2 Installation and Connection

2-1 Operating Environment

Install this product in a location that meets those conditions listed in Table 2-1-1.

Item	Specifications
Location	Indoor
Ambient temperature	-10 to +50 °C (for products of 25 kW or less, the ventilating covers must be removed if ambient temperature exceeds +40 °C)
Relative humidity	5 to 95 % (No condensation)
Atmosphere	Pollution degree 2
Air pressure	86 to 106 kPa
Vibration	3 mm : from 2 to less than 9 Hz, 9.8 m/s^2 : from 9 to less than 20 Hz, 2 m/s^2 : from 20 to less than 55 Hz, 1 m/s^2 : from 55 to less than 200 Hz

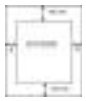
Table 2-1-1 Operating environment

Altitude	Output current reduction rate
1000 m or lower	1.00
1000 - 1500 m	0.97
1500 - 2000 m	0.95
2000 - 2500 m	0.91
2500 - 3000 m	0.88

Table 2-1-2 Output current reduction rate based on altitude

2-2 Installation Method

1. Securely fasten the product in an upright position on a solid structure such that GVX2000 is facing the front.
   Do not turn the product upside down or install in a horizontal position.
2. As heat is generated during inverter operation, the spaces shown in Fig. 2-2-1 are required to ensure sufficient cooling. As heat radiates upward, do not install the product beneath a device sensitive to heat.



Top

Inverter

Left

Right

25 kW or less
Gap X can be 0.
(side-by-side installation)
30 kW or more:
Gap X >= 50 mm

Bottom

Figure 2-2-1

3. As the heat sink may reach a temperature of 90 °C during inverter operation, ensure that the material surrounding the product can withstand this temperature.

WARNING
Install this product on nonflammable material such as metal.

4. When installing this product in a control panel, consider ventilation to prevent ambient temperature of the inverter from exceeding the specified value. Do not install the product in an area from which heat cannot be sufficiently released.
5. If two or more inverters must be installed in the same device or control panel, arrange the units horizontally to minimize the effect of heat. If two or more inverters must be installed vertically, place an insulated plate between the inverters to minimize the effect of heat.

6. When shipped from the factory, inverters are internal cooling type inside panel. An inverter of 25 kW or less can be converted to an external cooling type simply by adding an optional mounting adapter. An inverter of 30 kW or more can be converted simply by moving mounting adapter.
   In an external cooling system, a heat sink radiating about 70 % of total inverter heat (total loss) can be placed outside the device or control panel.
   Ensure that heat sink surfaces are kept free of foreign matter (lint, moist dust particles etc)..

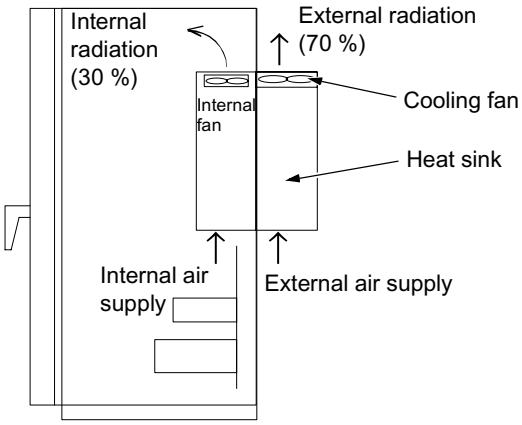


Figure 2-2-2 External cooling system

WARNING

1. In case of external cooling system, cover the inverter rear side in order not to touch the main capacitor and braking resistor. **Electric shock may result.**
2. Ensure that the inverter and heat sink surfaces are kept free of foreign matter such as lint, paper dust, small chips of wood or metal, and dust.
   Fire or accident may result.

An inverter of 30 kW or more can be converted to an external cooling type simply by moving upper and lower mounting brackets as shown in Fig. 2-2-3. Remove the M6 bracket screws, move the brackets, then secure the brackets using the M5 case mounting screws. (The bracket screws are no longer required after changing the bracket mounting position).

Voltage series	Inverter type	Bracket screws	Case mounting screws
400 V	GVX2000-30-T to GVX2000-132-T	5	5
	GVX2000-160-T to GVX2000-200-T	8	8
	GVX2000-220-T to GVX2000-500-T	6	6

Quantity of mounting screw

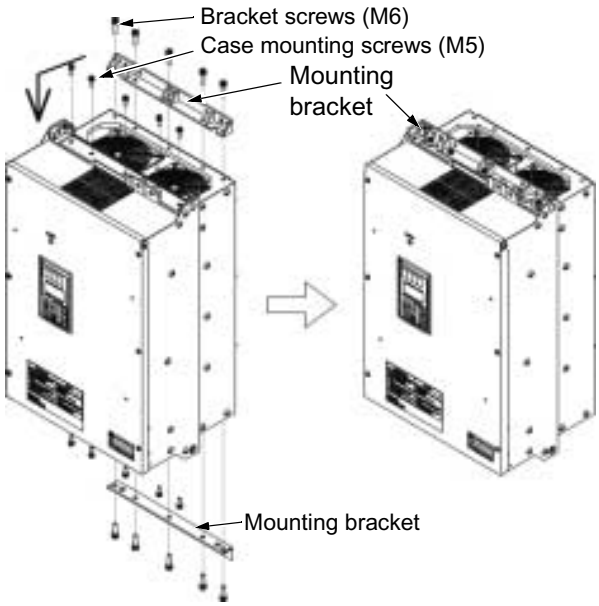


Figure 2-2-3

7. For inverters of 25 kW or less, remove the ventilating covers if ambient temperature exceeds +40 °C.

   Removing the ventilating covers
   One ventilating cover is mounted on top of the inverter and two or three are mounted at the bottom. Remove the surface cover, then remove ventilating covers by popping out the cover inserts as shown in Fig. 2-2-4.

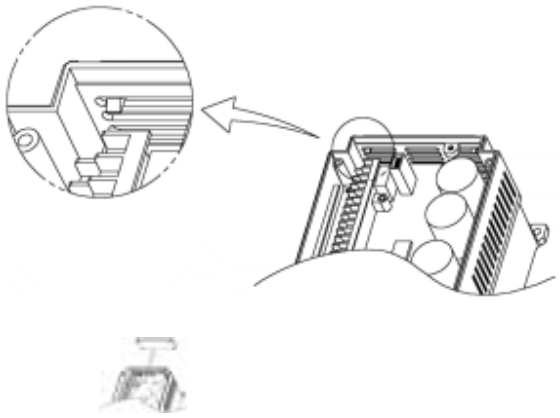


Figure 2-2-4 Removing the ventilating cover

2-3 Connection

Remove the surface cover before connecting the terminal blocks as follows.

