

## YASKAWA AC Drive GA500

Versatile Compact Type

200 V CLASS, THREE-PHASE INPUT: 0.1 to 22 kW  
200 V CLASS, SINGLE-PHASE INPUT: 0.1 to 3.7 kW  
400 V CLASS, THREE-PHASE INPUT: 0.2 to 30 kW



# Smart & Compact

The world's smallest class,  
top performance drive

With the customer's interest always in mind, Yaskawa Electric Corporation leads the industry in developing drives that meet demand with uncompromising quality.

Based on the concepts of versatility, ease of use, and stability, the GA500 new drive series was created to be the smallest in its class, provide innovative permanent magnet motor control and ensure continual operation of customer machinery and equipment.

Backed by leading performance in the compact model class, the GA500 can help customer machinery and equipment achieve unprecedented evolution.



Innovative PM Motor Control

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Continuous Operation of Machinery and Equipment  
enabled by Predict Potential Failures

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Improve Efficiency of Production Management with the  
Introduction of IoT Using Sensing Technology

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GA500 provides the best value for your application, whether it is development, design, production technology or after-sales service.

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## Production Technology

## Maintenance

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LCD Keypad  
Bluetooth LCD Keypad

Improved operability  
and maintenance

Note: Bluetooth is a registered trademark of Bluetooth SIG, Inc.

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Simple Replacement of V1000 Drive

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# Maximize the Performance of Your Machines

Yaskawa has succeeded in creating a compact motor incorporating its many years of experience in the development of motor control technology. Our products can deliver a performance that exceeds all expectations.

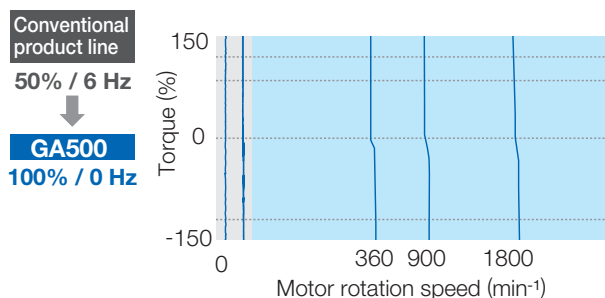


## Innovative

### Stable Drive for High-impact Loads

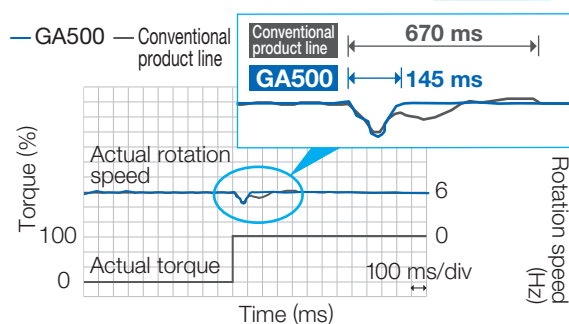
The GA500 uses Yaskawa's unique sensorless PM motor control technology to detect the magnetic pole position of the PM motor and operates at an output of zero speed/100% torque.

#### ■ Speed - Torque Characteristics



Note: The capacity of the drive and motor must be taken into account with output at 200% torque.

#### ■ Speed Change with a High-impact Load



#### Compressor (Freezer)

- Stable drive even with residual pressure
- Startup possible with any refrigerants



#### Vacuum Pump

- Startup possible even with impurities
- Stable drive even during atmospheric release

### Product Lineup Including Compact Sizes and Medium-capacity Models

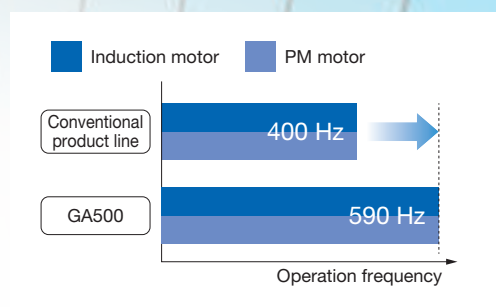
Products are available in the 200-V class up to 22 kW (ND) and in the 400-V class up to 30 kW (ND).

The drive can now be used for newer, less-traditional applications and can contribute to a smaller footprint for machinery and equipment.



## 590 Hz! Highest of the Industry\*<sup>1</sup>

Achieving high-speed operation with a maximum output frequency of 590 Hz\*<sup>2</sup> with induction motors and PM motors, machines can be made more compact and efficient as gears and belts do not need to be used with motors.



### General Processing Machinery

- High precision drive matched with workpieces
- Reduced number of encoders, gears, and belts

\*1: According to Yaskawa's research (as of September 2018)

\*2: Output frequency is 590 Hz after review of Export Control Order.

# PM Motor Control

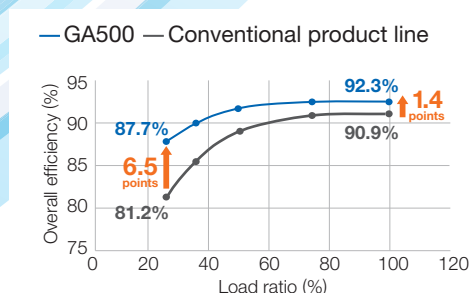
## Improve Overall Machine Efficiency by up to 7 Points\*<sup>3</sup>

Newly equipped PM Advanced Open Loop Vector control allows the motor to operate while detecting the magnetic pole position of the PM motor, which minimizes the amount of energy used.

\*3: For Yaskawa PM motors: Load ratio 25%



### ■ Comparison of overall efficiency of drive and motor in constant torque applications



Note: Motor Speed: 100% (60 Hz)

	Load ratio	Conventional product line	GA500
Drive efficiency	25%	96.9%	97.9%
	100%	97.8%	98.6%
Motor efficiency	25%	83.9%	89.6%
	100%	92.9%	93.6%
Overall efficiency	25%	81.2%	87.7%
	100%	90.9%	92.3%



### Compressors, Conveyor machines

- Improve energy savings with light loads
- Boost COP and IPLV values

COP (Coefficient of Performance): Performance coefficient of air conditioning heat source equipment.  
IPLV (Integrated Part Load Value): Simple index of the U.S. Air-Conditioning and Refrigeration Institute, which defines the period performance coefficient from the COP at four points with different loads.

## Able to Drive Synchronous Reluctance Motor

With EZ Open Loop Vector control, it is possible to drive a reluctance motor with high energy savings.

A synchronous reluctance motor uses a magnet-less structure to create a low-cost, highly-efficient motor that does not generate secondary current loss.

# Continuous Operation of Machinery and Equipment

Yaskawa drives contribute to the stable operation and improvement of operating rates with a function to predict potential failures by detecting the deterioration of machinery and equipment, as well as a new function that extends service life.

## Predict Potential Failures of Machinery using Drives\*

The GA500 helps users build machinery and production lines for continuous operation. The drive detects and informs users about unusual operations in machinery and equipment.

DriveWorksEZ

P.17



### Transport Conveyor

- Belt break
- Drive chain break
- Roller bearing deterioration



Belt damage



### Chiller Compressor

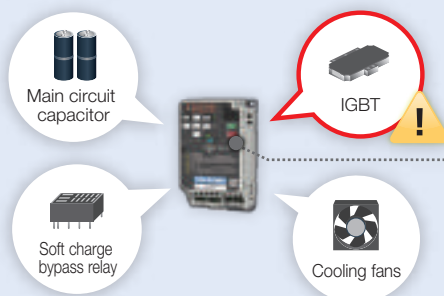
- Liquid return detection, etc.

Various Machinery in Operation on



## Predict Drive Service Life\*

The GA500 monitors deterioration of built-in, limited lifetime service parts in real time and notifies users about replacement timing.



Limited lifetime service parts	Replacement
Cooling fans	User
Main circuit capacitor	Parts replacement (Support by Yaskawa sales representatives)
Soft charge bypass relay	Parts replacement (Support by Yaskawa sales representatives)
<b>IGBT</b>	<b>Drive replacement</b> ⚠

Predicts deterioration of essential parts of drives!

and Equipment  
Production Lines



### Fan

- Filter clogging
- Wing damage
- Loose pulley belt



### Pump

- Motor bearings
- Deterioration of bearings

## Longer Motor Service Life

The GA500 prevents the phenomenon of a reduction in the magnetic force (irreversible demagnetization), which requires replacement with a PM motor, and helps reduce downtime.



Prevent Demagnetization of PM Motor

\*: Refer to "Predict Potential Failures with Yaskawa's Drives (CHEP C710617 38)" for details.

# Improve Production Management with IoT

Yaskawa drives do more than just drive motors—they also extract data from machines in real time to monitor conditions. They utilize the extracted data to predict potential failures and also connect to the host controllers to share the data so that it improves the efficiency of production management.



Diagnosis

## Prevent Major Problems Before They Occur

Yaskawa drives can monitor the status of machinery and equipment via the motor.  
Monitored data is sent to the host and the drive can detect unusual operations to predict potential failures in machinery.

DriveWorksEZ

P.17



Visualizes

## Monitors machine conditions in real time while the drive is in operation

### Extracted Data

- Motor speed, Frequency
- Power consumption
- Load current
- Torque
- Motor voltage
- etc.



Power consumption

Torque

etc.

## Access Complete Data on Machinery

Monitored data (current, power consumption, torque, etc.) stored in the drive can be collected and analyzed to enhance the efficiency of production management



Controller



Edge computer  
(YASKAWA Cockpit\*)

\*: Software that collects, stores, and analyzes data on facilities and equipment at production sites in real time.

Power consumption

Torque



Connects

## Connect to Various Host Controllers

The GA500 supports a variety of industrial networks in Japan and around the world, including MECHATROLINK, for connectivity to various host controllers.



\*: Option required

Communication Options

P.49



Stores

## High-speed Scanning to Analyze Detailed Behavior

Monitored data (current, power consumption, torque, etc.) from the drive can be stored to a microSD card at high speed to be used in for detailed data analysis and investigation of factors when a problem occurs.

DriveWizard

P.16

LCD Keypad

P.19



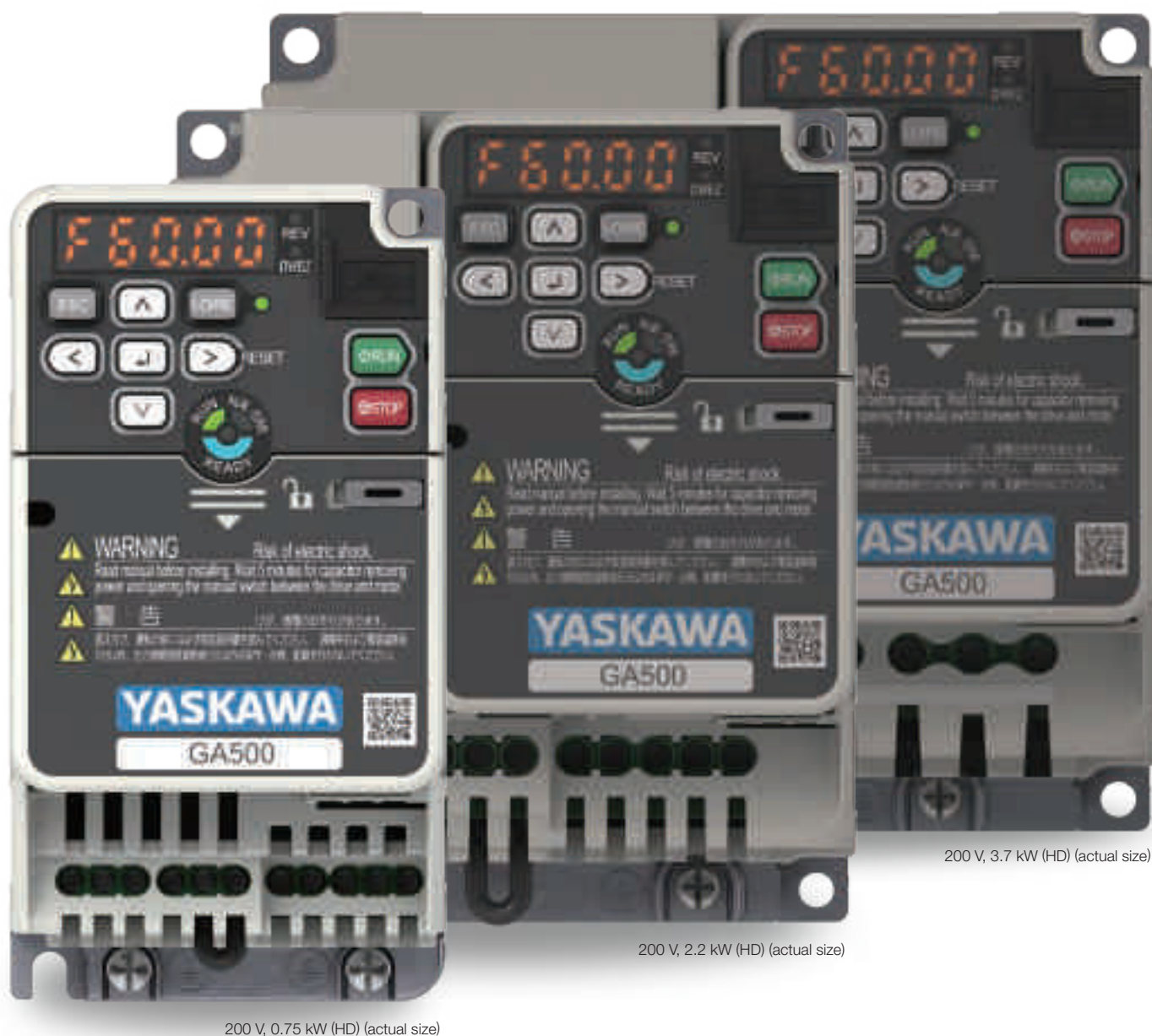
Note: DeviceNet is a trademark of Open DeviceNet Vendor Association, Inc. (ODVA).  
EtherCAT is a trademark of Beckhoff Automation GmbH.  
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# Reduce Machinery and Control Panel Footprint

The GA500 is designed with the functions of peripheral devices already built in, which eliminates the need for these devices, saving space and energy and reducing wiring. Initial investment can be minimized.

## The World's Smallest Drive for Smaller Machinery



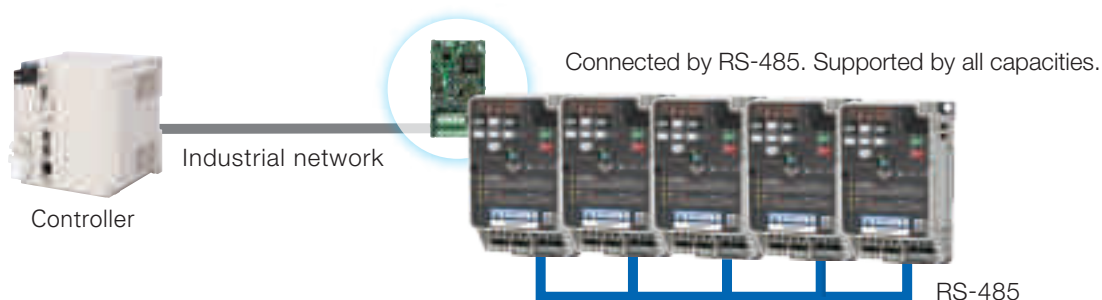
200 V, 3.7 kW (HD) (actual size)

200 V, 2.2 kW (HD) (actual size)

200 V, 0.75 kW (HD) (actual size)

# Reduced Number of Parts

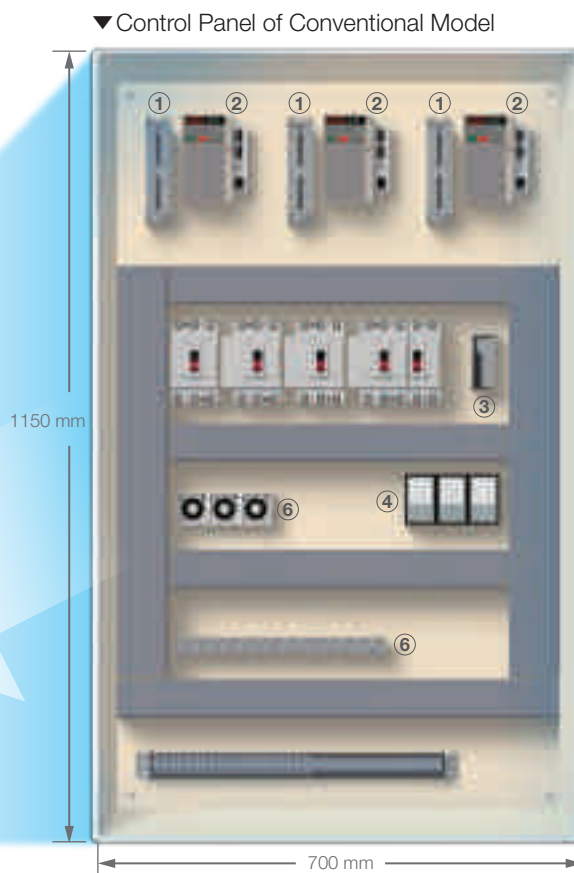
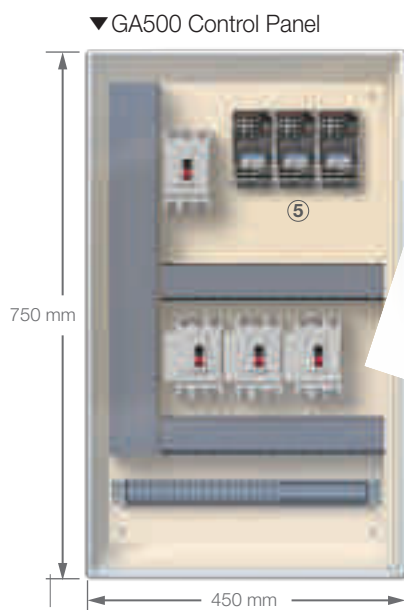
The network protocol for industrial use has been converted to RS-485 to enable control of up to five drives from a single communication option.



# Smaller Control Panel with Integrated Peripheral Device Functions

Installation work hours  
Approx.  
**50%**  
Reduction

Installation space  
Approx.  
**60%**  
Reduction



- ① EMC Filter
- ② 24 Vdc Power Supply
- ③ 24 Vdc Power Supply (150 mA)
- ④ Analog output conversion circuit (voltage to current)
- ⑤ Close installation with drive (side-by-side)
- ⑥ Timer, relay



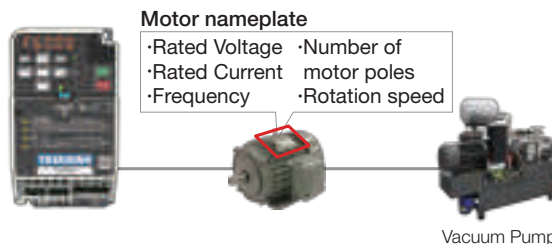
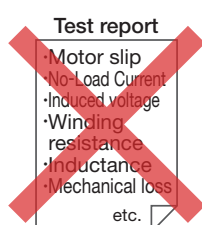
# Easy Maintenance

This product lineup comes with a variety of functions to help minimize the time and cost of operations from drive selection to troubleshooting.



## Tuning Possible with Machinery Installed

Easy tuning can be performed even on motors manufactured overseas and motors without information on performance or status with connected machinery to ensure high-performance driving.



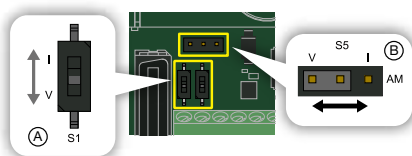
## Significant Reduction in Wiring

### Easily Switch between Voltage and Current

Analog input (A): 0 to 10 V,  
4 to 20 mA, 0 to 20 mA  
Analog output (B): 0 to 10 V,  
4 to 20 mA

### Controllers with 24-V Common Method Supported

You can switch between the Sinking mode (NPN) and Sourcing mode (PNP) on the multi-function digital input terminals and between internal and external power supply.



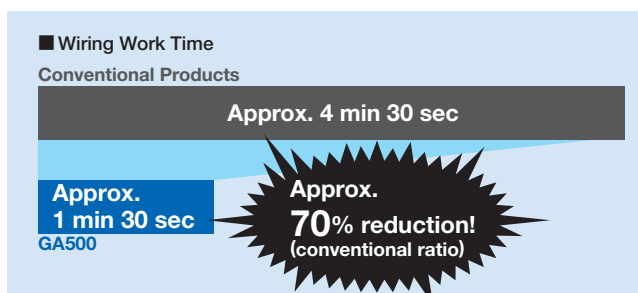
### Wiring Reduction

Virtual I/O function can reduce external wiring. This function virtually wires the I/O terminal of the drive internally without actual wires.

### Use of European Terminals for Easy Wiring

Significant reduction in work hours because crimp terminal and crimping operation are now obsolete.

Note: For tool use, see page 35.





Maintenance

## Closed-Door Operations and Monitoring\*1

By installing an LED keypad on the surface of the control panel, you can operate and monitor the drive installed inside the panel without having to open a door.

\*1: Requires compact Keypad Panel Mounting Kit (optional)

- **Intuitive operation keys**
- **Status display visible from a distance**

## Monitor Performance Life

▼ Limited lifetime service parts of drive



### Highly-Reliable Design

- **Varnish-Coated Printed Circuit Board**  
(IEC60721-3-3:3C2.3S2)
- **Design life of 10 years**
- **Environment-resistant design** (option)

Vibration-resistant

Dust-resistant

Moisture-resistant

Gas-resistant

Oil-resistant

## Quick Response

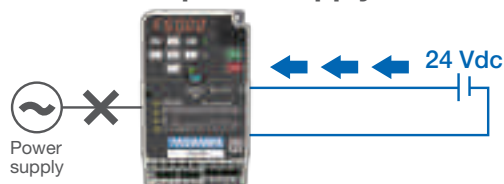
You can perform recovery work and confirm malfunctions without applying main circuit power.

DriveWizard Mobile

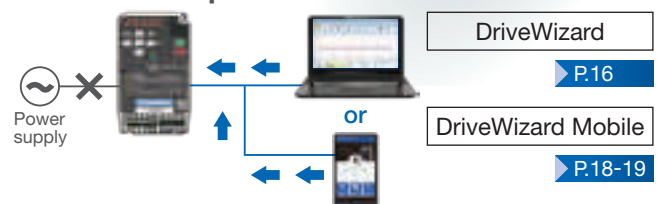
▶ P.18-19

Reduced Downtime

### Method 1: Supply power from 24 Vdc external power supply



### Method 2: Supply power from a computer or a smartphone via USB cable\*2



\*2: A commercially-available USB cable can be used.

## Less Downtime

There is no need to reprogram and rewire the replacement drive in the event of failure. Simply replace the control board to instantly and securely replace the drive. You can select various parameter backup methods.

- **Standard keypad:** Stores the parameters of a single drive
- **Optional LCD keypad:** Stores the parameters of up to four drives



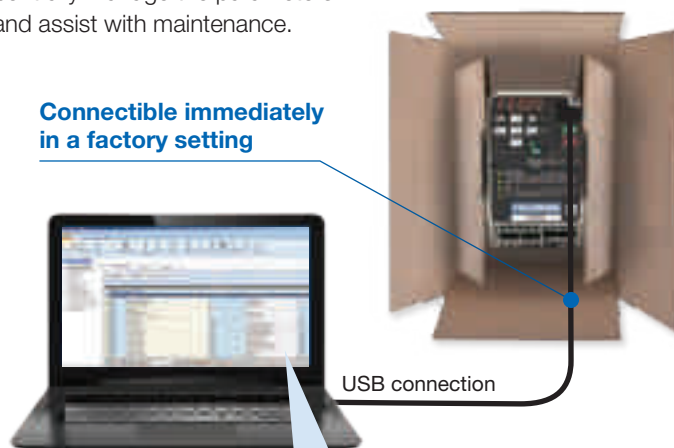
# Support from Machinery and Equipment Startup to Maintenance

## Support Tool DriveWizard

Simply connect the drive to a computer with a USB cable to centrally manage the parameters. You can use the oscilloscope function to monitor operations and assist with maintenance.

