Chapter 6 Control Terminals

CAUTION

Analog input terminals (AVI, ACI, AUI, ACM)

☑ Analog input signals are easily affected by external noise. Use shielded wiring and keep it as short as possible (< 20m) with proper grounding. If the noise is inductive, connecting the shield to the ACM terminal can reduce interference.

☑ Use twisted-pair wire for weak analog signals.

☑ If the analog input signals are affected by noise from the AC motor drive, connect a capacitor and a ferrite core as shown in Figure 6-1.

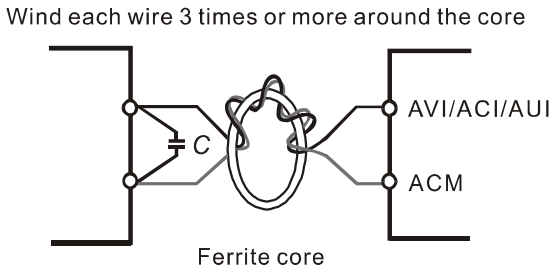


Figure 6-1

Contact input terminals (FWD, REV, MI1–MI8, COM)

☑ The "COM" terminal is the common side of the photo-coupler. Any of wiring method, the "common point" of all photo-coupler must be the "COM".

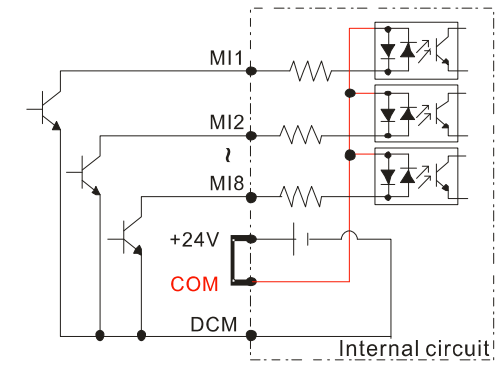


Figure 6-2

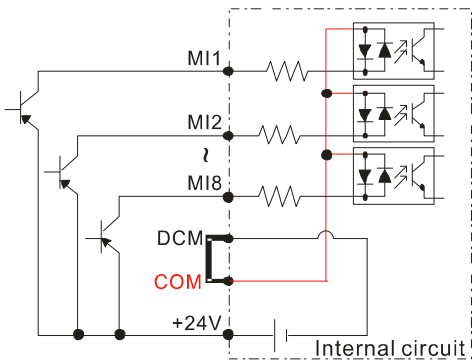


Figure 6-3

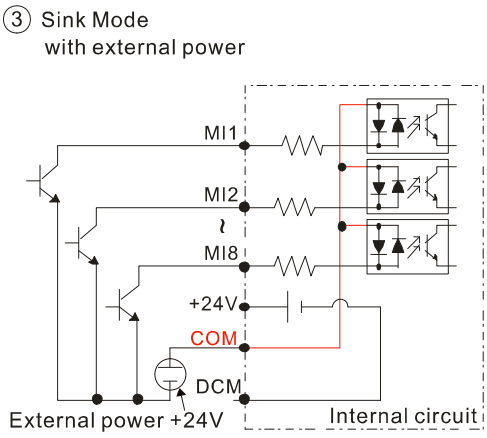


Figure 6-4

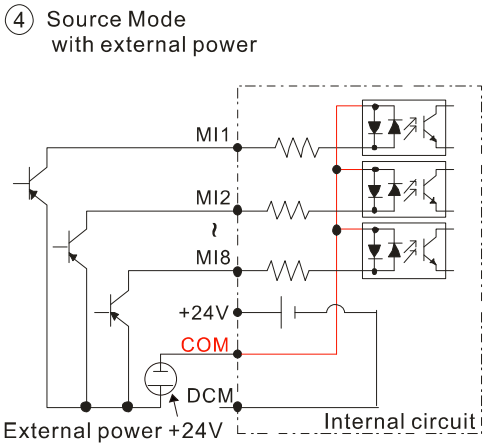


Figure 6-5

☑ When the photo-coupler uses internal power supply, the switch connection for Sink and Source modes shows as Figure 6-2 and Figure 6-3: MI-DCM: Sink mode, MI-+24V: Source mode.

