | Output from buffer for PG input (AM26C31) | |
| | CN9-5 | LDZ/ | | | |
| Totem Pole Outputs | CN9-17 | TPA | PG Frequency Divider Output A-phase Signal | PG frequency divider output signals of totem pole type (12V, 50 mA) | |
| | CN9-7 | 0VI | | | |
| | CN9-18 | TPB | PG Frequency Divider Output B-phase Signal | | |
| | CN9-8 | 0VI | | | |
| | CN9-19 | TPZ | PG Z-phase Signal Output | Output from buffer for PG input (totem pole type 12V, 50 mA) | |
| | CN9-9 | 0VI | | | |
| Analog Inputs | CN9-20 | 0V | Analog Command 1 | To connect to CN2-2 (IN1) and CN2-27 (0V) of the Control Signal Connector (CN2). To be used for entering analog command signal for position controller. | |
| | CN9-10 | IN1 | | | |

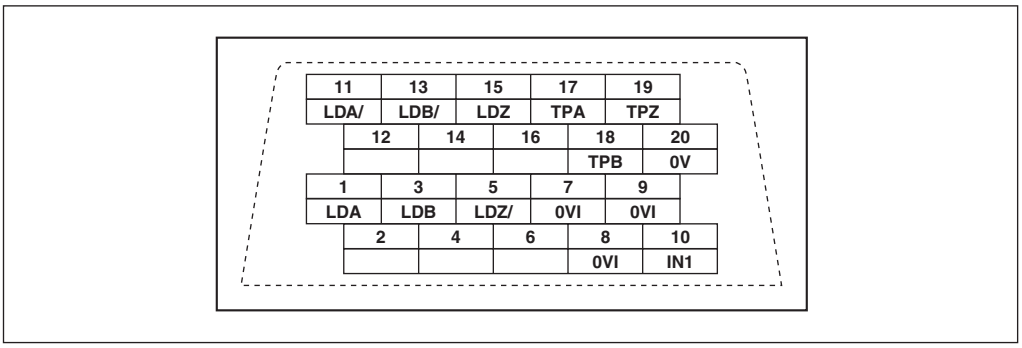



Figure 4.3 - Pin Arrangement of Connector of PG Frequency Divider Outputs (CN9) (Viewed from Connection Cable Side)

### 4.1.4 Connector COMM.1 (CN4) for Communication

The connector COMM.1 (CN4) is used for connecting a host computer or an VZ3000/ VZ3000G operator's terminal OPCU-2 to VZ3000 drive for communication. Table 4.4 shows the uses of the connector pins of this connector, and Figure 4.4 illustrates the pin arrangement.

Table 4.4 - Connector Pins of COMM. 1 (CN4) for Communication

| Kind | Pin No. | Mark | Name of Signal | Description |
|---|---|---|---|---|
| RS-232-C Port | CN4-6 | TXD | Transmitting Data | Communication signal in Modbus protocol.<br>Signal Level: RS-232-C |
| | CN4-5 | RXD | Receiving Data | |
| | CN4-16 | 0VIX | Signal Ground | |
| | CN4-15 | 0VIX | | |
| | CN4-8 | RTS | Request for Transmission | Jumpered in the drive as shown here. |
| | CN4-18 | CTS | Transmission enable | |
| | CN4-9 | DCD | Detection of Transmission Carrier | |
| | CN4-7 | DSR | Data Set Ready | |
| | CN4-17 | DTR | Data Terminal Ready | |
| Power Output | CN4-1 | +5VIX | 5 V Power Output | Dedicated 5 V power for VZ3000/ VZ3000G operator's terminal OPCU-2. |
| | CN4-3 | +5VIX | | |
| | CN4-4 | +5VIX | | |
| | CN4-11 | 0VIX | | |
| | CN4-12 | 0VIX | | |
| | CN4-13 | 0VIX | | |
| | CN4-14 | 0VIX | | |

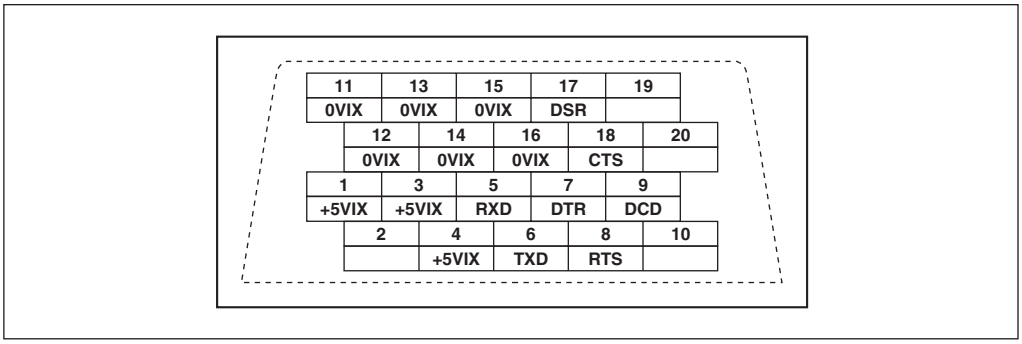



Figure 4.4 - Pin Arrangement of Connector COMM. 1 (CN4) for Communication (Viewed from Connection Cable Side)

### 4.1.5 Connector COMM. 2 (CN3) for Communication

The connector COMM.2 (CN3) is used for communication with a host computer connected. Table 4.5 describes how the connector pins of this connector are used, and Figure 4.5 shows the pin arrangement of the connector.

Table 4.5 - Connector Pins of COMM. 2 (CN3) for Communication

| Kind | Pin No. | Mark | Name of Signal | Description |
|---|---|---|---|---|
| RS-232-C Port | CN3-6 | TXD | Transmitting Data | Communication signal in Modbus protocol.<br>Signal Level: RS-232-C |
| | CN3-5 | RXD | Receiving Data | |
| | CN3-16 | 0VCOM | Signal Ground | |
| | CN3-15 | 0VCOM | | |
| | CN3-8 | RTS | Request for Transmission | Jumpered in the controller as shown here. |
| | CN3-18 | CTS | Transmission Enable | |
| | CN3-9 | DCC | Detection of Transmission Carrier | |
| | CN3-7 | DSR | Data Set Ready | |
| | CN3-17 | DTR | Data Terminal Ready | |
| Power Input | CN3-3 | +5VCOM | 5 V Power Input for Communication | Power for transmission circuit. The following connection is required to perform single communication. For multi-communication, connect as shown in Figure 7.19.<br>When internal power is used:<br>Jumper between +5VCOM and +5VIX between 0VCOM and 0VIX.<br>When external power is used:<br>Connect the power (5 V (+/-5%) 30 mA) to +5VCOM and 0VCOM. |
| | CN3-4 | +5VCOM | | |
| | CN3-12 | 0VCOM | | |
| | CN3-13 | 0VCOM | | |
| | CN3-14 | 0VCOM | | |
| Power Output | CN3-1 | +5VIX | 5 V Power Output | |
| | CN3-11 | 0VIX | | |

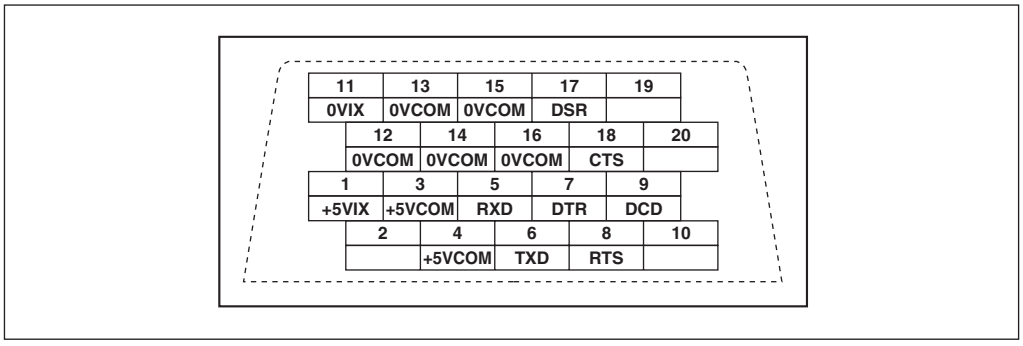



Figure 4.5 - Pin Arrangement of Connector COMM. 2 (CN3) for Communication (Viewed from Connection Cable Side)

### 4.1.6 Connector COMM. 3 (CN5) for Cascade Connection at Multi-communication with Host Computer

When multiple VZ3000 drives are connected in cascade and communicate with a host computer (see Section 7.20), connector COMM. 3 (CN5) of the drive is connected to connector COMM. 2 (CN2) of adjacent drive. Each connector pin of the connector COMM. 3 (CN5) is used as described in Table 4.6. Figure 4.6 shows the pin arrangement.

Table 4.6 - Connector Pins of COMM. 3 (CN5) for Cascade Connection at Multi-communication with Host Computer

| Kind | Pin No. | Mark | Name of Signal | Description |
|---|---|---|---|---|
| Communication Signal | CN5-6 | TXD | Transmitting Data | For cascade connection. |
| | CN5-5 | RXT | Receiving Data | |
| | CN5-16 | 0VCOM | Signal Ground | |
| | CN5-15 | 0VCOM | | |
| Power Input | CN5-3 | +5VCOM | 5 V Power Input for Communication | Power for communication circuit. Connect power (5 V (+/-5%), 30 mA multiplied by the number of units connected in cascade) between +5 VCOM and 0VCOM. |
| | CN5-4 | +5VCOM | | |
| | CN5-13 | 0VCOM | | |
| | CN5-14 | 0VCOM | | |

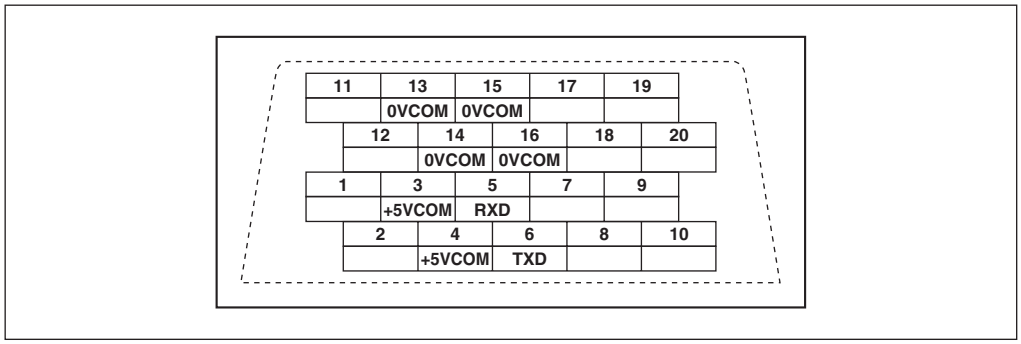



Figure 4.6 - Pin Arrangement of Connector COMM. 3 (CN5) for Cascade Connection at Multi-communication with Host Computer (Viewed from Connection Cable Side)

### 4.1.7 Connector GF (CN15) for Ground Fault Detection

For inverter units UVZ3255 and UVZ3275, ground fault detection elements are installed outside of the unit. If no earth leakage breaker is installed outside of the unit, it is recommended to install a ground fault detection element outside of the unit. The following are the recommended detection element and other components.

Detection element: Use either one of the following elements:

- Type MZT-53 (Mitsubishi Electric)
  (inside diameter of through hole: 53 millimeters)
- Type MZT-68 (Mitsubishi Electric)
  (inside diameter of through hole: 68 millimeters)
- Type MZT-90 (Mitsubishi Electric)
  (inside diameter of through hole: 90 millimeters)

Plug: 172130 (Nippon AMP)

Receptacle: 170384-1 (Nippon AMP)

Cable: UL1430 AWG20 to AWG22 (max. 2 meters)

Table 4.7 shows the function of each pin of the connector GF (CN15) to be used for ground fault detection.

Table 4.7 - Connector Pins of Connector GF (CN15) for Ground Fault Detection

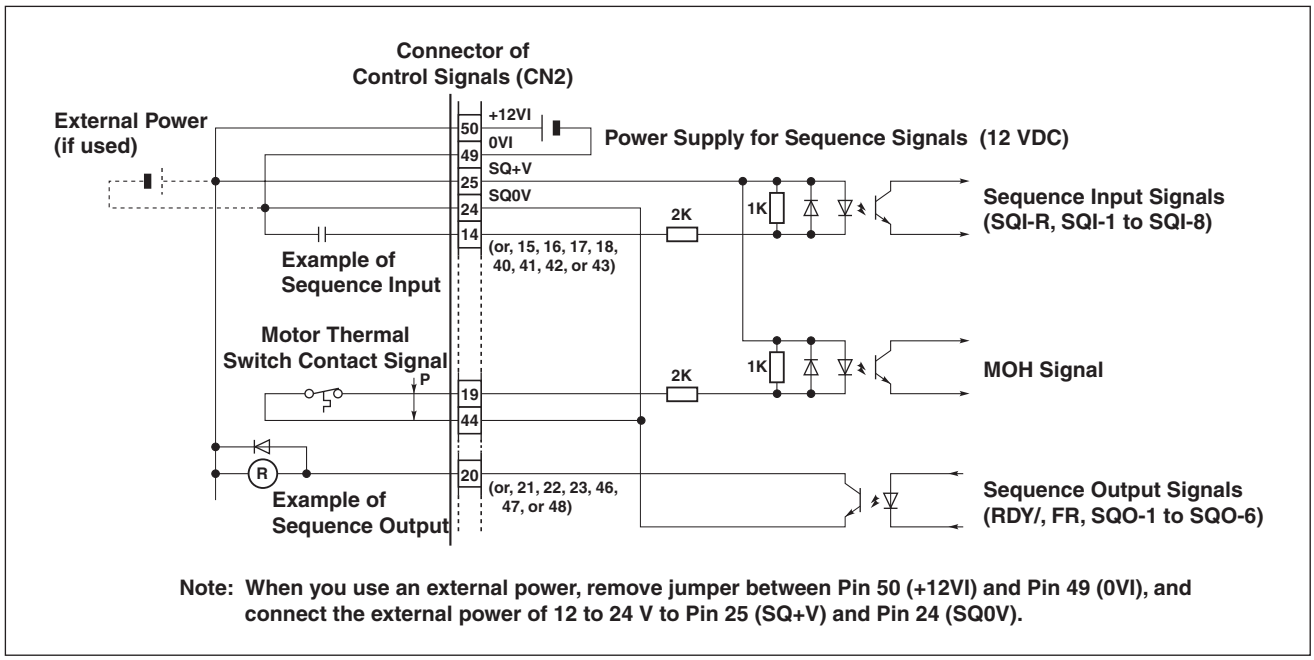
| Kind | Pin No. | Mark | Name of Signal | Description |
|---|---|---|---|---|
| Ground Fault Detection | CN15-1 | GF-1 | Ground fault detection | For detection of ground fault. |
| | CN15-2 | GF-2 | | |

## 4.2 Input and Output Signals

The following sections describe how to use the input and output signals of the VZ3000 drive.

### 4.2.1 Sequence Input and Output Signals

The sequence input and output signals shown in Table 4.1 are used for controlling the VZ3000 drive, such as RUN signal to the drive. Figure 4.7 shows the connection of these sequence input and output signals.




**Note: When you use an external power, remove jumper between Pin 50 (+12VI) and Pin 49 (0VI), and connect the external power of 12 to 24 V to Pin 25 (SQ+V) and Pin 24 (SQ0V).**

Figure 4.7 - Sequence Input and Output Signals

### 4.2.2 Analog Input and Output Signals

The VZ3000 drive has five analog inputs and two analog outputs. The analog inputs are connected to analog commands which are set by parameters as shown in Table 4.1, while the analog outputs are used for monitoring the items to be specified by parameters as shown in Table 4.1. Figure 4.8 illustrates connection of the analog input and output signals.

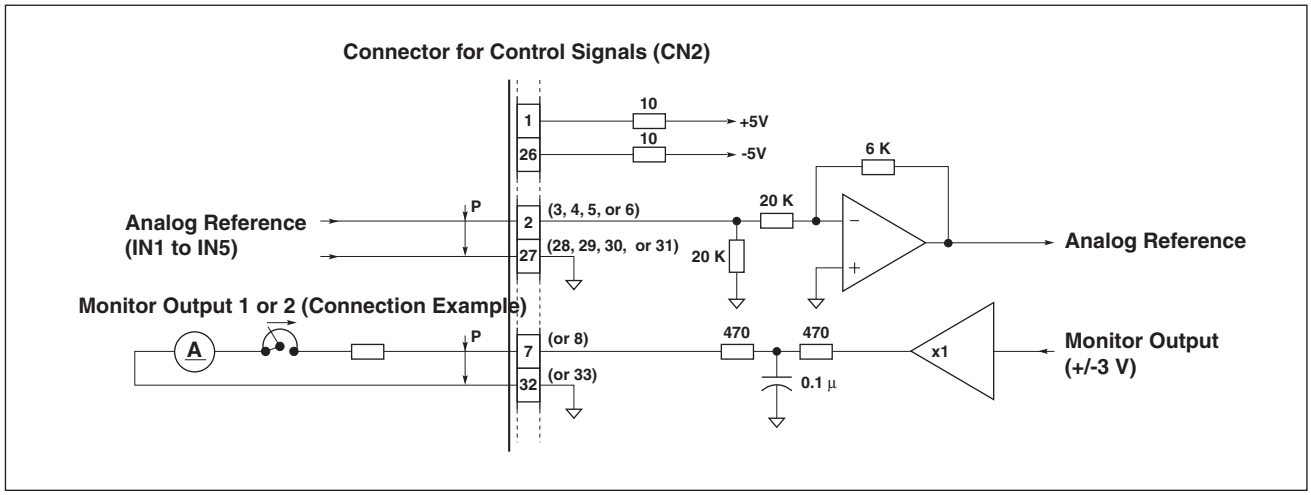



Figure 4.8 - Analog Input/Output Signals

### 4.2.3 Input Signals from Pulse Encoder (PG)

As described in Section 4.1.2, the VZ3000 drive uses feedback signals from a pulse encoder (PG) mounted on motor for control, and Figure 4.9 shows connection of these PG input signals.

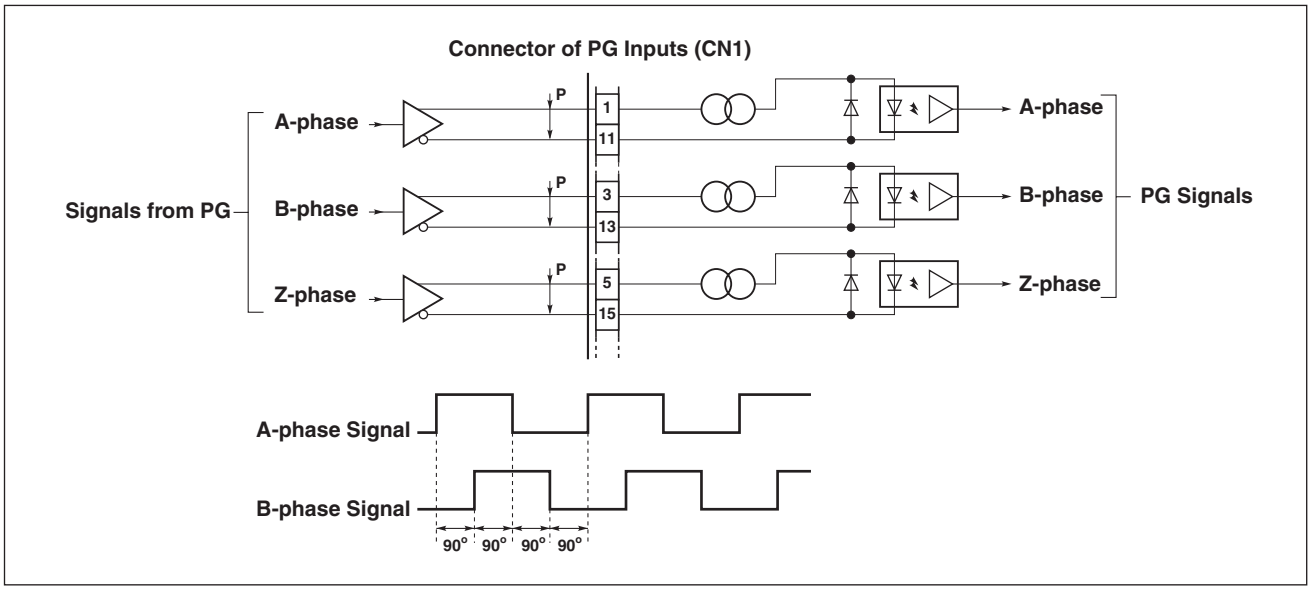



Figure 4.9 - Pulse Encoder (PG) Input Signals

### 4.2.4 Output Signals from Pulse Encoder (PG) Frequency Divider

The pulse encoder (PG) frequency divider outputs are available as line driver outputs or totem pole outputs (refer to Section 4.1.3), and Figure 4.10 shows connection of these outputs.

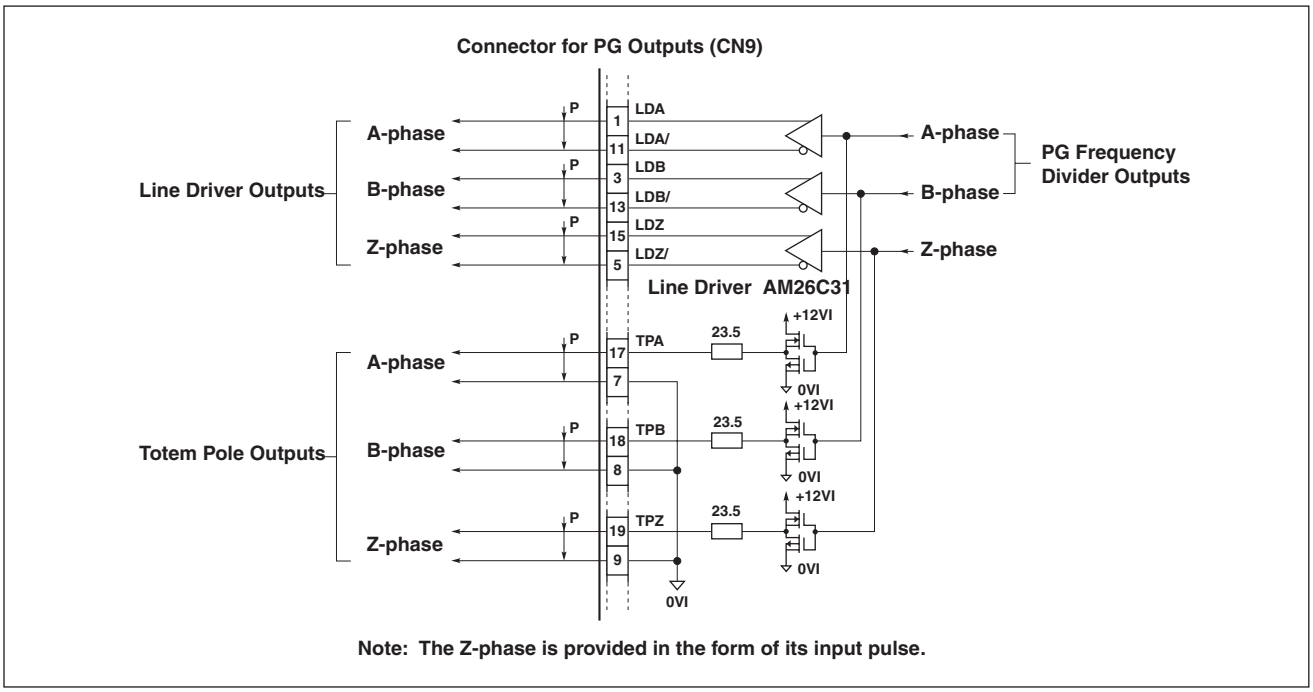



Figure 4.10 - Pulse Encoder (PG) Frequency Divider Output Signals

### 4.2.5 Timing Flow of Input and Output Signals

The VZ3000 drive handles the sequence input and output signals according to the following timing (see Figure 4.11).

1. When the drive is powered up, the DC bus will be charged and the control power will be established in approximately 12 seconds.
2. If the drive is normal, the FAULT contact signal (between FR1 and FR2) is turned ON, and the ready-for-operation signal (RDY) will be ON.
3. In approximately 20 to 40 milliseconds after the RUN signal is turned ON, the driver output will be turned ON and motor control will be started.
4. When protection circuit is activated, the drive output is turned OFF immediately, the motor control will stop, and the FAULT contact signal (between FR1 and FR2) will be turned OFF.
5. The condition of item 4 above will be maintained until the RESET signal is turned ON or power is once turned OFF and then reapplied. The RESET signal becomes effective only when the RUN signal is OFF.

   If the drive is normal, the FAULT contact signal (between FR1 and FR2) will become ON and the ready-for-operation signal (RDY) will become ON immediately after the RESET signal becomes first ON and then OFF. In 20 to 40 milliseconds after the RUN signal becomes ON, the driver output will be turned ON and the motor control will be restarted.

6. When power to the controller is turned OFF during controlling the motor, the DC Bus voltage will start to drop, and when the DC bus voltage becomes lower than a certain level, the protection circuit will be activated, the FAULT contact signal (between FR1 and FR2) will become OFF, and the ready-for-operation signal (RDY) will be turned OFF. As a result, the motor will be shut down, and soon after, the control power will be turned OFF.

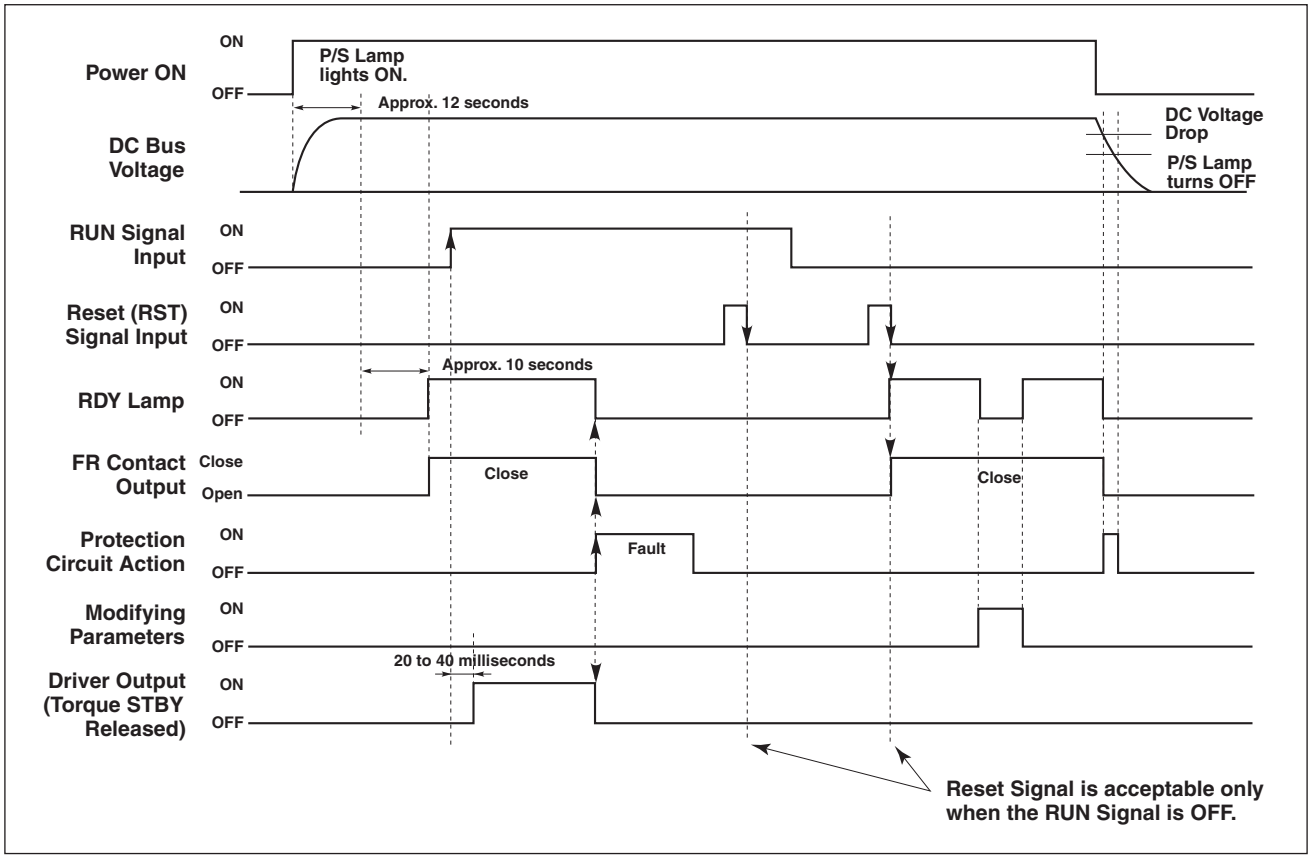



Figure 4.11 - Input and Output Signal Timing

### 4.2.6 Input and Output Signal Timing of Converter Unit UAZ3275

Converter unit UAZ3275 has a control function to turn ON/OFF charging DC bus voltage according to the following timing as shown in Figure 4.12.

1. When AC power to the drive is turned ON, the control power will rise up, and if the controller is normal, the FAULT contact signal (between FR and FR) will become ON.
2. When the RUN input signal to the converter unit is turned ON, the RDY lamp will start flashing and precharging with thyristor will begin.
3. When precharging is complete and the DC bus voltage reaches a certain level, the RDY lamp will light ON continuously.

4. When protection circuit is activated, the corresponding LED will light ON and the RDY lamp will be turned OFF. The thyristor will immediately be turned OFF and the FAULT contact output signal (between FR and FR) will also be turned OFF. Then, the DC bus voltage will drop.

   In case of the standard wiring, the "n" display will appear on the inverter unit side, the motor will become free-run, and the FAULT contact output signal on the inverter unit side (between FR1 and FR2) will also become OFF. Then, the DC bus voltage will be lost, the control power on the inverter unit side will stop, and displays will disappear.

5. The condition of item 4 above will be maintained until the RESET signal is turned ON or power is once turned OFF and then reapplied. The "n" display on the inverter unit side will be reset simultaneously with resetting fault on the converter unit side. Note, however, that if the RUN input signal to the inverter unit is ON, resetting is impossible. Turn OFF the RUN input signal to the inverter unit to make resetting possible.

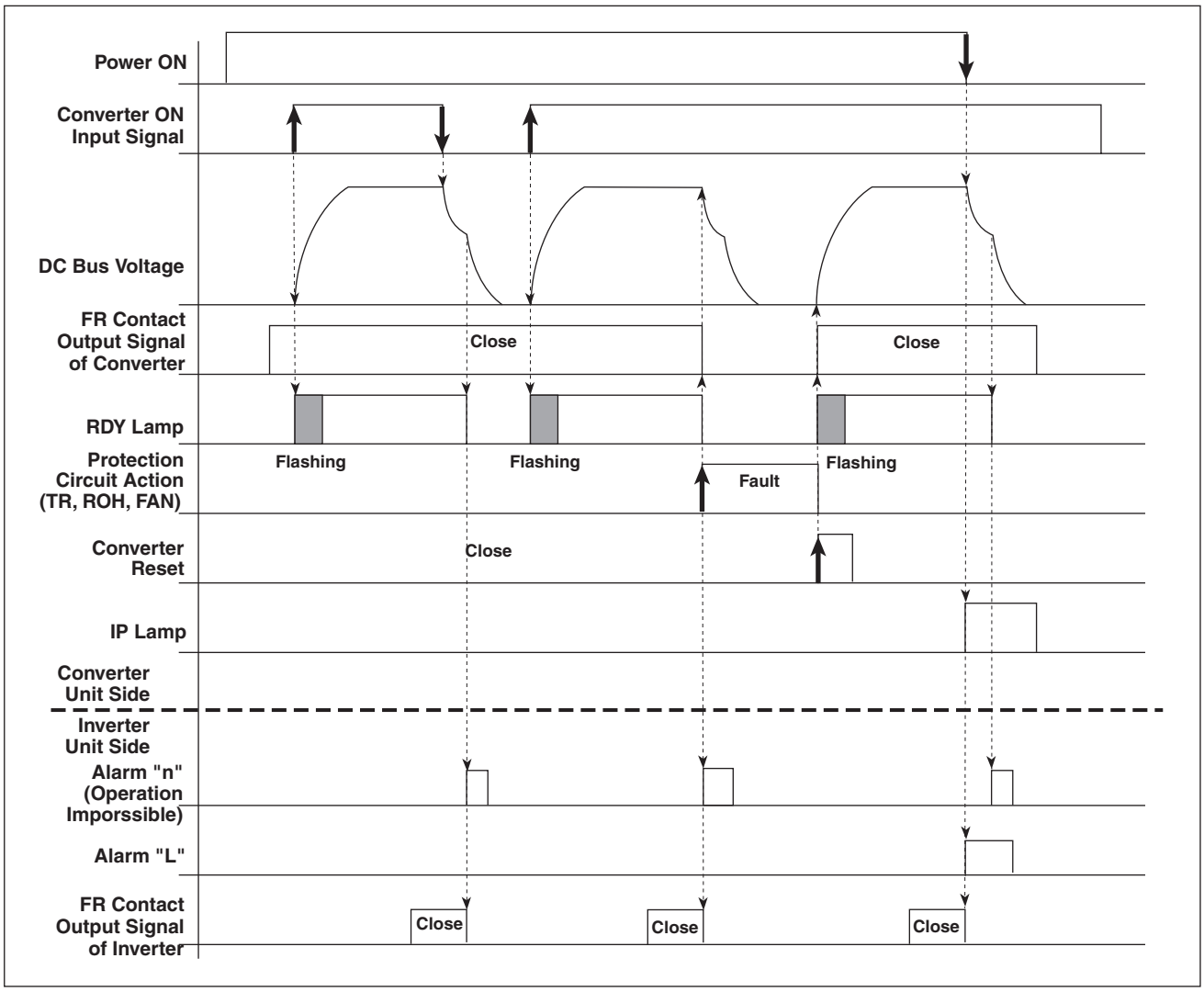



Figure 4.12 - Input and Output Signal Timing of Converter Unit UAZ3275

## 4.3 Wiring Drive

**ATTENTION:** Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, operate, or service the equipment. Read and understand this instruction manual and other applicable instruction manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** The user is responsible for conforming with all the applicable local, national and international codes. Wiring practices, grounding, disconnects, and overcurrent protection are of particular importance. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** Do not use a megger to perform continuity checks in the drive equipment. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

### 4.3.1 Input Power Requirements

Verify that input power to the VZ3000 drive corresponds to the drive's nameplate voltage and frequency, and that the plant power supply has a sufficient capacity to support the input current requirements of the drive.

