YASKAWA

YASKAWA AC Drive-A1000

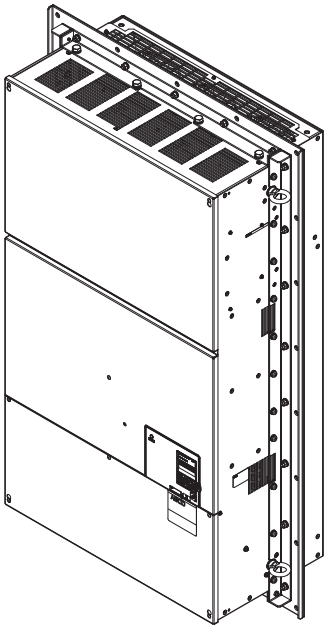
High Performance Vector Control Drive

6-Phase/12-Pulse Input Installation Guide

Type: CIMR-AU4T□□□□

Models: 400 V Class: 22 to 355 kW (25 to 550 HP ND)

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.



MANUAL NO. TOEP C710616 50B

Table of Contents

i

Preface & General Safety

This section provides safety messages pertinent to this product that, if not heeded, may result in fatality, personal injury, or equipment damage. Yaskawa is not responsible for the consequences of ignoring these instructions.

i.1 Preface

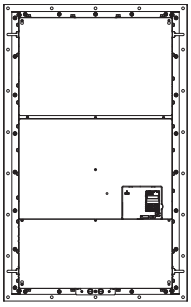
Yaskawa manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Yaskawa products remain the responsibility of the equipment manufacturer or end user. Yaskawa accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any Yaskawa product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All systems or equipment designed to incorporate a product manufactured by Yaskawa must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by Yaskawa must be promptly provided to the end user. Yaskawa offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the Yaskawa manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. Yaskawa assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

This manual is designed to ensure correct and suitable application of A1000-Series Drives with 6-Phase/12-Pulse rectification. Read this manual before attempting to install or operate a drive and keep it in a safe, convenient location for future reference. Be sure you understand all precautions and safety information before attempting application.

Use this manual as the primary reference to install and wire A1000 drives with 6-Phase/12-Pulse rectification together with the A1000 Quick Start Guide and Technical Manual.

◆ Applicable Documentation

The following manuals are available for A1000 series drives:

	**A1000 Series AC Drive 6-Phase/12-Pulse Input Installation Guide (TOEP C710616 50) (this book)**
	This guide is packaged together with the product and contains additional information required to install and wire the A1000 drive with 6-Phase/12-Pulse rectification. This manual is available for download at: www.yaskawa.com.
	A1000 Series AC Drive Quick Start Guide
	Read this guide first. This guide is packaged together with the product and contains basic information required to install and wire the A1000 drive. It also gives an overview of fault diagnostics, maintenance, and parameter settings. The purpose of this guide is to prepare the drive for a trial run with an application and for basic operation. This manual is available for download at: www.yaskawa.com.
	A1000 Series AC Drive Technical Manual
	This manual provides detailed information on parameter settings, drive functions, and MEMOBUS/ Modbus specifications. Use this manual to expand drive functionality and to take advantage of higher performance features. This manual is available for download at: www.yaskawa.com.

i.2 General Safety

⚠ WARNING

Fire Hazard - Drive Short-Circuit Current Rating

Install adequate branch circuit protection according to applicable local codes and this manual.

Failure to comply could result in fire and damage to the A1000 drive or injury to personnel.

The device is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 480 Vac maximum (400 V class), when protected by branch circuit protection devices specified in this manual.

◆ General Application Precautions

■ Selection

Installing a Transformer

Install a 6-Phase/12-Pulse isolation transformer with each of the output windings phase shifted by 30 electrical degrees or install a Hybrid 6-Phase topology on the power supply.

Installing a Reactor

Install an AC reactor in following situations:

- to suppress harmonic current
- to smooth peak current that results form capacitor switching.
- when the power supply capacity (kVA) is 10 times or more greater than the drive capacity according to ***Figure i.1***.
- when the drive is running from a power supply system with thyristor converters.

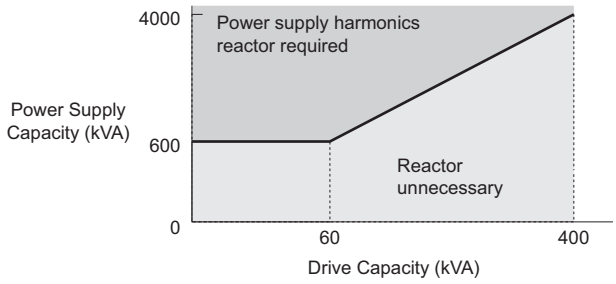


Figure i.1 Installing a Reactor

This Page Intentionally Blank

1

Receiving

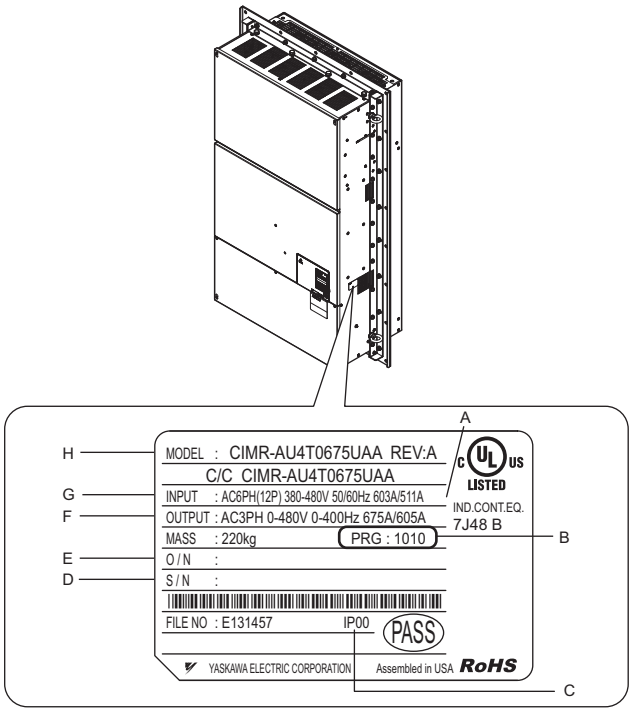
This chapter explains how to inspect the drive upon receipt, and gives an overview of the components.

1.1 Model Number and Nameplate Check

Please perform the following tasks after receiving the drive:

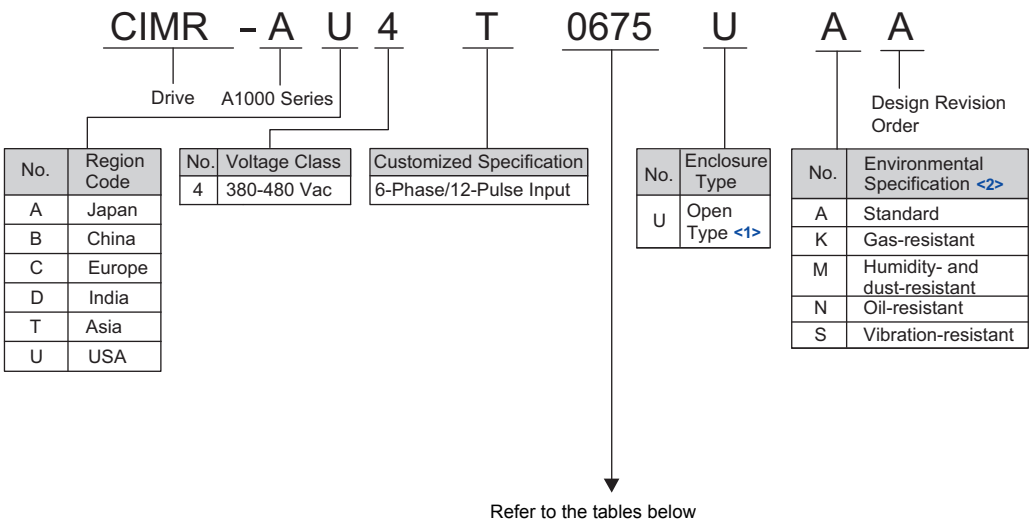
- Inspect the drive for damage.
  If the drive appears damaged upon receipt, contact the shipper immediately.
- Verify receipt of the correct model by checking the information on the nameplate.
- If you have received the wrong model or the drive does not function properly, contact your supplier.

◆ Nameplate



A – Normal duty amps / Heavy duty amps
B – Software version
C – Enclosure type
D – Serial number
E – Lot number
F – Output specifications
G – Input specifications
H – AC drive model

Figure 1.1 Nameplate Information Example



No.	Region Code
A	Japan
B	China
C	Europe
D	India
T	Asia
U	USA

No.	Voltage Class
4	380-480 Vac

Customized Specification
6-Phase/12-Pulse Input

No.	Enclosure Type
U	Open Type <1>

No.	Environmental Specification <2>
A	Standard
K	Gas-resistant
M	Humidity- and dust-resistant
N	Oil-resistant
S	Vibration-resistant

<1> Provides method of mounting drive with backside (heatsink) external to enclosure, with NEMA 12 integrity.
<2> Drives with these specifications do not guarantee complete protection for the environmental conditions indicated.

■ 6-Phase/12-Pulse 400 V Class Rated Output

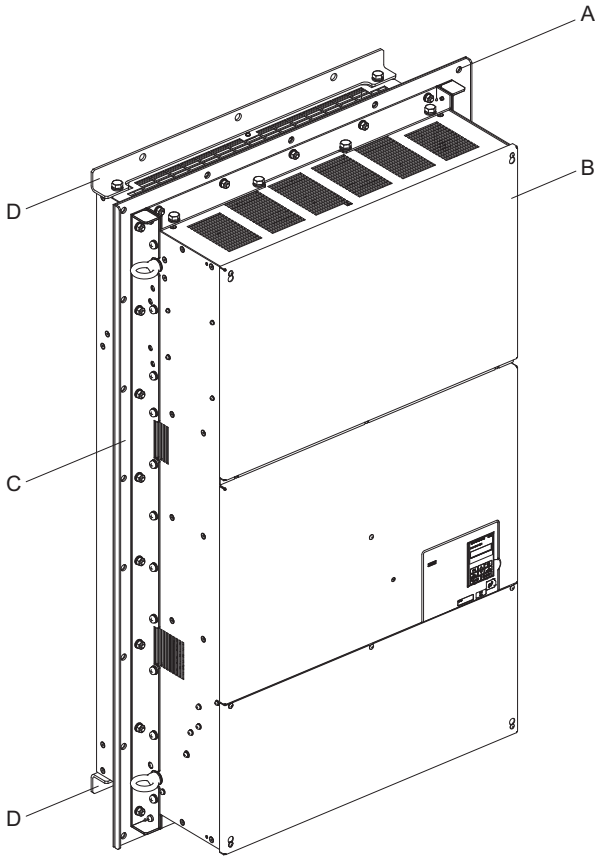
Normal Duty		
No.	**Max. Motor Capacity kW (HP)**	**Rated Output Current A**
0058	30 (40)	58
0072	37 (50)	72
0088	45 (60)	88
0103	55 (75)	103
0139	75 (100)	139
0165	90 (125)	165
0208	110 (150)	208
0250	132 (200)	250
0296	160 (250)	296
0362	185 (300)	362
0414	220 (350)	414
0515	250 (400)	515
0675	355 (500-550)	675

Heavy Duty		
No.	**Max. Motor Capacity kW (HP)**	**Rated Output Current A**
0058	22 (25-30)	45
0072	30 (40)	60
0088	37 (50-60)	75
0103	45 (50-60)	91
0139	55 (75)	112
0165	75 (100)	150
0208	90 (125-150)	180
0250	110 (150)	216
0296	132 (200)	260
0362	160 (250)	304
0414	185 (300)	370
0515	220 (350)	450
0675	315 (400-450-500)	605

1.2 Component Names

This section gives an overview of the drive components described in this manual.

◆ Flange Type Enclosure (NEMA Type 12 Backside)



A – Installation hole
B – A1000 6-Phase/12-Pulse Drive
C – Mounting flange <1>
D – Shipping package attachment (to be removed before installation)

<1> Provides method of mounting drive with backside (heatsink) external to enclosure, with NEMA 12 integrity.

Figure 1.2 Flange Type Enclosure (CIMR-A□4T0675)

NOTICE: *Remove the shipping package attachments before installing.*

2

Mechanical Installation

This chapter explains how to properly mount and install the drive.

2.1 Mechanical Installation

This section outlines specifications and the environment for proper mechanical installation of the drive.

◆ Installation Environment

Install the drive in an environment matching the specifications below to help prolong the optimum performance life of the drive.

Table 2.1 Installation Environment

Environment	Conditions
Installation Area	Indoors
Ambient Temperature	-10°C to +40°C (Flange Type Enclosure) Drive reliability improves in environments without wide temperature fluctuations. When using the drive in an enclosure panel, install a cooling fan or air conditioner in the area to ensure that the air temperature inside the enclosure does not exceed the specified levels. Do not allow ice to develop on the drive.
Humidity	95% RH or less and free of condensation
Storage Temperature	-20°C to +60°C
Surrounding Area	Install the drive in an area free from: • oil mist and dust • metal shavings, oil, water, or other foreign materials • radioactive materials • combustible materials (e.g., wood) • harmful gases and liquids • excessive vibration • chlorides • direct sunlight.
Altitude	Up to 1000 m without derating, up to 3000 m with output current and voltage derating.
Vibration	10 Hz to 20 Hz at 9.8 m/s^2 20 Hz to 55 Hz at 5.9 m/s^2 (Models CIMR-A□4T0058 to 0165) or 2.0 m/s^2 (Models CIMR-A□4T0208 to 0675)
Orientation	Install the drive vertically to maintain maximum cooling effects.

NOTICE: *Avoid placing drive peripheral devices, transformers, or other electronics near the drive as the electrical interference created can lead to erroneous operation. If such devices must be used in close proximity to the drive, take proper steps to shield the drive from noise.*

NOTICE: *Damage to Equipment. Drive heatsink air outlet temperature may be over 80°C. Do not install components above the air outlet that may be damaged by 80°C air temperature.*

NOTICE: *Prevent foreign matter such as metal shavings and wire clippings from falling into the drive during installation. Failure to comply could result in damage to the drive. Place a temporary cover over the top of the drive during installation. Remove the temporary cover before drive start-up, as the cover will reduce ventilation and cause the drive to overheat.*

◆ Removing the Shipping Package Attachments

Remove the shipping package attachments before installation.

Note: The number of screws varies in accordance with the drive model.

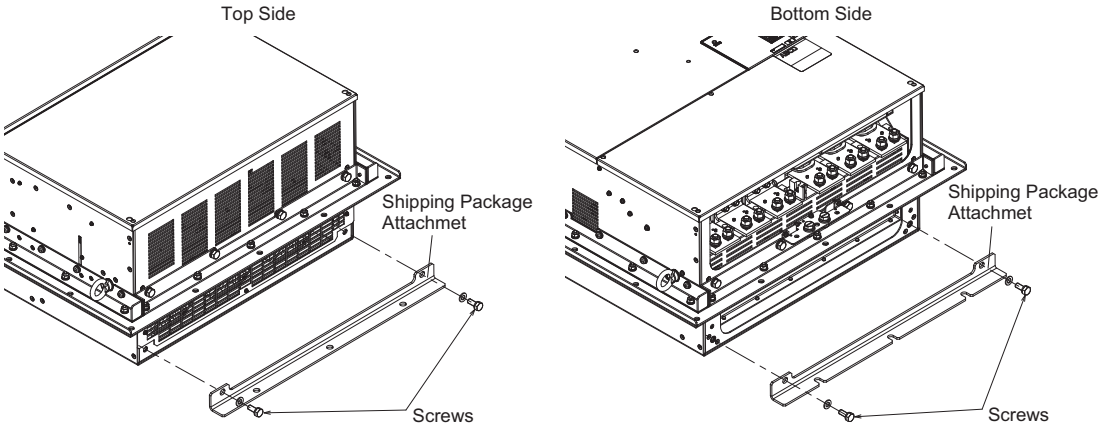


Figure 2.1 Removing the Shipping Package Attachments (example: CIMR-A□4T0675U)

◆ Dimensions

■ Flange Type Enclosure

CIMR-A□4T0058U

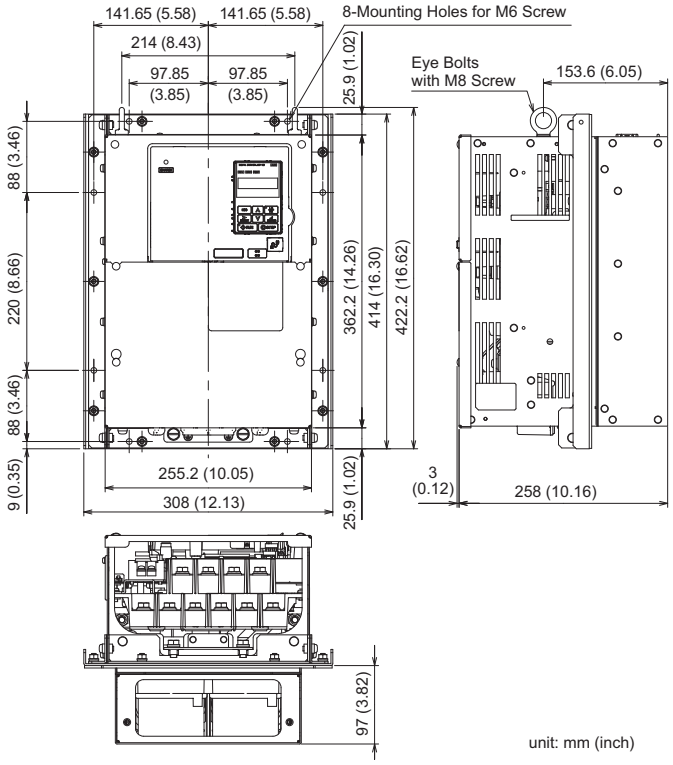


Figure 2.2 Dimensions (CIMR-A□4T0058U)

