2-3-4 Connection examples

1) Keypad panel operation

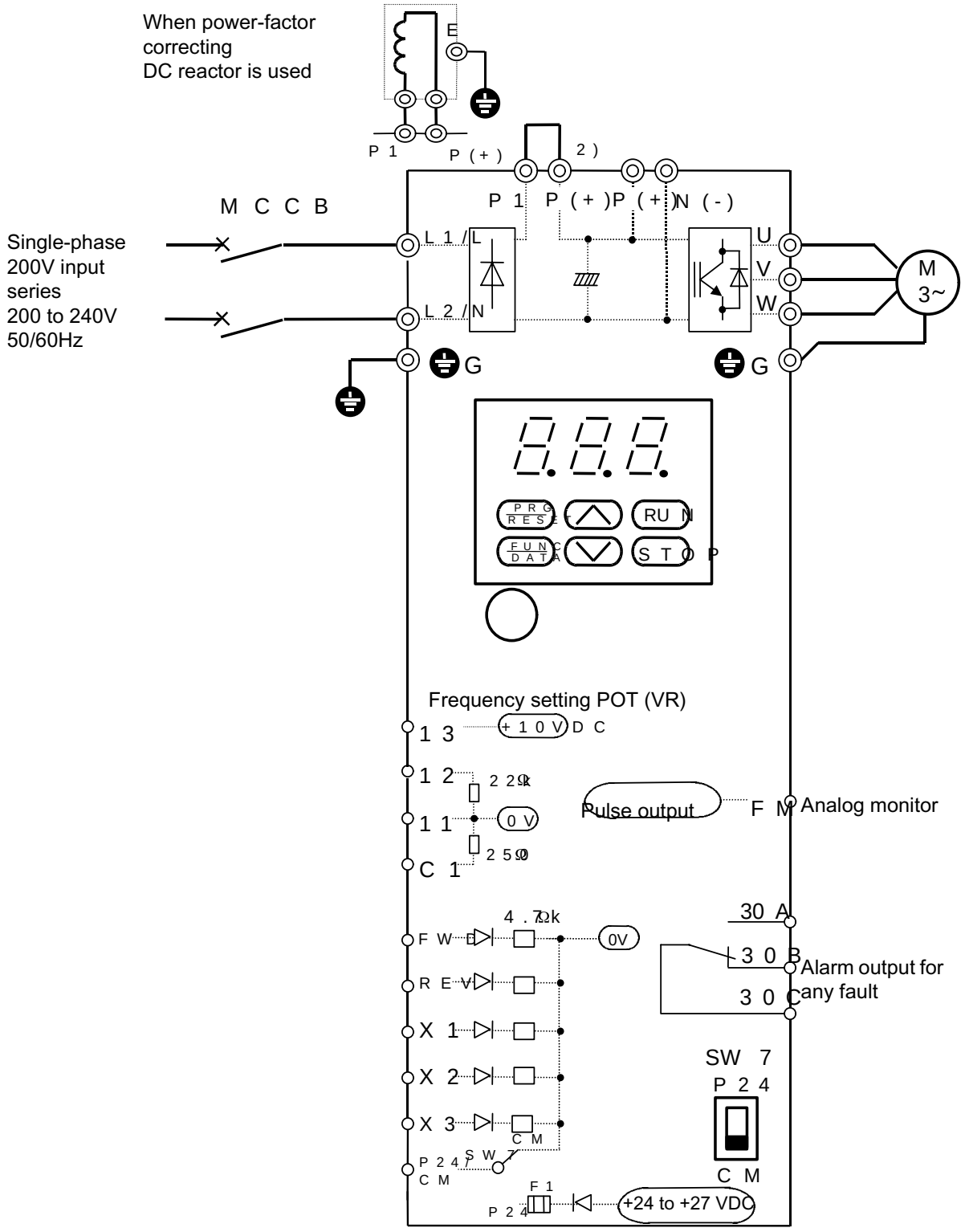


Figure 2-3-9 Wiring diagram of keypad panel operation

- The RUN and STOP keys on the keypad panel can be used to start and stop the operation and the frequency setting POT (VR) can be used to set a frequency only by connecting the power supply and motor with functions set in the factory. Forward rotation is set in the factory.
- Connect the surge absorber in parallel to coils (such as coils of the magnetic contactor and solenoid) near the inverter.
- Remove the jumper between the P1 and P(+) terminals before connecting the optional power-factor correcting DC reactor.