☑ When the photo-coupler uses external power supply, remove the short circuit cable between the +24V and COM terminals. The connection mode is Sink mode or Source mode according to the below:

The “+” of 24V connects to “COM: Sink mode

The “-“ of 24V connects to COM: Source mode

Transistor outputs (MO1, MO2, MCM)

☑ Connect the digital outputs to the correct polarity.

☑ When connecting a relay to the digital outputs, connect a surge absorber across the coil and check the polarity.

6-1 Remove the Cover for Wiring

Remove the top cover before wiring the multi-function input and output terminals.

NOTE The drive appearances shown in the figures are for reference only, a real drive may look different.

Frame A & B

Applicable models: VFD007C23A-21; VFD007C43A-21; VFD007C4EA-21; VFD015C23A-21; VFD015C43A-21; VFD015C4EA-21; VFD015C53A-21; VFD022C23A-21; VFD022C43A-21; VFD022C4EA-21; VFD022C53A-21; VFD037C23A-21; VFD037C43A-21; VFD037C4EA-21; VFD037C53A-21; VFD040C43A-21; VFD040C4EA-21; VFD055C23A-21; VFD055C43A-21; VFD055C4EA-21; VFD055C53A-21; VFD075C23A-21; VFD075C43A-21; VFD075C4EA-21; VFD075C53A-21; VFD110C23A-21; VFD110C43A-21; VFD110C4EA-21; VFD110C53A-21; VFD150C43A-21; VFD150C4EA-21; VFD150C53A-21

Screw torque: 12–15 kg-cm / [10.4–13 lb-in.] / [1.2–1.5 Nm]

Loosen the screws and press the tabs on both sides to remove the cover.

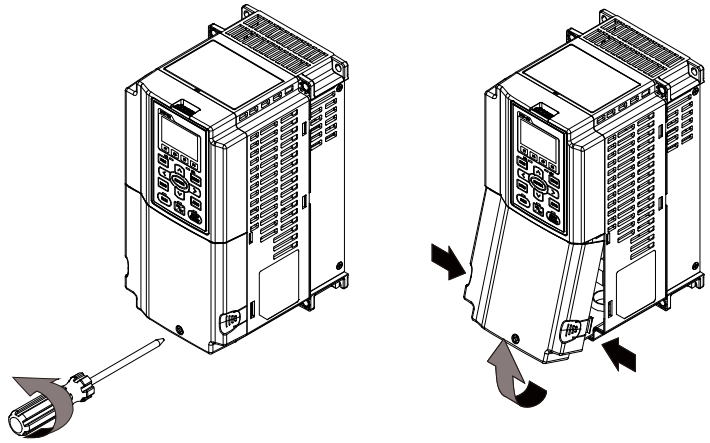


Figure 6-6

Frame C

Applicable models: VFD150C23A-21; VFD185C23A-21; VFD185C43A-21; VFD185C4EA-21; VFD185C63B-21; VFD220C23A-21; VFD220C43A-21; VFD220C4EA-21; VFD220C63B-21; VFD300C43A-21; VFD300C4EA-21; VFD300C63B-21; VFD370C63B-21

Screw torque: 12–15 kg-cm / [10.4–13 lb-in.] / [1.2–1.5 Nm]

Loosen the screws and press the tabs on both sides to remove the cover.