CIMR-A□4T0072U

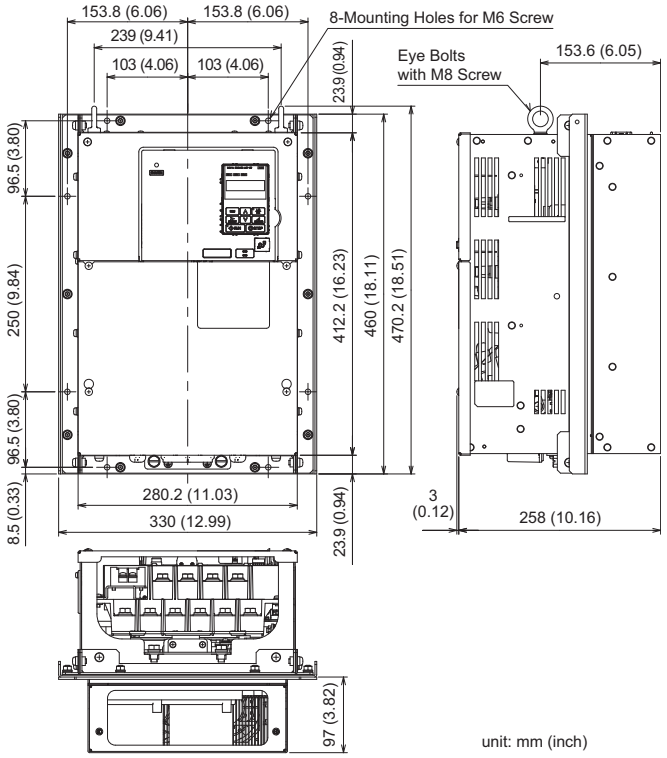


Figure 2.3 Dimensions (CIMR-A□4T0072U)

CIMR-A□4T0088U, 0103U

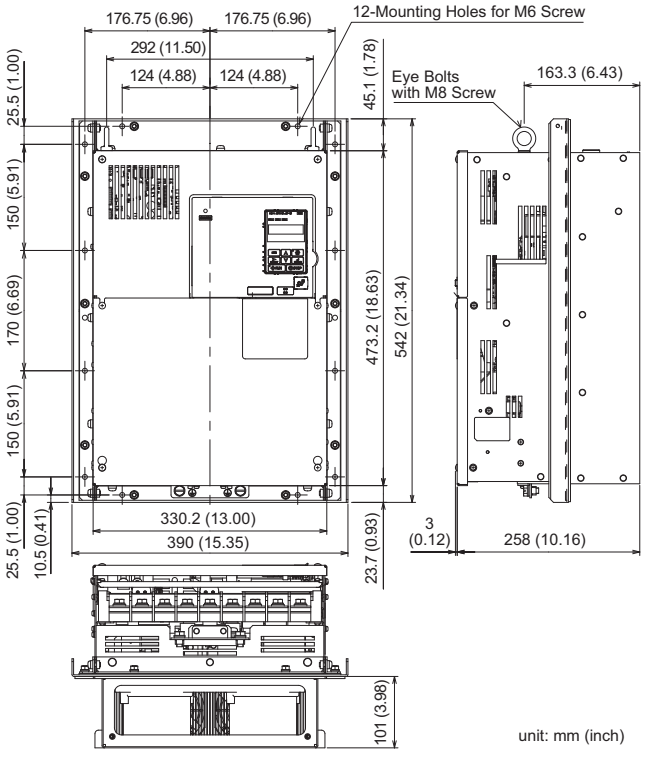


Figure 2.4 Dimensions (CIMR-A□4T0088U, 0103U)

CIMR-A□4T0139U, 0165U

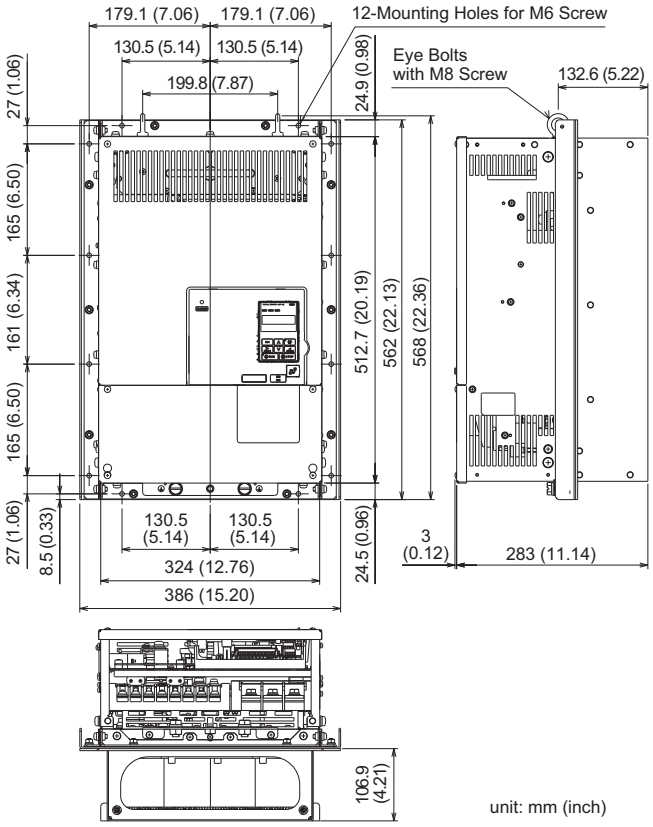


Figure 2.5 Dimensions (CIMR-A□4T0139U, 0165U)

CIMR-A□4T0208U

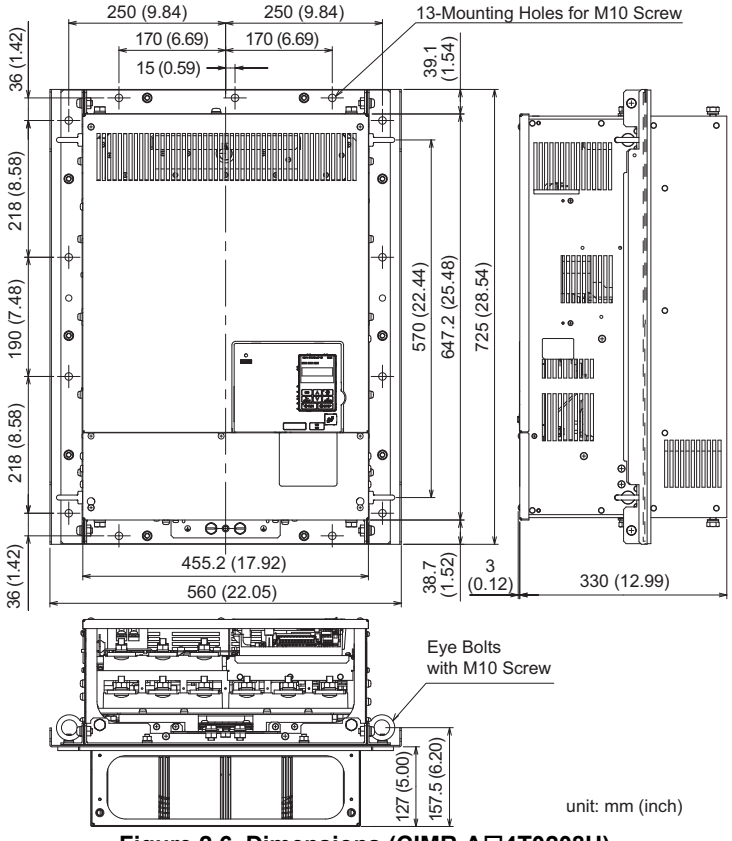


Figure 2.6 Dimensions (CIMR-A□4T0208U)

CIMR-A□4T0250U to 0362U

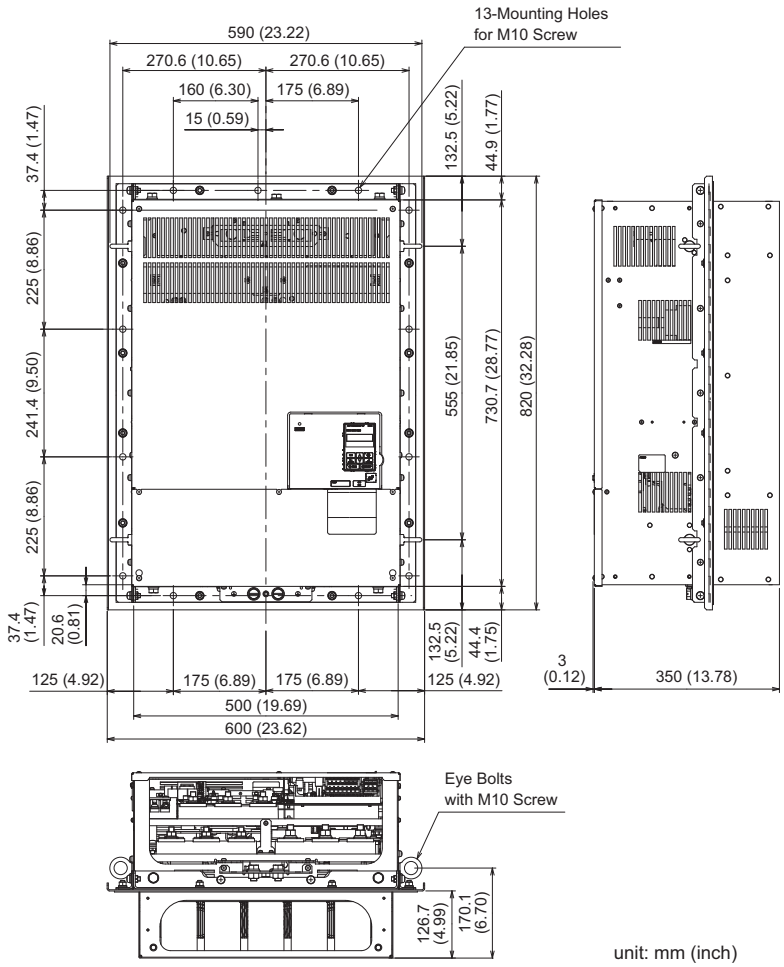


Figure 2.7 Dimensions (CIMR-A□4T0250U to 0362U)

CIMR-A□4T0414U

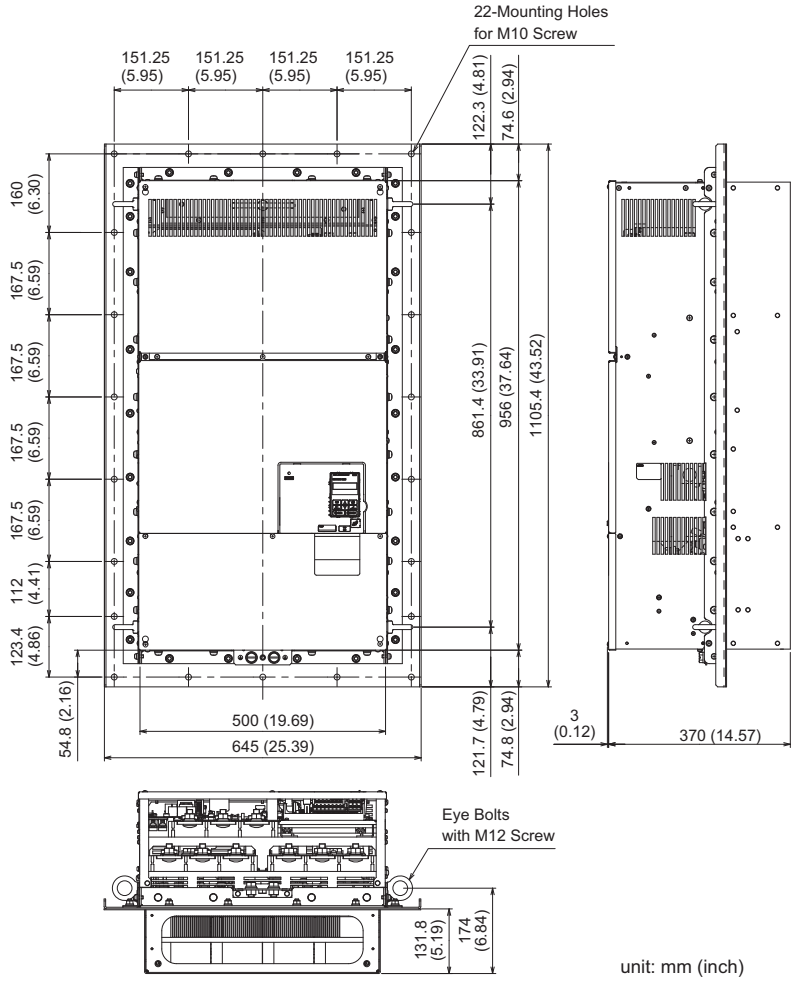


Figure 2.8 Dimensions (CIMR-A□4T0414U)

CIMR-A□4T0515U, 0675U

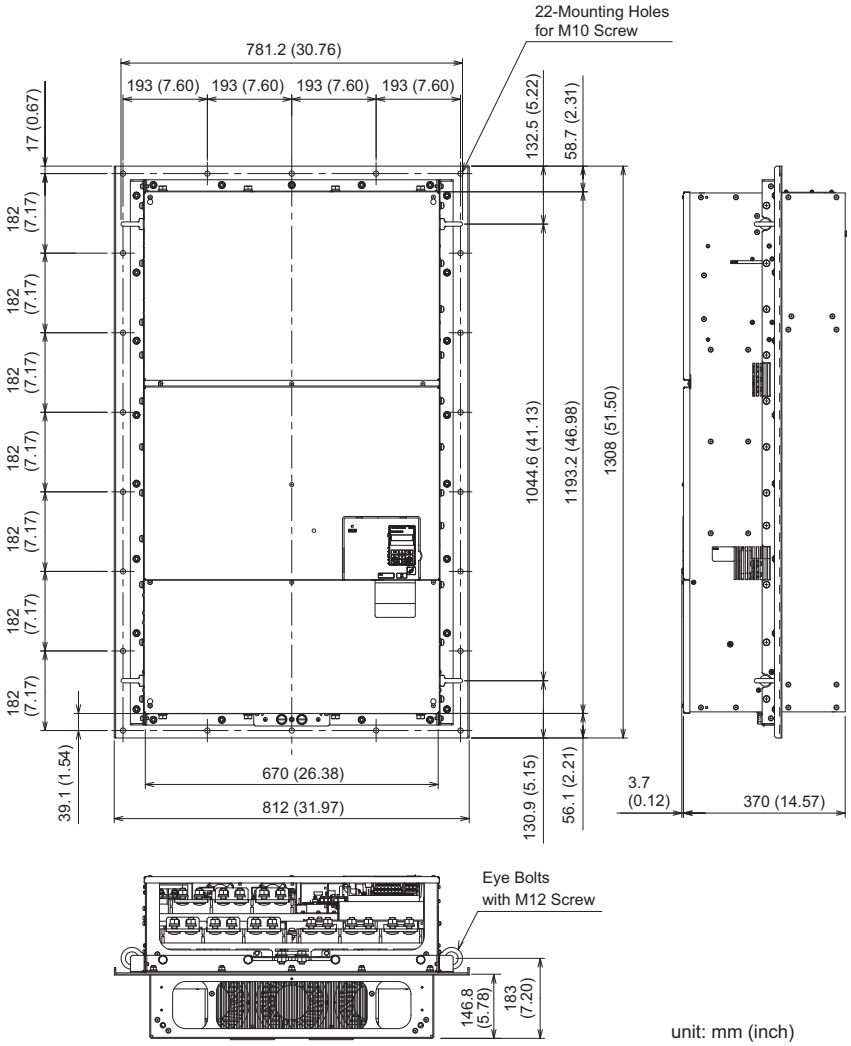


Figure 2.9 Dimensions (CIMR-A□4T0515U, 0675U)

◆ Panel Cut-Out Dimensions

■ Flange Type Enclosure

CIMR-A□4T0058U

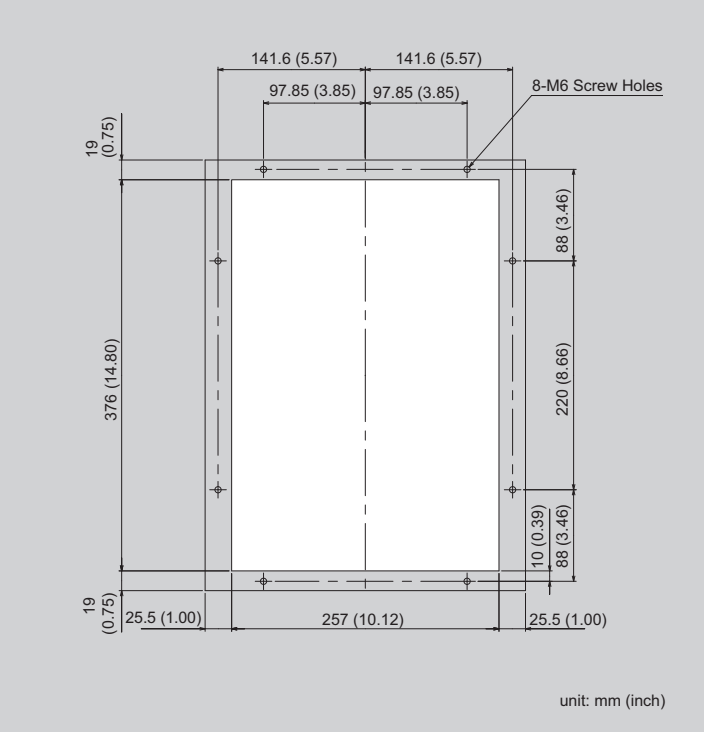


Figure 2.10 Panel Cut-Out Dimensions (CIMR-A□4T0058U)

