3.2 Main Circuit Wiring

This section describes the functions, specifications, and procedures required to safely and properly wire the main circuit of the drive.

NOTICE: *Do not solder the ends of wire connections to the drive. Soldered wiring connections can loosen over time. Improper wiring practices could result in drive malfunction due to loose terminal connections.*

◆ Main Circuit Terminal Functions

Table 3.1 Main Circuit Terminal Functions

Terminal	Type	Function	Reference
R/L1	Main circuit power supply input	Connects line power to the drive. Drives with single-phase 200 V input power use terminals R/L1 and S/L2 only (T/L3 must not be used).	–
S/L2			
T/L3			
U/T1	Drive output	Connects to the motor.	*36*
V/T2			
W/T3			
B1	Braking resistor	Available for connecting a braking resistor or the braking resistor unit option.	–
B2			
+1	DC reactor connection	These terminals are shorted at shipment. Remove the shorting bar between +1 and +2 when connecting a DC reactor to this terminal.	–
+2			
+1	DC power supply input	For connecting a DC power supply.	–
–			
⏚ (2 terminals)	Ground	Grounding Terminal For 200 V class: 100 Ω or less For 400 V class: 10 Ω or less	*36*

◆ Wire Gauges and Tightening Torque

Select the appropriate wires and crimp terminals from *Table 3.2* through *Table 3.4*.

Note:
1. Wire gauge recommendations based on drive continuous current ratings using 75 °C 600 Vac vinyl-sheathed wire assuming ambient temperature within 30 °C and wiring distance less than 100 m.
2. Terminals +1, +2, –, B1 and B2 are for connecting optional devices such as a DC reactor or braking resistor. Do not connect other non-specified devices to these terminals.

- Consider the amount of voltage drop when selecting wire gauges. Increase the wire gauge when the voltage drop is greater than 2% of motor rated voltage. Ensure the wire gauge is suitable for the terminal block. Use the following formula to calculate the amount of voltage drop:
- Line drop voltage (V) = √3 x wire resistance (Ω/km) x wire length (m) x current (A) x 10^{-3}
- Refer to instruction manual TOBPC72060000 for braking unit or braking resistor unit wire gauges.
- *Refer to UL Standards Compliance on page 156* for information on UL compliance.

■ Single-Phase 200 V Class

Table 3.2 Wire Gauge and Torque Specifications

Model CIMR-V□BA	Terminal	Screw Size	Tightening Torque N•m (lb.in.)	Applicable Gauge mm² (AWG)	Recommended Gauge mm² (AWG)
0001 0002 0003	R/L1, S/L2, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M3.5	0.8 to 1.0 (7.1 to 8.9)	0.75 to 2.0 (18 to 14)	2 (14)
0006	R/L1, S/L2, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	2 (14)
0010	R/L1, S/L2, U/T1, V/T2, W/T3, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	3.5 (12)
	–, +1, +2, B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	5.5 (10)
0012	R/L1, S/L2, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	5.5 (10)
0018	R/L1, S/L2, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M5	2 to 2.5 (17.7 to 22.1)	3.5 to 8 (12 to 8)	8 (8)

■ Three-Phase 200 V Class

Table 3.3 Wire Gauge and Torque Specifications

Model CIMR-V□2A	Terminal	Screw Size	Tightening Torque N•m (lb.in.)	Applicable Gauge mm² (AWG)	Recommended Gauge mm² (AWG)
0001 0002 0004 0006	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M3.5	0.8 to 1.0 (7.1 to 8.9)	0.75 to 2.0 (18 to 14)	2 (14)
0010	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2, B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	2 (14)
	⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	3.5 (12)
0012	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	3.5 (12)
0020	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	5.5 (10)
0030	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, -, +1, +2	M4	1.2 to 1.5 (10.6 to 13.3)	5.5 to 14 (10 to 6)	8 (8)
	B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	5.5 (10)
	⏚	M5	2 to 2.5 (17.7 to 22.1)	5.5 to 14 (10 to 6)	8 (8)
0040	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, -, +1, +2	M4	1.2 to 1.5 (10.6 to 13.3)	5.5 to 14 (10 to 6)	14 (6)
	B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	5.5 (10)
	⏚	M5	2 to 2.5 (17.7 to 22.1)	5.5 to 14 (10 to 6)	8 (8)