2-3-1 Basic connection

1. Always connect power to the L1/R, L2/S, and L3/T main circuit power terminals of the inverter. Connecting power to another terminal will damage the inverter. Check that the power voltage is within the maximum allowable voltage marked on the nameplate, etc.
2. Always ground the ground terminal to prevent disasters such as fire or electric shock and to minimize noise.
3. Use a reliable crimp terminal for connection between a terminal and a cable.
4. After terminating the connection (wiring), confirm the following:
   a) Confirm that the connection is correct.
   b) Confirm that all necessary connections have been made.
   c) Confirm that there is no short-circuit or ground fault between terminals and cables.
5. Connection modification after power-on
   The smoothing capacitor in the direct current portion of the main circuit cannot be discharged immediately after the power is turned off.
   To ensure safety, use a multimeter to check that the voltage of the direct current (DC) is lowered to the safety range (25 V DC or less) after the charge lamp goes off. Also, confirm that the voltage is zero before short-circuiting. The residual voltage (electric charge) may cause sparks.

WARNING

1. Always connect a ground wire.
   Electric shock or fire may result.
2. Ensure that a licensed specialist performs all wiring works.
3. Confirm that the power is turned off (open) before commencing wiring operations.
   Electrical shock may result.

Basic connection diagram

- GVX2000 15 kW or more

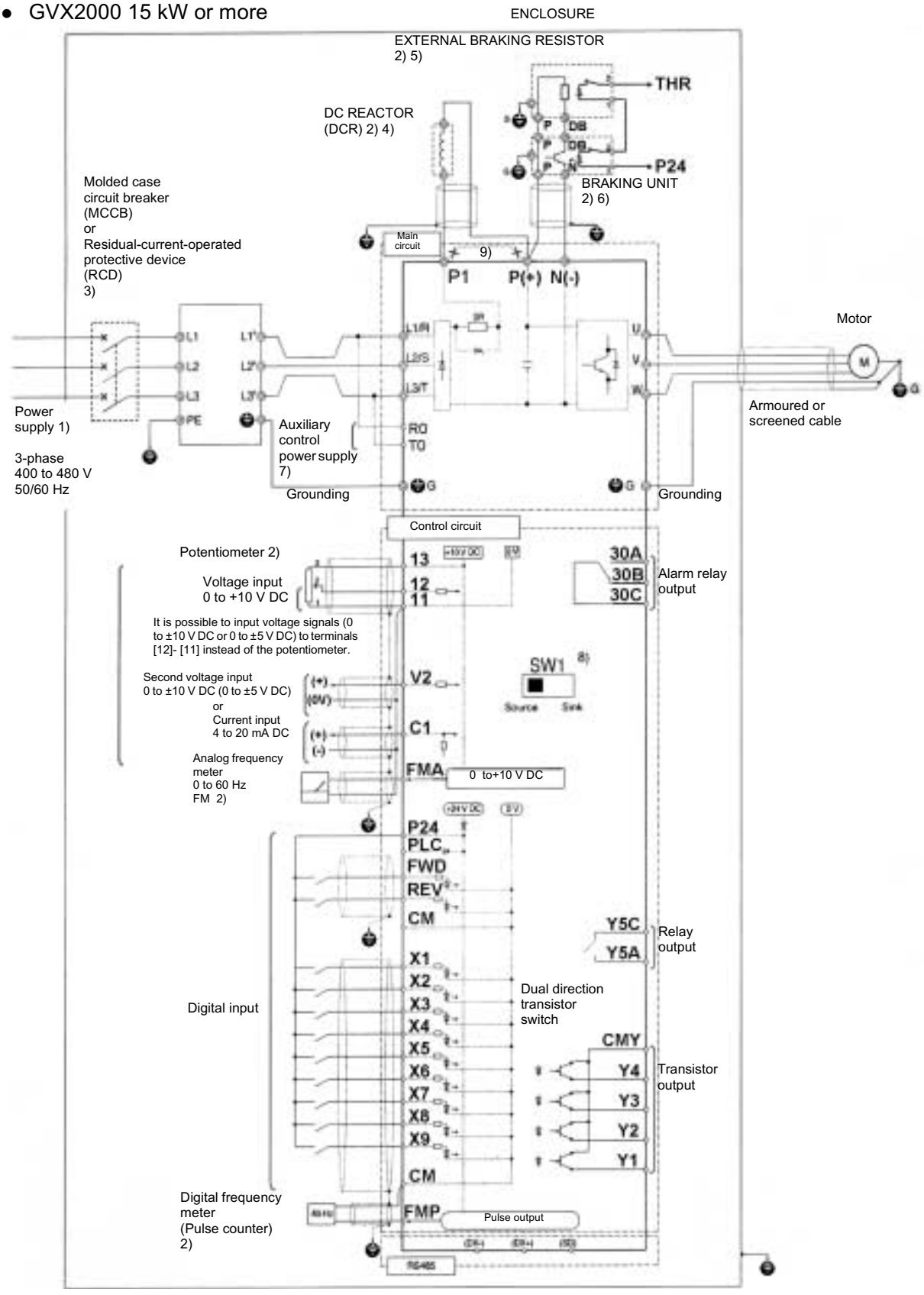
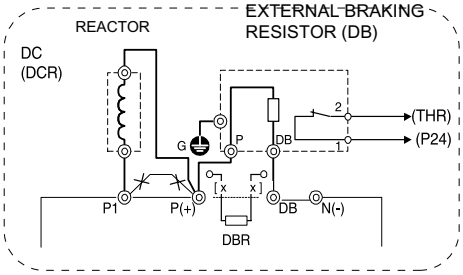


Figure 2-3-1

- GVX2000 11 kW or less



Notes:

1. Common terminals [11], (CM), and <CMY> of the control circuit are insulated independently.
2. The following options support the inverters:

Inverter models / Items	Modelli di inverter per prestazioni elevate [AP] o standard [ST]
Power factor correcting DC reactor (DCR)	For application of power less than 75 kW (high performances or standard performances [HP] o [ST]): - option (separate installation) - remove the jumper between P1 and P(+) before connecting the DCR For application of power 90 kW or more ([HP] o [ST]) - provided standard (separate installation) - always connect this DCR

1) Use an inverter with the rated voltage matching power supply voltage.

2) Option. Use as required.

3) Use this peripheral device when necessary.

4) To use the power-factor correcting DCR, remove the jumper 9) between P1 and P(+). For inverters of 75 kW or more, the jumper is not connected between P1 and P(+).

5) To connect the external braking resistor (option),

- Always use with the braking unit (option) 6) (GVX2000: 15 kW or more,)
- Disconnect the jumper between P(+) and DB of the internal resistor 8) P(+) must be insulated from DB. (GVX2000: 11 kW or less)

6) Connect the braking unit (option) to the P(+) - N(-). Connect auxiliary terminals [1] and [2] by confirming polarities according to the figure.

7) This terminal is provided as standard for the inverters of 2.2 kW or more. The inverter can be operated without auxiliary control-power input.

8) If SW1 is set to SOURCE, digital input terminals are ON when 24 V (P24) are supplied to the terminal (PNP-Logic).
If SW1 is set to SINK, digital input terminals are ON when 0 V (CM) are connected (NPN-Logic).
All explanations in this manual assume that SW1 is set to SOURCE (factory setting).