CIMR-A□4T0072U

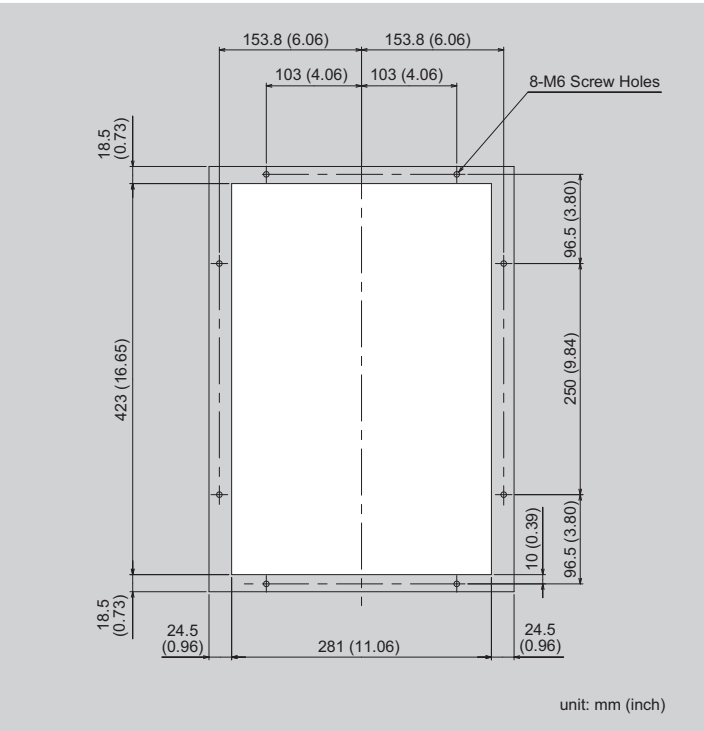


Figure 2.11 Panel Cut-Out Dimensions (CIMR-A□4T0072U)

CIMR-A□4T0088U, 0103U

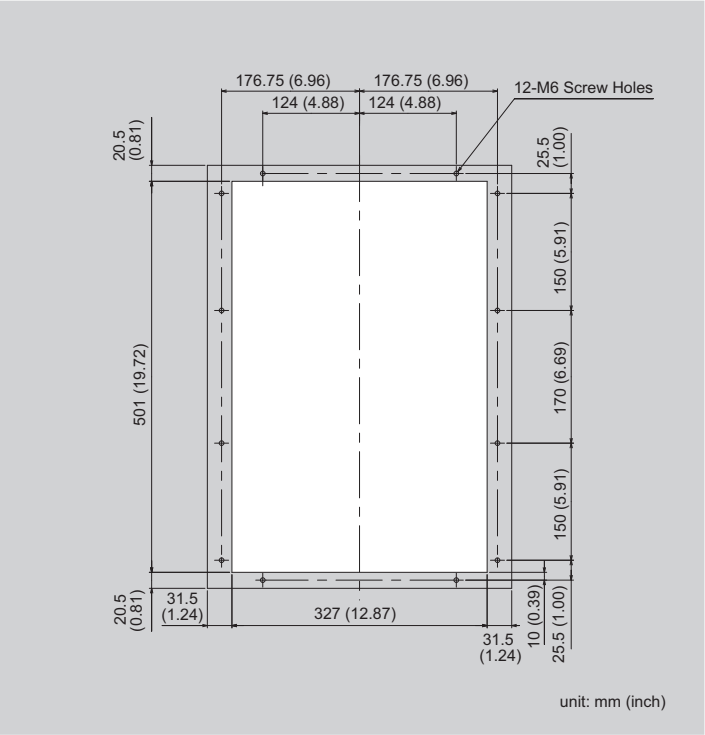


Figure 2.12 Panel Cut-Out Dimensions (CIMR-A□4T0088U, 0103U)

CIMR-A□4T0139U, 0165U

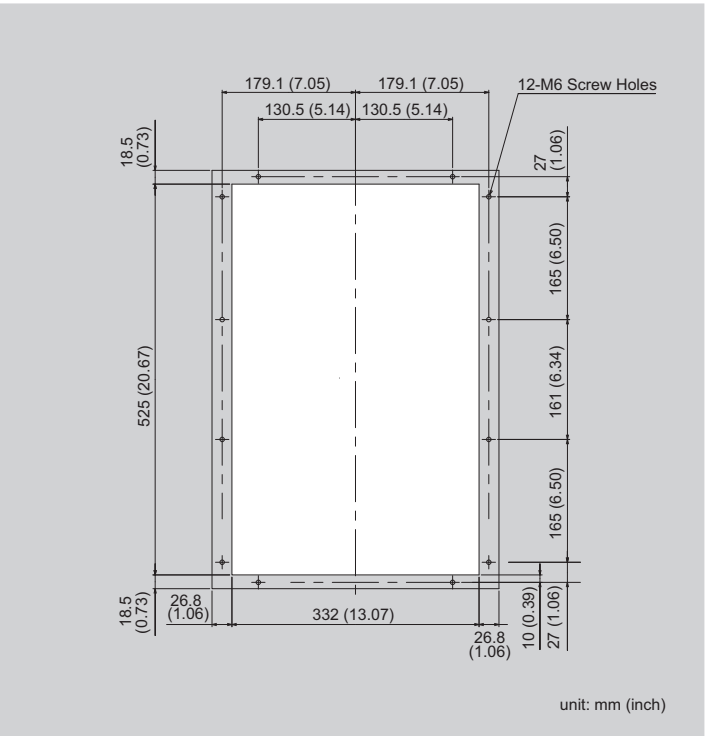


Figure 2.13 Panel Cut-Out Dimensions (CIMR-A□4T0139U, 0165U)

CIMR-A□4T0208U

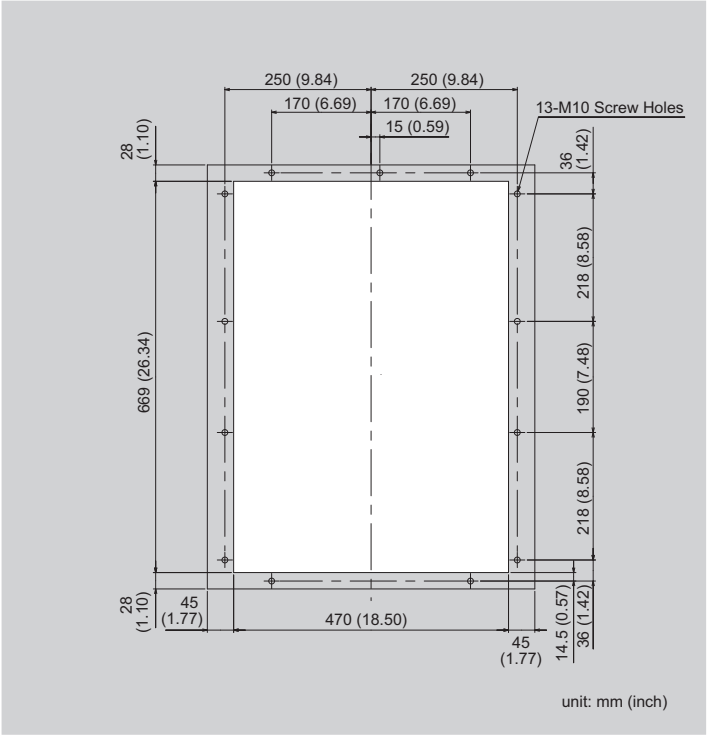


Figure 2.14 Panel Cut-Out Dimensions (CIMR-A□4T0208U)

CIMR-A□4T0250U to 0362U

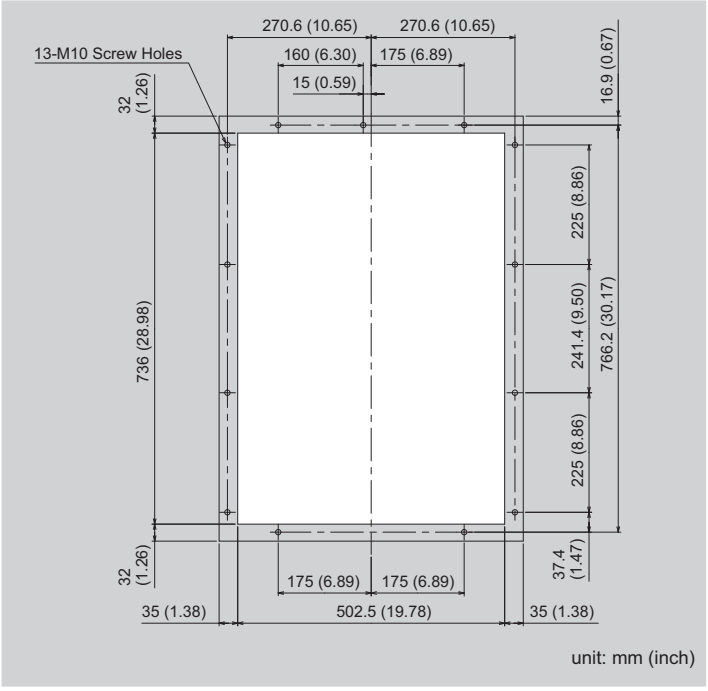


Figure 2.15 Panel Cut-Out Dimensions (CIMR-A□4T0250U to 0362U)

CIMR-A□4T0414U

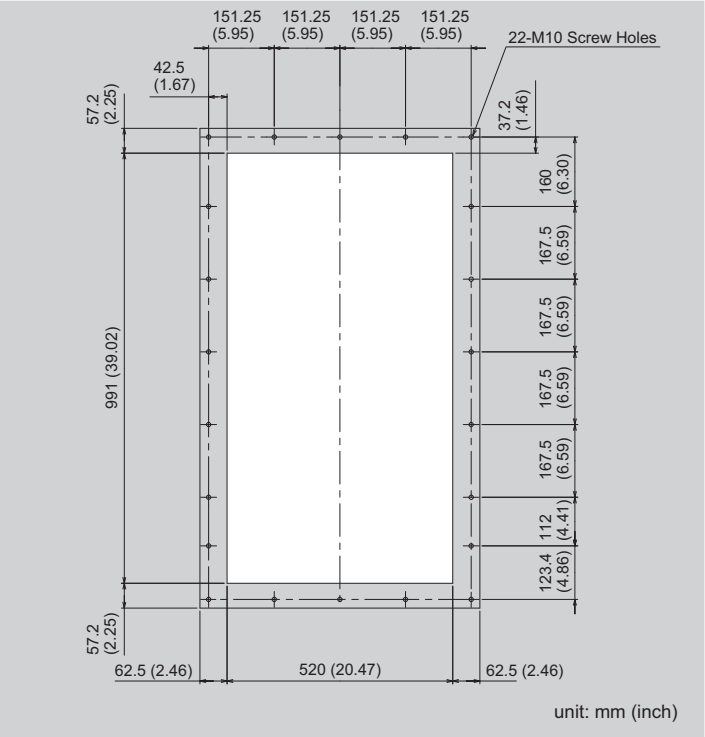


Figure 2.16 Panel Cut-Out Dimensions (CIMR-A□4T0414U)

CIMR-A□4T0515U, 0675U

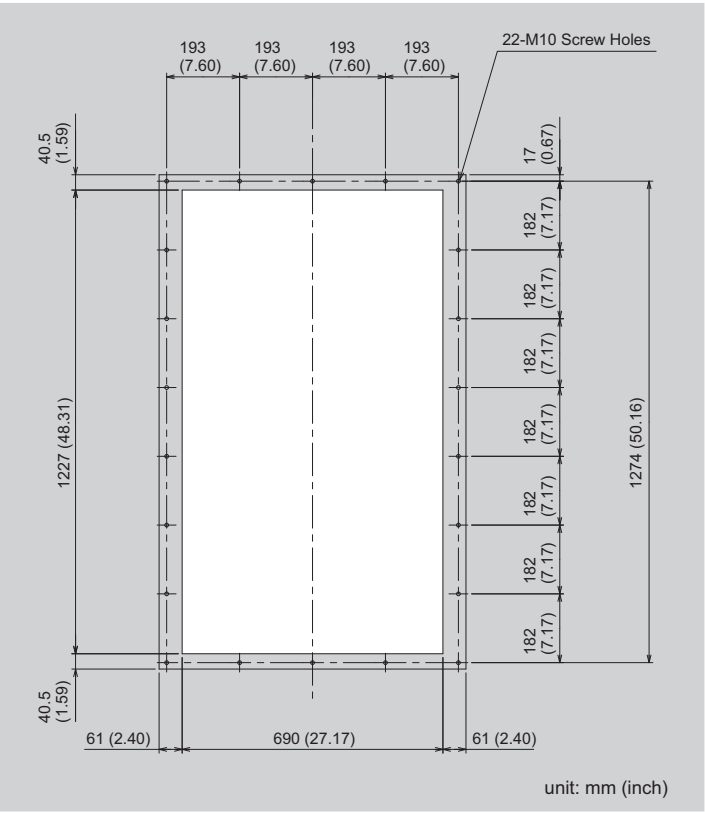


Figure 2.17 Panel Cut-Out Dimensions (CIMR-A□4T0515U, 0675U)

◆ Weight

Table 2.2 Drive Weight

CIMR-A□4T□□□□U	0058	0072	0088	0103	0139	0165	0208	0250	0296	0362	0414	0515	0675
Drive Weight kg (lb)	21 (46.3)	24 (52.9)	35 (77.2)	35 (77.2)	39 (86.0)	40 (88.2)	78 (172.0)	90 (198.4)	95 (209.4)	97 (213.8)	127 (280.0)	210 (463.0)	215 (474.0)

This Page Intentionally Blank

3

Electrical Installation

This chapter explains proper procedures for wiring the main circuit terminals and power supply.

3.1 Standard Connection Diagram

Connect the drive and peripheral devices as shown in ***Figure 3.1***. It is possible to set and run the drive via the digital operator without connecting digital I/O wiring. Refer to A1000 Quick Start Guide for instructions on operating the drive.

WARNING! *Fire Hazard - Drive Short-Circuit Current Rating. Install adequate branch circuit protection according to applicable local codes and this manual. Failure to comply could result in fire and damage to the A1000 drive or injury to personnel. The device is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 480 Vac maximum (400 V class), when protected by branch circuit protection devices specified in this manual.*

NOTICE: *Equipment Hazard. Standard motors used with PWM drives may experience winding failures due to surge voltages, when input line voltage is greater than 480 V or motor wire distance is greater than 100 meters. Select a motor design with insulation tolerant of surge voltages, such as drive-rated motor for use with PWM drives. Failure to comply could lead to motor winding failure.*

Note: The minimum load for the relay outputs M1-M2, M3-M4, M5-M6, and MA-MB-MC is 10 mA.

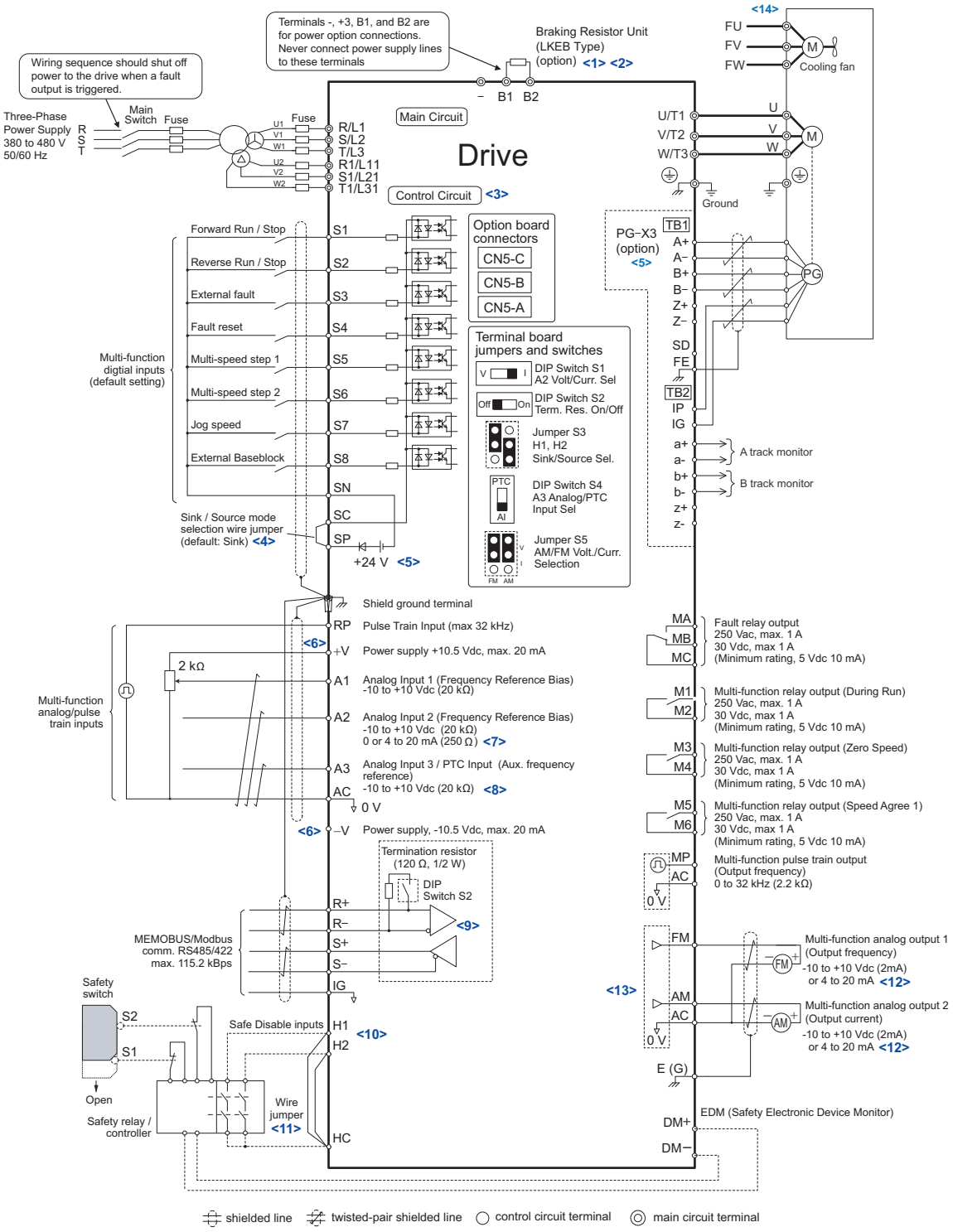


Figure 3.1 Drive Standard Connection Diagram (example: CIMR-A□4T0058)

<1> Set up a thermal relay sequence to disconnect drive main power in the event of an overheat condition on the dynamic braking option.
<2> Set L8-55 to 0 to disable the protection function of the built-in braking transistor of the drive when using an optional regenerative converter or dynamic braking option. Leaving L8-55 enabled may cause a braking resistor fault (rF). Additionally, disable Stall Prevention (L3-04 = 0) when using an optional regenerative converter, regenerative or braking units, or dynamic braking option. Leaving L3-04 enabled may prevent the drive from stopping within the specified deceleration time.
<3> Supplying power to the control circuit separately from the main circuit requires a 24 V power supply (option).
<4> This figure illustrates an example of a sequence input to S1 through S8 using a non-powered relay or an NPN transistor. Install the wire jumper between terminals SC-SP for Sink mode, between SC-SN for Source mode, or leave the jumper out for external power supply. Never short terminals SP and SN, as it will damage the drive.