**ATTENTION:** If the power supply connected does not meet the input line voltage requirements, incorrect voltage is applied, causing an IET. Failure to observe this precaution could result in damage to, or destruction of, the drive.

Provide a transformer between the plant power supply and the drive if the correct input line voltage is not available. (Note that cooling fan motors are for 200 V class.)

Connect the drive to a power source of a short-circuit current less than (or equal to) 5,000A.

### 4.3.2 Grounding Drive

**ATTENTION:** The user is responsible to meet all code requirements with respect to grounding all equipment. Failure to observe this precaution could result in severe bodily injury or loss of life.

Connect an adequate equipment grounding conductor or bonding jumper to motor frame, remote operator's control station (if used), input power transformer (if used), and drive enclosure. Run this conductor or jumper **unbroken** to grounding electrode conductor (earth ground).

### 4.3.3 Power Wiring

Size and select input and output power wire according to all applicable codes in consideration of cable type, wiring method, wiring distance, and current and voltage to be applied. Refer to Tables 4.10 and 4.11 for wire size for power wiring.

**ATTENTION:** Motor leads U, V, and W must be connected to terminals 601 (U), 602 (V), and 603 (W) respectively. Do not change motor rotation direction by changing wiring, but by using parameters. Failure to observe these precautions could result in damage to, or destruction of, this equipment.

Connect motor leads U, V, and W to terminals 601 (U), 602 (V), and 603 (W), respectively, as shown in Figures 4.14 to 4.16.

**Important:** Normal operation of the motor could not be obtained unless the mark of each motor lead corresponds to the mark of the connected terminal.

Use a copper wire, which temperature rating is 60/75 ˚C, by all means.

### 4.3.4 Control and Signal Wiring

Use the following procedure to install control and signal wiring.

1. Be sure all control and signal wiring is isolated from power wiring. Current in power circuits can induce voltages in signal wiring.
2. Run signal wiring in a separate steel conduit (steel or flexible armored steel). Dedicated conduit is preferable.
3. Do not route signal wiring through junction or terminal boxes that contain control wiring.
4. Control wiring and PG wiring must intersect power wiring at an angle of 90 degree.
5. Do not route signal wiring near devices generating magnetic fields externally.
6. Do not extend the pulse encoder cable longer than 200 meters (660 feet). When a longer cable is used, special consideration is required such as use of dedicated metal conduit, to reduce influence of noise.

### 4.3.5 Basic Wiring Diagrams

The standard factory setting of the drive is for speed control. Figures 4.14 to 4.16 show the basic wiring diagrams for the speed control. Figure 4.14 shows the basic wiring diagram for unitized type drives and Figure 4.15 for separate type drives except the drive containing inverter unit UVZ3255 and converter unit UAZ3275. The drive using the combination of inverter unit UVZ3255 and converter unit UAZ3275 is shown in Figure 4.16. If you need to change the setting (control), see the separate instruction manuals for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027) and/or for the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021).

## 4.4 Notes on Wiring

**ATTENTION:** Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service the equipment. Read and understand this manual and other applicable instruction manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** The user is responsible for conforming with all the applicable local, national and international codes. Wiring practices, grounding, disconnects, and overcurrent protection are of particular importance. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** Do not use a megger to perform continuity checks in the drive equipment. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

1. The typical values of input power capacities are shown in Tables 9.5 and 9.6. Note, however, that the input power required varies depending on the input impedance. Provide an input power system with less voltage fluctuation so the voltage does not become below the specified value at the terminals 181 (R), 182 (S), and 183 (T) even at overload requiring instantaneously large power. Some VZ3000 drives require AC reactors to be installed in the AC input power line to converters (refer to Figures 4.14 to 4.16). When input power capacity exceeds 1000 kVA, be sure to provide an AC reactor for the AC input power. See Table 9.8 or 9.9 for selection of AC reactors.
2. No circuit breaker is built in VZ3000 drive. Be sure to provide adequate circuit breakers in input power lines as shown in Figures 4.14 to 4.16. Select circuit breakers (1NFB and 2NFB) from Table 4.8 or 4.9. If you use an earth leakage breaker, select the one provided with adequate measures against radio frequency.

   Provide also a magnetic contactor selected in reference to Table 4.8 or 4.9, if required.

Table 4.8 - Selection of Circuit Breakers for 200 V Motors

| **Motor (kW)** | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 22 | 30 | 37 | 45 | 55 | 75 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Circuit Breaker Rating (A)** | 1NFB | 10 | 20 | | 30 | 50 | | 75 | 100 | 100 | 150 | 175 | 200 | 250 | 350 |
| | 2NFB | - | 3 | | | | | | | | 10 | | | | |

Table 4.9 - Selection of Circuit Breakers for 400 V Motors

| **Motor (kW)** | | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Circuit Breaker Rating (A)** | 1NFB | 10 | | 20 | | 30 | 50 | | 60 | 75 | 100 | 100 |
| | 2NFB | 3 | | | | | | | | | | |

3. Connect controller output terminals 601 (U), 602 (V) and 603 (W) to the motor lead terminals U, V and W, respectively. (In case of inverter unit UVZ3275, drive output terminals U, Us, V, Vs, W and Ws must be connected to motor lead terminals $U_1$, $U_2$, $V_1$, $V_2$, $W_1$ and $W_2$, respectively.) Incorrect connection may cause improper operation.
4. Be sure to connect motor grounding terminal, G (E) to drive grounding terminal, G (E) for single point grounding.
5. Insert appropriate thermal relays into the drive output lines, 601 (U), 602 (V) and 603 (W). Select the capacities of the thermal relays base on the rated current shown in Tables 9.1 through 9.4.
6. Completely isolate signal wiring (speed reference and others), pulse encoder cable and communication cable from power wiring. Do not run them in the same conduit. It is prohibited to wire the power line in parallel with signal or pulse encoder line.
7. Make signal wiring (such as speed reference) as short as possible. When a longer wire is necessary, isolate signal by using an isolation amplifier.
8. Be sure to provide magnetic contactor, relay, solenoid valve, and electromagnetic brake around VZ3000 drive with a noise-suppression device to prevent noise interference. Use a CR filter (surge suppressor) for an AC operation circuit, and a counter-parallel diode for a DC operation circuit.
9. When an external regenerative resistor is used, a resistor overheat protection kit (optional) to meet the used external resistor must be used. For wiring, refer to Figures 4.14 to 4.16.
10. When wiring is finished, check that all wiring has been connected correctly.

## 4.5 Wire Size

1. Wire size for the power wiring is shown in Tables 4.10 and 4.11. When you select the wire, take account of temperature rise and voltage drop caused by wire type, wiring method and/or wiring distance. Regarding the power wiring, use a copper wire, which temperature rating is 60/75 ˚C, by all means.

Table 4.10 - Wire Size (in Square Millimeters) for Power Wiring of 200 V Motors

| Terminal \ Motor(kW) | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 22 | 30 | 37 | 45 | 55 | 75 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 181 (R), 182 (S), 183 (T) | 2 | 3.5 | 3.5 | 3.5 | 5.5 | 8 | 14 | 22 | 30 | 60 | 100 | 150 | 150 | 200 |
| 147 (P), 145 (N) | 2 | 3.5 | 3.5 | 3.5 | 5.5 | 8 | 14 | 22 | 30 | 60 | 100 | 150 | 150 | 200 |
| 147 (P), B1, B2 (PB) (1) | 2 | 3.5 | 3.5 | 3.5 | 5.5 | 8 | 14 | 22 | 30 | 60 | 100 | 150 | 150 | 200 |
| 601 (U), 602 (V), 603 (W) | 2 | 3.5 | 3.5 | 3.5 (5.5) (2) | 5.5 (8) (2) | 8 (14) (2) | 14 | 22 | 30 | 60 | 100 | 150 | 150 | 100 |
| Us, Vs, Ws | - | - | - | - | - | - | - | - | - | - | - | - | - | 100 |
| G (E) | 2 | 2 | 2 | 3.5 | 5.5 | 5.5 | 14 | 14 | 14 | 22 | 22 | 38 | 38 | 38 |
| Motor Cooling Fan | - | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

(1) Change wire size for wiring to B1 and B2 (PB) based on used capacity of regenerative resistor. Use a wire of 5.5 square millimeters for jumpering between terminals 147 (P) and B1 of converter unit UAZ3237.
(2) Values in parentheses show wire size for servo motors.

Table 4.11 - Wire Size (in Square Millimeters) for Power Wiring of 400 V Motors

| Terminal \ Motor(kW) | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 181 (R), 182 (S), 183 (T) | 2 | 3.5 | 3.5 | 3.5 | 3.5 | 5.5 | 8 | 14 | 14 | 22 | 30 |
| 147 (P), 145 (N) | 2 | 3.5 | 3.5 | 3.5 | 5.5 | 5.5 | 8 | 14 | 14 | 22 | 30 |
| 147 (P), B1, B2 (PB) (1) | 2 | 3.5 | 3.5 | 3.5 | 5.5 | 5.5 | 8 | 14 | 14 | 22 | 30 |
| 601 (U), 602 (V), 603 (W) | 2 | 3.5 | 3.5 | 3.5 | 3.5 (5.5) (2) | 5.5 (8) (2) | 8 (14) (2) | 14 | 14 | 22 | 30 |
| G (E) | 2 | 2 | 2 | 3.5 | 5.5 | 5.5 | 8 | 14 | 14 | 14 | 14 |
| Motor Cooling Fan | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

(1) Change wire size for wiring to B1 and B2 (PB) based on used capacity of regenerative resistor.
(2) Values in parentheses show wire size for servo motors.

2. Use twisted pair wire of 0.2 to 0.5 square millimeters (#24 AWG to #20 AWG) for speed reference and sequence signals that are connected to connector CN2 for control signals.
3. Use a dedicated cable for connection of pulse encoder as shown in Table 4.14. The details of the each cable are shown in Table 9.7.
4. Use a dedicated cable for connection of host computer or VZ3000/VZ3000G operator's terminal OPCU-2 as shown in Figure 9.1.
5. Terminal sizes of drives are shown in Tables 4.12 and 4.13.

Table 4.12 - Terminal Size of 200-230 VAC/380-460 VAC Common Type Units

| Terminal \ Unit | UVZC3001 UVZC3003 | UVZC3007 | UAZ3022(-A) UVZ3022 | UAZ3030(-A) UVZ3030 | UAZ3037(-A) UVZ3037 |
|---|---|---|---|---|---|
| 181 (R), 182 (S), 183 (T)<br>147 (P), 145 (N), B1, B2<br>601 (U), 602 (V), 603 (W)<br>G (E) | M4 | | M6 | | |
| FR1, FR2, +VC, 0VC, RDY, IP | M3.5 | | | | |

Table 4.13 - Terminal Size of 200-230 VAC Dedicated Type Units

| Terminal \ Unit | UVZC3201 UVZC3202 UVZC3203 | UVZC3207 | UAZ3222(-A) UVZ3222 | UAZ3237(-A) [1] UVZ3230 UVZ3237 | UAZ3275 [2] UVZ3255 UVZ3275 |
|---|---|---|---|---|---|
| 181 (R), 182 (S), 183 (T)<br>147 (P), 145 (N), B1, B2 (PB)<br>601 (U), 602 (V), 603 (W)<br>G (E) | M4 | | M6 | M10 | M10 |
| FR1, FR2, +VC, 0VC, RDY, IP | M3.5 | | | | |

(1) The terminal size for G(E) is M6, and for B1 is M4.
(2) The terminal size for U, V, W, Us, Vs, Ws and G (E) is M8, and for PB is M6.

6. Tightening torques of drives are shown in Table 4-14 and Table 4-15.

Table 4-14 - Tightening Torque of 200-230 VAC / 380-460 VAC Common Type Units

Torque: N-m (lb-in)

| Unit | Main Circuit Terminal Block | Control Circuit Terminal Block | Terminal Block of the Overheat Fault Output for Built-in Resistor |
|---|---|---|---|
| UVZC3001, UVZC3003, UVZC3007 | 1.4 (12.1) | 1.0 (8.6) | 0.5 (4.4) |
| UAZ3022-A, UAZ3030-A, UAZ3037-A | 2.9 (26.0) | 1.0 (8.6) | 0.5 (4.4) |
| UVZ3022, UVZ3030, UVZ3037 | 2.9 (26.0) | 1.0 (8.6) | - |

Table 4-15 - Tightening Torque of 200-230 VAC Dedicated Type Units

Torque: N-m (lb-in)

| Unit | Main Circuit Terminal Block | Control Circuit Terminal Block | Terminal Block of the Overheat Fault Output for Built-in Resistor |
|---|---|---|---|
| UVZC3201, UVZC3202, UVZC3203 | 1.2 (10.4) | 1.0 (8.6) | 0.5 (4.4) |
| UVZC3207 | 1.4 (12.1) | 1.0 (8.6) | 0.5 (4.4) |
| UAZ3222-A | 2.9 (26.0) | 1.0 (8.6) | 0.5 (4.4) |
| UAZ3237-A | - | 1.0 (8.6) | 0.5 (4.4) |
| UVZ3222 | 2.9 (26.0) | 1.0 (8.6) | - |
| UAZ3275, UVZ3230, UVZ3237, UVZ3255, UVZ3275 | - | 1.0 (8.6) | - |

## 4.6 Connecting Pulse Encoder

Figure 4.12 shows connection between a VZ3000 drive and a pulse encoder (PG). For this connection, use an appropriate pulse encoder (PG) cable as shown in Table 4.14. For more information on the PG cables, refer to Table 9.7.

Maximum cable length of a pulse encoder (PG) cable is 200 meters (660 feet). A longer cable has a larger effect of noise. Therefore, take adequate noise suppressing measures, such as use of dedicated duct for pulse encoder cable, when you use a longer cable length.

Table 4.16 - Pulse Encoder (PG) Cable Selection

| **Applicable Pulse Encoder (PG) Cable** | | Model | MB-B5026 (1)<br>MB-B5027 (2) | MB-B5024 (1)<br>MB-B5025 (2) |
|---|---|---|---|---|
| | | Connection | Refer to Table 9.7. | Refer to Table 9.7. |
| **Motor** | 200 V | Standard Motor | 3.7 kW to 75 kW | 1.5 kW to 2.2 kW |
| | | Servo Motor | 30 to 55 kW | 0.75 kw to 22kW |
| | 400 V | Standard Motor | - | 1.5 kW to 75 kW |
| | | Servo Motor | 30 to 55 kW | 0.75 kW to 22 kW |

(1) This cable has connectors at its both ends.

(2) This cable has connector at motor end only.

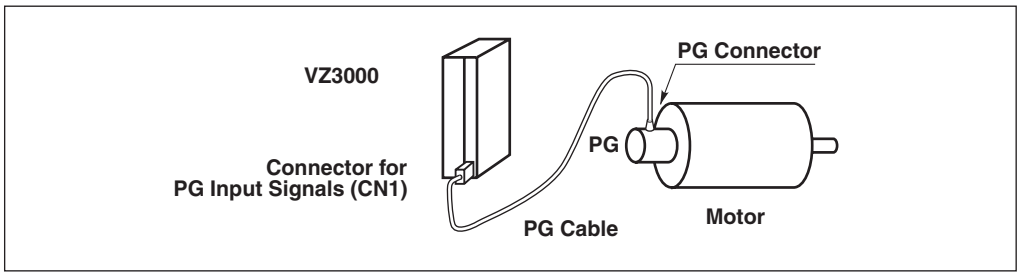



Figure 4.13 - Connection between a VZ3000 Drive and a Pulse Encoder (PG)

1> Circuit breakers (1NFB and 2NFB) must be installed in the AC input power line. See Table 4.8 or 4.9 for selection.

2> If you use a 400 V motor, a transformer must be provided for its cooling fan motor, because a 400 V motor (a center fan cooled motor) uses a 200 V fan.

3> When you desire to use the power regeneration function, mount a regenerative resistor and an electromagnetic contactor M outside of the VZ3000 controller. Remove the jumper between 147 (P) and B1 and connect the resistor between 147 (P) and B2.

For the externally mounted regenerative resistor, install a resistor overheat protection kit (see Section 9.8), and provide a sequence circuit to open the electromagnetic contactor M with the contact signal from the resistor overheat protection kit. Select an adequate capacity of the electromagnetic contactor M with reference to the circuit breaker ratings shown in Table 4.8 or 4.9.

When the built-in regenerative resistor is used, refer to Section 7.18.2.

4> The type of the resistor overheat protection kit to be used depends on the used resistor (see Figures 9.8 and 9.9).

5> In case external regenerative resistors are used, use protection by means of voltage detection of resistor in order to eliminate overheat of regenerative resistor to be caused due to short circuit of regenerative resistor, in addition to the resistor overheat protection kit described in Item 3 above. Use the following setting level:

Setting Level = $\sqrt{2}$ x AC Input Voltage (Vrms) x 0.9 x 0.867 x 2/3 x 1/n
= 0.736 x AC Input Voltage (Vrms) x 1/n,

where 2/3 : The detection level should be 2/3 of the minimum bus voltage.
n : Number of resistors connected in series.

Recommended voltage relay: Model SDV-FH of OMRON.

6> Correct connector pin number and correct connection to the controller must be selected from Table 9.7 for pulse encoder (PG) cable. For wiring PG, use a dedicated cable shown in Table 9.7.

7> If you use a three-phase cooling fan, use three wires for connection, and verify that the cooling fan rotates to the direction of air-inhaling.

8> For the UL/IEC/C-UL listed units, install UL listed fuses shown in Table 9.10 in the AC input power lines.

9> Install a circuit breaker (3NFB) or a fuse in the sequence circuit.

10> If you do not use the START/STOP push button, short the STOP button, and use normally open contact of ON-delay timer in place of the START button so that the ON-delay timer will be activated and the contact in place of the START button will be turned OFF after the elemectromagnetic contactor M closed and its auxiliary contact closed. (Because continuous powering is restricted depending on timers, the timer should be selected carefully.)

11> Because AC reactor can restrain harmonic current of power supply, it is recommended to install an AC reactor in the AC input power line to the converter.

The wiring diagram shown in this figure is for speed control which is the initial factory setting of the VZ3000 controller. If you need to change control, refer to the separate instruction manuals for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027) and/or for the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021).

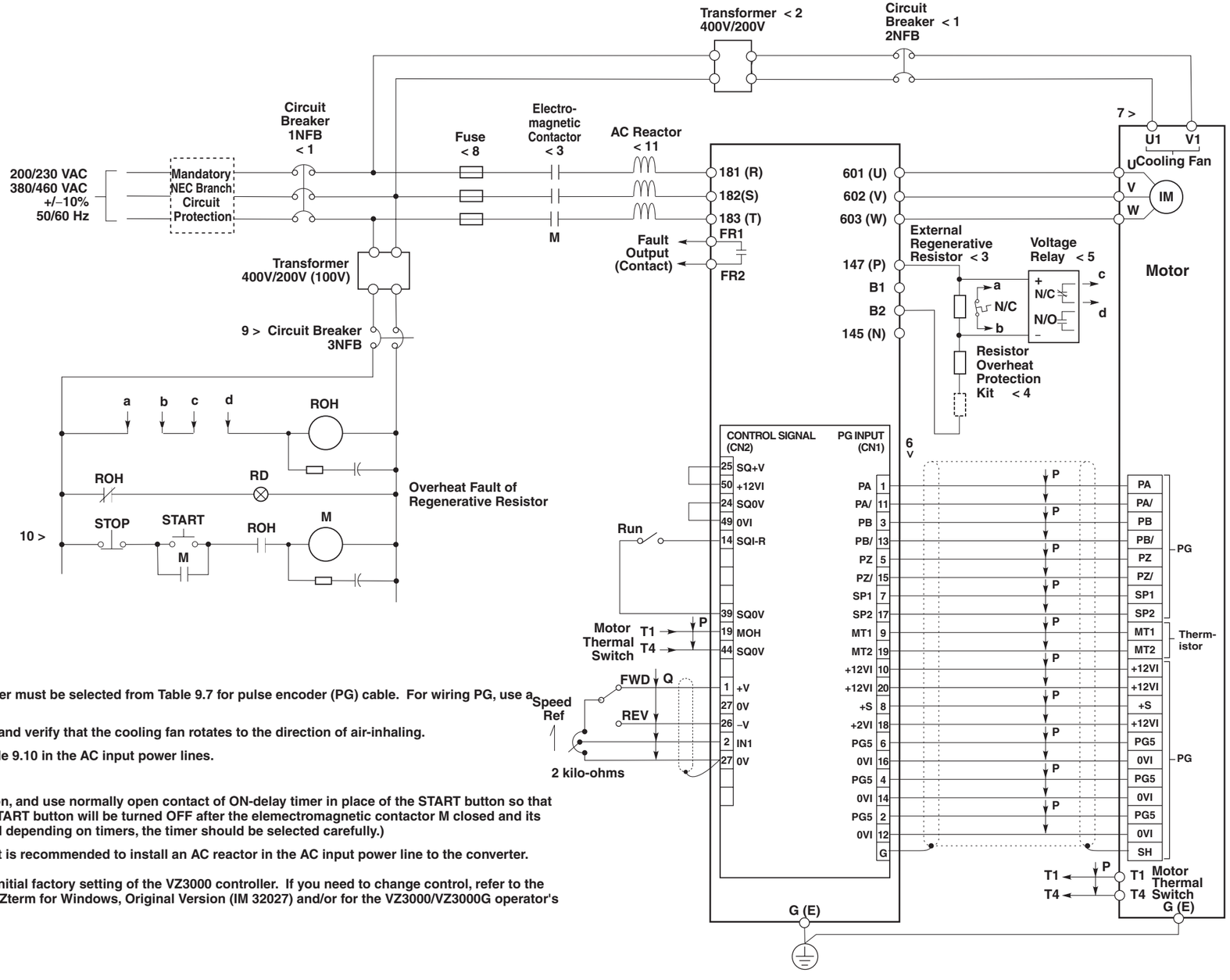



Figure 4.14 - Basic Wiring Diagram for Unitized Type Units UVZC3001 to UVZC3007 and UVZC3201 to UVZC3207 (for Speed Control)

1> Circuit breakers (1NFB and 2NFB) must be installed in the AC input power line. See Table 4-8 or 4-9 for selection.

2> If you use a 400 V motor, a transformer must be provided for its cooling fan motor, because a 400 V motor (a center fan cooled motor) uses a 200 V fan.

3> When you desire to use the power regeneration function, mount a regenerative resistor and an electromagnetic contactor M outside of the VZ3000 controller.

To use the built-in regenerative resistor, jumper between 147 (P) and B1 and open B2. When an external regenerative resistor is used, connect the resistor between 147 (P) and B2, and open B1.

For the regenerative resistor mounted outside, install a resistor overheat protection kit (see Section 9.8), and provide a sequence circuit to open the electromagnetic contactor with the contact signal from the resistor overheat protection kit. Select an adequate capacity of the electromagnetic contactor with reference to the circuit breaker ratings shown in Table 4.8 or 4.9.

When the built-in regenerative resistor is used, refer to Section 7.18.2.

4> The type of the resistor overheat protection kit to be used depends on the used resistor (see Figures 9.8 and 9.9).

5> In case external regenerative resistors are used, use protection by means of voltage detection of resistor in order to eliminate overheat of regenerative resistor to be caused due to short circuit of regenerative resistor, in addition to the resistor overheat protection kit. Use the folloiwing setting level:

Setting elevel = $\sqrt{2}$ x AC Input Voltage (Vrms) x 0.9 x 0.867 x 2/3 x 1/n
= 0.736 x AC Input Voltage (Vrms) x 1/n,

where 2/3 : The detection level should be 2/3 of the minimum bus voltage.
n : Number of resistors connected in series.

Recommended voltage relay: Model SDV-FH of OMRON.

6> Correct connector pin number and correct connection to the controller must be selected from Table 9.7 for pulse encoder (PG) cable. For wiring PG, use a dedicated cable shown in Table 9.7.

7> If you use a three-phase cooling fan, use three wires for connection, and verify that the cooling fan rotates to the direction of air-inhaling.

8> For converter unit UAZ3237, install an AC reactor in the AC input power line. Because AC reactor can restrain harmonic current of power supply, it is also recommended to install an AC reactor in AC input power line for other converters.

9> For the UL/IEC/C-UL listed units, install UL listed fuses shown in Table 9.10 in the AC input power lines.

10> Install a circuit breaker (3NFB) or a fuse in the sequence circuit.

11> If you do not use the START/STOP push button, short the STOP button, and use the normally open contact of the ON-delay timer in place of the START button so that the ON-delay timer will be activated and the contact in place of theSTART button will be turned OFF after the electromagnetic contactor M closed and its auxiliary contact closed. (Because continuous powering is restricted depending on timers, the timer should be selected carefully.)

The wiring diagram shown in this figure is for speed control which is the initial factory setting of the VZ3000 controller. If you need to change control, refer to the separate instruction manuals for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027) and/or for the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021).

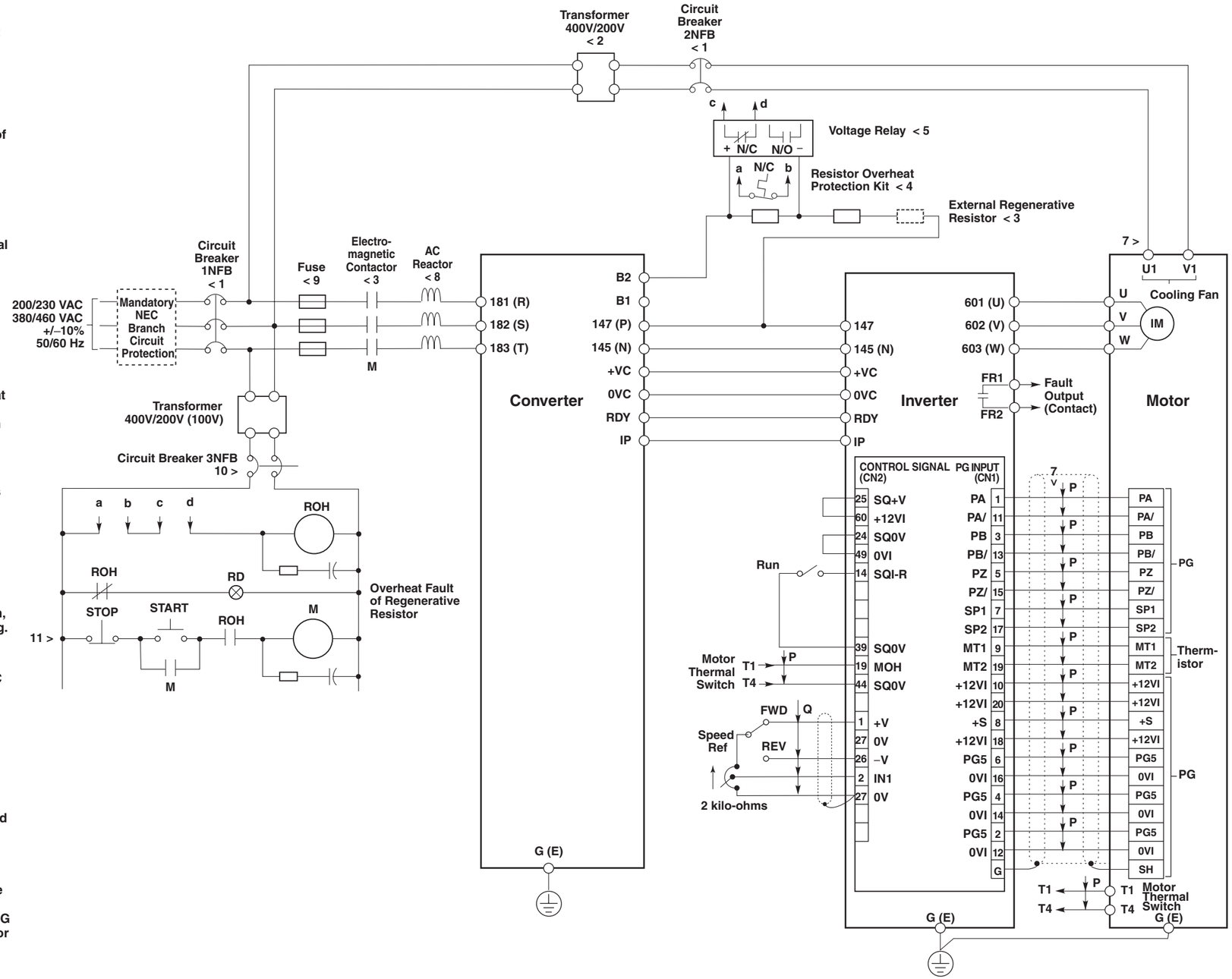
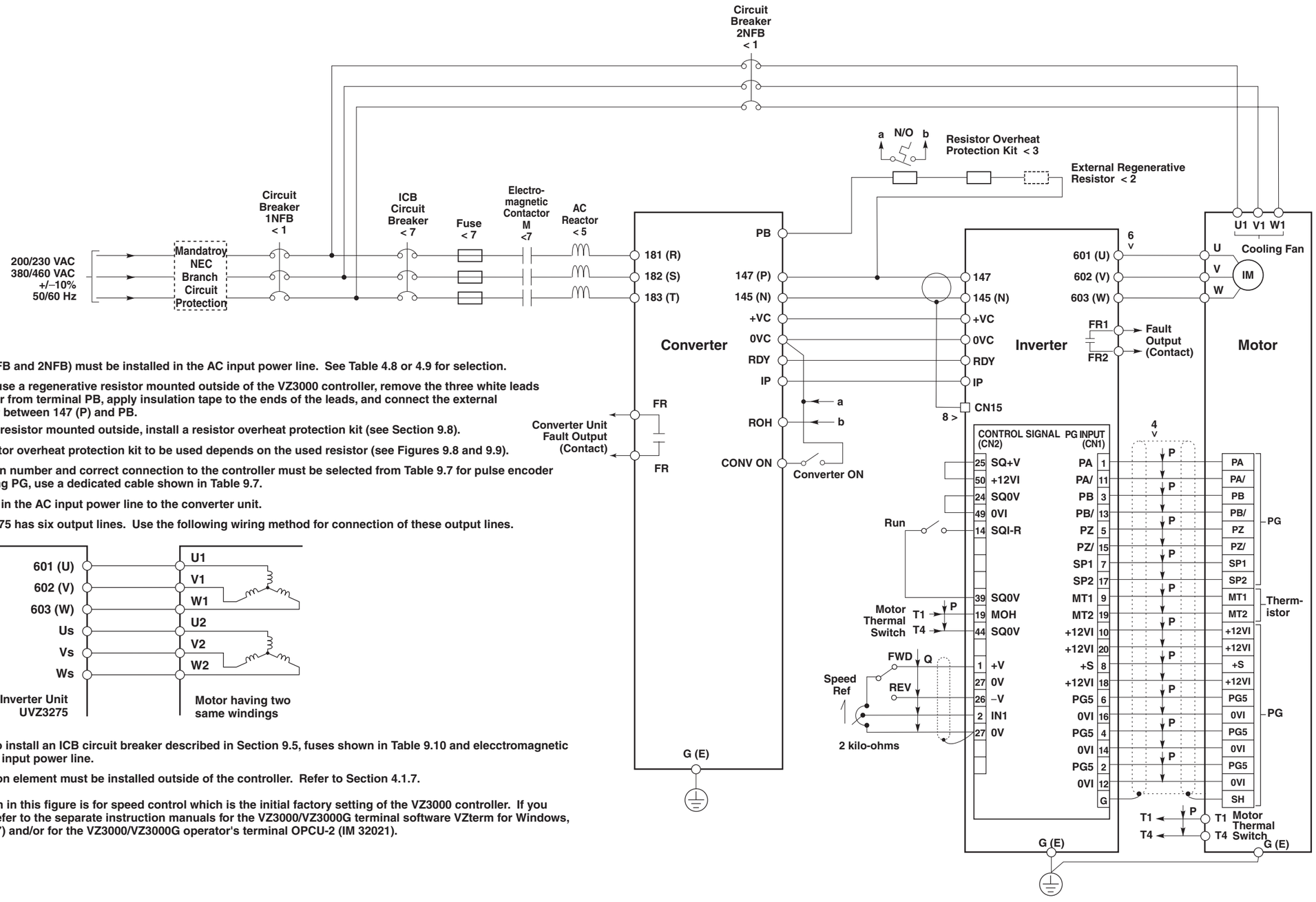



Figure 4.15 - Basic Wiring Diagram for Separate Type Inverter Units UVZ3022 to UVZ3037 and UVZ3222 to UVZ3237 and Converter Units UAZ3022(-A) to UAZ3037(-A) and UAZ3222(-A) to UAZ3237(-A) (for Speed Control)




1> Circuit breakers (1NFB and 2NFB) must be installed in the AC input power line. See Table 4.8 or 4.9 for selection.

2> When you desire to use a regenerative resistor mounted outside of the VZ3000 controller, remove the three white leads of the built-in resistor from terminal PB, apply insulation tape to the ends of the leads, and connect the external regenerative resistor between 147 (P) and PB.

For the regenerative resistor mounted outside, install a resistor overheat protection kit (see Section 9.8).

3> The type of the resistor overheat protection kit to be used depends on the used resistor (see Figures 9.8 and 9.9).

4> Correct connector pin number and correct connection to the controller must be selected from Table 9.7 for pulse encoder (PG) cable. For wiring PG, use a dedicated cable shown in Table 9.7.

5> Install an AC reactor in the AC input power line to the converter unit.

6> Invearter unit UVZ3275 has six output lines. Use the following wiring method for connection of these output lines.




7> It is recommended to install an ICB circuit breaker described in Section 9.5, fuses shown in Table 9.10 and elecctromagnetic contactors in the AC input power line.

8> Ground fault detection element must be installed outside of the controller. Refer to Section 4.1.7.

The wiring diagram shown in this figure is for speed control which is the initial factory setting of the VZ3000 controller. If you need to change control, refer to the separate instruction manuals for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027) and/or for the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021).

Figure 4.16 - Basic Wiring Diagram for Separate Type Inverter Unit UVZ3255 and UVZ3275 and Converter Unit UAZ3275 (for Speed Control)

# CHAPTER 5

# Starting and Adjusting Drive

This chapter provides detailed procedure for starting up the VZ3000 drive and information on the basic adjustment.

**ATTENTION:** Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service the equipment. Read and understand this manual and other applicable instruction manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait for a while for the DC bus capacitors to discharge and then check the voltage with a voltmeter at faceplate terminals 147 (P) and 145 (N) to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** Following procedures require that power is applied to the controller. Use one hand to hold tools or test probes. Keep your other hand behind you and be sure that you are insulated from the floor and all other structures. A backup technician must be in line of sight when this work is being performed, to assist in case of emergency. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** Be sure that the input disconnect (breaker) is in the correct position of ON or OFF depending on the work to be performed. Failure to observe this precaution could result in severe bodily injury or loss of life.