### Simple Connection

- Connect using a commercially-available USB cable (Mini B to Type A)
- Connect even when no power is supplied to the drive



### Simple Adjustment

- Read/write drive parameters
- Function for automatically replacing parameters from existing V1000 drive
- Auto-Tuning
- Visual monitor that is easy to understand at a glance



### Easy Maintenance

- Use the drive monitor to confirm the status of the machinery
  - Output frequency (Motor Rotation Speed)
  - Load Current
  - Output voltage
  - Power consumption
  - Torque
  - Hours of operation
  - Maintenance period

### Easy Fault Analysis

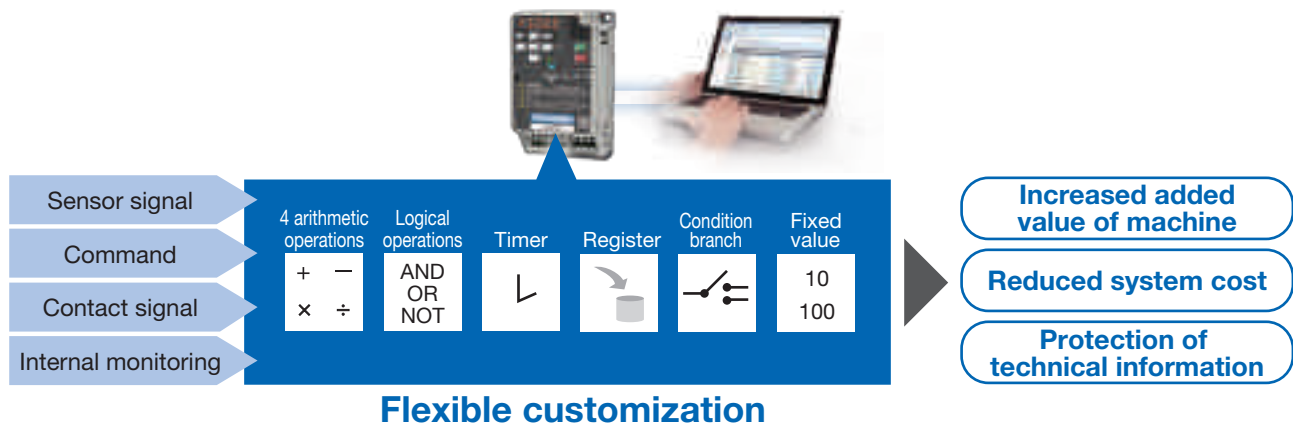
- Displays the saved data on a microSD card as a waveform
- Displays the drive monitor data as a graph
- Displays the I/O terminal status
- Displays the fault history



# Customize the Drive to Suit Your Needs

## Programming Tool DriveWorksEZ

By combining the sensor signal, drive command, and internal monitor input signal with the arithmetic functions (function block) of the drive, the added value can be improved since costs are reduced as a result of adding a predict potential failures function and integrating peripheral devices.



### Other Features

- Easy program copying: Use the LCD keypad (optional) to copy the program and write data to another GA500.
- Simulation function: Check program operations even without using a drive.

### Application Examples

Predict potential failures of Machinery	Correcting sensor signals to enhance the functions of the machine	Significantly reduce the number of peripheral devices and sensors
<p>Bearing deterioration</p> <p>Gear deterioration</p> <p>Belt damage</p>	<p>Vibration sensor</p> <p>Power sensor</p> <p>Air flow sensor</p>	<p>Power sensor</p> <p>Vibration sensor</p> <p>Air flow sensor</p>
<ul style="list-style-type: none"> <li>• Foreign materials in conveyor</li> <li>• Belt damage</li> <li>• Bearing damage</li> <li>• Pulley deterioration (wear)</li> </ul>	<ul style="list-style-type: none"> <li>• Constant pressure control of pump</li> <li>• Constant air flow control of fan</li> <li>• Optimum temperature control</li> <li>• Multiple pump control</li> <li>• Dancer tension control</li> </ul>	<ul style="list-style-type: none"> <li>• Impact stop function</li> <li>• Repetitive starts and stops</li> <li>• Forward/reverse run</li> <li>• Simple positioning control</li> <li>• Load unbalance detection</li> </ul>

**Contact Yaskawa for details on other solutions.**

# Use a Smartphone to Adjust the Drive and Perform Maintenance

## Smartphone App DriveWizard Mobile

### Wireless Access with a Smartphone

By installing a Bluetooth integrated keypad (option) to the panel surface, you can remotely access the drive with a smartphone. Edit parameters, perform operations and check monitored data in real-time.

- Monitor the operation status
- Troubleshoot errors
- Stop operation and perform tuning
- Check fault history and parameter settings



Download DriveWizard Mobile for free from the App Store or Google Play. You can also use hyper-links on Yaskawa's product and technical information website (<http://www.e-mechatronics.com>) to access the App Store and Google Play.

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QR Code is a registered trademark of DENSO WAVE INCORPORATED.  
Bluetooth is a registered trademark of Bluetooth SIG, Inc.



## Efficient Production Management via the Cloud

By registering the machinery and equipment data or the parameters to a dedicated customer page, you can efficiently perform maintenance of machinery and equipment.



### LCD keypad (Optional) User-Friendly Text Display

- Display 3 monitor items on 1 screen
- Check when faults occur at a single glance
- Note: Requires a Hitachi Maxell "CR2016 Lithium Manganese Dioxide Battery" or equivalent
- Stores the parameters of up to four drives
- Simple initial setting with interactive start-up wizard function
- Data log function (when a microSD card is installed)
- Automatic parameter backup function

#### ▼ Simple initial setting with interactive start-up wizard function

10:00	FWD	Init Setup
Language Selection		
Set Date/Time		
Setup Wizard		
Show Initial Setup Screen		
Back	Home	

10:00	FWD	wizard
Select run reference source		
(Start / Stop method)		
Keypad		
Digital Input		
Memobus/Modbus Communications		
Option PCB		
Back	Home	

10:00	FWD	wizard
Pending Parameter Changes		
Control Method Selection		
A1-02	3	(2)
Frequency Reference Selection 1		
b1-01	0	(1)
Back	Home	

10:00	FWD	wizard
would you like to apply the		
parameter settings?		
No		
Yes		
Back	Home	

# Simple Replacement of V1000 Drive

The GA500 was designed to be compatible with the Yaskawa AC drive V1000. You can upgrade from the V1000 to the GA500 with the same environment and settings.

## Size Compatibility

### Simple Replacement with No Attachments

The size of the GA500 is compatible with that of the existing V1000 drives. Wiring to the main circuit terminal and control circuit terminal is simple.



## Option Compatibility

### Optional Units

You can also use various peripheral devices and communication option units without modifications.



AC reactor



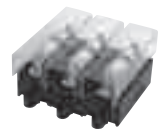
DC reactor



Zero-Phase reactor



Braking resistor



Fuses

## Parameter Compatibility

# Compatible Parameters for Easy Replacement

DriveWizard simplifies migration, eliminates the need to reset parameters, and shortens work time.



## Comparison of GA500 and conventional model (V1000)

There are significant improvements over the conventional product line in performance, ease of use, and maintenance.

		V1000	Which Is Better?	GA500
Motor Capacity		<ul style="list-style-type: none"> <li>· 200 V Class, 3-phase: 0.1 to 18.5 / 15 kW</li> <li>· 200 V Class, single-phase: 0.1 to 3.7 kW</li> <li>· 400 V Class, 3-phase: 0.2 to 18.5 / 15 kW</li> </ul>	<	<ul style="list-style-type: none"> <li>· 200 V Class, 3-phase: 0.1 to 22 / 18.5 kW</li> <li>· 200 V Class, single-phase: 0.1 to 3.7 kW</li> <li>· 400 V Class, 3-phase: 0.2 to 30 / 22 kW</li> </ul>
Performance	Motor	<ul style="list-style-type: none"> <li>· Induction motor</li> <li>· SPM motor</li> </ul>	<	<ul style="list-style-type: none"> <li>· Induction motor</li> <li>· IPM/SPM motor</li> <li>· Synchronous reluctance motor</li> </ul>
	Starting Torque	50%/6 Hz (Open Loop Vector Control for PM)	<	100%/0 Hz (Advanced Open Loop Vector Control for PM)
	Maximum Output Frequency	<ul style="list-style-type: none"> <li>· V/f Control: 400 Hz</li> <li>· Open Loop Vector Control: 400 Hz</li> <li>· Open Loop Vector Control for PM: 400 Hz</li> </ul>	<	<ul style="list-style-type: none"> <li>· V/f Control: 590 Hz</li> <li>· Open Loop Vector Control: 590 Hz</li> <li>· Open Loop Vector Control for PM: 590 Hz</li> <li>· Advanced Open Loop Vector Control for PM: 270 Hz</li> </ul>
Ease of Use	Operates 5 drives with 1 option	No	<	Yes
	Number of Steps in DriveWorksEZ	50	<	100
Maintenance	Removable Keypad	No	<	Yes
	Fault display when the drive is de-energized Parameter Settings	No	<	Yes ① Supply power from 24 Vdc external power supply ② Supply power from a computer or a smartphone

# Product Lineup

Motor Capacity kW	Three-Phase 200 V Class				Single-Phase 200 V Class				Three-Phase 400 V Class			
	Heavy Duty		Normal Duty		Heavy Duty		Normal Duty		Heavy Duty		Normal Duty	
	Catalog Code GA50A	Rated Output	Catalog Code GA50A	Rated Output	Catalog Code GA50A	Rated Output	Catalog Code GA50A	Rated Output	Catalog Code GA50A	Rated Output	Catalog Code GA50A	定格出力 電流
0.1	2001	0.8 A			B001	0.8 A						
0.2	2002	1.6 A	2001	1.2 A	B002	1.6 A	B001	1.2 A	4001	1.2 A		
0.4	2004	3 A	2002	1.9 A	B004	3 A	B002	1.9 A	4002	1.8 A	4001	1.2 A
0.75	2006	5 A	2004	3.5 A	B006	5 A	B004	3.5 A	4004	3.4 A	4002	2.1 A
1.1	2008	6.9 A	2006	6 A			B006	6 A				
1.5	2010	8 A	2008	8 A	B010	8 A			4005	4.8 A	4004	4.1 A
2.2	2012	11 A	2010	9.6 A	B012	11 A	B010	9.6 A	4007	5.6 A	4005	5.4 A
3	2018	14 A	2012	12.2 A			B012	12.2 A	4009	7.3 A	4007	7.1 A
3.7	2021	17.6 A	2018	17.5 A	B018	17.6 A			4012	9.2 A	4009	8.9 A
5.5	2030	25 A	2021	21 A					4018	14.8 A	4012	11.9 A
7.5	2042	33 A	2030	30 A					4023	18 A	4018	17.5 A
11	2056	47 A	2042	42 A					4031	24 A	4023	23.4 A
15	2070	60 A	2056	56 A					4038	31 A	4031	31 A
18.5	2082	75 A	2070	70 A					4044	39 A	4038	38 A
22			2082	82 A					4060	45 A	4044	44 A
30											4060	60 A

# Model Number

Drives can be customized according to your specifications.

CIPR- GA50 A 2 001 A B A A - C A A A S A

1      2      3      4      5      6      7      8      9      10      11      12      13      14

No	Description
1	Product series · GA500 series
2	Region code · A: Japan
3	Input power supply voltage · B: 1-Phase AC 200 V Class · 2: 3-Phase AC 200 V Class · 4: 3-Phase AC 400 V Class
4	Output Current*1
5	EMC noise filter · A: No internal EMC filter (Standard) · E: Internal EMC filter
6	Protection Design · B: IP20/UL Open Type · F: IP20/UL Type 1
7	Environmental specification · A: Standard · K: Gas-resistant · M: Humidity-resistant and dust-resistant · N: Oil-resistant · P: Humidity-resistant, dust-resistant, and vibration-resistant · R: Gas-resistant and vibration-resistant · S: Vibration-resistant · T: Oil-resistant and vibration-resistant Note: Drives with these specifications do not guarantee complete protection for the environmental conditions indicated.
8	Design revision order

\*1: Indicates the rated output current of the Normal Duty rating rounded off to the nearest whole number.

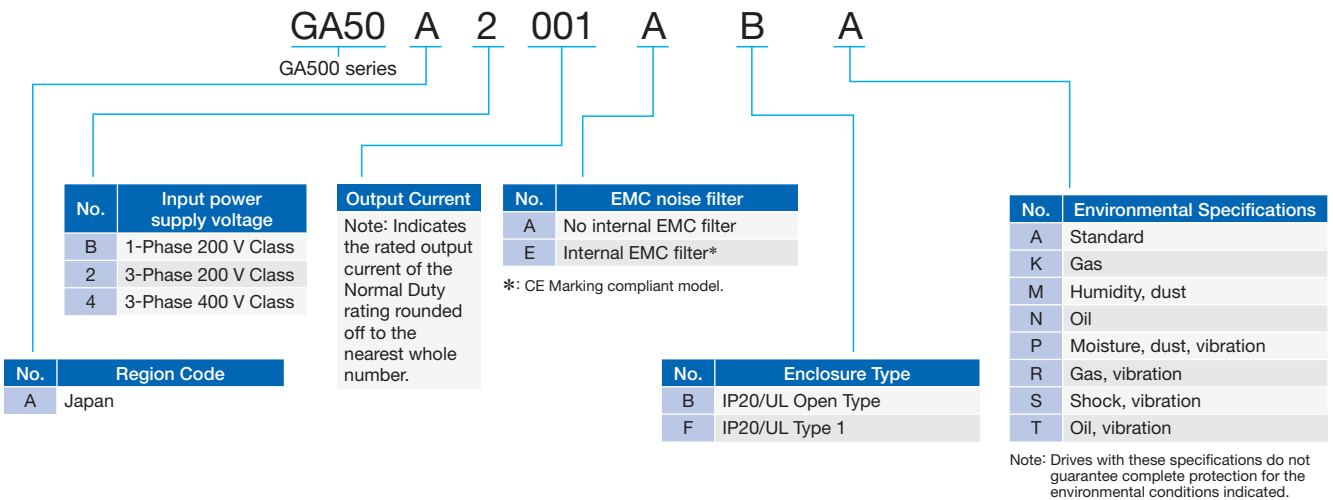
For details, refer to the rated output current for the product lineup.

\*2: Under development

\*3: A separate cable must be purchased to connect the drive and the keypad.  
Refer to the section on keypad extension cables for peripheral devices and options for more details.

No	Description
9	Control circuit terminal board · C: Screw clamp terminal board type (Standard)
10	Option · A: No option (Standard) · F: SI-C3 (CC-Link)*2 · G: SI-ET3 (MECHATROLINK-III)*2 · H: SI-N3 (DeviceNet)*2 · J: SI-P3 (PROFIBUS-DP)*2 · K: SI-T3 (MECHATROLINK-II)*2 · M: SI-S3 (CANopen)*2 · N: SI-ES3 (EtherCAT)*2 · P: SI-EM3 (Modbus TCP/IP)*2 · R: SI-EN3 (Ethernet/IP)*2 · S: SI-EP3 (PROFINET)*2
11	Option · A: No option (Standard)
12	Option · A: No option (Standard)
13	Keypad · A: LCD keypad*3 · B: LCD keypad (humidity-resistant and dust-resistant)*3 · D: Bluetooth Keypad*3 · E: Bluetooth Keypad (humidity-resistant and dust-resistant)*3 · F: LED keypad*3 · G: LED keypad (humidity-resistant and dust-resistant)*3 · L: Blank cover · S: Half-Size LED Keypad(Standard)(humidity-resistant and dust-resistant)
14	Special applications A: Standard

## Catalog Code





# Basic Instructions

Outstanding operability and quick setup

## Keypad Names and Functions

### ① LED Display

Displays data, parameters, and errors.

### ② REV LED

Illuminated when a reserve Run command is active.

### ③ DWEZ LED

Illuminated when DriveWorksEZ is in operation

### ⑦ LO/RE LED

Lit: When the keypad is selected for Run command and frequency reference control (LOCAL).  
Off: When a device other than the keypad is selected for Run command and frequency reference control (REMOTE).

### ⑥ LO/RE Selection Key

Switches drive control between the keypad (LOCAL) and an external source (REMOTE) for the Run command and frequency reference.

### ⑨ RUN Key

Starts the drive in LOCAL mode.

### ⑩ STOP Key

Stops drive operation.



### ④ ESC Key

- Returns to the previous display.
- Push and hold this key to return to the Frequency Reference display.

### ⑤ Display Operation Keys

#### LEFT Arrow Key

- Moves the digit to be changed to the left, such as when setting a parameter value.

#### UP Arrow Key / DOWN Arrow Key

- Scrolls up or down the display.
- Increases the parameter number or setting value.
- Decreases the parameter number or setting value.

#### RIGHT Arrow (RESET) Key

- Moves the cursor to the right, such as when setting a parameter value.
- Resets the drive to clear a fault.

#### ENTER Key

- Push to enter a mode, parameter and setting values.
- Push to move to the next display.

### ⑧ Com port

For connecting to a PC (DriveWizard or DriveWorksEZ), a USB copy unit or a LCD keypad.

### ⑪ Front Cover Lock




Slide to the left to unlock, and then remove the front cover.

### ⑫ QR code

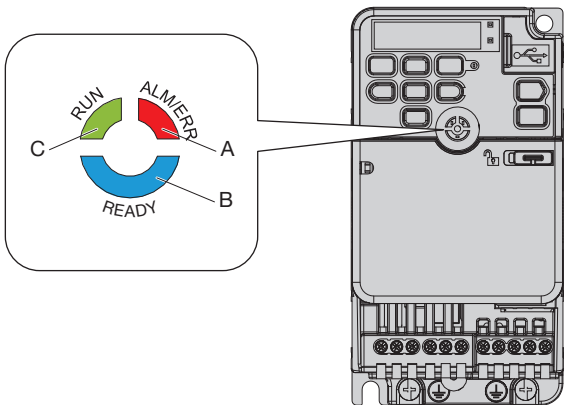
Import the dedicated smartphone application "DriveWizard Mobile" and use it to retrieve product information.

Note: QR code is a registered trademark of DENSO WAVE INCORPORATED.

## Keypad LED

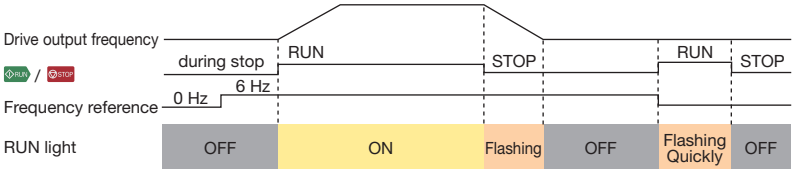
Indicator LED	ON	OFF
	The drive received a reverse Run command.	The drive received a forward Run command.
	The user is using DriveWorksEZ.	The user is not using DriveWorksEZ.
	Sets the Run command source to the keypad (LOCAL).	Sets the Run command source to a non-keypad external command (REMOTE).

LED Status Ring













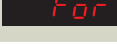

LED Status Ring		State	Content
A		Lit	The drive detected a fault.
		Flashing	The drive has detected: <ul style="list-style-type: none"> <li>• An Alarm</li> <li>• An oPE</li> <li>• A fault or error during Auto-Tuning</li> </ul> Note: If the drive detects a fault and an error at the same time, this LED will be lit to indicate the fault.
		OFF	The drive is in normal operation. There are no alarms or faults present.
B		Lit	The drive is operating or is ready for operation.
		Flashing	The drive is in STo [Safe Torque Off] mode.
		OFF	<ul style="list-style-type: none"> <li>• The drive detected a fault.</li> <li>• There is no fault and the drive received an operation command, but the drive cannot operate (such as when in Programming Mode, or when is flashing).</li> </ul>
C		Lit	The drive is in operation.
		Flashing	<ul style="list-style-type: none"> <li>• The drive is decelerating to stop.</li> <li>• The drive was issued a Run command and the frequency reference is 0 Hz.</li> <li>• A DC injection braking command is input via a multi-function digital input terminal while the drive is stopped.</li> </ul>
		Flashing Quickly	<ul style="list-style-type: none"> <li>• The drive received a Run command from the MFDI terminals and is switching to REMOTE Mode while the drive is in LOCAL Mode.</li> <li>• The drive received a Run command from the MFDI terminals when the drive is not in Drive Mode.</li> <li>• The drive received a Fast Stop command.</li> <li>• The safety function shuts off the drive output.</li> <li>• The user pushed STOP on the keypad while the drive is operating in REMOTE Mode.</li> <li>• The drive is energized with an active Run command and b1-17 = 0 [Run Command at Power Up = Disregard Existing RUN Command].</li> <li>• The drive is set to coast-to-stop with timer (b1-03 = 3 [Stopping Method Selection = Coast to Stop with Timer]), and the Run command is disabled then enabled during the Run wait time.</li> </ul>
		OFF	The drive output is stopped.

How the RUN light works:



## Basic Instructions (continued)

### Keypad Example

	Display Content	Key Operation	Display	Function
Drive Mode	• Frequency Reference (Drive Mode)	 		Displays the frequency reference (default display).
Programming Mode	• Auto-Tuning Mode			Measures the motor characteristics required for vector control and sets those to the drive automatically.
	• Parameter Settings Menu			Sets the drive functions.
	• Setup Mode			Automatically sets the optimal parameter settings for the set application.
	• Verify Menu			Displays all parameters that have been edited or changed from their default settings in Programming Mode or in Auto-Tuning.
Drive Mode	• Monitor Menu			Displays the drive status, fault details and fault history.
	• Output Voltage			Displays the output voltage
	• Output Current			Displays the output current.
	• Output Frequency			Displays the output frequency.
	• Direction (forward)			Changes the direction of motor rotation.

# Model Selection

## Optimizing Control for Each Application

GA500 offers two separate performance ratings: Heavy Duty and Normal Duty.

Heavy Duty is capable of creating more powerful torque, while Normal Duty allows the drive to operate a larger motor.

Difference between load ratings:

	Heavy Duty Rating	Normal Duty Rating
Parameter settings	C6-01=0	C6-01=1 (default)
Overload tolerance	150% 60s	110% 60s
Carrier frequency	High carrier frequency	Low carrier frequency (SwingPWM)*

\*: Use Swing PWM to quiet undesirable motor noise generated when operating with a low carrier frequency.

### Heavy Duty Applications

#### ● Applications



#### ● Selecting a Drive

For a conveyor application using an 11 kW motor, select GA50A2056 and set it for Heavy Duty performance (C6-01=0).

Catalog code: GA50A2056

Heavy Duty: 11 kW

11 kW

Conveyor



### Normal Duty Applications

#### ● Applications



#### ● Selecting a Drive

For a fan application using a 11 kW motor, select GA50A2042 and set it for Normal Duty performance (C6-01=1: default).

Catalog code: GA50A2042

Normal Duty: 11 kW

11 kW

Fan



Use the table below to replace from V1000 to the GA500 series.

Max. Applicable Motor Capacity kW	Model	200 V								400 V			
		Three-Phase				Single-Phase				Three-Phase			
		Heavy Duty Rating		Normal Duty Rating		Heavy Duty Rating		Normal Duty Rating		Heavy Duty Rating		Normal Duty Rating	
		Model CIMR-VA2A	Catalog Code GA50A	Model CIMR-VA2A	Catalog Code GA50A	Model CIMR-VABA	Catalog Code GA50A	Model CIMR-VABA	Catalog Code GA50A	Model CIMR-VA4A	Catalog Code GA50A	Model CIMR-VA4A	Catalog Code GA50A
0.1		0001	2001	—	—	0001	B001	—	—	—	—	—	—
0.2		0002	2002	0001	2001	0002	B002	0001	B001	0001	4001	—	—
0.4		0004	2004	0002	2002	0003	B004	0002	B002	0002	4002	0001	4001
0.75		0006	2006	0004	2004	0006	B006	0003	B004	0004	4004	0002	4002
1.1		0008	2008	0006	2006	—	—	0006	B006	—	—	—	—
1.5		0010	2010	0008	2008	0010	B010	—	—	0005	4005	0004	4004
2.2		0012	2012	0010	2010	0012	B012	0010	B010	0007	4007	0005	4005
3		0018	2018	0012	2012	—	—	0012	B012	0009	4009	0007	4007
3.7		0020	2021	0018	2018	0018	B018	—	—	0011	4012	0009	4009
5.5		0030	2030	0020	2021	—	—	—	—	0018	4018	0011	4012
7.5		0040	2042	0030	2030	—	—	—	—	0023	4023	0018	4018
11		0056	2056	0040	2042	—	—	—	—	0031	4031	0023	4023
15		0069	2070	0056	2056	—	—	—	—	0038	4038	0031	4031

# Standard Specifications

Parameter C6-01 sets the drive for Heavy Duty or Normal Duty (default) performance.