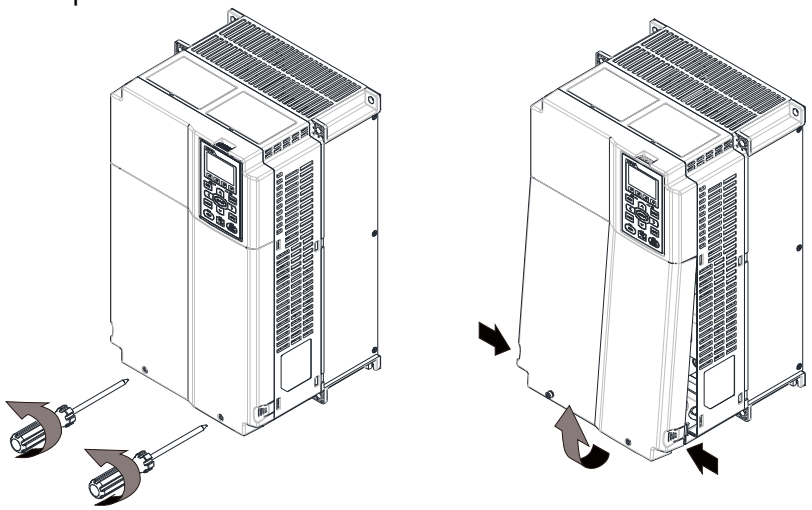


Figure 6-7

Frame D0 & D

Applicable models: VFD300C23A-00; VFD300C23A-21; VFD370C23A-00; VFD370C23A-21;
VFD370C43S-00; VFD370C43S-21; VFD450C43S-00; VFD450C43S-21;
VFD450C63B-00; VFD450C63B-21; VFD550C43A-00; VFD550C43A-21;
VFD750C43A-00; VFD750C43A-21; VFD550C63B-00; VFD550C63B-21

Screw torque: 12–15 kg-cm / [10.4–13 lb-in.] / [1.2–1.5 Nm]

To remove the cover, lift it slightly and pull outward.

Loosen the screws and press the tabs on both sides to remove the cover.

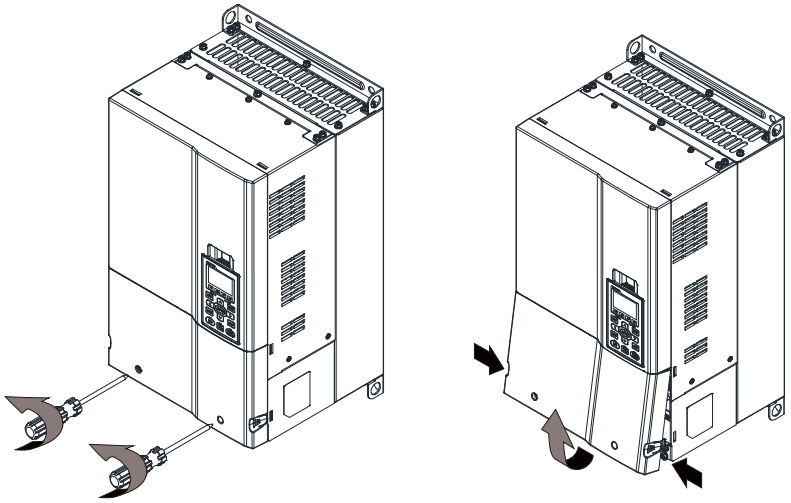


Figure 6-8

Frame E

Applicable models: VFD450C23A-00; VFD450C23A-21; VFD550C23A-00; VFD550C23A-21;
VFD750C23A-00; VFD750C23A-21; VFD750C63B-00; VFD750C63B-21;
VFD900C43A-00; VFD900C43A-21; VFD900C63B-00; VFD900C63B-21;
VFD1100C43A-00; VFD1100C43A-21; VFD1100C63B-00; VFD1100C63B-21;
VFD1320C63B-00; VFD1320C63B-21

Screw torque: 12–15 kg-cm / [10.4–13 lb-in.] / [1.2–1.5 Nm]

To remove the cover, lift it slightly and pull outward.