## 5.1 Checking before Start-up

Be sure to check the following before power is applied to the VZ3000 drive.

1. Both the controller and the motor are grounded.
2. No terminals and connectors are loose, or mis-connected.
3. No foreign materials such as screws and/or wire fragments are left inside the equipment.
4. There is no short circuit with regard to the terminals 181 (R), 182 (S), 183 (T), 601 (U), 602 (V), 603 (W), and G (E), or no ground fault with regard to these terminals except G (E).

5. Regenerative resistor is connected properly.

   Connect regenerative resistors to converter units other than model UAZ3275 as follows:

   - When the built-in regenerative resistor is used:

     Jumper terminals 147 (P) and B1, and open B2.

     **Important:** When you use the built-in regenerative resistor, refer to Section 7.18.2 and verify that it is properly connected for the application.

   - When an external regenerative resistor is used:

     Remove the jumper between 147 (P) and B1, connect the external resistor between 147 (P) and B2, and open B1.

   Connection of a regenerative resistor to converter unit UAZ3275 is performed as follows:

   - When the built-in regenerative resistor is used:

     Connect three white leads of the built-in regenerative resistor to terminal PB.

   - When an external regenerative resistor is used:

     Remove three white leads of the built-in regenerative resistor from terminal PB, apply insulation tape to the ends of the leads, and connect the external regenerative resistor between terminals 147 (P) and PB.

6. External sequence circuit operates normally.

## 5.2 Operation Steps

The following shows start-up procedure when VZ3000 drive is set up with the basic speed control parameters and is connected according to the basic wiring diagram shown in Figure 4.14, 4.15 or 4.16. If you operate the drive for the first time, perform start-up with motor uncoupled from machine and check operation of the drive, references, operation sequence, rotating speed and rotation direction of motor.

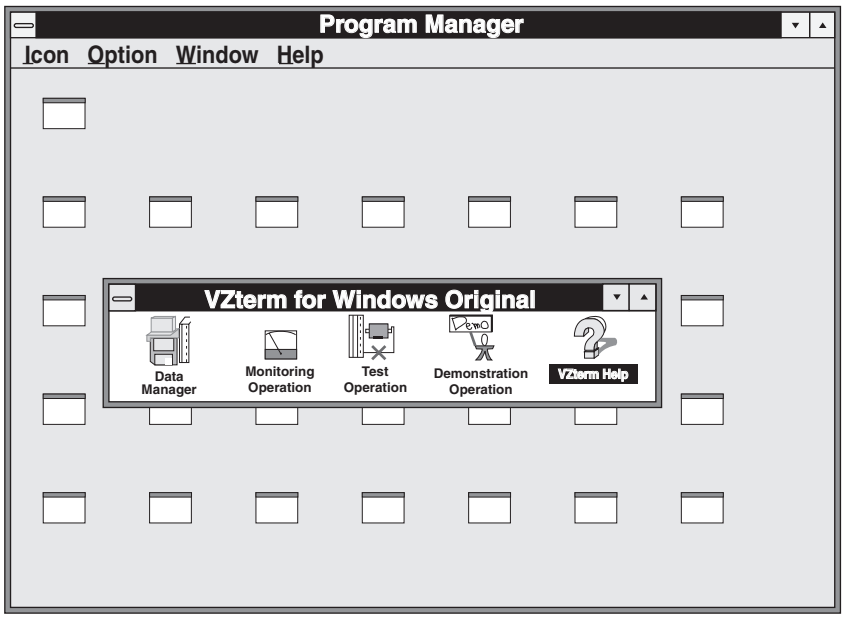
To monitor or to set Application Parameters, a host computer or an VZ3000/VZ3000G operator's terminal OPCU-2 is required. For the details, refer to the instruction manuals for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027) and the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021).

### 5.2.1 Start-up with Host Computer

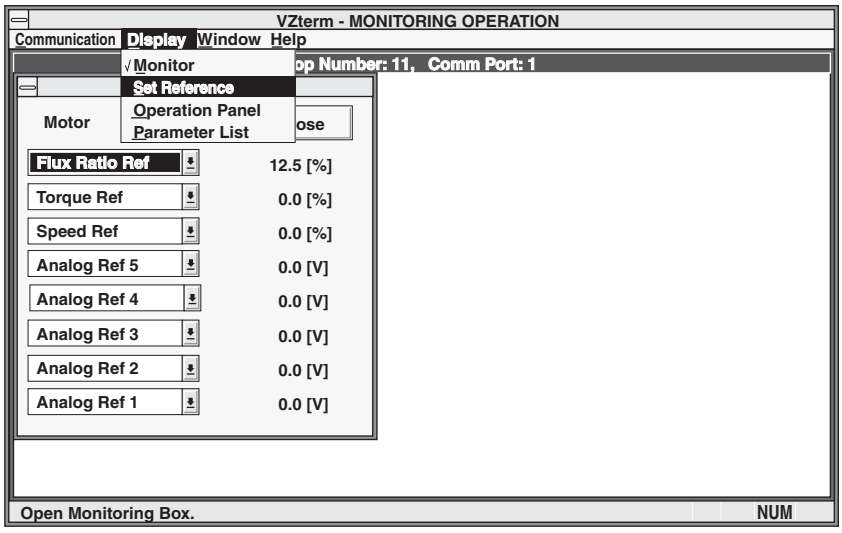
This section describes start-up procedure by using the dedicated terminal software VZterm for Windows executed on a host computer. For detailed description and operation of the terminal software VZterm for Windows and the host computer, refer to the instruction manual for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027).

1. Uncouple the motor from the machine (load).
2. Verify that the motor frame is securely connected.
3. Turn the RUN switch OFF.
4. Verify that the P/S and POWER display lamps on the faceplate of the VZ3000 drive are OFF.
5. Wire the VZ3000 drive according to the basic wiring diagram shown in Figure 4.14, 4.15 or 4.16.
6. Connect the host computer to the drive with a dedicated cable. Use the RS232C Port on the host computer and the COMM.1 (CN4) Connector on the drive for the connection.
7. Turn power to the host computer ON and start the software Windows.
8. Turn power to the VZ3000 drive ON, and verify that the P/S and POWER display lamps on its faceplate are turned ON. In 10 seconds after the POWER and P/S lamps are turned ON, the RDY lamp on the faceplate will be turned ON.
9. Select the "VZterm for Windows Original" from the group icons displayed on the host computer screen, and then select the "Monitoring Operation" from the Program Manager screen as shown in Figure 5.1. (For the detailed procedure, refer to the instruction manual for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027).) The Monitoring Operation screen as shown in Figure 5.1 will be displayed.

   The COM lamp on the drive faceplate will be turned ON.




**Windows Screen**




**Screen for Monitoring Operation**

Figure 5.1 - Screen Displayed When Executing Terminal Software VZterm for Windows

10. Verify that the speed potentiometer is set to 0 (CCW).
11. Turn the RUN switch ON. "Motor Run" in the Monitoring Operation screen will be displayed in dark letters. The RUN lamp on the drive faceplate will be turned ON.
12. Turn the FWD/REV switch to FWD.
13. To output speed reference, turn the speed potentiometer clockwise (CW) gradually.

14. Check that the motor rotates according to the reference voltage.

    Monitor the speed reference and the actual speed by using the monitoring items on the host computer.

15. Turn the speed potentiometer gradually to zero (0) to stop the motor. Turn the FWD/REV switch to REV. Then, repeat the steps 13 and 14 above.

16. Turn the speed potentiometer gradually to zero (0) to stop the motor.

17. Turn the RUN switch OFF. The Monitoring Operation screen on the host computer displays "Motor Stop". The RUN lamp on the drive faceplate will be turned OFF.

18. Turn power to the VZ3000 drive OFF. In one minute after the POWER lamp on the drive faceplate is turned OFF, the P/S and COM lamps will also be turned OFF.

## 5.3 Basic Adjustment

This section describes how to change the set values of the Application Parameters by using the Monitoring Operation screen on the host computer. For the details of the Application Parameters, refer to the instruction manual for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027). Note that only the Application Parameters can be modified with the Monitoring Operation screen. You cannot change other parameters, i.e., Drive Parameters, Motor Parameters and Control Parameters.

Use the following procedure to change the Application Parameters.

1. Select the "Monitoring Operation" from the VZterm for Windows Original group window on the host computer.
2. You may leave the RUN switch ON. In such a case, however, exercise extreme caution for the motor operation.
3. Select "Parameter List" from the displayed menu.
4. Select the Application Parameters on the Parameter List/Edit dialog box.
5. Specify the parameter you desire to change.
6. Enter the desired value to the parameter.

The adjusted value is stored in nonvolatile memory of the controller and will not disappear even if power is disconnected.

The following sections describe adjustment of basic items more in detail.

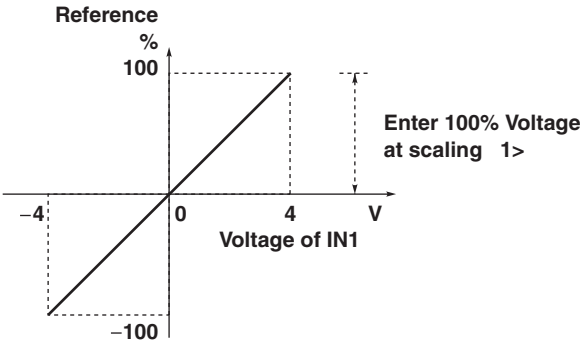
### 5.3.1 Adjustment of Analog Inputs

Voltage for rated values of analog input references, such as speed references, entered from analog inputs IN1 to IN5 can be set to any value within a range 2 to 10 V.

The following example shows the procedure to set the rated value (100%) of IN1 reference to 4 V. See Figure 5.2.

1. Perform the steps 1 to 4 in Section 5.3.
2. Select IN1 Maximum Voltage from the displayed Application Parameter screen.
3. Enter the example value of 4.00.

The above procedure allows you to perform scaling for IN1, so rated value will be obtained at reference voltage of 4 V. The same way can be applied to scaling other analog inputs, IN2 to IN5.




**1> When the Analog References 1 to 5 of the Control Parameter are used as speed or flux ratio, set the rated value (100%) to 4 V.**
**If the Analog References 1 to 5 are used as torque, sub-torque, FWD torque limit or REV torque limit, set the maximum value (the value set by the overload rated current) to 4 V. Note that the when FWD or REV torque limit is used for the Analog References 1 to 5, only positive (+) voltage is valid, and any negative (–) voltage is limited by 0%.**

Figure 5.2 - Scaling of Input Reference

### 5.3.2 Adjustment of Accel/Decel Time

To obtain smooth acceleration/deceleration as shown in Figure 5.3 against step change of input speed reference, you must adjust accel/decel time (ramp time). You can also select an accel/decel curve from among five alternatives listed in Section 7.4.

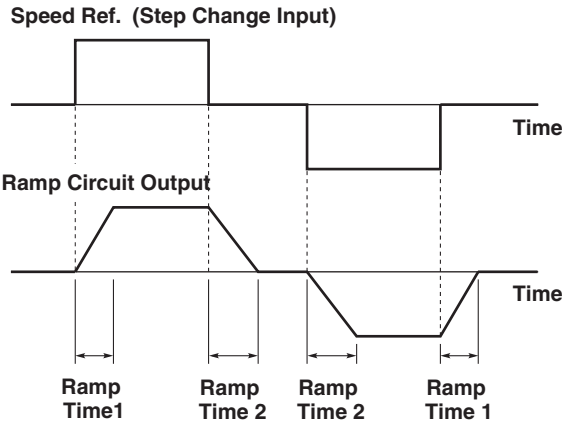



Figure 5.3 - Accel/Decel Time

1. Select Ramp Time 1 and 2 from the Application Parameter screen. Ramp time indicates accel/decel time from zero (0) speed to rated speed and vice versa. The accel/decel slopes are rated speed to ramp time. When torque limit is applied, accel/decel time will be prolonged accordingly.
2. Set desired ramp time to Ramp Time 1 and 2. The adjustable range is 0.01 to 500 seconds.

### 5.3.3 Adjustment of S-curve Time

S-curve accel/decel allows you to make the beginning and end portions of ramp curve smoother as shown in Figure 5.4, by extending the time to be required to increase the speed from zero (0) to the rated speed or to decrease the speed from the rated speed to zero (0) by the S-curve Time.

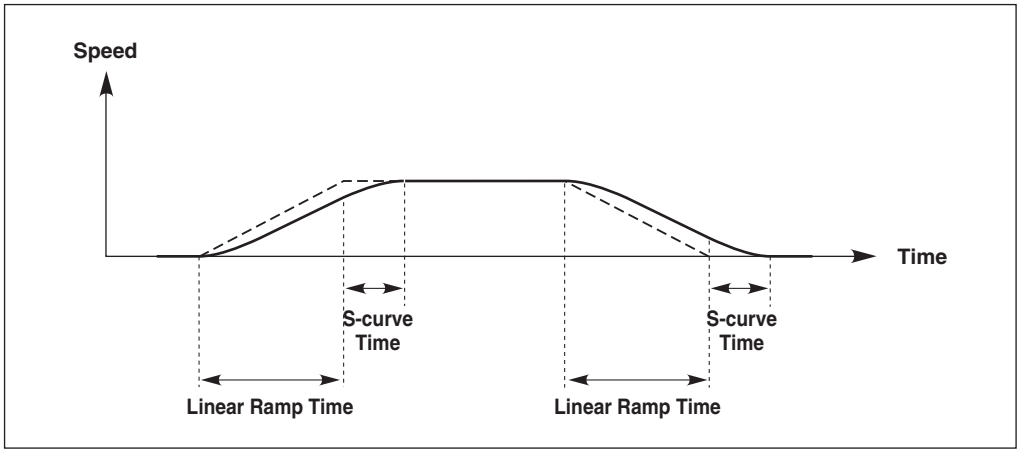



Figure 5.4 - S-curve Accel/Decel

Use the following procedure to set the S-curve Time.

1. Select S-curve Time from the Application Parameter screen.
2. Set a desired S-curve Time. The adjustable range is 0.00 to 500.00 seconds. If you set 0.00, accel/decel will be linear.

   The set value must be equal to or smaller than a half of the set value of the Ramp Time 1 or 2 whichever is shorter.

### 5.3.4 Adjustment of Speed Loop Gain

Required speed loop gain varies depending on load inertia of machine coupled to motor and other factors. To attain the best speed control performance, adjust speed loop gain as required.

When the inertia of the machine coupled to the motor is already known, you can adjust speed loop gain by selecting the "Speed Regulator Calculation" from the VZterm for Windows Tuning group window on the host computer. See the instruction manual for the VZ3000/VZ3000G terminal software VZterm for Windows, Tuning Version (IM 32028) for the procedure.

If the inertia is unknown or if more precise adjustment is required, adjust the Speed Amplifier Proportional Gain and the Speed Amplifier Break Point Frequency (Angular Rate) using the following procedure.

1. Select the Ramp Time 1 and 2 from the Application Parameter screen.
2. Set the Ramp Time 1 and 2 to 0.01 seconds.
3. Select the S-curve Time from the Application Parameter screen.

4. Set the S-curve Time to 0.00 seconds.
5. Set the speed reference to approx. 10% of the motor rated speed by the speed reference potentiometer and then increase the speed reference stepwise.
6. Observe the waveform of the speed feedback output at Monitor Output 1 (between the pins CN2-7 and CN2-32 of the Control Signal Connector) with an oscilloscope. See Figures 4.8 and 5.5.

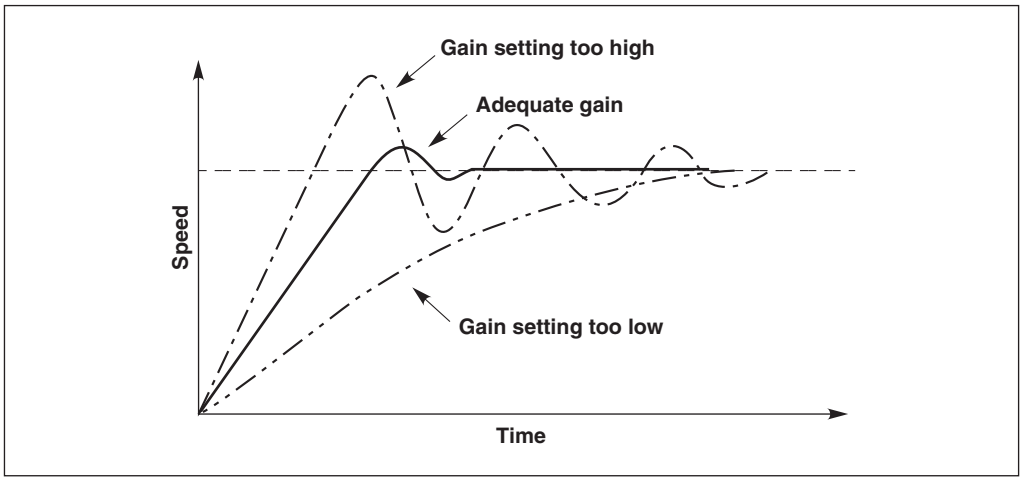



Figure 5.5 - Step Response of Speed

#### 5.3.4.1 Adjustment of Speed Amplifier Proportional Gain

First, adjust the Speed Amplifier Proportional Gain as follows.

1. Select the Speed Amplifier Break Point Frequency (angular rate) from the Application Parameter screen.
2. Set the Speed Amplifier Break Point Frequency (angular rate) to 0.0 radians/second.
3. Select the Speed Loop Amplifier Proportional Gain from the Application Parameter screen.
4. Select an adequate value for the Speed Loop Amplifier Proportional Gain to get a smaller overshoot (see Figure 5.5) and quick response, while increasing speed reference stepwise and observing the waveform.
5. Set the found value.

**Important:** The speed amplifier proportional gain is not dependent on the setting of the overload current rating, except for the Control Board of Revision 0.6 or earlier. For the Control Board of Revision 0.6 or earlier, the speed amplifier proportional gain must be changed inversely proportionally to the overload current rating, when the overload current rating is changed.

#### 5.3.4.2 Adjustment of Speed Amplifier Break Point Frequency (Angular Rate)

As the next step, adjust the Speed Amplifier Break Point Frequency (angular rate) by using the following steps.

1. Select the Speed Amplifier Break Point Frequency (angular rate) from the Application Parameter screen.
2. Find a suitable value for the Speed Amplifier Break Point Frequency (Angular Rate) to give a smaller overshoot and a quick response while increasing speed reference stepwise and observing the waveform (see Figure 5.5).
3. Set the found value.

### 5.3.5 Adjustment of Torque Limit

The torque limit circuit sets limit values of torque references from torque reference inputs and speed regulator outputs. The torque limits are set for both of forward and reverse operation as shown in Figure 5.6. When the torque limit is set to a value exceeding the set value of the overload current rating, the set value of the torque limit becomes void, and the set value of the overload current rating will be used as the torque limit.

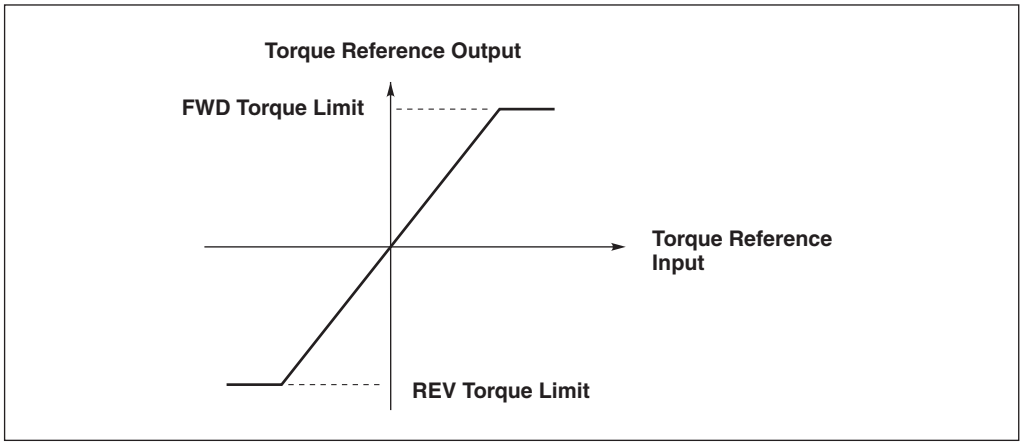



Figure 5.6 - Torque Limit

Use the following steps to set the torque limit.

1. Select the FWD Torque Limit or the REV Torque Limit from the Application Parameter screen.
2. Set the desired torque limits for FWD and REV respectively. The adjustable range is 0 to 300%.

# CHAPTER 6
# Troubleshooting

**ATTENTION:** Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should service this equipment. Read and understand this manual and other applicable instruction manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** This equipment is at line voltage when AC power is connected to the controller. Whenever power is removed, verify with a voltmeter at faceplate terminals 147 (P) and 145 (N) that the DC bus capacitors are discharged before touching any internal components of the controller. Failure to observe this precaution could result in severe bodily injury or loss of life.

This chapter describes contents of error codes and actions to correct problems.

## 6.1 Error and Alarm

When an error or alarm condition is detected, the seven-segment LED (MONITOR LED) on the faceplate of the VZ3000 drive displays a letter code as listed in Tables 6.1 through 6.3, the display flashing or continuously lighting depending on the error or alarm condition detected.

Detailed contents of error and alarm conditions will be displayed on the host computer or on the VZ3000/VZ3000G operator's terminal OPCU-2 connected to the VZ3000 drive. If you desire to know detailed contents of error and/or alarm conditions based on displayed letter codes, refer to Tables 6.1 to 6.3. To obtain details of error and/or alarm conditions from the host computer, use to the help of the host computer.

1) Displaying Method of Letter Codes

   When an error occurs, the corresponding error code flashes. When multiple errors are detected at a time, the LED display flashes and the error codes for the detected errors will be scrolled one after another.

   When an alarm condition is detected, the corresponding alarm code flashes. When multiple alarm conditions occur at a time, the LED display flashes and the corresponding alarm codes will be displayed one after another.

   If both error and alarm condition occur at a time, only the error code is displayed in the manner as described above.

   Continuous display of error code without flashing shows fatal fault of the Control Board as listed in Table 6.3.

2) Turning Power OFF and Display

Inverter units of VZ3000 drives produce their control power from DC bus voltage.

Turning OFF AC input power will raise instantaneous AC power dip or loss. If such power OFF condition continues further, DC bus voltage will go down, and when DC bus voltage becomes lower than the bus low voltage detection level, Bus Low Voltage error will occur and will be maintained. If this condition is held further, the control power of the inverter unit will be lost and the error display will disappear.

Be careful that in case of the above-mentioned error, the control power continues maintained and the error is maintained if the power is reapplied before the control power has been lost. Therefore, when AC input power is turned OFF, be sure to reapply the power after verifying the "P/S" LED on the inverter unit has been turned OFF.

Table 6.1 - Error Codes (Flashing on MONITOR LED)

| No. | Code | Type of Error | Possible Cause | Items to be Inspected | Action |
|---|---|---|---|---|---|
| 10 | 0 | Motor Overheat/ Overload | 1. Motor thermal switch was closed.<br>2. Electronic thermal overload of either one of the following was activated:<br>150% for 60 sec or longer,<br>200% for 26 sec or longer,<br>300% for 10 sec or longer.<br>3. No sequence input power is available. | 1. Overload operation cycle.<br>2. Motor ambient temperature (must be lower than 40 degree C (104 degree F)).<br>3. Motor's cooling fan.<br>4. PWM carrier frequency was increased.<br>5. Sequence input power. | 1. Reduce operation load rate to 100% or less.<br>2. Cool down ambient temperature.<br>3. Repair motor cooling fan.<br>4. Change the PWM carrier frequency to the standard value.<br>5. Provide appropriate sequence input power. |
| 11 | 1 | Option Board Failure | Option board failure. | | 1. See instruction manual of the option board. |
| 12 | 2 | Power Element Failure | Overcurrent or overheat of power elements, or drop of power source for drive.<br>Drop of DC bus voltage due to rapid increase of load. | 1. Setting of Drive and Motor Parameters.<br>2. Short of motor U, V and W wiring.<br>3. Drive or power element failure.<br>4. Overload operation cycle.<br>5. Incorrect setting of corresponding jumper shown in Table 2.4. | 1. Check setting of parameters.<br>2. Check wiring and repair short.<br>3. Repair the controller.<br>4. Reduce operation load rate to 100% or less.<br>5. Correct the jumper setting. |
| 13 | 3 | Bus Overvoltage | DC bus input power exceeded:<br>432 V for 200 V class controller,<br>825 V for 400 V class controller. | 1. Input power exceeds specifications.<br>2. Damping torque is beyond handling capacity. | 1. Verify that input power is appropriate.<br>2. Set a lower current limit or select an appropriate resistance value for external regenerative resistor. |
| 14 | 4 | Bus overcurrent | (This error code is not used.) | | |

Table 6.1 - Error Codes (Flashing on MONITOR LED) (continued)

| No. | Code | Type of Error | Possible Cause | Items to be Inspected | Action |
|---|---|---|---|---|---|
| 15 | 5 | Wrong Setting or Data Unconverted (1) | 1. Drop number is set to zero (0).<br>2. Set data is invalid.<br>3. Communication code is invalid (at communicating with a host computer).<br>4. Motor is not for input voltage class. | 1. Drop number is out of its setting range.<br>2. Set data or data combination is out of their setting range.<br>3. Communication cable.<br>4. Power voltage and motor no-load voltage. | 1. Set a drop number within a range of 1 to 99.<br>2. Correct set data.<br>3. Check controller grounding, and connection of communication cable.<br>4. Correct Motor Parameters. |
| 16 | 6 | Motor Overspeed/ Speed Deviation Error | 1. Motor speed exceeded overspeed detection level.<br>2. Deviation of motor speed from speed reference exceeded speed deviation upper or lower limit. | 1. Improper overspeed detection level.<br>2. Overshoot at rapid acceleration or deceleration.<br>3. Material running out or cutting off during torque control operation.<br>4. Motor is driven by load. | 1, 2. Adjust speed regulator gain and/or overspeed detection level.<br>3. Add speed clamping circuit.<br>4. Reduce load. |
| 17 | C | Communication error | Communication errors occurred more than allowable number of times. | 1. Improper baud rate.<br>2. Electrical noise. | 1. Use proper baud rate (standard: 9600).<br>2. Install noise suppressors. |
| 18 | r | Control Board failure | 1. Fault was detected as a result of power-up self-diagnostic.<br>2. Option board failure was detected when optional card was installed. | 1. Control Board failure.<br>2. Option board failure. | 1. Replace the Control Board.<br>2. Replace the option board. |
| 19 | E | Pulse Encoder (PG) Failure (2) | Incorrect A-phase/B-phase signal level of pulse encoder (PG). | 1. Miswiring or disconnection of pulse encoder (PG) wiring.<br>2. Pulse encoder (PG) failure.<br>3. Input power failure. | 1. Correct the wiring.<br>2. Replace the pulse encoder (PG).<br>3. Repair or replace the input power supply. |
| 20 | G | Ground Fault (3) | Ground fault was detected in motor U, V, and W wiring or in wiring of external regenerative resistor. (4) | 1. Insufficient insulation of the motor wiring.<br>2. Insufficient insulation of the motor.<br>3. Insufficient insulation of the external regenerative resistor or its wiring. | 1, 3. Correct the wiring.<br>2. Repair the motor.<br>3. Correct the wiring or replace the external resistor. |
| 21 | H | Drive Overheat | 1. Fault of controller cooling fan(s).<br>2. Temperature sensor of internal regenerative resistor was activated. (4) | 1. Drive cooling fan failure.<br>2. Regeneration frequency exceeded rating of internal regenerative resistor.<br>3. Ambient temperature exceeded 55 degree C (131 degree F). | 1. Replace the cooling fan(s).<br>2. Reduce regeneration frequency (times) or provide external regenerative resistor. |

Table 6.1 - Error Codes (Flashing on MONITOR LED) (continued)

| No. | Code | Type of Error | Possible Cause | Items to be Inspected | Action |
|---|---|---|---|---|---|
| 22 | L | AC Power Supply Failure | 1. When using an external converter unit, the IP signal from the converter unit has been kept for longer than the setting of Inst. Pwr. Dip Detect Time of Application Parameter.<br>2. DC bus voltage is lower than:<br>211 V for 200 V class controller,<br>399 V for 400 V class controller. | 1. Power loss or circuit breaker trip.<br>2. Converter unit fault. | 1. Check the input power supply.<br>2. Repair the converter unit. |
| 23 | P | Control Power Supply Failure | (This error code is not used.) | | |
| 24 | U | Bus Low Voltage [5], [6] | DC bus voltage is lower than:<br>196 V for 200 V class controller,<br>371 V for 400 V class controller. | 1. Input power is lower than the specifications.<br>2. Short of DC bus input power.<br>3. Internal power elements fault.<br>4. Converter unit fault. | 1. Provide proper input power according to specifications.<br>2. Check an external regenerative resistor.<br>3. Repair the controller.<br>4. Repair the converter unit. |
| 25 | d | Driver Power Supply Failure | (This error code is not used.) | | |

[1] When parameters are transmitted to the controller, this error code may be displayed instantaneously, though no fault occurred.
[2] This error will be cleared when the drive enters into the test operation mode.
[3] This error code is not used for models UVZC3201 to UVZC3203 and UVZ3230 to UVZ3275. But when an external grounding fault detecting element is connected to inverter unit UVZ3255 or UVZ3275, this error code will be used.
[4] This is applicable to unitized type unit UVZC3201 to UVZC3207 and UVZC3001 to UVZC3007.
[5] This error code is not displayed on models UVZ3022 to UVZ3037 and UVZ3215 to UVZ3275. Also, this error code is not displayed when models UVZC3001 to UVZC3007 or UVZC3201 to UVZC3207 are used with a common bus input power.
[6] When an external converter unit is used, the bus low voltage error of the inverter unit will be cleared, if the inverter unit does not receive the RDY signal from the converter unit.

Table 6.2 - Alarm Codes (Flashing on MONITOR LED)

| No. | Code | Type of Alarm | Possible Cause | Items to be Inspected | Action |
|---|---|---|---|---|---|
| 26 | 7 | Motor Overheat Alarm | Motor temperature measured by thermistor exceeded set value of overheat temperature. | 1. Overload operation cycle.<br>2. Motor ambient temperature (must be lower than 40 degree C (104 degree F)).<br>3. Motor cooling fan. | 1. Reduce the load rate of operation to 100% or lower.<br>2. Cool down the ambient temperature.<br>3. Repair the motor cooling fan.<br>4. Correct the set value of motor overheat temperature. |
| 27 | 8 | During Torque Limiting (displayed only during speed control) | Torque reference is limited by FWD or REV torque limit. | 1. Load is too large.<br>2. Accel/decel time is too short.<br>3. Set value of torque limit is too small. | 1. Reduce the load.<br>2. Set a longer accel/decel time.<br>3. Set a larger torque limit. |
| 28 | 9 | Torque Control Failure (displayed only during torque control) | Speed is clamped in torque control by using added speed clamping circuit. | Load status becomes less than torque reference. | Set the load status within the control range. |
| 29 | A | Line Overspeed | Motor speed exceeded the detection levels 1 and 2 for alarm. | Adequacy of the speed detection levels 1 and 2 for alarm. | Reduce the motor speed. |
| 30 | F | Motor Temperature Sensor Failure | Thermistor resistance for motor is out of allowable range. | 1. Short, disconnection, contact failure of wiring.<br>2. Thermistor failure.<br>3. Motor temperature is lower than Ð5 degree C (23 degree F).<br>4. Motor temperature is higher than 150 degree C (302 degree F). | 1. Check the wiring.<br>2. Replace the thermistor.<br>3. Operate the motor in warm air. |
| 31 | J | EEPROM Write Error | Error of writing to EEPROM occurred. | 1. Writing to EEPROM exceeded hundred thousand times.<br>2. Element failure. | 1, 2. Replace the Control Board. |
| 32 | b | During Base Blocking (1) (3) | Base block is activated for protection at power-up. | Power was turned ON while RUN signal was ON. | Turn RUN signal ON after power-up. |
| 33 | c | Communication Error | Communication error occurred or communication watchdog error was detected. | 1. Improper baud rate.<br>2. Electrical noise. | 1. Correct baud rate (standard: 9600).<br>2. Install noise suppressors. |
| 34 | h | Set Data Ignored | Set data is invalid. | 1. Set data is beyond setting range.<br>2. Set data combination is beyond setting range. | 1, 2. Correct the set data. |

Table 6.2 - Alarm Codes (Flashing on MONITOR LED) (continued)

| No. | Code | Type of Alarm | Possible Cause | Items to be Inspected | Action |
|---|---|---|---|---|---|
| 35 | L | AC Power Supply Instantaneous Power Failure | 1. When an external converter unit is used, the IP signal from the converter unit was received.<br>2. DC bus voltage is lower than:<br>211 V for 200 V class controller,<br>399 V for 400 V class controller. | 1. Instantaneous power loss.<br>2. Input power voltage is out of the specifications, or power capacity is too small. | 1. Check input power.<br>2. Correct power capacity. |
| 36 | o | Overload Alarm | Overload operation continued for over 80% of allowable overload time. | 1. Overload operation cycle.<br>2. Incorrect set value.<br>3. Phase loss of U, V, W output.<br>4. PWM carrier frequency was increased. | 1. Reduce the load rate to 100% or less.<br>2. Correct Drive and Motor Parameters.<br>3. Correct the wiring. Repair the drive if necessary.<br>4. Change the PWM carrier frequency to the standard value. |
| 37 | n | Converter Unit Failure, or External Preparation Assigned to Sequence Input not Ready. (1) (2) | Fault signal of converter unit was detected. Or though external hardware ready was assigned to a sequence input, no input has been received. | 1. Input power of converter unit is OFF or below its specifications.<br>2. Converter unit failure.<br>3. External hardware ready signal has not been entered. | 1. Establish the input power.<br>2. Repair the converter unit.<br>3. Check the external sequence signal source. |
| 38 | y | Option Board Fault | Communication with option board was disconnected due to option board failure. | Option board failure. | See instruction manual of the option board. |
| 39 | - | Forced Stop (1) (4) | Forced stop command was received through communication. | Check the status of the command source. | Take adequate action depending on the status of the command source. |

(1) Operation cannot be performed while this code is displayed.
(2) This code will be cleared when converter unit becomes ready for operation. But when RUN signal is ON, this code cannot be cleared even if converter unit is ready for operation. In such a case, first turn OFF the RUN signal.
(3) This code will be cleared by turning OFF RUN signal of external sequence input.
(4) This code will be cleared by turning OFF RUN signal of external sequence input and pressing RESET switch.