## 200 V Class (Three-Phase)

Catalog Code GA50A:.....			2001	2002	2004	2006	2008	2010	2012	2018	2021	2030	2042	2056	2070	2082	
Max. Applicable Motor Capacity*1		kW	HD	0.1	0.2	0.4	0.75	1.1	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5
			ND	0.2	0.4	0.75	1.1	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22
Input	Rated Input Current	A	HD	0.7	1.5	2.9	5.8	7	7.5	11	15.6	18.9	24	37	52	68	96
			ND	1.1	2.6	3.9	7.3	8.8	10.8	13.9	18.5	24	37	52	68	80	114
Output	Rated Output Current	A	HD	0.8	1.6	3	5	6.9	8	11	14	17.6	25	33	47	60	75
			ND	1.2	1.9	3.5	6	8	9.6	12.2	17.5	21	30	42	56	70	82
	Overload Tolerance		· HD Rating: 150% of rated output current for 60 s. · ND Rating: 110% of rated output current for 60 s. Note: Derating may be required for applications that start and stop frequently.														
	Carrier Frequency		Derating the output current enables a maximum of 15 kHz to be set. (Derating the output current is not necessary for an ND rating of 2 kHz and an HD rating up to 10 kHz.)					Derating the output current enables a maximum of 15 kHz to be set. (Derating the output current is not necessary for an ND rating of 2 kHz and an HD rating up to 8 kHz.)									
	Max. Output Voltage		Three-phase 200 to 240 V Note: The maximum output voltage is proportional to the input voltage.														
	Max. Output Frequency		590 Hz The frequencies that can be set vary depending on the control mode used.														
Measures for Harmonics	DC Reactor		External options														
Braking Function	Braking Transistor		Built-in														
EMC filter	EMC filter (IEC61800-3)		Internal (factory option)														
Power	Rated Voltage/ Rated Frequency		· Three-phase AC power supply 200 V to 240 V 50/60 Hz · DC power supply 270 V to 340 V														
	Allowable Voltage Fluctuation		-15% to 10%														
	Allowable Frequency Fluctuation		±5%														
	Power Supply*2	kVA	HD	0.3	0.7	1.3	2.7	3.2	3.4	5	7.1	8.7	11	17	24	31	44
ND			0.5	1.2	1.8	3.3	4	4.9	6.4	8.5	11	17	24	31	37	52	

\*1: The rated output current of the drive output amps should be equal to or greater than the motor rated current.

\*2: Rated input capacity is calculated with a power line voltage of 240 V.

## 200 V Class (Single-Phase)

Catalog Code GA50A:.....			B001	B002	B004	B006	B010	B012	B018
Max. Applicable Motor Capacity*1*2	kW	HD	0.1	0.2	0.4	0.75	1.5	2.2	3.7
		ND	0.2	0.4	0.75	1.1	2.2	3	—
Input	Rated Input Current	A	HD	1.4	2.8	5.5	11	14.1	35
		ND	2	5	7.3	13.8	20.2	24	—
Output	Rated Output Current	A	HD	0.8	1.6	3	5	8	17.6
		ND	1.2	1.9	3.5	6	9.6	12.2	—
	Overload Tolerance		· HD Rating: 150% of rated output current for 60 s. · ND Rating: 110% of rated output current for 60 s. Note: Derating may be required for applications that start and stop frequently.						
	Carrier Frequency		Derating the output current enables a maximum of 15 kHz to be set. (Derating the output current is not necessary for an ND rating of 2 kHz and an HD rating up to 10 kHz.)						Derating the output current enables a maximum of 15 kHz to be set. (Derating the output current is not necessary for an ND rating of 2 kHz and an HD rating up to 8 kHz.)
	Max. Output Voltage		Single-phase 200 to 240 V Note: The maximum output voltage is proportional to the input voltage.						
	Max. Output Frequency		590 Hz						
Measures for Harmonics	DC Reactor		External options						
Braking Function	Braking Transistor		Built-in						
EMC filter	EMC Filter (IEC61800-3)		Internal (factory option)						External options
Power	Rated Voltage/ Rated Frequency		· Single-phase AC power supply 200 V to 240 V 50/60 Hz · DC power supply 270 V to 340 V						
	Allowable Voltage Fluctuation		-15% to 10%						
	Allowable Frequency Fluctuation		±5%						
	Power Supply*3	HD	0.4	0.7	1.5	2.9	3.7	5.4	9.2
		ND	0.5	1.3	1.9	3.6	5.3	6.3	—

\*1: The rated output current of the drive output amps should be equal to or greater than the motor rated current.

\*2: Drives with a single-phase power supply input have three-phase output. Single-phase motors cannot be used.

\*3: Rated input capacity is calculated with a power line voltage of 240 V.



400 V Class

Catalog Code GA50A: [ ] [ ] [ ] [ ] [ ] [ ]			4001	4002	4004	4005	4007	4009	4012	4018	4023	4031	4038	4044	4060	
Max. Applicable Motor Capacity*1		kW	HD	0.2	0.4	0.75	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22
			ND	0.4	0.75	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22.0	30.0
Input	Rated Input Current	A	HD	1.2	1.8	3.2	4.4	6	8.2	10.4	15	20	29	39	50.5	59.7
			ND	1.2	2.1	4.3	5.9	8.1	9.4	14	20	24	38	44	59.7	80.7
Output	Rated Output Current	A	HD	1.2	1.8	3.4	4.8	5.6	7.3	9.2	14.8	18	24	31	39	45
			ND	1.2	2.1	4.1	5.4	7.1	8.9	11.9	17.5	23.4	31	38	44	60
	Overload Tolerance		・ HD Rating: 150% of rated output current for 60 s. ・ ND Rating: 110% of rated output current for 60 s. Note: Derating may be required for applications that start and stop frequently.													
	Carrier Frequency		Derating the output current enables a maximum of 15 kHz to be set. (Derating the output current is not necessary for an ND rating of 2 kHz and an HD rating up to 8 kHz.)													
	Max. Output Voltage		Three-phase 380 to 480 V Note: The maximum output voltage is proportional to the input voltage.													
	Max. Output Frequency		590 Hz The frequencies that can be set vary depending on the control mode used.													
Measures for Harmonics	DC Reactor		External options													
Braking Function	Braking Transistor		Built-in													
EMC filter	EMC Filter (IEC61800-3)		Internal (factory option)													
Power	Rated Voltage/ Rated Frequency		・ Three-phase AC power supply 380 V to 480 V 50/60 Hz ・ DC power supply 513 V to 679 V													
	Allowable Voltage Fluctuation		-15% to 10%													
	Allowable Frequency Fluctuation		±5%													
	Power Supply*2 kVA	HD	1.1	1.6	2.9	4	5.5	7.5	9.5	14	18	27	36	47	55	
ND		1.1	1.9	3.9	5.4	7.4	8.6	13	18	22	35	40	55	74		

\*1: The rated output current of the drive output amps should be equal to or greater than the motor rated current.

\*2: Rated input capacity is calculated with a power line voltage of 480 V.

# Standard Specifications

## Common Specifications

Item		Specifications
Control Characteristics	Control Method	The following controls are selected by parameters. <ul style="list-style-type: none"> <li>· V/f Control (V/f)</li> <li>· Open Loop Vector Control (OLV)</li> <li>· Open Loop Vector Control for PM (OLV/PM)</li> <li>· Advanced Open Loop Vector Control for PM (AOLV/PM)</li> <li>· EZ Open Loop Vector Control (EZOLV)</li> </ul>
	Frequency Control Range	<ul style="list-style-type: none"> <li>· EZ Open Loop Vector Control: 0.01 Hz to 120 Hz</li> <li>· Advanced Open Loop Vector Control for PM: 0.01 Hz to 270 Hz</li> <li>· V/f Control, Open Loop Vector Control, Open Loop Vector Control for PM: 0.01 Hz to 590 Hz</li> </ul>
	Frequency Accuracy (Temperature Fluctuation)	Digital reference: within $\pm 0.01\%$ of the max. output frequency ( $-10^{\circ}\text{C}$ to $+40^{\circ}\text{C}$ ) Analog reference: within $\pm 0.1\%$ of the max. output frequency ( $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ )
	Frequency Setting Resolution	Digital reference: 0.01 Hz Analog reference: 1/2048 of the maximum output frequency setting (11 bit)
	Output Frequency Resolution	0.001 Hz
	Frequency Setting Resolution	Main frequency reference: 0 to 10 Vdc (20 k $\Omega$ ), 4 to 20 mA (250 $\Omega$ ), 0 to 20 mA (250 $\Omega$ ) Main speed reference: Pulse train input (max. 32 kHz)
	Starting Torque	<ul style="list-style-type: none"> <li>· V/f Control: 150%/3 Hz</li> <li>· Open Loop Vector Control: 150%/0.6 Hz*1</li> <li>· Open Loop Vector Control for PM: 100%/10% speed</li> <li>· Advanced Open Loop Vector Control for PM: 100%/0 min<sup>-1</sup>*1</li> <li>· EZ Open Loop Vector Control: 100%/10% speed</li> </ul> <p>Note: To achieve specifications listed for Advanced Open Loop Vector Control for PM;  Set n8-57 to 1 (High frequency injection is enabled), and perform Rotational Auto-Tuning to drive a non-Yaskawa PM motor.</p>
	Speed Control Range	<ul style="list-style-type: none"> <li>· V/f Control: 1:40</li> <li>· Open Loop Vector Control: 1:100</li> <li>· Open Loop Vector Control for PM: 1:10</li> <li>· Advanced Open Loop Vector Control for PM: 1:100</li> <li>· EZ Open Loop Vector Control: 1:10</li> </ul> <p>Note: 1. To achieve specifications listed for Advanced Open Loop Vector Control for PM;  Set n8-57 to 1 (High frequency injection is enabled), and perform Rotational Auto-Tuning to drive a non-Yaskawa PM motor.  2. Advanced Open Loop Vector Control for PM 1:100 is valid in the momentary operation region.  When using the motor continuously, it is necessary to consider the capacity of the GA500 and the motor.</p>
	Zero Speed Control	Possible in Advanced Open Loop Vector Control for PM.
	Torque Limit	Parameter settings allow separate limits in four quadrants in Open Loop Vector Control, Advanced Open Loop Vector Control for PM, and EZ Open Loop Vector Control.
	Accel/Decel Time	0.0 s to 6000.0 s The drive allows four selectable combinations of independent acceleration and deceleration settings.
	Braking Torque	<p>Approx. 20%  Approx. 125% with a dynamic braking option</p> <ul style="list-style-type: none"> <li>· Short-time average deceleration torque</li> <li>Motor capacity 0.1/0.2 kW: 150% minimum</li> <li>Motor capacity 0.4/0.75 kW: 100% minimum</li> <li>Motor capacity 1.5 kW: 50% minimum</li> <li>Motors 2.2 kW and larger: 20% minimum, Overexcitation Braking / High Slip Braking allow for approx. 40%</li> </ul> <p>Note: 1. Set L3-04 = 0 [Stall Prevention during Decel = Disabled] when using a regenerative converter, regenerative unit, braking unit, braking resistor, or braking resistor unit.  Failure to obey could prevent the drive from stopping in the specified deceleration time and cause serious injury or death.  2. Short-time deceleration torque refers to the torque required to decelerate the motor (uncoupled from the load) from the rated speed to zero. Actual specifications may vary depending on motor characteristics.  3. Continuous regenerative torque and short-time deceleration torque for motors 2.2 kW and larger vary depending on motor characteristics.</p>
	V/f Characteristics	User-selected programs, V/f preset patterns possible
	Main Control Functions	Feed Forward Control, Momentary Power Loss Ride-Thru, Speed Search, Overtorque detection, torque limit, 17 Step Speed (max.), accel/decel switch, S-curve accel/decel, 3-wire sequence, Auto-Tuning (rotational, stationary), 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 Deceleration, High Slip Braking, PID control (with Sleep function), Energy Saving Control, MEMOBUS/Modbus (RTU mode) Communications (RS-485/422, max. 115.2 kbps), Fault Restart, Application Presets, DriveWorksEZ (customized functions), Parameter Backup Function, Online Tuning, KEB, Overexcitation Deceleration, Overvoltage Suppression, High Frequency Injection, etc.

Item		Specifications
Protection Function	Motor Protection	Motor overheat protection based on output current
	Momentary Overcurrent Protection	Drive stops when output current exceeds 200% of the HD output current. Note: 200% is the target value. The value varies depending on the capacity.
	Overload Protection	Drive stops when the output current exceeds these overload tolerances. • HD Rating: 150% of the drive rated output current for 60 s. • ND Rating: 110% of the drive rated output current for 60 s.
	Overvoltage Protection	200 V class: Stops when the DC bus voltage is more than approximately 410 V 400 V class: Stops when the DC bus voltage is more than approximately 820 V
	Undervoltage Protection	200 V class: Stops when the DC bus voltage decreases to less than approximately 190 V 400 V class: Stops when the DC bus voltage decreases to less than approximately 380 V
	Momentary Power Loss Ride-Thru	Stops when power loss is longer than 15 ms. Continues operation if power loss is shorter than 2 s (depending on parameter settings). Note: 1. Stop time may be shortened depending on the load and motor speed. 2. Continuous operation time varies by drive capacity. Catalog codes 2001 to 2042 and 4002 to 4023 require a Momentary Power Loss Recovery Unit to continue operation through a 2 s power loss.
	Heatsink Overheat Protection	Thermistor
	Braking Resistance Overheat Protection	Overheat sensor for braking resistor (optional ERF type, 3% ED)
	Stall Prevention	Stall prevention during acceleration/deceleration and constant speed operation
	Ground Fault Protection	Protection by electronic circuit Note: Protection may not be provided under the following conditions as the motor windings are grounded internally during run: Low resistance to ground from the motor cable or terminal block. Drive already has a short-circuit when the power is turned on.
	Charge LED	Charge LED illuminates when DC bus voltage is more than 50 V.
Environment	Area of Use	Indoors
	Power Supply	Overcurrent Category III
	Ambient Temperature	IP20/UL Open Type: -10°C to +50°C IP20/UL Type 1: -10°C to +40°C • When installing the drive in an enclosure, use a cooling fan or air conditioner to keep the internal air temperature in the permitted range. • Do not let the drive freeze. • To install IP20/UL Open Type drives in areas with ambient temperatures ≤ 60°C (140°F), derate the output current and output voltage. • To install IP20/UL Type 1 drives in areas with ambient temperatures ≤ 50°C (122°F), derate the output current and output voltage.
	Humidity	95% RH or less (no condensation)
	Storage Temperature	-20 to +70°C (short-term temperature during transportation)
	Surrounding Area	Pollution degree 2 or less Install the drive in an area without: • Oil mist, corrosive or flammable gas, or dust • Metal powder, oil, water, or other unwanted materials • Radioactive materials or flammable materials, including wood • Harmful gas or fluids • Salt • Direct sunlight
	Altitude	1000 m or less*2
	Shock	• 10 Hz to 20 Hz, 1 G (9.8 m/s <sup>2</sup> ) • 20 Hz to 55 Hz, 0.6 G (5.9 m/s <sup>2</sup> )
	Installation Orientation	Install the drive vertically for sufficient cooling airflow.
	Standards Compliance	• UL61800-5-1 • EN61800-3 • IEC/EN61800-5-1 • Two Safe Disable inputs and 1EDM output according to ISO/EN13849-1 Cat.3 PLe, IEC/EN61508 SIL3
	Protection Design	IP20/UL Open Type, IP20/UL Type 1 Note: Install a UL Type 1 Kit on an IP20/UL Open Type drive to convert the drive to IP20/UL Type 1.

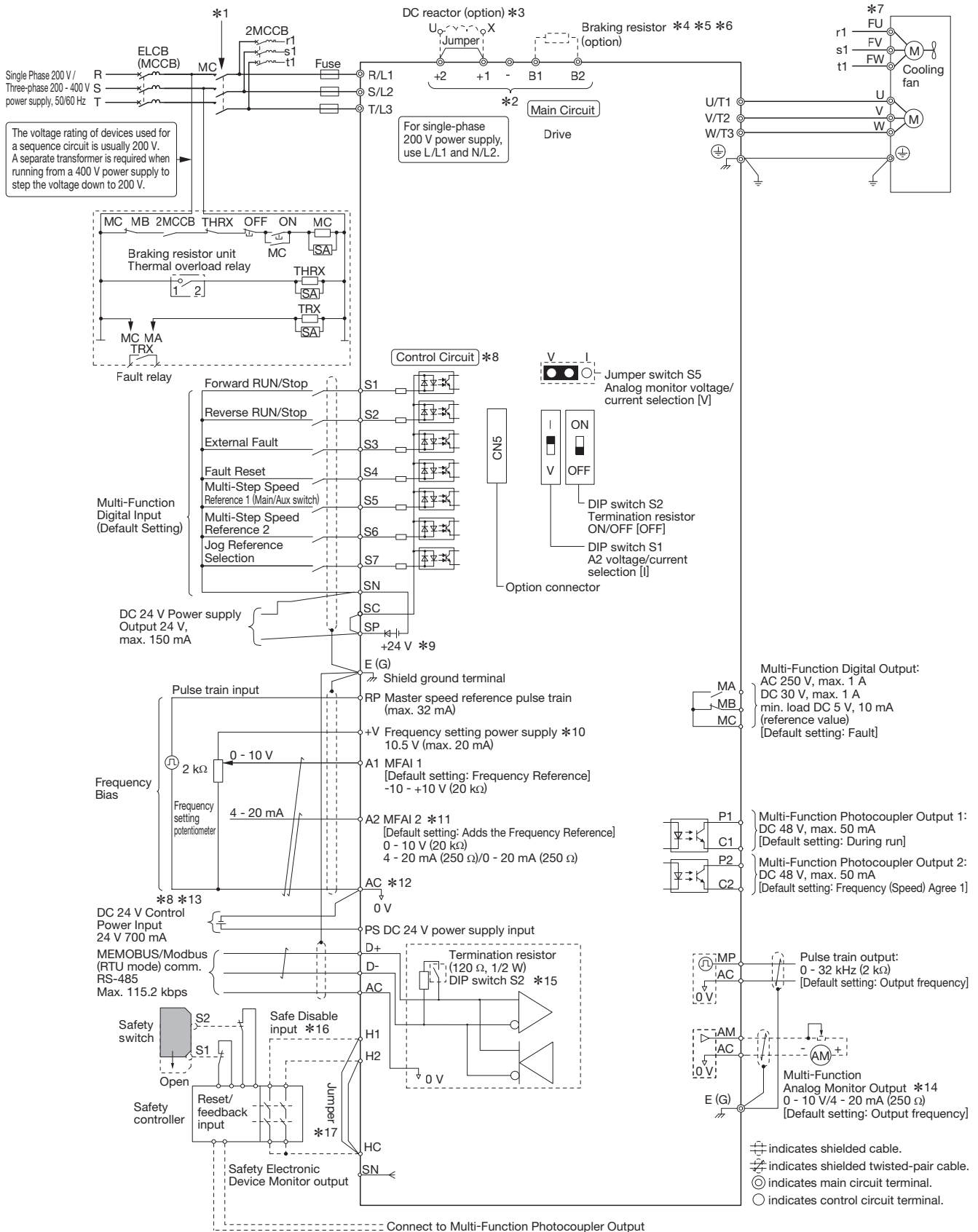
\*1: Increase the drive and motor capacities.

\*2: Altitudes over 1000 m and up to 4000 m are possible by derating the output current by 1% for every 100 m.  
Contact a Yaskawa representative or salesperson for more information.

Note: 1. Perform Rotational Auto-Tuning to achieve specifications listed for Open Loop Vector Control and Advanced Open Loop Vector Control.  
2. Install the drive in an environment matching the specifications in the table above for optimum performance life.

# Standard Connection Diagram

## Standard Connection Diagram



- \* 1: Yaskawa recommends setting the wiring sequence to de-energize the drive with the fault relay output. If the drive outputs a fault during fault restart when using the fault restart function, set L5-02 = 1 (Fault Contact at Restart Select = Always Active) to de-energize the drive. Be careful when using a cut-off sequence. The default setting for L5-02 is 0 (Active Only when Not Restarting).
- \* 2: Connect peripheral options to terminal –, +1, +2, B1, and B2. Do not connect an AC power supply lines to these terminals. Failure to obey will cause damage to the drive.
- \* 3: When installing an optional DC reactor, remove the jumper between terminals +1 and +2.
- \* 4: When using an optional regenerative converter or regenerative unit (when not using an internal braking transistor), set L8-55 = 0 (Internal DB Transistor Protection = Disable). If L8-55 = 1 (Protection Enabled), the drive will detect rF (Braking Resistor Fault).
- \* 5: When using an optional regenerative converter, regenerative unit, braking resistor, or braking resistor unit, set L3-04 = 0 (Stall Prevention during Decel = Disabled). If L3-04 = 1 (General Purpose: Default), the drive could possibly not stop in the specified deceleration time.
- \* 6: When using an ERF type braking resistor, set L8-01 = 1 (3% ERF DB Resistor Protection = Enabled) and set the wiring sequence to de-energize the drive with the fault relay output.
- \* 7: Cooling fan wiring is not necessary for self-cooling motors.
- \* 8: Connect a 24-V power supply to terminals PS-AC to operate the control circuit while the main circuit power supply is OFF.
- \* 9: Install jumpers between terminals SC-SP and SC-SN to set the MFDI power supply (sinking/sourcing mode or internal/external power supply). Do not close the circuit between terminals SP and SN. Failure to obey will cause damage to the drive.
  - Sinking Mode: Install a jumper between terminals SC and SP. Do not close the circuit between terminals SC and SN. Failure to obey will cause damage to the drive.
  - Sourcing Mode: Install a jumper between terminals SC and SN. Do not close the circuit between terminals SC and SP. Failure to obey will cause damage to the drive.
  - External Power Supply: Remove the jumper between terminals SC-SN and terminals SC-SP.
- \*10: The maximum output current capacity for terminal +V on the control circuit is 20 mA. Do not install a jumper between Analog Input +V and AC. Failure to obey can cause the drive to malfunction or fail.
- \*11: DIP switch S1 sets terminal A2 for voltage or current input. The default setting for S1 is current input ("I" side).
- \*12: Do not ground the control circuit terminals AC or connect them to the drive. Failure to obey can cause drive malfunction or failure.
- \*13: Connect the positive lead from an external 24 Vdc power supply to terminal PS and the negative lead to terminal AC. Do not connect terminals PS and AC inversely. Failure to obey will cause damage to the drive.
- \*14: Use multi-function analog monitor outputs with analog frequency meters, ammeters, voltmeters, and wattmeters. Do not use monitor outputs with feedback-type signal devices.
- \*15: Set DIP switch S2 to "ON" to enable the termination resistor in the last drive in a MEMOBUS/Modbus (RTU mode) network.
- \*16: Use only SOURCE Mode for Safe Disable input.
- \*17: Disconnect the jumpers between H1 and HC, and H2 and HC to use the Safe Disable input.