2-3-2 Connecting the main circuit and ground terminals

Symbol	Terminal name	Description
L1/R, L2/S, L3/T	Main circuit power terminal	Connects a 3-phase power supply.
U, V, W	Inverter output terminal	Connects a 3-phase motor.
R0, T0	Auxiliary control-power input terminal	Connects a backup AC power supply to the control circuit. (Not supported for inverter of 0.75 kW or less)
P1, P(+)	DC reactor connecting terminal	Connects the optional power-factor correcting DC reactor.
P(+), DB	External braking resistor connecting terminal	Connects the optional external braking resistor. (For inverter of 11 kW or less)
P(+), N(-)	DC link circuit terminal	Supplies DC link circuit voltage to the external braking unit (option) or power regeneration unit (option).
⏚G	Inverter ground terminal	Grounds the inverter chassis (case) to the earth.

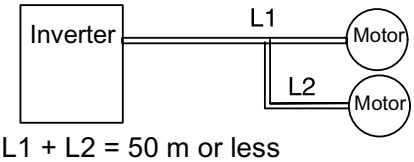
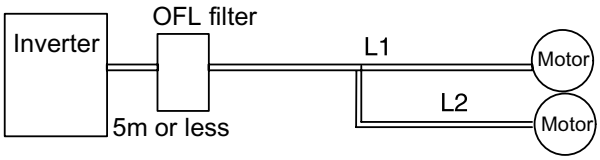
Table 2-3-1 Functions of main circuit terminals and ground terminals

1) Main circuit power terminals (L1/R, L2/S, L3/T)

1. Connect these terminals to the power supply via a molded-case circuit breaker or earth-leakage circuit breaker for circuit (wiring) protection. Phase-sequence matching is unnecessary.
2. To ensure safety, a magnetic contactor should be connected to disconnect the inverter from the power supply when the inverter protective function activates.
3. Use control circuit terminal FWD/REV or the RUN/STOP key on the keypad panel to start or stop the inverter. The main circuit power should be used to start or stop the inverter only if absolutely necessary and then should not be used more than once every hour.
4. Do not connect these terminals to a single-phase power supply.

2) Inverter output terminal (U, V, W)

1. Connect these terminals to a 3-phase motor in the correct phase-sequence. If the direction of motor rotation is incorrect, exchange any two of the U, V, and W phases.
2. Do not connect a phase-advance capacitor or surge absorber to inverter output.
3. If the cable from the inverter to the motor is very long, a high-frequency current may be generated by stray capacitance between the cables and result in an overcurrent trip of the inverter, an increase in leakage current, or a reduction in current indication precision.
   To prevent this, the cable must not exceed 50 meters (for 5.5 kW or less) or 100 meters (for 7.5 kW or more).
   If the cable must be long, connect an optional output circuit filter (OFL filter)

Without output circuit filter connected	With output circuit filter connected
 L1 + L2 = 50 m or less (4 kW or less) 100m or less (7.5 kW or more)	 L1 + L2 = 400 m or less
To drive two or more motors, the total length of cable to these motors must not exceed 50 meters (for 5.5 kW or less) or 100 meters (for 7.5 kW or more).	To drive two or more motors via an OFL filter, the total length of cable to these motors must not exceed 400 meters.

Note: When a motor protective thermal O/L relay is inserted between the inverter and the motor, the thermal O/L relay may malfunction (particularly in the 400 V series) even when the cable length is 50 meters or less. To resolve, insert an OFL filter or reduce the carrier frequency of the inverter operation noise. (Use function code "F26 Motor sound").

Driving 400 V series motor by inverter

When a motor is driven by a PWM-type inverter, the motor terminals may be subject to surge voltage generated by inverter element switching. When the cable of the motor (the 400 V series in particular) is extremly long, surge voltage will deteriorate motor insulation.

To prevent this when driving the 400 V series motor using the inverter, ensure one of the following:

1. Use a well-insulated motor.
2. Connect an optional OFL filter to the output terminal of the inverter.
3. Minimize the length of the cable between the inverter and the motor (less than 20 meters).

• - Inverter generating loss

Inverter type	Generating loss (W) at fc carrier frequency		Inverter type	Generating loss (W) at fc carrier frequency	
	fc=(2kHz)	fc=(15kHz)		fc=(2kHz)	fc=(15kHz)
GVX2000-0.55-T	35	60	GV2000-30-T	1000	1400
GVX2000-1.1-T	45	85	GV2000-37-T	1000	1700
GVX2000-2.2-T	60	110	GV2000-45-T	1000	1700
GVX2000-3.0-T	80	150	GV2000-55-T	1150	1950
GVX2000-5.5-T	130	230	GV2000-75-T	1400	2300
GVX2000-7.5-T	170	300	GV2000-90-T	2000	2800 1)
GVX2000-11-T	230	400	GV2000-110-T	2350	3250 1)
GVX2000-15-T	300	520	GV2000-132-T	2600	3600 1)
GVX2000-18.5-T	360	610	GV2000-160-T	2950	4150 1)
GVX2000-22-T	460	770	GV2000-200-T	3450	4900 1)
GVX2000-25-T	550	900	GV2000-220-T	3950	5750 1)

1) fc = 10 kHz

Table 2-3-1 Inverter GVX2000-T generating loss at 2 and 15 kHz switching frequency (F26)

3) Auxiliary control-power input terminals (R0 and T0)

The inverter operates even if power is not provided to these terminals.
If a protective circuit operates and the magnetic contactor on the inverter power side is opened (off), the inverter control circuit power, the alarm output (30A, B, and C), and the keypad panel display goes off.
To prevent this, the same AC power as the main circuit AC power must be supplied (as auxiliary control power) to the auxiliary control-power input terminals (R0 and T0).

1. To ensure effective noise reduction when using a radio noise filter, the output power from the filter must go to the auxiliary control-power input terminals. If these terminals are connected to the input side of the filter, the noise reduction effect deteriorates.

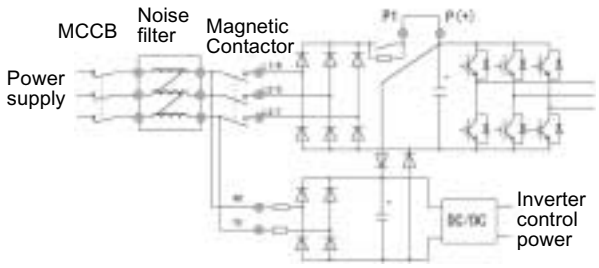


Figure 2-3-2 Connecting the auxiliary control-power input terminals

4) DC reactor connecting terminals (P1 and P(+))

1. Before connecting a power-factor correcting DC reactor (optional) to these terminals, remove the factory-installed jumper.
2. If a DC reactor is not used, do not remove the jumper.

Note: For inverter of 75 kW or more, the DC reactor is provided as a separate standard component and should always be connected to the terminals.

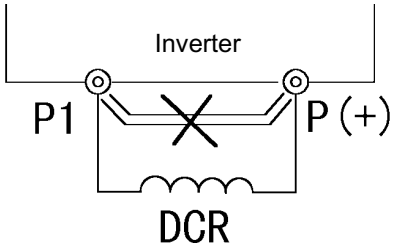


Figure 2-3-3

5) External braking-resistor connecting terminals (P(+) and DB) (11 kW or less)

For the GVX2000 of 11 kW or less, a built-in braking resistor is connected to terminals P(+) and DB. If this braking resistor does not provide sufficient thermal capacity (e.g., in highly repetitive operation or heavy inertia load operation), an external braking resistor (option) must be mounted to improve braking performance.