<5> This voltage source supplies a maximum current of 150 mA when not using a digital input card DI-A3.
<6> The maximum output current capacity for the +V and -V terminals on the control circuit is 20 mA. Never short terminals +V, -V, and AC, as it can cause erroneous operation or damage the drive.
<7> Set DIP switch S1 to select between a voltage or current input signal to terminal A2. The default setting is for current input.
<8> Set DIP switch S4 to select between analog or PTC input for terminal A3.
<9> Set DIP switch S2 to the ON position to enable the termination resistor in the last drive in a MEMOBUS/Modbus network.
<10> Use jumper S3 to select between Sink mode, Source mode, and external power supply for the Safe Disable inputs.
<11> Disconnect the wire jumper between H1 - HC and H2 - HC when utilizing the Safe Disable input.
<12> Monitor outputs work with devices such as analog frequency meters, ammeters, voltmeters, and wattmeters. They are not intended for use as a feedback-type signal.
<13> Use jumper S5 to select between voltage or current output signals at terminals AM and FM. Set parameters H4-07 and H4-08 accordingly.
<14> Self-cooling motors do not require the same wiring necessary for motors with cooling fans.

WARNING! *Sudden Movement Hazard. Do not close the wiring for the control circuit unless the multifunction input terminal parameters are properly set. Improper sequencing of run/stop circuitry could result in death or serious injury from moving equipment.*

WARNING! *Sudden Movement Hazard. Ensure start/stop and safety circuits are wired properly and in the correct state before energizing the drive. Failure to comply could result in death or serious injury from moving equipment. When programmed for 3-Wire control, a momentary closure on terminal S1 may cause the drive to start.*

WARNING! *Sudden Movement Hazard. When using a 3-Wire sequence, set the drive to 3-Wire sequence prior to wiring the control terminals and set parameter b1-17 to 0 so the drive will not accept a Run command at power up (default). If the drive is wired for a 3-Wire sequence but set up for a 2-Wire sequence (default), and parameter b1-17 is set to 1 so the drive accepts a Run command at power up, the motor will rotate in reverse direction at drive power up and may cause injury.*

WARNING! *Sudden Movement Hazard. Confirm the drive I/O signals and external sequence before executing the application preset function. Executing the application preset function or setting A1-06 ≠ 0 will change the drive I/O terminal functions and may cause unexpected equipment operation. Failure to comply may cause death or serious injury.*

NOTICE: *When using the automatic fault restart function with wiring designed to shut off the power supply upon drive fault, make sure the drive does not trigger a fault output during fault restart (L5-02 = 0, default). Failure to comply will prevent the automatic fault restart function from working properly.*

NOTICE: *Do not connect AC control circuit ground to drive enclosure. Improper drive grounding can cause control circuit malfunction.*

3.2 Main Circuit Connection Diagram

Refer to diagrams in this section when wiring the main circuit of the drive. Connections vary based on drive capacity.

NOTICE: *Do not use the negative DC bus terminal "–" as a ground terminal. This terminal is at high DC voltage potential. Improper wiring connections could damage the drive.*

◆ 6-Phase/12-Pulse Input 400 V Class (CIMR-A□4T0058, 0072)

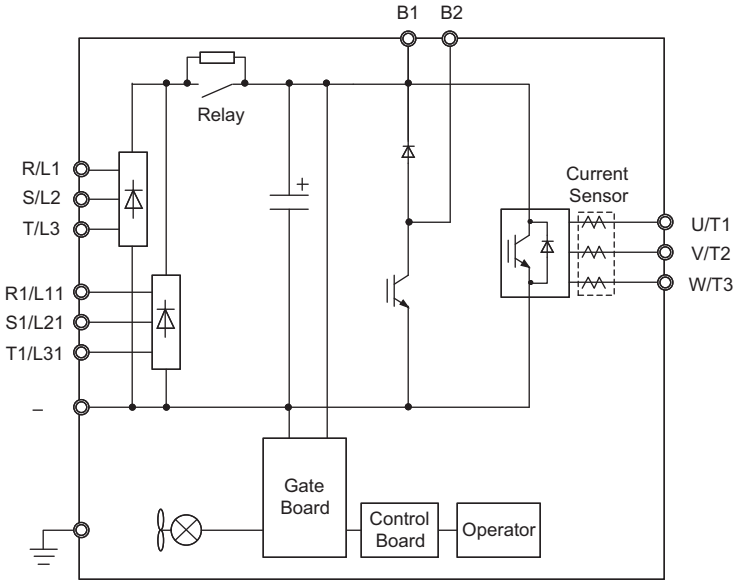


Figure 3.2 A1000 6-Phase/12-Pulse Drive Internal Main Circuit Diagram (CIMR-A□4T0058, 0072)

◆ 6-Phase/12-Pulse Input 400 V Class (CIMR-A□4T0088 to 0139)

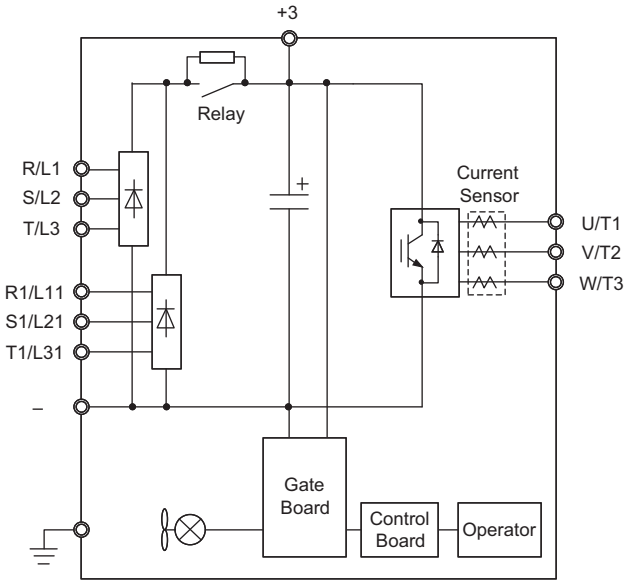


Figure 3.3 A1000 6-Phase/12-Pulse Drive Internal Main Circuit Diagram (CIMR-A□4T0088 to 0139)

◆ 6-Phase/12-Pulse Input 400 V Class (CIMR-A□4T0165 to 0675)

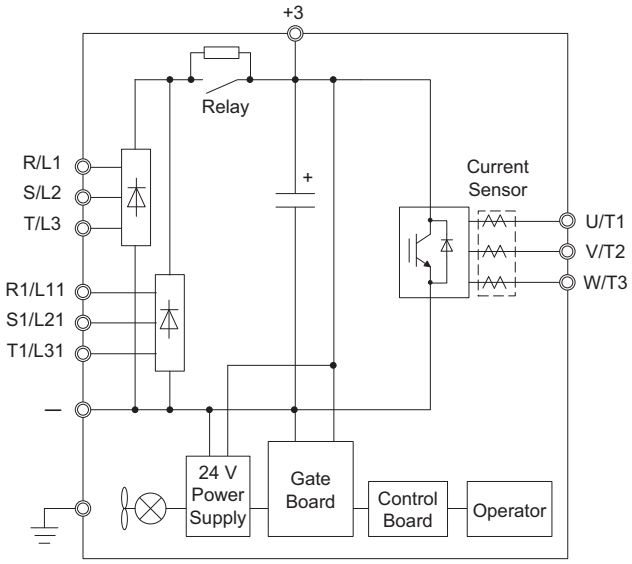


Figure 3.4 A1000 6-Phase/12-Pulse Drive Internal Main Circuit Diagram (CIMR-A□4T0165 to 0675)

◆ 6-Phase/12-Pulse Rectification

■ Installing a Transformer

Install a 6-Phase/12-Pulse isolation transformer with output windings phase shifted by 30 electrical degrees or install a Hybrid 6-Phase topology on the power supply.

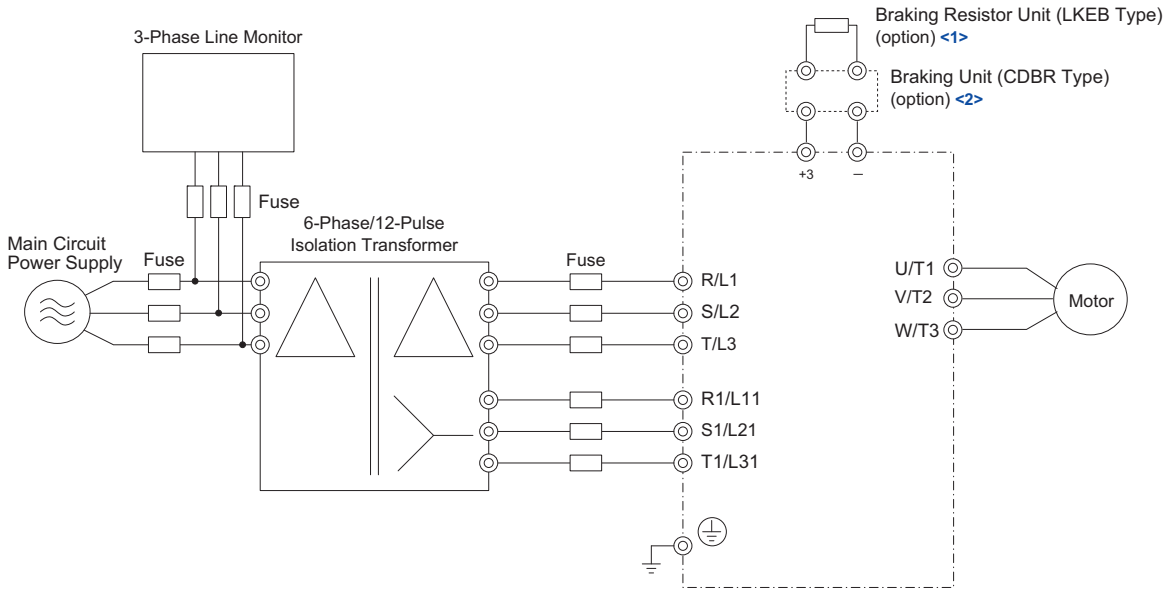
■ Installing a 3-Phase Line Monitor

Yaskawa requires installation of a 3-Phase line monitor to protect the drive in the event of an input line phase loss.

The 3-Phase line monitor must be installed on the primary circuit of the 6-Phase/12-Pulse transformer and connected to the A1000 drive to remove the RUN command when a phase loss condition occurs.

The A1000 power circuit may be damaged during a phase-loss condition if a 3-Phase line monitor is not properly installed.

■ Connection Diagram



<1> A braking resistor can be connected to the B1 and B2 terminals on the CIMR-A☐4T0058 and 0072 drives.
<2> A braking unit cannot be connected to the CIMR-A☐4T0058 and 0072 drives.

Figure 3.5 Main Circuit Terminal Connections

3.3 Main Circuit Terminal Configuration

Figure 3.6 to *Figure 3.12* show the different main circuit terminal arrangements for the drive capacities.

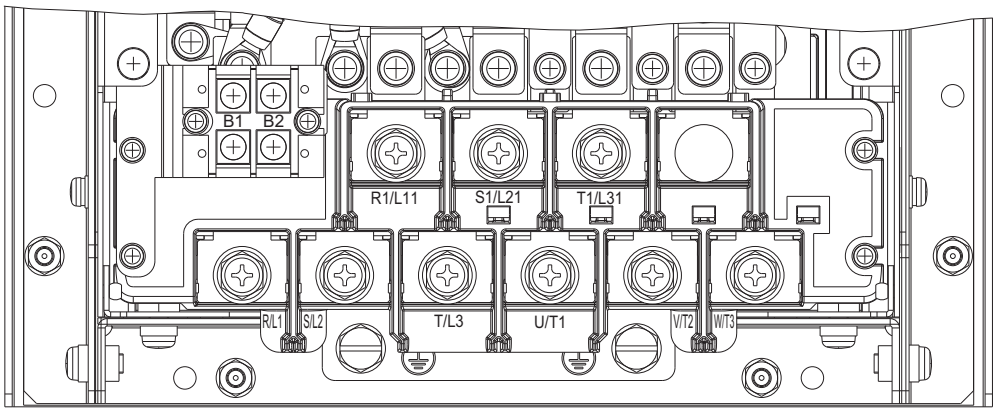


Figure 3.6 Main Circuit Terminal Configuration (CIMR-A☐4T0058, 0072)

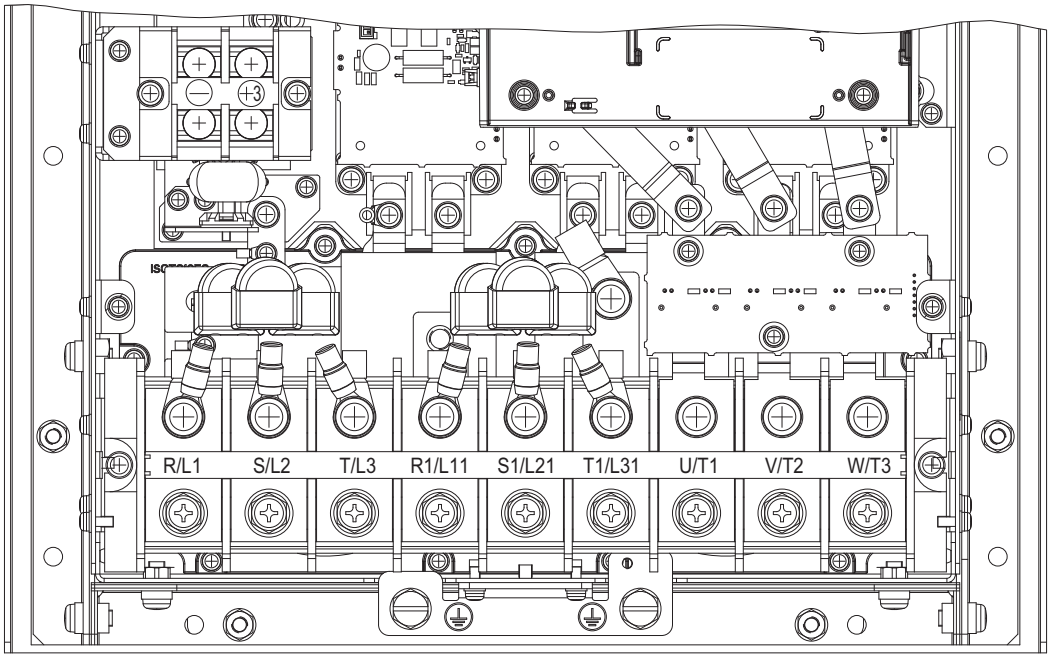


Figure 3.7 Main Circuit Terminal Configuration (CIMR-A☐4T0088, 0103)

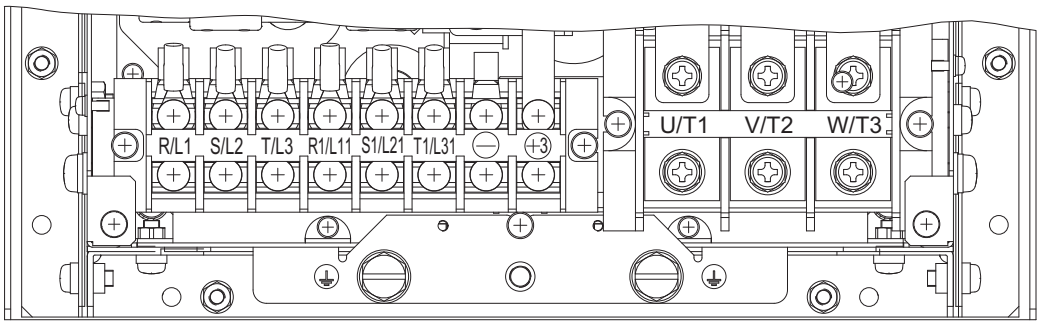


Figure 3.8 Main Circuit Terminal Configuration (CIMR-A☐4T0139, 0165)

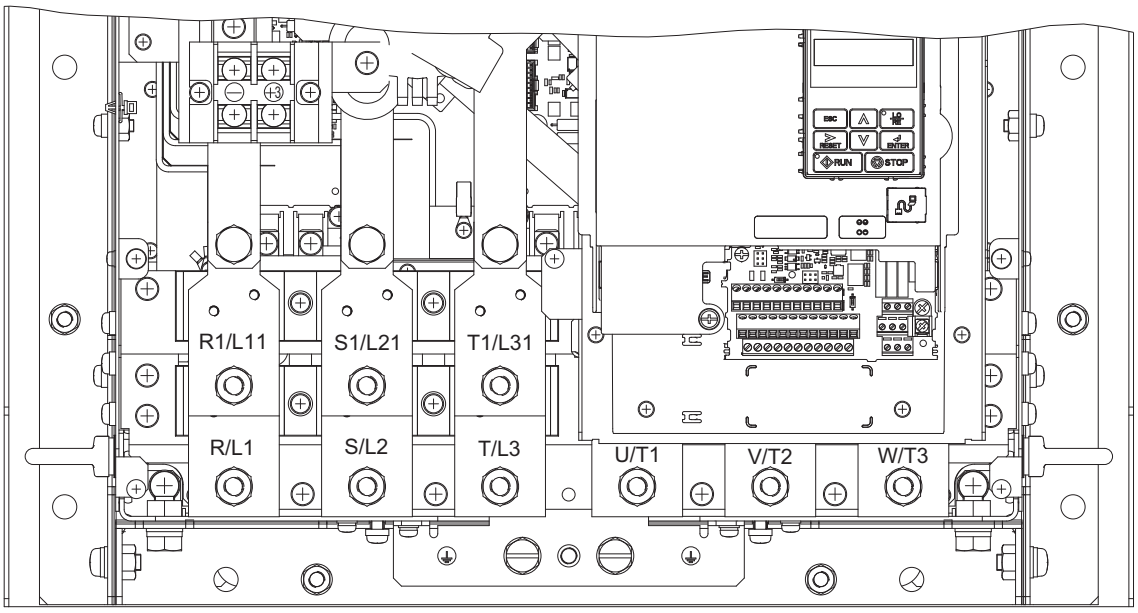


Figure 3.9 Main Circuit Terminal Configuration (CIMR-A□4T0208)