# Terminal Specifications

## Terminal Functions


### Main Circuit Terminals

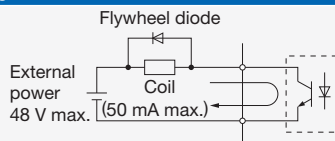
Terminal	Terminal Name	Function
R/L1	Main circuit power supply input, Three-phase (Use only for three-phase power supply)	Connects line power to the drive.
S/L2		
T/L3		
L/L1	Main circuit power supply input, Single-phase (Use only for single-phase power supply)	Connects line power to the drive.
N/L2		
U/T1	Drive output	Connects to the motor.
V/T2		
W/T3		
B1	Braking resistor	Available for connecting a braking resistor or braking resistor unit.
B2		
+1	DC reactor connection	Terminal to connect a DC reactor. Make sure to remove the jumper between terminals +1 and +2 when connecting a DC reactor. Note: You can not install a DC reactor to drives with Catalog Codes GA50AB001 to B018.
+2		
+1	DC power supply input	For connecting a DC power supply.
–		
⊕ Two terminals	Ground	Grounding terminal Grounding resistance for 200 V class: 100 Ω or less Grounding resistance for 400 V class: 10 Ω or less

### Control Circuit Terminals (200 V/400 V Class)

Terminal Type	Terminal	Signal Function (default)	Description (Signal Level)
Multi-Function Digital Input (MFDI)	S1	MFDI selection 1 (ON: Forward run OFF: Stop)	<ul style="list-style-type: none"> <li>Photocoupler</li> <li>24 V, 6 mA</li> <li>Note: Install the jumpers between terminals SC-SP and SC-SN to set the power supply for multi-function digital input.</li> <li>Sinking Mode: Install a jumper between terminals SP and SC.</li> <li>Sourcing Mode: Install a jumper between terminals SN and SC.</li> <li>External power supply: No jumper necessary.</li> <li>NOTICE: Do not close the circuit between terminals SP and SN. Failure to obey will cause damage to the drive.</li> </ul>
	S2	MFDI selection 2 (ON: Reverse run OFF: Stop)	
	S3	MFDI selection 3 (External fault, N.O.)	
	S4	MFDI selection 4 (Fault reset)	
	S5	MFDI selection 5 (Multi-step speed reference 1)	
	S6	MFDI selection 6 (Multi-step speed reference 2)	
	S7	MFDI selection 7 (Jog command)	
	SN	MFDI power supply 0V	MFDI power supply, 24 V (maximum 150 mA) NOTICE: Do not close the circuit between terminals SP and SN. Failure to obey will cause damage to the drive.
	SC	MFDI selection common	
	SP	MFDI power supply +24 Vdc	
Safe Disable Input	H1	Safe Disable input 1	Remove the jumper between terminals H1-HC and H2-HC to use the Safe Disable input. • 24 V, 6 mA • ON: Normal operation • OFF: Coasting motor • Internal impedance 4.7 kΩ • Minimum OFF time of 3 ms.
	H2	Safe Disable input 2	
	HC	Safe Disable function common	
Master Frequency Reference	RP	Master frequency reference pulse train input (Master frequency reference)	• Input frequency: 0 Hz to 32 kHz • Duty cycle: 30% to 70% • H level voltage: 3.5 V to 13.2 V • L level voltage: 0.0 V to 0.8 V • Input impedance: 3 kΩ
	+V	Power supply for frequency setting	10.5 V (allowable current 20 mA max.)
	A1	Multi-function analog input 1 (Master frequency reference)	Voltage input • 0 V to 10 V/100% (input impedance: 20 kΩ)
	A2	Multi-function analog input 2 (Combined to terminal A1)	Voltage input or current input Select terminal A2 with DIP switch S1-2 and H3-09 [Terminal A2 Signal Level Select]. • 0 V to 10 V/100% (input impedance: 20 kΩ) • 4 mA to 20 mA/100%, 0 mA to 20 mA/100% (input impedance: 250Ω)
	AC	Frequency reference common	0 V
Multi-Function Digital Output (MFDO)	MA	N.O. output (Fault)	• Relay output • 30 Vdc, 10 mA to 1 A • 250 Vac, 10 mA to 1 A • Minimum load: 5 Vdc, 10 mA (Reference value)
	MB	N.C. output (Fault)	
	MC	Digital output common	

## Control Circuit Terminals (200 V/400 V Class) (continued)

Terminal Type	Terminal	Signal Function (default)	Description (Signal Level)
Multi-Function Photocoupler Output	P1	Multi-function photocoupler output 1 (During run)	<div>· Photocoupler output</div> <div>· 48 Vdc or less, 2 to 50 mA</div> <div>Note: Connect a flywheel diode as shown in the figure when driving an inductive load such as a relay coil. Make sure that the diode rating is larger than the circuit voltage.</div> <div></div>
	C1		
	P2	Multi-function photocoupler output 2 (Speed agree 1)	
	C2		
Monitor Output	MP	Pulse train input (Output frequency)	32 kHz (maximum)
	AM	Analog monitor output (Output frequency)	<div>Select voltage or current output.</div> <div>· 0 V to 10 V/0% to 100%</div> <div>· 4 mA to 20 mA/0% to 100% (receiver recommended impedance: 250)</div> <div>Note: Select with jumper switch H4-07 [Terminal AM Signal Level Select].</div>
	AC	Monitor common	0 V



## External Power Supply Input Terminals (200 V/400 V Class)

Type	Terminal	Terminal Name (Default)	Function
External Power Supply Input Terminals	PS	External 24 V power supply input	Supplies backup power to the drive control circuit, keypad, and option board. 21.6 Vdc to 26.4 Vdc, 700 mA
	AC	External 24 V power supply ground	0 V

## Serial Communication Terminals (200 V/400 V Class)

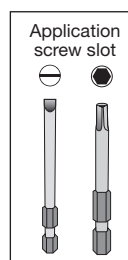
Classification	Terminal	Signal Function	Description (Signal Level)
MEMOBUS/Modbus (RTU mode) Communications	D+	Communications input (+)	MEMOBUS/Modbus (RTU mode) communications: Use an RS-485 cable to connect the drive. Note: Set DIP switch S2 to ON to enable the termination resistor in the last drive in a MEMOBUS/Modbus (RTU mode) network.
	D-	Communications input (-)	
	AC	Shield ground	
			<ul style="list-style-type: none"> <li>RS-485</li> <li>MEMOBUS/Modbus (RTU mode) communications protocol</li> <li>Max. 115.2 kbps</li> </ul>

## Tools for Wiring European Style Terminal Blocks (Recommended product)

Check the "Terminal size / Wire gauge" on the next page and prepare the tools for wiring.

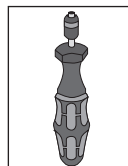
Screw size	Screw type	Recommended Product
M3	Slot	Prepare the following two tools. <ul style="list-style-type: none"> <li>Bit [ PHOENIX CONTACT] Model: SF-BIT-SL 0,5X3,0-70</li> <li>Torque screwdriver [PHOENIX CONTACT] Model: TSD-M 1,2NM (0.3 to 1.2 N·m)</li> </ul>
M4	Slot	Prepare the following two tools. <ul style="list-style-type: none"> <li>Bit [ PHOENIX CONTACT] Model: SF-BIT-SL 1,0X4,0-70</li> <li>Torque screwdriver [PHOENIX CONTACT] Model: TSD-M 3NM (1.2 to 3 N·m)</li> </ul>
M5	Slot	When wiring drive models GA50□2056 and GA50□4060 or earlier models, be sure to correctly select tools based on the wire gauges. <p>Wiring Gauge: 25 mm<sup>2</sup> or AWG10</p> <ul style="list-style-type: none"> <li>Bit [ PHOENIX CONTACT] Model: SF-BIT-SL 1,2X6,5-70</li> <li>Torque screwdriver [PHOENIX CONTACT] Model: TSD-M 3NM (1.2 to 3 N·m)</li> </ul> <p>Wiring Gauge: 30 mm<sup>2</sup> or AWG8</p> <ul style="list-style-type: none"> <li>Torque wrench that includes a torque measurement range of 4.5 N·m</li> <li>Bit socket holder of 6.35 mm</li> </ul>
M6	Hex socket (WAF: 5)	Prepare the following three tools. <ul style="list-style-type: none"> <li>Bit [ PHOENIX CONTACT] Model: SF-BIT-HEX 5-50</li> <li>Torque wrench that includes a torque measurement range of 9 N·m</li> <li>Bit socket holder of 6.35 mm</li> </ul>

### Bit



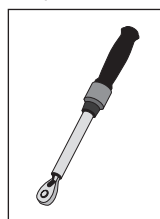
Model	Tip of Bit	Code No.
SF-BIT-SL 0,5X3,0-70	Slot Tip, M3	100-247-064
SF-BIT-SL 1,0X4,0-70	Slot Tip, M4	100-250-491
SF-BIT-SL 1,2X6,5-70	Slot Tip, M5	100-250-492
SF-BIT-HEX 5-50	Hexagon Tip, M6	100-250-488

### Torque screwdriver

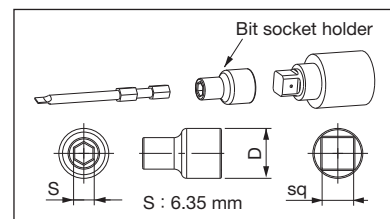


Model	Measurement Range	Code No.
TSD-M 3NM	1.2 to 3 N·m	100-250-493

### Torque wrench



### Bit socket holder



# Terminal Specifications (continued)

## Terminal Size / Wire Gauge

### Three-Phase 200 V Class

Symbols indicating the shape of the terminal screws: ⊕ : (+/-), ⊖ : Slot (-), ⑤ : Hex socket (WAF: 5)

Catalog code GA50A□	Terminal	Recommended Gauge mm <sup>2</sup>	Wire Range mm <sup>2</sup>	Wire Stripping Length*1 mm	Terminal Screw		Tightening Torque N·m	Catalog code GA50A□	Terminal	Recommended Gauge mm <sup>2</sup>	Wire Range mm <sup>2</sup>	Wire Stripping Length*1 mm	Terminal Screw		Tightening Torque N·m
					Size	Shape							Size	Shape	
2001	R/L1, S/L2, T/L3	2	2 to 2	6.5	M3	⊖	0.5 to 0.6	2018	R/L1, S/L2, T/L3	3.5	2 to 5.5	10	M4	⊖	1.5 to 1.7
	U/T1, V/T2, W/T3	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	3.5	2 to 5.5	10	M4	⊖	1.5 to 1.7
	-, +1, +2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		-, +1, +2	5.5	3.5 to 8	10	M4	⊖	1.5 to 1.7
	B1, B2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	⊖	1.5 to 1.7
2002	R/L1, S/L2, T/L3	2	2 to 2	6.5	M3	⊖	0.5 to 0.6	2021	R/L1, S/L2, T/L3	5.5	3.5 to 8	10	M4	⊖	1.5 to 1.7
	U/T1, V/T2, W/T3	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	3.5	3.5 to 5.5	10	M4	⊖	1.5 to 1.7
	-, +1, +2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		-, +1, +2	8	2 to 14	10	M4	⊖	1.5 to 1.7
	B1, B2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	⊖	1.5 to 1.7
2004	R/L1, S/L2, T/L3	2	2 to 2	6.5	M3	⊖	0.5 to 0.6	2030	R/L1, S/L2, T/L3	8	2 to 14	10	M4	⊖	1.5 to 1.7
	U/T1, V/T2, W/T3	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	8	2 to 14	10	M4	⊖	1.5 to 1.7
	-, +1, +2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		-, +1, +2	14	3.5 to 14	10	M4	⊖	1.5 to 1.7
	B1, B2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		B1, B2	3.5	2 to 5.5	10	M4	⊖	1.5 to 1.7
2006	R/L1, S/L2, T/L3	2	2 to 2	8	M3	⊖	0.5 to 0.6	2042	R/L1, S/L2, T/L3	14	3.5 to 14	10	M4	⊖	1.5 to 1.7
	U/T1, V/T2, W/T3	2	2 to 2	8	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	14	3.5 to 14	10	M4	⊖	1.5 to 1.7
	-, +1, +2	2	2 to 2	8	M3	⊖	0.5 to 0.6		-, +1, +2	22	5.5 to 30	18	M5	⊖	2.3 to 2.5*2 4.1 to 4.5*3
	B1, B2	2	2 to 2	8	M3	⊖	0.5 to 0.6		B1, B2	5.5	3.5 to 8	10	M4	⊖	1.5 to 1.7
2008	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6	2056	R/L1, S/L2, T/L3	22	5.5 to 30	18	M5	⊖	2.3 to 2.5*2 4.1 to 4.5*3
	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	14	5.5 to 22	18	M5	⊖	2.3 to 2.5*2 4.1 to 4.5*3
	-, +1, +2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		-, +1, +2	30	8 to 30	18	M5	⊖	2.3 to 2.5*2 4.1 to 4.5*3
	B1, B2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		B1, B2	14	2 to 14	10	M4	⊖	1.5 to 1.7
2010	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6	2070	R/L1, S/L2, T/L3	30	8 to 38	20	M6	⑤	5 to 5.5
	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	22	5.5 to 30	20	M6	⑤	5 to 5.5
	-, +1, +2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		-, +1	28	14 to 50	20	M6	⑤	5 to 5.5
	B1, B2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		B1, B2	14	5.5 to 14	10	M4	⊖	1.5 to 1.7
2012	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6	2082	R/L1, S/L2, T/L3	38	14 to 50	20	M6	⑤	5 to 5.5
	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	30	8 to 38	20	M6	⑤	5 to 5.5
	-, +1, +2	3.5	2 to 5.5	8	M3	⊖	0.5 to 0.6		-, +1	50	22 to 60	20	M6	⑤	5 to 5.5
	B1, B2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		B1, B2	14	5.5 to 14	10	M4	⊖	1.5 to 1.7

\*1: Remove the insulator from the tips of wires to the length shown in "Wire Stripping Length."

\*2: 22 mm<sup>2</sup> maximum

\*3: 30 mm<sup>2</sup> minimum

Note: The recommended wire gauges based on drive continuous current ratings using 75°C 600 V class 2 heat resistant indoor PVC wire.

Assume the following usage conditions:

· Ambient temperature: 40°C or lower

· Wiring distance: 100 m or shorter

· Normal Duty rated current value

## Single-Phase 200 V Class

Symbols indicating the shape of the terminal screws: ⊕ : (+ / -), ⊖ : Slot (-), ⊙ : Hex socket (WAF: 5)

Catalog code GA50A □	Terminal	Recommended Gauge mm <sup>2</sup>	Wire Range mm <sup>2</sup>	Wire Stripping Length <sup>*1</sup>	Terminal Screw		Tightening Torque N·m	Catalog code GA50A □	Terminal	Recommended Gauge mm <sup>2</sup>	Wire Range mm <sup>2</sup>	Wire Stripping Length <sup>*1</sup>	Terminal Screw		Tightening Torque N·m
					Size	Shape							Size	Shape	
B001	L/L1, N/L2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6	B010	L/L1, N/L2	3.5	2 to 5.5	8	M3	⊖	0.5 to 0.6
	U/T1, V/T2, W/T3	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6
	—, +1	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		—, +1	3.5	2 to 5.5	8	M3	⊖	0.5 to 0.6
	B1, B2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		B1, B2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6
B002	L/L1, N/L2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6	B012	L/L1, N/L2	5.5	3.5 to 8	10	M4	⊖	1.5 to 1.7
	U/T1, V/T2, W/T3	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	2	2 to 3.5	10	M4	⊖	1.5 to 1.7
	—, +1	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		—, +1	5.5	3.5 to 8	10	M4	⊖	1.5 to 1.7
	B1, B2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	⊖	1.5 to 1.7
B004	L/L1, N/L2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6	B018	L/L1, N/L2	8	3.5 to 14	10	M4	⊖	1.5 to 1.7
	U/T1, V/T2, W/T3	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	3.5	2 to 5.5	10	M4	⊖	1.5 to 1.7
	—, +1	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		—, +1	8	3.5 to 14	10	M4	⊖	1.5 to 1.7
	B1, B2	2	2 to 2	6.5	M3	⊖	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	⊖	1.5 to 1.7
B006	L/L1, N/L2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6	*1: Remove the insulator from the tips of wires to the length shown in "Wire Stripping Length." Note: The recommended wire gauges based on drive continuous current ratings using 75°C 600 V class 2 heat resistant indoor PVC wire. Assume the following usage conditions: · Ambient temperature: 40°C or lower · Wiring distance: 100 m or shorter · Normal Duty rated current value							
	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6								
	—, +1	2	2 to 3.5	8	M3	⊖	0.5 to 0.6								
	B1, B2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6								

## Three-Phase 400 V Class

Symbols indicating the shape of the terminal screws: ⊕ : (+ / -), ⊖ : Slot (-), ⊙ : Hex socket (WAF: 5)

Catalog code GA50A□	Terminal	Recommended Gauge mm <sup>2</sup>	Wire Range mm <sup>2</sup>	Wire Stripping Length <sup>*1</sup>	Terminal Screw		Tightening Torque N·m	Catalog code GA50A□	Terminal	Recommended Gauge mm <sup>2</sup>	Wire Range mm <sup>2</sup>	Wire Stripping Length <sup>*1</sup>	Terminal Screw		Tightening Torque N·m
					Size	Shape							Size	Shape	
4001	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6	4018	R/L1, S/L2, T/L3	3.5	2 to 5.5	10	M4	⊖	1.5 to 1.7
	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	3.5	2 to 5.5	10	M4	⊖	1.5 to 1.7
	－, +1, +2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		－, +1, +2	5.5	3.5 to 8	10	M4	⊖	1.5 to 1.7
	B1, B2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	⊖	1.5 to 1.7
4002	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6	4023	R/L1, S/L2, T/L3	5.5	3.5 to 8	10	M4	⊖	1.5 to 1.7
	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	5.5	3.5 to 8	10	M4	⊖	1.5 to 1.7
	－, +1, +2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		－, +1, +2	5.5	2 to 8	10	M4	⊖	1.5 to 1.7
	B1, B2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	⊖	1.5 to 1.7
4004	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6	4031	R/L1, S/L2, T/L3	14	2 to 14	10	M4	⊖	1.5 to 1.7
	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	8	2 to 14	10	M4	⊖	1.5 to 1.7
	－, +1, +2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		－, +1, +2	14	3.5 to 22	18	M5	⊖	2.3 to 2.5 <sup>*2</sup>
	B1, B2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		B1, B2	3.5	2 to 5.5	10	M4	⊖	1.5 to 1.7
4005	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6	4038	R/L1, S/L2, T/L3	14	5.5 to 14	10	M4	⊖	1.5 to 1.7
	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	14	3.5 to 14	10	M4	⊖	1.5 to 1.7
	－, +1, +2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		－, +1, +2	14	5.5 to 22	18	M5	⊖	2.3 to 2.5 <sup>*2</sup>
	B1, B2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		B1, B2	5.5	3.5 to 8	10	M4	⊖	1.5 to 1.7
4007	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6	4044	R/L1, S/L2, T/L3	14	5.5 to 22	18	M5	⊖	2.3 to 2.5 <sup>*2</sup>
	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	14	5.5 to 22	18	M5	⊖	2.3 to 2.5 <sup>*2</sup>
	－, +1, +2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		－, +1, +2	22	5.5 to 30	18	M5	⊖	2.3 to 2.5 <sup>*2</sup> 4.1 to 4.5 <sup>*3</sup>
	B1, B2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		B1, B2	8	2 to 14	10	M4	⊖	1.5 to 1.7
4009	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6	4060	R/L1, S/L2, T/L3	22	5.5 to 30	18	M5	⊖	2.3 to 2.5 <sup>*2</sup> 4.1 to 4.5 <sup>*3</sup>
	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		U/T1, V/T2, W/T3	14	5.5 to 22	18	M5	⊖	2.3 to 2.5 <sup>*2</sup>
	－, +1, +2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		－, +1	30	8 to 30	18	M5	⊖	2.3 to 2.5 <sup>*2</sup> 4.1 to 4.5 <sup>*3</sup>
	B1, B2	2	2 to 3.5	8	M3	⊖	0.5 to 0.6		B1, B2	14	3.5 to 14	10	M4	⊖	1.5 to 1.7
4012	R/L1, S/L2, T/L3	2	2 to 3.5	10	M4	⊖	1.5 to 1.7	*1: Remove the insulator from the tips of wires to the length shown in "Wire Stripping Length." *2: 22 mm <sup>2</sup> maximum *3: 30 mm <sup>2</sup> minimum Note: The recommended wire gauges based on drive continuous current ratings using 75°C 600 V class 2 heat resistant indoor PVC wire. Assume the following usage conditions: ・ Ambient temperature: 40°C or lower   ・ Wiring distance: 100 m or shorter ・ Normal Duty rated current value							
	U/T1, V/T2, W/T3	2	2 to 3.5	10	M4	⊖	1.5 to 1.7								
	－, +1, +2	3.5	2 to 5.5	10	M4	⊖	1.5 to 1.7								
	B1, B2	2	2 to 3.5	10	M4	⊖	1.5 to 1.7								

# Dimensions

## Enclosures

### 200 V Class

HD: Heavy Duty, ND: Normal Duty

Three-Phase Catalog Code GA50A		2001	2002	2004	2006	2008	2010	2012	2018	2021	2030	2042	2056	2070	2082
Three-Phase Catalog Code GA50A		B001	B002	B004	B006	—	B010	B012	—	B018	—	—	—	—	—
Max. Applicable Motor Capacity kW	HD	0.1	0.2	0.4	0.75	1.1	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5
	ND	0.2	0.4	0.75	1.1	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22
IP20/UL Open Type		IP20 supported with standard model													
IP20/UL Type 1		Option supported (Install UL Type 1 Kit on IP20/UL Open Type Drive)													

### 400 V Class

HD: Heavy Duty, ND: Normal Duty

Catalog Code GA50A		4001	4002	4004	4005	4007	4009	4012	4018	4023	4031	4038	4044	4060
Max. Applicable Motor Capacity kW	HD	0.2	0.4	0.75	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22
	ND	0.4	0.75	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30
IP20/UL Open Type		IP20 supported with standard model												
IP20/UL Type 1		Option supported (Install UL Type 1 Kit on IP20/UL Open Type Drive)												

#### ■ IP20/UL Open Type (without Built-in EMC Filter)

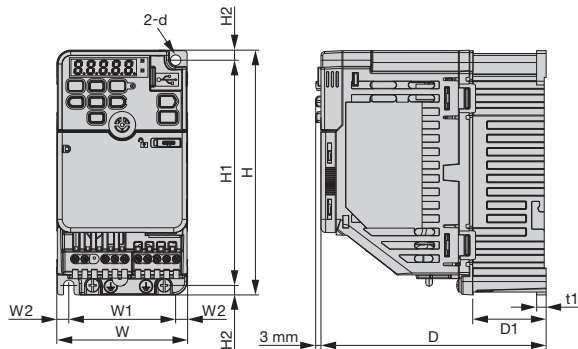


Figure 1

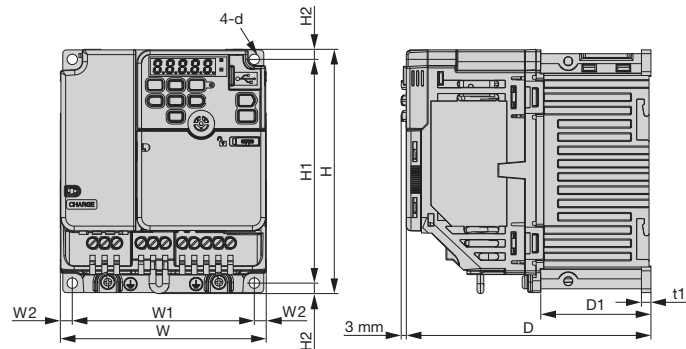


Figure 2

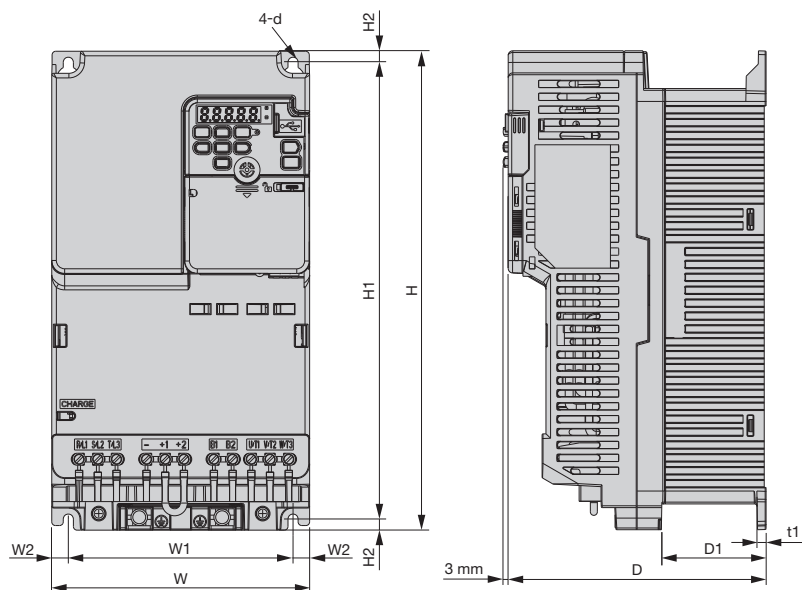


Figure 3

### Three-Phase 200 V Class: IP20/UL Open Type (without Built-in EMC Filter)

Catalog Code GA50A	Figure	Dimensions mm										Weight kg
		W	H	D	D1	W1	W2	H1	H2	t1	d	
2001	1	68	128	76	6.5	56	6	118	5	3	M5	0.5
2002												
2004	1	68	128	108	38.5	56	6	118	5	5	M5	0.8
2006	1	68	128	128	58.5	56	6	118	5	5	M5	0.9
2008	2	108	128	129	56.5	96	6	118	5	5	M5	1.5
2010												
2012	2	108	128	137.5	56.5	96	6	118	5	5	M5	1.5
2018	2	140	128	143	65	128	6	118	5	5	M5	2.0
2021												
2030	3	140	260	140	55	122	9	248	6	5	M5	3.4
2042	3	140	260	140	55	122	9	248	6	5	M5	3.6
2056	3	180	300	143	55	160	10	284	8	5	M5	5.5
2070	3	220	350	187	78	192	14	336	7	5	M6	7.5
2082	3	220	350	187	78	192	14	336	7	5	M6	8.0

### Single-Phase 200 V Class: IP20/UL Open Type (without Built-in EMC Filter)

Catalog Code GA50A	Figure	Dimensions mm										Weight kg
		W	H	D	D1	W1	W2	H1	H2	t1	d	
B001	1	68	128	76	6.5	56	6	118	5	3	M5	0.5
B002												
B004	1	68	128	118	38.5	56	6	118	5	5	M5	0.8
B006	2	108	128	137.5	56.5	96	6	118	5	5	M5	1.5
B010	2	108	128	154	56.5	96	6	118	5	5	M5	1.5
B012	2	140	128	163	65	128	6	118	5	5	M5	2.1
B018	2	170	128	180	65	158	6	118	5	5	M5	2.9

### Three-Phase 400 V Class: IP20/UL Open Type (without Built-in EMC Filter)

Catalog Code GA50A	Figure	Dimensions mm										Weight kg
		W	H	D	D1	W1	W2	H1	H2	t1	d	
4001	2	108	128	81	8.5	96	6	118	5	5	M5	0.8
4002	2	108	128	99	26.5	96	6	118	5	5	M5	0.9
4004	2	108	128	137.5	56.5	96	6	118	5	5	M5	1.5
4005	2	108	128	154	56.5	96	6	118	5	5	M5	1.5
4007												
4009												
4012	2	140	128	143	65	128	6	118	5	5	M5	2.0
4018	3	140	260	140	55	122	9	248	6	5	M5	3.0
4023	3	140	260	140	55	122	9	248	6	5	M5	3.2
4031	3	180	300	143	55	160	10	284	8	5	M5	4.6
4038	3	180	300	143	55	160	10	284	8	5	M5	4.8
4044	3	190	350	204	94	160	15	336	7	5	M6	6.5
4060												

Note: External and mounting dimensions are different for standard mounting and panel through mounting.  
Please refer to P.44 - 47 for panel through mounting.