2) External operation (when external power supply is used)

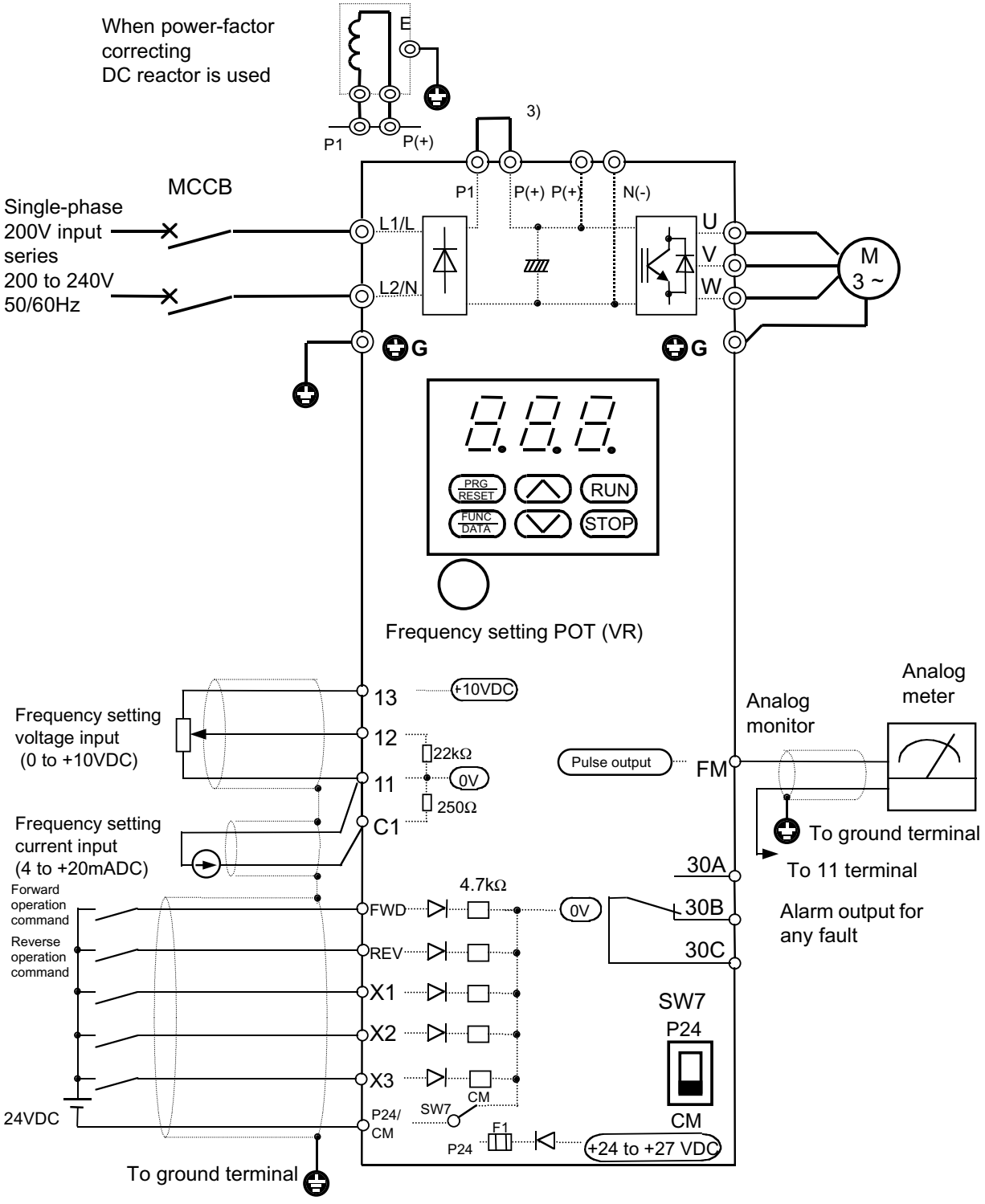


Figure 2-3-10 Wiring diagram of external operation (when external power supply is used)