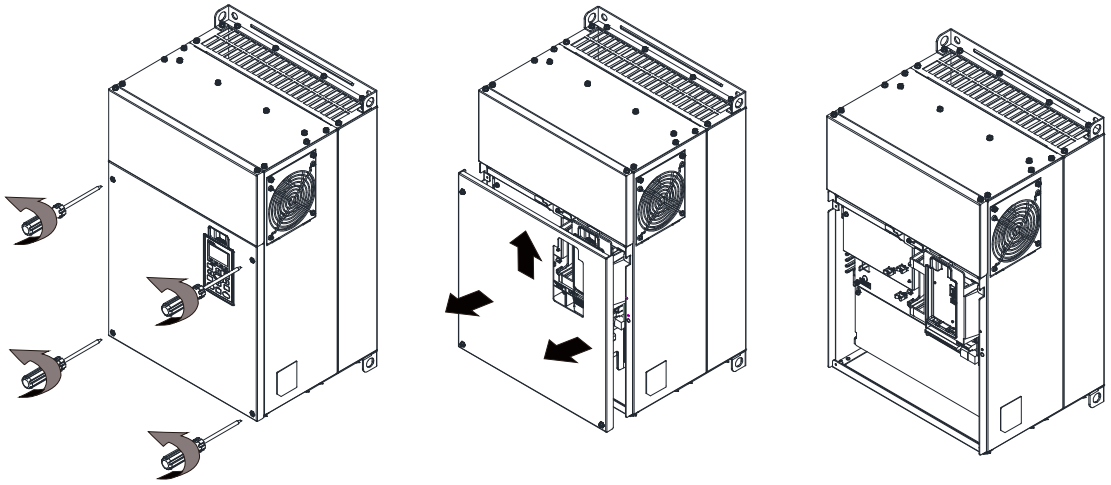


Figure 6-9

Frame F

Applicable models: VFD900C23A-00; VFD900C23A-21; VFD1320C43A-00; VFD1320C43A-21; VFD1600C43A-00; VFD1600C43A-21; VFD1600C63B-00; VFD1600C63B-21; VFD2000C63B-00; VFD2000C63B-21

Screw torque: 12–15 kg-cm / [10.4–13 lb-in.] / [1.2–1.5 Nm]

To remove the cover, lift it slightly and pull outward.

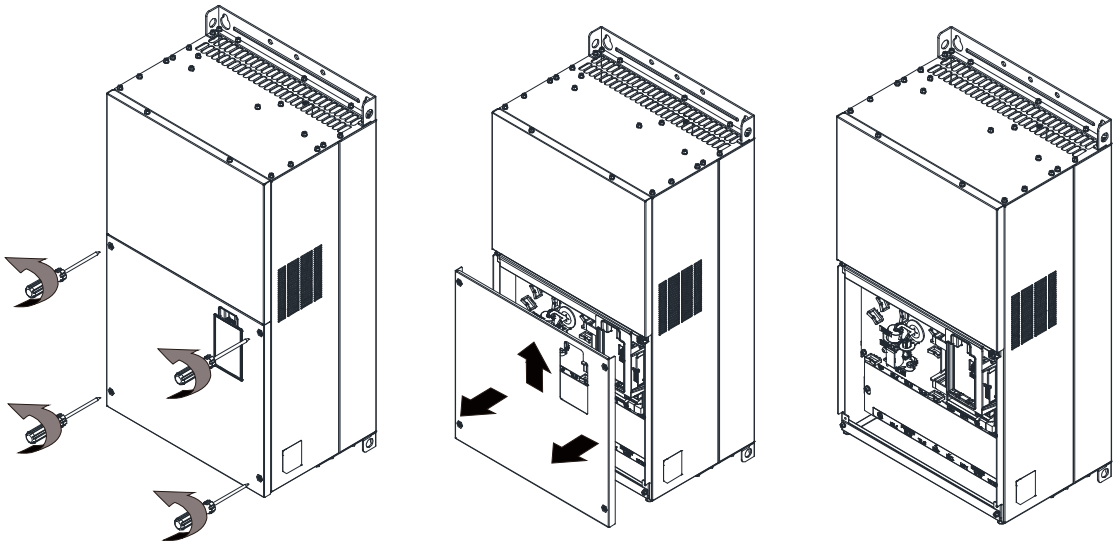


Figure 6-10

Frame G

Applicable models: VFD1850C43A-00; VFD1850C43A-21; VFD2000C43A-00; VFD2000C43A-21; VFD2200C43A-00; VFD2200C43A-21; VFD2500C43A-00; VFD2500C43A-21; VFD2500C63B-00; VFD2500C63B-21; VFD3150C63B-00; VFD3150C63B-21

Screw torque: 12–15 kg-cm / [10.4–13 lb-in.] / [1.2–1.5 Nm]

To remove the cover, lift it slightly and pull outward.