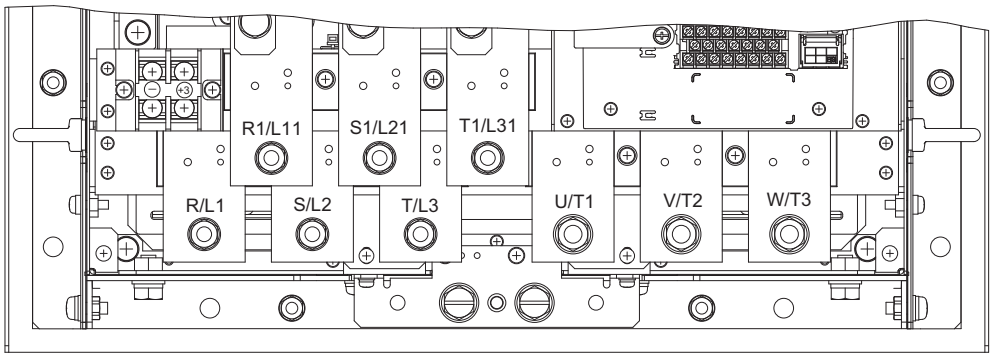


Figure 3.10 Main Circuit Terminal Configuration (CIMR-A□4T0250 to 0362)

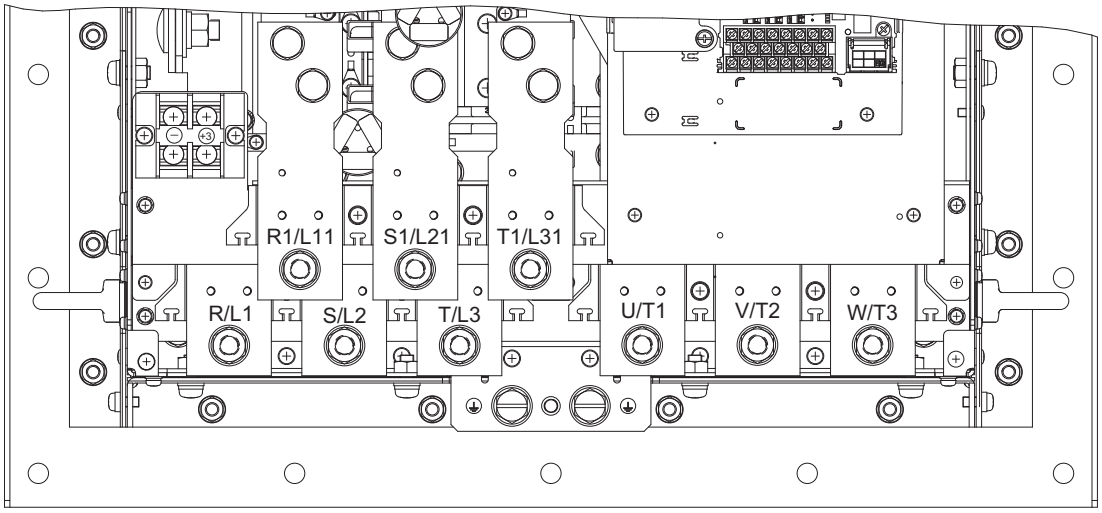


Figure 3.11 Main Circuit Terminal Configuration (CIMR-A□4T0414)

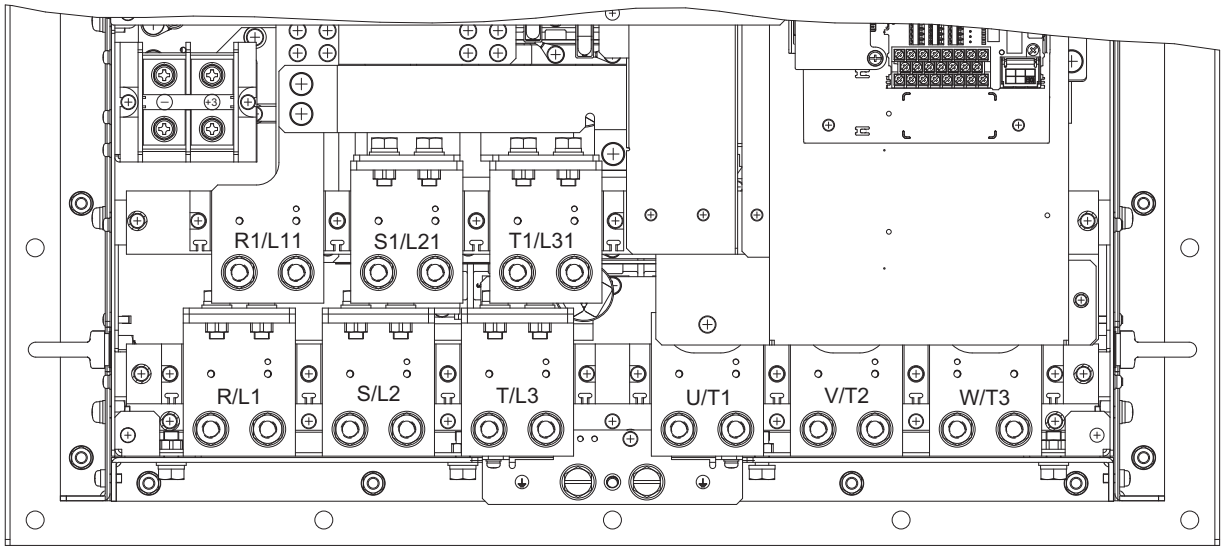


Figure 3.12 Main Circuit Terminal Configuration (CIMR-A□4T0515, 0675)

3.4 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.*

NOTICE: *Do not switch the drive input to start or stop the motor. Frequently switching the drive on and off shortens the life of the DC bus charge circuit and the DC bus capacitors, and can cause premature drive failures. For the full performance life, refrain from switching the drive on and off more than once every 30 minutes.*

◆ Main Circuit Terminal Functions

Table 3.1 Main Circuit Terminal Functions

Terminal	Type		Function
Model CIMR-A☐	4T0058, 4T0072	4T0088 to 4T0675	
R/L1	Main circuit power supply input		Connects line power to the drive
S/L2			
T/L3			
R1/L11			
S1/L21			
T1/L31			
U/T1	Drive output		Connects to the motor
V/T2			
W/T3			
B1	Braking resistor	Not available	Available for connecting a braking resistor or a braking resistor unit option
B2			
–	Not available	Braking unit connection (+3, –)	Only for connecting dynamic braking options
+3			
⏚	10 Ω or less		Grounding terminal

Note: DC power supply input is not available for 6-Phase/12-Pulse Input models.

◆ Main Circuit Fuses

The A1000 6-Phase/12-Pulse drive requires fuses to be installed on each of the 6 input phases between the 6-Phase/12-Pulse transformer and the A1000 drive. To maintain standards compliance select fuses from ***Table C.1***. according to drive model.

◆ Wire Gauges and Tightening Torque

Use *Table 3.2* to select the appropriate wires and crimp terminals.

Wire gauges listed in the tables are for use in the United States.

Note: **1.** Wire gauge recommendations based on drive continuous current ratings (ND) using 75°C 600 Vac vinyl-sheathed wire assuming ambient temperature within 40°C and wiring distance less than 100 m.

2. Terminals +3 and – are for connecting optional devices such as a braking unit. Do not connect other nonspecific 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) = $\sqrt{3}$ × wire resistance (Ω/km) × wire length (m) × current (A) × 10^{-3}
- Refer to instruction manual TOBP C720600 00/TOBP C720600 01 for braking unit option or braking resistor option wire gauges.
- Use terminal +3 and the negative terminal when connecting a braking unit option.
- Do not connect the regenerative converter or the regenerative unit to the 6-Phase/12-Pulse A1000 drive.
- Refer to *UL Standards Compliance on page 64* for information on UL compliance.

Yaskawa recommends using closed-loop crimp terminals on all drive models. UL/cUL approval requires the use of closed-loop crimp terminals when wiring the drive main circuit terminals. Use only the tools recommended by the terminal manufacturer for crimping. Refer to *Closed-Loop Crimp Terminal Size on page 65* for closed-loop crimp terminal recommendations.

The wire gauges listed in *Table 3.2* are Yaskawa recommendations and are based on the 6-Phase input current ratings specified in *Table C.1*. Refer to local codes for proper wire gauge selections.

■ 6-Phase/12-Pulse Input 400 V Class

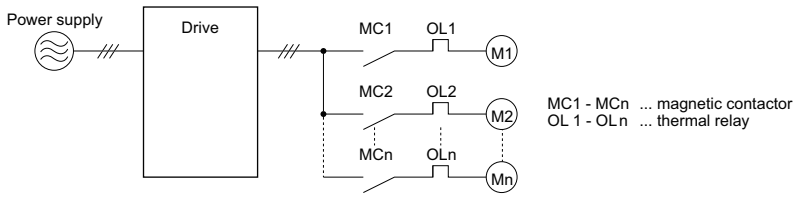
Table 3.2 Wire Gauge and Torque Specifications

Model CIMR-A☐	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N-m (ib.in.)
4T0058	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	8	10 to 1/0	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	4	10 to 1/0		
	B1, B2	–	14 to 10	M4	1.1 to 1.2 (9.74 to 10.6)
	⏚	6	8 to 6	M8	9 to 11 (79.7 to 97.4)
4T0072	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	8	10 to 1/0	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	3	10 to 1/0		
	B1, B2	–	14 to 10	M4	1.1 to 1.2 (9.74 to 10.6)
	⏚	6	6	M8	9 to 11 (79.7 to 97.4)
4T0088	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	6	6 to 1/0	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	2	6 to 1/0		
	–, +3	–	12 to 2	M6	2.5 to 3.0 (22.1 to 26.6)
	⏚	4	6 to 4	M8	9 to 11 (79.7 to 97.4)

Model CIMR-A☐	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N-m (ib.in.)
4T0103	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	6	6 to 1/0	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	1	6 to 1/0		
	–, +3	–	12 to 2	M6	2.5 to 3.0 (22.1 to 26.6)
	⏚	4	6 to 4	M8	9 to 11 (79.7 to 97.4)
4T0139	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	4	12 to 2	M6	2.5 to 3.0 (22.1 to 26.6)
	U/T1, V/T2, W/T3	2/0	6 to 4/0	M8	9 to 11 (79.7 to 97.4)
	–, +3	–	12 to 2	M6	2.5 to 3.0 (22.1 to 26.6)
	⏚	4	4	M10	18 to 23 (159 to 204)
4T0165	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	3	12 to 2	M6	2.5 to 3.0 (22.1 to 26.6)
	U/T1, V/T2, W/T3	4/0	6 to 4/0	M8	9 to 11 (79.7 to 97.4)
	–, +3	–	12 to 2	M6	2.5 to 3.0 (22.1 to 26.6)
	⏚	4	4 to 2	M10	18 to 23 (159 to 204)
4T0208	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	1	2 to 300	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	300	2 to 300		
	–, +3	–	12 to 2	M6	2.5 to 3.0 (22.1 to 26.6)
	⏚	4	4 to 300	M10	18 to 23 (159 to 204)
4T0250	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	2/0	1 to 600	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	400	1/0 to 600		
	–, +3	–	22 to 1/0	M6	2.5 to 3.0 (22.1 to 26.6)
	⏚	2	2 to 350	M10	18 to 23 (159 to 204)
4T0296	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	3/0	1 to 600	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	500	2/0 to 600	M12	32 to 40 (283 to 354)
	–, +3	–	22 to 1/0	M6	2.5 to 3.0 (22.1 to 26.6)
	⏚	2	2 to 350	M12	32 to 40 (283 to 354)
4T0362	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	4/0	1 to 600	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	4/0 × 2P	3/0 to 600	M12	32 to 40 (283 to 354)
	–, +3	–	22 to 1/0	M6	2.5 to 3.0 (22.1 to 26.6)
	⏚	1	1 to 350	M12	32 to 40 (283 to 354)

Model CIMR-A☐	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N-m (ib.in.)
4T0414	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	300	4/0 to 300	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	300 × 2P	4/0 to 300		
	–, +3	–	22 to 1/0	M6	2.5 to 3.0 (22.1 to 26.6)
	⏚	1	1 to 3/0	M12	32 to 40 (283 to 354)
4T0515	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	4/0 × 2P	3/0 to 300	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	4/0 × 4P	3/0 to 300		
	–, +3	–	6 to 250	M8	13.5 to 15 (119.5 to 132.8)
	⏚	1/0	1/0 to 300	M12	32 to 40 (283 to 354)
4T0675	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	300 × 2P	4/0 to 300	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	300 × 4P	4/0 to 300		
	–, +3	–	6 to 250	M8	13.5 to 15 (119.5 to 132.8)
	⏚	2/0	2/0 to 300	M12	32 to 40 (283 to 354)

3.5 Wiring Checklist

☑	No.	Item	Page(s)
		Drive, Peripherals, Option Cards	
☐	1	Check drive model number to ensure receipt of correct model.	*10*
☐	2	Make sure you have the correct braking resistors, noise filters, and other peripheral devices.	–
☐	3	Check that any installed option cards are the correct model.	–
		Installation Area and Physical Setup	
☐	4	Ensure that the area surrounding the drive complies with specifications.	*14*
		Power Supply Voltage, Output Voltage	
☐	5	The voltage from the power supply should be within the input voltage specification range of the drive.	–
☐	6	The voltage rating for the motor should match the drive output specifications.	*10*
☐	7	Verify that the drive is properly sized to run the motor.	
		Main Circuit Wiring	
☐	8	Confirm proper branch circuit protection as specified by national and local codes.	*28*
☐	9	Properly wire the power supply to drive terminals R/L1, S/L2, T/L3, R1/L11, S1/L21, and T1/L31. **Note:** Confirm that a 6-Phase/12-Pulse isolation transformer with each of the output windings phase shifted by 30 electrical degrees or a Hybrid 6-Phase topology is installed on the power supply.	*31*
☐	10	Properly wire the drive and motor together. The motor lines and drive output terminals U/T1, V/T2, and W/T3 should match in order to produce the desired phase order. If the phase order is incorrect, the drive will rotate in the opposite direction.	–
☐	11	Use 600 Vac vinyl-sheathed wire for the power supply and motor lines.	*38*
☐	12	Use the correct wire gauges for the main circuit. Refer to *Wire Gauges and Tightening Torque on page 38*. • 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) = $\sqrt{3}$ × wire resistance (Ω/km) × wire length (m) × current (A) × 10^{-3} • If the cable between the drive and motor exceeds 50 m, adjust the carrier frequency set to C6-02 accordingly.	*38*
☐	13	Properly ground the drive.	–
☐	14	Tighten control circuit and grounding terminal screws. Refer to *Wire Gauges and Tightening Torque on page 38*.	*38*
☐	15	Set up overload protection circuits when running multiple motors from a single drive.  **Note:** Close MC1 - MCn before operating the drive. MC1 - MCn cannot be switched off during run.	–
☐	16	Install a magnetic contactor when using a dynamic braking option. Properly install the resistor and ensure that overload protection shuts off the main power supply using the magnetic contactor.	–
☐	17	Verify phase advancing capacitors, input noise filters, or GFCIs are NOT installed on the output side of the drive.	–
		Control Circuit Wiring	
☐	18	Use twisted-pair line for all drive control circuit wiring.	–
☐	19	Ground the shields of shielded wiring to the GND terminal.	–
☐	20	For 3-Wire sequence, set parameters for multi-function contact input terminals S1 - S8, and wire control circuits.	–

3.5 Wiring Checklist

☑	No.	Item	Page(s)
☐	21	Properly wire any option cards.	–
☐	22	Check for any other wiring mistakes. Only use a multimeter to check wiring.	–
☐	23	Properly fasten drive control circuit terminal screws. Refer to *Wire Gauges and Tightening Torque on page 38*.	*38*
☐	24	Pick up all wire clippings.	–
☐	25	Ensure that no frayed wires on the terminal block are touching other terminals or connections.	–
☐	26	Properly separate control circuit wiring and main circuit wiring.	–
☐	27	Analog signal line wiring should not exceed 50 m.	–
☐	28	Safe Disable input wiring should not exceed 30 m.	–

4

Start-Up Programming & Operation

4.1 Powering Up the Drive

Review the following checklist before applying power to the A1000.

Table 4.1 Checklist

Item to Check	Description
Power supply	6-Phase/12-Pulse Isolated 380 to 480 Vac 50/60 Hz, 30 electrical degrees phase shifted each phase
	Properly wire the power supply input terminals (R/L1, S/L2, T/L3, R1/L11, S1/L21, T1/L31). <1>
	Check for proper grounding of drive and motor.
Drive output terminals and motor terminals	Properly wire drive output terminals U/T1, V/T2, and W/T3 with motor terminals U, V, and W.
Control circuit terminals	Check control circuit terminal connections.
Drive control terminal status	Open all control circuit terminals (off).
Status of the load and connected machinery	Decouple the motor from the load.

<1> Install a 6-Phase/12-Pulse isolation transformer with each of the output windings phase shifted by 30 electrical degrees or use a Hybrid 6-Phase topology.

5

Peripheral Devices & Options

This chapter explains the installation of peripheral devices and options available for the drive.

5.1 Drive Options and Peripheral Devices

The following table of peripheral devices lists the names of the various accessories and options available for the A1000. Contact your local Yaskawa sales representative or catalog for details on all available peripheral devices.

- **Peripheral Device Selection:** Refer to the Yaskawa catalog for selection and part numbers.
- **Peripheral Device Installation:** Refer to the corresponding option manual for installation instructions.