- Use this connection to start, stop the operation and set the frequency with external signals. 0 to 10V DC can be set while function F01 is set to 1 and +4 to +20mA DC can be set while function F01 is set to 2. Set function F02 to 1.
- Set SW7 at CM
- Remove the jumper between the P1 and P(+) terminals before connecting the optional power-factor correcting DC reactor.
- Connect the surge absorber in parallel to coils (such as coils of the magnetic contactor and solenoid) near the inverter
- Use twisted or shielded wire as control signal wire. Connect the shield to the ground terminal.

3) External operation (when internal power supply is used)

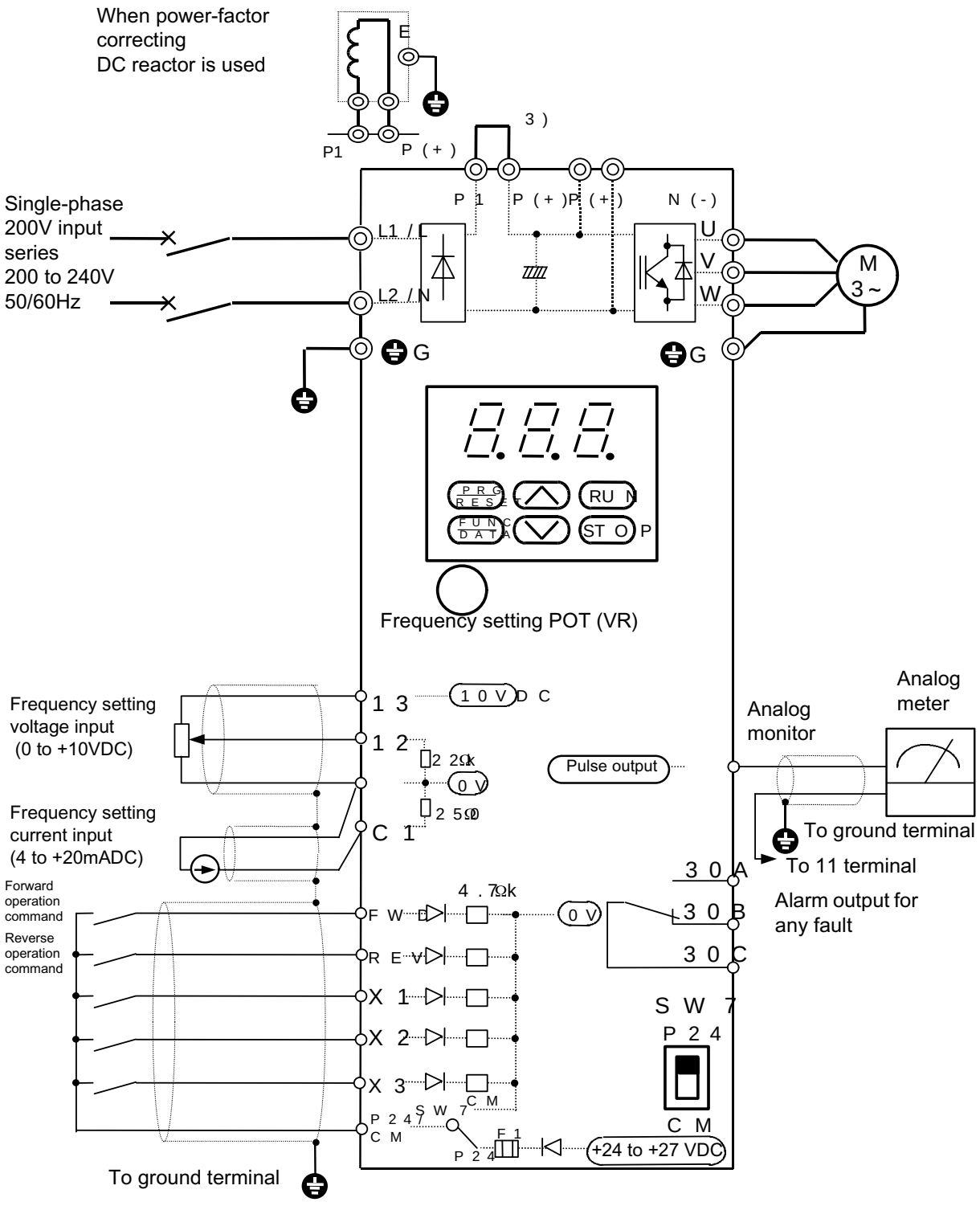


Figure 2-3-11 Wiring diagram of external operation (when internal power supply is used)

- Use this connection to start, stop the operation and set the frequency with external signals. 0 to 10V DC can be set while function F01 is set to 1 and +4 to +20mA DC can be set while function F01 is set to 2. Set function F02 to 1.
- Set SW7 at P24
- Remove the jumper between the P1 and P(+) terminals before connecting the optional power-factor correcting DC reactor.
- Connect the surge absorber in parallel to coils (such as coils of the magnetic contactor and solenoid) near the inverter.
- Use twisted or shielded wire as control signal wire. Connect the shield to the ground terminal.

4) Connection to PLC (when external thermal O/L relay is used)