1. Remove the built-in braking resistor from terminals P(+) and DB. Insulate the resistor-removed terminals with adhesive insulation tape, etc.
2. Connect terminals P(+) and DB of the external braking resistor to terminals P(+) and DB of the inverter.
3. The wiring (cables twisted or otherwise) should not exceed 5 meters.

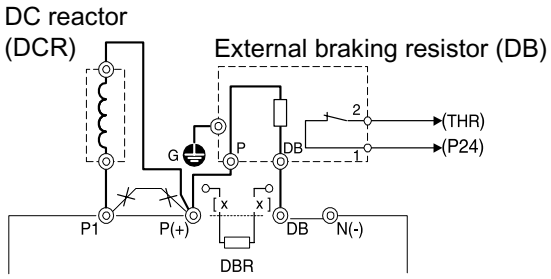


Figure 2-3-4 Connection (11 kW or less)

6) DC link circuit terminals (P(+) and N(-))

The GVX2000 inverter of 15 kW or more does not contain a drive circuit for the braking resistor. To improve braking performance, an external braking unit (option) and an external braking resistor (option) must be installed.

1. Connect terminals P(+) and N(-) of the braking unit to terminals P(+) and N(-) of the inverter. The wiring (cables twisted or otherwise) should not exceed 5 meters.
2. Connect terminals P(+) and DB of the braking resistor to terminals P(+) and DB of the braking unit.
   The wiring (cables twisted or otherwise) should not exceed 10 meters. When terminals P(+) and N(-) of the inverter are not used, leave terminals open. If P(+) is connected to N(-) or the braking resistor is connected directly, the resistor will break.
3. Auxiliary contacts 1 and 2 of the braking unit have polarity.
   To connect the power regeneration unit, refer to the "Power Regeneration Unit Instruction Manual".

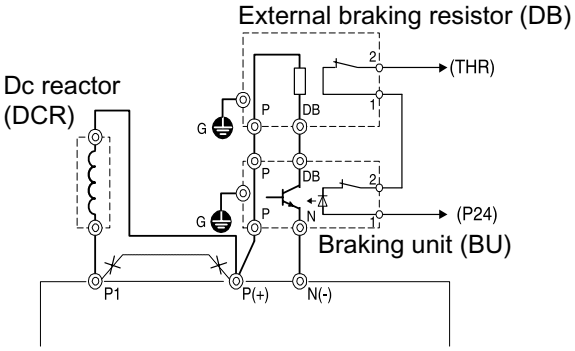


Figure 2-3-5 Connection (15 kW or more)

7) Inverter ground terminal

To ensure safety and noise reduction, always ground the inverter ground terminal. Also, metal frames of electrical equipment must be grounded as specified in the Electric Facility Technical Standard.

The connection procedure is as follows:

1. Ground metal frames to a ground terminal (Ground resistance: 10 Ω or less).
2. Use a suitable cable (short and thick) to connect the inverter system to the ground terminal.

8) Auxiliary power switching connector (CN UX) (for inverter of 30 kW or more)

When an inverter of 30 kW or more requires a main circuit power voltage as listed in Table 2-3-2, disconnect auxiliary power switching connector CN UX from U1 and connect to U2. For the switching method, see Fig. 2-3-8

Frequency [Hz]	Power voltage range [VAC]
50	380 - 398
60	380 - 430

Table 2-3-2 Main circuit power voltage requiring auxiliary power switching connector switching

CAUTION

1. Check that the number of phases and rated voltage of this product match those of the AC power supply.
2. Do not connect the AC power supply to the output terminals (U, V, W), because this will damage the inverter.
   Injury may result.
3. Do not connect a braking resistor directly to the DC terminals (P[+] and N[-]).
   Fire may result.

9) Fan power switching connector (CN RXTX) (for inverter of 30 kW or more)

GVX2000 without options supports DC power input via DC common connection by connecting the power regeneration converter (RHC series) as shown in Fig. 2-3-7.
For details, refer to technical documentation.
The inverter of 30 kW or more contains an AC-powered component (e.g. AC cooling fan).
To use the inverter using DC power input, switch the fan power switching connector (CN RXTX) inside the inverter to the R0-T0 side and provide AC power to the R0 and T0 terminals. (See Fig. 2-3-6).
For the switching method, see Fig. 2-3-8.

Note: In the standard state, the fan power switching connector (CN RXTX) is connected to the L1/R-L3/T side. When DC power input is not used, do not switch this connector.
The same AC voltage as the main circuit power voltage must be supplied to the auxiliary control-power input terminals (R0 and T0). If not supplied, the fan does not rotate and the inverter will overheat (OH1).