# Dimensions

## ■ IP20/UL Open Type (with Built-in EMC Filter)

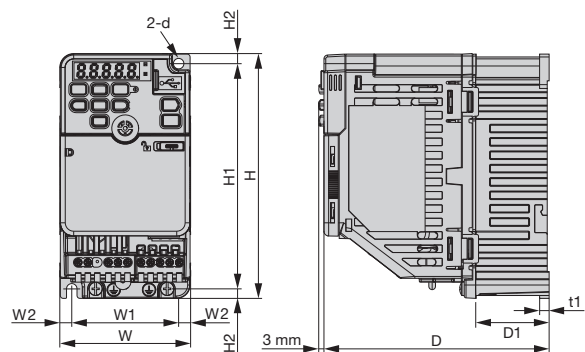


Figure 1

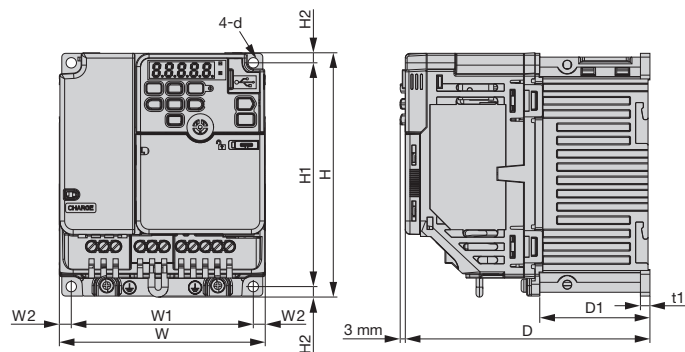


Figure 2

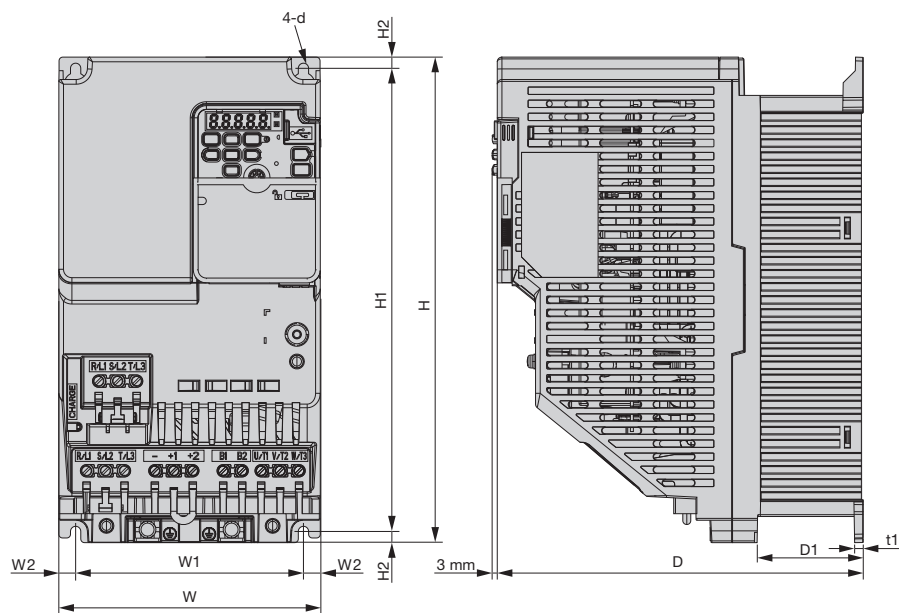


Figure 3

## Three-Phase 200 V Class: IP20/UL Open Type (with Built-in EMC Filter)

Catalog Code GA50A	Figure	Dimensions mm										Weight kg
		W	H	D	D1	W1	W2	H1	H2	t1	d	
2001	1	68	128	116	6.5	56	6	118	5	3	M5	0.6
2002												
2004	1	68	128	148	38.5	56	6	118	5	5	M5	0.9
2006	1	68	128	168	58.5	56	6	118	5	5	M5	1.1
2008	2	108	128	174	56.5	96	6	118	5	5	M5	1.6
2010												
2012	2	108	128	182.5	56.5	96	6	118	5	5	M5	1.6
2018	2	140	128	193	65	128	6	118	5	5	M5	2.4
2021												
2030	3	140	260	196	55	122	9	248	6	5	M5	3.9
2042	3	140	260	196	55	122	9	248	6	5	M5	4.1
2056	3	180	300	196	55	160	10	284	8	5	M5	6.0
2070	3	220	350	216	78	192	14	336	7	5	M6	8.5
2082	3	220	350	216	78	192	14	336	7	5	M6	9.0

## Single-Phase 200 V Class: IP20/UL Open Type (with Built-in EMC Filter)

Catalog Code GA50A	Figure	Dimensions mm										Weight kg
		W	H	D	D1	W1	W2	H1	H2	t1	d	
B001	1	68	128	116	6.5	56	6	118	5	3	M5	0.7
B002												
B004	1	68	128	158	38.5	56	6	118	5	5	M5	1.0
B006	2	108	128	182.5	56.5	96	6	118	5	5	M5	1.8
B010	2	108	128	199	56.5	96	6	118	5	5	M5	1.8
B012	2	140	128	203	65	128	6	118	5	5	M5	2.7

## Three-Phase 400 V Class: IP20/UL Open Type (with Built-in EMC Filter)

Catalog Code GA50A	Figure	Dimensions mm										Weight kg
		W	H	D	D1	W1	W2	H1	H2	t1	d	
4001	2	108	128	126	8.5	96	6	118	5	5	M5	1.4
4002	2	108	128	144	26.5	96	6	118	5	5	M5	1.5
4004	2	108	128	182.5	56.5	96	6	118	5	5	M5	1.9
4005	2	108	128	199	56.5	96	6	118	5	5	M5	1.9
4007												
4009												
4012	2	140	128	193	65	128	6	118	5	5	M5	2.6
4018	3	140	260	196	55	122	9	248	6	5	M5	3.9
4023												
4031	3	180	300	196	55	160	10	284	8	5	M5	5.5
4038												
4044	3	190	350	251	94	160	15	336	7	5	M6	8.0
4060	3	190	350	251	94	160	15	336	7	5	M6	8.5

Note: External and mounting dimensions are different for standard mounting and panel through mounting.  
Please refer to P.44 - 47 for panel through mounting.

# Dimensions

## ■ IP20/UL Type 1

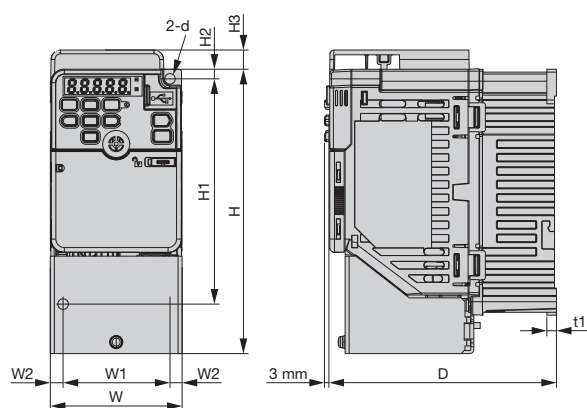


Figure 1

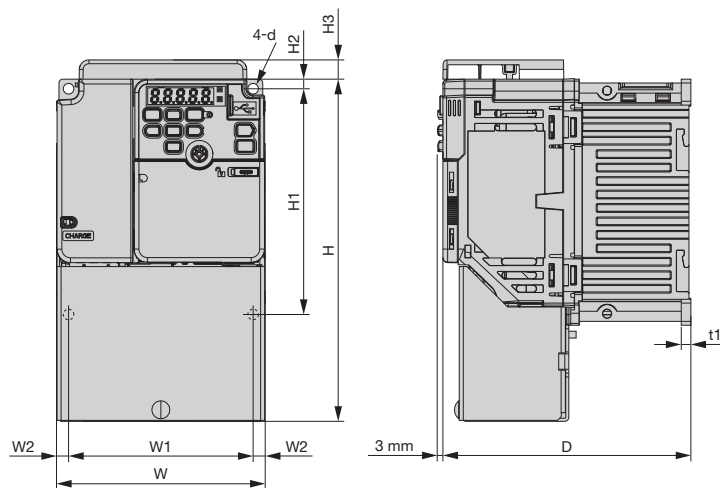


Figure 2

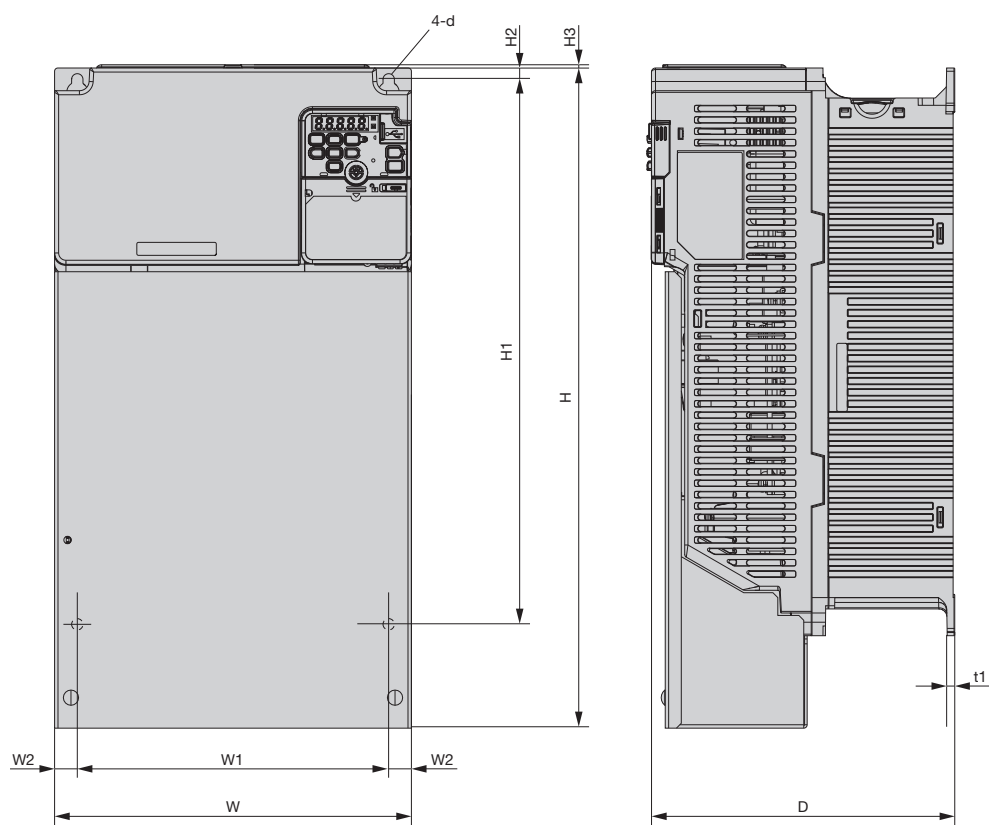


Figure 3

Three-Phase 200 V Class: IP20/UL Type 1

Catalog Code GA50A	Figure	Dimensions mm										Weight kg	UL Type 1 Kit Code No. (Model No.)
		W	H	D	W1	W2	H1	H2	H3	t1	d		
2001	1	68	148	76	56	6	118	5	10	3	M5	0.7	ZBAA-GA50V1-1 (100-243-340)
2002													
2004	1	68	148	108	56	6	118	5	10	5	M5	1.0	ZBAA-GA50V1-1 (100-243-340)
2006	1	68	148	128	56	6	118	5	10	5	M5	1.1	ZBAA-GA50V1-1 (100-243-340)
2008	2	108	178	129	96	6	118	5	10	5	M5	1.9	ZBAA-GA50V2-3 (100-243-344)
2010													
2012	2	108	178	137.5	96	6	118	5	10	5	M5	1.9	ZBAA-GA50V2-1 (100-243-342)
2018	2	140	178	143	128	6	118	5	10	5	M5	2.5	ZBAA-GA50V3-2 (100-243-346)
2021													
2030	3	140	298	140	122	9	248	6	1.5	5	M5	4.0	ZBAA-GA50V5-1 (100-243-348)
2042												4.2	
2056	3	180	340	143	160	10	284	8	1.5	5	M5	6.4	ZBAA-GA50V6-1 (100-243-349)
2070	3	220	403	187	192	14	336	7	1.5	5	M6	8.9	ZBAA-GA50V7-1 (100-243-350)
2082												9.4	

Single-Phase 200 V Class: IP20/UL Type 1

Catalog Code GA50A	Figure	Dimensions mm										Weight kg	UL Type 1 Kit Code No. (Model No.)
		W	H	D	W1	W2	H1	H2	H3	t1	d		
B001	1	68	148	76	56	6	118	5	10	3	M5	0.7	ZBAA-GA50V1-1 (100-243-340)
B002													
B004	1	68	148	118	56	6	118	5	10	5	M5	1.0	ZBAA-GA50V1-2 (100-243-341)
B006	2	108	178	137.5	96	6	118	5	10	5	M5	1.9	ZBAA-GA50V2-1 (100-243-342)
B010	2	108	178	154	96	6	118	5	10	5	M5	2.0	ZBAA-GA50V2-2 (100-243-343)
B012	2	140	178	163	128	6	118	5	10	5	M5	2.6	ZBAA-GA50V3-1 (100-243-345)
B018	3	170	182	180	158	6	118	5	1.5	5	M5	3.5	ZBAA-GA50V4-1 (100-243-347)

Three-Phase 400 V Class: IP20/UL Type 1

Catalog Code GA50A	Figure	Dimensions mm										Weight kg	UL Type 1 Kit Code No. (Model No.)
		W	H	D	W1	W2	H1	H2	H3	t1	d		
4001	2	108	149	81	96	6	118	5	10	5	M5	1.0	ZBAA-GA50V2-4 (100-253-019)
4002	2	108	149	99	96	6	118	5	10	5	M5	1.1	ZBAA-GA50V2-4 (100-253-019)
4004	2	108	149	137.5	96	6	118	5	10	5	M5	1.8	ZBAA-GA50V2-5 (100-253-020)
4005	2	108	178	154	96	6	118	5	10	5	M5	2.0	ZBAA-GA50V2-2 (100-243-343)
4007													
4009													
4012	2	140	178	143	128	6	118	5	10	5	M5	2.5	ZBAA-GA50V3-2 (100-243-346)
4018	3	140	298	140	122	9	248	6	1.5	5	M5	3.6	ZBAA-GA50V5-1 (100-243-348)
4023												3.8	
4031	3	180	340	143	160	10	284	8	1.5	5	M5	5.5	ZBAA-GA50V6-1 (100-243-349)
4038												5.7	
4044	3	190	403	204	160	15	336	7	1.5	5	M6	7.6	ZBAA-GA50V8-1 (100-243-351)
4060													

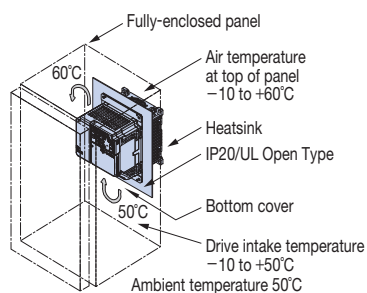
Note: UL Type 1 Kit (option) is required. The values in the table are the dimensions for the UL Type 1 Kit mounted to the IP20/UL Open Type Drive.

# Fully-Enclosed Design and Drive Watt Loss Data

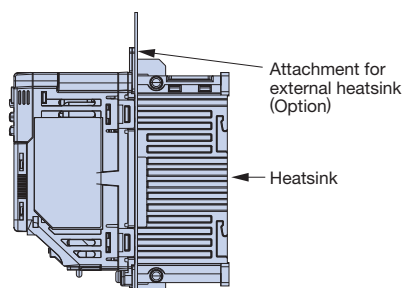
When you install the drive in a control panel, the maximum intake air temperature is 50°C.

The heatsink can alternatively be mounted outside the control panel, thus reducing the amount of heat inside the panel and allowing for a more compact set up.

## · Cooling Design for Fully-Enclosed Panel

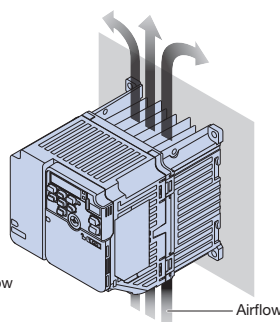
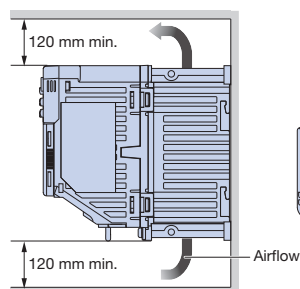
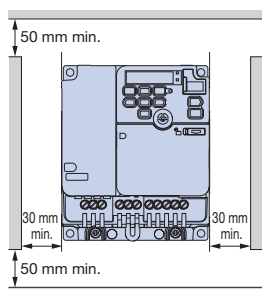


## · Mounting the External Heatsink



Intake air temperature for external heatsink  
 Open chassis side: 35 °C  
 Heatsink side: 35 °C  
 Use only an IP20/UL Open Type for the external heatsink.

## · Ventilation Space



For installing the drive (IP20/UL Open Type) with capacity of 200 V class 22 kW or 400 V class 22 kW, be sure to leave enough clearance during installation for main circuit wiring for maintenance.

## ● Drive Watt Loss Data

### Three-Phase 200 V Class Heavy Duty Ratings

Catalog Code GA50A		2001	2002	2004	2006	2008	2010	2012	2018	2021	2030	2042	2056	2070	2082
Rated Output Current	A	0.8	1.6	3	5	6.9	8	11	14	17.6	25	33	47	60	75
Carrier Frequency	kHz	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Watt Loss*	Internal	6	7	9	13	14	17	23	26	36	45	55	77	108	132
	Heatsink	4	7	13	22	30	37	49	61	83	163	200	269	411	439
	Total Watt Loss	10	14	22	35	44	54	72	87	119	208	255	346	519	571

### Single-Phase 200 V Class Heavy Duty Ratings

Catalog Code GA50A		B001	B002	B004	B006	B010	B012	B018
Rated Output Current	A	0.8	1.6	3	5	8	11	17.6
Carrier Frequency	kHz	2	2	2	2	2	2	2
Watt Loss*	Internal	7	10	13	17	30	40	49
	Heatsink	4	7	13	23	37	48	72
	Total Watt Loss	11	17	26	40	67	88	121

### Three-Phase 400 V Class Heavy Duty Ratings

Catalog Code GA50A		4001	4002	4004	4005	4007	4009	4012	4018	4023	4031	4038	4044	4060
Rated Output Current	A	1.2	1.8	3.4	4.8	5.6	7.3	9.2	14.8	18	24	31	39	45
Carrier Frequency	kHz	2	2	2	2	2	2	2	2	2	2	2	2	2
Watt Loss*	Internal	8	10	13	15	16	21	27	48	53	68	81	109	114
	Heatsink	7	10	21	29	33	45	60	126	152	191	256	338	328
	Total Watt Loss	15	20	34	44	49	66	87	174	205	259	337	447	442

### Three-Phase 200 V Class Normal Duty Ratings

Catalog Code GA50A		2001	2002	2004	2006	2008	2010	2012	2018	2021	2030	2042	2056	2070	2082
Rated Output Current	A	1.2	1.9	3.5	6	8	9.6	12.2	17.5	21	30	42	56	70	82
Carrier Frequency	kHz	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Watt Loss*	Internal	7	9	11	14	18	25	30	35	52	63	84	109	142	160
	Heatsink	5	9	16	25	37	51	61	82	111	240	307	367	534	531
	Total Watt Loss	12	18	27	39	55	76	91	117	163	303	391	476	676	691

### Single-Phase 200 V Class Normal Duty Ratings

Catalog Code GA50A		B001	B002	B004	B006	B010	B012
Rated Output Current	A	1.2	1.9	3.5	6	9.6	12.2
Carrier Frequency	kHz	2	2	2	2	2	2
Watt Loss*	Internal	8	14	14	17	36	48
	Heatsink	6	11	17	26	50	60
	Total Watt Loss	14	25	31	43	86	108

### Three-Phase 400 V Class Normal Duty Ratings

Catalog Code GA50A		4001	4002	4004	4005	4007	4009	4012	4018	4023	4031	4038	4044	4060
Rated Output Current	A	1.2	2.1	4.1	5.4	7.1	8.9	11.9	17.5	23.4	31	38	44	60
Carrier Frequency	kHz	2	2	2	2	2	2	2	2	2	2	2	2	2
Watt Loss*	Internal	8	13	14	16	20	28	39	52	86	101	108	137	176
	Heatsink	7	12	24	32	44	58	83	155	236	284	341	417	490
	Total Watt Loss	15	25	38	48	64	86	122	207	322	385	449	554	666

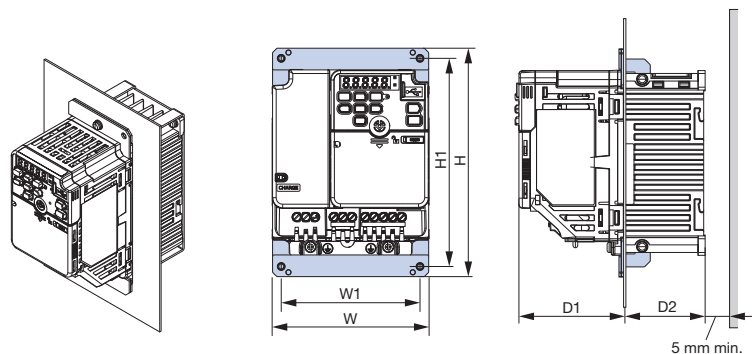
\*: Watt loss is calculated in the following conditions:  
 ·200 V class: Input voltage 220 V, power frequency 60 Hz, load ratio 100%  
 ·400 V class: Input voltage 440 V, power frequency 60 Hz, load ratio 100%  
 Contact your Yaskawa or nearest agent when not calculating watt loss in the above conditions.



# Fully-Enclosed Design and Drive Watt Loss Data

## ● Heatsink External Mounting Kit

When the heatsink is installed outside the drive, mounting kit is required.