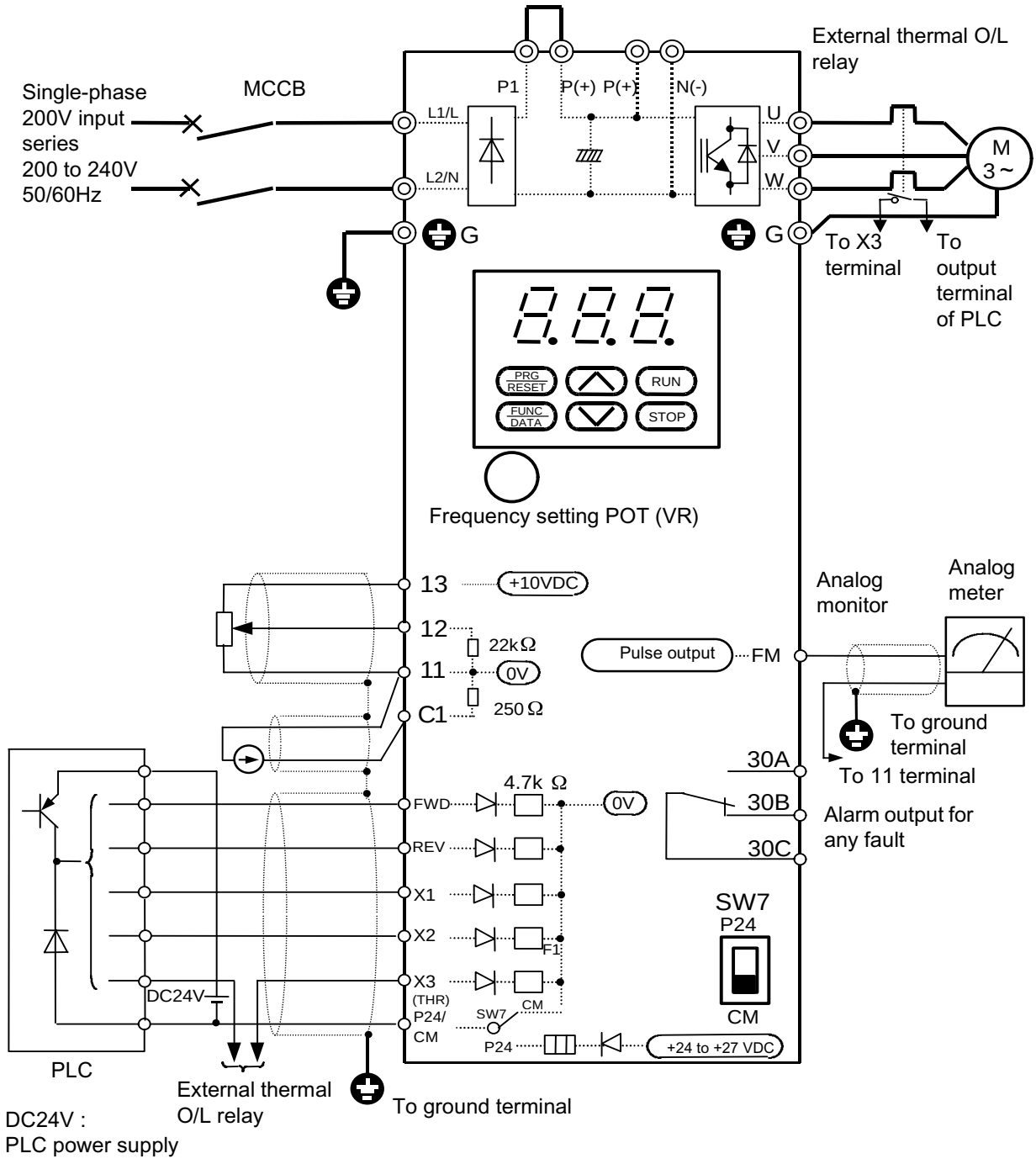


Figure 2-3-12 Connection example of PLC terminal (using THR function terminal)

- Set SW7 at CM
- In the figure above, the power is supplied to external thermal relay from the power supply of the PLC. If the power supply of the PLC is turned off while the inverter remains turned on, OH2 trips.
- To prevent OH2 from tripping upon shutdown of the PLC, deselect the THR terminal function and use the electronic relay of the inverter

CAUTION When SW7 is set at P24, possibly causing inner parts to damage.

5) Connection to PLC (when analog signal is input from PLC)