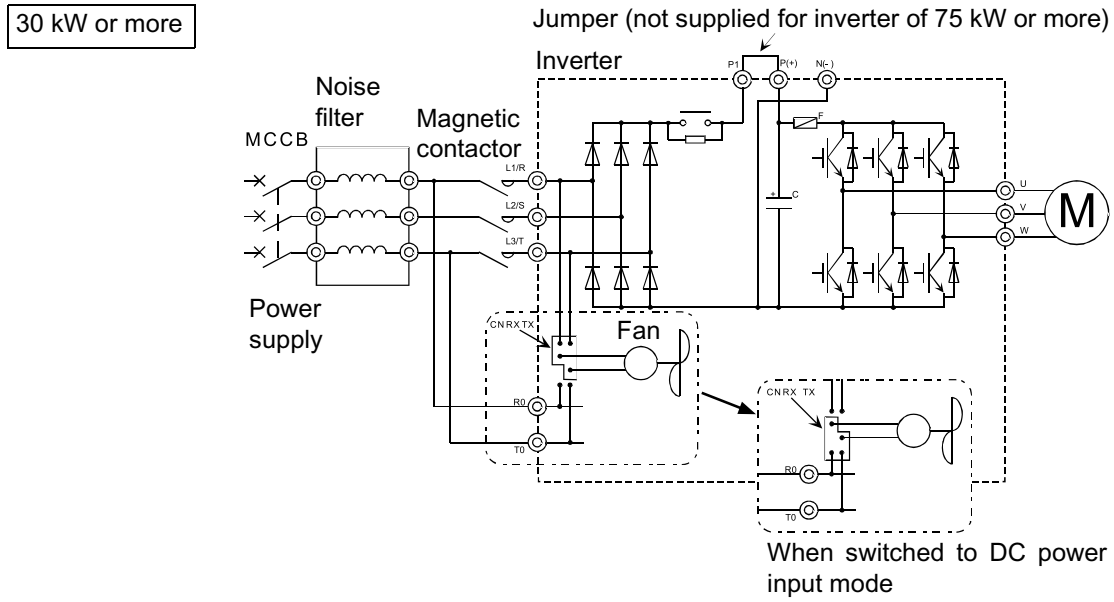


Figure 2-3-6 Fan power switching

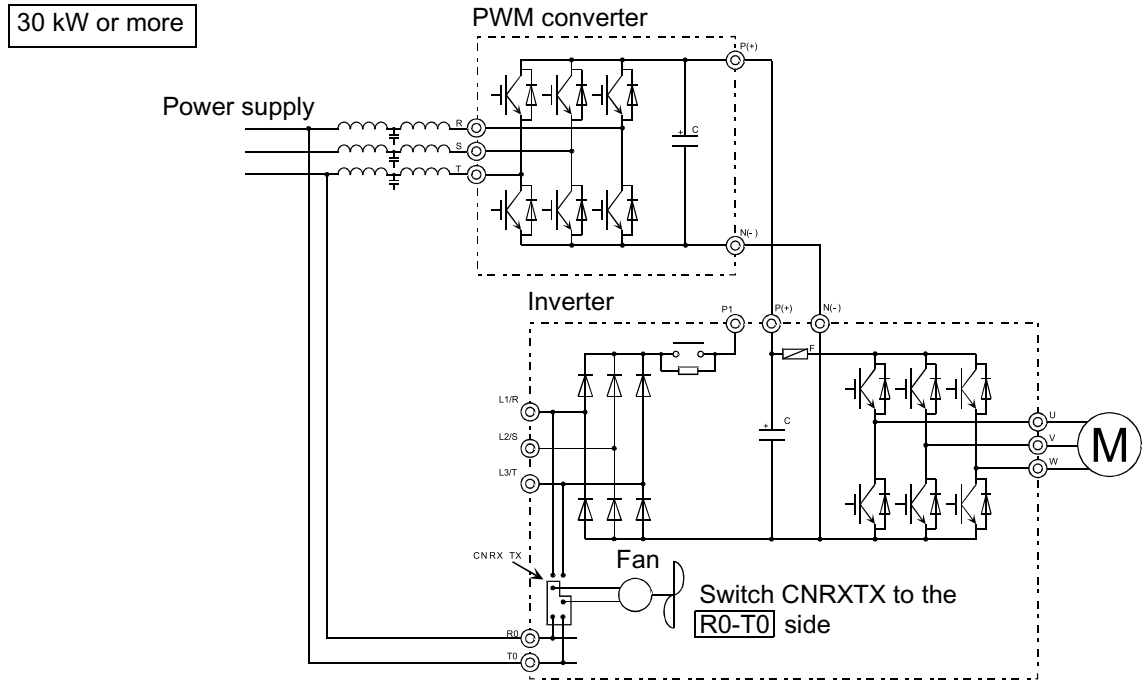
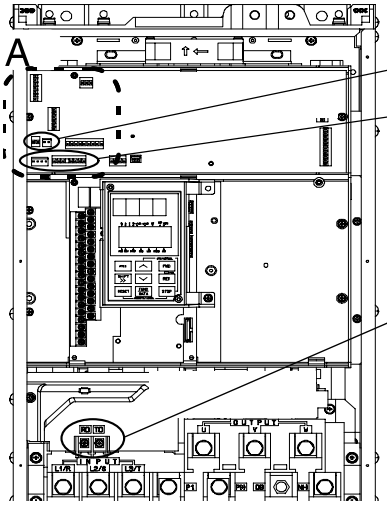


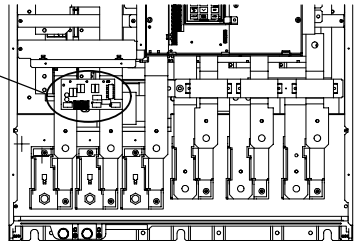
Figure 2-3-7 Example of connection by combination with power regeneration converter

Note: To connect the power regeneration converter to an inverter of 25 kW or less, do not connect the power supply directly to the auxiliary control-power input terminals (R0 and T0) of the inverter.
However, if such a connection is required, insulate these input terminals from the main power of the power regeneration converter with an insulation transformer.
The connection example of a power regeneration unit is provided in the "Power Regeneration Unit Instruction Manual".

The switching connectors are mounted on the power PCB above the control PCB as shown below.

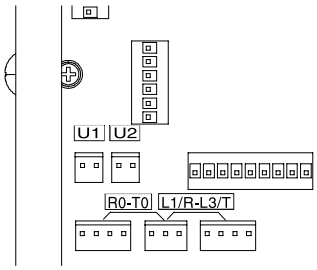


GVX2000-30-T to
GVX2000-132-T



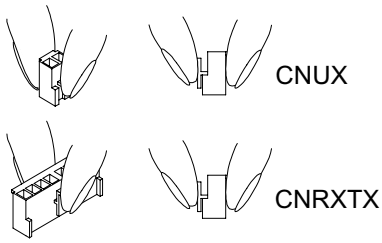
GVX2000-160-T to
GVX2000-500-T

<Enlarged view of part A>

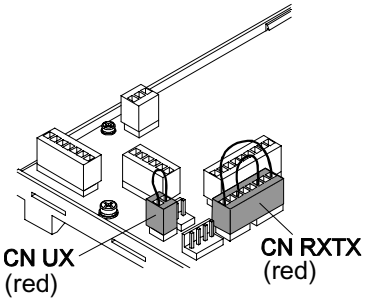


When shipped from the factory, CN UX is connected to the **U1** side and CN RXTX is connected to the **L1/R-L3/T** side.

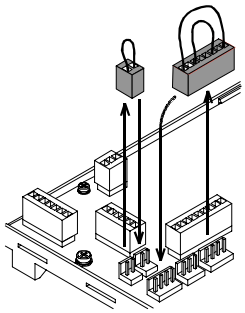
Note: To remove a connector, unlock the connector (using the locking mechanism) and pull. To mount a connector, push the connector until it click locks.



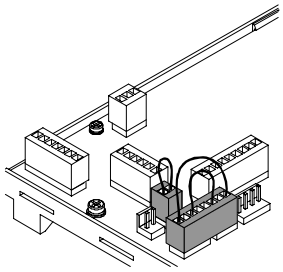
<Oblique view of part A>



Factory shipment status



Connector removal



After connector switching

CNUX: **U1**

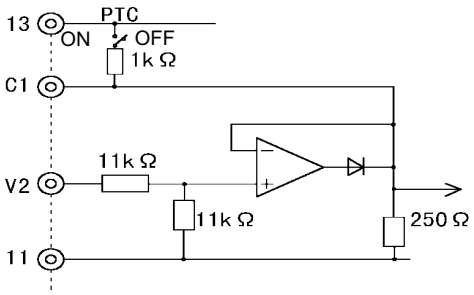
CNRXTX: **L1/R-L3/T**

In this figure the power voltage is 380 to 398 V AC, 50 Hz (or 380 to 430 V AC, 60 Hz) and the inverter is used in DC power input mode.

Figure 2-3-8 Power switching connectors (only for 30 kW or more)

2-3-3 Connecting the control terminals

Table 2-3-3 lists the functions of the control circuit terminals (switch SW1 set to source).
A control circuit terminal should be connected according to the setting of its functions.