Catalog Code GA50A[ ]	Dimensions    mm								Heatsink External Mounting Kit Code No. (Model No.)
	IP20/UL Open Type (with/without Built-in EMC Filter)				IP20/UL Open Type (with Built-in EMC Filter)		IP20/UL Open Type (without Built-in EMC Filter)		
	W	H	W1	H1	D1	D2	D1	D2	
2001	68	160	56	148	109.5	6.5	69.5	6.5	ZPSA-GA50V1-1 (100-242-250)
2002									
2004	68	160	56	148	109.5	38.5	69.5	38.5	ZPSA-GA50V1-2 (100-242-251)
2006	68	160	56	148	109.5	58.5	69.5	58.5	ZPSA-GA50V1-3 (100-242-252)
2008	108	158	96	144	117.5	56.5	72.5	56.5	ZPSA-GA50V2-3 (100-242-255)
2010					126		81		
2012									
2018	140	158	128	144	128	65	78	65	ZPSA-GA50V3-1 (100-242-256)
2021									
2030	158	286	122	272	141	55	85	55	ZPSA-GA50V5-1 (100-242-258)
2042									
2056	198	322	160	308	141	55	88	55	ZPSA-GA50V6-1 (100-242-259)
2070	241	380	192	362	138	78	109	78	ZPSA-GA50V7-1 (100-242-260)
2082									
B001	68	160	56	148	109.5	6.5	69.5	6.5	ZPSA-GA50V1-1 (100-242-250)
B002									
B004	68	160	56	148	119.5	38.5	79.5	38.5	ZPSA-GA50V1-2 (100-242-251)
B006	108	158	96	144	126	56.5	81	56.5	ZPSA-GA50V2-2 (100-242-254)
B010	108	158	96	144	142.5	56.5	97.5	56.5	ZPSA-GA50V2-3 (100-242-255)
B012	140	158	128	144	138	65	98	65	ZPSA-GA50V3-1 (100-242-256)
B018	170	158	158	144	-	-	115	65	ZPSA-GA50V4-1 (100-242-257)
4001	108	158	96	144	117.5	8.5	72.5	8.5	ZPSA-GA50V2-1 (100-242-253)
4002	108	158	96	144	117.5	26.5	72.5	26.5	ZPSA-GA50V2-2 (100-242-254)
4004					126	56.5	81	56.5	
4005	108	158	96	144	142.5	56.5	97.5	56.5	ZPSA-GA50V2-3 (100-242-255)
4007									
4009									
4012	140	158	128	144	128	65	78	65	ZPSA-GA50V3-1 (100-242-256)
4018	158	286	122	272	141	55	85	55	ZPSA-GA50V5-1 (100-242-258)
4023									
4031	198	322	160	308	141	55	88	55	ZPSA-GA50V6-1 (100-242-259)
4038									
4044	211	380	160	362	157	94	110	94	ZPSA-GA50V8-1 (100-255-479)
4060									

## ● Panel Modification for Heatsink External Mounting Kit

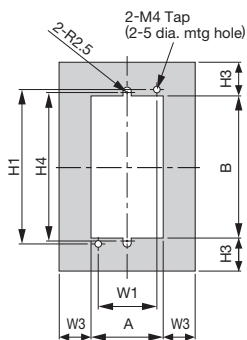


Figure 1

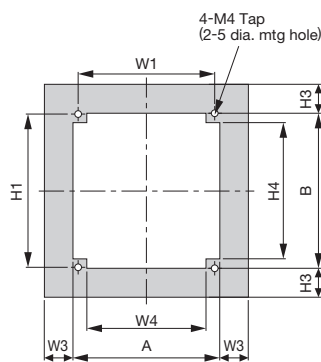


Figure 2

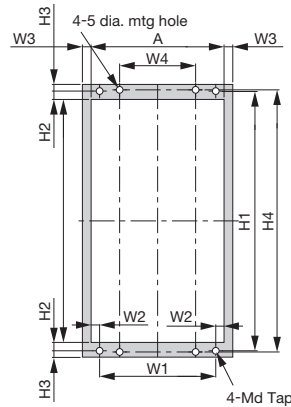


Figure 3

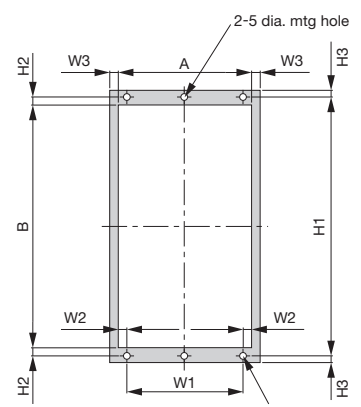


Figure 4

Note: The shaded area is the size when in installing the gasket.  
Guarantee a wider and higher gasket width space than the following W and H information.

### Three-Phase 200 V Class

Catalog Code GA50A	Figure	Dimensions mm										
		W1	W2	W3	W4	H1	H2	H3	H4	A	B	d
2001	1	56	—	30.5	—	148	—	32	142	69	136	—
2002		56	—	30.5	—	148	—	32	142	69	136	—
2004		56	—	30.5	—	148	—	32	142	69	136	—
2006	2	56	—	30.5	—	148	—	32	142	69	136	—
2008		96	—	27	80	144	—	27	128	106	146	—
2010		128	—	27	112	144	—	27	128	138	146	—
2012	3	122	9	9	—	272	8.5	7	—	140	255	5
2018		160	10	9	—	308	10.5	7	—	180	287	5
2021		192	14	10.5	—	362	10.5	9	—	220	341	6
2030	4	122	9	9	—	272	8.5	7	—	140	255	5
2042		160	10	9	—	308	10.5	7	—	180	287	5
2056		192	14	10.5	—	362	10.5	9	—	220	341	6
2070		122	9	9	—	272	8.5	7	—	140	255	5
2082		160	10	9	—	308	10.5	7	—	180	287	5
		192	14	10.5	—	362	10.5	9	—	220	341	6

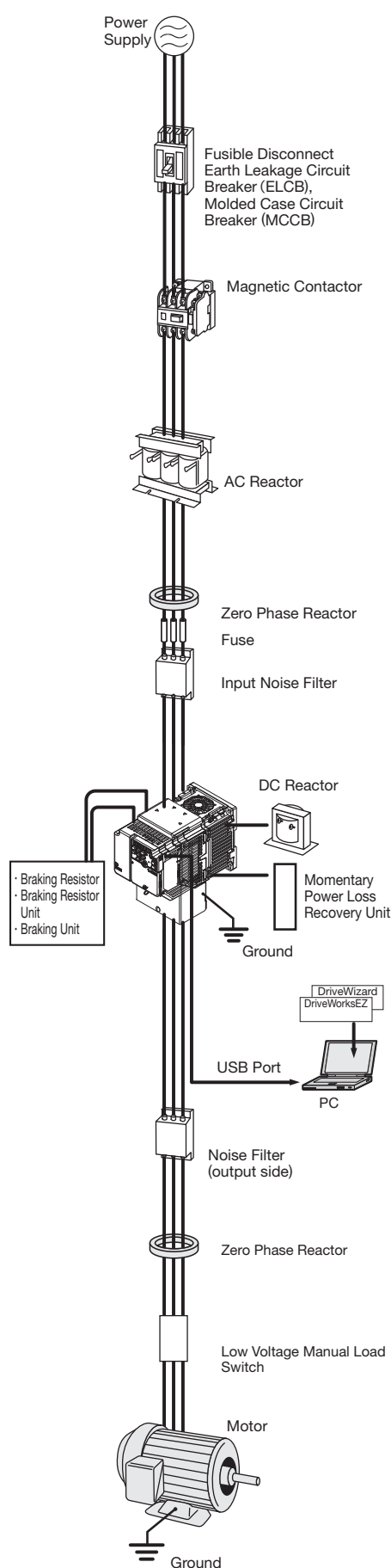
### Single-Phase 200 V Class

Catalog Code GA50A	Figure	Dimensions mm										
		W1	W2	W3	W4	H1	H2	H3	H4	A	B	d
B001	1	56	—	30.5	—	148	—	32	142	69	136	—
B002		56	—	30.5	—	148	—	32	142	69	136	—
B004		56	—	30.5	—	148	—	32	142	69	136	—
B006	2	96	—	27	80	144	—	27	128	106	146	—
B010		96	—	27	80	144	—	27	128	106	146	—
B012		128	—	27	112	144	—	27	128	138	146	—
B018	2	158	—	27	142	144	—	27	128	168	146	—
		158	—	27	142	144	—	27	128	168	146	—
		158	—	27	142	144	—	27	128	168	146	—

### Three-Phase 400 V Class

Catalog Code GA50A	Figure	Dimensions mm										
		W1	W2	W3	W4	H1	H2	H3	H4	A	B	d
4001	2	96	—	27	80	144	—	27	128	106	146	—
4002		96	—	27	80	144	—	27	128	106	146	—
4004		96	—	27	80	144	—	27	128	106	146	—
4005	2	96	—	27	80	144	—	27	128	106	146	—
4007		96	—	27	80	144	—	27	128	106	146	—
4009		96	—	27	80	144	—	27	128	106	146	—
4012	2	128	—	27	112	144	—	27	128	138	146	—
4018		128	—	27	112	144	—	27	128	138	146	—
4023		128	—	27	112	144	—	27	128	138	146	—
4031	3	122	9	9	—	272	8.5	7	—	140	255	5
4038		160	10	9	—	308	10.5	7	—	180	287	5
4044		192	14	10.5	—	362	10.5	9	—	220	341	6
4060	4	122	9	9	—	272	8.5	7	—	140	255	5
		160	10	9	—	308	10.5	7	—	180	287	5
		192	14	10.5	—	362	10.5	9	—	220	341	6

# Peripheral Devices and Options



Name	Purpose	Model, Manufacturer	Page
Earth Leakage Circuit Breaker (ELCB)	Always install an ELCB on the power-supply side to protect the power supply system and to prevent an overload at the occurrence of shortcircuit, and to protect the drive from ground faults that could result in electric shock or fire. Note: When an ELCB is installed for the upper power supply system, an MCCB can be used instead of an ELCB. Choose an ELCB designed to minimize harmonics specifically for AC drives. Use one ELCB per drive, each with a current rating of at least 30 mA.	NV series* by Mitsubishi Electric Corporation	P.50
Molded Case Circuit Breaker	Always install a MCCB on the power-supply side to protect the power supply system and to prevent an overload at the occurrence of a short-circuit.	NF series* by Mitsubishi Electric Corporation	P.50
Magnetic Contactor	Interrupts the power supply to the drive. In addition to protecting drive circuitry, a magnetic contactor also prevents damage to a braking resistor if used.	SC series* by Fuji Electric FA Components & Systems Co., Ltd	P.51
Surge Protector	Absorbs the voltage surge from switching of electro-magnetic contactors and control relays. Install a surge protector to the magnetic contactors and control relays as well as magnetic valves and magnetic braking coil.	DCR2 series RFN series by Nippon Chemi-Con Corporation	P.51
DC Reactor	· Used for harmonic current suppression and total improving power factor. Should be used if the power supply capacity is larger than 600 kVA.	UZDA series	P.52
AC Reactor	· Suppresses harmonic current · Improves the power factor of the input power supply	UZBA series	P.54
Zero Phase Reactor	Reduces noise from the line that enters into the drive input power system. Should be installed as close as possible to the drive. Can be used on both the input and output sides.	F6045GB F11080GB by Hitachi Metals, Ltd.	P.57
Fuse / Fuse Holder	Protects internal circuitry in the event of component failure. Fuse should be connected to the input terminal of the drive.	CR6L series CMS series by Fuji Electric	P.56
Capacitor-Type Noise Filter	Reduces noise from the line that enters into the drive input power system. The noise filter can be used in combination with a zero-phase reactor. Note: Available for drive input only. Do not connect the noise filter to the output terminals.	3XYG 1003 by Okaya Electric Industries Co., Ltd.	P.58
Input Noise Filter	Reduces noise from the line that enters into the drive input power system. Should be installed as close as possible to the drive. Note: For CE Marking (EMC Directive) compliant models, refer to GA700 Technical Manual.	RTEN series by TDK-Lambda	P.59
Output Noise Filter	Reduces noise from the line that enters into the drive input power system. Should be installed as close as possible to the drive.	LF series by NEC Tokin Corporation	P.61
Braking Resistor	Used to shorten the deceleration time by dissipating regenerative energy through a resistor. (3% ED)	ERF150WJ series CF120-B579 series	P.62
Braking Resistor Unit	Used to shorten the deceleration time by dissipating regenerative energy through a resistor unit (10% ED). A thermal overload relay is built in (10% ED).	LKEB series	P.62
PC cable	Connect the drive and PC when using DriveWizard or DriveWorksEZ. The cable length must be 3 m or less.	Commercially available USB2.0 A-miniB cable.	P.64
LCD Keypad	Keypad that displays text.	JVOP-KPLCA04AEA, KPLCA04MEA	P.64
Bluetooth LCD Keypad	Bluetooth connection enables the drive to be operated from a smartphone.	JVOP-KPLCC04ABA, KPLCC04MBA	P.64
LED Keypad	For easier operation using the LED screen when connecting the optional LED Keypad to the drive. Allows for remote operation. Includes a Copy function for saving drive settings.	JVOP-KPLEA04AAA	P.64
Blank Cover	Attach the blank cover when you remove the half-size LED keypad from the drive.	JVOP-KPBCH04AAA	P.64
Compact Keypad Panel Mounting Kit	Use this attachment when you install the standard keypad on the surface of a control panel.	900-192-933-001 900-192-933-002	P.65
Keypad Extension Cable	It is used as an extension cable when operating the keypad remotely.	WV001: 1 m WV003: 3 m	P.64
Momentary Power Loss Recovery Unit	Ensures continuous drive operation for a power loss of up to 2 s.	P0010 (200 V class) P0020 (400 V class)	P.58
Frequency Meter, Current Meter		DCF-6A	P.66
Frequency Setting Potentiometer (2 kΩ)		RV30YN	P.66
Frequency Meter Adjusting Potentiometer (20 kΩ)		RV30YN20S	P.66
Control Dial for Frequency Setting Potentiometer	Allows the user to set and monitor the frequency, current, and voltage using an external device.	K-2901-M	P.66
Output Voltage Meter		SCF-12NH	P.67
Potential Transformer		UPN-B	P.67
Heatsink External Mounting Kit	Required for heatsink installation. Current derating may be needed when using a heatsink.	—	P.46
UL Type 1 Kit	To change an IP20/UL Open Type drive to an IP20/UL Type 1 drive.	—	P.42
DIN Rail Attachment	Use this attachment when you install the drive inside the panel. Install the attachment to the back of the drive.	—	P.65
Low Voltage Manual Load Switch	Prevents shock from the voltage created on the terminals board from a coasting PM motor.	AICUT, LB series* by Aichi Electric Works Co., Ltd	—

\*: Recommended by Yaskawa. Contact the manufacturer in question for availability and specifications of non-Yaskawa products.

## ● Communication Options

Type	Name	Model	Function	Manual No.
Communications Options	MECHATROLINK-II Interface	SI-T3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through MECHATROLINK-II communication with the host controller. Note: Use options with software versions of 6108 or later.	TOBPC73060086 SIEPC73060086
	MECHATROLINK-III Interface	SI-ET3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through MECHATROLINK-III communication with the host controller. Note: Use options with software versions of 6202 or later.	TOBPC73060088 SIEPC73060088
	CC-Link Interface	SI-C3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through CC-Link communication with the host controller.	TOBPC73060083 SIEPC73060083
	DeviceNet Interface	SI-N3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through DeviceNet communication with the host controller. Note: Use options with software versions of 1114 or later.	TOBPC73060084 SIEPC73060084
	PROFIBUS-DP Interface	SI-P3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through PROFIBUS-DP communication with the host controller.	TOBPC73060082 SIEPC73060082
	CANopen Interface	SI-S3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through CANopen communication with the host controller.	TOBPC73060085 SIEPC73060085
	EtherCAT Interface	SI-ES3*	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through EtherCAT communication with the host controller.	–
	EtherNet/IP Interface	SI-EN3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through EtherNet/IP communication with the host controller.	TOBPC73060092 SIEPC73060092
	Modbus TCP/IP Interface	SI-EM3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through Modbus TCP/IP communication with the host controller.	TOBPC73060091 SIEPC73060091
	PROFINET Interface	SI-EP3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through PROFINET communication with the host controller.	TOBPC73060089 SIEPC73060089

\*: Contact Yaskawa for EtherCAT.

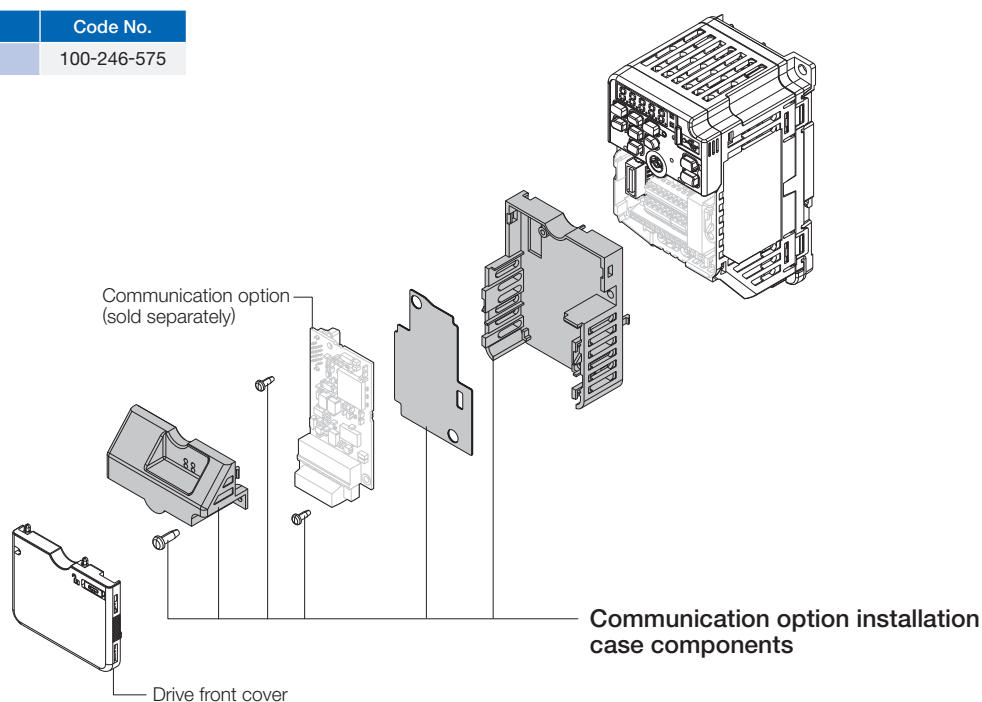
Note: Each communication option requires a separate configuration file to link to the network.

## ● Option Card Mounting Kit

Make sure to purchase this attachment when you use a communication option.

The option includes an option cover and an installation base and an separator.

Model	Code No.
JOHB-GA50	100-246-575



## Peripheral Devices and Options (continued)

### ● Earth Leakage Circuit Breaker, Molded Case Circuit Breaker

Device selection is based on the motor capacity.  
Make sure that the rated breaking capacity is higher than the short-circuit current for the power supply. Protect the wiring to withstand the short-circuit current for the power supply using a combination of fuses if the rated breaking capacity of the MCCB or ELCB is insufficient, such as when the power transformer capacity is large.



Earth Leakage Circuit Breaker  
[Mitsubishi Electric Corporation]



Molded Case Circuit Breaker  
[Mitsubishi Electric Corporation]

#### Three-Phase 200 V Class

Motor Capacity (kW)	Earth Leakage Circuit Breaker						Molded Case Circuit Breaker					
	Without Reactor*1			With Reactor*1			Without Reactor*1			With Reactor*1		
	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2
0.1	NV32-SV	5	10/10	NV32-SV	5	10/10	NF32-SV	5	7.5/7.5	NF32-SV	5	7.5/7.5
0.2	NV32-SV	5	10/10	NV32-SV	5	10/10	NF32-SV	5	7.5/7.5	NF32-SV	5	7.5/7.5
0.4	NV32-SV	5	10/10	NV32-SV	5	10/10	NF32-SV	5	7.5/7.5	NF32-SV	5	7.5/7.5
0.75	NV32-SV	10	10/10	NV32-SV	10	10/10	NF32-SV	10	7.5/7.5	NF32-SV	10	7.5/7.5
1.5	NV32-SV	15	10/10	NV32-SV	10	10/10	NF32-SV	15	7.5/7.5	NF32-SV	10	7.5/7.5
2.2	NV32-SV	20	10/10	NV32-SV	15	10/10	NF32-SV	20	7.5/7.5	NF32-SV	15	7.5/7.5
3.7	NV32-SV	30	10/10	NV32-SV	20	10/10	NF32-SV	30	7.5/7.5	NF32-SV	20	7.5/7.5
5.5	NV63-SV	50	15/15	NV63-SV	40	15/15	NF63-SV	50	15/15	NF63-SV	40	15/15
7.5	NV125-SV	60	50/50	NV63-SV	50	15/15	NF125-SV	60	50/50	NF63-SV	50	15/15
11	NV125-SV	75	50/50	NV125-SV	75	50/50	NF125-SV	75	50/50	NF125-SV	75	50/50
15	NV250-SV	125	85/85	NV125-SV	100	50/50	NF250-SV	125	85/85	NF125-SV	100	50/50
18.5	NV250-SV	150	85/85	NV250-SV	125	85/85	NF250-SV	150	85/85	NF250-SV	125	85/85
22	NV250-SV	175	85/85	NV250-SV	150	85/85	NV250-SV	175	85/85	NF250-SV	150	85/85

#### Single-Phase 200 V Class

Motor Capacity (kW)	Earth Leakage Circuit Breaker						Molded Case Circuit Breaker					
	Without Reactor*1			With Reactor*1			Without Reactor*1			With Reactor*1		
	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2
0.1	NV32-SV	5	10/10	NV32-SV	5	10/10	NF32-SV	5	7.5/7.5	NF32-SV	5	7.5/7.5
0.2	NV32-SV	5	10/10	NV32-SV	5	10/10	NF32-SV	5	7.5/7.5	NF32-SV	5	7.5/7.5
0.4	NV32-SV	10	10/10	NV32-SV	10	10/10	NF32-SV	10	7.5/7.5	NF32-SV	10	7.5/7.5
0.75	NV32-SV	20	10/10	NV32-SV	15	10/10	NF32-SV	20	7.5/7.5	NF32-SV	15	7.5/7.5
1.5	NV32-SV	30	10/10	NV32-SV	20	10/10	NF32-SV	30	7.5/7.5	NF32-SV	20	7.5/7.5
2.2	NV32-SV	30	10/10	NV32-SV	20	10/10	NF32-SV	30	7.5/7.5	NF32-SV	20	7.5/7.5
3.7	NV63-SV	50	15/15	NV63-SV	40	15/15	NF63-SV	50	15/15	NF63-SV	40	15/15

#### 400 V Class

Motor Capacity (kW)	Earth Leakage Circuit Breaker						Molded Case Circuit Breaker					
	Without Reactor*1			With Reactor*1			Without Reactor*1			With Reactor*1		
	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2
0.2	NV32-SV	5	5/5	NV32-SV	5	5/5	NF32-SV	3	2.5/2.5	NF32-SV	3	2.5/2.5
0.4	NV32-SV	5	5/5	NV32-SV	5	5/5	NF32-SV	3	2.5/2.5	NF32-SV	3	2.5/2.5
0.75	NV32-SV	5	5/5	NV32-SV	5	5/5	NF32-SV	5	2.5/2.5	NF32-SV	5	2.5/2.5
1.5	NV32-SV	10	5/5	NV32-SV	10	5/5	NF32-SV	10	2.5/2.5	NF32-SV	10	2.5/2.5
2.2	NV32-SV	15	5/5	NV32-SV	10	5/5	NF32-SV	15	2.5/2.5	NF32-SV	10	2.5/2.5
3.7	NV32-SV	20	5/5	NV32-SV	15	5/5	NF32-SV	20	2.5/2.5	NF32-SV	15	2.5/2.5
5.5	NV32-SV	30	5/5	NV32-SV	20	5/5	NF32-SV	30	2.5/2.5	NF32-SV	20	2.5/2.5
7.5	NV32-SV	30	5/5	NV32-SV	30	5/5	NF32-SV	30	2.5/2.5	NF32-SV	30	2.5/2.5
11	NV63-SV	50	7.5/7.5	NV63-SV	40	7.5/7.5	NF63-SV	50	7.5/7.5	NF63-SV	40	7.5/7.5
15	NV125-SV	60	25/25	NV63-SV	50	7.5/7.5	NF125-SV	60	25/25	NF63-SV	50	7.5/7.5
18.5	NV125-SV	75	25/25	NV125-SV	60	25/25	NF125-SV	75	25/25	NF125-SV	60	25/25
22	NF125-SV	100	25/25	NV125-SV	75	25/25	NF125-SV	100	25/25	NF125-SV	75	25/25
30	NV250-SV	125	36/36	NV125-SV	100	25/25	NF250-SV	125	36/36	NF125-SV	100	25/25

\*1: The AC or DC reactor is connected to the drive.

\*2: Icu: Rated ultimate short-circuit breaking capacity Ics: Rated service short-circuit breaking capacity.



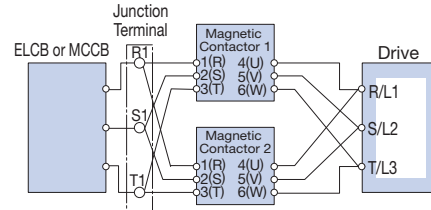
## ● Magnetic Contactor

Base device selection on motor capacity.



**Magnetic Contactor**  
[Fuji Electric FA Components & Systems Co., Ltd]

### Wiring a Magnetic Contactor in Parallel



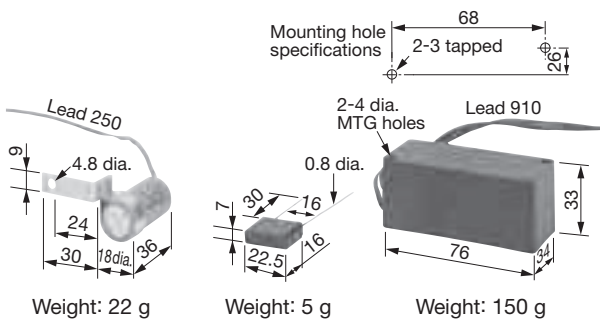
Note: When wiring contactors in parallel, make sure wiring lengths are the same to keep current flow even to the relay terminals.