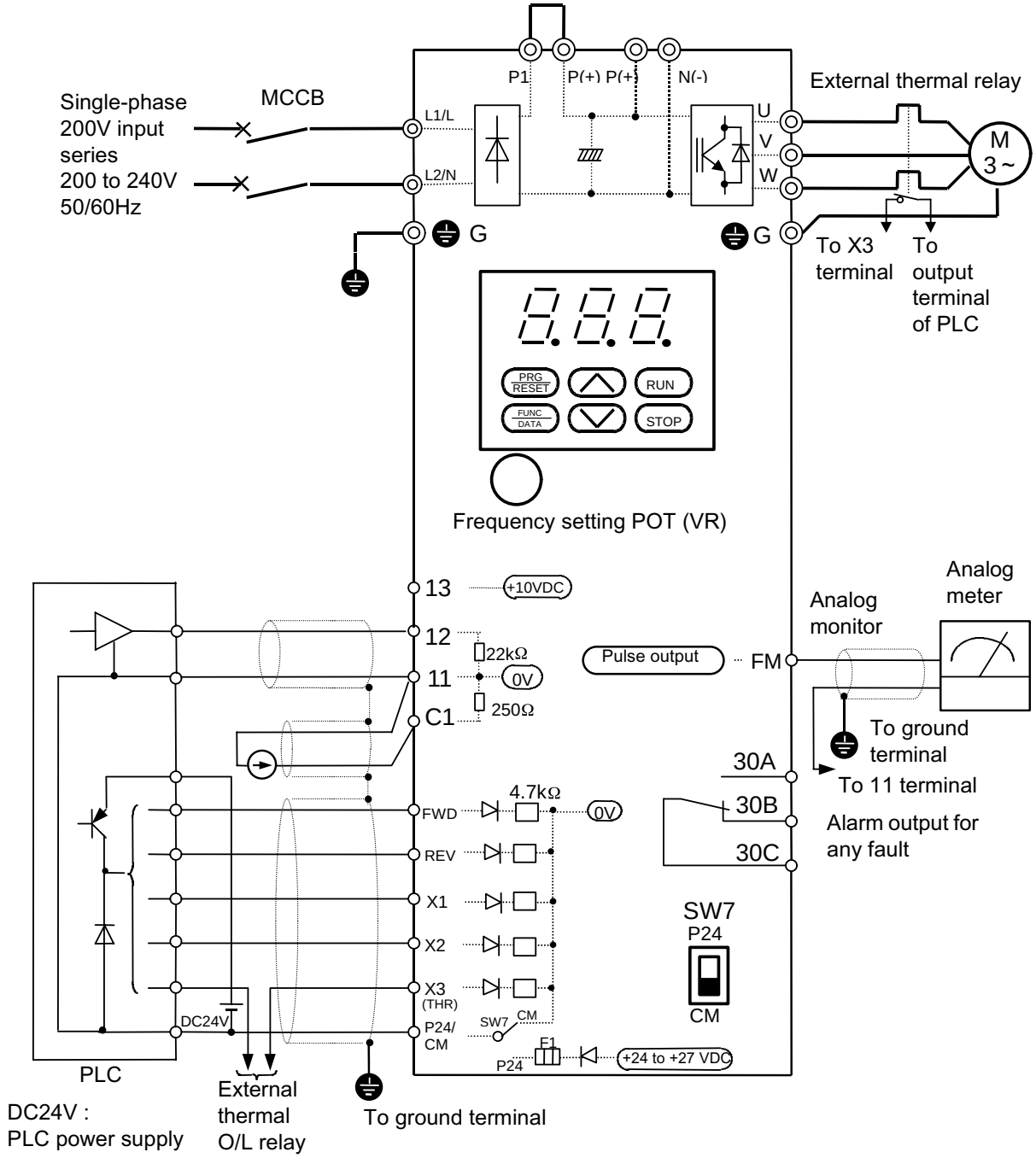


Figure 2-3-13 Connection example of PLC terminal (when analog signal is input from PLC)

1) Set SW7 at CM.
2) With this connection, the power is supplied from the PLC power supply to the external thermal O/L relay. So, OH2 trip is activated by PLC power-off with the inverter turned on.
3) To prevent inverter trip with OH2 when the PLC power being turned off, do not select the THR terminal function and use the inverter electronic thermal O/L relay.

CAUTION When SW7 is set at P24, poly switch (F1) activates a current limit to turn the power off.

2-4 Others

2-4-1 Harmonic component

A harmonic component which may influence the phase-advance capacitor and generator is included in the inverter input current. If necessary, connect a power-factor correcting DC reactor (DCR) (option) for the inverter.

2-4-2 Noise

When noise generated from the inverter may affect peripheral equipment, and noise generated from peripheral equipment may malfunction the inverter, the following basic countermeasures should be taken.

1) When noise affects other devices via power and ground wires
   - Separate the ground of the inverter and that of the affected device.
   - Connect a noise filter to the inverter power wire.
   - Use an isolation transformer to separate the power supply of the inverter and that of the affected device.

2) When another device is affected by induction or radiation
   - Separate the main circuit wiring of the inverter from the control wiring and wiring of the affected device.
   - Encase the inverter main circuit wiring in a metal tube and ground the metal tube near the inverter.
   - Encase the inverter in a metal rack and ground the rack.
   - Connect a noise filter to the inverter power wire.

3) When noise generated from peripheral equipment affects the inverter
   - Use twisted or twisted-pair shielded wires for the inverter control wiring. Ground the shields.
   - Connect a surge absorber in parallel to the coil of the magnetic contactor and solenoid.
   - If the power supply includes much distortion of the waveform or surge, connect an impedance matching AC reactor for coordination of power supply.

2-4-3 Leakage current

Leakage current flows through the inverter I-O wiring and motor stray capacitance when the inverter transistor is turned on and off.
Table 2-3-3 lists the countermeasures for the problems caused by the leakage current.