Table 5.1 Available Peripheral Devices

Option	Model Number	Description
Power Options		
AC Reactor	–	Protects the drive when operating from a large power supply and improves the power factor by suppressing harmonic distortion.
Braking Resistor	–	For use with systems that require dynamic braking with up to 3% ED. If higher ED is required, use a Braking Resistor Unit.
Input/Output Option Cards		
Analog Input	AI-A3	• Allows high precision, high resolution analog reference input • Input channels: 3 • Voltage input: -10 to 10 Vdc (20 kΩ), 13- bit signed • Current input: 4 to 20 mA or 0 to 20 mA (250 kΩ), 12-bit
Analog Monitor	AO-A3	• Provides extra multi-function analog output terminals • Output channels: 2 • Output voltage: -10 to 10 V, 11-bit (signed)
Digital Input	DI-A3	• Sets the frequency reference by digital inputs • Input channels: 18 (including SET signal and SIGN signal) • Input signal type: BCD 16-bit (4-digit), 12-bit (3-digit), 8-bit (2-digit) • Input signal: 24 Vdc, 8 mA
Digital Output	DO-A3	• Provides extra insulated multi-function digital outputs • Photocoupler relays: 6 (48 V, up to 50 mA) • Contact relays: 2 (250 Vac/up to 1 A, 30 Vdc/up to 1 A)
Motor Speed Feedback Option Cards		
Motor PG Feedback Line Driver Interface	PG-X3	• For speed feedback input by connecting a motor encoder • Input: 3-track (can be used with 1 or 2 tracks), line driver, 300 kHz max • Output: 3-track, line driver • Encoder power supply: 5 V or 12 V, max current 200 mA
Motor PG Feedback Open Collector Interface	PG-B3	• For speed feedback input by connecting a motor encoder • Input: 3-track (can be used with 1 or 2 tracks), HTL encoder connection, 50 kHz max • Output: 3-track, open collector • Encoder power supply: 12 V, max current 200 mA
Communication Option Cards		
EtherNet/IP	SI-EN3	Connects to an EtherNet/IP network.
Modbus TCP/IP	SI-EM3	Connects to a Modbus TCP/IP network.
DeviceNet	SI-N3	Connects to a DeviceNet network
PROFIBUS-DP	SI-P3	Connects to a PROFIBUS-DP network.
MECHATROLINK-II	SI-T3	Connects to a MECHATROLINK-II network.
CC-Link <1>	SI-C3	Connects to a CC-Link network
CANopen <1>	SI-S3	Connects to a CANopen network.
Interface Options		
LCD Operator	JVOP-180	Digital operator with 8 languages, clear text LCD display, and copy function; max. cable length for remote usage: 3 m
LED Operator	JVOP-182	5-digit LED operator; max. cable length for remote usage: 3 m
Remote Operator Cable	UWR000051, 1 m cable UWR000052, 2 m cable	RJ-45, 8-pin straight through, UTP CAT5e, extension cable (1 m or 2 m) to connect the digital operator for remote operation.
USB Copy Unit	JVOP-181	• Allows the user to copy and verify parameter settings between drives. • Functions as an adapter to connect the drive to a USB port on a PC.

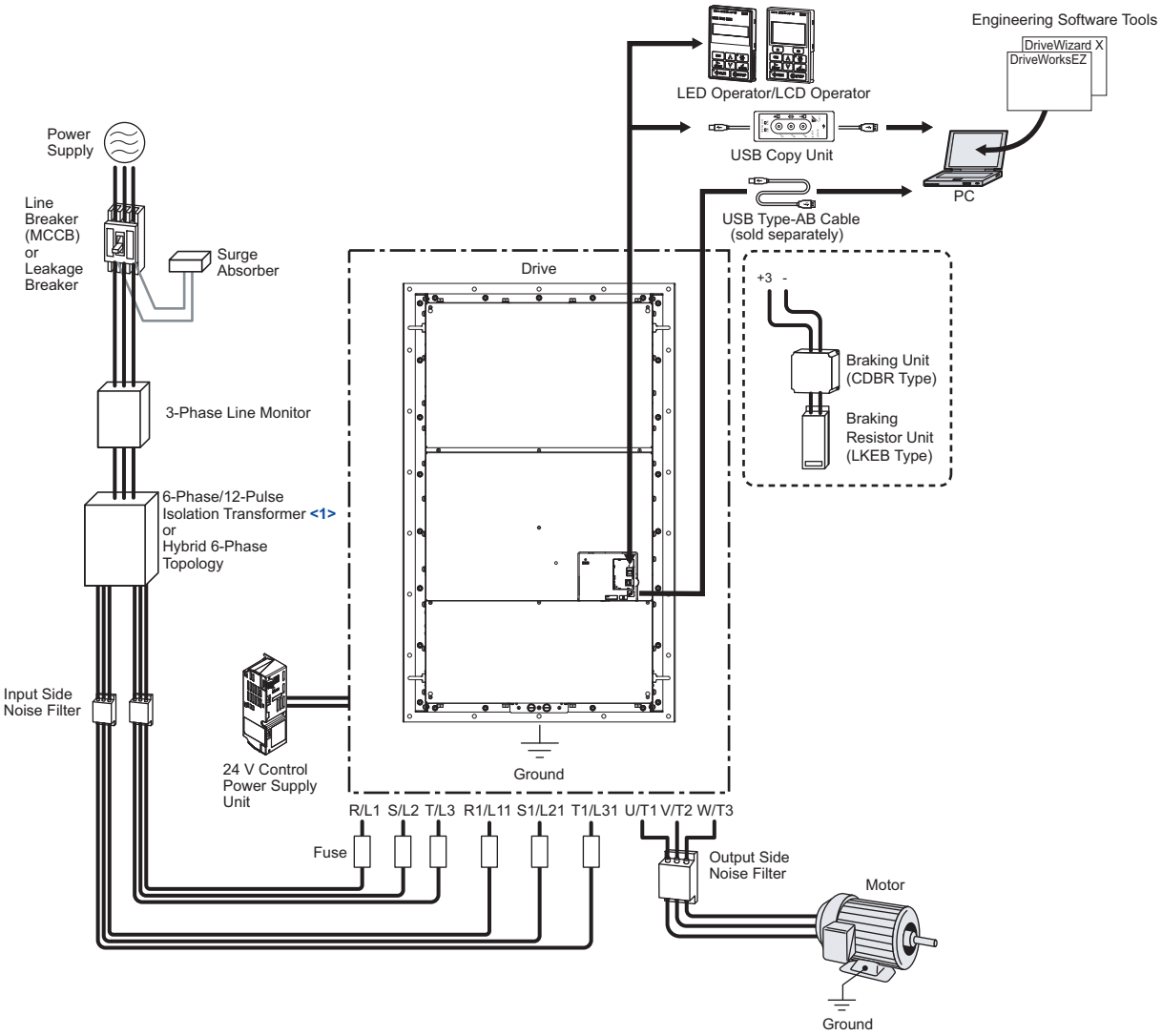
Option	Model Number	Description
Mechanical Options		
IP20/NEMA Type 1 Kit	Contact Yaskawa	Parts to make the drive conform to IP20/NEMA Type 1 enclosure requirements.
IP20/NEMA Type 1, 4, 12 Blank Keypad Kit	UUX0000526	Provides digital operator (JVOP-180, JVOP-182) functionality on an enclosure designed for IP20/NEMA Type 1, 3R, 4, 4X, 12, or IP□6 environment. This keypad has a blank label on the front.
IP20/NEMA Type 1, 4, 12 Yaskawa Logo Keypad Kit	UUX0000527	Provides digital operator (JVOP-180, JVOP-182) functionality on an enclosure designed for IP20/NEMA Type 1, 3R, 4, 4X, 12, or IP□6 environment. This keypad has a Yaskawa brand label on the front.
Others		
24 V Power Supply	PS-A10HB	Supplies the drive controller with 24 Vdc power during main power loss.
PC Software Tools		
DriveWizard Industrial	Contact Yaskawa	PC tool for drive setup and parameter management.
DriveWorksEZ	Contact Yaskawa	PC tool for enhanced programming of the drive.

<1> Limited support. Contact a Yaskawa representative or the nearest Yaskawa sales office for assistance.

5.2 Connecting Peripheral Devices

Figure 5.1 illustrates how to configure the drive and motor to operate with various peripheral devices.

Refer to the specific manual for the devices shown below for more detailed installation instructions.



<1> With each of the output windings phase shifted by 30 electrical degrees.

Figure 5.1 Connecting Peripheral Devices

Note: If the drive is set to trigger a fault output when the fault restart function is activated (L5-02 = 1), then a sequence to interrupt power when a fault occurs will turn off the power to the drive while the drive attempts to restart. The default setting for L5-02 is 0 (fault output active during restart).

5.3 Installing Peripheral Devices

This section describes the proper steps and precautions to take when installing or connecting various peripheral devices to the drive.

NOTICE: *Use a class 2 power supply when connecting to the control terminals. Improper application of peripheral devices could result in drive performance degradation due to improper power supply. Refer to NEC Article 725 Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power Limited Circuits for requirements concerning class 2 power supplies.*

◆ Dynamic Braking Options

Dynamic braking (DB) helps bring the motor to a smooth and rapid stop when working with high inertia loads. As the drive lowers the frequency of a motor moving a high inertia load, regeneration occurs. This can cause an overvoltage situation when the regenerative energy flows back into the DC bus capacitors. A braking resistor prevents these overvoltage faults.

NOTICE: *Do not allow unqualified personnel to use the product. Failure to comply could result in damage to the drive or braking circuit. Carefully review the braking resistor instruction manual when connecting a braking resistor option to the drive.*

Note: **1.** Properly size the braking circuit to dissipate the power required to decelerate the load in the desired time. Ensure that the braking circuit can dissipate the energy for the set deceleration time prior to running the drive.
2. Set L8-55 to 0 to disable the internal braking transistor of the drive protection when using braking resistor options.

WARNING! *Fire Hazard. The braking unit connection terminals are +3 and –. Do not connect a braking resistor directly to any other terminals. Improper wiring connections could result in death or serious injury by fire. Failure to comply may result in damage to the braking circuit or drive.*

NOTICE: *Connect a braking unit to the drive as shown in the I/O wiring examples. Improperly wiring braking circuits could result in damage to the drive or equipment.*

■ Installing a Braking Unit: CDBR Type

To install a CDBR type braking unit, follow the wiring instructions described in the CDBR manual (TOBP C720600 00/ TOBP C720600 01).

Select only braking units listed in ***Table 5.2*** for A1000 6-Phase/12-Pulse input.

Table 5.2 Braking Unit Selection

Max. Applicable Motor kW (HP)	Drive Duty	A1000 Drive	Braking Unit	Max Allowable Qty
		CIMR-A□4T	CDBR-	
22 (25-30)	Heavy Duty	0058	built-in	1
30 (40)	Normal Duty	0058	built-in	1
	Heavy Duty	0072		1
37 (50-60)	Normal Duty	0072	built-in	1
	Heavy Duty	0088	4045□	1
45 (50-60)	Normal Duty	0088	4045□	1
	Heavy Duty	0103		1
55 (75)	Normal Duty	0103	4045□	1
	Heavy Duty	0139	4030□	1
75 (100)	Normal Duty	0139	4030□	1
	Heavy Duty	0165	4045□	1
90 (125-150)	Normal Duty	0165	4045□	1
	Heavy Duty	0208		1
110 (150)	Normal Duty	0208	4220□	1
	Heavy Duty	0250		1
132 (200)	Normal Duty	0250	4220□	1
	Heavy Duty	0296		1
160 (250)	Normal Duty	0296	4220□	1
	Heavy Duty	0362		1

Max. Applicable Motor kW (HP)	Drive Duty	A1000 Drive	Braking Unit	Max Allowable Qty
		CIMR-A□4T	CDBR-	
185 (300)	Normal Duty	0362	4220□	1
	Heavy Duty	0414		1
220 (350)	Normal Duty	0414	4220□	1
	Heavy Duty	0515		1
250 (400-450)	Normal Duty	0515	4220□	1
315 (400-450-500)	Heavy Duty	0675	4220□	2
355 (500-550)	Normal Duty	0675	4220□	2

■ Using Braking Units in Parallel

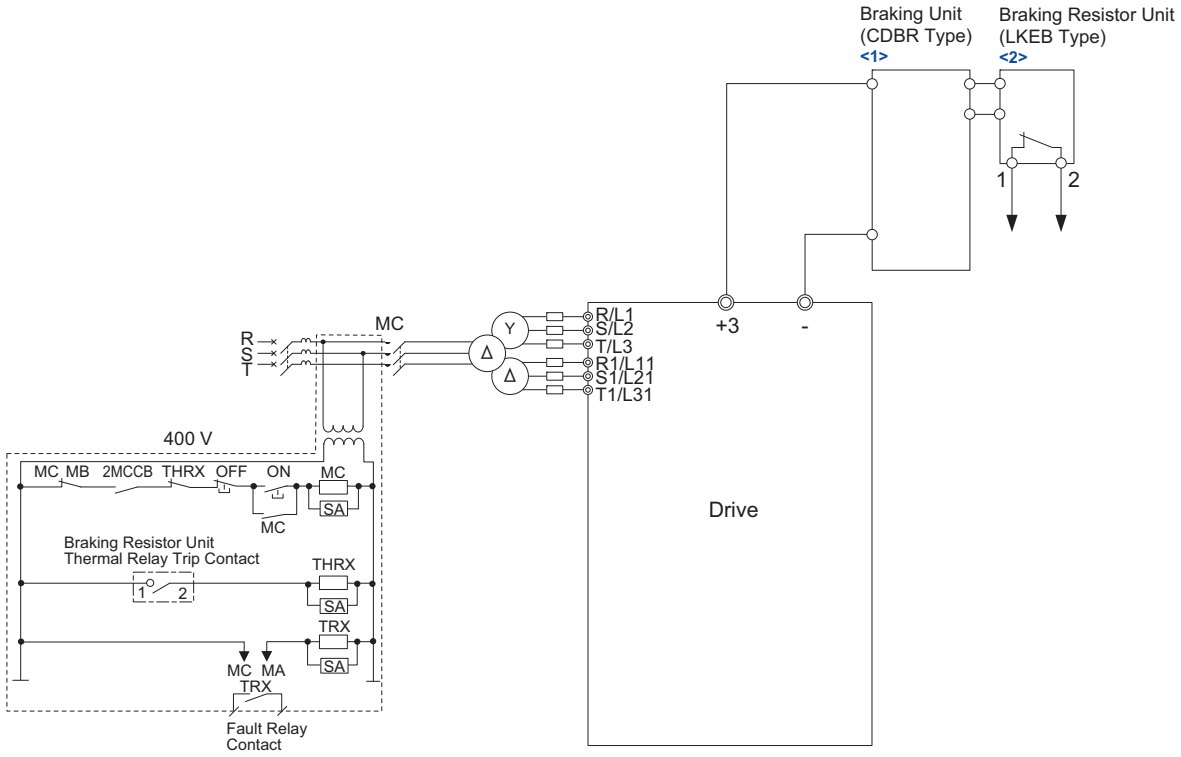
Only A1000 model CIMR-A□4T0675 can accept up to two braking units. Smaller 6-Phase/12-Pulse models are not compatible with parallel (more than one) braking units.

■ Installing Other Types of Braking Resistors

When installing braking resistors other than the LKEB type, make sure that the braking transistor in the braking unit will not be overloaded with the required duty cycle and the selected resistance value. Use a resistor that is equipped with a thermal overload relay contact, and utilize this contact to disconnect main power to the drive in case of braking resistor overheat.

■ Braking Resistor Overload Protection

If using a braking resistor option, a sequence such as the one shown in ***Figure 5.2*** is recommended to interrupt the power supply in case the braking resistor overheats.



<1> A braking unit cannot be connected to the CIMR-A□4T0058 and 0072 drives.
<2> A braking resistor can be connected to the B1 and B2 terminals on the CIMR-A□4T0058 and 0072 drives.

Figure 5.2 Power Supply Interrupt for Braking Resistor Overheat Protection (Example)

Appendix: A

Specifications

A.1 Power Ratings

◆ 6-Phase/12 Pulse Input 400 V Class Drive Models CIMR-A□4T0058 to 0208

Table A.1 Power Ratings (CIMR-A□4T0058 to 0208)

Item			Specification						
CIMR-A□4T			0058	0072	0088	0103	0139	0165	0208
Maximum Applicable Motor Capacity kW (HP) <1>		ND Rating	30 (40)	37 (50)	45 (60)	55 (75)	75 (100)	90 (125)	110 (150)
		HD Rating	22 (25-30)	30 (40)	37 (50-60)	45 (50-60)	55 (75)	75 (100)	90 (125-150)
Input	Input Current (A) <2>	ND Rating	58	71	86	105	142	170	207
		HD Rating	43	58	71	86	105	142	170
	Rated Voltage Rated Frequency		6-Phase/12-Pulse: 380 Vac to 480 Vac 50/60 Hz **Note:** 6-Phase isolated supply with each of the output windings phase shifted by 30 electrical degrees or Hybrid 6-phase topology.						
	Allowable Voltage Fluctuation		-15% to 10%						
	Allowable Frequency Fluctuation		±5%						
	Input Power (kVA)	ND Rating	53.0	64.9	78.6	96.0	130	156	189
		HD Rating	39.3	53.0	64.9	78.6	96.0	130	155
Output	Rated Output Capacity (kVA) <3>	ND Rating <4>	44	55	67	78	106	126	159
		HD Rating	34	48	57	69	85	114	137 <6>
	Rated Output Current (A)	ND Rating <4>	58	72	88	103	139	165	208
		HD Rating	45 <5>	60 <5>	75 <5>	91 <5>	112 <5>	150 <6>	180 <6>
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)						
	Carrier Frequency		User adjustable between 1 kHz and 15 kHz				User adjustable between 1 kHz and 10 kHz		
	Maximum Output Voltage (V)		Three-phase: 380 V to 480 V (proportional to input voltage)						
	Maximum Output Frequency (Hz)		400 Hz (user-adjustable)						

<1> The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.
<2> Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring conditions, and power supply impedance. This input current rating is the 3-Phase total input current rating. For the 6-Phase input current rating see ***Table C.1***.
<3> Rated motor capacity is calculated with a rated output voltage of 440 V.
<4> Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.
<5> Carrier frequency can be increased to 8 kHz while keeping this current derating. Higher carrier frequency settings require derating.
<6> Carrier frequency can be increased to 5 kHz while keeping this current derating. Higher carrier frequency settings require derating.