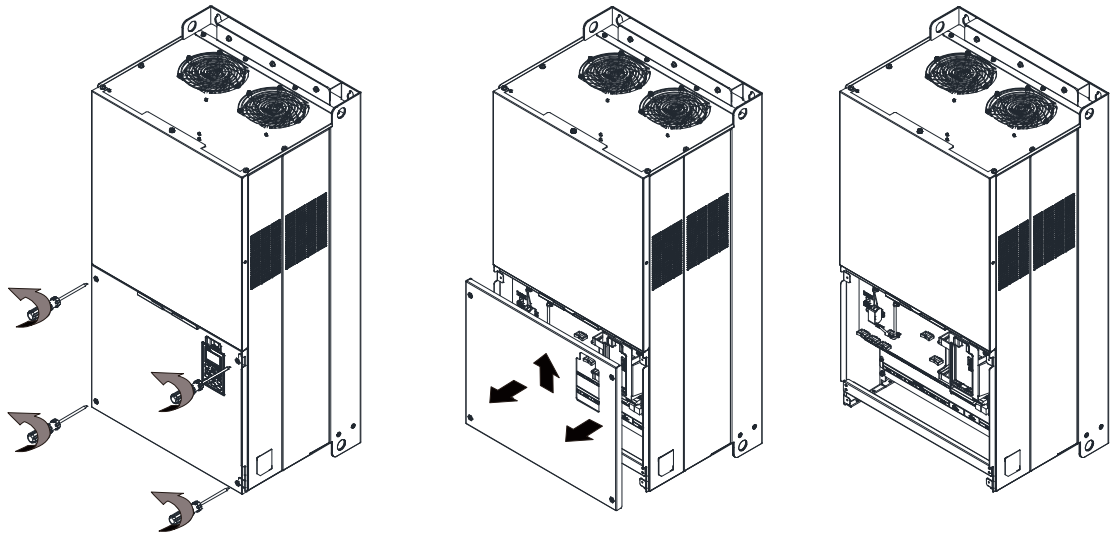


Figure 6-11

Frame H

Applicable models: VFD2800C43A-00; VFD2800C43C-21; VFD3150C43A-00; VFD3150C43C-21; VFD3550C43A-00; VFD3550C43C-21; VFD4000C43A-00; VFD4000C43C-21; VFD4000C63B-00; VFD4500C43A-00; VFD4500C43C-21; VFD4500C63B-00; VFD5000C43A-00; VFD5000C43C-21; VFD5600C43A-00; VFD5600C43C-21; VFD5600C63B-00; VFD6300C63B-00

Screw torque: 14–16 kg-cm / [12.15–13.89 lb-in.] / [1.4–1.6 Nm]

To remove the cover, lift it slightly and pull outward.