Table 6.3 - Codes for Fatal Faults (Continuously Lighting on MONITOR LED)

| No. | Code | Type of Error | Possible Cause | Items to be Inspected | Action |
|---|---|---|---|---|---|
| 40 | 0. | Processor internal error | Self-diagnostic failure at power up | Control Board failure | Replace the Control Board. |
| 41 | 1. | | | | |
| 42 | 2. | | | | |
| 43 | 3. | | | | |
| 44 | 4. | | | | |
| 45 | 6. | | | | |
| 46 | 7. | Mismatching of revisions | Mismaching of revisions between main-firmware and sub-firmware.<br>Mismatching of revisions between sub-firmware and option board. | Control Board failure.<br>Option board failure. | Replace the Control Board.<br>Replace option board. |

## 6.2 Detailed (Supplemental) Information on Error of Control Board

An error of the Control Board " ⌐ " indicates that a fault was detected as a result of the self-diagnostic. When an error of the Control Board occurred, it is basically required to replace the Control Board.

In such a case, however, it is possible to obtain the detailed (or supplementary) information about the error from the numbers to be read out by setting the reference number "41039" or "41041" to the Monitor M21 of the VZ3000/VZ3000G operator's terminal OPCU-2. Because the numbers to be displayed are hexadecimal, they must be converted to binary numbers to obtain the detailed information about the error as shown in Tables 6.4 and 6.5.

Table 6.4 - Detailed Control Board Fault When Reference Number 41039 is Used

| Bit Number | Possible Defective Portion | Fault |
|---|---|---|
| 15 (MSB) | Control Board | Time out of sub-processor XF |
| 14 | Control Board | Time out of sub-processor RDY |
| 13 | Control Board | - |
| 12 | Control Board/Driver Board | Faulty entrance of output voltage VFC |
| 11 | Control Board/Driver Board | Faulty entrance of DC bus voltage VFC |
| 10 | Control Board | Fault of No. 1 expansion I/O |
| 9 | Control Board | Fault of No. 2 expansion I/O |
| 8 | Control Board | - |
| 7 | Control Board | Fault of No. 1 D/A |
| 6 | Control Board | - |
| 5 | Control Board/Driver Board/ Power Board | Offset fault of U-phase |
| 4 | Control Board/Driver Board/ Power Board | Offset fault of W-phase |
| 3 | Control Board | DPR memory fault |
| 2 | Control Board | EEPROM fault |
| 1 | Control Board | Drop switch fault |
| 0 (LSB) | Control Board | Time out of main processor |

Table 6.5 - Detailed Control Board Fault When Reference Number 41041 is Used

| Bit Number | Possible Defective Portion | Fault |
|---|---|---|
| 15 (MSB) to 3 | - | - |
| 2 | Control Board and Option Board | Time out of option board |
| 1 | Control Board | Defective A/D conversion |
| 0 (LSB) | Control Board | Time out of sub-processor |

## 6.3 Special Care When Fuses are Blown

Inverter unit of a separate type drive is equipped with fuses for protecting the drive from secondary damage when the inverter unit is damaged. Since blowing of fuses is considered as fatal damage having occurred, it is important first to eliminate its causes before replacement of fuses.

## 6.4 Safety Precautions

1. Be sure that the input disconnect is in the correct position, either ON or OFF, depending on the work to be performed.
2. A backup technician must be in line of sight when the work is being performed, to assist in case of emergency.

**ATTENTION:** Do not use a megger to perform continuity checks in the drive equipment. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

3. Use one hand to hold tools or test probes. Keep your other hand behind you, and be sure that you are insulated from the floor and all other structures.

## 6.5 Preliminary Review

1. Before disconnecting the power, check status of display lamps shown in Table 2.3.
2. Turn power OFF. Wait for longer than three minutes until the POWER lamp goes off, and verify that DC bus voltage has dropped to zero.
3. Confirm the following:
   - No terminals or connectors are loose.
   - Power supply voltage is normal.
   - Inverter unit, converter unit and motor frame are properly grounded.
   - Surge suppressors are mounted to noise sources (coils), such as relays, solenoid valves, magnetic brakes located in the vicinity of drive and motor.
   - In case of a controller having DC bus with fuse, the fuse is not blown.
4. Turn power ON after removing all causes of errors shown with reference to Tables 2.3, 6.1 and 6.2 and verifying that the drive is normal.

## 6.6 Fault/Symptom Troubleshooting Flow Charts

Identify the fault symptom from the following list. Proceed to the flow chart corresponding to the symptom.

**ATTENTION:** Some of the remaining steps are performed with power ON. Exercise extreme care because hazardous voltage exists. Failure to observe this precaution could result in severe bodily injury or loss of life.

1. Motor does not run.
2. Motor does not stop.
3. Motor' rotation is not stable.
4. High vibration is observed when motor stops running.
5. Acceleration/deceleration is not smooth.

### 6.6.1 Motor does not Run

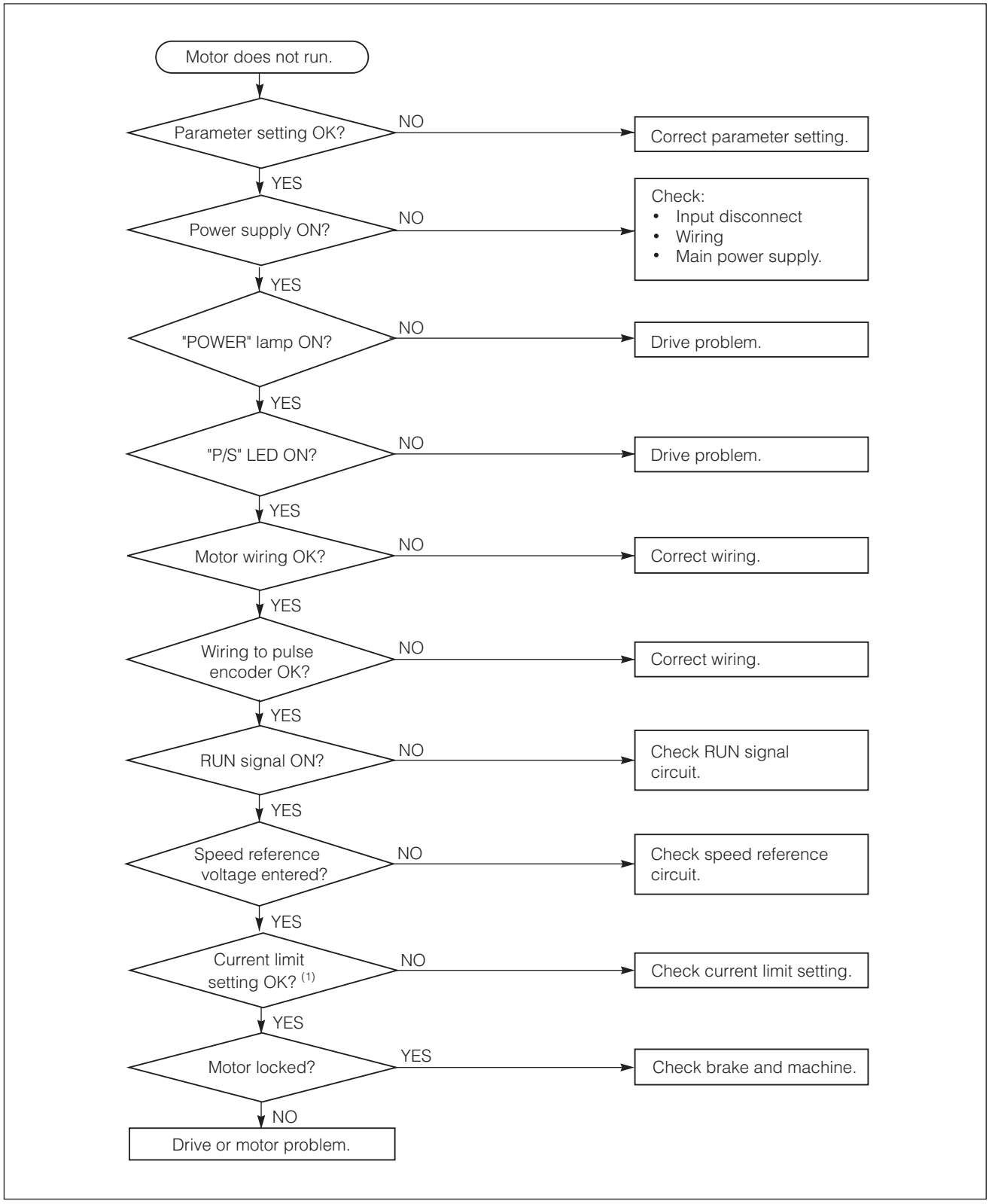



Figure 6.1 - Motor does not Run

### 6.6.2 Motor does not Stop

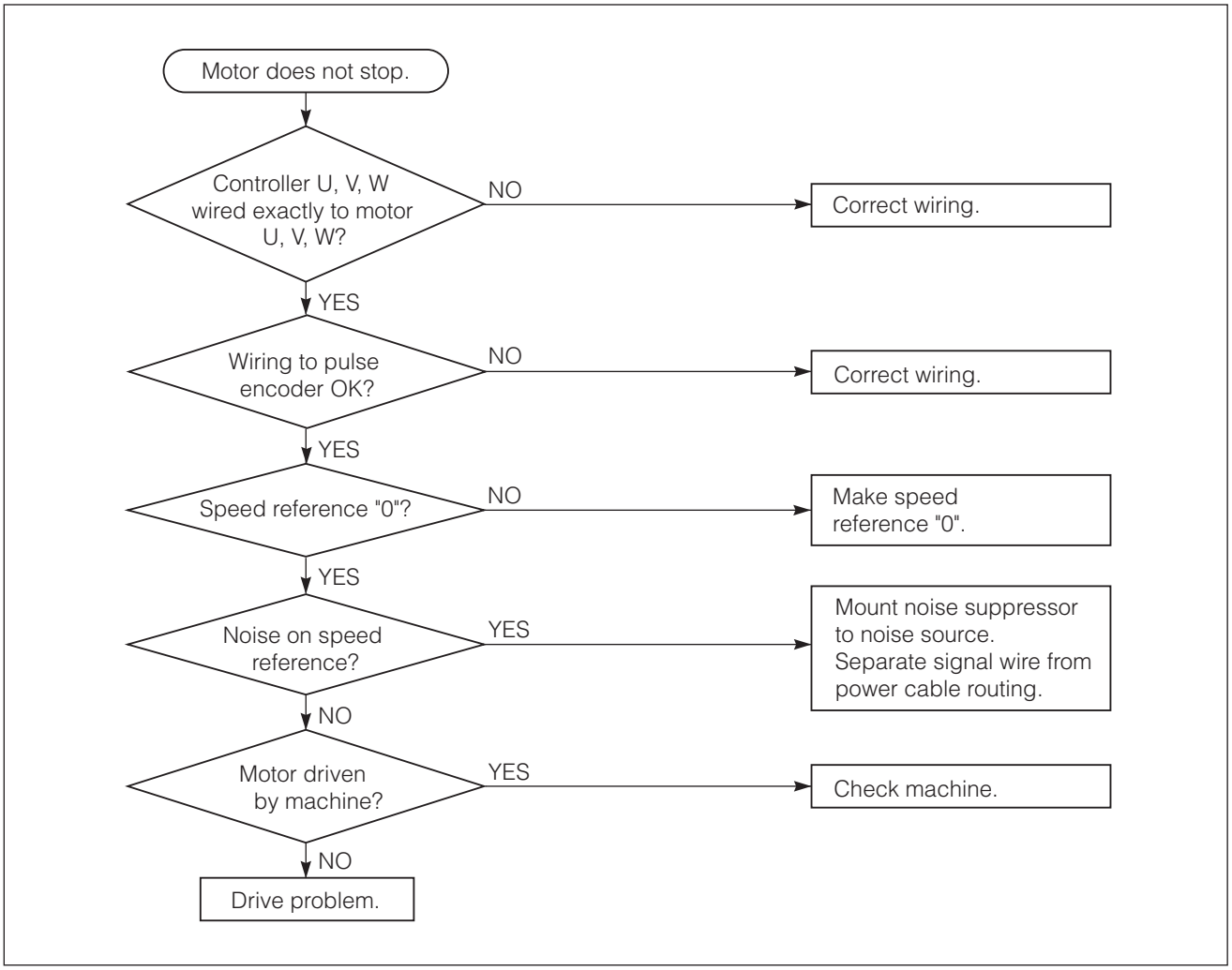



Figure 6.2 - Motor does not Stop

### 6.6.3 Motor's Rotation is not Stable

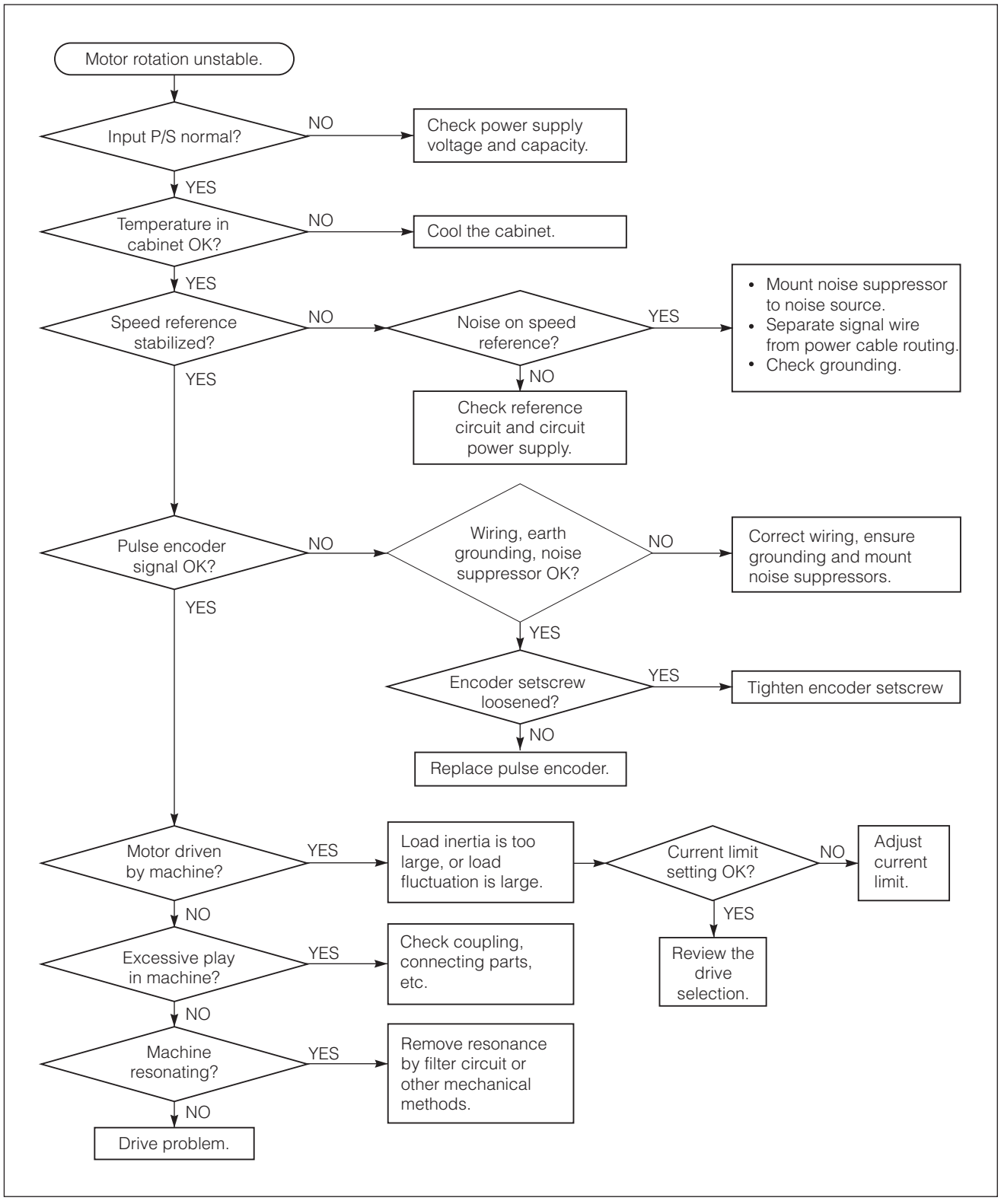



Figure 6.3 - Motor's Rotation is not Stable

### 6.6.4 High Vibration is Observed When Motor Stops Running

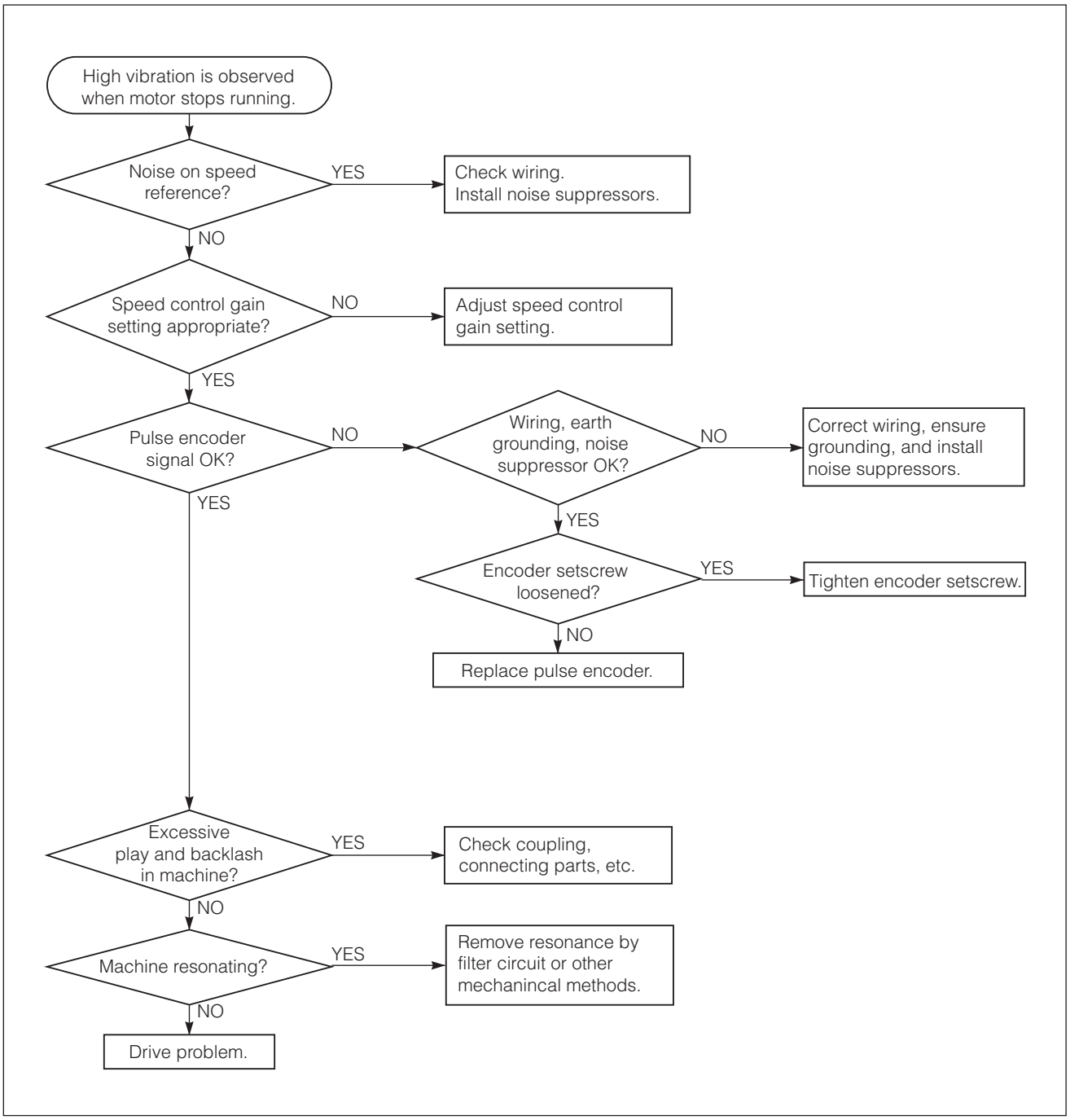



Figure 6.4 - High Vibration is Observed when Motor Stops Running

### 6.6.5 Acceleration/Deceleration is not Smooth

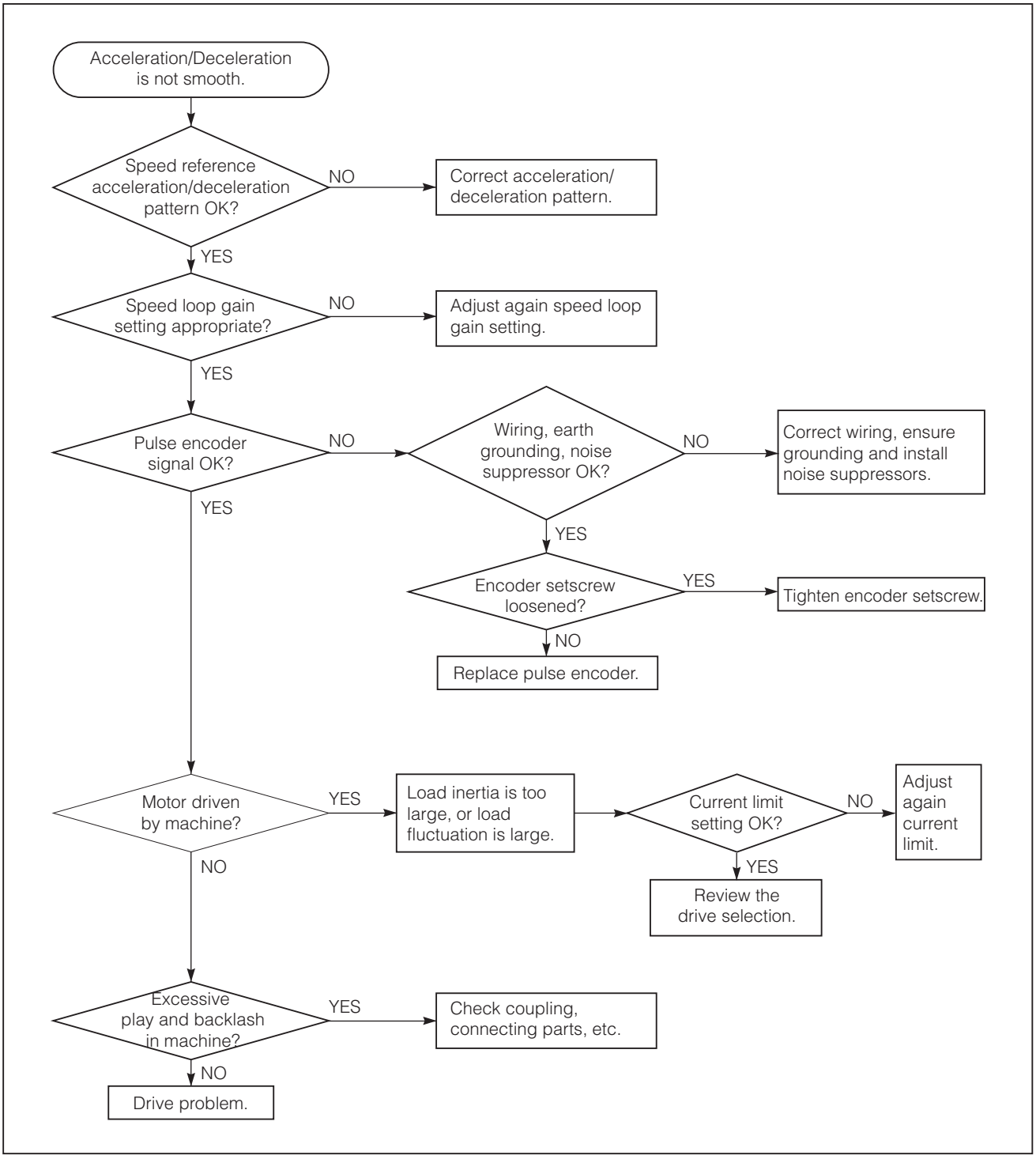



Figure 6.5 - Acceleration/Deceleration is not Smooth

# CHAPTER 7
# Application

This chapter describes various applications of VZ3000 drive. You can change control mode and/or add new functions by changing parameters with a host computer or an operator's terminal OPCU-2. Use the procedure described in the instruction manual for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027) or the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021), to change and specify appropriate parameters for operation.

## 7.1 Analog Signals for Reference and Monitoring

Various commands are available: five channels of external analog input references, commands given through communication, commands from option boards, and internally preset auxiliary commands such as jogging command.

Commands must be set in advance for a selected control mode, as speed reference, torque reference, flux ratio reference, torque limit reference, and others. These references shown in Table 7.1 belong to the Control Parameters. Refer to the instruction manual for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Versions (IM 32027) or the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021) for the detailed description of these parameters.

Table 7.1 - Various References

| References | | Parameters |
|---|---|---|
| Speed References | Main Speed References | Analog References 1 to 5<br>Speed Reference via Communication<br>Speed Reference from Option Board |
| | Auxiliary Speed Ref. | Auxiliary Speed References 1 to 3 |
| Torque References | Main Torque References | Analog References 1 to 5<br>Torque Reference via Communication<br>Torque Reference from Option Board |
| | Auxiliary Torque References | Auxiliary Torque References 1 and 2 |
| Flux Ratio References | Main Flux Ratio References | Analog Reference 3<br>Flux Ratio Reference via Communication<br>Flux Ratio Reference from Option Board |
| | Auxiliary Flux Ratio References | Auxiliary Flux Ratio Reference 1 |
| Torque Limit References | FWD & REV Torque Limit References | Analog Reference 4 |
| | FWD Torque Limit References | Analog Reference 4<br>FWD Torque Limit Reference via Communication<br>FWD Torque Limit Reference from Option Board |
| | REV Torque Limit References | Analog Reference 5<br>REV Torque Limit Reference via Communication<br>REV Torque Limit Reference from Option Board |
| Subsystem Torque References | | Analog Reference 1<br>Option Board Sub-Torque Reference |

Note 1) More than one operation cannot be specified to one analog reference at a time.
2) When you select multiple references classified as a main reference, final value of the main reference is the total value of the multiple references.

## 7.2 RUN ON/OFF Sequence

Use this application to start operation when the RUN ON switch is energized, and then to hold the operation until the RUN OFF switch is energized and the motor speed comes to zero (0). Figure 7.1 shows the external sequence circuit and the timing flow for the application. Assign appropriate items to "Sequence Inputs" of the Control Parameters as shown in Table 7.2 to use this application.

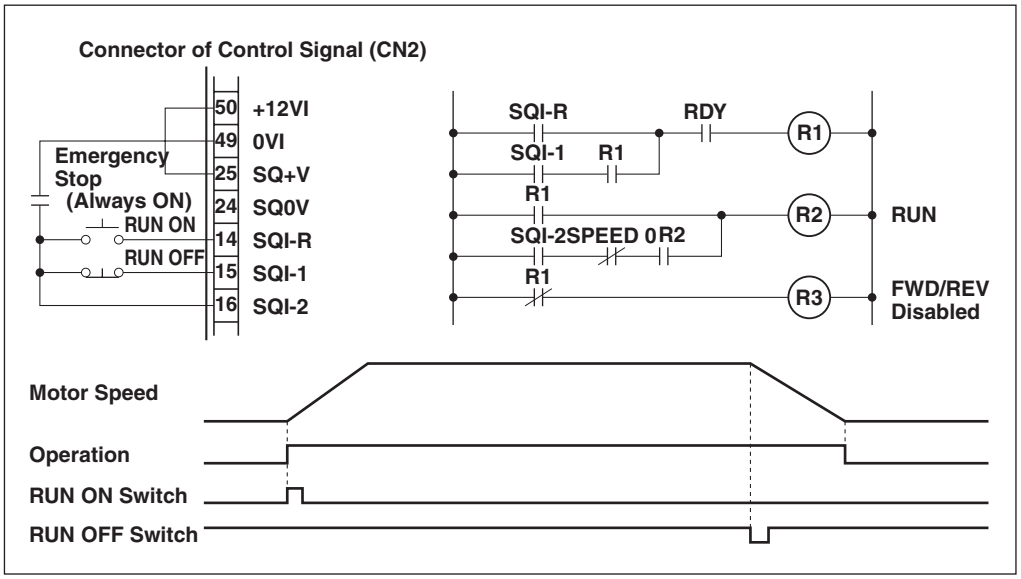



Figure 7.1 - Application of RUN ON/OFF Sequence

Table 7.2 - Items to be Assigned to Sequence Inputs for Run ON/OFF Sequence

| Kind of Parameter | Parameter | Items to be Assigned to Sequence Inputs |
|---|---|---|
| Control Parameter | Sequence Input | SQI-1: Run Hold/Release<br>SQI-2: Run Hold to Zero Speed<br>SQI-2: Select necessary Command (such as Main Speed Reference ON/OFF and Main Torque Reference ON/OFF) |

## 7.3 Sequence Input Signals Using MOP Up and Down

MOP (motor-operated potentiometer) is used to accelerate or decelerate motor speed by "MOP Up" and "MOP Down" assigned to "Sequence Inputs" of the Control Parameters. The MOP is useful to accelerate or decelerate motor speed from multiple places. For more information, refer to the instruction manual of the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027) or the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021).

To reset the MOP, energize the RUN OFF switch described in Section 7.2 or disable FWD and REV speed references described in Section 7.6. Table 7.3 shows setting of the related parameters, and Figure 7.3 illustrates an example of timing flow.

Table 7.3 - Example of Parameter Setting to Use MOP

| Kind of Parameter | Parameter | Assignment to Sequence Inputs or Parameter Setting |
|---|---|---|
| Control Parameter | Sequence Input | Items to be assigned to Sequence Input:<br>SQI-1: MOP Up<br>SQI-2: MOP Down |
| | Selection of Auxiliary Speed Reference 3 | Use the auxiliary speed reference 3 alone as the speed reference, without the main speed reference. |
| Application Parameter | Ramp Time 1<br>Ramp Time 2<br>DB Ramp Time | Set accel/decel time adequately for the application to be used. |

Note: Setting resolution of speed reference using MOP varies depending on accel/decel time ("Ramp Time 1", "Ramp Time 2" or "DB Ramp Time") as follows:

$$\text{Setting Resolution of Speed Reference} = \frac{5}{\text{Accel/Decel Time (sec)}} \quad (\%)$$

The curve of the speed reference will be smoothed when passing through a ramp circuit as shown in Figure 7.2. When S-curve time is added to the speed reference using MOP Up/Down, the accel/decel time will be extended by the S-curve time.

When the DB ramp time is selected as accel/decel time of ramp circuit as described in Section 7.8, the DB ramp time will be applied to the both acceleration and deceleration.

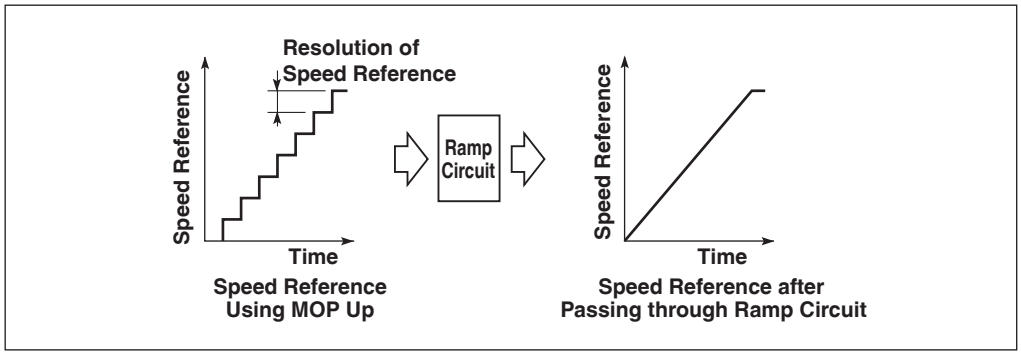



Figure 7.2 - Speed Reference Curves Using MOP and after Passing through Ramp Circuit

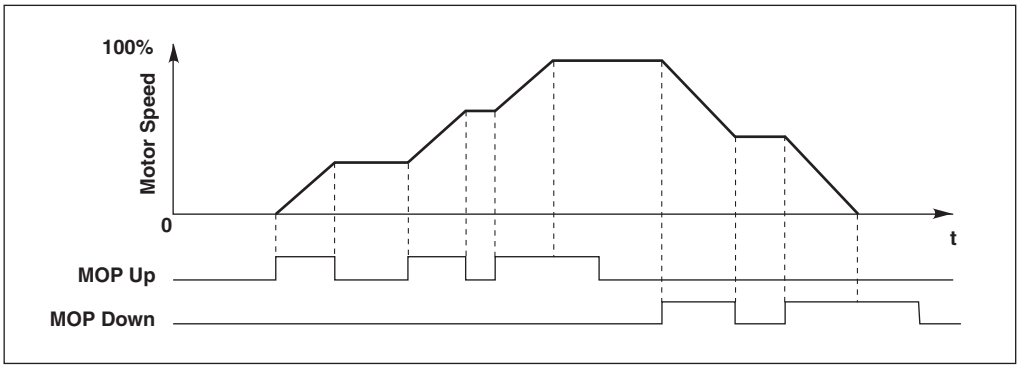



Figure 7.3 - Application of Sequence Input Using MOP Up/Down

## 7.4 Ramp/S-Curve Speed Reference

You can choose a pattern of speed reference from the five alternatives shown in Figures 7.4 through 7.8.