Motor Capacity (kW)	Three-Phase 200 V Class				Single-Phase 200 V Class				400 V Class			
	Without Reactor*		With Reactor*		Without Reactor*		With Reactor*		Without Reactor*		With Reactor*	
	Model	Rated Current (A)	Model	Rated Current (A)	Model	Rated Current (A)	Model	Rated Current (A)	Model	Rated Current (A)	Model	Rated Current (A)
0.1	SC-03	11	SC-03	11	SC-03	11	SC-03	11	—	—	—	—
0.2	SC-03	11	SC-03	11	SC-03	11	SC-03	11	SC-03	7	SC-03	7
0.4	SC-03	11	SC-03	11	SC-03	11	SC-03	11	SC-03	7	SC-03	7
0.75	SC-05	13	SC-03	11	SC-4-0	18	SC-4-0	18	SC-03	7	SC-03	7
1.5	SC-4-0	18	SC-05	13	SC-N2	35	SC-N1	26	SC-05	9	SC-05	9
2.2	SC-N1	26	SC-4-0	18	SC-N2	35	SC-N2	35	SC-4-0	13	SC-4-0	13
3.7	SC-N2	35	SC-N1	26	SC-N2S	50	SC-N2S	50	SC-4-1	17	SC-4-1	17
5.5	SC-N2S	50	SC-N2	35	—	—	—	—	SC-N2	32	SC-N1	25
7.5	SC-N3	65	SC-N2S	50	—	—	—	—	SC-N2S	48	SC-N2	32
11	SC-N4	80	SC-N4	80	—	—	—	—	SC-N2S	48	SC-N2S	48
15	SC-N5	93	SC-N4	80	—	—	—	—	SC-N3	65	SC-N2S	48
18.5	SC-N7	152	SC-N6	125	—	—	—	—	SC-N4	80	SC-N3	65
22	SC-N7	152	SC-N6	125	—	—	—	—	SC-N5	90	SC-N4	80
30	—	—	—	—	—	—	—	—	SC-N5	90	SC-N4	80

\*: The AC or DC reactor is connected to the drive.

## ● Surge Protector

Dimensions (mm)



[Nippon Chemi-Con Corporation]

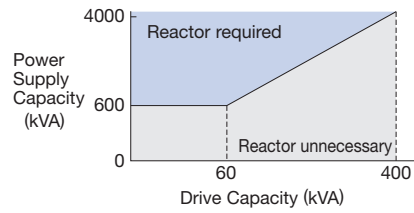
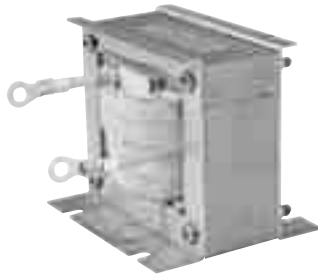
### Product Line

Surge Protector		Model	Specifications	Code No.
Peripheral Devices				
200 V to 230 V	Large-Capacity Coil (other than relay)	DCR2-50A22E	AC 220V 0.5 $\mu$ F+200 $\Omega$	C002417
200 V to 240 V	Control Relay MY2, MY3 [Omron Corporation] MM2, MM4 [Omron Corporation] HH22, HH23 [Fuji Electric]	DCR2-10A25C	AC 250V 0.1 $\mu$ F+100 $\Omega$	C002482
380 to 480 V		RFN3AL504KD	DC 1000V 0.5 $\mu$ F+220 $\Omega$	C002630

# Peripheral Devices and Options (continued)

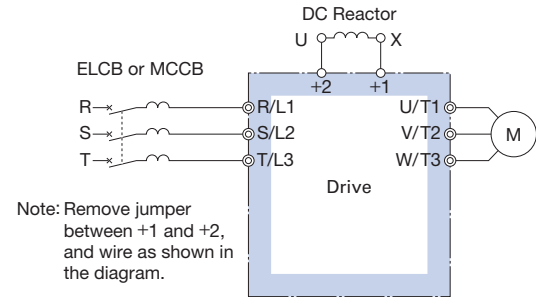
## ● DC Reactor (UZDA-B for DC circuit)

Base device selection on motor capacity.



Note: Reactor recommended for power supplies larger than 600 kVA. Use an AC reactor if power supply is 0.2 kW or smaller.

### Connection Diagram



### Dimensions (mm)

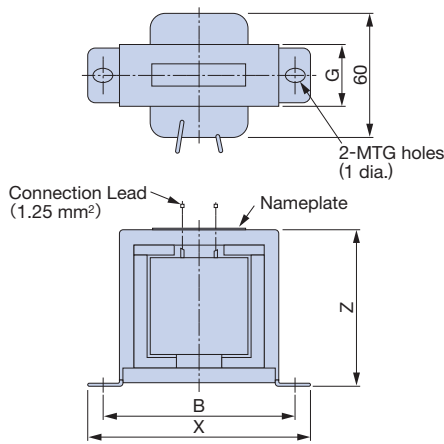


Figure 1

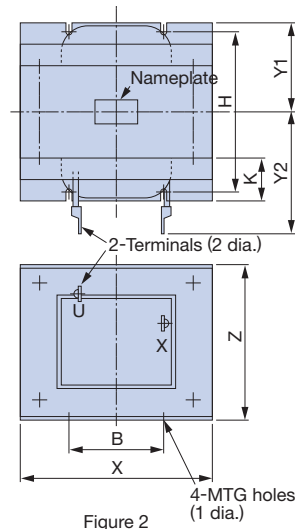


Figure 2

### 200 V Class Three-Phase Input Series

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)										Weight (kg)	Watt Loss (W)	Wire Gauge* (mm²)
					X	Y2	Y1	Z	B	H	K	G	1 dia.	2 dia.			
0.4	5.4	8	100-250-672	1	85	-	-	53	74	-	-	32	M4	-	0.8	8	2
0.75																	
1.5																	
2.2	18	3	100-250-660	2	86	80	36	76	60	55	18	-	M4	M5	2	18	5.5
3.7																	
5.5																	
7.5	36	1	100-250-668	2	105	90	46	93	64	80	26	-	M6	M6	3.2	22	8
11																	
15																	
18.5	90	0.4	100-250-679	2	133	120	52.5	117	86	80	25	-	M6	M8	6.5	45	30

Note: 1. Refer to the technical documentation for the 200 V class, single-phase input series. Contact Yaskawa or your nearest sales representative for more details.  
2. Use an AC reactor for a motor capacity of 0.2 kW or less.

### 400 V Class Three-Phase Input Series

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)										Weight (kg)	Watt Loss (W)	Wire Gauge* (mm²)
					X	Y2	Y1	Z	B	H	K	G	1 dia.	2 dia.			
0.4	3.2	28	100-250-664	1	85	-	-	53	74	-	-	32	M4	-	0.8	9	2
0.75																	
1.5																	
2.2	5.7	11	100-250-674	1	90	-	-	60	80	-	-	32	M4	-	1	11	2
3.7																	
5.5																	
7.5	23	3.6	100-250-662	2	105	90	46	93	64	80	26	-	M6	M5	3.2	27	5.5
11																	
15																	
18.5	47	1.3	100-250-670	2	115	125	57.5	100	72	90	25	-	M6	M6	6	42	14

\*: Cable: IV, 75°C, ambient temperature 45°C, 3 lines max.

## Terminal Type



## Dimensions (mm)

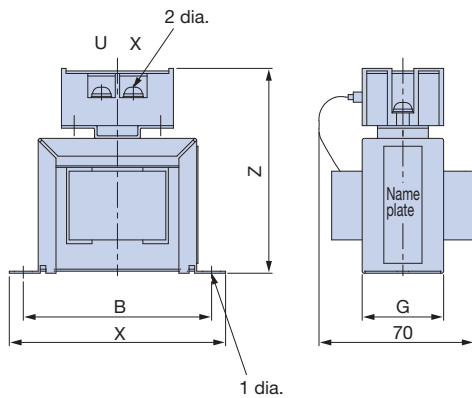


Figure 1

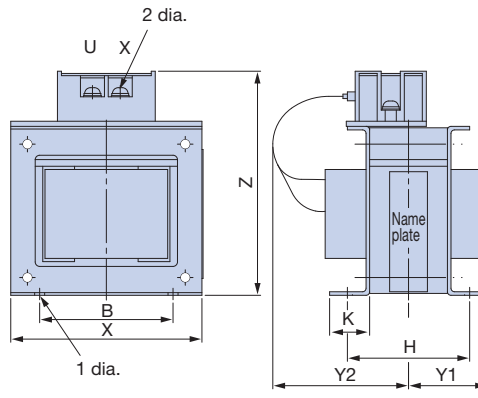


Figure 2

## 200 V Class Three-Phase Input Series

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)										Weight (kg)	Watt Loss (W)
					X	Y2	Y1	Z	B	H	K	G	1 dia.	2 dia.		
0.4	5.4	8	100-250-673	1	85	—	—	81	74	—	—	32	M4	M4	0.8	8
0.75					85	—	—	81	74	—	—	32	M4	M4		
1.5					85	—	—	81	74	—	—	32	M4	M4		
2.2	18	3	100-250-661	2	86	84	36	101	60	55	18	—	M4	M4	2	18
3.7					86	84	36	101	60	55	18	—	M4	M4		
5.5					86	84	36	101	60	55	18	—	M4	M4		
7.5	36	1	100-250-669	2	105	94	46	129	64	80	26	—	M6	M4	3.2	22
11					105	94	46	129	64	80	26	—	M6	M4		
15					105	94	46	129	64	80	26	—	M6	M4		
18.5	90	0.5	100-250-678	2	105	124	56	135	64	100	26	—	M6	M6	4.9	29
					105	124	56	135	64	100	26	—	M6	M6		
					105	124	56	135	64	100	26	—	M6	M6		
	90	0.4	100-250-680	2	133	147.5	52.5	160	86	80	25	—	M6	M6	6.5	44
					133	147.5	52.5	160	86	80	25	—	M6	M6		
					133	147.5	52.5	160	86	80	25	—	M6	M6		

Note: Refer to the technical documentation for the 200 V class, single-phase input series. Contact Yaskawa or your nearest sales representative for more details.

## 400 V Class Three-Phase Input Series

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)										Weight (kg)	Watt Loss (W)
					X	Y2	Y1	Z	B	H	K	G	1 dia.	2 dia.		
0.4	3.2	28	100-250-665	1	85	—	—	81	74	—	—	32	M4	M4	0.8	9
0.75					85	—	—	81	74	—	—	32	M4	M4		
1.5					85	—	—	81	74	—	—	32	M4	M4		
2.2	5.7	11	100-250-675	1	90	—	—	88	80	—	—	32	M4	M4	1	11
3.7					90	—	—	88	80	—	—	32	M4	M4		
5.5					90	—	—	88	80	—	—	32	M4	M4		
7.5	12	6.3	100-250-659	2	86	84	36	101	60	55	18	—	M4	M4	2	16
11					86	84	36	101	60	55	18	—	M4	M4		
15					86	84	36	101	60	55	18	—	M4	M4		
18.5	23	3.6	100-250-663	2	105	104	46	118	64	80	26	—	M6	M4	3.2	27
					105	104	46	118	64	80	26	—	M6	M4		
					105	104	46	118	64	80	26	—	M6	M4		
	33	1.9	100-250-667	2	105	109	51	129	64	90	26	—	M6	M4	4	26
					105	109	51	129	64	90	26	—	M6	M4		
					105	109	51	129	64	90	26	—	M6	M4		
	47	1.3	100-250-671	2	115	142.5	57.5	136	72	90	25	—	M6	M5	6	42
					115	142.5	57.5	136	72	90	25	—	M6	M5		
					115	142.5	57.5	136	72	90	25	—	M6	M5		

## Peripheral Devices and Options (continued)

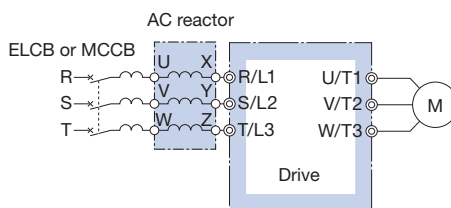
### ● AC Reactor (UZBA-B for 50/60 Hz Input)

Base device selection on motor capacity.

#### Lead Wire Type



#### Connection Diagram



Note: When using low noise type drives (high-carrier frequency of 2.5 kHz or more), do not connect an AC reactor to the output side (U/T1, V/T2, W/T3) of the drive.

#### Dimensions (mm)

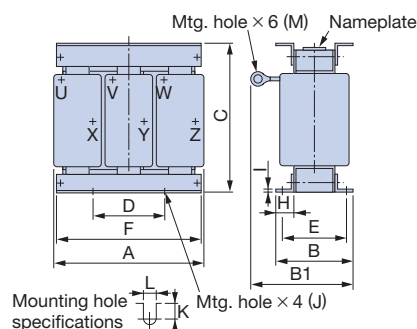


Figure 1

#### 200 V Class Three-Phase Input Series

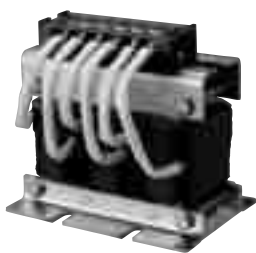
Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)													Weight (kg)	Watt Loss (W)
					A	B	B1	C	D	E	F	H	I	J	K	L	M		
3.7	20	0.53	100-250-562	1	130	88	114	105	50	70	130	22	3.2	M6	11.5	7	M5	3	35
5.5	30	0.35	100-250-578	1	130	88	119	105	50	70	130	22	3.2	M6	9	7	M5	3	45
7.5	40	0.265	100-250-584	1	130	98	139	105	50	80	130	22	3.2	M6	11.5	7	M6	4	50
11	60	0.18	100-250-594	1	160	105	147.5	130	75	85	160	25	2.3	M6	10	7	M6	6	65
15	80	0.13	100-250-599	1	180	100	155	150	75	80	180	25	2.3	M6	10	7	M8	8	75
18.5	90	0.12	100-250-602	1	180	100	150	150	75	80	180	25	2.3	M6	10	7	M8	8	90
22	120	0.09	100-250-552	1	180	100	155	150	75	80	180	25	2.3	M6	10	7	M10	8	90

Note: Refer to the technical documentation for the 200 V class, single-phase input series. Contact Yaskawa or your nearest sales representative for more details.

#### 400 V Class Three-Phase Input Series

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)													Weight (kg)	Watt Loss (W)
					A	B	B1	C	D	E	F	H	I	J	K	L	M		
7.5	20	1.06	100-250-564	1	160	90	115	130	75	70	160	25	2.3	M6	10	7	M5	5	50
11	30	0.7	100-250-580	1	160	105	132.5	130	75	85	160	25	2.3	M6	10	7	M5	6	65
15	40	0.53	100-250-586	1	180	100	140	150	75	80	180	25	2.3	M6	10	7	M6	8	90
18.5	50	0.42	100-250-590	1	180	100	145	150	75	80	180	25	2.3	M6	10	7	M6	8	90
22	60	0.36	100-250-596	1	180	100	150	150	75	80	180	25	2.3	M6	10	7	M6	8.5	90
30	80	0.26	100-250-601	1	210	100	150	175	75	80	205	25	3.2	M6	10	7	M8	12	95

## Terminal Type



## Dimensions (mm)

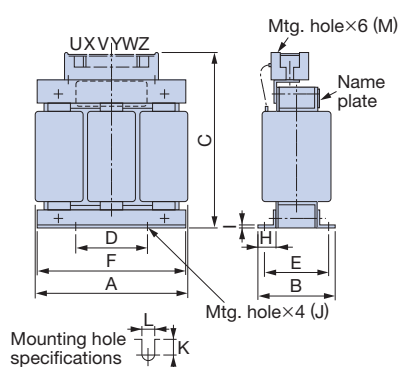


Figure 1

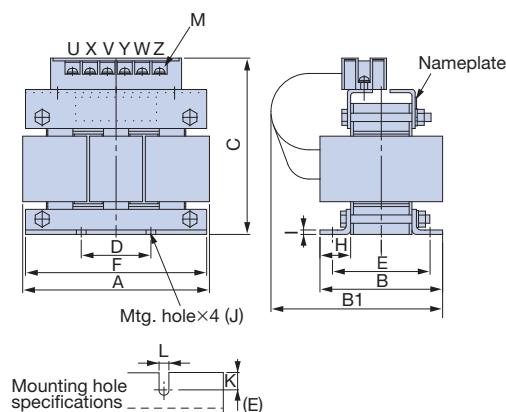


Figure 2

## 200 V Class Three-Phase Input Series

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)													Weight (kg)	Watt Loss (W)
					A	B	B1	C	D	E	F	H	I	J	K	L	M		
0.1	2	7	100-250-577	1	120	71	—	115	40	50	105	20	2.3	M6	10.5	7	M4	2.5	15
0.2	2	7	100-250-577	1	120	71	—	115	40	50	105	20	2.3	M6	10.5	7	M4	2.5	15
0.4	2.5	4.2	100-250-558	1	120	71	—	120	40	50	105	20	2.3	M6	10.5	7	M4	2.5	15
0.75	5	2.1	100-250-592	1	120	71	—	120	40	50	105	20	2.3	M6	10.5	7	M4	2.5	15
1.5	10	1.1	100-250-550	1	130	88	—	130	50	70	130	22	3.2	M6	9	7	M4	3	25
2.2	15	0.71	100-250-555	1	130	88	—	130	50	70	130	22	3.2	M6	9	7	M4	3	30
3.7	20	0.53	100-250-563	2	135	88	140	130	50	70	130	22	3.2	M6	9	7	M4	3	35
5.5	30	0.35	100-250-579	2	135	88	150	130	50	70	130	22	3.2	M6	9	7	M4	3	45
7.5	40	0.265	100-250-585	2	135	98	160	140	50	80	130	22	3.2	M6	9	7	M5	4	50
11	60	0.18	100-250-595	2	165	105	185	170	75	85	160	25	2.3	M6	10	7	M6	6	65
15	80	0.13	100-250-600	2	185	100	180	195	75	80	180	25	2.3	M6	10	7	M6	8	75
18.5	90	0.12	100-250-603	2	185	100	180	195	75	80	180	25	2.3	M6	10	7	M6	8	90

## 400 V Class Three-Phase Input Series

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)													Weight (kg)	Watt Loss (W)
					A	B	B1	C	D	E	F	H	I	J	K	L	M		
0.2	1.3	18	100-250-549	1	120	71	—	120	40	50	105	20	2.3	M6	10.5	7	M4	2.5	15
0.4	1.3	18	100-250-549	1	120	71	—	120	40	50	105	20	2.3	M6	10.5	7	M4	2.5	15
0.75	2.5	8.4	100-250-559	1	120	71	—	120	40	50	105	20	2.3	M6	10.5	7	M4	2.5	15
1.5	5	4.2	100-250-593	1	130	88	—	130	50	70	130	22	3.2	M6	9	7	M4	3	25
2.2	7.5	3.6	100-250-598	1	130	88	—	130	50	70	130	22	3.2	M6	9	7	M4	3	25
3.7	10	2.2	100-250-551	1	130	88	—	130	50	70	130	22	3.2	M6	9	7	M4	3	40
5.5	15	1.42	100-250-556	1	130	98	—	130	50	80	130	22	3.2	M6	9	7	M4	4	50
7.5	20	1.06	100-250-565	2	165	90	160	155	75	70	160	25	2.3	M6	10	7	M4	5	50
11	30	0.7	100-250-581	2	165	105	175	155	75	85	160	25	2.3	M6	10	7	M4	6	65
15	40	0.53	100-250-587	2	185	100	170	185	75	80	180	25	2.3	M6	10	7	M5	8	90
18.5	50	0.42	100-250-591	2	185	100	170	185	75	80	180	25	2.3	M6	10	7	M5	8	90



# Peripheral Devices and Options (continued)

## Fuse/Fuse Holder

Install a fuse to the drive input terminals to prevent damage in case a fault occurs.

The following tables show UL Listed fuses.

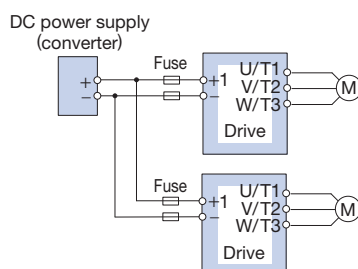


[Fuji Electric]

### Connection Diagram

DC Input Power Supply (example shows two drives connected in parallel.)

For use with an AC power supply see the connection diagram on page 32.



Note: When connecting multiple drives together, make sure that each drive has its own fuse. If any one fuse blows, all fuses should be replaced.

### Fuse Holder Dimensions (mm)

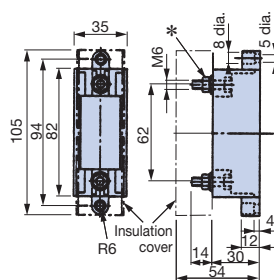


Figure 1

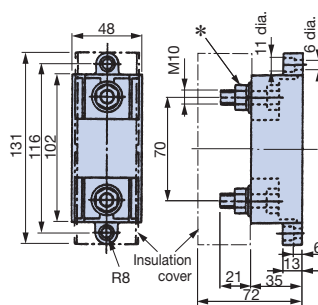


Figure 2

\*: Mounting components supplied separately.  
Tighten bolt when fuse is installed.

### Three-Phase 200 V Class

Catalog Code GA50A [ ]	AC Power Supply / DC Power Supply					
	Fuse			Fuse Holder		
	Model	Rated Short-Circuit Breaking Current (kA)	Qty.*1	Model	Qty.*1	Figure
2001	CR6L-20/UL	100	3	CMS-4	3	1
2002	CR6L-30/UL	100	3	CMS-4	3	1
2004	CR6L-50/UL	100	3	CMS-4	3	1
2006	CR6L-75/UL	100	3	CMS-5	3	2
2008	CR6L-100/UL	100	3	CMS-5	3	2
2010	CR6L-150/UL	100	3	CMS-5	3	2
2012	CR6L-200/UL	100	3	CMS-5	3	2
2018	CR6L-250*3	100	3	CMS-5	3	2

\*1: Multiple fuses are needed when using an AC power supply. DC power requires only two fuses.

\*2: Manufacturer does not recommend a specific fuse holder for this fuse. Contact the manufacturer for information on fuse dimensions.

\*3: UL Listed fuses are not available.

### Single-Phase 200 V Class

Catalog Code GA50A [ ]	AC Power Supply / DC Power Supply					
	Fuse			Fuse Holder		
	Model	Rated Short-Circuit Breaking Current (kA)	Qty.	Model	Qty.	Figure
B001	CR6L-20/UL	100	2	CMS-4	2	1
B002	CR6L-30/UL	100	2	CMS-4	2	1
B004	CR6L-50/UL	100	2	CMS-4	2	1
B006	CR6L-75/UL	100	2	CMS-5	2	1
B010	CR6L-100/UL	100	2	CMS-5	2	1
B012	CR6L-150/UL	100	2	CMS-5	2	1

### Three-Phase 400 V Class

Catalog Code GA50A [ ]	AC Power Supply / DC Power Supply					
	Fuse			Fuse Holder		
	Model	Rated Short-Circuit Breaking Current (kA)	Qty.*1	Model	Qty.*1	Figure
4001	CR6L-20/UL	100	3	CMS-4	3	1
4002	CR6L-30/UL	100	3	CMS-4	3	1
4004	CR6L-50/UL	100	3	CMS-4	3	1
4005	CR6L-75/UL	100	3	CMS-5	3	2
4007	CR6L-100/UL	100	3	CMS-5	3	2
4009	CR6L-150/UL	100	3	CMS-5	3	2
4012	CR6L-200/UL	100	3	CMS-5	3	2
4018	CR6L-250*3	100	3	CMS-5	3	2

\*1: Multiple fuses are needed when using an AC power supply. DC power requires only two fuses.

\*2: Manufacturer does not recommend a specific fuse holder for this fuse. Contact the manufacturer for information on fuse dimensions.

## ● Zero Phase Reactor

Zero-phase reactor should match wire gauge.\*

\* : Current values for wire gauges may vary based on electrical codes.

The table below lists selections based on Japanese electrical standards and Yaskawa's ND rating.

Contact Yaskawa for questions regarding UL.

Pass each wire (U/T1, V/T2, W/T3) through the core 4 times. Noise will be more effectively reduced when more wire is wrapped.

If the wire is thick and cannot be wrapped around the core, pass it through in series of no less than 4 cores.

### FINEMET Zero-Phase Reactor to Reduce Radio Noise

Note: FINEMET is a registered trademark of Hitachi Metals, Ltd.



[Hitachi Metals, Ltd.]

#### Connection Diagram

Compatible with the input and output side of the drive.