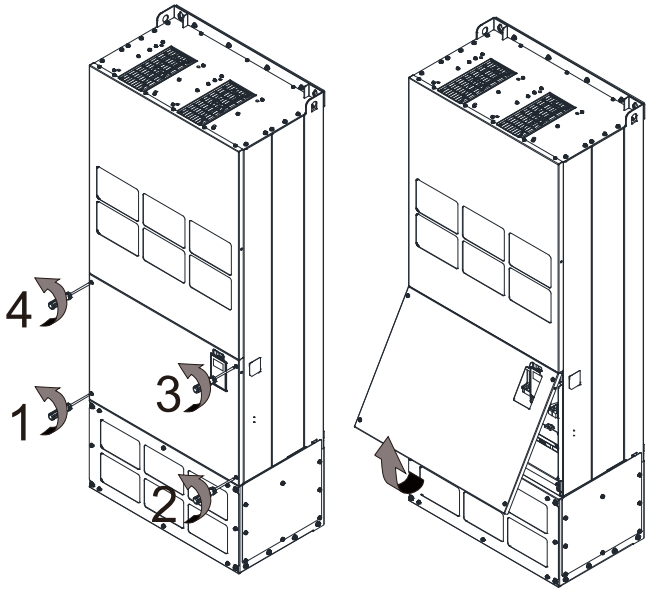


Figure 6-12

690V Frame H3

Applicable models: VFD4000C63B-21; VFD4500C63B-21; VFD5600C63B-21; VFD6300C63B-21

Screw torque: 14–16 kg-cm [12.15–13.89 lb-in.] [1.37–1.57 Nm]

To remove the cover, lift it slightly and pull outward.

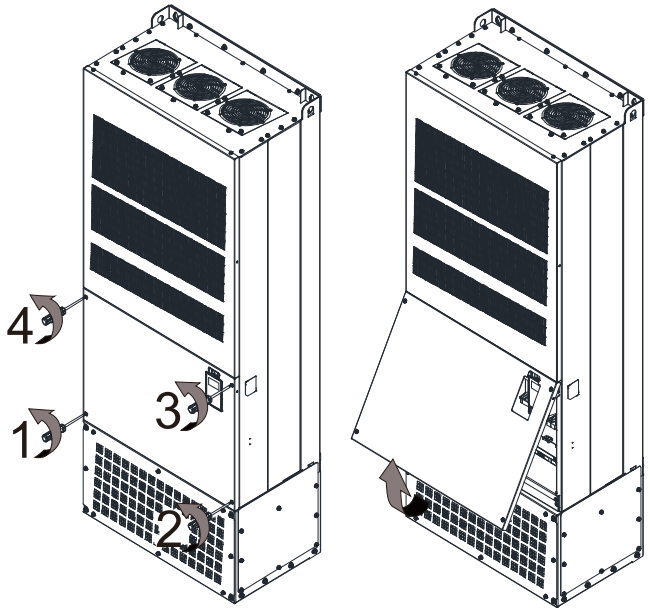


Figure 6-13

6-2 Control Terminal Specifications

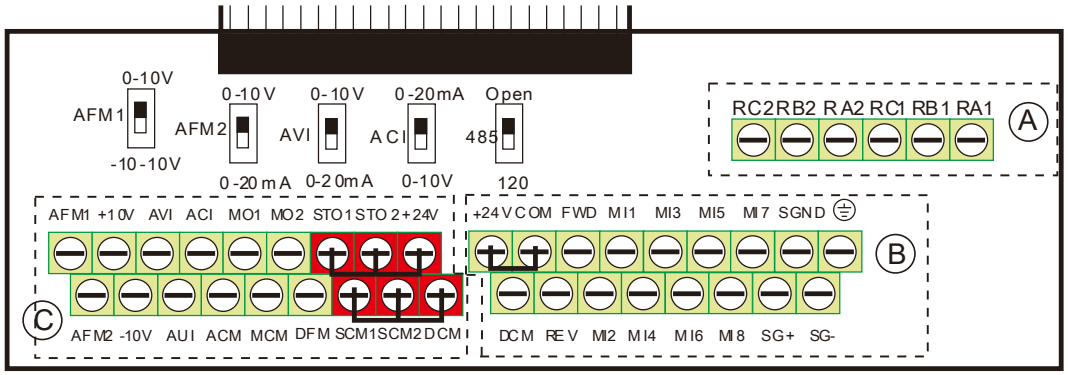


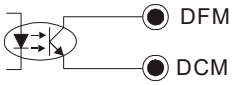
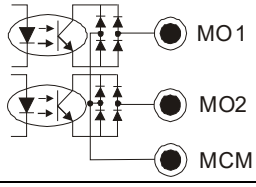
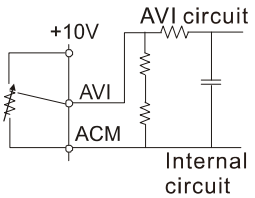
Figure 6-14. Removable Terminal Block