Classification	Terminal symbol	Terminal name	Function
Analog input	13	Potentiometer power supply	Used for +10 V DC power supply for frequency setting POT (variable resistor of 1 to 5 kΩ)
	12	Voltage input	1. Frequency is set according to the analog input voltage supplied from an external circuit. - 0 to +10 V DC/0 to 100 % - Reversible operation using positive and negative signals: 0 to +/- 10 V DC/0 to 100 % - Reverse operation: +10 to 0 V DC/0 to 100 % 2. The feedback signal for PID control is input. 3. The analog input value from the external circuit is used for torque control. Input resistance: 22 kΩ
	V2	Voltage input	1. Frequency is set according to the analog input voltage supplied from an external circuit. - 0 to +10 V DC/0 to 100 % - Reverse operation: +10 to 0 V DC/0 to 100 % It can be used only one terminal "V2" or "C1" alternatively. Input resistance: 22 kΩ
	C1	Current input	1. Frequency is set according to the analog input current supplied from an external circuit. - 4 to 20 mA DC/0 to 100 % - Reverse operation: 20 to 4 mA DC/0 to 100 % 2. The feedback signal for PID control is input. 3. PTC thermistor input (Enabling in function H26) It can be used only one terminal "V2" or "C1" alternatively. Input resistance: 250 Ω 
	11	Analog input common	Common terminal for analog input signals

<table>
<tr><th>Classification</th><th>Terminal symbol</th><th>Terminal name</th><th>Function</th></tr>
<tr><td rowspan="14">Digital input</td><td>FWD</td><td>Forward operation/ Stop command</td><td>Used for forward operation (when FWD-P24 is on) or deceleration and stop (when FWD-P24 is off)</td></tr>
<tr><td>REV</td><td>Reverse operation/ Stop command</td><td>Used for reverse operation (when REV-P24 is on) or deceleration and stop (when REV-P24 is off)</td></tr>
<tr><td>X1</td><td>Digital input 1</td><td rowspan="10">The coast-to-stop command, external alarm, alarm reset, multistep frequency selection, and other functions (from an external circuit) can be assigned to terminals X1 to X9.
For details, see "Setting the Terminal Functions E01 to E09" in Section 5.2, "Details of Each Function."
<Specifications of digital input circuit>
<table><tr><th colspan="2">Item</th><th>min.</th><th>typ.</th><th>max.</th></tr><tr><td rowspan="2">Operating voltage</td><td>ON level</td><td>22 V</td><td>24 V</td><td>27 V</td></tr><tr><td>OFF level</td><td>0 V</td><td>-</td><td>2 V</td></tr><tr><td colspan="2">Operating current at ON level</td><td>-</td><td>3.2 mA</td><td>4.5 mA</td></tr><tr><td colspan="2">Allowable leakage current at OFF level</td><td>-</td><td>-</td><td>0.5 mA</td></tr></table></td></tr>
<tr><td>X2</td><td>Digital input 2</td></tr>
<tr><td>X3</td><td>Digital input 3</td></tr>
<tr><td>X4</td><td>Digital input 4</td></tr>
<tr><td>X5</td><td>Digital input 5</td></tr>
<tr><td>X6</td><td>Digital input 6</td></tr>
<tr><td>X7</td><td>Digital input 7</td></tr>
<tr><td>X8</td><td>Digital input 8</td></tr>
<tr><td>X9</td><td>Digital input 9</td></tr>
<tr><td></td><td></td></tr>
<tr><td>P24</td><td>Control unit power supply</td><td>+24 V DC power supply for control input
Maximum output current : 100 mA</td></tr>
<tr><td>CM</td><td>Common for P24</td><td>Common terminal for P24 and FMP terminals</td></tr>
<tr><td>PLC</td><td>PLC signal power</td><td>Used to connect power supply for PLC output signals (rated voltage 24 (22 to 27) V DC) at sink logic operation.</td></tr>
<tr><td>Analog output</td><td>FMA (11: Common terminal)</td><td>Analog monitor</td><td>Outputs monitor signal using analog DC voltage 0 to +10 V DC. The meaning of this signal is one of the following:
- Output frequency (before slip compensation)
- Output frequency (after slip compensation)
- Output current
- Output voltage
- Output torque
- Load factor
- Power consumption
- PID feedback value
- PG feedback value
- DC link circuit voltage
- Universal AO
Connectable impedance: 5 kΩ minimum</td></tr>
<tr><td>Pulse output</td><td>FMP (CM: Common terminal)</td><td>Frequency monitor (pulse waveform output)</td><td>Outputs a monitor signal using the pulse waveform. This signal has the same function as the FMA signal.</td></tr>
</table>

<table>
<tr><th>Classification</th><th>Terminal symbol</th><th>Terminal name</th><th>Function</th></tr>
<tr><td rowspan="6">Transistor output</td><td>Y1</td><td>Transistor output 1</td><td rowspan="5">A running signal, frequency equivalence signal, overload early warning signal, and other signals from the inverter are output (as transistor output) to arbitrary ports.
For details, see "Setting the Terminal Functions E20 to E23" in Section 5.2, "Details of Each Function."
<Specifications of transistor output circuit>
<table><tr><th colspan="2">Item</th><th>min.</th><th>typ.</th><th>max.</th></tr><tr><td rowspan="2">Operating voltage</td><td>ON level</td><td>-</td><td>2 V</td><td>3 V</td></tr><tr><td>OFF level</td><td>-</td><td>24 V</td><td>27 V</td></tr><tr><td colspan="2">Maximum load current at ON level</td><td>-</td><td>-</td><td>50 mA</td></tr><tr><td colspan="2">Leakage current at OFF level</td><td>-</td><td>-</td><td>0.1 mA</td></tr></table></td></tr>
<tr><td>Y2</td><td>Transistor output 2</td></tr>
<tr><td>Y3</td><td>Transistor output 3</td></tr>
<tr><td>Y4</td><td>Transistor output 4</td></tr>
<tr><td>CMY</td><td>Transistor output common</td><td>Common terminal for transistor output signals
This terminal is insulated from terminals [CM] and [11].</td></tr>
<tr><td rowspan="2">Relay output</td><td>30A, 30B, 30C</td><td>Alarm output for any fault</td><td>If the inverter is stopped by an alarm (protective function), the alarm signal is output from the relay contact output terminal (1SPDT).
Contact rating: 48 V DC, 0.5 A
An excitation mode (excitation at alarm occurrence or at normal operation) can be selected.</td></tr>
<tr><td>Y5A, Y5C</td><td>Multipurpose-signal relay output</td><td>These signals can be output similar to the Y1 to Y4 signals above.
The contact rating for any fault is the same as that of the alarm output above.</td></tr>
<tr><td rowspan="2">Communica-tion</td><td>DX+, DX-</td><td>RS485 communication input-output</td><td>Input-output signal terminals for RS485 communication.
UP to 31 inverters can be connected using the daisy chain method.</td></tr>
<tr><td>SD</td><td>Communication-cable shield connection terminal</td><td>Terminal for connecting the shield of a cable.
The terminal is electrically floating.</td></tr>
</table>

Table 2-3-3 Functions of the control circuit terminals

1) Analog input terminals
(13, 12, V2,C1, and 11)

1. These terminals receive weak analog signals that may be affected by external noise. The cables should be as short as possible (20 meters or less), should be shielded, and should be grounded in principle. If the cables are affected by external induction noise, the shielding effect may be improved by connecting the shield to terminal [11].