	Problem	Countermeasures
1	Trip of earth leakage circuit breaker on main power supply side	1. Set the carrier frequency lower. 2. Shorten the wiring between the inverter and motor. 3. Increase the ELCB/RCD sensitivity current. 4. Replace the ELCB/RCD with an ELCB/RCD that is designed for high frequencies.
2	Trip of external thermal O/L relay	1. Set the carrier frequency lower. 2. Increase the thermal O/L relay set value. 3. Use the inverter electronic thermal O/L relay.

Table 2-3

3 Operation

3-1 Inspection and Preparation before Operation

Check the following before operation:

1) Check whether the connection is correct.
   For single-phase 200V series, check whether the power supply is connected correctly to the L1/L and L2/N terminals. Also check whether the inverter grounding terminal ⏚G is securely connected.
2) Check for short-circuits and ground faults between terminals and between live parts.
3) Check for loose terminals, connectors, and screws.
4) Check whether the motor is separated from mechanical equipment.
5) Set switches to OFF before turning on the power so that the inverter will not start or operate abnormally at power-on.
6) Check the following after power-on:
   a) Check for alarms displayed on the keypad panel.

WARNING

1. Always install the surface cover before turning on the power. Do not remove the surface cover during conduction. **Otherwise electric shock could occur.**
2. Do not operate a switch with wet hands. **Otherwise electric shock could occur.**

3-2 Operation Method

There are various operation methods. Select a method depending on the purpose and operation specifications with reference to Chapters 4 and 5. Table 3-2-1 lists operation methods used generally.

Operation method	Frequency setting	Running command
Operation by using keypad panel	Built-in frequency setting POT (VR) or UP/DOWN key	RUN/STOP key
Operation by using external signal terminal	Setting by using analog voltage, analog current, and external POT (VR)	Contact input (switch) ● When SW7 is set at CM Connect external power supply and connect terminal FWD with the (+) terminal of the external power supply, or connect terminal REV with the (+) terminal of the external power supply. ● When SW7 is set at P24 Connect terminal FWD with P24/CM or connect terminal REV with P24/CM. Refer to section 2-3-3.

Table 3-2-1 General operation method

3-3 Trial Run

The motor rotates when a frequency value and running command are input from the keypad panel or external signal terminal.
Refer to Table 3-3-1.
Use a low frequency (about 5Hz) for trial runs.
A frequency can be set using the built-in frequency setting POT (VR) , and forward/stop can be performed using the keypad panel with the functions set in the factory.

Operation method	Frequency setting	Running command
Operation by using keypad panel	(When built-in POT (VR) is used) The frequency increases when the variable resistor is turned clockwise and reduces when it is turned counterclockwise. The motor accelerates when the variable resistor is turned clockwise during operation and decelerates when it is turned counterclockwise.	Operation starts when the RUN key is pressed. The motor decelerates and stops when the STOP key is pressed.
Operation by using external signal terminal	(When the UP/DOWN key is used) Frequency increases when the UP key is pressed. It reduces when the DOWN key is pressed.	• When SW7 is set at CM Connect external power supply and turn FWD (REV) on to start. Turn it off to bring the inverter to deceleration and stop. • When SW7 is set at P24 Turn FWD (REV) on to start. Turn it off to bring the inverter to deceleration and stop. Operation is not stopped although the STOP key is pressed. Refer to section 2-3-3.

Table 3-3-1 Running command

Check the following items:

a) Rotation direction
b) Whether rotation is smooth (whether there is a motor buzzing noise or abnormal vibration)
c) Whether acceleration and deceleration are smooth
d) Whether the inverter cooling fan is rotating (1.5kW or more)

If no abnormality is detected, check the item again by increasing the frequency.
Even if the output from the inverter is stopped, you will be get an electric shock when you touch the main circuit terminals such as inverter output terminals U, V and W if the voltage is supplied to the main power supply input terminal.
The smoothing capacitor in the inverter has been charged when the power is turned off and it is not discharged immediately. Before touching the electric circuit, wait until at least five minutes have elapsed after power-off and the charge lamp is off, indicating the voltage is already low.
After checking normality in the above trial run, start operation.