Function name	Area	Conductor	Stripping Length (mm)	Maximum Wire Gauge	Minimum Wire Gauge	Tightening Torque (±10 %)
RELAY Terminals	Ⓐ	Conductor cross section solid wire	4–5	1.5 mm² [16 AWG]	0.2 mm² [26 AWG]	5 kg-cm [4.3 lb-in.] [0.49 Nm]
		Conductor cross section stranded wire				
Control Terminals	Ⓑ	Conductor cross section solid wire	6–7			8 kg-cm [6.9 lb-in.] [0.78 Nm]
		Conductor cross section stranded wire				
Control Terminals	Ⓒ	Conductor cross section solid wire				2 kg-cm [1.7 lb-in.] [0.20 Nm]
		Conductor cross section stranded wire				

Wiring precautions:

- In the figure above, the factory default for STO1, STO2, +24V and SCM1, SCM2, DCM are short-circuited. Use the +24V power supply of the safety function (as shown in section Ⓒ of above figure) for STO only. Do NOT use it for other purposes. The factory setting for +24V-COM is short-circuited and SINK mode (NPN); please refer to Chapter 4 Wiring for detail.
- Tighten the wiring with slotted screwdriver:
  Ⓐ Ⓑ is 3.5 mm (wide) x 0.6 mm (thick); Ⓒ is 2.5 mm (wide) x 0.4 mm (thick)
- When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.

Terminals	Terminal Function	Factory Setting (NPN mode)
+24V	Digital control signal common (Source)	+24V ± 5% 200 mA
COM	Digital control signal common (Sink)	Common for multi-function input terminals
FWD	Forward-Stop command	FWD-DCM: ON➔ forward running OFF➔ deceleration to stop
REV	Reverse-Stop command	REV-DCM: ON➔ reverse running OFF➔ deceleration to stop

Terminals	Terminal Function	Factory Setting (NPN mode)
MI1 – MI8	Multi-function input 1–8	Refer to Pr.02-01–02-08 to program the multi-function inputs MI1–MI8. Source mode ON: activation current 3.3 mA ≥ 11 V_{DC} OFF: cut-off voltage ≤ 5 V_{DC} Sink Mode ON: activation current 3.3 mA ≤ 13 V_{DC} OFF: cut-off voltage ≥ 19 V_{DC}
DFM	Digital frequency signal output  Figure 6-15	DFM uses pulse voltage as an output monitoring signal; Duty-cycle: 50 % Min. load impedance: 1 kΩ / 100 pF Max. current endurance: 30 mA Max. voltage: 30 V_{DC}
DCM	Digital control / Frequency signal common	
MO1	Multi-function output 1 (photocoupler)	The AC motor drive outputs various monitoring signals, such as drive in operation, frequency reached, and overload indication through a transistor (open collector).  Figure 6-16
MO2	Multi-function output 2 (photocoupler)	
MCM	Multi-function output common	Max 48 V_{DC} 50 mA
RA1	Multi-function relay output 1 (N.O.) a	Resistive Load 3A (N.O.) / 3A (N.C.) 250 V_{AC} 5A (N.O.) / 3A (N.C.) 30 V_{DC} Inductive Load (COS 0.4) 1.2A (N.O.) / 1.2A (N.C.) 250 V_{AC} 2.0A (N.O.) / 1.2A (N.C.) 30 V_{DC} To output different kinds of monitoring signals such as motor drive in operation, frequency reached, and overload indication.
RB1	Multi-function relay output 1 (N.C.) b	
RC1	Multi-function relay common	
RA2	Multi-function relay output 2 (N.O.) a	
RB2	Multi-function relay output 2 (N.C.) b	
RC2	Multi-function relay common	
+10V	Potentiometer power supply	Power supply for analog frequency setting: +10V_{DC} 20 mA
-10V	Potentiometer power supply	Power supply for analog frequency setting: -10V_{DC} 20 mA
AVI	Analog voltage frequency command  Figure 6-17	Impedance: 20 kΩ Range: 0–20 mA / 4–20 mA / 0–10 V = 0–Max. Operation Frequency (Pr.01-00) AVI switch, factory setting is 0–10 V