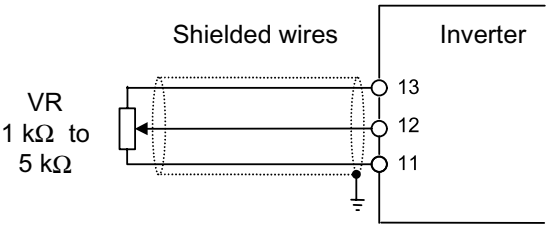


Figure 2-3-9

2. If contacts must be connected to these circuits, twin (bifurcated type) contacts for handling weak signals must be used. A contact must not be connected to terminal [11].

3. If an external analog signal output device is connected to these terminals, it may malfunction as a result of inverter noise.
To prevent malfunction, connect a ferrite core or capacitor to the external analog signal output device.

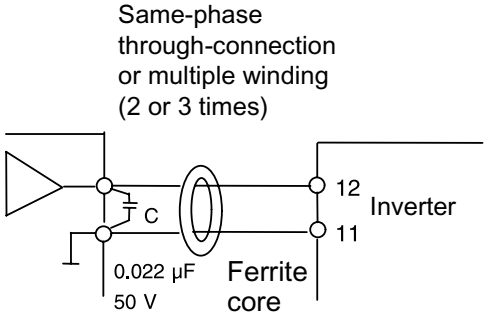


Figure 2-3-10 Example of noise prevention

2) Digital input terminals
(FWD, REV, X1 to X9 and CM)

1. Digital input terminals (e.g., FWD, REV, X1 to X9) are generally turned on or off by connecting or disconnecting the line to the P24 terminal. If +24 V power supply is provided from external, connect each terminals as shown in Fig. 2-3-11.

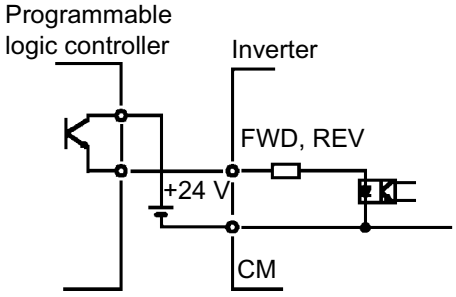


Figure 2-3-11 Connection for External power supply

2. When using a contact input, a relay having highly reliable contact must be used.

3) Transistor output terminals (Y1 to Y4, CMY)

1. To connect a control relay, connect a surge absorbing diode to both ends of its exciting coil.

4) Others

1. To prevent a malfunction as a result of noise, control terminal cables must be placed as far as possible from the main circuit cables.
2. The control cables inside the inverter must be secured to prevent direct contact with live section (e.g., main-circuit terminal block) of the main circuit.

WARNING

Control lines generally do not have enhanced insulation.
If the insulation of a control line is damaged, the control signals may be exposed to high voltage in the main circuit. The Low Voltage Directive in Europe also restricts the exposure to high voltage.
Electric shock may result.

CAUTION

The inverter, motor, and cables generate noise.
Check that the ambient sensors and devices do not malfunction.
Accident may result.

5) Wiring of control circuit

- GVX2000-30-T to GVX2000-132-T

1. Pull out the control circuit wiring along the left panel as shown in Fig. 2-3-12.
2. Secure the cable to cable binding hole A (on the left wall of the main circuit terminal block) using a cable-tie (e.g., Insulock).
   The cable-tie must not exceed 3.5 mm in width and 1.5 mm in thickness.
3. When the optional PC board is mounted, the signal lines must be secured to cable binding hole B.

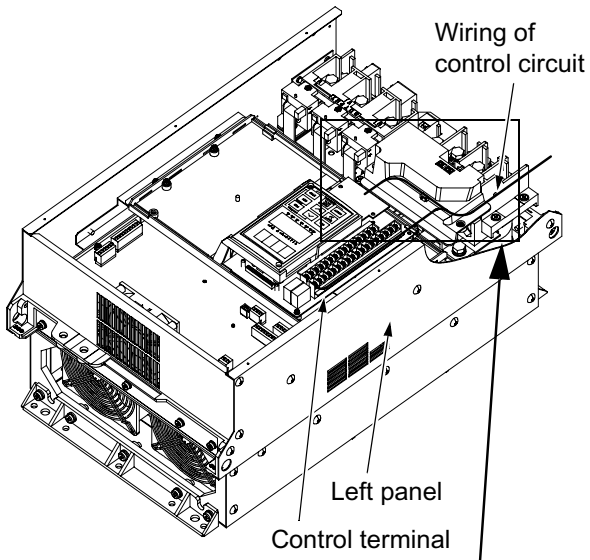


Figure 2-3-12 The wiring route of the control circuit

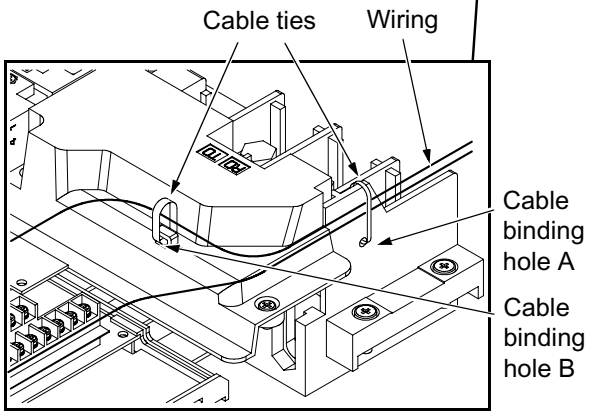


Figure 2-3-13 The securing positions of the control-circuit line of inverter

- GVX2000-160-T to GVX2000-200-T

1. As shown in Fig. 2-3-14, pull out the cables along the left panel
2. Secure cables to holes of cable-tie holder (on the way of wiring) using cable-ties (e.g., Insulok). The cable-ties must not exceed 3.8 mm in width and 1.5 mm in thickness.

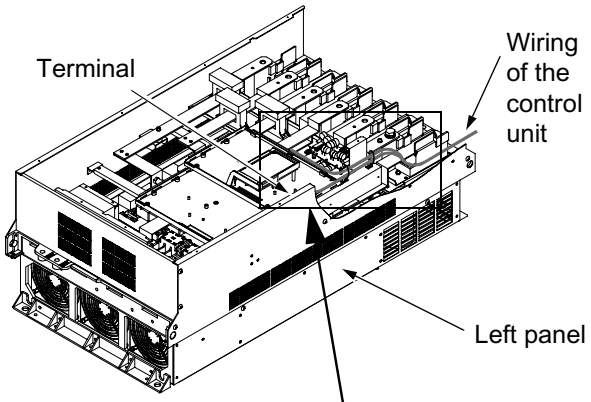


Figure 2-3-14 The wiring route of the control unit

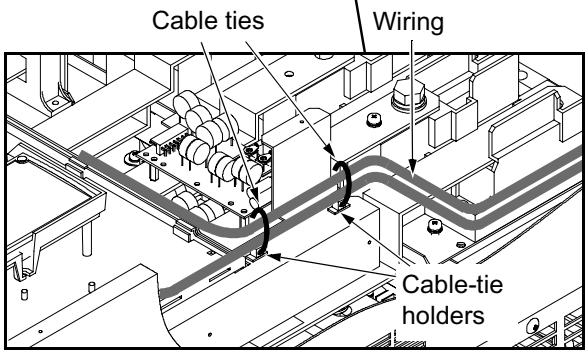


Figure 2-3-15 The securing points of the cables

- GVX2000-220-T to GVX2000-500-T

1. As shown in Fig. 2-3-16, pull out the cables along the left panel
2. Secure cables to holes of cable-tie holder (on the way of wiring) using cable-ties (e.g., Insulok). The cable-ties must not exceed 3.8 mm in width and 1.5 mm in thickness.