Model CIMR-V□2A	Terminal	Screw Size	Tightening Torque N•m (lb.in.)	Applicable Gauge mm² (AWG)	Recommended Gauge mm² (AWG)
0056	R/L1, S/L2, T/L3, U/T1, V/T2, W/ T3, -, +1, +2	M6	4 to 6 (35.4 to 53.1)	14 to 22 (6 to 4)	22 (4)
	B1, B2	M5	2 to 2.5 (17.7 to 22.1)	5.5 to 8 (10 to 8)	8 (8)
	⏚	M6	4 to 6 (35.4 to 53.1)	14 to 22 (6 to 4)	22 (4)
0069	R/L1, S/L2, T/L3, U/T1, V/T2, W/ T3, -, +1, +2	M8	9 to 11 (79.7 to 11.0)	8 to 38 (8 to 2)	38 (2)
	B1, B2	M5	2 to 2.5 (17.7 to 22.1)	8 to 14 (8 to 6)	14 (6)
	⏚	M6	4 to 6 (35.4 to 53.1)	8 to 22 (8 to 4)	22 (4)

■ Three-Phase 400 V Class

Table 3.4 Wire Gauge and Torque Specifications

Model CIMR-V□4A	Terminal	Screw Size	Tightening Torque N•m (lb.in.)	Applicable Gauge mm² (AWG)	Recommended Gauge mm² (AWG)
0001 0002 0004 0005 0007	R/L1, S/L2, T/L3, U/T1, V/T2, W/ T3, –, +1, +2, B1, B2, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	2 (14)
0009	R/L1, S/L2, T/L3, U/T1, V/T2, W/ T3, –, +1, +2, B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	2 (14)
	⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	3.5 (12)
0011	R/L1, S/L2, T/L3, U/T1, V/T2, W/ T3, –, +1, +2, B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	2 (14)
	⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	3.5 (12)
0018	R/L1, S/L2, T/L3, U/T1, V/T2, W/ T3, -, +1, +2, B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	5.5 (10)
	⏚	M5	2 to 2.5 (17.7 to 22.1)	5.5 to 14 (10 to 6)	5.5 (10)
0023	R/L1, S/L2, T/L3, U/T1, V/T2, W/ T3, -, +1, +2	M4	1.2 to 1.5 (10.6 to 13.3)	5.5 to 14 (10 to 6)	8 (8)
	B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.0 to 5.5 (14 to 10)	5.5 (10)
	⏚	M5	2 to 2.5 (17.7 to 22.1)	5.5 to 14 (10 to 6)	5.5 (10)
0031	R/L1, S/L2, T/L3, U/T1, V/T2, W/ T3, -, +1, +2	M5	2 to 2.5 (17.7 to 22.1)	5.5 to 14 (10 to 6)	8 (8)
	B1, B2	M5	2 to 2.5 (17.7 to 22.1)	5.5 to 8 (10 to 8)	8 (8)
	⏚	M6	4 to 6 (35.4 to 53.1)	5.5 to 14 (10 to 6)	8 (8)

Model CIMR-V□4A	Terminal	Screw Size	Tightening Torque N•m (lb.in.)	Applicable Gauge mm² (AWG)	Recommended Gauge mm² (AWG)
0038	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, -, +1, +2	M5	2 to 2.5 (17.7 to 22.1)	5.5 to 14 (10 to 6)	14 (6)
	B1, B2	M5	2 to 2.5 (17.7 to 22.1)	5.5 to 8 (10 to 8)	8 (8)
	⏚	M6	4 to 6 (35.4 to 53.1)	5.5 to 14 (10 to 6)	8 (8)

◆ Main Circuit Terminal Power Supply and Motor Wiring

This section outlines the various steps, precautions, and checkpoints for wiring the main circuit terminals and motor terminals.