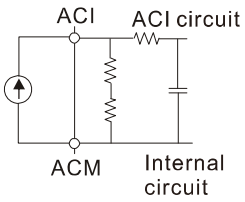
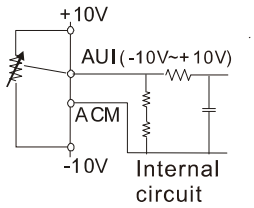
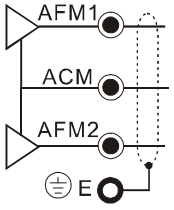
Terminals	Terminal Function	Factory Setting (NPN mode)
ACI	Analog current input  Figure 6-18	Impedance: 250 Ω Range: 0–20mA / 4–20mA / 0–10V = 0–Max. Operation Frequency (Pr.01-00) ACI Switch, factory setting is 4–20 mA
AUI	Auxiliary analog voltage input  Figure 6-19	Impedance: 20 kΩ Range: -10– +10 V_{DC} = 0–Max. Operation Frequency (Pr. 01-00)
AFM1	Multi-function analog voltage output  Figure 6-20	0–10V Max. output current 2mA, Max. load 5 kΩ -10–10V maximum output current 2 mA, maximum load 5 kΩ Output current: 2 mA max Resolution: 0–10V corresponds to Max. operation frequency Range: 0–10V → -10– +10V AFM1 Switch, factory setting is 0–10V
AFM2		0–10V Max. output current 2 mA, Max. load 5 kΩ 0–20 mA Max. load 500 Ω Output current: 20 mA max Resolution: 0–10V corresponds to Max. operation frequency Range: 0–10V → 4–20 mA AFM2 Switch, factory setting is 0–10V
ACM	Analog signal common	Analog signal common terminal
STO1 SCM1 STO2 SCM2	Default setting is shorted Power removal safety function for EN954-1 and IEC/EN61508 When STO1–SCM1; STO2–SCM2 is activated, the activation current is 3.3 mA ≥ 11V_{DC} Note: Refer to Chapter 17 SAFE TORQUE OFF FUNCTION for details.	
SG+ SG- SGND	Modbus RS-485 Note: Refer to Chapter 12 Descriptions Of Parameter Settings parameter group 09 Communication Parameters for details.	
RJ45	PIN 1, 2, 7, 8: Reserved PIN 3, 6: SGND PIN 4: SG- PIN 5: SG+	

Table 6-1

* Analog control signal wiring specification: 0.75 mm^2 [18 AWG] with shielded stranded wire

6-3 Remove the Terminal Block

1. Loosen the screws by screwdriver. (As shown in figure below).

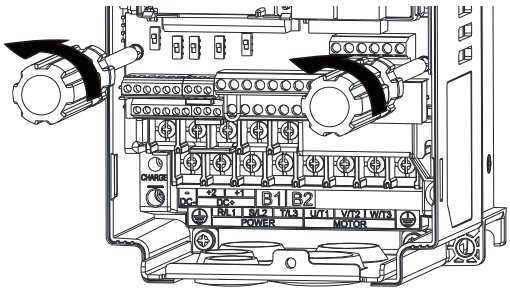


Figure 6-21

2. Remove the control board by pulling it out for a distance 6–8 cm (as 1 in the figure) then lift the control board upward (as 2 in the figure).

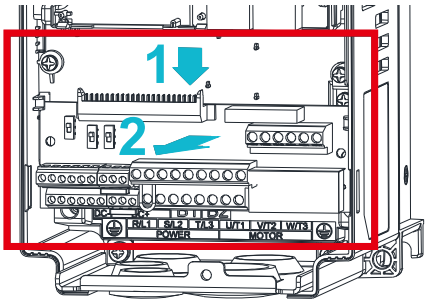


Figure 6-22