◆ 6-Phase/12 Pulse Input 400 V Class Drive Models CIMR-A□4T0208 to 0675

Table A.2 Power Ratings (CIMR-A□4T0208 to 0675)

Item			Specification					
CIMR-A□4T			0250	0296	0362	0414	0515	0675
Maximum Applicable Motor Capacity kW (HP) <1>		ND Rating	132 (200)	160 (250)	185 (300)	220 (350)	250 (400)	355 (500-550)
		HD Rating	110 (150)	132 (200)	160 (250)	185 (300)	220 (350)	315 (400-450-500)
Input	Input Current (A) <2>	ND Rating	228	275	317	376	427	603
		HD Rating	190	228	275	317	376	511
	Rated Voltage Rated Frequency		6-Phase/12-Pulse: 380 Vac to 480 Vac 50/60 Hz **Note:** 6-Phase isolated supply with each of the output windings phase shifted by 30 electrical degrees or Hybrid 6-Phase topology.					
	Allowable Voltage Fluctuation		-15% to 10%					
	Allowable Frequency Fluctuation		±5%					
	Input Power (kVA)	ND Rating	227	274	316	375	425	601
		HD Rating	189	227	274	316	375	534
Output	Rated Output Capacity (kVA) <3>	ND Rating <4>	191	226	276	316	392	514
		HD Rating	165 <5>	198 <5>	232 <5>	282 <4>	343 <4>	461 <4>
	Rated Output Current (A)	ND Rating <4>	250	296	362	414	515	675
		HD Rating	216 <5>	260 <5>	304 <5>	370 <4>	450 <4>	605 <4>
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)					
	Carrier Frequency		User-adjustable between 1 kHz and 10 kHz			User-adjustable between 1 kHz and 5 kHz		
	Maximum Output Voltage (V)		Three-phase: 380 V to 480 V (proportional to input voltage)					
	Maximum Output Frequency (Hz)		400 Hz (user-adjustable)					

<1> The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.
<2> Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring conditions, and power supply impedance. This input current rating is the 3-Phase total input current rating. For the 6-Phase input current rating see ***Table C.1***.
<3> Rated motor capacity is calculated with a rated output voltage of 440 V.
<4> Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.
<5> Carrier frequency can be increased to 5 kHz while keeping this current derating. Higher carrier frequency settings require derating.

A.2 Drive Specifications

Note: **1.** Perform rotational Auto-Tuning to obtain the performance specifications given below.
2. For optimum performance life of the drive, install the drive in an environment that meets the required specifications.

Item		Specification
Control Characteristics	Control Method	The following control methods can be set using drive parameters: • V/f Control (V/f) • V/f Control with PG (V/f w/PG) • Open Loop Vector Control (OLV) • Closed Loop Vector Control (CLV) • Open Loop Vector Control for PM (OLV/PM) • Advanced Open Loop Vector Control for PM (AOLV/PM) • Closed Loop Vector Control for PM (CLV/PM)
	Frequency Control Range	0.01 Hz to 400 Hz
	Frequency Accuracy (Temperature Fluctuation)	Digital input: within ±0.01% of the max output frequency (-10°C to +40°C) Analog input: within ±0.1% of the max output frequency (25°C ±10°C)
	Frequency Setting Resolution	Digital inputs: 0.01 Hz Analog inputs: 1/2048 of the maximum output frequency setting (11 bit plus sign)
	Output Frequency Resolution	0.001 Hz
	Frequency Setting Signal	-10 V to 10 V, 0 V to 10 V, 0 mA to 20 mA, 4 mA to 20 mA, Pulse Train Input
	Starting Torque <2>	V/f, V/f w/PG: 150% at 3 Hz OLV: 200% at 0.3 Hz <1> CLV, AOLV/PM, CLV/PM: 200% at 0.0 r/min <1> OLV/PM: 100% at 3 Hz
	Speed Control Range <2>	V/f, V/f w/PG: 1:40 OLV: 1:200 CLV, CLV/PM: 1:1500 OLV/PM: 1:20 AOLV/PM: 1:100
	Speed Control Accuracy <2>	OLV: ±0.2% (25°C ±10°C) CLV: ±0.02% (25°C ±10°C)
	Speed Response <2>	OLV, OLV/PM, AOLV/PM: 10 Hz CLV, CLV/PM: 50 Hz
	Torque Limit	Parameters setting allow separate limits in four quadrants (available in OLV, CLV, AOLV/PM, CLV/PM)
	Accel/Decel Time	0.0 s to 6000.0 s (4 selectable combinations of independent acceleration and deceleration settings)
	Braking Torque	Approx. 20% (approx. 125% when using braking resistor) <3> • Short-time decel torque <4> : over 100% for 0.4/ 0.75 kW motors, over 50% for 1.5 kW motors, and over 20% for 2.2 kW and above motors <5> (overexcitation braking/High Slip Braking: approx. 40%) • Continuous regenerative torque: approx. 20% <5> (approx. 125% with dynamic braking resistor option <3> : 10% ED, 10 s)
	V/f Characteristics	User-selected programs and V/f preset patterns possible
	Main Control Functions	Torque Control, Droop Control, Speed/torque Control Switching, Feed Forward Control, Zero Servo Function, Momentary Power Loss Ride-Thru, Speed Search, Overtorque/Undertorque Detection, Torque Limit, 17 Step Speed (max), Accel/decel Switch, S-curve Accel/decel, 3-wire Sequence, Autotuning (rotational, stationary tuning), Dwell, Cooling Fan on/off Switch, Slip Compensation, Torque Compensation, Frequency Jump, Upper/lower Limits for Frequency Reference, DC Injection Braking at Start and Stop, Overexcitation Braking, High Slip Braking, PID Control (with sleep function), Energy Saving Control, MEMOBUS/Modbus Comm. (RS-422/RS-485 max, 115.2 kbps), Fault Restart, Application Presets, DriveWorksEZ (customized function), Removable Terminal Block with Parameter Backup Function, Online Tuning, KEB, Overexcitation Deceleration, Inertia (ASR) Tuning, Overvoltage Suppression, High Frequency Injection.

Item		Specification
Protection Functions	Motor Protection	Electronic thermal overload relay
	Momentary Overcurrent Protection	Drive stops when output current exceeds 200% of Heavy Duty Rating
	Overload Protection	Drive stops after 60 s at 150% of rated Heavy Duty output current <6>
	Overvoltage Protection	Stops when DC bus voltage exceeds approx. 820 V
	Undervoltage Protection	Stops when DC bus voltage falls below approx. 380 V
	Momentary Power Loss Ride-Thru	Immediately stop after 15 ms or longer power loss <7> . Continuous operation during power loss than 2 s (standard)
	Heatsink Overheat Protection	Thermistor
	Braking Resistor Overheat Protection	Overheat input signal for braking resistor (Optional ERF-type, 3% ED)
	Stall Prevention	Stall Prevention is available during acceleration, deceleration, and during run.
	Ground Protection	Electronic circuit protection <8>
	DC Bus Charge LED	Remains lit until DC bus voltage falls below 50 V
Environment	Area of Use	Indoors
	Ambient Temperature	-10°C to +40°C (Flange Type Enclosure)
	Humidity	95 RH% or less (no condensation)
	Storage Temperature	-20°C to +60°C (short-term temperature during transportation)
	Altitude	Up to 1000 m without derating, up to 3000 m with output current and voltage derating.
	Vibration/Shock	10 Hz to 20 Hz: 9.8 m/s^2 20 Hz to 55 Hz: 5.9 m/s^2 (CIMR-A☐4T0058 to 0165) or 2.0 m/s^2 (CIMR-A☐4T0208 to 0675)
Standard		UL 508C
Protection Design		Flange Type Enclosure (NEMA Type 12 Backside)

<1> Select control modes in accordance with drive capacity.
<2> The accuracy of these values depends on motor characteristics, ambient conditions, and drive settings. Specifications may vary with different motors and with changing motor temperature. Contact Yaskawa for consultation.
<3> Disable Stall Prevention during deceleration (L3-04 = 0) when using a regenerative converter, a regenerative unit, a braking resistor or the Braking Resistor Unit. The default setting for the Stall Prevention function will interfere with the braking resistor.
<4> Instantaneous average deceleration torque refers to the torque required to decelerate the motor (uncoupled from the load) from the rated motor speed down to zero in the shortest time.
<5> Actual specifications may vary depending on motor characteristics.
<6> Overload protection may be triggered when operating with 150% of the rated output current if the output frequency is less than 6 Hz.
<7> May be shorter due to load conditions and motor speed.
<8> Ground protection cannot be provided when the impedance of the ground fault path is too low, or when the drive is powered up while a ground fault is present at the output.

A.3 Drive Watt Loss Data

Table A.3 Watt Loss

Model CIMR-A☐	Normal Duty				Heavy Duty			
	Rated Amps (A) <1>	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
4T0058	58	453	197	651	45 <3>	341	159	501
4T0072	72	588	244	835	60 <3>	477	206	685
4T0088	88	669	285	957	75 <3>	556	241	800
4T0103	103	827	329	1160	91 <3>	714	285	1001
4T0139	139	1179	487	1672	112 <3>	1100	447	1562
4T0165	165	1520	624	2148	150 <3>	1647	629	2293
4T0208	208	1746	553	2299	180 <3>	2199	586	2786
4T0250	250	2305	729	3034	216 <2>	2308	663	2971
4T0296	296	2308	772	3077	260 <2>	2295	694	2987
4T0362	362	3168	874	4016	304 <2>	3075	788	3846
4T0414	414	3443	1083	4524	370 <2>	3578	1012	4590
4T0515	515	4850	1474	6323	450 <1>	3972	1234	5206
4T0675	675	4861	1789	6648	605 <1>	4191	1504	5695

<1> Value assumes the carrier frequency is set to 2 kHz.
<2> Value assumes the carrier frequency is set to 5 kHz or less.
<3> Value assumes the carrier frequency is set to 8 kHz or less.

A.4 Drive Derating Data

◆ Temperature Derating

To ensure the maximum performance life, the drive output current must be derated as shown in ***Figure A.1*** when the drive is installed in areas with high ambient temperature or if drives are mounted side-by-side in a cabinet. In order to ensure reliable drive overload protection, set parameters L8-12 and L8-35 according to the installation conditions.

■ Parameter Settings

No.	Name	Description	Range	Def.
L8-12	Ambient Temperature Setting	Adjust the drive overload (oL2) protection level when the drive is installed in an environment that exceeds its ambient temperature rating.	-10 to 50	40°C
L8-35	Installation Method Selection	0: IP00/Open-Chassis Enclosure 1: Side-by-Side Mounting 2: IP20/NEMA Type 1 Enclosure 3: Finless Drive or External Heatsink Installation	0 to 3	3

IP00/Open-Chassis Enclosure

Drive operation between -10°C and 50°C allows 100% continuous current without derating.

Side-by-Side Mounting

Drive operation between -10°C and 30°C allows 100% continuous current without derating. Operation between 30°C and 50°C requires output current derating.

IP20/NEMA Type 1 Enclosure

Drive operation between -10°C and 40°C allows 100% continuous current without derating. Operation between 40°C and 50°C requires output current derating.

External Heatsink Installation, Finless Drive

Drive operation between -10°C and 40°C allows 100% continuous current without derating. Operation between 40°C and 50°C requires output current derating.

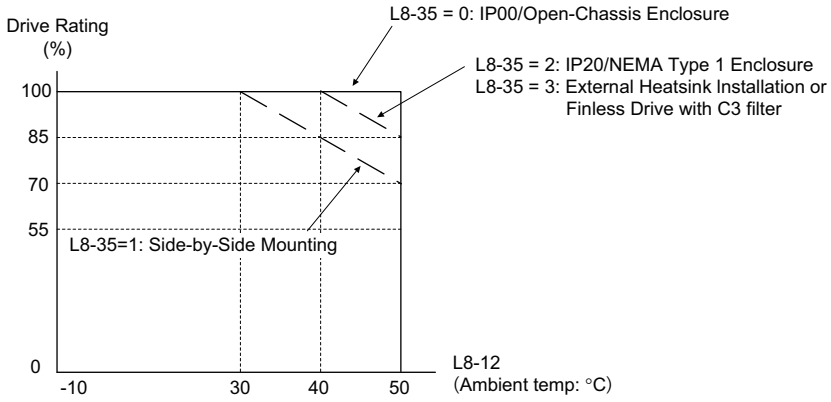


Figure A.1 Ambient Temperature and Installation Method Derating

◆ Altitude Derating

The drive standard ratings are valid for an installation altitude up to 1000 m. If the altitude exceeds 1000 m both the drive rated voltage and the rated output current must be derated for 1% per 100 m. The maximum altitude is 3000 m.

This Page Intentionally Blank

Appendix: B

Parameter List

B.1 L: Protection Function

◆ L8: Drive Protection

No. (Addr. Hex)	Name	Description	Values
L8-01 (4AD)	Internal Dynamic Braking Resistor Protection Selection (ERF type)	0: Resistor overheat protection disabled 1: Resistor overheat protection enabled	Default: 0 Range: 0, 1
L8-02 (4AE)	Overheat Alarm Level	An overheat alarm occurs when heatsink temperature exceeds the L8-02 level.	Default: <I> Min.: 50°C Max.: 150°C
L8-03 (4AF)	Overheat Pre-Alarm Operation Selection	0: Ramp to stop. A fault is triggered. 1: Coast to stop. A fault is triggered. 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. A fault is triggered. 3: Continue operation. An alarm is triggered. 4: Continue operation at reduced speed as set in L8-19.	Default: 3 Range: 0 to 4
L8-05 (4B1)	Input Phase Loss Protection Selection	Selects the detection of input current phase loss, power supply voltage imbalance, or main circuit electrolytic capacitor deterioration. 0: Disabled 1: Enabled	Default: 1 Range: 0, 1
L8-07 (4B3)	Output Phase Loss Protection Selection	0: Disabled 1: Enabled (triggered by a single phase loss) 2: Enabled (triggered when two phases are lost)	Default: 1 Range: 0 to 2
L8-09 (4B5)	Output Ground Fault Detection Selection	0: Disabled 1: Enabled	Default: <I> Range: 0, 1
L8-10 (4B6)	Heatsink Cooling Fan Operation Selection	0: During run only. Fan operates only during run for L8-11 seconds after stop. 1: Fan always on. Cooling fan operates whenever the drive is powered up.	Default: 0 Range: 0, 1
L8-11 (4B7)	Heatsink Cooling Fan Off Delay Time	Sets a delay time to shut off the cooling fan after the Run command is removed when L8-10 = 0.	Default: 60 s Min.: 0 Max.: 300
L8-12 (4B8)	Ambient Temperature Setting	Enter the ambient temperature. This value adjusts the oL2 detection level.	Default: 40°C Min.: -10 Max.: 50
L8-15 (4BB)	oL2 Characteristics Selection at Low Speeds	0: No oL2 level reduction below 6 Hz. 1: oL2 level is reduced linearly below 6 Hz. It is halved at 0 Hz.	Default: 1 Range: 0, 1
L8-18 (4BE)	Software Current Limit Selection	0: Disabled 1: Enabled	Default: 0 Range: 0, 1
L8-19 (4BF)	Frequency Reduction Rate during Overheat Pre-Alarm	Specifies the frequency reference reduction gain at overheat pre-alarm when L8-03 = 4.	Default: 0.8 Min.: 0.1 Max.: 0.9
L8-27 (4DD)	Overcurrent Detection Gain	Sets the gain for overcurrent detection as a percentage of the motor rated current. Overcurrent is detected using the lower value between the overcurrent level of the drive or the value set to L8-27.	Default: 300.0% Min.: 0.0 Max.: 300.0
L8-29 (4DF)	Current Unbalance Detection (LF2)	0: Disabled 1: Enabled	Default: 1 Range: 0, 1
L8-32 (4E2)	Main Contactor and Cooling Fan Power Supply Failure Selection	Determines drive response when a fault occurs with the internal cooling fan. 0: Ramp to stop 1: Coast to stop 2: Fast stop (Decelerate to stop using the deceleration time set to C1-09) 3: Alarm only (“FAn” will flash) 4: Continue operation at reduced speed as set to L8-19.	Default: 1 Range: 0 to 4

No. (Addr. Hex)	Name	Description	Values
L8-35 (4EC)	Installation Method Selection	0: IP00/Open-Chassis enclosure 1: Side-by-Side mounting 2: IP20/NEMA Type 1 enclosure 3: Finless model drive or external heatsink installation	Default: 3 <1> <2> Range: 0 to 3
L8-38 (4EF)	Carrier Frequency Reduction	0: Disabled 1: Enabled below 6 Hz 2: Enabled for the entire speed range	Default: <3> Range: 0 to 2
L8-40 (4F1)	Carrier Frequency Reduction Off Delay Time	Sets the time that the drive continues running with reduced carrier frequency after the carrier reduction condition is gone. Setting 0.00 s disables the carrier frequency reduction time.	Default: <4> Min.: 0.00 s Max.: 2.00 s
L8-41 (4F2)	High Current Alarm Selection	0: Disabled 1: Enabled. An alarm is triggered at output currents above 150% of drive rated current.	Default: 0 Range: 0, 1
L8-55 (45F)	Internal Braking Transistor Protection	0: Disabled. Disable when using an optional braking unit. 1: Protection enabled.	Default: 1 Range: 0, 1
L8-78 (2CC)	Power Unit Output Phase Loss Protection	Enables motor protection in the event of output phase loss. 0: Disabled 1: Enabled	Default: 1 Range: 0, 1

<1> Default setting is dependent on parameters C6-01, Drive Duty Selection, and o2-04, Drive Model Selection.
<2> Parameter setting value is not reset to the default value when the drive is initialized.
<3> Default setting is dependent on parameters A1-02, Control Method Selection, and o2-04, Drive Model Selection.
<4> Default setting is determined by parameter A1-02, Control Method Selection.

This Page Intentionally Blank

Appendix: C

Standards Compliance

This appendix explains the guidelines and criteria for maintaining UL standards.