WARNING

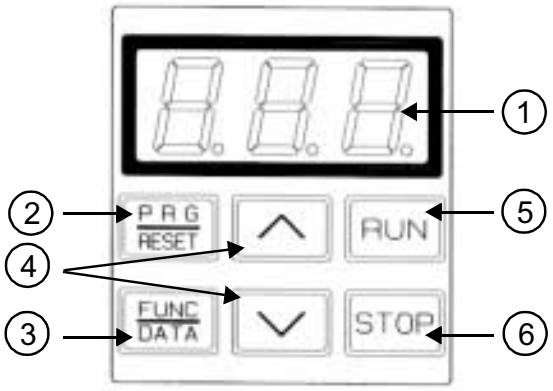
1. The STOP key is valid only when the function has been set.
   Assign another switch to emergency stops.
   Otherwise accidents could occur.
2. Operation starts suddenly if alarm reset is done with an running signal input. Check that no running signal is input before alarm reset.
   Otherwise accidents could occur.

CAUTION

Do not touch the heat sink.
Otherwise burns could occur.

4 Keypad Panel

4-1 Names and Functions



(1) Digital display
In program mode: Shows function codes and data codes.
In Operation mode: Shows the output frequency and output current, etc.
In Trip mode: Shows a code indicating the causes of the trip.

(2) Program (Reset) key
Switches between Operation mode and Program mode.
In Trip mode: Resets the trip status and change to Operation mode.

(3) Function/Data key
In Operation mode: Switches between frequency display and output current display during stopped and running. In Program mode: Used to read and write various function codes and function data items.

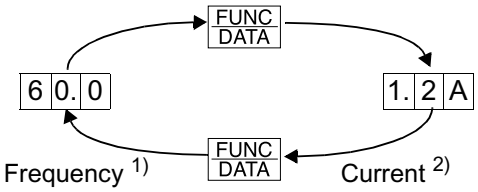
(4) Up/down keys
In Operation mode: Used to increase and reduce the frequency (motor speed).In Program mode: Used to change a function code and data value.

(5) RUN key
This key is used to start operation.
The LED is on during operation.
This key does not function when the data code from the external signal (digital input) is selected (F02 = 1).

(6) STOP key
This key is used to stop operation.
This key does not function when the data code from the external signal (digital input) is selected (F02 = 1).

4-2 Operating Keypad Panel

1) Switching monitor
The display can be switched between frequency display and output current display by pressing the FUNC DATA in Operation mode.



1) Frequency is displayed as a percentage with the least significant digit in PID control operation (function H20 is set to 1 or 2):
1 0. 0. for 10%
1 0 0. for 100%

2) The reference frequency is displayed when the ⋀ ⋁ key is pressed in current indication.

2) Stopping operation
Operation is started when the RUN is pressed, and is stopped when the STOP is pressed while function F 0 2 is set to a value other than _ _ 1.

The rotation direction is:

F 0 2 = _ _ 0 : Forward rotation with FWD-P24/CM ON, and reverse rotation with REV-P24/CM ON

F 0 2 = _ _ 2 : Forward rotation (FWD/REV input is ignored.)

F 0 2 = _ _ 3 : Reverse rotation (FWD/REV input is ignored.)

3) Changing frequency
The frequency increases when the ∧ is pressed and decreases when the ∨ is pressed while function F01 is set to 00.

The change speed is increased when the FUNC DATA is pressed at the same time as the ∧ or ∨.

Note: Do not turn the power off for five seconds after monitor switching or function setting, to prevent Er1 occurrence.

4) Setting function

	Procedure	Display
1	Press the PRG RESET key to set the program mode.	60.0 F00
2	Press the ∧ ∨ key to select a function.	F01 [1)]
3	Press the FUNC DATA key to display data.	01
4	Press the ∧ ∨ key to change the data.	02
5	Press the FUNC DATA to save the data.	F02
6	Changing another function Press the PRG RESET to cancel the program mode.	60.0

1) The function code display changes as shown below.
The o01 to o11 are displayed only with o00 set to 01.