### 7.4.1 Step Speed Reference

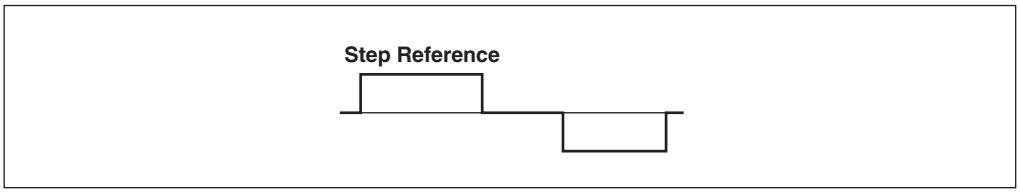



Figure 7.4 - Step Speed Reference

Table 7.4 - Parameter Setting of Step Speed Reference

| Kind of Parameter | Parameter | Setting |
|---|---|---|
| Control Parameter | Accel/Decel Ramp Mode | Normal Mode |
| Application Parameter | Ramp Time 1<br>Ramp Time 2<br>S-curve Time | 0.01<br>0.01<br>0.00 |

### 7.4.2 Ramp Curve Speed Reference

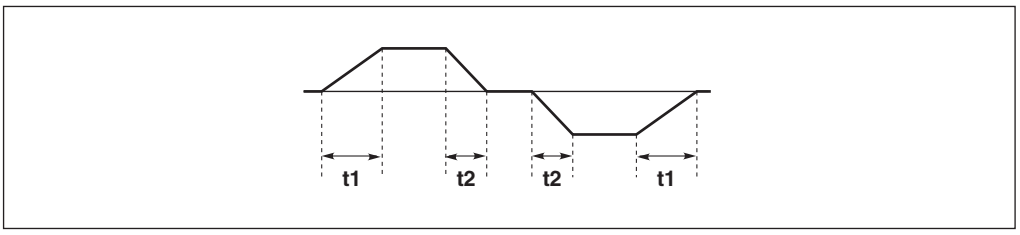



Figure 7.5 - Ramp Curve Speed Reference

Table 7.5 - Parameter Setting of Ramp Curve Speed Reference

| Kind of Parameter | Parameter | Setting |
|---|---|---|
| Control Parameter | Accel/Decel Ramp Mode | Normal Mode |
| Application Parameter | Ramp Time 1<br>Ramp Time 2<br>S-curve Time | t1<br>t2<br>0.00 |

### 7.4.3 Ramp Curve Speed Reference of Absolute Value

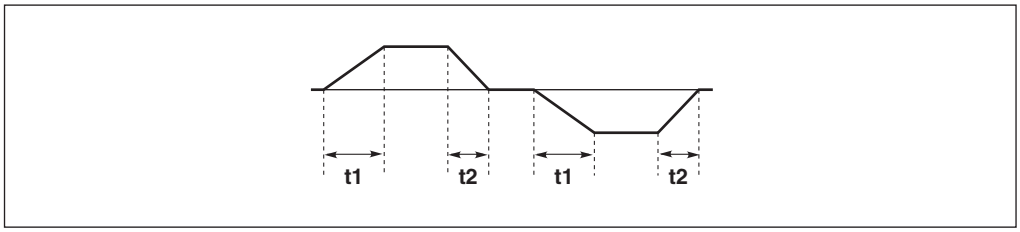



Figure 7.6 - Ramp Curve Speed Reference of Absolute Value

Table 7.6 - Parameter Setting of Ramp Curve Speed Reference of Absolute Value

| Kind of Parameter | Parameter | Setting |
|---|---|---|
| Control Parameter | Accel/Decel Ramp Mode | Absolute Value Mode |
| Application Parameter | Ramp Time 1<br>Ramp Time 2<br>S-curve Time | t1<br>t2<br>0.00 |

### 7.4.4 S-curve Speed Reference

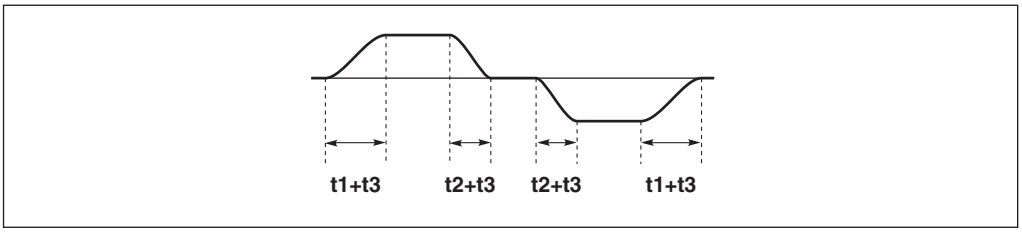



Figure 7.7 - S-curve Speed Reference

Table 7.7 - Parameter Setting of S-curve Speed Reference

| Kind of Parameter | Parameter | Setting |
|---|---|---|
| Control Parameter | Accel/Decel Ramp Mode | Normal Mode |
| Application Parameter | Ramp Time 1<br>Ramp Time 2<br>S-curve Time | t1<br>t2<br>t3 (1) |

(1) t3 must be equal to or smaller than a half of the set value of Ramp Time 1 or 2 whichever is shorter.

### 7.4.5 S-curve Reference of Absolute Value

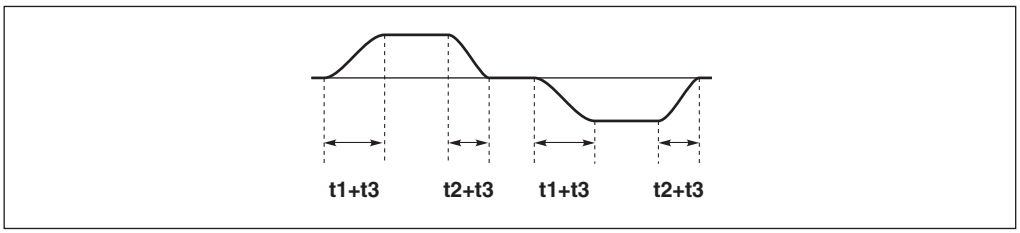



Figure 7.8 - S-curve Speed Reference of Absolute Value

Table 7.8 - Parameter Setting of S-curve Speed Reference of Absolute Value

| Kind of Parameter | Parameter | Setting |
|---|---|---|
| Control Parameter | Accel/Decel Ramp Mode | Absolute Value Mode |
| Application Parameter | Ramp Time 1<br>Ramp Time 2<br>S-curve Time | t1<br>t2<br>t3 (1) |

(1) t3 must be equal to or smaller than a half of the set value of Ramp Time 1 or 2 whichever is shorter.

## 7.5 Switching Rotation Direction

You can select a way to switch rotation direction from the four patterns as shown in Table 7.9, by assigning appropriate items to "Sequence Inputs" of the Control Parameter. (Motor's rotation direction cannot be switched by changing the U, V and W wiring of the main circuit, unlike a general-purpose induction motor.)

Table 7.9 - Items to be Assigned to Sequence Input for Switching Rotation Direction

| | Control Parameter | | |
|---|---|---|---|
| | **Rotation Direction** | **Item to be Assigned to Sequence Input** [1] | **Rotation Direction** [1] [2] |
| 1 | FWD Rotation "CW" | - | FWD with positive (+) reference<br>REV with negative (-) reference |
| 2 | FWD Rotation "CW" | SQI-(n): Direction Select | Switched by Sequence Input SQI-(n).<br>Input ON: REV with positive (+) reference<br>FWD with negative (-) reference<br>Input OFF: FWD with positive (+) reference<br>REV with negative (-) reference |
| 3 | REV Rotation "CCW" | - | REV with positive (+) reference<br>FWD with negative (-) reference |
| 4 | REV Rotation "CCW" | SQI-(n): Direction Select | Switched by Sequence Input SQI-(n)<br>Input ON: FWD with positive (+) reference<br>REV with negative (-) reference<br>Input OFF: REV with positive (+) reference<br>FWD with negative (-) reference |

[1] The "n" in parentheses indicates a user selectable number of sequence input.
[2] The polarities in speed control are shown here. In torque control, the polarities are reverse to those shown here.

## 7.6 Enable/Disable FWD and REV Speed Reference

This application is used to enable or disable FWD and/or REV speed reference by assigning appropriate operations to "Sequence Inputs" of the Control Parameter. It is possible to set ten patterns of control method as shown in Table 7.10. Refer to the instruction manual of the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027) for the detailed description of each Control Parameter and for items to be assigned. (This application can conveniently be used as a stop signal for a shuttle movement.)

Table 7.10 - Parameter Setting for Enabling/Disabling FWD and REV Speed Reference Inhibit

| | Control Parameter | | | | Enable or Disable of FWD and/or REV Speed Reference [1] |
|---|---|---|---|---|---|
| | **Speed Ref. Inhibit** | **FWD Speed Ref. Inhibit** | **REV Speed Ref. Inhibit** | **Item to be Assigned to Sequence Input [1]** | |
| 1 | Disable | Disable | Disable | - | All speed references are enabled. |
| 2 | Enable | Disable | Disable | - | All speed references are disabled. |
| 3 | Disable | Disable | Disable | SQI-(n): FWD and REV Ref. Inhibit ON/OFF | Switched by Sequence Input, SQI-(n).<br>Input ON: Speed reference inhibited.[2]<br>Input OFF: Speed reference enabled. |
| 4 | Enable | Disable | Disable | SQI-(n): FWD and REV Ref. Inhibit ON/OFF | Switched by Sequence Input, SQI-(n).<br>Input ON: Speed reference enabled.<br>Input OFF: Speed reference inhibited.[2] |
| 5 | Disable | Enable | Disable | - | FWD (+) speed reference is disabled. |
| 6 | Disable | Disable | Disable | SQI-(n): FWD Ref. Inhibit ON/OFF | Switched by Sequence Input, SQI-(n).<br>Input ON: FWD speed ref. inhibited.<br>Input OFF: FWD speed ref. enabled. |
| 7 | Disable | Enable | Disable | SQI-(n): FWD Ref. Inhibit ON/OFF | Switched by Sequence Input, SQI-(n).<br>Input ON: FWD speed ref. enabled.<br>Input OFF: FWD speed ref. inhibited. |
| 8 | Disable | Disable | Enable | - | REV (-) speed reference is disabled. |
| 9 | Disable | Disable | Disable | SQI-(n): REV Ref. Inhibit ON/OFF | Switched by Sequence Input, SQI-(n).<br>Input ON: REV speed ref. inhibited.<br>Input OFF: REV speed ref. enabled. |
| 10 | Disable | Disable | Enable | SQI-(n): REV Ref. Inhibit ON/OFF | Switched by Sequence Input, SQI-(n).<br>Input ON: REV speed ref. enabled.<br>Input OFF: REV speed ref. inhibited. |

[1] The "n" in parentheses indicates a user selectable number of sequence input.
[2] When the MOP described in Section 7.3 is used, the MOP will be reset by disabling all the speed references.

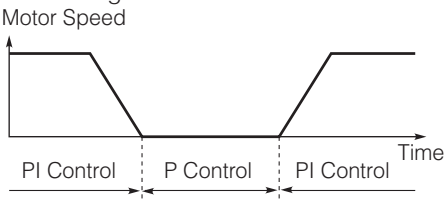
## 7.7 Switching P/PI Control of Speed

When a speed amplifier is set to PI-control (proportional-integral control), the amplifier will act to minimize motor speed error from speed reference at constant speed. Therefore, PI-control is used at constant speed. In the PI-control, however, motor does not come to full stop due to offset voltage, etc., even if speed reference of analog input is zero (0), and continues to move slowly by accumulated errors. This problem can be prevented by switching the amplifier from PI-control to P-control.

It is possible to automatically switch a speed amplifier between the P-control and the PI control. In the automatic switching of the P/PI control, motor speed is detected and the PI-control is automatically switched to the P-control when reference comes to zero (stop).

Five patterns of the P/PI control switching are available, and either one can be selected by setting the Control Parameters and assigning appropriate item to "Sequence Input" of the Control Parameter as shown in Table 7.11.

Table 7.11 - Items to be Assigned to Sequence Input for P/PI Control Switching

| | Control Parameter | | P/PI Control Selection [1] |
|---|---|---|---|
| | Speed Regulator | Item to be Assigned to Sequence Input [1] | |
| 1 | PI-Control | - | PI-Control is selected for speed amplifier. |
| 2 | PI-Control | SQI-(n): Speed Loop P/PI Selection | Switched by Sequence Input, SQI-(n).<br>Input ON: P-Control<br>Input OFF: PI-Control |
| 3 | P-Control | - | P-Control is selected for speed amplifier. |
| 4 | P-Control | SQI-(n): Speed Loop P/PI Selection | Switched by Sequence Input, SQI-(n).<br>Input ON: PI-Control<br>Input OFF: P-Control |
| 5 | PI-Control | SQI-(n): Speed Loop P/PI Selection<br>SQO-(m): Motor Zero Speed (Assignment of sequence Output) | Automatic switching of P/PI control.<br>While motor is running, PI-Control is selected. By detecting motor speed, PI-Control is automatically switched to P-Control when reference comes to zero (stop). To use this control method, jumper SQI-(n) and SQO-(m) of the connector of the control signal (CN2) with external wiring.<br>  |

[1] The "n" in parentheses indicates a user selectable number of sequence input, and the "m" shows a user selectable number of sequence output.

## 7.8 Selection of DB Ramp Time

Use this application to switch accel/decel time of ramp circuit from "Ramp Time 1" and "Ramp Time 2" (Application Parameters) to "DB Ramp Time" (Control Parameter). Assign an appropriate item to "Sequence Input" (Control Parameter). Four kinds of setting are possible as shown in Table 7.12. The DB ramp time is used, for example, to switch deceleration rate when an emergency stop is required.

**Important:** If you set "S-curve Time" (Application Parameter), accel/decel time may become larger than set value of "S-curve Time" plus "DB Ramp Time" due to relationship between "DB Ramp Time" and "Ramp Time 1". Therefore, when you desire to switch to DB Ramp Time from outside by assigning "DB Ramp Time Enable/Disable Switching" to a sequence input, set "S-curve Time" to "0" so that S-curve Time will not be used.

Table 7.12 - Items to be Assigned to Sequence Input for Switching Accel/Decel Time from Ramp Time to DB Ramp Time

| | Control Parameter | | Selection of Accel/Decel Time (1) |
|---|---|---|---|
| | DB Ramp Time | Item to be Assigned to Sequence Input (1) | |
| 1 | Disable | - | Acceleration/deceleration with Ramp Time 1 and Ramp Time 2. |
| 2 | Disable | SQI-(n): DB Ramp Time Enable/Disable Switching | Switched by Sequence Input, SQI-(n).<br>Input ON: Acceleration/deceleration with DB Ramp Time.<br>Input OFF: Acceleration/deceleration with Ramp Time 1 and Ramp Time 2. |
| 3 | Enable | - | Acceleration/deceleration with DB Ramp Time. |
| 4 | Enable | SQI-(n): DB Ramp Time Enable/Disable Switching | Switched by Sequence Input, SQI-(n).<br>Input ON: Acceleration/deceleration with Ramp Time 1 and Ramp Time 2.<br>Input OFF: Acceleration/deceleration with DB Ramp Time. |

(1) The "n" in parentheses indicates a user selectable number of sequence input.

### 7.8.1 DB Stop Function

This is an emergency stop function to be used at emergency or for fast stop, and provides a function higher than or equal to DB braking of DC motor. In normal condition, the motor accelerates in the Ramp Time 1 and decelerates in the Ramp Time 2. When this function is used and if an emergency stop signal is entered, speed reference comes to zero (0) and motor stops in the DB Ramp Time as shown in Figure 7.9. You can choose to turn ON or OFF the external contact signal, SQI-(n) and SQI (m) as shown in Table 7.13.

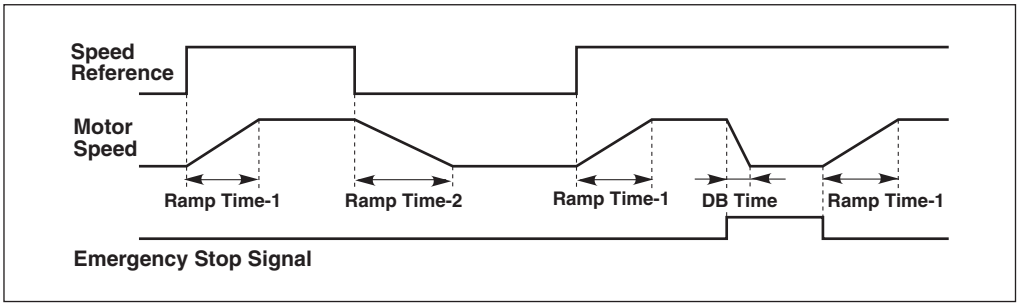



Figure 7.9 - Timing Flow for DB Stop Function

Table 7.13 - Parameter Setting to Use DB Stop Function

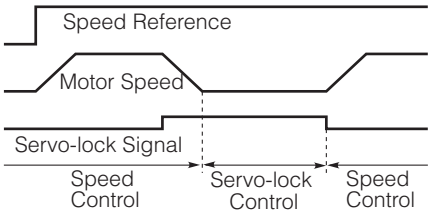
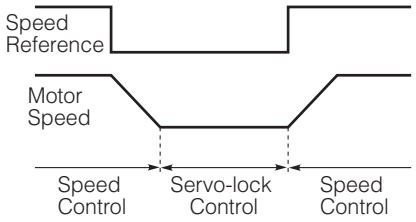
| Kind of Parameter | Parameter | Selection 1 (SQI-(n) ON with External Signal of Emergency Stop) [1] | Selection 2 (SQI-(n) OFF with External Signal of Emergency Stop) [1] |
|---|---|---|---|
| Control Parameter | FWD & REV Speed Ref. Inhibit | FWD and REV speed reference enabled | FWD & REV speed reference inhibited |
| | DB Ramp Time | DB Ramp Time disabled | DB Ramp Time enabled |
| | Sequence Input | SQI-(n): DB Ramp Time Enable/Disable Switching; FWD & REV speed ref. enable/disable switching. | |
| Application Parameter | DB Ramp Time | Set a ramp time of t seconds (emergency stop time) | |

[1] The "n" in parentheses indicates a user selectable number of sequence input.

## 7.9 Servo-lock Control

Servo-lock control is position control to keep a fixed stop position when servo-lock signal enters while motor stops with zero speed reference. It can be selected by selection of Control Parameters to start the servo-lock control either by using an external sequence signal or automatically by using speed reference. See Table 7.14. Also, refer to "Servo Lock Position Gain" and "Position Deviation Angle" of Application Parameters. If the controller is set to torque control, it must be switched to speed control.

Table 7.14 - Items to be Assigned to Sequence Input for Servo-lock Control

| | Control Parameter | | | Servo-lock Control Selection [1] |
|---|---|---|---|---|
| | **Servo-lock** | **Servo-lock Command** | **Item to be Assigned to Sequence Input [1]** | |
| 1 | Not Use | - | - | Servo-lock control is not performed. |
| 2 | Use | External Signal | SQI-(n): Servo-lock | When sequence input (SQI-(n)) is turned ON, speed reference input will automatically be inhibited, and servo-lock will become effective after motor stops.   |
| 3 | Use | Speed Reference | - | When speed reference comes to zero and motor stops, servo-lock will become effective automatically. When speed reference value becomes larger than zero, servo-lock will be released automatically.   |

[1] The "n" in parentheses indicates a user selectable number of sequence input.

## 7.10 Notch Filter and Low Pass Filter

When torque vibrates with a certain frequency due to resonance of machine or other reasons, a notch filter has an effect to attenuate only torque reference close to the said frequency. On the other hand, a low pass filter attenuates torque reference of high frequency.

The notch filter and the low pass filter can be set by Control Parameters and Application Parameters as shown in Tables 7.15 and 7.16 respectively.

Table 7.15 - Parameter Setting for Notch Filter

| Kind of Parameter | Parameter | Setting |
|---|---|---|
| Control Parameter | Notch Filter | ON (used) |
| Application Parameter | Notch Filter Angular Rate<br>Notch Filter Q Factor | ω (radius/second)<br>Q |

Table 7.16 - Parameter Setting for Low Pass Filter

| Kind of Parameter | Parameter | Setting |
|---|---|---|
| Control Parameter | Torque Low Pass Filter | ON (used) |
| Application Parameter | Torque LPF Angular Rate<br>Attenuation Constant | ω (radius/second)<br>ζ |

## 7.11 Torque Control

Four kinds of torque control are selectable by setting Control Parameters and Application Parameters as shown in Table 7.17. Specify torque reference as reference input. For setting procedures of references, refer to the instruction manuals for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027) or the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021).

Table 7.17 - Parameter Setting for Torque Control

| | Control Parameter | | | Control Mode Selection [1] |
|---|---|---|---|---|
| | Control Mode | Speed Clamp | Item to be Assigned to Sequence Input [1] | |
| 1 | Torque Control Mode | OFF (not used) | - | Torque control. |
| 2 | Torque Control Mode | ON (used) | - | Torque control with speed clamp. |
| 3 | Speed Control Mode | OFF (not used) | SQI-(n): Speed/Torque Mode Select | Switched by Sequence Input, SQI-(n).<br>Input ON: Torque Control<br>Input OFF: Speed Control |
| 4 | Torque Control Mode | OFF (not used) | SQI-(n): Speed/Torque Mode Select | Switched by Sequence Input, SQI-(n).<br>Input ON: Speed Control<br>Input OFF: Torque Control |

[1] The "n" in parentheses indicates a user selectable number of sequence input.

## 7.12 Flux Control

Four kinds of flux control are selectable by setting Control Parameters as shown in Table 7.18. To use this application, flux ratio reference must be selected as reference input. For the setting procedure, refer to the instruction manuals for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027) or the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021).

Weakening flux may cause response of speed loop to be inefficient, resulting in a problem. In such a case, you can change speed loop gain inversely proportional to flux ratio by selecting "variable" for "Speed Amplifier Gain" of Control Parameter to avoid inefficient response.

Table 7.18 - Parameter Setting for Flux Control

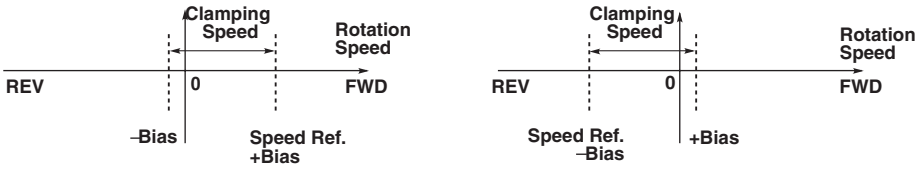
| | Control Parameter | | Flux Control Selection |
|---|---|---|---|
| | **Flux Reference** | **Speed Amplifier Gain** | |
| 1 | Speed Basis | Fixed | Constant flux (constant torque control) is kept until the motor reaches the base speed, and then, constant output control is performed between the base speed and the rated speed.<br>Speed amplifier gain is fixed. |
| 2 | Speed Basis | Automatically Variable | Constant flux (constant torque control) is kept until the motor reaches the base speed, and then, constant output control is performed between the base speed and the rated speed.<br>Speed amplifier gain automatically varies inversely proportionally to flux ratio. |
| 3 | External Reference | Fixed | Flux control is performed according to an external flux ratio reference.<br>Speed amplifier gain is fixed. |
| 4 | External Reference | Automatically Variable | Flux control is performed according to an external flux ratio reference.<br>Speed amplifier gain automatically varies inversely proportionally to flux ratio. |

## 7.13 Speed Clamp

This application is provided to avoid uncontrolled running of motor when load is suddenly reduced due to running out or cutoff of material during torque control. In such a case, this application clamps motor speed to sum of preset speed and bias (15% of rated speed). See Tables 7.19 and Figure 7.10. To use this application, specify both torque reference and speed reference as reference input. For the setting procedure of references, see the related Control Parameters shown in the instruction manuals for the VZ3000/VZ3000G terminal software VZterm for Windows, Original Version (IM 32027) or the VZ3000/VZ3000G operator's terminal OPCU-2 (IM 32021).

Table 7.19 - Selection of Motor Clamping Speed

| | Speed Clamp (Control Parameter) | Speed Reference | Torque Reference | Clamping Speed |
|---|---|---|---|---|
| 1 | ON (used) | Positive | Positive | Speed Reference plus Bias |
| 2 | | | Negative | Negative (-) Bias |
| 3 | | Negative | Positive | Positive (+) Bias |
| 4 | | | Negative | Speed Reference minus Bias |




**1. If speed reference is positive (+).** **2. If speed reference is negative (–).**

Figure 7.10 - Clamping Speed Setting Range with Positive/Negative Speed Reference

## 7.14 Detection of Exceeding Speed Deviation Limit

This application allows you to generate an alarm for speed deviation error when motor speed exceeds an allowable deviation limit for a given speed reference. To use this alarm, select "ON" (used) for "Speed Deviation Limit" of the Control Parameter and set "Speed Deviation Upper and Lower Limits" of the Application Parameters as shown in Table 7.20. For the relation between the speed, the speed reference and the speed deviation upper and lower limits, refer to Figure 7.11.

Table 7.20 - Setting Alarm Generation for Speed Deviation Error

| | Speed Deviation Error Detection (Control Parameter) | Speed Reference | Speed Deviation | Selection of Speed Deviation Upper and Lower Limits (Application Parameter) |
|---|---|---|---|---|
| 1 | ON (used) | FWD | Speed reference is smaller than speed. | Speed Deviation Upper Limit |
| 2 | | | Speed reference is larger than speed. | Speed Deviation Lower Limit |
| 3 | | REV | Speed reference is larger than speed. | Speed Deviation Upper Limit |
| 4 | | | Speed reference is smaller than speed. | Speed Deviation Lower Limit |

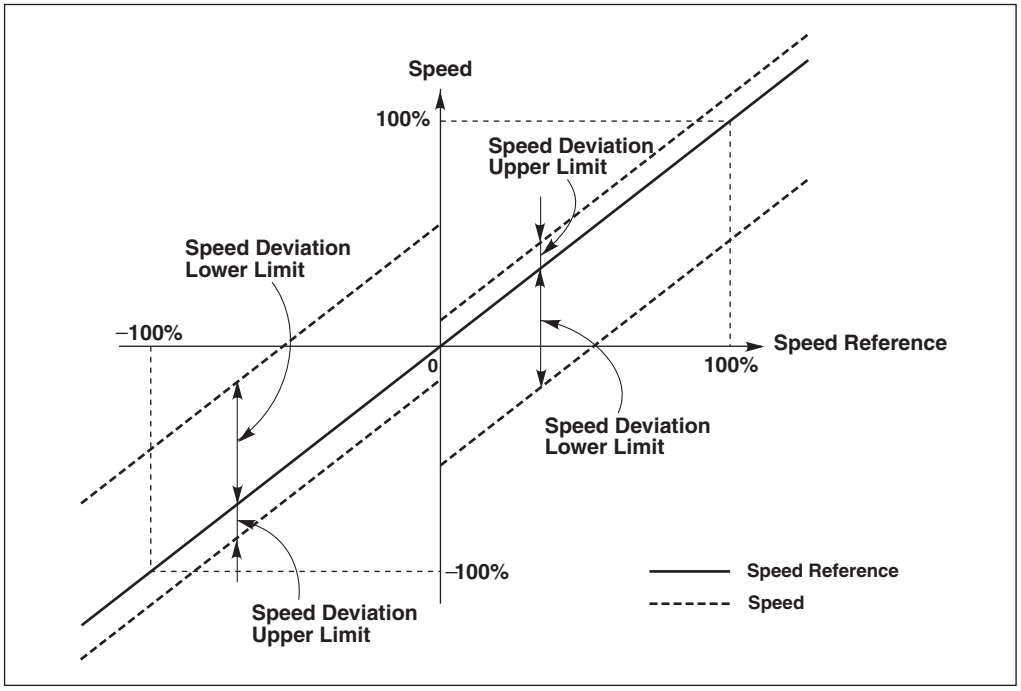



Figure 7.11 - Relation between Speed Reference and Speed Deviation Upper and Lower Limits

## 7.15 Overload Detection

Overload is detected by using motor thermal switch signal or electronic thermal overload relay signal entering from outside, and each of them detects overload under the condition described in Table 7.21.

Table 7.21 - Setting Overload Detection

| Signal for Detection | Selection of Overload Detection |
|---|---|
| Motor Thermal Switch Signal | When the motor thermal switch signal of sequence input is turned OFF, an error will be detected. |
| Electronic Thermal Overload Relay Signal | The electronic thermal overload relay characteristics are decided by the following parameters, and overload will be detected depending on the load condition.<br>Link Overload Detection with Carrier Frequency (Control Parameter): Selection of enable/disable.<br>Carrier Frequency Calibration (Application Parameter): 20 to 100% (1)<br>PWM Carrier Frequency (Drive Parameter): 7.5 kHz and 15 kHz |

(1) When PWM Carrier Frequency (Drive Parameter) is 7.5 kHz, Carrier Frequency Calibration (Application Parameter) is 40 to 100%.

To use a VZ3000 drive at low noise, any carrier frequency is selectable arbitrarily. But since increasing carrier frequency will increase switching loss, electronic thermal overload relay characteristics must be changed with carrier frequency. The carrier frequency is determined by the product of PWM carrier frequency and carrier frequency calibration. Figures 7.12 and 7.13 show the electronic thermal overload relay characteristics.

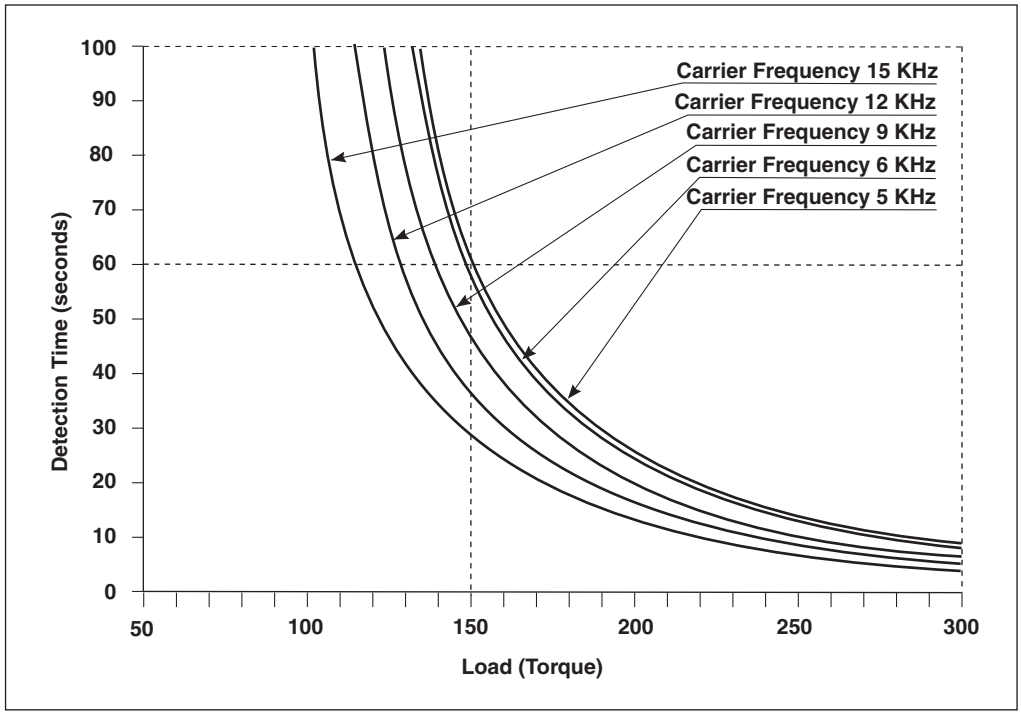



Figure 7.12 - Electronic Thermal Overload Relay Characteristics of Models UVZC3001 to UVZ3022 and UVZC3201 to UVZ3207

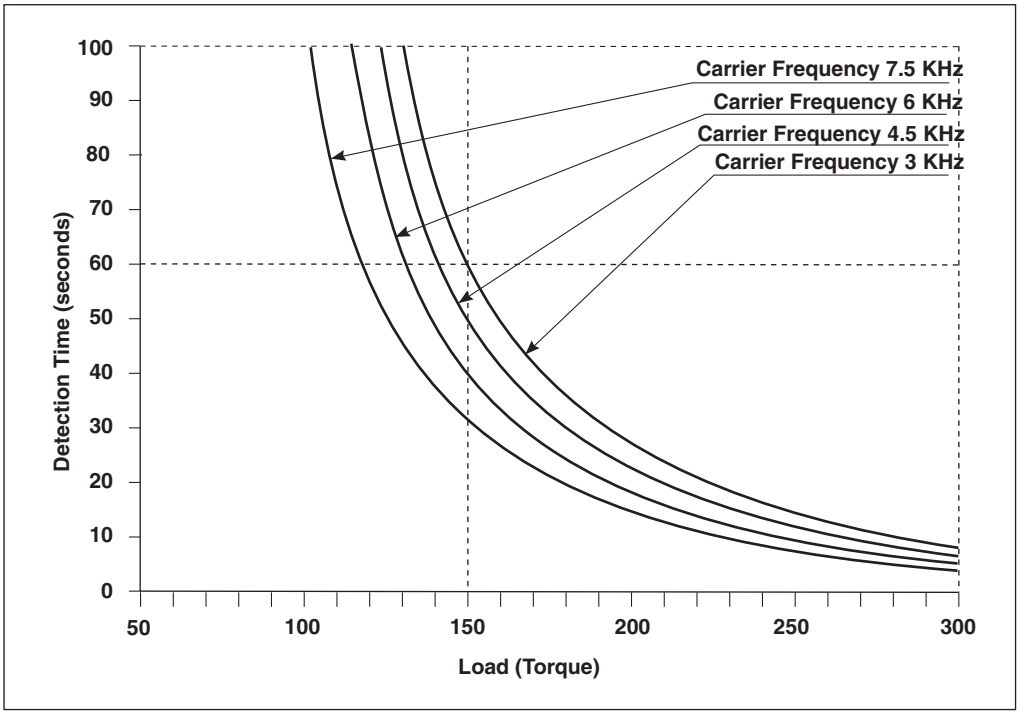



Figure 7.13 - Electronic Thermal Overload Relay Characteristics of Models UVZ3030, UVZ3037 and UVZ3222 to UVZ3275

To use a low noise type drive and configure a drive as shown in Table 9.5 or 9.6, disable Link Overload Detection with Carrier Frequency of Control Parameter.

When carrier frequency is changed, rated current must be derated as shown in Figure 7.14 or 7.15. If a current larger than those shown in these figures flows, the protective function of overload detection will be activated and the error code "0" will be displayed.