NOTICE: *When connecting the motor to the drive output terminals U/T1, V/T2, and W/T3, the phase order for the drive and motor should match. Failure to comply with proper wiring practices may cause the motor to run in reverse if the phase order is backward.*

NOTICE: *Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits. Improper application of noise filters could result in damage to the drive.*

NOTICE: *Do not connect the AC power line to the output motor terminals of the drive. Failure to comply could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals.*

■ Cable Length Between Drive and Motor

When the cable length between the drive and the motor is too long (especially at low frequency output), note that the cable voltage drop may cause reduced motor torque. Drive output current will increase as the leakage current from the cable increases. An increase in leakage current may trigger an overcurrent situation and weaken the accuracy of the current detection.

Adjust the drive carrier frequency according to the following table. If the motor wiring distance exceeds 100 m because of the system configuration, reduce the ground currents.

Refer to ***Table 3.5*** to set the carrier frequency to an appropriate level.

Table 3.5 Cable Length Between Drive and Motor

Cable Length	50 m or less	100 m or less	Greater than 100 m
Carrier Frequency	15 kHz or less	5 kHz or less	2 kHz or less

Note: When setting carrier frequency, calculate the cable length as the total distance of wiring to all connected motors when running multiple motors from a single drive.

■ Ground Wiring

Follow the precautions to wire the ground for one drive or a series of drives.

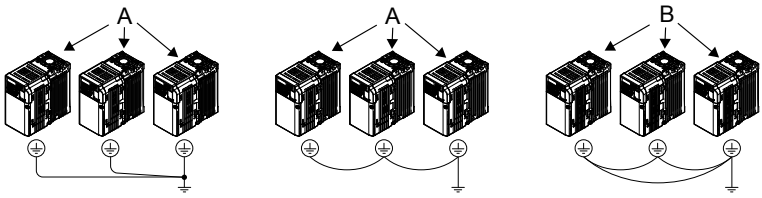
WARNING! *Electrical Shock Hazard. Always use a ground wire that complies with technical standards on electrical equipment and minimize the length of the ground wire. Improper equipment grounding may cause dangerous electrical potentials on equipment chassis, which could result in death or serious injury.*

WARNING! *Electrical Shock Hazard. Be sure to ground the drive ground terminal. (200 V Class: Ground to 100 Ω or less, 400 V Class: Ground to 10 Ω or less). Improper equipment grounding could result in death or serious injury by contacting ungrounded electrical equipment.*

NOTICE: *Do not share the ground wire with other devices such as welding machines or large-current electrical equipment. Improper equipment grounding could result in drive or equipment malfunction due to electrical interference.*

NOTICE: *When using more than one drive, ground multiple drives according to instructions. Improper equipment grounding could result in abnormal operation of drive or equipment.*

Refer to ***Figure 3.3*** when using multiple drives. Do not loop the ground wire.



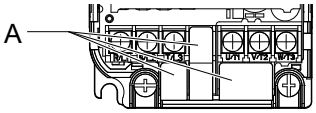
A – Correct **B – Incorrect**

Figure 3.3 Multiple Drive Wiring

■ Wiring the Main Circuit Terminal

WARNING! *Electrical Shock Hazard. Shut off the power supply to the drive before wiring the main circuit terminals. Failure to comply may result in death or serious injury.*

Note: A cover placed over the DC Bus and braking circuit terminals prior to shipment helps prevent miswiring. Cut away covers as needed for terminals with a needle-nose pliers.



A – Protective Cover to Prevent Miswiring

Note: The ground terminal screw on IP20/NEMA Type 1 holds the protective cover in place.