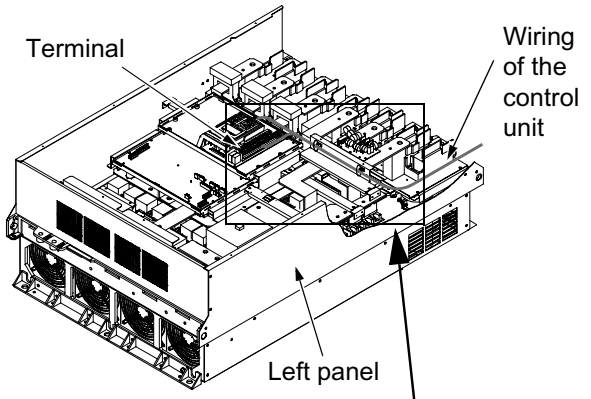


Figure 2-3-16 The wiring route of the control unit

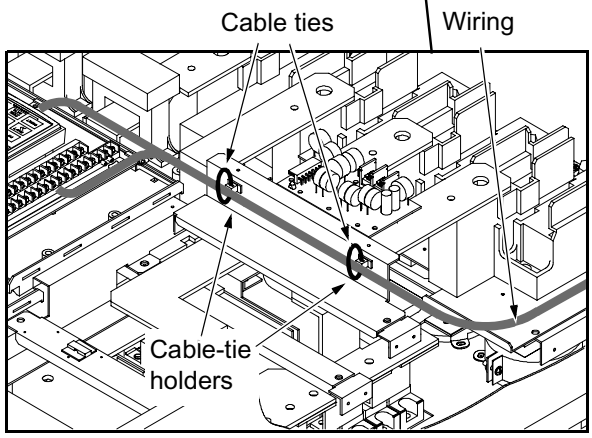


Figure 2-3-17 The securing points of the cables

2-3-4 Terminal arrangement

1) Main circuit terminals

GVX2000-0.55-T to GVX2000-1.1-T

L1/R	L2/S	L3/T	DB	P1	P(+)	N(-)	U	V	W

G
G

Screw size M3.5

GVX2000-2.2-T to GVX2000-5.5-T

R0 T0 Screw size M3.5

L1/R	L2/S	L3/T	DB	P1	P(+)	N(-)	U	V	W

G Screw size M4 G

GVX2000-7.5-T to GVX2000-11-T

R0 T0 Screw size M3.5

L1/R	L2/S	L3/T	DB	P1	P(+)	N(-)	U	V	W

G Screw size M5 G

GVX2000-15-T to GVX2000-25-T

R0 T0 Screw size M3.5

L1/R	L2/S	L3/T	P1	P(+)	N(-)	U	V	W

G
G

Screw size M6

GVX2000-30 to GVX2000-75-T

Screw size M4

R0	T0		U	V	W
L1/R	L2/S	L3/T	P1	P(+)		N(-)

G G Screw size M8

GVX2000-90-T to GVX2000-132-T

Screw size M4

R0	T0		U	V	W
L1/R	L2/S	L3/T	P1	P(+)		N(-)

G G Screw size G: M8
other terminals: M10

GVX2000-160-T to GVX2000-500-T

R0 T0 Screw size M4

L1/R	L2/S	L3/T	U	V	W
			P1	P(+)	N(-)

G G Screw size G: M10
other terminals: M12

2) Control circuit terminals

30C	30A
30B	Y5A
Y5C	CMY
Y4	Y3
Y2	Y1
11	C1
12	FMA
13	FMP
V2	PLC
CM	X1
CM	X2
FWD	X3
REV	X4
P24	X5
P24	X6
DX-	X7
DX+	X8
SD	X9

2-3-5 Applicable equipment and wire size for main circuit

Voltage	Application motor [kW]	Inverter type	HP/ST	Fuse/MCCB current rating [A]		Tightening torque [N•m]				Recommended wire size [mm^2]					
				With DCR	Without DCR	L1/R, L2/S, L3/T U, V, W P1, P(+), DB, N(-)	G	R0, T0	Control	L1/R, L2/S, L3/T (G) With DCR	L1/R, L2/S, L3/T (G) Without DCR	U, V, W	R0, T0	P1, P(+)	P(+), DB, N(-)	Control
3 phase 400V	0.4	GVX2000-0.55-T	HP	6	6	1.2		-	0.7	2.5 (2.5)	2.5 (2.5)	2.5	2.5	2.5	2.5	0.2 to 0.75
	0.75	GVX2000-1.1-T	HP	6	6											
	1.5	GVX2000-2.2-T	HP	6	10	1.8		1.2								
	2.2	GVX2000-3.0-T	HP	10	16											
	3.7	GVX2000-5.5-T	HP	10	16											
	5.5	GVX2000-7.5-T	HP	16	20	3.5										
	7.5		ST	20	32						6 (6)					
	7.5	GVX2000-11-T	HP													
	11		ST	32	40					6 (6)	10 (10)	4		4		
	11	GVX2000-15-T	HP			5.8										
	15		ST	40	50					10 (10)		6		6		
	15	GVX2000-18.5-T	HP								16 (16)	10		10		
	18.5		ST	40	63											
	18.5	GVX2000-22-T	HP								25 (16)					
	22		ST	50	80											
	22	GVX2000-25-T	HP													
	30	GVX2000-30-T	ST	80	100	13.5				16 (10)	50 (25)	25	2.5 to 6	25	2.5	
	30	GVX2000-37-T	HP													
	37		ST	100	125					25 (16)	70 (35)	35		35		
	37	GVX2000-45-T	HP													
	45		ST	100	160					35 (25)	70 (35)	50		50		
	45	GVX2000-55-T	HP													
	55		ST	125	200					50 (25)	35X2 (35)	70		70	4	
	55	GVX2000-75-T	HP													
	75		ST	200	-					35X2	-	35X2		50X2	6	
	75	GVX2000-90-T	HP			27	13.5			95 (50)		95				
	90		ST	200	-					50X2 (50)	-	50X2		70X2	10	
	90	GVX2000-110-T	HP													
	110		ST	250	-					70X2 (70)	-	70X2		95X2		
	110	GVX2000-132-T	HP													
	132		ST	315	-					70X2 (70)	-	95X2		120X2		
	132	GVX2000-160-T	HP			48	27									
	160		ST	400	-					120X2 (120)	-	120X2		150X2	16	
	160	GVX2000-200-T	HP													
	200		ST	400	-					150X2 (150)	-	185X2		185X2	25	
	200	GVX2000-220-T	HP													
	220		ST	500	-					185X2 (185)	-	185X2		185X2	50	
	220	GVX2000-280-T	HP													
	280		ST	630	-					240X2	-	300X2		300X2		

Note: The type of wire is 70 °C 600 V Grade heat-resistant polyvinyl chloride insulated wires (PVC).
The above-mentioned wire size are the recommended size under the condition of the ambient temperature 50 °C or lower.