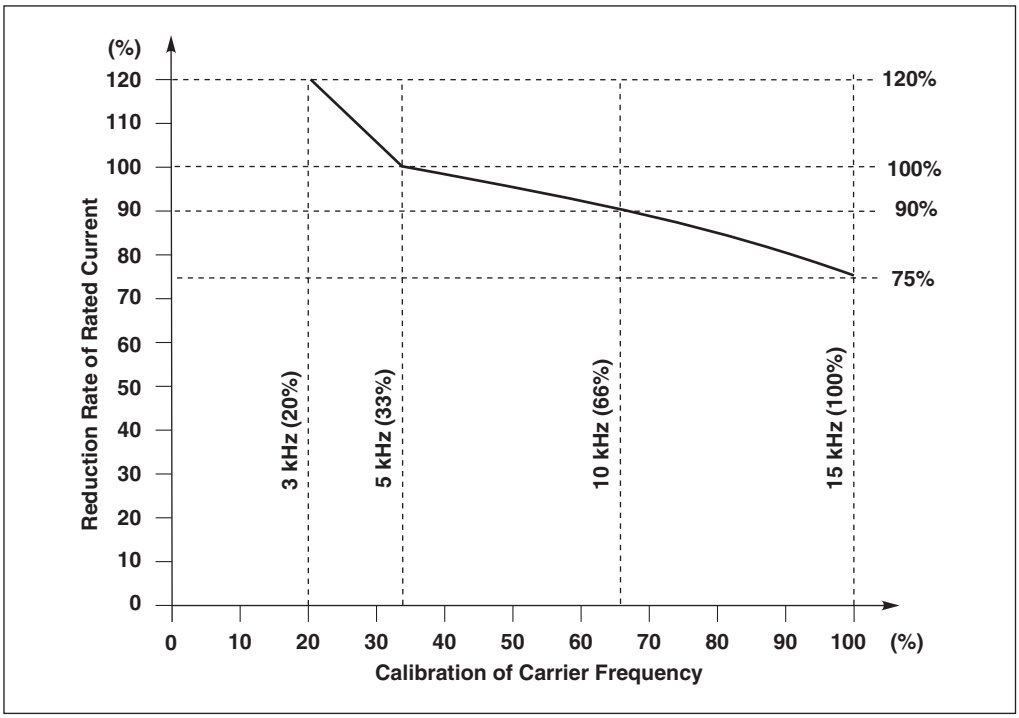



Figure 7.14 - Reduction Rate of Rated Current for Low Noise Type of Models UVZC3001 to UVZ3022 and UVZC3201 to UVZ3207

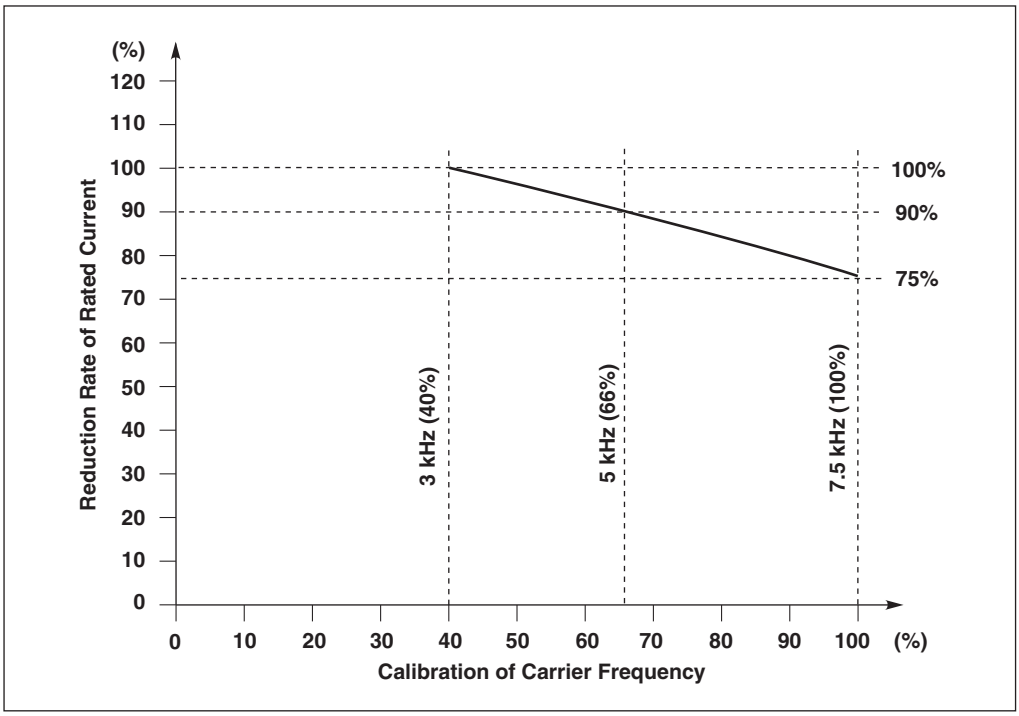



Figure 7.15 - Reduction Rate of Rated Current for Low Noise Type of Models UVZ3030, UVZ3037 and UVZ3222 to UVZ3275

## 7.16 Automatic Change of Carrier Frequency

Power loss (heat generation) of the drive becomes larger when bus voltage becomes higher. Also, when rotating field frequency supplied to the motor is low, current may be concentrated to a certain phase, resulting in extremely large heat generation at the phase.

To prevent such a problem, VZ3000 drive is provided with a function to decrease PWM carrier frequency automatically so that power loss can be reduced. Therefore, you may recognize a change in switching sound at continuous regeneration or a low speed operation, though this is not a fault. A Control Parameter allows you to enable/disable this function.

## 7.17 Single Phase Application

Single-phase power can be applied to converter unit by derating output of converter unit to a half of that of three-phase power. The rated outputs of motors for three-phase and single-phase power are shown in Tables 7.22 and 7.23. The terminals R and S must be used for connection of single-phase power.

Use of an AC reactor is recommended to improve power factor for input power.

Table 7.22 - Rated Outputs of 200-230 VAC/380-460 VAC Common Type Converter Units for Three-Phase Power and Single-Phase Power

| Model of Unit | | | UVZC3001 | UVZC3003 | UVZC3007 | UAZ3022(-A) (2) | UAZ3037(-A) (2) |
|---|---|---|---|---|---|---|---|
| Rated Output (1) | Three-phase power | 200 V | 0.75 KW | 2.2 KW | 3.7 KW | 11 KW | 18.5 KW |
| | | 400 V | 1.5 KW | 3.7 KW | 7.5 KW | 22 KW | 37 KW |
| | Single-phase power | 200 V | 0.4 KW | 1.1 KW | 2.2 KW | 5.5 KW | 7.5 KW |
| | | 400 V | 0.75 KW | 2.2 KW | 3.7 KW | 11 KW | 18.5 KW |

(1) The rated output is indicated as output of applicable motor.
(2) When you use model UAZ3022(-A) and UAZ3037(-A) for single-phase operation, be sure to turn ON the SW2-2 on the Control Board DCVR-5.

Table 7.23 - Rated Outputs of 200-230 VAC Dedicated Type Converter Units for Three-Phase Power and Single-Phase Power

| Model of Unit | | UVZC3201 | UVZC3202 | UVZC3203 | UVZC3207 | UAZ3222(-A) (2) | UAZ3237(-A) (2) |
|---|---|---|---|---|---|---|---|
| Rated Output (1) | Three-phase power | 1.5 KW | 2.2 KW | 3.7 KW | 7.5 KW | 22 KW | 37 KW |
| | Single-phase power | 0.75 KW | 1.1 KW | 2.2 KW | 3.7 KW | 11 KW | 18.5 KW |

(1) The rated output is indicated as output of applicable motor.
(2) When you use model UAZ3222(-A) and UAZ3237(-A) for single-phase operation, be sure to turn ON the SW2-2 on the Control Board DCVR-5.

## 7.18 Regenerating Operation

### 7.18.1 Regenerative Power

When a motor receives force from connected machine or inertia during deceleration, it runs in regenerative mode, and returns power to the VZ3000 drive. This regenerative power is stored in capacitors inside the controller, resulting in increasing DC bus voltage. If the voltage goes up to a certain level, the drive discharges the power to resistor to limit increase of voltage. This operation is called "regenerating operation". Generated power depends on control method and mechanical configuration of system ($GD^2$).

Figure 7.16 shows an example for capacity selection of regenerative resistor when operation with inertia is repeated.

In Figure 7.16, the shaded portions show regenerative power, and its average amount P(ave) is calculated by the following equation:

$$P(ave)\ [W] = 1/2 \times P_p \times t/T$$

Three to four times the above average regenerative power is to be selected as the resistor capacity, taking account of heat generation of the resistor. The resistance values of the resistors are shown in Tables 2.5 to 2.7.

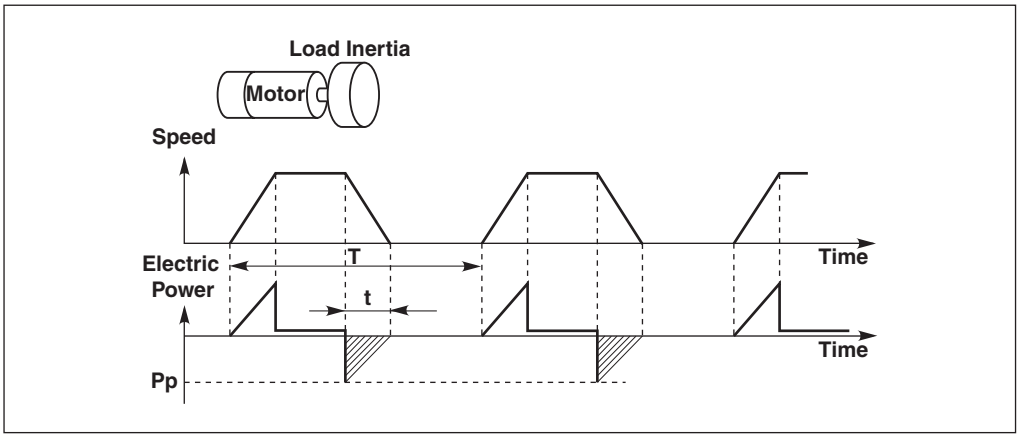



Figure 7.16 - Example of Repeated Operation with Inertia

When you use an external regenerative resister, connect it between terminals 147(P) and B2 and open terminal B1. For converter unit UAZ3275, remove three white leads of built-in regenerative resistor from terminal PB, apply insulation tape to the ends of the leads, and connect an external regenerative resistor between terminals 147 (P) and PB.

To perform control in regenerative mode continuously, such as uncoiler, unwinder and elevator operation, use an optional power regeneration unit. In such a case, be sure to turn ON switch 2SW-4 on control board DCVR-5 of converter unit UAZ3022(-A) to UAZ3037(-A), UAZ3222(-A) and UAZ3037(-A). For converter unit UAZ3275, short jumper JP9 on control board ACDC-2.

## 7.18.2 Built-in Regenerative Resistor

Although a unit having converter portion has built-in regenerative resistor, do not use such a regenerative resistor for usual operation. It must be used only for startup adjustment by electrical personnel who are familiar with the VZ3000 drive, provided that AC input power to the drive should immediately be cut off when any fault is detected. Note, however, the built-in regenerative resistors of the following units can be used for usual operation when the undermentioned conditions are met.

| | |
|---|---|
| Unitized Type Units | Revision 0.7 or later of UVZC3201<br>Revision 0.7 or later of UVZC3202<br>Revision 0.A or later of UVZC3203<br>Revision 0.A or later of UVZC3207<br>Revision 0.6 or later of UVZC3001<br>Revision 0.6 or later of UVZC3003<br>Revision 0.A or later of UVZC3007 |
| Separate Type Converter Units | UAZ3222-A<br>UAZ3237-A<br>UAZ3275<br>UAZ3022-A<br>UAZ3030-A<br>UAZ3037-A |

In case of converter unit UAZ3275, the built-in regenerative resistor of its standard unit can be used for usual operation. In case of other units, their internal regenerative resistors can be used for usual operation when the AC input power can be cut off by using contact signal from thermal switch for overheat protection of built-in regenerative resistor as shown in Figure 7.17.

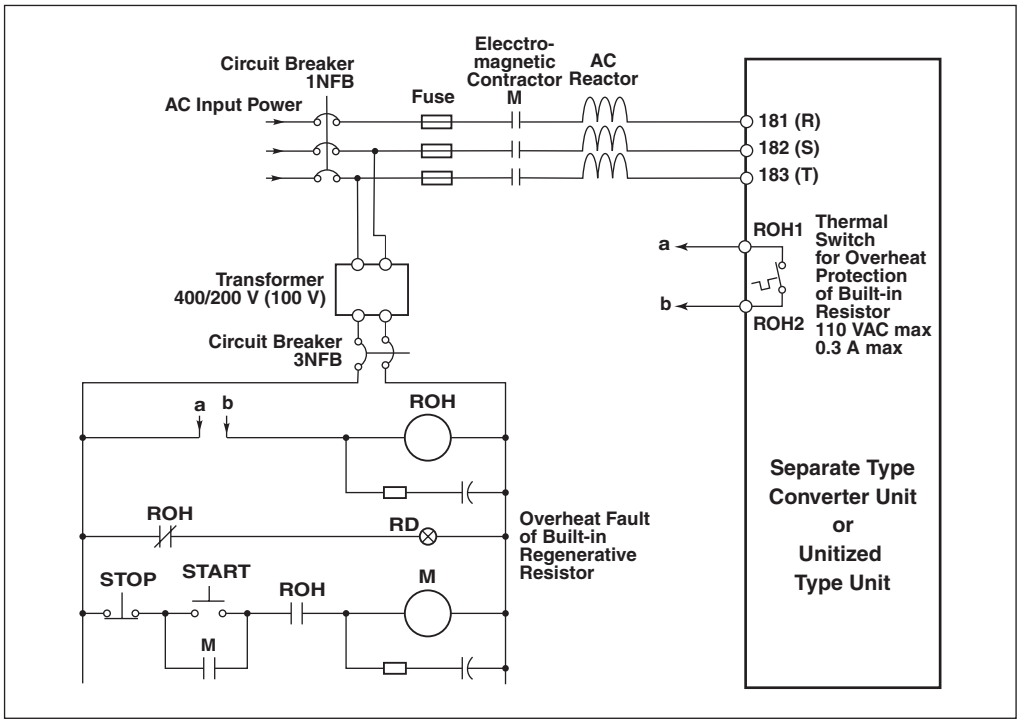
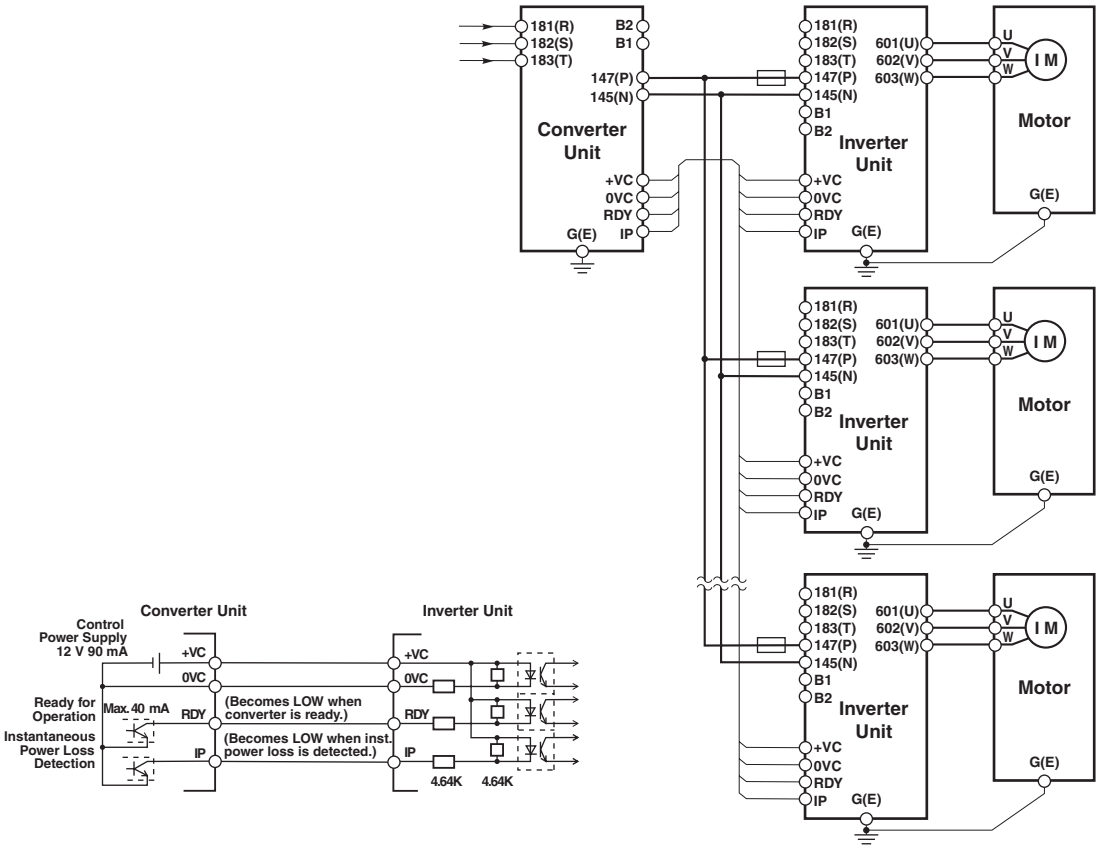



Figure 7.17 - Sequence Circuit to Cut off AC Input Power to Controller by Using Contact Signal from Thermal Switch for Overheat Protection of Built-in Regenerative Resistor

## 7.19 Use of Common Bus

It is possible to connect multiple inverter units to a DC bus power to be supplied by one converter unit as shown in Figure 7.18. By connecting control signal lines of a converter unit to multiple inverter units in parallel, regenerative circuits of inverter units are disabled, and regenerative circuit on converter unit is used.




**Note 1: Signal wiring and PG wiring are not included in the figure.**

**2: The maximum number of inverter units, to which signal lines from a converter unit can be connected in parallel, is 15. If more than 15 inverter units are to be connected, use external relays from which signal lines must be branched.**

**The following are recommended solid relay and socket for this purpose.**

**Solid Relay : G3RD-X02SN 12 VDC (OMRON)**
**Socket : P2RF-05 (OMRON)**

Figure 7.18 - Example of Multiple Connection with Common Bus Power

The maximum number of inverter units connectable to a converter unit is determined to maintain total output capacity of inverter units less than or equal to output capacity of converter unit.

The wiring length for the DC bus power must be minimized eliminating loops, to reduce the inductance of wiring.

Unitized type VZ3000 drives have no built-in fuses. Therefore, if multiple unitized inverters are connected to a common DC bus, install an appropriate fuse on DC bus input line of each inverter unit as shown in Figure 7.17 so that any defective inverter can be disconnected from the common DC bus. Refer to Section 9.6.2 for the fuses.

## 7.20 Multi-Communication

Communication between a host computer and multiple inverter units is possible, by connecting connector COMM.2 (CN3) of a VZ3000 drive to connector COMM.3 (CN5) of next VZ3000 drive in a cascade system and connecting 5 V power supply (5V +/- 5%, 3 mA multiplied by number of VZ3000 drives in the cascade system) to last VZ3000 drives as power supply for entire system. See Figure 7.19. The number of VZ3000 drives connectable in a cascade system is ten as standard, 99 at maximum. (When more than ten drives are connected, a lower baud rate must be used for communication.)

Maximum cable length between a host computer and first VZ3000 drive is 15 meters (50 feet) (when dedicated cable is used, maximum cable length can be extended up to 100 meters (300 feet)), and maximum cable length between drives is 15 meters (50 feet).

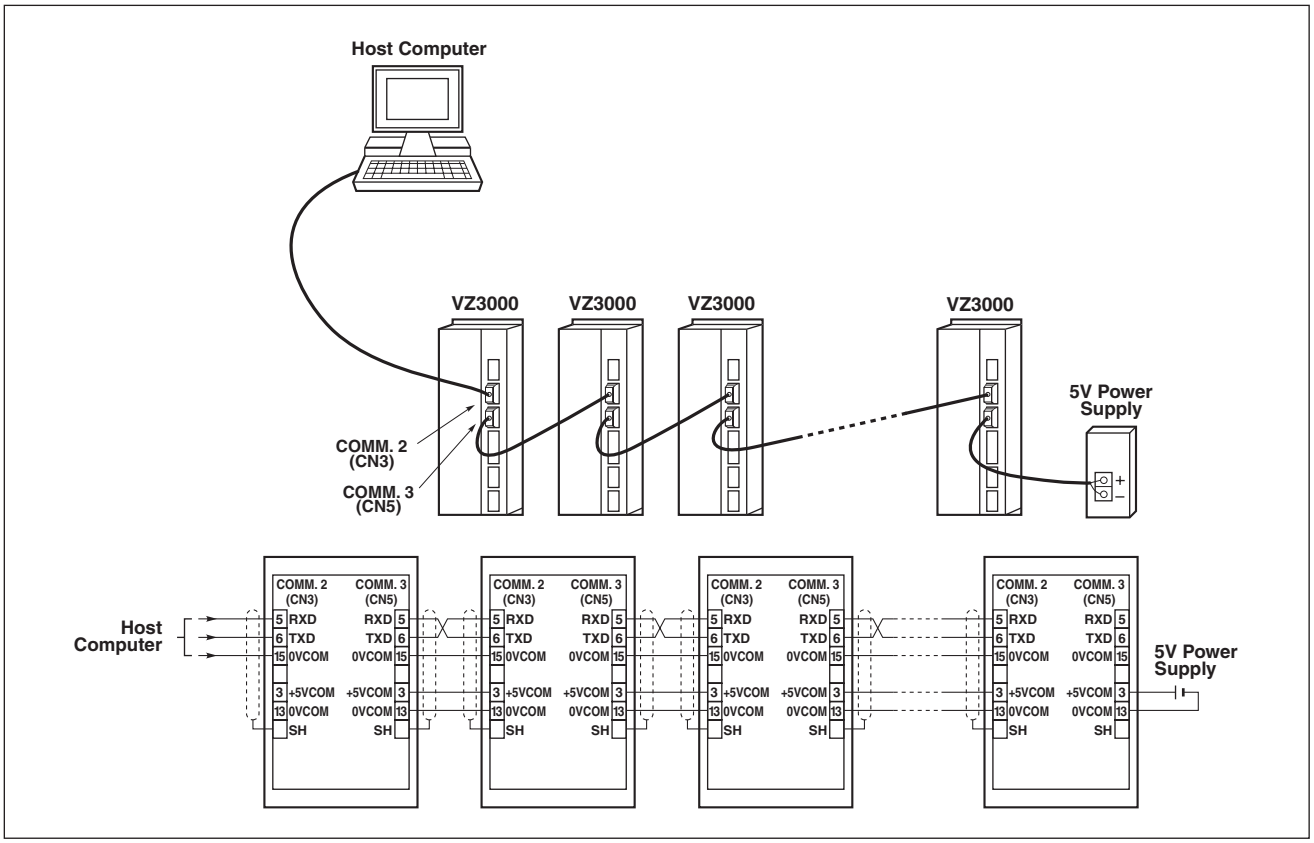



Figure 7.19 - Example of Connection for Multi-Communication

# CHAPTER 8

# Spare Parts

## 8.1 Spare Part Lists for 200-230 VAC/380-460 VAC Common Type Drives

Tables 8.1 show the spare part list for 200-230 VAC/380-460 VAC common type inverter units and Table 8.2 shows the spare part list for 200-230 VAC/380-460 VAC common type converter units. The numbers shown in the tables are the required quantities of the parts, and the blank means inapplicable part.

The standard or specifications of the parts in these lists might be changed by integration or abolition of parts. If you need spare parts, contact Reliance Electric.

Table 8.1 - Spare Part List for 200-230 VAC/380-460 VAC Common Type Inverter Units

| Name of Part | Standard/ Specifications | Part Number | Quantity | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | UVZC-3001 | UVZC-3003 | UVZC-3007 | UVZ-3022 | UVZ-3030 | UVZ-3037 |
| Control Board | DASR-1 | 826701 | 1 | 1 | 1 | 1 | 1 | 1 |
| Driver Board | PWCC-2 | 826702 | 1 | 1 | 1 | - | - | - |
| | PWCC-4 | 826706 | - | - | - | 1 | 1 | - |
| | PWCC-6 | 826722 | - | - | - | - | - | 1 |
| Power Board | HYPB-1 | 826728 | 1 | 1 | - | - | - | - |
| | HYPB-2 | 826703 | - | - | 1 | - | - | - |
| | HYPB-4 | 826707 | - | - | - | 1 | - | - |
| | HYPB-5 | 826709 | - | - | - | - | 1 | - |
| | HYPB-6 | 826723 | - | - | - | - | - | 1 |
| | BDI-004 | 826708 | - | - | - | 3 | 3 | 3 |
| Fuse | A60X200 | 286317 | - | - | - | 1 | 1 | - |
| | 70SHB150 | 285961 | - | - | - | - | - | 1 |
| Power Element | PM50RHA120 | 532509 | 1 | 1 | 1 | - | - | - |
| | PM150DHA120 | 536602 | - | - | - | 3 | - | - |
| | PM200DSA120 | 536651 | - | - | - | - | 3 | 3 |
| Rectifier | DF75AA-160 | 512733 | 1 | 1 | 1 | - | - | - |
| Capacitor | HCGF5A2W332NE10R | 453149 | 2 | 2 | 2 | - | - | - |
| | HCGF5A2W392NE10R | 453148 | - | - | - | 2 | - | - |
| | HCGF5A2W472NF10R | 453150 | - | - | - | - | 2 | 4 |
| Cooling Fan | MMF-08C24DS-F | 373700 | 1 | 1 | 2 | - | - | - |
| | MMF-09B24DH-F | 373702 | - | - | - | 3 | 3 | - |
| | MMF-12C24DH-RA2 | 373701B | - | - | - | - | - | 2 |

Table 8.1 - Spare Part List for 200-230 VAC/380-460 VAC Common Type Inverter Units (continued)

| Name of Part | Standard/ Specifications | Part Number | Quantity | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | UVZC-3001 | UVZC-3003 | UVZC-3007 | UVZ-3022 | UVZ-3030 | UVZ-3037 |
| Regenerative Resistor | MUC22N290JIX570CER | 429521 | - | - | 2 | - | - | - |
| | MUS22N680JIX570CER | 429526 | 1 | 1 | - | - | - | - |
| Precharge Resistor | RGH80LSY18ΩK | 429212 | 1 | 1 | 1 | - | - | - |
| Relay | G7L-1A-TUB (DC24V) | 307541 | 1 | 1 | 1 | - | - | - |
| Connector Plug (CN2) Shell | 10150-3000VE | 359803 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 10350-42A0-008 | 359810 | 1 | 1 | 1 | 1 | 1 | 1 |
| Connector Plug (CN9) Shell | 10120-3000VE | 359801 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 10320-52A0-008 | 359811 | 1 | 1 | 1 | 1 | 1 | 1 |

Table 8.2 - Spare Part List for 200-230 VAC/380-460 VAC Common Type Converter Units

| Name of Part | Standard/ Specifications | Part Number | Quantity | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | UAZ-3022 | UAZ-3022-A | UAZ-3030 | UAZ-3030-A | UAZ-3037 | UAZ-3037-A |
| Control Board [1] | DCVR-5 | 826705 | 1 | 1 | 1 | 1 | 1 | 1 |
| Power Board [1] | ACDC-1 | 826704 | 1 | - | 1 | - | 1 | - |
| | ACDC-5 | 826748 | - | 1 | - | 1 | - | 1 |
| Rectifier | RM75TC-2H | 512781 | 1 | 1 | 1 | 1 | - | - |
| | DF200AA160 | 512901 | - | - | - | - | 1 | 1 |
| Regenerative Transistor | QM100E3Y-2H | 534503 | 1 | - | 1 | - | - | - |
| | QM150E3Y-2H | 524604 | - | - | - | - | 1 | - |
| | CM100E3U-24H | 529211 | - | 1 | - | 1 | - | - |
| | CM150E3U-24H | 529212 | - | - | - | - | - | 1 |
| Capacitor | HCGF5A2W472N | 453147A | 4 | 4 | - | - | - | - |
| | HCGF6A2W562NDS | 453201B | - | - | 4 | 4 | 4 | 4 |
| Cooling Fan | MMF-12C24DH-RA2 | 373701B | 1 | 1 | 1 | 1 | 1 | 1 |
| Regenerative Resistor | RGH400LSY30ΩK | 429705A | 2 | 2 | - | - | - | - |
| | RGH400LSY20ΩK | 429717 | - | - | 2 | 2 | - | - |
| | RGH400LSY15ΩK | 429718 | - | - | - | - | 2 | 2 |
| Precharge Resistor | RGHS400LSY4.7ΩK | 429716 | 1 | 1 | 1 | 1 | 1 | 1 |
| Relay | SC-4-1/G (DC24V) | 301061A | 1 | 1 | - | - | - | - |
| | SD-N35 (DC24V) | 302113 | - | - | 1 | 1 | 1 | 1 |

[1] Use Revision 0.3 or later of Control Board DCVR-5 together with Revision 0.2 or later of Control Board ACDC-1 as a set.
Use Revision 0.2 or earlier of Control Board DCVR-5 together with Revision 0.1 or earlier of Control Board ACDC-1 as a set.

## 8.2 Spare Part Lists for 200-230 VAC Dedicated Type Drives

Tables 8.3 show the spare part list for 200-230 VAC dedicated type inverter units and Table 8.4 shows the spare part list for 200-230 VAC dedicated type converter units. The numbers shown in the tables are the required quantities of the parts, and the blank means inapplicable part.

The standard or specifications of the parts in these lists might be changed by integration or abolition of parts. If you need spare parts, contact Reliance Electric.

Table 8.3 - Spare Part List for 200-230 VAC Dedicated Type Inverter Units

| Name of Part | Standard/ Specifications | Part Number | Quantity | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | UVZC-3201 | UVZC-3202 | UVZC-3203 | UVZC-3207 | UVZ-3222 | UVZ-3230 | UVZ-3237 | UVZ-3255 | UVZ-3275 |
| Control Board | DASR-1 | 826701 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Driver Board | PWCC-2 | 826702 | - | - | - | 1 | - | - | - | - | - |
| | PWCC-6 | 826722 | - | - | - | - | 1 | 1 | 1 | - | - |
| | PWCC-10 | 826729 | 1 | 1 | - | - | - | - | - | - | - |
| | PWCC-11 | 826726 | - | - | 1 | - | - | - | - | - | - |
| | PWCC-17 | 826732 | - | - | - | - | - | - | - | 1 | 1 |
| Power Board | HYPB-12 | 826719 | - | - | - | 1 | - | - | - | - | - |
| | BDI-014 | 826721 | - | - | - | - | 1 | - | - | - | - |
| | BDI-015 | 826731 | - | - | - | - | - | 3 | - | - | - |
| | BDI-004 | 826708 | - | - | - | - | - | - | 3 | - | - |
| | BDI-017 | 826730 | - | - | - | - | - | - | - | 3 | - |
| | BDI-018 | 826734 | - | - | - | - | - | - | - | - | 6 |
| Fuse | A50P300 | 286319 | - | - | - | - | 1 | 1 | - | - | - |
| | A50P350 | 286324 | - | - | - | - | - | - | 1 | - | - |
| | A50P450 (1) | 286329A | - | - | - | - | - | - | - | 1 | - |
| | A50P600 | 286330 | - | - | - | - | - | - | - | - | 1 |
| Power Element | PM30RSF060 | 532308 | 1 | 1 | - | - | - | - | - | - | - |
| | PM50RSK060 | 532510 | - | - | 1 | - | - | - | - | - | - |
| | PM75RHA060 | 532754 | - | - | - | 1 | - | - | - | - | - |
| | PM200CSA060 | 532851 | - | - | - | - | 1 | - | - | - | - |
| | PM300DSA060 | 536661 | - | - | - | - | - | 3 | - | - | - |
| | PM400DSA060 | 536671 | - | - | - | - | - | - | 3 | - | - |
| | PM600DSA060 | 536681 | - | - | - | - | - | - | - | 3 | 6 |
| Rectifier | DF30DB80 | 512601C | 1 | 1 | 1 | - | - | - | - | - | - |
| | DF75BA80 | 512734 | - | - | - | 1 | - | - | - | - | - |

Table 8.3 - Spare Part List for 200-230 VAC Dedicated Type Inverter Units (continued)

| Name of Part | Standard/ Specifications | Part Number | Quantity | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | UVZC-3201 | UVZC-3202 | UVZC-3203 | UVZC-3207 | UVZ-3222 | UVZ-3230 | UVZ-3237 | UVZ-3255 | UVZ-3275 |
| Capacitor | HCGF5A2W222I | 453145 | 1 | 1 | - | - | - | - | - | - | - |
| | HCGF5A2W332I | 453146 | - | - | 1 | - | - | - | - | - | - |
| | HCGF5A2W332NE10R | 453149 | - | - | - | 2 | - | - | - | - | - |
| | HCGF5A2W472NF10R | 453150 | - | - | - | - | 2 | 4 | 6 | - | - |
| | HCGF5A2W472NF10RDS | 453150B | - | - | - | - | - | - | - | 8 | 12 |
| Cooling Fan | 109P0424H3D01 | 373652 | 1 | 1 | 2 | - | - | - | - | - | - |
| | MMF-08C24DS-F | 373700 | - | - | - | 2 | - | - | - | - | - |
| | MMF-12C24DH-FA1 | 373701D | - | - | - | - | 2 | 2 | 2 | - | - |
| | MMF-12C24DH-RA2 | 373701B | - | - | - | - | - | - | - | 3 | 3 |
| Regenerative Resistor | MUC22N470JIX570CER | 429525 | 1 | 1 | - | - | - | - | - | - | - |
| | MUC22N290JIX570CER | 429521 | - | - | 1 | - | - | - | - | - | - |
| | MUC22N6R8JIX570CER | 429522 | - | - | - | 2 | - | - | - | - | - |
| Precharge Resistor | RGBS40HS10ΩK | 422466 | - | - | - | 1 | - | - | - | - | - |
| Relay | G7L-2A-BUB (DC24V) | 307537 | - | - | - | 1 | - | - | - | - | - |
| Connector Plug (CN2) Shell | 10150-3000VE | 359803 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 10350-42A0-008 | 359810 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Connector Plug (CN9) Shell | 10120-3000VE | 359801 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 10320-52A0-008 | 359811 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

(1) The fuse specification for inverter unit having no unit revision number is "A50P400".