C.1 UL Standards

◆ UL Standards Compliance

The UL/cUL mark applies to products in the United States and Canada. It indicates that UL has performed product testing and evaluation, and determined that their stringent standards for product safety have been met. For a product to receive UL certification, all components inside that product must also receive UL certification.

Figure C.1 UL/cUL Mark

This drive is tested in accordance with UL standard UL508C and complies with UL requirements. The conditions described below must be met to maintain compliance when using this drive in combination with other equipment:

■ Installation Area

Do not install the drive to an area greater than pollution degree 2 (UL standard).

■ Ambient Temperature

Install the drive in an environment with an ambient temperature of -10°C to 40°C (Flange Type Enclosure).

■ Factory Recommended Branch Circuit Protection

Yaskawa recommends installing one of the following types of branch circuit protection on a secondary circuit of a 6-Phase/12-Pulse transformer to maintain standards compliance.
Refer to local codes for proper Branch Circuit Protection on the primary circuit of a 6-Phase/12-Pulse transformer.
The maximum Time Delay fuse is 175% of drive input current rating listed in ***Table C.1***. This covers any Class CC, J or T class fuse.
A Class L fuse is also approved for this rating at 175% drive input current listed in ***Table C.1***.

Table C.1 Factory Recommended A1000 AC Drive Branch Circuit Protection

Model CIMR-A☐	Nominal Output Power kW (HP)	AC Drive Input Amps/Phase <1>	Time-Delay Fuse Class J or T Rating Amps
4T0058	30 (40)	29	40
4T0072	37 (50)	35.5	50
4T0088	45 (60)	43	60
4T0103	55 (75)	52.5	75
4T0139	75 (100)	71	90
4T0165	90 (125)	85	110
4T0208	110 (150)	103.5	150
4T0250	132 (200)	124	175
4T0296	160 (250)	150	225
4T0362	185 (300)	173	225
4T0414	220 (350)	205	275
4T0515	250 (400)	232.5	350
4T0675	355 (550)	328.5	450

<1> This amp rating is 1/2 rated current because the 3-Phase current is split between 6 input phases for the 6-Phase/12-Pulse A1000 drive. Use this amp rating to select input wiring size as recommended in ***Table 3.2***.

■ Main Circuit Terminal Wiring

Yaskawa recommends using closed-loop crimp terminals on all drive models. UL/cUL approval requires the use of UL Listed closed-loop crimp terminals when wiring the drive main circuit terminals. Use only the tools recommended by the terminal manufacturer for crimping. Refer to *Closed-Loop Crimp Terminal Size on page 65* for closed-loop crimp terminal recommendations.

Closed-Loop Crimp Terminal Recommendations

Yaskawa recommends using closed-loop crimp terminals on all drive models. UL approval requires the use of UL Listed crimp terminals when wiring the drive main circuit terminals. Use only crimping tools as specified by the crimp terminal manufacturer. Yaskawa recommends crimp terminals made by JST and Tokyo DIP (or equivalent) for the insulation cap. *Table C.2* matches the wire gauges and terminal screw sizes with Yaskawa-recommended crimp terminals, tools, and insulation caps. Refer to the appropriate Wire Gauge and Torque Specifications table for the wire gauge and screw size for your drive model. Place orders with a Yaskawa representative or the Yaskawa sales department.

The closed-loop crimp terminal sizes and values listed in *Table C.2* are Yaskawa recommendations. Refer to local codes for proper selections.

Table C.2 Closed-Loop Crimp Terminal Size

Wire Gauge	Terminal Screws	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code <1>
			Machine No.	Die Jaw		
14 AWG	M4	R2-4	YA-4	AD-900	TP-003	100-054-028
12 / 10 AWG	M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	M5	R5.5-5	YA-4	AD-900	TP-005	100-054-030
	M6	R5.5-6	YA-4	AD-900	TP-005	100-068-029
	M8	R5.5-8	YA-4	AD-900	TP-005	100-068-030
8 AWG	M4	8-4	YA-4	AD-901	TP-008	100-054-031
	M5	R8-5	YA-4	AD-901	TP-008	100-054-032
	M8	R8-8	YA-4	AD-901	TP-008	100-061-111
6 AWG	M4	14-NK4	YA-4, YA-5	AD-902, AD-952	TP-014	100-054-033
	M5	R14-5	YA-4, YA-5	AD-902, AD-952	TP-014	100-054-034
	M6	R14-6	YA-4, YA-5	AD-902, AD-952	TP-014	100-051-261
	M8	R14-8	YA-4, YA-5	AD-902, AD-952	TP-014	100-054-035
	M10	R14-10	YA-4, YA-5	AD-902, AD-952	TP-014	100-061-112
4 AWG	M6	R22-6	YA-5	AD-953	TP-022	100-051-262
	M8	R22-8	YA-5	AD-953	TP-022	100-051-263
	M10	R22-10	YA-5	AD-953	TP-022	100-061-113
3 / 2 / 1 AWG	M6	38-S6	YA-5	AD-954	TP-038	100-068-031
	M8	R38-8	YA-5	AD-954	TP-038	100-051-264
	M10	R38-10	YA-5	AD-954	TP-038	100-061-114
1/0 AWG 1/0 AWG × 2P	M8	R60-8	YA-5 YF-1, YET-300-1	AD-955 TD-321, TD-311	TP-060	100-051-265
	M10	R60-10	YA-5 YF-1, YET-300-1	AD-955 TD-321, TD-311	TP-060	100-051-266
1 AWG × 2P 2 AWG × 2P	M10	38-L10	YA-5 YF-1, YET-150-1	AD-954 TD-224, TD-212	TP-038	100-051-556
2/0 AWG 2/0 AWG × 2P	M10	70-10	YF-1, YET-300-1	TD-323, TD-312	TP-080	100-054-036
3/0 AWG	M10	80-10	YF-1, YET-300-1	TD-323, TD-312	TP-080	100-051-267
3/0 AWG × 2P 3/0 AWG × 4P	M10	80-L10	YF-1, YET-150-1 YF-1, YET-300-1	TD-227, TD-214 TD-323, TD-312	TP-080	100-051-557
	M12	80-L12	YF-1, YET-150-1 YF-1, YET-300-1	TD-227, TD-214 TD-323, TD-312	TP-080	100-051-558

Wire Gauge	Terminal Screws	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code <1>
			Machine No.	Die Jaw		
4/0 AWG	M8	100-8	YF-1, YET-150-1 YF-1, YET-300-1	TD-228, TD-214 TD-324, TD-312	TP-100	100-068-032
	M10	R100-10	YF-1, YET-150-1 YF-1, YET-300-1	TD-228, TD-214 TD-324, TD-312	TP-100	100-051-269
4/0 AWG × 2P 4/0 AWG × 4P	M10	100-L10	YF-1, YET-150-1 YF-1, YET-300-1	TD-228, TD-214 TD-324, TD-312	TP-100	100-051-559
	M12	100-L12	YF-1, YET-150-1 YF-1, YET-300-1	TD-228, TD-214 TD-324, TD-312	TP-100	100-051-560
250 / 300 kcmil	M10	R150-10	YF-1, YET-150-1 YF-1, YET-300-1	TD-229, TD-215 TD-325, TD-313	TP-150	100-051-272
	M12	R150-12	YF-1, YET-150-1 YF-1, YET-300-1	TD-229, TD-215 TD-325, TD-313	TP-150	100-051-273
250 kcmil × 2P 250 kcmil × 4P 300 kcmil × 2P 300 kcmil × 4P	M10	150-L10	YF-1, YET-150-1 YF-1, YET-300-1	TD-229, TD-215 TD-325, TD-313	TP-150	100-051-561
	M12	150-L12	YF-1, YET-150-1 YF-1, YET-300-1	TD-229, TD-215 TD-325, TD-313	TP-150	100-051-562
350 kcmil	M10	180-10	YF-1, YET-300-1	TD-326, TD-313	TP-200	100-066-687
	M12	180-12	YF-1, YET-300-1	TD-326, TD-313	TP-200	100-066-689
400 kcmil	M10	200-10	YF-1, YET-300-1	TD-327, TD-314	TP-200	100-051-563
	M12	R200-12	YF-1, YET-300-1	TD-327, TD-314	TP-200	100-051-275
350 kcmil × 2P	M12	180-L12	YF-1, YET-300-1	TD-326, TD-313	TP-200	100-066-688
400 kcmil × 2P	M12	200-L12	YF-1, YET-300-1	TD-327, TD-314	TP-200	100-051-564
500 kcmil 600 / 650 kcmil 500 kcmil × 2P 600 kcmil × 2P	M10	325-10	YF-1, YET-300-1	TD-328, TD-315	TP-325	100-051-565
	M12	325-12	YF-1, YET-300-1	TD-328, TD-315	TP-325	100-051-277

<1> Codes refer to a set of three crimp terminals and three insulation caps. Prepare input and output wiring using two sets for each connection.
Example 1: Models with 300 kcmil for both input and output require one set for input terminals and one set for output terminals, so the user should order two sets of [100-051-272].
Example 2: Models with 4/0 AWG × 2P for both input and output require two sets for input terminals and two sets for output terminals, so the user should order four sets of [100-051-560].

Note: Use crimp insulated terminals or insulated shrink tubing for wiring connections. Wires should have a continuous maximum allowable temperature of 75°C 600 Vac UL-approved vinyl-sheathed insulation.

■ Low Voltage Wiring for Control Circuit Terminals

Wire low voltage wires with NEC Class 1 circuit conductors. Refer to national state or local codes for wiring. Use a UL Listed class 2 power supply for the control circuit terminal when not using the internal control power supply of the drive. Refer to NEC Article 725 Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power Limited Circuits for requirements concerning class 1 circuit conductors and class 2 power supplies.

Table C.3 Control Circuit Terminal Power Supply

Input / Output	Terminal Signal	Power Supply Specifications
Open collector outputs	P1, P2, PC, DM+, DM-	Requires class 2 power supply
Digital inputs	S1 to S8, SC, HC, H1, H2	Use the internal LVLC power supply of the drive. Use class 2 for external power supply.
Analog inputs / outputs	+V, -V, A1, A2, A3, AC, AM, FM	Use the internal LVLC power supply of the drive. Use class 2 for external power supply.

■ Drive Short Circuit Rating

The drive is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes, 480 Vac maximum (400 V Class) when protected by fuses listed in ***Table C.1***.

◆ Drive Motor Overload Protection

Set parameter E2-01 (motor rated current) to the appropriate value to enable motor overload protection. The internal motor overload protection is UL Listed and in accordance with the NEC and CEC.

■ E2-01: Motor Rated Current

Setting Range: Model-dependent

Default Setting: Model-dependent

Parameter E2-01 protects the motor when parameter L1-01 is not set to 0. The default for L1-01 is 1, which enables protection for standard induction motors.

If Auto-Tuning has been performed successfully, the motor data entered to T1-04 is automatically written to parameter E2-01.

If Auto-Tuning has not been performed, manually enter the correct motor rated current to parameter E2-01.

■ L1-01: Motor Overload Protection Selection

The drive has an electronic overload protection function (oL1) based on time, output current, and output frequency that protects the motor from overheating. The electronic thermal overload function is UL-recognized, so it does not require an external thermal relay for single motor operation.

This parameter selects the motor overload curve used according to the type of motor applied.

Table C.4 Overload Protection Settings

Setting	Description	
0	Disabled	Disabled the internal motor overload protection of the drive.
1	Standard fan-cooled motor (default)	Selects protection characteristics for a standard self-cooled motor with limited cooling capabilities when running below the rated speed. The motor overload detection level (oL1) is automatically reduced when running below the motor rated speed.
2	Drive duty motor with a speed range of 1:10	Selects protection characteristics for a motor with self-cooling capability within a speed range of 10:1. The motor overload detection level (oL1) is automatically reduced when running below 1/10 of the motor rated speed.
3	Vector motor with a speed range of 1:100	Selects protection characteristics for a motor capable of cooling itself at any speed including zero speed (externally cooled motor). The motor overload detection level (oL1) is constant over the entire speed range.
4	Permanent Magnet motor with variable torque	Selects protection characteristics for a variable torque PM motor. The motor overload detection level (oL1) is automatically reduced when running below the motor rated speed.
5	Permanent Magnet motor with constant torque	Selects protection characteristics for a constant torque PM motor. The motor overload detection level (oL1) is constant over the whole speed range.
6	Standard fan-cooled motor (50 Hz)	Selects protection characteristics for a standard self-cooled motor with limited cooling capabilities when running below the rated speed. The motor overload detection level (oL1) is automatically reduced when running below the motor rated speed.

When connecting the drive to more than one motor for simultaneous operation, disable the electronic overload protection (L1-01 = 0) and wire each motor with its own motor thermal overload relay.

Enable motor overload protection (L1-01 = 1 to 6) when connecting the drive to a single motor, unless another motor overload preventing device is installed. The drive electronic thermal overload function causes an oL1 fault, which shuts off the output of the drive and prevents additional overheating of the motor. The motor temperature is continually calculated while the drive is powered up.

■ L1-02: Motor Overload Protection Time

Setting Range: 0.1 to 5.0 min

Factory Default: 1.0 min

Parameter L1-02 determines how long the motor is allowed to operate before the oL1 fault occurs when the drive is running at 60 Hz and at 150% of the full load amp rating (E2-01) of the motor. Adjusting the value of L1-02 can shift the set of oL1 curves up the y axis of the diagram below, but will not change the shape of the curves.

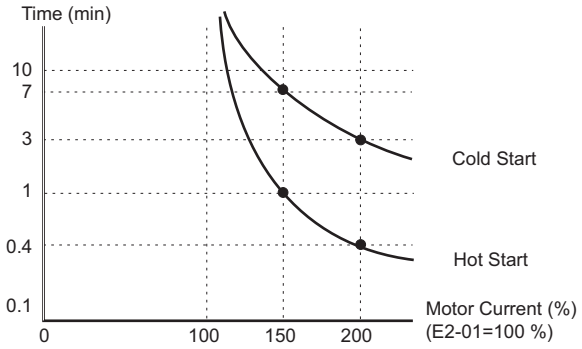
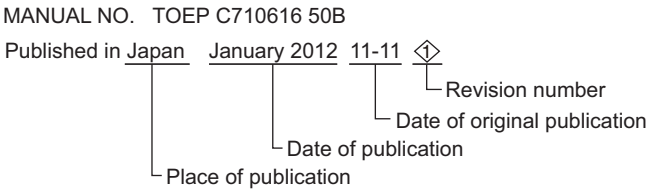


Figure C.2 Motor Overload Protection Time

Revision History

The revision dates and the numbers of the revised manuals appear on the bottom of the back cover.



Date of Publication	Revision Number	Section	Revised Content
January 2012	◇1	All	Addition: Smaller drive capacities added along with corresponding data 400 V Class: CIMR-A□4T0058 to 4T0208
November 2011	–	–	First Edition

YASKAWA AC Drive-A1000

High Performance Vector Control Drive

6-Phase/12-Pulse Input Installation Guide

YASKAWA AMERICA, INC.
2121 Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone: (800) YASKAWA (927-5292) or 1-847-887-7000 Fax: 1-847-887-7310
http://www.yaskawa.com

DRIVE CENTER (INVERTER PLANT)
2-13-1, Nishimiyaichi, Yukuhashi, Fukuoka, 824-8511, Japan
Phone: 81-930-25-3844 Fax: 81-930-25-4369
http://www.yaskawa.co.jp

YASKAWA ELECTRIC CORPORATION
New Pier Takeshiba South Tower, 1-16-1, Kaigan, Minatoku, Tokyo, 105-6891, Japan
Phone: 81-3-5402-4502 Fax: 81-3-5402-4580
http://www.yaskawa.co.jp

YASKAWA ELÉTRICO DO BRASIL LTDA.
Avenda Fagundes Filho, 620 Bairro Saude, São Paulo, SP04304-000, Brasil
Phone: 55-11-3585-1100 Fax: 55-11-5581-8795
http://www.yaskawa.com.br

YASKAWA EUROPE GmbH
Hauptstrasse 185, 65760 Eschborn, Germany
Phone: 49-6196-569-300 Fax: 49-6196-569-398
http://www.yaskawa.eu.com

YASKAWA ELECTRIC UK LTD.
1 Hunt Hill Orchardton Woods, Cumbernauld, G68 9LF, United Kingdom
Phone: 44-1236-735000 Fax: 44-1236-458182
http://www.yaskawa.co.uk

YASKAWA ELECTRIC KOREA CORPORATION
9F, Kyobo Securities Bldg., 26-4, Yeouido-dong, Yeongdeungpo-gu, Seoul, 150-737, Korea
Phone: 82-2-784-7844 Fax: 82-2-784-8495
http://www.yaskawa.co.kr

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
151 Lorong Chuan, #04-01, New Tech Park, 556741, Singapore
Phone: 65-6282-3003 Fax: 65-6289-3003
http://www.yaskawa.com.sg

YASKAWA ELECTRIC (SHANGHAI) CO., LTD.
12F, Carlton Bld., No.21 HuangHe Road, HuangPu District, Shanghai 200003, China
Phone: 86-21-5385-2200 Fax: 86-21-5385-3299
http://www.yaskawa.com.cn

YASKAWA ELECTRIC (SHANGHAI) CO., LTD. BEIJING OFFICE
Room 1011, Tower W3 Oriental Plaza, No. 1 East Chang An Ave.,
Dong Cheng District, Beijing, 100738, China
Phone: 86-10-8518-4086 Fax: 86-10-8518-4082

YASKAWA ELECTRIC TAIWAN CORPORATION
9F, 16, Nanking E. Rd., Sec. 3, Taipei, 104, Taiwan
Phone: 886-2-2502-5003 Fax: 886-2-2505-1280

YASKAWA ELECTRIC INDIA PRIVATE LIMITED
#17/A Electronics City, Hosur Road Bangalore 560 100 (Karnataka), India
Phone: 91-80-4244-1900 Fax: 91-80-4244-1901
http://www.yaskawaindia.in

YASKAWA ELECTRIC CORPORATION

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

Specifications are subject to change without notice for ongoing product modifications and improvements.

TOEPC71061650

MANUAL NO. TOEP C710616 50B

Published in Japan January 2012 11-11 ◇1
11-12-8_YAI