Table 8.4 - Spare Part List for 200-230 VAC Dedicated Type Converter Units

| Name of Part | Standard/ Specifications | Part Number | Quantity | | | | |
|---|---|---|---|---|---|---|---|
| | | | UAZ-3222 | UAZ-3222-A | UAZ-3237 | UAZ-3237-A | UAZ-3275 |
| Control Board [1] | DCVR-5 | 826705 | 1 | 1 | 1 | 1 | - |
| | ACDC-3 (ACDC-2) [2] | 826733 | - | - | - | - | 1 |
| Power Board [1] | ACDC-1 | 826704 | 1 | - | 1 | - | - |
| | ACDC-5 | 826748 | - | 1 | - | 1 | 1 |
| Snubber Board | 60-50398-01 | 391024 | - | - | - | - | 1 |
| Rectifier | DF200BA80 | 512902 | 1 | 1 | - | - | - |
| | DD110F-80 | 514704 | - | - | 1 | 1 | - |
| | PAH2008 | 574931 | - | - | - | - | 1 |
| Regenerative Transistor | QM150E3Y-H | 534601 | 1 | - | - | - | - |
| | SQD300BA060 | 534807 | - | - | 1 | - | - |
| | GM150E3U-12H | 529209 | - | 1 | - | - | - |
| | CM300E3U-12H | 529210 | - | - | - | 1 | - |
| | 1MBI300L-060 | 534906 | - | - | - | - | 1 |
| Capacitor | HCGF6A2W562NDS | 453201B | 2 | 2 | - | - | - |
| | HCGF6A2W562IDS | 453201C | - | - | 2 | 2 | - |
| | HCGF5A2G472IE10R | 453136C | - | - | - | - | 2 |
| Cooling Fan | MMF-12C24DH-RA2 | 373701B | 1 | 1 | 1 | 1 | - |
| | MB-B5100A | 926501A | - | - | - | - | 1 |
| Regenerative Resistor | RGH400LSY7.5ΩK | 429715A | 2 | 2 | - | - | - |
| | RGHS400LSY4.0ΩK | 429720 | - | - | 2 | 2 | - |
| | RGHS400LSY4.7ΩK | 429716 | - | - | - | - | 3 |
| Precharge Resistor | RGHS150LSY3.9ΩK | 429352 | 1 | 1 | - | - | - |
| | RGHS400LSY2.4ΩK | 429719 | - | - | 1 | 1 | - |
| Relay | SD-N35 (DC24V) | 302113 | 1 | 1 | 1 | 1 | - |

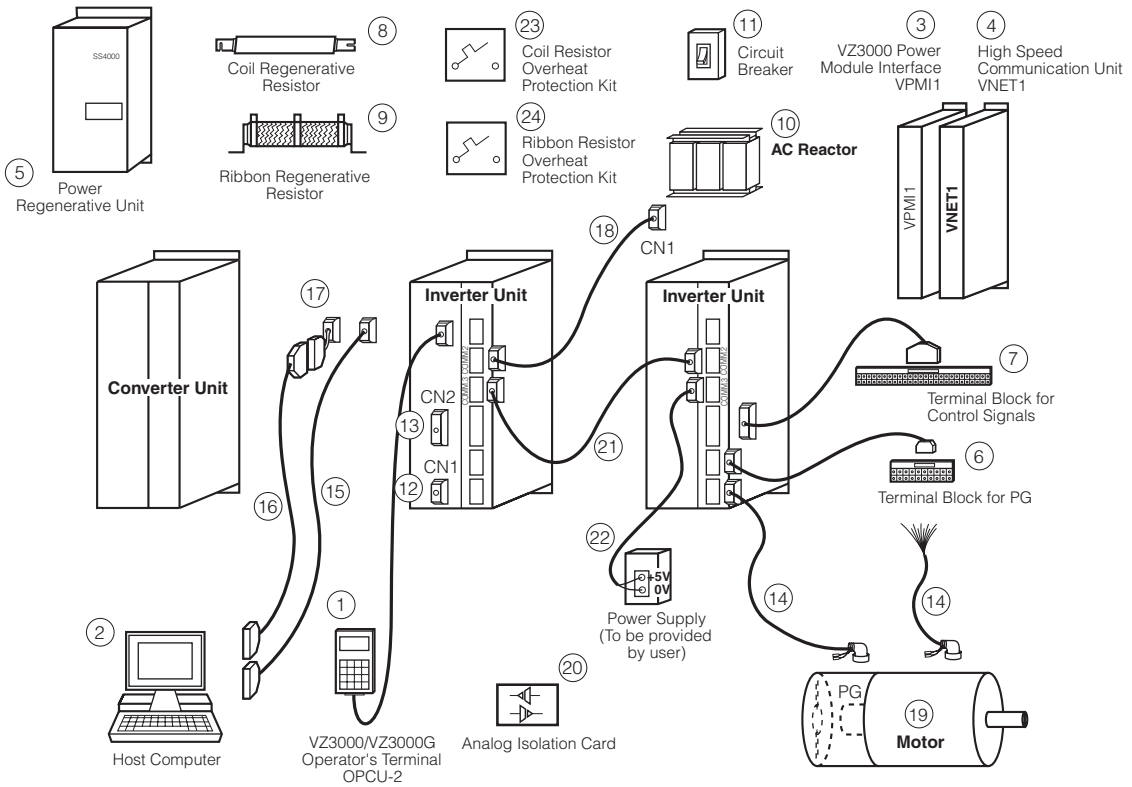
[1] Use Revision 0.3 or later of Control Boardf DCVR-5 together with Revision 0.2 or later of Control Board ACDC-1 as a set.
Use Revision 0.2 or earlier of Control Boardf DCVR-5 together with Revision 0.1 or earlier of Control Board ACDC-1 as a set.
[2] Use Control Board ACDC-3 for replacement of Control Board ACDC-2.

# CHAPTER 9

# Peripherals

## 9.1 Optional Items

Figure 9.1 shows the optional items.




| No. | Name of Optional Items | Specifications | Instruction Manual |
|---|---|---|---|
| 1 | VZ3000/VZ3000G Operator's Terminal OPCU-2 and Cable | Separate Information | 32021 |
| 2 | Software for Host Computer | Separate Information | 32027 |
| 3 | VZ3000 Power Module Interface VPMI1 | Separate Information | 32025 and 32026 |
| 4 | High Speed Communication Unit VNET1 | Separate Information | 32024 |
| 5 | Power Regenerating Unit | See Section 9.7. | 35001 |
| 6 | Terminal Block and Cable for PG | Separate Information | 51010 |
| 7 | Terminal Block and Cable for Control Signals | Separate Information | 51011 |
| 8 | Coil Regenerative Resistor | See Section 9.8. | – |
| 9 | Ribbon Regenerative Resistor | See Section 9.8. | – |
| 10 | AC Reactor | See Section 9.4. | – |
| 11 | Circuit Breaker | Table 4.8 or 4.9 | – |
| 12 | Connector for PG | Table 4.2 (Accessory) | – |
| 13 | Connector for Control Signals | Table 4.1 (Accessory) | – |

| No. | Name of Optional Items | Specifications | Instruction Manual |
|---|---|---|---|
| 14 | Pulse Encoder (PG) Cable | See Section 9.3. | 51010 |
| 15 | Host Computer Cable 1 | Separate Information | 51009 |
| 16 | Host Computer Cable 2 | Separate Information | 51009 |
| 17 | Conversion Cable for Host Computer | Separate Information | 51009 |
| 18 | Connection Cable between VZ3000 Units | Separate Information | 51009 |
| 19 | AC Motor | See Section 9.2. | – |
| 20 | Analog Isolation Card | Separate Information | – |
| 21 | Communication Cable in Cascade System (MB-B5032) | Separate Information | 51009 |
| 22 | Power Supply Cable in Cascade System (MB-B5040) | Separate Information | 51009 |
| 23 | Coil Resistor Overheat Protection Kit (MB-B5071/B5142) | See Section 9.8. | – |
| 24 | Ribbon Resistor Overheat Protection Kit (MB-B5072/B5143) | See Section 9.8. | – |

Figure 9.1 - Optional Items

## 9.2 Motor Specifications

The specifications of typical 400 V class and 200 V class standard inertia motors and low inertia (servo) motors are shown in Tables 9.1 through 9.4. Other types of motors such as constant horsepower motors are also available.

Table 9.1 - Specifications of 400 V Class Standard Inertia Motors

| Description \ Model No. | | VMGF-400115 | VMGF-400215 | VMGF-400315 | VMGF-400515 | VMGF-400715 | VMGF-401115 | VMGF-401515 | VMGF-401815 | VMGF-402215 | VMGF-403015 | VMGF-403715 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated Output (kW) | | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 |
| Base Speed (r/min) (1) | | 1500 | | | | | | | | | | |
| Max. Speed (r/min) (1) | | 3600 | | | | | | | | | 3000 | |
| Rated Current (Arms) (2) | | 4.7 | 6.3 | 10 | 15.5 | 20.5 | 29 | 37 | 45 | 53 | 71 | 85 |
| Rated Torque (N-m (kg-m)) | | 9.5 (0.97) | 14.0 (1.43) | 23.5 (2.40) | 35.0 (3.57) | 47.7 (4.87) | 70.0 (7.14) | 95.5 (9.74) | 117.6 (12.0) | 140.1 (14.3) | 191.1 (19.5) | 235.2 (24.0) |
| Overload Capacity | | 150% for 60 seconds | | | | | | | | | | |
| Speed Feedback | | Pulse Encoder of 2048 PPR | | | | | | | | | | |
| Insulation Class | | Class F | | | | | | | | | | |
| Vibration, Noise | | V 10/75 dB (A) | | | | | | | | | V 10/80 dB (A) | |
| Protection/Cooling Method | | Totally Enclosed Separately Ventilated Type | | | | | | | | | | |
| Installation | | Foot Mounted Type | | | | | | | | | | |
| Cooling Fan (3) | Power Supply | Single-phase 200 VAC, 50 Hz or 200/230 VAC, 60 Hz | | | | | Three-phase 200 VAC, 50 Hz or 200/230 VAC, 60 Hz | | | | | |
| | Capacity (W) | 50/70 | | | | | 170/190 | | | | 150/210 | |
| Paint Color | | Munsell N5 | | | | | | | | | | |
| Ambinet Temperature | | 0 to 40 degree C (32 to 104 degree F) | | | | | | | | | | |
| Weight (kg) | | 28 | 32 | 50 | 65 | 75 | 115 | 135 | 190 | 220 | 265 | 295 |

(1) r/min means revoluation per minute.
(2) The rated current values for VMGF-400115, VMGF-400215, VMGF-401815 and VMGF-403715 are interim values.
(3) For 400 V motor, provide a transformer for cooling fan motor, because 200/230 VAC motor is used for cooling fan.

Table 9.2 - Specifications of 400 V Class Low Inertia (Servo) Motors

| Description \ Model No. | VMSM-400015 | VMSM-400115 | VMSM-400215 | VMSM-400315 | VMSM-400515 | VMSM-400715 | VMSM-401115 | VMSM-401515 | VMSM-402215-H | VMSM-403010-H |
|---|---|---|---|---|---|---|---|---|---|---|
| Rated Output (kW) | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 22 | 30 |
| Base Speed (r/min) (1) | 1500 | | | | | | | | | 1000 |
| Max. Speed (r/min) (1) | 2000 | | | | | | | | | |
| Rated Current (Arms) | 2.8 (2) | 5.4 | 7.3 | 12.3 | 17.3 | 22 | 34 | 42 | 58.5 | 88 |
| Rated Torque (N-m (kg-m)) | 4.8 (0.49) | 9.5 (0.97) | 14.0 (1.43) | 23.5 (2.40) | 35.0 (3.57) | 47.8 (4.87) | 70.0 (7.14) | 95.5 (9.74) | 140 (14.3) | 286 (29.2) |
| Overload Capacity | 150% for 60 seconds or 200% for 30 seconds | | | | | | | | | |
| Speed Feedback | Pulse Encoder of 2048 PPR | | | | | | | | | |
| Insulation Class | Class F | | | | | | | | | |
| Vibration, Noise | V 10/75 dB (A) | | | | | | | | | V 15/80 dB (A) |
| Protection/Cooling Method | (4) | Totally Enclosed Separately Ventilated Type | | | Drip-proof Separately Ventilated Type | | | | | |
| Installation | Flanged Type (Horizontal) | | | | | | | | Foot Mounted Type (5) | |
| Cooling Fan (3) Power Supply | - | Single-phase 200 VAC, 50 Hz or 200/230 VAC, 60 Hz | | | | | Three-phase 200 VAC, 50 Hz or 200/230 VAC, 60 Hz | | | |
| Cooling Fan (3) Capacity (W) | - | 34 | | | | | 100 | | | 750 |
| Paint Color | Body: Munsell N1.5, Cover: Munsell N9.5 | | | | | | | | | Munsell N1.5 |
| Ambinet Temperature | 0 to 40 degree C (32 to 104 degree F) | | | | | | | | | |
| Weight (kg) | 36 | 37 | 38 | 40 | 70 | 75 | 135 | 140 | 200 | 300 |

(1) r/min means revoluation per minute.
(2) The above-mentioned rated current value for 0.75 kW motor is an interim value.
(3) For 400 V motor, provide a transformer for cooling fan motor, because 200/230 VAC motor is used for cooling fan.
(4) The protection and cooling method for 0.75 kW motor is totally enclosed self-ventilated type.
(5) 22 kW motor of flanged type is also available (Model VMGM-402215).

Table 9.3 - Specifications of 200 V Class Standard Inertia Motors

| Description \ Model No. | VMGW-200115 | VMGW-200215 | VMGW-200315 | VMGW-200515 | VMGW-200715 | VMGW-201115 | VMGW-201515 | VMGW-201815 | VMGW-202215 | VMGM-203015 | VMGM-203715 | VMGM-204515 | VMGM-205515 | VMGM-207515 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated Output (kW) | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 |
| Base Speed (r/min) (1) | 1500 | | | | | | | | | | | | | |
| Max. Speed (r/min) (1) | 2250 | | | | | | | | | 2000 | | | | |
| Rated Current (Arms) | 7.5 | 11.0 | 17.9 | 23.2 | 32.7 | 47.0 | 63.0 | 76.0 | 90.0 | 145.0 | 183.0 | 220.0 | 260.0 | 346.0 |
| Rated Torque (N-m (kg-m)) | 9.5 (0.97) | 14.0 (1.43) | 23.5 (2.40) | 35.0 (3.57) | 47.8 (4.87) | 70.0 (7.14) | 95.5 (9.74) | 118 (12.0) | 140 (14.3) | 191 (19.5) | 235 (24.0) | 286 (29.2) | 350 (35.7) | 477 (48.7) |
| Overload Capacity | 150% for 60 seconds | | | | | | | | | | | | | |
| Speed Feedback | Pulse Encoder of 2048 PPR | | | | | | | | | | | | | |
| Insulation Class | Class F | | | | | | | | | | | | | |
| Vibration, Noise | V 10/75 dB (A) | | | | | | | | | V 15/85 dB (A) | | | | |
| Protection/Cooling Method | Totally Enclosed Separately Ventilated Type | | | | | | | | | Drip-proof Separately Ventilated Type | | | | |
| Installation | Flanged Type | Foot Mounted Type | | | | | | | | | | | | |
| Cooling Fan (3) Power Supply | Single-phase 200 VAC, 50 Hz or 200/230 VAC, 60 Hz | | | | | Three-phase 200 VAC, 50 Hz or 200/230 VAC, 60 Hz | | | | | | | | |
| Cooling Fan (3) Capacity (W) | 22 | 50 | 80 | | | 135 | | | | 750 | | | | |
| Paint Color | Munsell 7.5BG 6/1.5 | | | | | | | | | Munsell N1.5 | | | | |
| Ambinet Temperature | 0 to 40 degree C (32 to 104 degree F) | | | | | | | | | | | | | |
| Weight (kg) | 28 | 37 | 50 | 67 | 77 | 105 | 120 | 170 | 195 | 225 | 225 | 300 | 335 | 390 |

(1) r/min means revoluation per minute.

Table 9.4 - Specifications of 200 V Class Low Inertia (Servo) Motors

| Description \ Model No. | | VMSM-200015 | VMSM-200115 | VMSM-200215 | VMSM-200315 | VMSM-200515 | VMSM-200715 | VMSM-201115 | VMSM-201515 | VMSM-202215 | VMSM-203010 | VMSM-203710 | VMSM-205510 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated Output (kW) | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 22 | 30 | 37 | 55 |
| Base Speed (r/min) (1) | | 1500 | | | | | | | | | 1000 | | |
| Max. Speed (r/min) (1) | | 2000 | | | | | | | | | 1000 | | |
| Rated Current (Arms) | | 5.3 | 11.4 | 15 | 24.5 | 34.8 | 44 | 67.1 | 80.7 | 120 | 176.0 | 210.0 | 334.0 |
| Rated Torque (N-m (kg-m)) | | 4.8 (0.49) | 9.5 (0.97) | 14.0 (1.43) | 23.5 (2.40) | 35.0 (3.57) | 47.8 (4.87) | 70.0 (7.14) | 95.5 (9.74) | 140 (14.3) | 286 (29.2) | 353 (36.0) | 526 (53.6) |
| Overload Capacity | | 150% for 60 seconds, 200% for 30 seconds or 300% for 10 seconds | | | | | | | | | | | |
| Speed Feedback | | Pulse Encoder of 2048 PPR | | | | | | | | | | | |
| Insulation Class | | Class F | | | | | | | | | | | |
| Vibration, Noise | | V 10/75 dB (A) | | | | | | | | | | | |
| Protection/Cooling Method | | (2) | Totally Enclosed Separately Ventilated Type | | | Drip-proof Separately Ventilated Type | | | | | | | |
| Installation | | Flanged Type (Horizontal) | | | | | | | | | Foot Mounted Type | | |
| Cooling Fan (3) | Power Supply | - | Single-phase 200 VAC, 50 Hz or 200/230 VAC, 60 Hz | | | | | Three-phase 200 VAC, 50 Hz or 200/230 VAC, 60 Hz | | | | | |
| | Capacity (W) | - | 34 | | | | | 80 | | | 750 | | |
| Paint Color | | Body: Munsell N1.5, Cover: Munsell N9.5 | | | | | | | | | Munsell N1.5 | | |
| Ambinet Temperature | | 0 to 40 degree C (32 to 104 degree F) | | | | | | | | | | | |
| Weight (kg) | | 36 | 37 | 38 | 40 | 70 | 75 | 135 | 140 | 200 | 300 | 320 | 400 |

(1) r/min means revoluation per minute.
(2) The protection and cooling method for 0.75 kW motor is totally enclosed self-ventilated type.

### 9.2.1 Appropriate Unit for Each Motor

**Important:** To select a VZ3000 drive for your motor, rated output current and instantaneous maximum output current of the controller must be larger than rated current and overload current of the motor.

Tables 9.5 and 9.6 show appropriate unit model numbers for 400 V and 200 V class motors respectively.

Table 9.5 - Appropriate Unit Model Numbers for 400 V Class Motors

| Motor (kW) | | **0.75** | **1.5** | **2.2** | **3.7** | **5.5** | **7.5** | **11** | **15** | **18.5** | **22** | **30** | **37** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Speed (r/min) [1] | | 1500 | | | | | | | | | | | |
| Input Power Capacity (kVA) [2] | | 1.4 | 2.9 | 4.2 | 7.0 | 10.5 | 14.3 | 21.0 | 28.6 | 35.2 | 41.9 | 57.2 | 67.3 |
| Standard Motor (Overload Capacity 150% 60 sec) | Standard Type [3] | UVZC3001 | | UVZC3003 | | UVZC3007 | | UAZ3022(-A) UVZ3022 | | | | UAZ3030(-A) UVZ3030 | UAZ3037(-A) UVZ3037 |
| | Low Noise Type [3] [4] | UVZC3001N | | UVZC3003N | | UVZC3007N | | UAZ3022(-A) UVZ3022N | | | | UAZ3030(-A) UVZ3030N | UAZ3037(-A) UVZ3037N |
| Servo Motor (Overload Capacity 150% 60 sec) | Standard Type [3] | – | UVZC-3001 | UVZC-3003 | UVZC3007 | | | UAZ3022(-A) UVZ3022 | | – | UAZ3022(-A) UVZ3022 | UAZ3455 UVZ3455 [5] | |
| Servo Motor (Overload Capacity 200% 30 sec) | Standard Type [3] | – | UVZC3003 | | UVZC3007 | | UAZ3022(-A) UVZ3022 | | | – | UAZ3022(-A) UVZ3030 | UAZ3455 UVZ3455 [5] | UAZ3455 UVZ3475 [5] |

[1] r/min means revolution per minute.

[2] The input power capacity shows the values at the rated output with three-phase input power. Use AC reactor shown in Table 9.9 for converter unit of 37 kW. When AC reactor shown in Table 9.9 is installed in AC input line of converter unit of 0.75 to 30 kW, input power capacity is approx. 80% of the above values.

[3] The above table is based on 5 kHz of carrier frequency for standard type unit and 10 kHz for low noise type unit, except UVZ3030 and UVZ3037. For standard type and low noise type of UVZ3030 and UVZ3037, 3 kHz and 5 kHz of carrier frequency are used respectively. If you use inverter units with a carrier frequency other than the above, see Table 2.6 and Figure 7.14 or 7.15 for reduction of rated output.

[4] When a low noise type unit is used, disable "Variable Carrier Frequency" of the Control Parameter and set "Carrier Frequency Calibration" of the Application Parameter to 66%.

[5] Refer to the instruction manual of VZ3000 380-460 VAC Drive Hardware (IM 32022).

Table 9.6 - Appropriate Unit Model Numbers for 200 V Class Motors

| Motor (kW) | | **0.75** | **1.5** | **2.2** | **3.7** | **5.5** | **7.5** | **11** | **15** | **18.5** | **22** | **30** | **37** | **45** | **55** | **75** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Speed (r/min) [1] | | 1500 | | | | | | | | | | | | | | |
| Input Power Capacity (kVA) [2] | | 1.4 | 2.9 | 4.2 | 7.0 | 10.5 | 14.3 | 21.0 | 28.6 | 35.2 | 34.1 | 46.4 | 57.3 | 69.7 | 85.1 | 116.1 |
| Standard Motor (Overload Capacity 150% 60 sec) | Standard Type [3] | UVZC3201 | | UVZC-3202 | UVZC-3203 | UVZC3207 | | UAZ3222(-A) UVZ3222 | | | | UAZ-3237(-A) UVZ-3230 | UAZ-3237(-A) UVZ-3237 | UAZ3275 UVZ3255 | | UAZ-3275 UVZ-3275 |
| | Low Noise Type [3] [4] | UVZC3201N | | UVZC-3202N | UVZC-3203N | UVZC3207N | | UAZ3222(-A) UVZ3222N | | | UAZ-3222(-A) UVZ-3230N | UAZ-3237(-A) UVZ-3237N | UAZ3237(-A) UVZ3255N | | UAZ-3275 UVZ-3275N | – |
| Servo Motor (Overload Capacity 150% 60 sec) | Standard Type [3] | UVZC-3201 | UVZC-3202 | UVZC-3203 | UVZC3207 | | UAZ3222(-A) UVZ3222 | | | – | UAZ-3222(-A) UVZ-3230 | UAZ-3237(-A) UVZ-3237 | UAZ-3237(-A) UVZ-3255 | – | UAZ-3275 UVZ-3275 | – |
| Servo Motor (Overload Capacity 200% 30 sec) | Standard Type [3] | UVZC-3201 | UVZC-3202 | UVZC-3203 | UVZC-3207 | UAZ3222(-A) UVZ3222 | | UAZ-3222(-A) UVZ-3230 | | – | UAZ-3237(-A) UVZ-3237 | UAZ3275 UVZ3255 | | – | – | – |

[1] r/min means revolution per minute.

[2] The input power capacity shows the values at the rated output with three-phase input power. Use AC reactor shown in Table 9.8 for converter unit of 22 to 75 kW. When AC reactor shown in Table 9.8 is installed in AC input line of converter unit of 0.75 to 18.5 kW, input power capacity is approx. 80% of the above values.

[3] The above table is based on 5 kHz of carrier frequency for standard type unit and 10 kHz for low noise type unit, except UVZ3222, UVZ3230 and UVZ3237. For standard type and low noise type of UVZ3222, UVZ3230 and UVZ3237, 3 kHz and 5 kHz of carrier frequency are used respectively. If you use inverter units with a carrier frequency other than the above, see Table 2.5 and Figure 7.14 or 7.15 for reduction rate of rated current.

[4] When a low noise type unit is used, disable "Variable Carrier Frequency" of the Control Parameter and set "Carrier Frequency Calibration" of the Application Parameter to 66%.

## 9.3 Pulse Encoder (PG) Cable

Table 9.7 shows the kinds of pulse encoder (PG) cables and their connection.

Table 9.7 - Kinds of Pulse Encoder (PG) Cables and their Connection

| Kind of Cable | Model No. | Cable Length (m) | Weight (kg) |
|---|---|---|---|
|  | MB-B5026A-5 | 4.6 | 0.6 |
| | MB-B5026A-8 | 7.6 | 0.9 |
| | MB-B5026A-15 | 15.2 | 1.7 |
| | MB-B5026A-30 | 30.5 | 3.4 |
| | MB-B5026A-N | N | 0.11N |

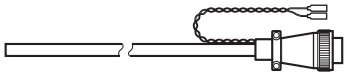
**Unit Side Connector**

| Signal | Pin No. |
|---|---|
| PA | 1 |
| PA/ | 11 |
| PB | 3 |
| PB/ | 13 |
| PZ | 5 |
| PZ/ | 15 |
| SP1 | 7 |
| SP2 | 17 |
| MT1 | 9 |
| MT2 | 19 |
| +12VI | 10 |
| +12VI | 20 |
| +S | 8 |
| +12VI | 18 |
| PG5 | 6 |
| 0VI | 16 |
| PG5 | 4 |
| 0VI | 14 |
| PG5 | 2 |
| 0VI | 12 |

| | |
|---|---|
| P | ORANGE 1 BLACK |
| | ORANGE 1 RED |
| P | GRAY 1 BLACK |
| | GRAY 1 RED |
| P | WHITE 1 BLACK |
| | WHITE 1 RED |
| P | YELLOW 1 BLACK |
| | YELLOW 1 RED |
| P | PINK 1 BLACK |
| | PINK 1 RED |
| P | ORANGE 2 BLACK |
| | ORANGE 2 RED |
| P | GRAY 2 BLACK |
| | GRAY 2 RED |
| P | WHITE 2 BLACK |
| | WHITE 2 RED |
| P | YELLOW 2 BLACK |
| | YELLOW 2 RED |
| P | PINK 2 BLACK |
| | PINK 2 RED |
| | SHIELD |

**PG Side Connector**

| Signal | Pin No. |
|---|---|
| PA | 1 |
| PA/ | 2 |
| PB | 8 |
| PB/ | 9 |
| PZ | 10 |
| PZ/ | 11 |
| SP1 | 5 |
| SP2 | 15 |
| MT1 | Hook-headed Terminal |
| MT2 | Hook-headed Terminal |
| +12VI | 12 |
| +12VI | 12 |
| +S | 16 |
| +12VI | 12 |
| PG5 | 16 |
| 0VI | 7 |
| PG5 | 13 |
| 0VI | 7 |
| PG5 | 13 |
| 0VI | 7 |
| SH | 4 |

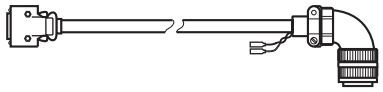
| Kind of Cable | Model No. | Cable Length (m) | Weight (kg) |
|---|---|---|---|
|  | MB-B5027-5 | 4.6 | 0.6 |
| | MB-B5027-8 | 7.6 | 0.9 |
| | MB-B5027-15 | 15.2 | 1.7 |
| | MB-B5027-30 | 30.5 | 3.4 |
| | MB-B5027-N | N | 0.11N |

**PG Side Connector**

| | |
|---|---|
| P | ORANGE 1 BLACK |
| | ORANGE 1 RED |
| P | GRAY 1 BLACK |
| | GRAY 1 RED |
| P | WHITE 1 BLACK |
| | WHITE 1 RED |
| P | YELLOW 1 BLACK |
| | YELLOW 1 RED |
| P | PINK 1 BLACK |
| | PINK 1 RED |
| P | ORANGE 2 BLACK |
| | ORANGE 2 RED |
| P | GRAY 2 BLACK |
| | GRAY 2 RED |
| P | WHITE 2 BLACK |
| | WHITE 2 RED |
| P | YELLOW 2 BLACK |
| | YELLOW 2 RED |
| P | PINK 2 BLACK |
| | PINK 2 RED |
| | SHIELD |

| Signal | Pin No. |
|---|---|
| PA | 1 |
| PA/ | 2 |
| PB | 8 |
| PB/ | 9 |
| PZ | 10 |
| PZ/ | 11 |
| SP1 | 5 |
| SP2 | 15 |
| MT1 | Hook-headed Terminal |
| MT2 | Hook-headed Terminal |
| +12VI | 12 |
| +12VI | 12 |
| +S | 16 |
| +12VI | 12 |
| PG5 | 16 |
| 0VI | 7 |
| PG5 | 13 |
| 0VI | 7 |
| PG5 | 13 |
| 0VI | 7 |
| SH | 4 |

Table 9.7 - Kinds of Pulse Encoder (PG) Cables and their Connection (continued)

| Kind of Cable | Model No. | Cable Length (m) | Weight (kg) |
|---|---|---|---|
|  | MB-B5024A-5 | 4.6 | 0.6 |
| | MB-B5024A-8 | 7.6 | 0.9 |
| | MB-B5024A-15 | 15.2 | 1.7 |
| | MB-B5024A-30 | 30.5 | 3.4 |
| | MB-B5024A-N | N | 0.11N |

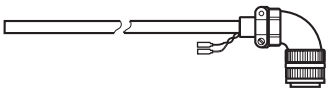
**Unit Side Connector**

| Signal | Pin No. |
|---|---|
| PA | 1 |
| PA/ | 11 |
| PB | 3 |
| PB/ | 13 |
| PZ | 5 |
| PZ/ | 15 |
| SP1 | 7 |
| SP2 | 17 |
| MT1 | 9 |
| MT2 | 19 |
| +12VI | 10 |
| +12VI | 20 |
| +S | 8 |
| +12VI | 18 |
| PG5 | 6 |
| 0VI | 16 |
| PG5 | 4 |
| 0VI | 14 |
| PG5 | 2 |
| 0VI | 12 |

| | | |
|---|---|---|
| P | ORANGE 1 BLACK | |
| | ORANGE 1 RED | |
| P | GRAY 1 BLACK | |
| | GRAY 1 RED | |
| P | WHITE 1 BLACK | |
| | WHITE 1 RED | |
| P | YELLOW 1 BLACK | |
| | YELLOW 1 RED | |
| P | PINK 1 BLACK | |
| | PINK 1 RED | |
| P | ORANGE 2 BLACK | |
| | ORANGE 2 RED | |
| P | GRAY 2 BLACK | |
| | GRAY 2 RED | JUMPER |
| P | WHITE 2 BLACK | |
| | WHITE 2 RED | |
| P | YELLOW 2 BLACK | |
| | YELLOW 2 RED | |
| P | PINK 2 BLACK | |
| | PINK 2 RED | |
| | SHIELD | |

**PG Side Connector**

| Signal | Pin No. |
|---|---|
| PA | A |
| PA/ | B |
| PB | C |
| PB/ | D |
| PZ | E |
| PZ/ | F |
| SP1 | N |
| SP2 | P |
| MT1 | L (Hook-headed Terminal) |
| MT2 | M (Hook-headed Terminal) |
| +12VI | G |
| +12VI | G |
| +S | R |
| +12VI | G |
| PG5 | R |
| 0VI | H |
| PG5 | S |
| 0VI | H |
| PG5 | S |
| 0VI | H |
| SH | K |

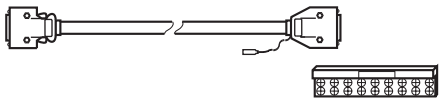
| Kind of Cable | Model No. | Cable Length (m) | Weight (kg) |
|---|---|---|---|
|  | MB-B5025A-5 | 4.6 | 0.6 |
| | MB-B5025A-8 | 7.6 | 0.9 |
| | MB-B5025A-15 | 15.2 | 1.7 |
| | MB-B5025A-30 | 30.5 | 3.4 |
| | MB-B5025A-N | N | 0.11N |

**PG Side Connector**

| | |
|---|---|
| P | ORANGE 1 BLACK |
| | ORANGE 1 RED |
| P | GRAY 1 BLACK |
| | GRAY 1 RED |
| P | WHITE 1 BLACK |
| | WHITE 1 RED |
| P | YELLOW 1 BLACK |
| | YELLOW 1 RED |
| P | PINK 1 BLACK |
| | PINK 1 RED |
| P | ORANGE 2 BLACK |
| | ORANGE 2 RED |
| P | GRAY 2 BLACK |
| | GRAY 2 RED |
| P | WHITE 2 BLACK |
| | WHITE 2 RED |
| P | YELLOW 2 BLACK |
| | YELLOW 2 RED |
| P | PINK 2 BLACK |
| | PINK 2 RED |
| | SHIELD |

| Signal | Pin No. |
|---|---|
| PA | A |
| PA/ | B |
| PB | C |
| PB/ | D |
| PZ | E |
| PZ/ | F |
| SP1 | N |
| SP2 | P |
| MT1 | L (Hook-headed Terminal) |
| MT2 | M (Hook-headed Terminal) |
| +12VI | G |
| +12VI | G |
| +S | R |
| +12VI | G |
| PG5 | R |
| 0VI | H |
| PG5 | S |
| 0VI | H |
| PG5 | S |
| 0VI | H |
| SH | K |

Table 9.7 - Kinds of Pulse Encoder (PG) Cables and their Connection (continued)

| Kind of Cable | Model No. | Cable Length (m) | Weight (kg) |
|---|---|---|---|
|  | MB-B5035A-1 | 0.6 | 0.1 |
| | MB-B5035A-2 | 1.6 | 0.2 |
| | MB-B5035A-3 | 2.6 | 0.3 |
| | | | |

**Unit Side Connector**

| Signal | Pin No. |
|---|---|
| PA | 1 |
| PA/ | 11 |
| PB | 3 |
| PB/ | 13 |
| PZ | 5 |
| PZ/ | 15 |
| SP1 | 7 |
| SP2 | 17 |
| MT1 | 9 |
| MT2 | 19 |
| +12VI | 10 |
| +12VI | 20 |
| +S | 8 |
| +12VI | 18 |
| PG5 | 6 |
| 0VI | 16 |
| PG5 | 4 |
| 0VI | 14 |
| PG5 | 2 |
| 0VI | 12 |

| | | |
|---|---|---|
| P | ORANGE 1 BLACK | |
| | ORANGE 1 RED | |
| P | GRAY 1 BLACK | |
| | GRAY 1 RED | |
| P | WHITE 1 BLACK | |
| | WHITE 1 RED | |
| P | YELLOW 1 BLACK | |
| | YELLOW 1 RED | |
| P | PINK 1 BLACK | |
| | PINK 1 RED | |
| P | ORANGE 2 BLACK | |
| | ORANGE 2 RED | |
| P | GRAY 2 BLACK | |
| | GRAY 2 RED | |
| P | WHITE 2 BLACK | |
| | WHITE 2 RED | |
| P | YELLOW 2 BLACK | |
| | YELLOW 2 RED | |
| P | PINK 2 BLACK | |
| | PINK 2 RED | |
| | SHIELD | GREEN |

**PG Side Connector**

| Signal | Terminal No. |
|---|---|
| PA | 1 |
| PA/ | 11 |
| PB | 3 |
| PB/ | 13 |
| PZ | 5 |
| PZ/ | 15 |
| SP1 | 7 |
| SP2 | 17 |
| MT1 | 9 |
| MT2 | 19 |
| +12VI | 10 |
| +12VI | 20 |
| +S | 8 |
| +12VI | 18 |
| PG5 | 6 |
| 0VI | 16 |
| PG5 | 4 |
| 0VI | 14 |
| PG5 | 2 |
| 0VI | 12 |
| SH | |

## 9.4 AC Reactor

### 9.4.1 Specifications of AC Reactors

AC reactor should be selected to conform to motor capacity. Tables 9.8 and 9.9 show recommended AC reactor to be selected for each motor. Table 9.8 shows AC reactors for 200 V class motors and Table 9.9 for AC reactors for 400 V class motors. If you desire to know outline dimensions of AC reactors or to use an AC reactor for an overload capacity other than 150%, contact Reliance Electric. Note that two reactors connected in series are used for 400 V class motor of 2.2 KW.

Table 9.8 - Selection of AC Reactors for 200 V Motors
(for Overload Capacity of 150 %, 60 Seconds)

| Motor Capacity (KW) | Model Number of AC Reactor | Rated Current (Arms) | Rated Inductance (Micro-henry) |
|---|---|---|---|
| 0.75 | LS3-5 / 4-1 | 5 | 2880 |
| 1.5 | LS3-10 / 4-1 | 10 | 1440 |
| 2.2 | LS3-15 / 4-1 | 15 | 960 |
| 3.7 | LS3-20 / 3-1 | 20 | 540 |
| 5.5 | LS3-30 / 3-1 | 30 | 360 |
| 7.5 | LS3-40 / 3-1 | 40 | 270 |
| 11 | LS3-60 / 3-1 | 60 | 180 |
| 15 | LS3-80 / 3-1 | 80 | 135 |
| 18.5 | LS3-100 / 3-1 | 100 | 108 |
| 22 | LS3-125 / 3-1 | 125 | 84 |
| 30 | LS3-160 / 3-1 | 160 | 66 |
| 37 | LS3-200 / 3-1 | 200 | 54 |
| 45 | LS3-250 / 3-1 | 250 | 42 |
| 55 | LS3-300 / 3-1 | 300 | 36 |
| 75 | LS3-400 / 3-1 | 400 | 27 |

Table 9.9 - Selection of AC Reactors for 400 V Motors
(for Overload Capacity of 150 %, 60 Seconds)

| Motor Capacity (KW) | Model Number of AC Reactor | Rated Current (Arms) | Rated Inductance (Micro-henry) |
|---|---|---|---|
| 1.5 | LS3-5 / 6-1 | 5 | 4320 |
| 2.2 | Two LS3-10 / 4-1 in Series | 10 | 2880 |
| 3.7 | LS3-10 / 3-1 | 10 | 2160 |
| 5.5 | LS3-15 / 6-1 | 15 | 1440 |
| 7.5 | LS3-20 / 6-1 | 20 | 1080 |
| 11 | LS3-30 / 6-1 | 30 | 720 |
| 15 | LS3-40 / 6-1 | 40 | 540 |
| 18.5 | LS3-50 / 6-1 | 50 | 432 |
| 22 | LS3-60 / 6-1 | 60 | 360 |
| 30 | LS3-80 / 6-1 | 80 | 270 |
| 37 | LS3-100 / 6-1 | 100 | 216 |

## 9.5 ICB Circuit Breaker

It is recommended to install the following ICB circuit breaker in the AC input line of converter unit UAZ3275.

| | |
|---|---|
| Model: | SA403RIN/1250 (Fuji) or equivalent |
| Required quantity: | One (1) |

## 9.6 Fuse

### 9.6.1 Recommended Fuses for AC Input Line

It is recommended to install the following fuse in the AC input line of converter unit UAZ3275 together with the ICB circuit breaker described in Section 9.5.

Fuse:

Model: 6.6URD31EF0630 (Ferraz) or equivalent
Required quantity: Three (3)

Fuse holder:

Model: SE31 J98701 (Ferraz) or equivalent
Required quantity: Three (3)

For the UL/IEC/C-UL listed units, install UL-listed fuse Class RK5 or J in the AC input power line. These units are of chassis type and must be installed in a cabinet. Table 9.10 shows the recommended fuses for the UL/IEC/C-UL listed units.

Table 9.10 - Recommended Fuses and Fuse Holders for the UL/IEC/C-UL Listed Units

| Drive Model | Breaking Current | Recommended Fuse | | Recommended Fuse Holder | |
|---|---|---|---|---|---|
| | | Model Number | Qty | Model Number | Qty |
| UVZC3001 | 9 A | TRS9R (Gould) | 3 | 60328R (Gould) | 3 |
| UVZC3003 | 17.5 A | TRS17 1/2R (Gould) | 3 | 60328R (Gould) | 3 |
| UVZC3007 | 30 A | TRS30R (Gould) | 3 | 60328R (Gould) | 3 |
| UAZ3022 | 85 A | TRS90R (Gould) | 3 | 61038R (Gould) | 3 |
| UAZ3030 | 115 A | TRS125R (Gould) | 3 | 62003R (Gould) | 3 |
| UAZ3037 | 150 A | TRS150R (Gould) | 3 | 62003R (Gould) | 3 |

### 9.6.2 Recommended Fuses for Unitized Type Inverter Units Connected to Common DC Bus

As described in Section 7.19, an appropriate fuse must be connected to DC bus input of each inverter unit when multiple unitized type inverter units are connected to a common DC bus in order to avoid secondary destruction when the units are damaged. Table 9.11 shows the recommended fuses for such purpose.

Table 9.11 - Recommended Fuses and Fuse Holders for Unitized Type Inverter Units Connected to a Common DC Bus

| Drive Model | Recommended Fuse | Recommended Fuse Holder |
|---|---|---|
| UVZC3201 | A50P35 (Gould) | P243G (Gould) |
| UVZC3202 | A50P35 (Gould) | P243G (Gould) |
| UVZC3203 | A50P35 (Gould) | P243G (Gould) |
| UVZC3207 | A50P70 (Gould) | P243E (Gould) |
| UVZC3001 | A100P35 (Gould) | P266G (Gould) |
| UVZC3003 | A100P35 (Gould) | P266G (Gould) |
| UVZC3007 | A100P35 (Gould) | P266G (Gould) |

## 9.7 Power Regenerating Unit

Regenerative energy generated by rapid deceleration of motor or by operation of motor with negative (regenerative) load is returned to incoming power for energy saving by SS4000 Power Regenerating Unit.

### 9.7.1 Features of the SS4000 Power Regenerating Unit

- **More Effective Energy Saving**

  Returning regenerative energy to incoming power realizes more effective energy saving in comparison with conventional method using regenerative resistor.

- **Smaller Mounting Space**

  Because no discharge resistor is required, mounting space can be reduced.

- **Various Capacities Available**

  Available are 18.5 to 55 kW of rated continuous capacities for 200 V class and 37 to 110 kW of rated continuous capacities for 400 V class, having maximum rated capacities of 28 to 82 kW for 200 V class and 55 to 165 kW for 400 V class for short time.

### 9.7.2 Specifications of SS4000 Power Regenerating Unit

The specifications of the SS4000 Power Regenerating Unit are shown in Table 9.11.

Table 9.12 - Specifications of SS4000 Power Regenerating Units

| **Voltage Class** | | **460 V** | | | **230 V** | | |
|---|---|---|---|---|---|---|---|
| **Number of Units Connected in Parallel** | | Single Unit | 2 Units in Parallel | 3 Units in Parallel | Single Unit | 2 Units in Parallel | 3 Units in Parallel |
| **Model Number** | | SS4437 | SS4437<br>SS4437P | SS4437<br>SS4437P<br>SS4437P | SS4218 | SS4218<br>SS4218P | SS4218<br>SS4218P<br>SS4218P |
| **Capacity of Motor to be Applied (KW)** | | 37 | 75 | 110 | 18.5 | 37 | 55 |
| **Input** | **Rated Capacity of Power Supply (KVA)** | 45 | 90 | 135 | 22.5 | 45 | 67.5 |
| | **Input Power Factor** | 0.95 or higher | | | | | |
| | **Power Supply** | Three-phase 380 to 460 VAC +10/-15%, 50/60 Hz +/-3% | | | Three-phase 200 to 230 VAC +10/-15%, 50/60 Hz +/-3% | | |
| | **Rated Current (Arms)** | 65 | 65 x 2 | 65 x 3 | 65 | 65 x 2 | 65 x 3 |
| | **Max. Current (1 min.) (Arms)** | 98 | 98 x 2 | 98 x 3 | 98 | 98 x 2 | 98 x 3 |
| | **PWM Carrier Frequency (kHz)** | 5, 10 (standard), and 15 | | | | | |
| **Output** | **Rated Output Capacity (KVA)** | 45 | 90 | 135 | 22.5 | 45 | 67.5 |
| | **Voltage (V)** | 700 (standard) | | | 350 (standard) | | |
| | **Rated Current (A)** | 64 | 128 | 192 | 64 | 128 | 192 |
| | **Max. Current (1 min.) (A)** | 96 | 192 | 288 | 96 | 192 | 288 |
| **Protection Function** | | Overcurrent, overload, overvoltage, low voltage, and phase loss | | | | | |
| **Output Signals** | | RDY signal, FR signal, instantaneous power loss signal, and main magnetic contactor reference contact | | | | | |
| **Monitor Display (by means of four-character seven-segment LED)** | | Input current, input power supply voltage, DC bus voltage, power, and load ratio | | | | | |

Table 9.12 - Specifications of SS4000 Power Regenerating Units (continued)

| Voltage Class | | 460 V | | | 230 V | | |
|---|---|---|---|---|---|---|---|
| Number of Units Connected in Parallel | | Single Unit | 2 Units in Parallel | 3 Units in Parallel | Single Unit | 2 Units in Parallel | 3 Units in Parallel |
| Model Number | | SS4437 | SS4437<br>SS4437P | SS4437<br>SS4437P<br>SS4437P | SS4218 | SS4218<br>SS4218P | SS4218<br>SS4218P<br>SS4218P |
| Input Signals | | RUN signal, RESET signal, and answer-back signal of main magnetic contactor | | | | | |
| Environment | Place of Installation | In a control cabinet (kept away from oil mist, metal powder, dust, other airborne contaminants, corrosive gas, inflammable gas and other dangerous gas) | | | | | |
| | Ambient Temperature | In use: -10 to 55 degree C (14 to 131 degree F)<br>Stored: -40 to 65 degree C (-40 to 149 degree F) | | | | | |
| | Ambient Humidity | 5 to 95% (non-condensation) | | | | | |
| | Elevation | Lower than 1,000 meters (3,300 feet) above see level | | | | | |
| | Vibration | Less than 1 G (25 Hz) | | | | | |
| | Shock | Less than 2 G | | | | | |
| Weight (kg) | | 13.5 | 13.5 x 2 | 13.5 x 3 | 13.5 | 13.5 x 2 | 13.5 x 3 |

## 9.7.3 Dimensions of SS4000 Power Regenerating Unit

Figure 9.2 shows the dimensions of the SS4000 Power Regenerating Unit.

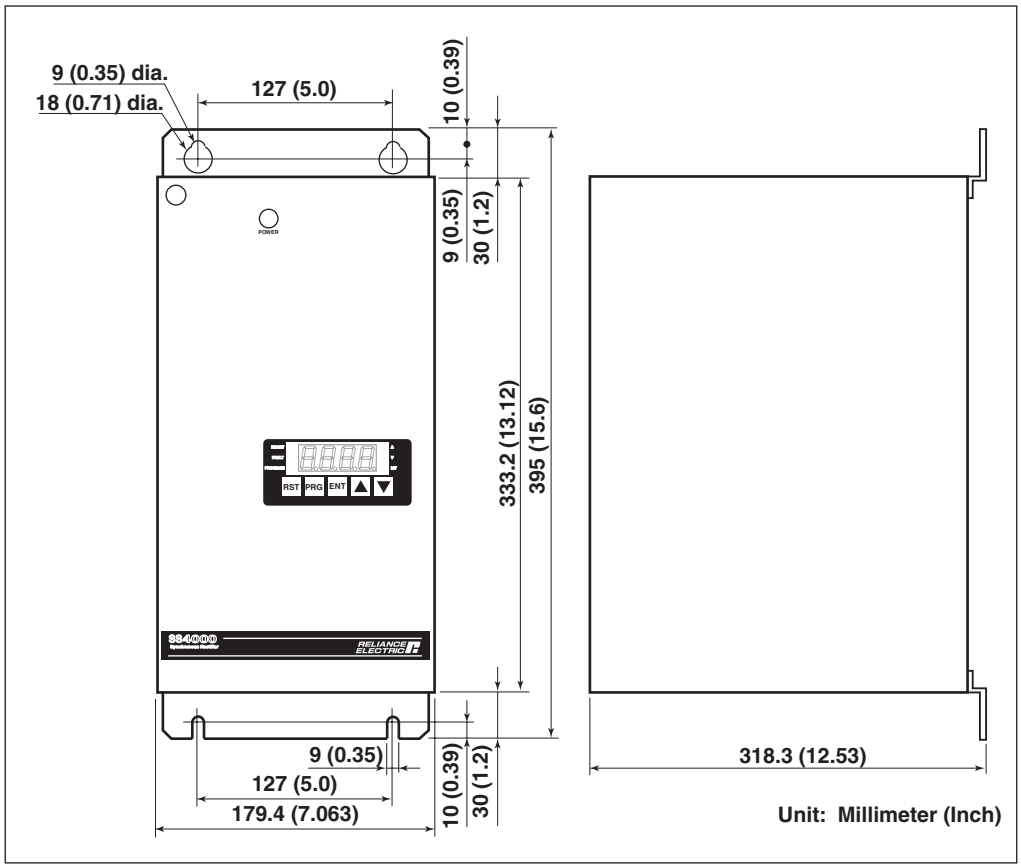



Figure 9.2 - Dimensional Outline Drawing of the SS4000 Power Regenerating Unit

### 9.7.4 Example of External Wiring for SS4000 Power Regenerating Unit

Figure 9.3 shows an example of external wiring for the SS4000 Power Regenerating Unit. For more information, refer to the instruction manual of the SS4000 Bidirectional Converter Hardware and Software (IM-35001).

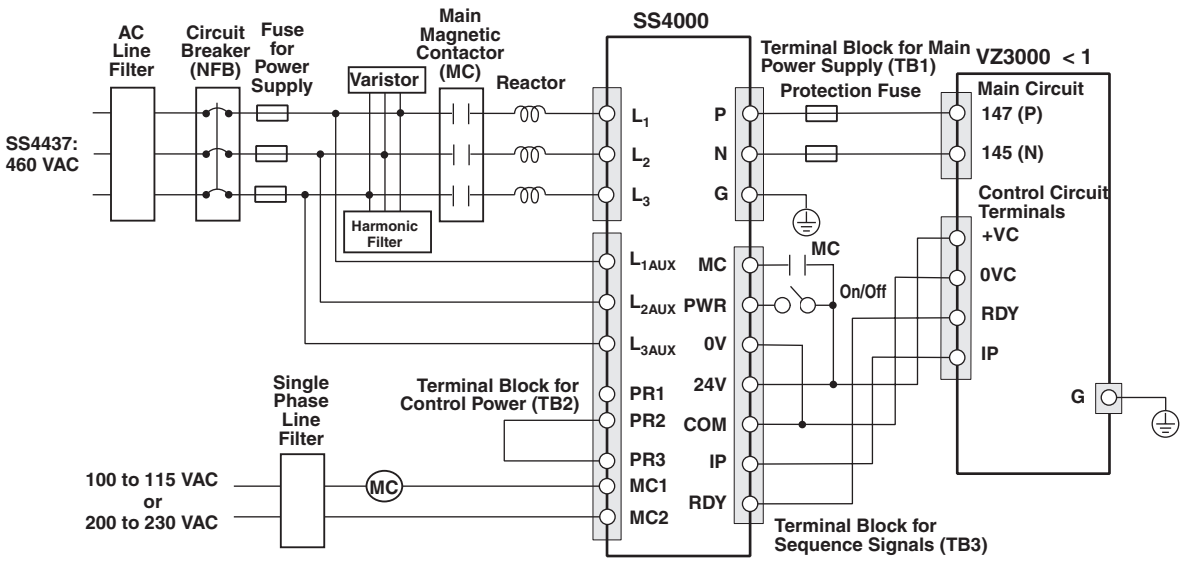



Figure 9.3 - Typical Connection of SS4000 Single Unit

## 9.8 External Regenerative Resistor and Resistor Overheat Protection Kit

When external resistors are used, each converter unit must be provided with a resistor overheat protection kit installed on the resistor possibly generating the largest heat. Because thermostat of the resistor overheat protection kit activates at 130 degree C (266 degree F), select an adequate resistor capacity to obtain resistor's temperature increase of about 100 degree C (180 degree F). In case of the following resistors, use them with an average power corresponding to 1/3 to 1/4 of the resistors' rated power.

There are two kinds of resistor overheat protection kits for coil resistor and ribbon resistor. Figures 9.4 and 9.6 show the dimensions of the resistor overheat protection kits for coil resistors, and Figures 9.5 and 9.7 show the dimensions of the resistor overheat protection kits for ribbon resistors. The recommended manufacturers and the model numbers of these resistors are as follows.

- Model Numbers and Manufacturers of Coil Resistor

  Model Number: 85161/1512
  Manufacturer: Sagami Denki
  Resistance Value: 1.5 Ohms
  Rated Power: 1.2 KW

  or

  Model Number: 85161/720
  Manufacturer: Sagami Denki
  Resistance Value: 0.7 Ohms
  Rated Power: 2.0 KW

**Important:** When you use model 85161/1512, turn the bracket B shown in Figures 9.4 and 9.6 upside down.

- Model Numbers and Manufacturers of Ribbon Resistor

  Model Number: R300osXΩ
  Manufacturer: Sagami Denki
  Rated Power: 450 W

  or

  Model Number: GRZG300-1BXΩ
  Manufacturer: Japan Resistor Manufacturing Co.
  Rated Power: 450 W

  (Place resistance value of 0.1, 0.2, 0.5, 1, 2, 5, or 10 (ohms) at the "X" in the model numbers.)

Because the thermostat of the resistor overheat protection kit is exposed to high temperature, use wiring materials having a heat resistance of 200 degree C (392 degree F) or higher and a withstand voltage of 600 V or higher, such as:

Heat Resistance Fluoro-rubber Cable AWM3532 of Furukawa Electric (Furukawa's Specification DTS1096)

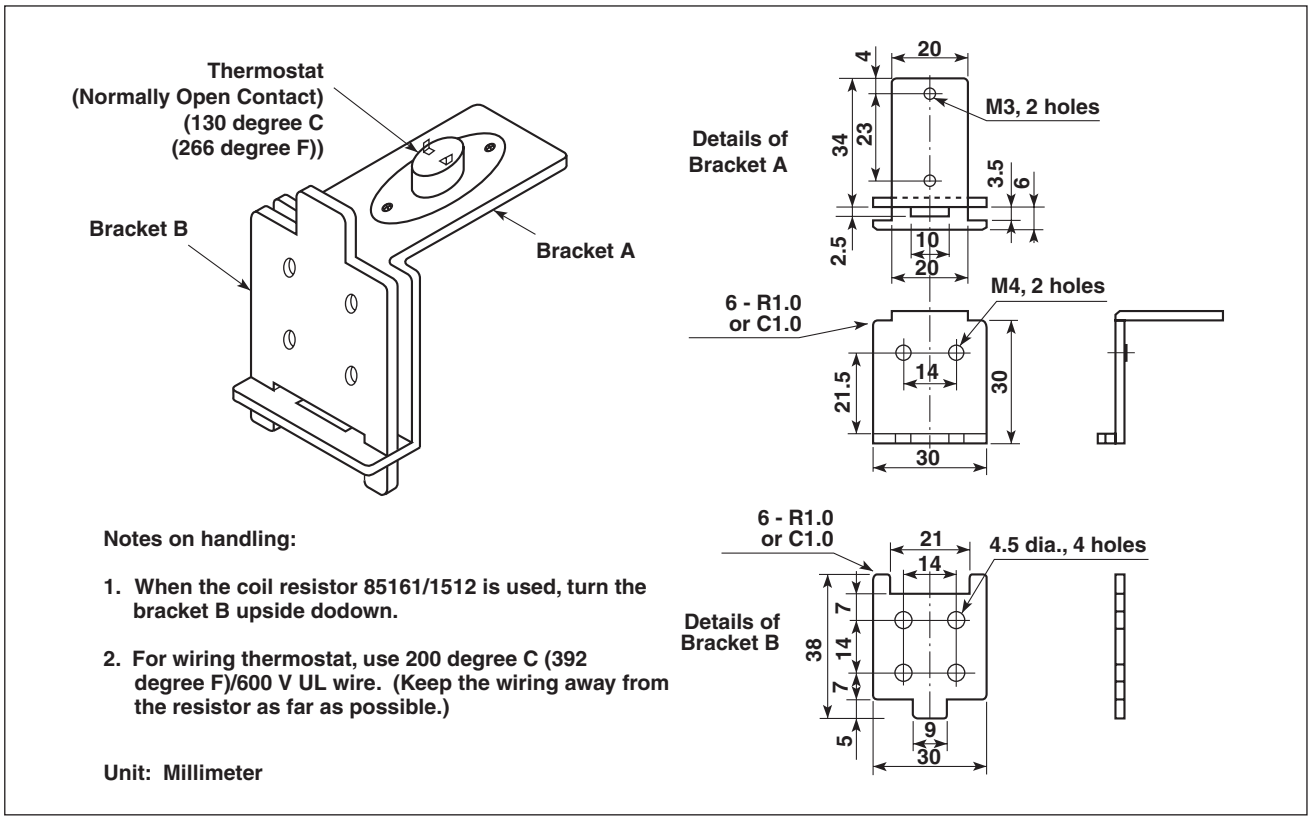



Figure 9.4 - Model MB-B5071 Coil Resistor Overheat Protection Kit (with Normally Open Contact)

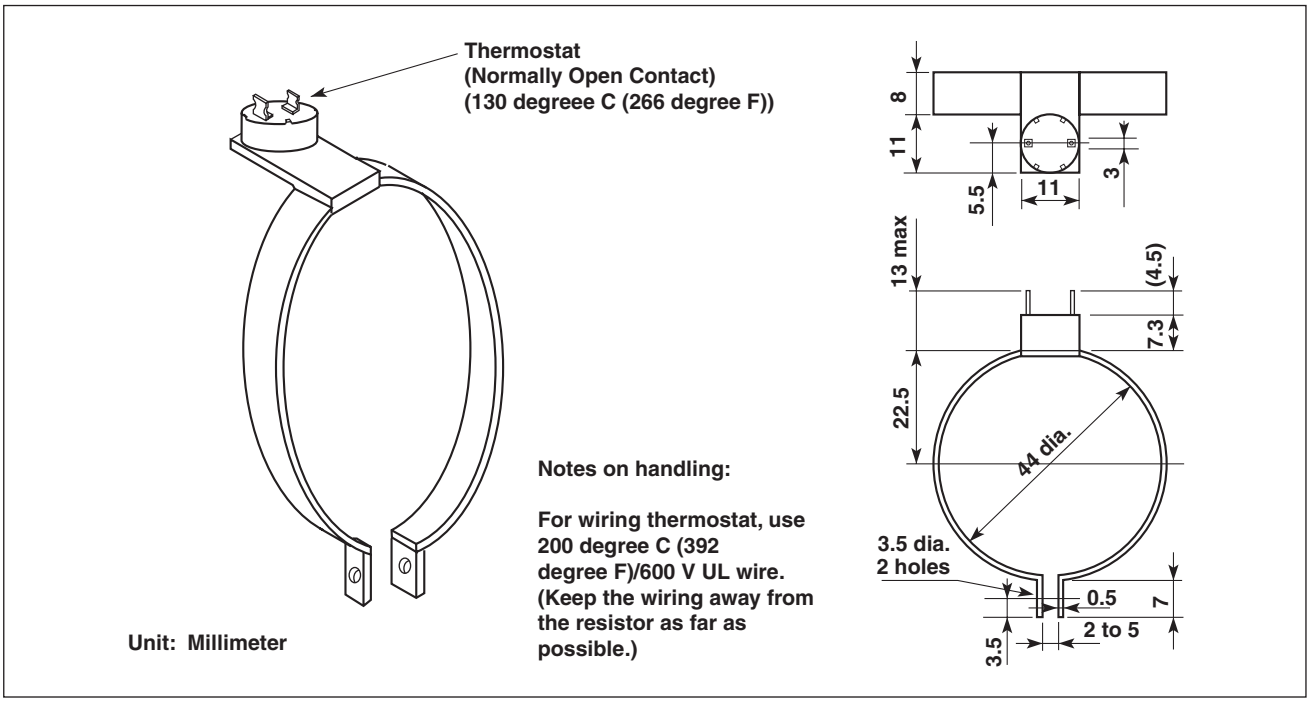



Figure 9.5 - Model MB-B5072 Ribbon Resistor Overheat Protection Kit (with Normally Open Contact)

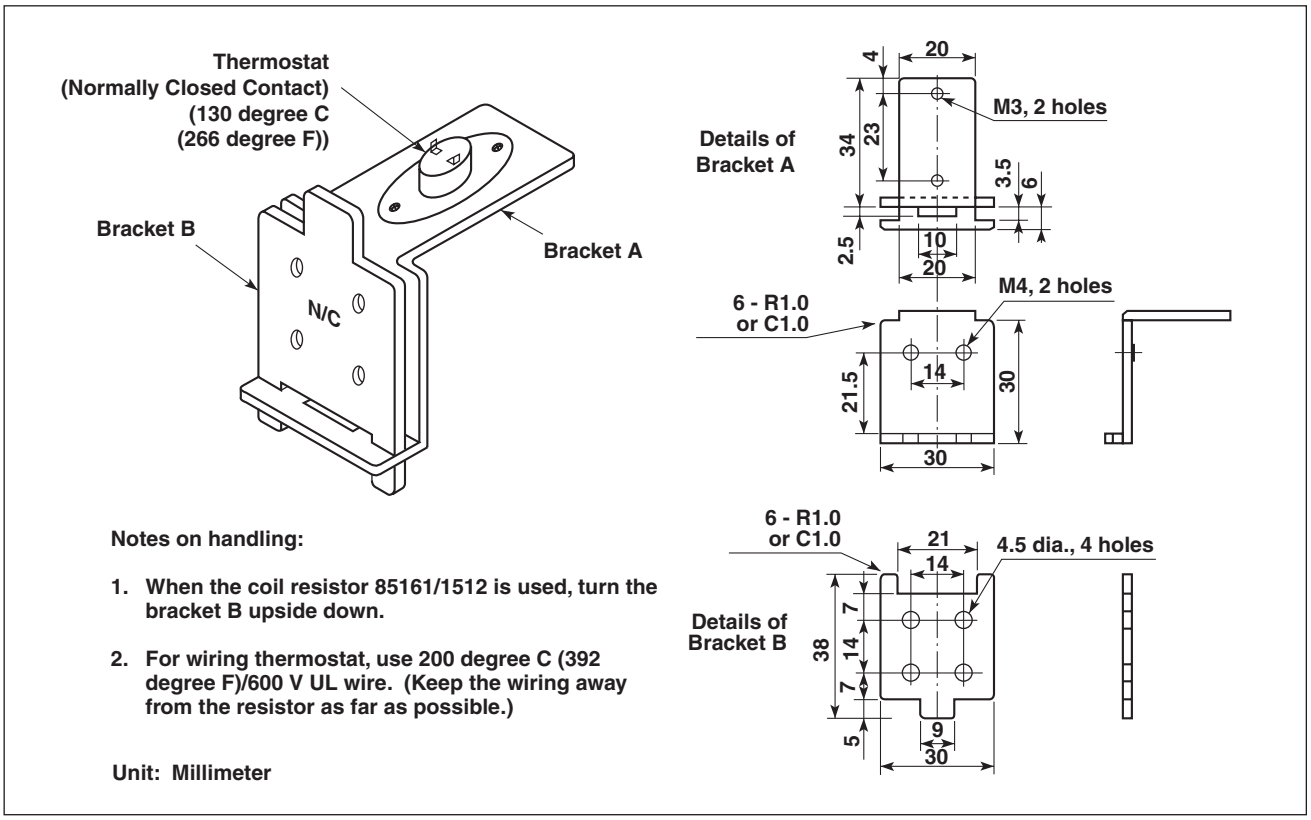



Figure 9.6 - Model MB-B5142 Coil Resistor Overheat Protection Kit (with Normally Closed Contact)

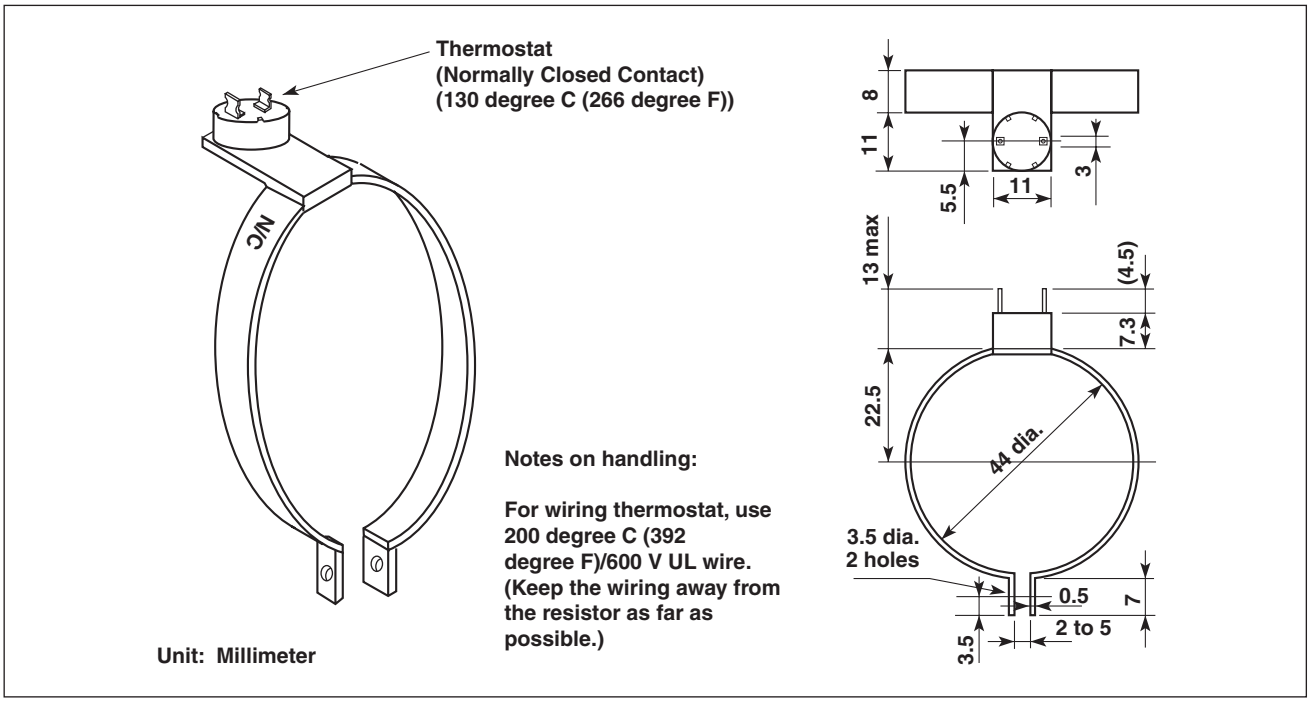
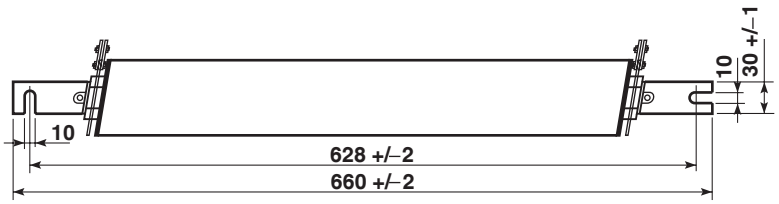


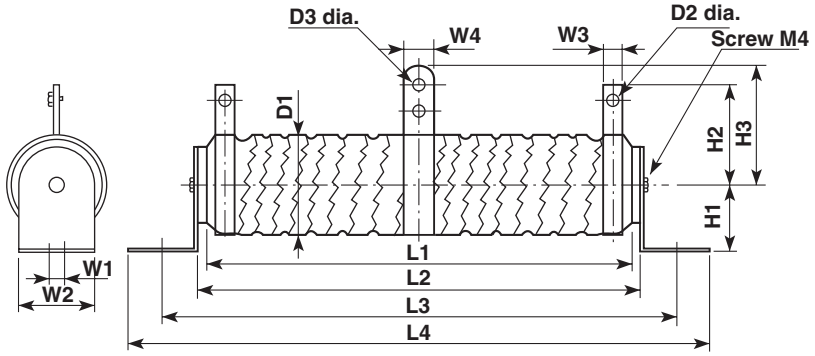

Figure 9.7 - Model MB-B5143 Ribbon Resistor Overheat Protection Kit (with Normally Closed Contact)




| Model | 85161/720 | 85161/1512 |
|---|---|---|
| Outside Dia. of Resistor | 69 mm | 65 mm |
| Nominal Resistance Value | 0.7 Ohm | 1.5 Ohms |
| Nominal Capacity | 2.0 kW | 1.2 kW |

**Unit: Millimeter**

Figure 9.8 - Coil Resistor




**Unit: Millimeter**

| Rated Power | L1 | L2 | L3 | L4 | W1 | W3 (1) | W4 (1) | H1 | H2 (1) | H3 (1) | D1 | D2 | D3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 450W | 254 | 274/264 | 315/309 | 345/335 | 10/9.5 | 11/10 | 11/10 | 45/40 | 42/39 | 42/45 | 50/47 | 4/5.5 | 4.2/5.5 |
| 600W | 330 | 350/340 | 390/385 | 420/411 | 10/9.5 | 11/10 | 11/10 | 45/40 | 42/39 | 42/45 | 50/47 | 4/5.5 | 4.2/5.5 |

**Note: When two numbers separated with a slash are shown, the first number shows the dimension of the product of Sagami Denki, and the second number shows the dimension of the product of Japan Resistor Manufacturing Co.**

**(1) In case of the products of Japan Resistor Manufacturing Co., apply the following dimensions to the products having rated current of 30 A or larger. The numbers in the parentheses in the following show the dimensions of the products of 450 W and 600 W.**

**W3 and W4 = 16, D2 and D3 = 8.2, H2 = 40 (60), H3 = 53 (60)**

Figure 9.9 - Ribbon Resistor

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