Example: Connection to output terminal

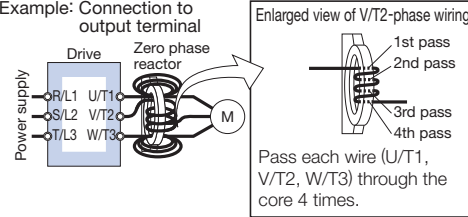
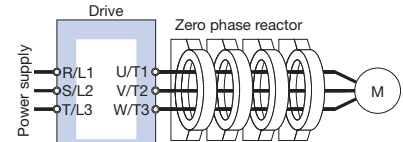


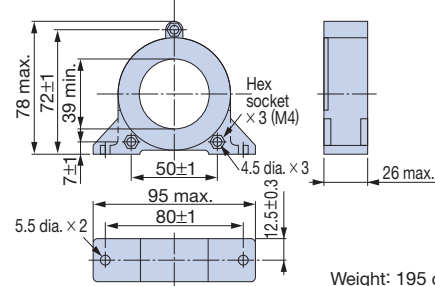
Diagram a



All wires (U/T1, V/T2, W/T3) should pass through the four cores of the reactor in series without winding.

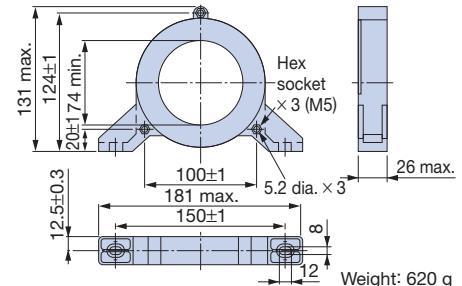
Diagram b

#### Dimensions (mm)



Model F6045GB

Weight: 195 g



Model F11080GB

Weight: 620 g

### Three-Phase 200 V Class

GA500		Zero Phase Reactor			
Motor Capacity (kW)	Recommended Gauge (mm <sup>2</sup> )	Model	Code No.	Qty.	Diagram
0.1	2	F6045GB	FIL001098	1	a
0.2					
0.4					
0.75					
1.5					
2.2	3.5	F6045GB	FIL001098	1	a
3.7					
5.5					
7.5					
11					
15	22	F6045GB	FIL001098	4	b
18.5	30	F6045GB	FIL001098	4	b
22	38	F6045GB	FIL001098	4	b

### Three-Phase 400 V Class

GA500		Zero Phase Reactor			
Motor Capacity (kW)	Recommended Gauge (mm <sup>2</sup> )	Model	Code No.	Qty.	Diagram
0.2	2	F6045GB	FIL001098	1	a
0.4					
0.75					
1.5					
2.2					
3.0					
3.7					
5.5					
7.5					
11					
15	5.5	F6045GB	FIL001098	1	a
18.5	14	F6045GB	FIL001098	4	b

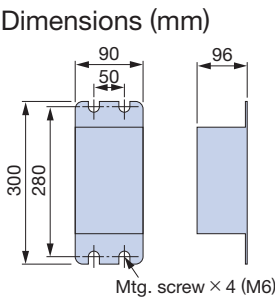
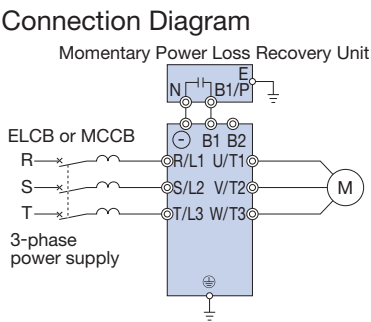
### Single-Phase 200 V Class

GA500		Zero Phase Reactor			
Motor Capacity (kW)	Recommended Gauge (mm <sup>2</sup> )	Model	Code No.	Qty.	Diagram
0.1	2	F6045GB	FIL001098	1	a
0.2					
0.4					
0.75					
1.5					
2.2	3.5	F6045GB	FIL001098	1	a
3.7	8	F11080GB	FIL001097	1	a

● Momentary Power Loss Recovery Unit



Weight: 2 kg



Model	Code No.
200 V Class: P0010	100-005-752
400 V Class: P0020	P0020

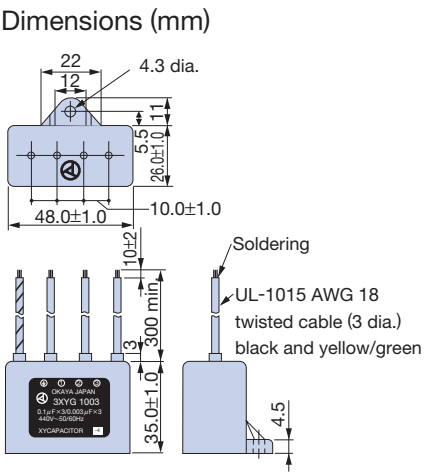
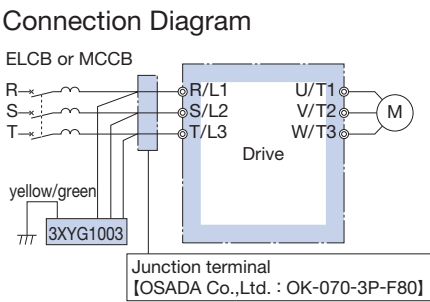
Note: Functions as a back-up power supply for drives up to 7.5 kW. Allows the drive to ride through a power loss up to 2 s long. The drive alone can continue running through a power loss lasting 0.1 s to 1.0 s. Results may vary with drive capacity.

● Capacitor-Type Noise Filter

Capacitor-type noise filter exclusively designed for drive input.  
For both 200 V and 400 V classes, the noise filter can be used with a zero-phase reactor.  
Note: The capacitor-type noise filter can be used for drive input only. Do not connect the noise filter to the output terminals.



[Okaya Electric Industries Co., Ltd.]



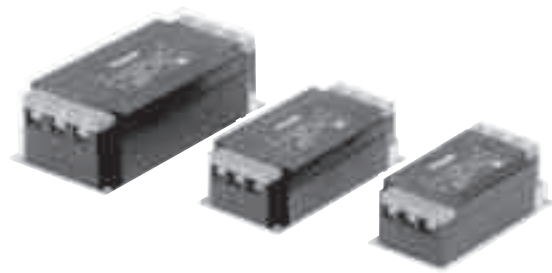
Model	Code No.
3XYG 1003	100-250-542

仕様	Rated Voltage	Capacitance (3 devices each)	Operating Temperature (°C)
	440 V	X (Δ connection) : 0.1 μF±20% Y (Λ connection) : 0.003 μF±20%	-40 to +85

Note: For use with 460 V and 480 V units, contact Yaskawa directly.

## Input Noise Filter

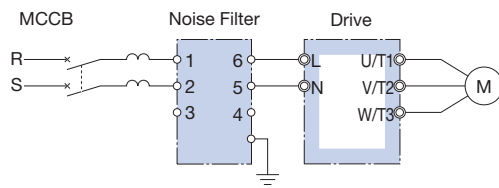
Base device selection on motor capacity.



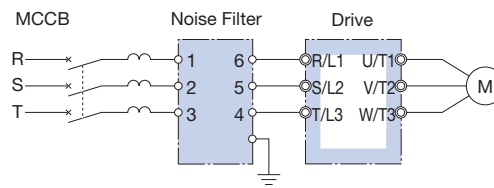
【TDK-Lambda】

Note: Refer to the instruction manual for information on the CE mark and compliance with the EMC directive.

### Connection Diagram



Single-Phase Input



Three-Phase Input

Note: Do not connect the input noise filter to the drive output terminals (U/T1, V/T2, W/T3).

### Dimensions (mm)

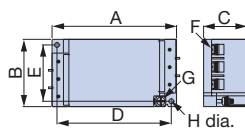


Figure 1

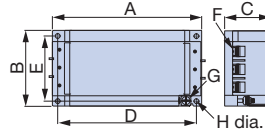


Figure 2

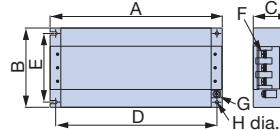


Figure 3

### Three-Phase 200 V Class

Motor Capacity (kW)	Model	Figure	Code No.	Qty.	Rated Current (A)	Dimensions (mm)								Recommended Tightening Torque	Weight (kg)
						A	B	C	D	E	F	G	H dia.		
0.1	RTEN-5010	1	300-082-980	1	10	120	63	42	110	53	M4	M4	4.5	M4 : 1.27 N·m M5 : 2.5 N·m M6 : 4.8 N·m M8 : 7.64 N·m	0.36
0.2	RTEN-5010	1	300-082-980	1	10	120	63	42	110	53	M4	M4	4.5		0.36
0.4	RTEN-5010	1	300-082-980	1	10	120	63	42	110	53	M4	M4	4.5		0.36
0.75	RTEN-5010	1	300-082-980	1	10	120	63	42	110	53	M4	M4	4.5		0.36
1.5	RTEN-5010	1	300-082-980	1	10	120	63	42	110	53	M4	M4	4.5		0.36
2.2	RTEN-5020	2	300-099-883	1	20	140	70	42	130	60	M4	M4	4.5		0.56
3.7	RTEN-5030	2	300-104-117	1	30	140	70	42	130	60	M4	M4	4.5		0.56
5.5	RTEN-5040	2	300-104-118	1	40	170	90	54	160	80	M5	M4	4.5		1.10
7.5	RTEN-5060	2	300-099-885	1	60	170	90	54	160	80	M5	M4	4.5		1.10
11	RTEN-5100	3	300-104-120	1	100	267	161	85	247	135	M8	M6	6.5		4.20
15	RTEN-5100	3	300-104-120	1	100	267	161	85	247	135	M8	M6	6.5		4.20
18.5	RTEN-5150	3	300-104-121	1	150	290	190	88	270	164	M8	M6	6.5		6.50
22	RTEN-5150	3	300-104-121	1	150	290	190	88	270	164	M8	M6	6.5		6.50

### Single-Phase 200 V Class

Motor Capacity (kW)	Model	Figure	Code No.	Qty.	Rated Current (A)	Dimensions (mm)								Recommended Tightening Torque	Weight (kg)
						A	B	C	D	E	F	G	H dia.		
0.1	RTEN-5010	1	300-082-980	1	10	120	63	42	110	53	M4	M4	4.5	M4 : 1.27 N·m M5 : 2.5 N·m	0.36
0.2	RTEN-5010	1	300-082-980	1	10	120	63	42	110	53	M4	M4	4.5		0.36
0.4	RTEN-5020	2	300-099-883	1	20	140	70	42	130	60	M4	M4	4.5		0.56
0.75	RTEN-5020	2	300-099-883	1	20	140	70	42	130	60	M4	M4	4.5		0.56
1.5	RTEN-5030	2	300-104-117	1	30	140	70	42	130	60	M4	M4	4.5		0.56
2.2	RTEN-5040	2	300-104-118	1	40	170	90	54	160	80	M5	M4	4.5		1.10
3.7	RTEN-5060	2	300-099-885	1	60	170	90	54	160	80	M5	M4	4.5		1.10

## Peripheral Devices and Options (continued)

### ● Input Noise Filter (continued)

Dimensions (mm)

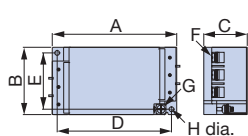


Figure 1

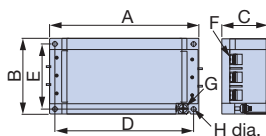


Figure 2

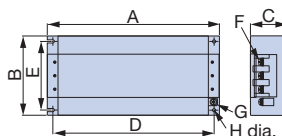


Figure 3

### Three-Phase 400 V Class

Motor Capacity (kW)	Model	Figure	Code No.	Qty.	Rated Current (A)	Dimensions (mm)								Recommended Tightening Torque	Weight (kg)
						A	B	C	D	E	F	G	H dia.		
0.2	RTEN-5006	1	300-099-882	1	6	120	63	42	110	53	M4	M4	4.5	M4 : 1.27 N·m M5 : 2.5 N·m M6 : 4.8 N·m M8 : 7.64 N·m	0.36
0.4	RTEN-5006	1	300-099-882	1	6	120	63	42	110	53	M4	M4	4.5		0.36
0.75	RTEN-5006	1	300-099-882	1	6	120	63	42	110	53	M4	M4	4.5		0.36
1.5	RTEN-5010	1	300-082-980	1	10	120	63	42	110	53	M4	M4	4.5		0.36
2.2	RTEN-5010	1	300-082-980	1	10	120	63	42	110	53	M4	M4	4.5		0.36
3	RTEN-5020	2	300-099-883	1	20	140	70	42	130	60	M4	M4	4.5		0.56
3.7	RTEN-5020	2	300-099-883	1	20	140	70	42	130	60	M4	M4	4.5		0.56
5.5	RTEN-5020	2	300-099-883	1	20	140	70	42	130	60	M4	M4	4.5		0.56
7.5	RTEN-5030	2	300-104-117	1	30	140	70	42	130	60	M4	M4	4.5		0.56
11	RTEN-5040	2	300-104-118	1	40	170	90	54	160	80	M5	M4	4.5		1.10
15	RTEN-5060	2	300-099-885	1	60	170	90	54	160	80	M5	M4	4.5		1.10
18.5	RTEN-5060	2	300-099-885	1	60	170	90	54	160	80	M5	M4	4.5		1.10
22	RTEN-5100	3	300-104-120	1	100	267	161	85	247	135	M8	M6	6.5		4.20
30	RTEN-5100	3	300-104-120	1	100	267	161	85	247	135	M8	M6	6.5		4.20

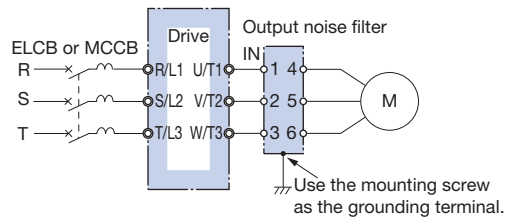
## Output Noise Filter

Base device selection on motor capacity.



[NEC Tokin Corporation]

### Connection Diagram



### Dimensions (mm)

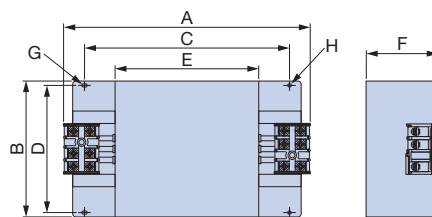


Figure 1

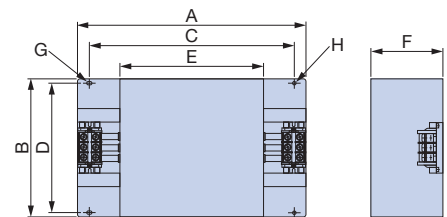


Figure 2

### Three/Single-Phase 200 V Class

Motor Capacity (kW)	Model	Code No.	Qty.	Rated Current (A)	Figure	Dimensions (mm)								Terminal Block		Weight (kg)
						A	B	C	D	E	F	G	H	Model	Screw Size	
0.1	LF-310KA	100-261-505	1	10	1	150	100	100	90	70	45	7×4.5 dia.	4.5 dia.	OTB-203	M4	0.5
0.2																
0.4																
0.75																
1.5	LF-320KA	100-261-506	1	20	1	150	100	100	90	70	45	7×4.5 dia.	4.5 dia.	OTB-203	M4	0.6
2.2																
3.7																
5.5	LF-350KA	100-261-510	1	50	2	260	180	180	160	120	65	7×4.5 dia.	4.5 dia.	CTKC-65S	M6	2
7.5																
11	LF-350KA	100-261-510	2	100	2	260	180	180	160	120	65	7×4.5 dia.	4.5 dia.	CTKC-65S	M6	2
15																
18.5																
22	LF-3110KB	100-261-513	1	110	2	540	340	480	300	340	240	9×6.5 dia.	6.5 dia.	CTKC-100	M8	19.5

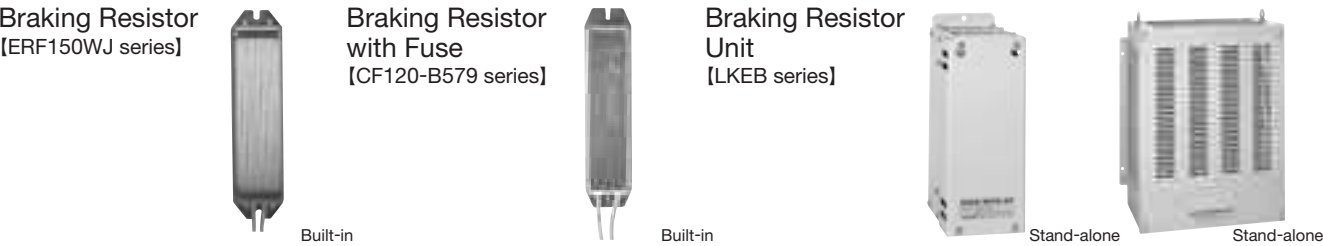
### Three-Phase 400 V Class

Motor Capacity (kW)	Model	Code No.	Qty.	Rated Current (A)	Figure	Dimensions (mm)								Terminal Block		Weight (kg)
						A	B	C	D	E	F	G	H	Model	Screw Size	
0.2	LF-310KB	100-261-507	1	10	1	150	100	100	90	70	45	7×4.5 dia.	4.5 dia.	OTB-203	M4	0.5
0.4																
0.75																
1.5																
2.2	LF-320KB	100-261-508	1	20	1	150	100	100	90	70	45	7×4.5 dia.	4.5 dia.	OTB-203	M4	0.6
3.7																
5.5																
7.5	LF-335KB	100-261-509	1	35	1	150	100	100	90	70	45	7×4.5 dia.	4.5 dia.	OTB-203	M4	0.8
11																
15	LF-345KB	100-261-511	1	45	2	260	180	180	160	120	65	7×4.5 dia.	4.5 dia.	CTKC-65S	M6	2
18.5																
22																
30	LF-375KB	100-261-512	1	75	2	540	320	480	300	340	240	9×6.5 dia.	6.5 dia.	CTKC-65S	M6	12



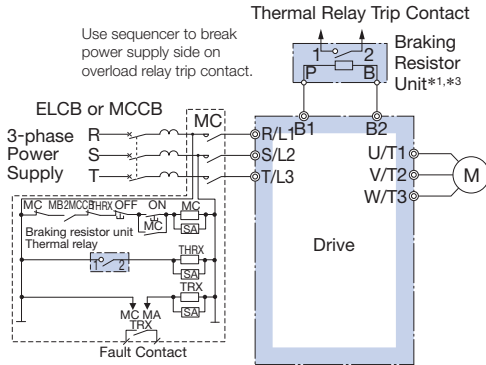
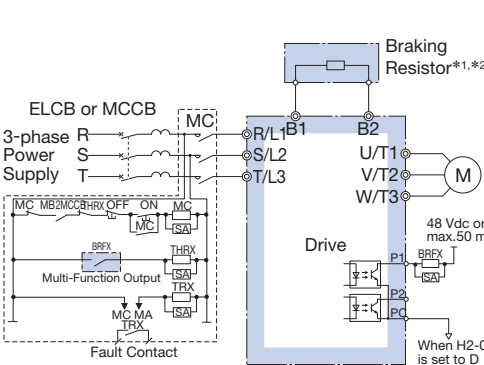
Braking Resistor, Braking Resistor Unit

Base device selection on motor capacity.



Connection Diagram

Set parameter L8-01 to 1 (resistor overheat protection enabled). And, set one of the multi-function digital output terminals (H2-□□) to D (braking resistor fault). With this setting, A sequence in which the power supply will be shut off is required. (When using a braking resistor with fuse, an external sequence is not required)

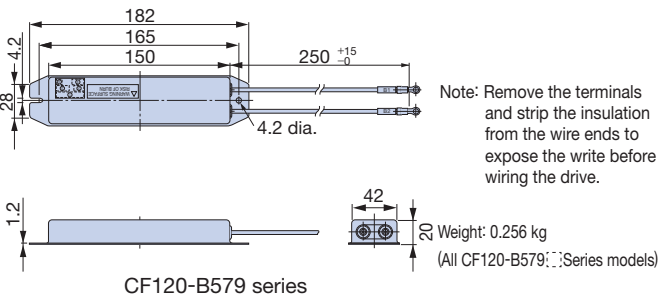
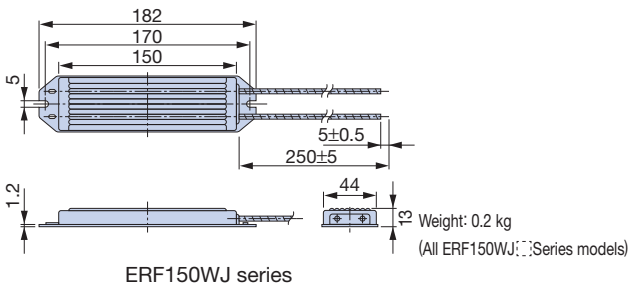


- \*1 : Disable Stall Prevention during deceleration by setting L3-04 (Stall Prevention Selection during Deceleration) to 0 (Disabled) when using a Braking Resistor or Braking Resistor Unit. The motor may not stop within the deceleration time if this setting is not changed from 1 (Enabled: default).
- \*2 : Set L8-01 to 1 to enable braking resistor overload protection in the drive when using ERF-type resistors.

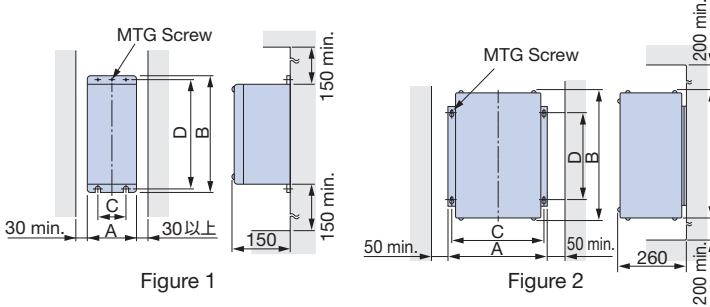
- \*3 : Be sure to protect non-Yaskawa braking resistors by thermal overload relay.
- Note: 1. For connections of the separate type braking unit (CDBR type) without using the built-in braking transistor, connect the B1 terminal of the drive to the + terminal of the braking resistor unit and connect the - terminal of the drive to the - terminal of the braking resistor unit. The B2 terminal is not used in this case. Set L8-55 = 0 (Internal DB Transistor Protection = Disable) to disable the protection function of the drive braking transistor. The drive may detect rF (Braking Resistor Fault).
2. Multiple braking resistors should be connected in parallel.

Dimensions (mm)

Braking Resistor



Braking Resistor Unit



Braking Resistor Unit Model	Figure	Dimensions (mm)					Weight (kg)	Allowable Average Power Consumption (W)
		A	B	C	D	MTG Screw		
LKEB-20P7	1	105	275	50	260	M5×3	3	30
LKEB-21P5	1	130	350	75	335	M5×4	4.5	60
LKEB-22P2	1	130	350	75	335	M5×4	4.5	89
LKEB-23P7	1	130	350	75	335	M5×4	5	150
LKEB-25P5	1	250	350	200	335	M6×4	7.5	220
LKEB-27P5	1	250	350	200	335	M6×4	8.5	300
LKEB-2011	2	266	543	246	340	M8×4	10	440
LKEB-2015	2	356	543	336	340	M8×4	15	600
LKEB-40P7	1	105	275	50	260	M5×3	3	30
LKEB-41P5	1	130	350	75	335	M5×4	4.5	60
LKEB-42P2	1	130	350	75	335	M5×4	4.5	89
LKEB-43P7	1	130	350	75	335	M5×4	5	150
LKEB-45P5	1	250	350	200	335	M6×4	7.5	220
LKEB-47P5	1	250	350	200	335	M6×4	8.5	300
LKEB-4011	2	350	412	330	325	M6×4	16	440
LKEB-4015	2	350	412	330	325	M6×4	18	600
LKEB-4018	2	446	543	426	340	M8×4	19	740
LKEB-4022	2	446	543	426	340	M8×4	19	880
LKEB-4030	2	356	956	336	740	M8×4	25	1200

## Specifications

### Three/Single-Phase 200 V Class

Max. Motor Capacity (kW)	ND/HD	GA500		Braking Resistor (Duty Factor: 3% ED, 10 s max.)*1										Braking Resistor Unit (Duty Factor : 10% ED, 10 s max.)*1						Min*2 Connectable Resistor (Ω)
		Three-Phase Catalog Code GA50A	Single-Phase Catalog Code GA50A	No Fuse					With Fuse					Model LKEB-	Resistor Specifications (per unit)	Qty.	Diagram	Braking Torque*3 (%)		
				Model ERF 150WJ	Resistance (Ω)	Qty.	Diagram	Braking Torque*3 (%)	Model CF120-B579	Resistance (Ω)	Qty.	Diagram	Braking Torque*3 (%)							
0.1	HD	2001	B001	401	400	1	A	220	A	400	1	A	220	40P7	70 W 750 Ω	1	B	220	300	
0.2	ND	2001	B001	401	400	1	A	220	A	400	1	A	220	40P7	70 W 750 Ω	1	B	125	300	
	HD	2002	B002																	
0.4	ND	2002	B002	401	400	1	A	110	A	400	1	A	110	40P7	70 W 750 Ω	1	B	65	300	
	HD	2004	B004	201	200	1	A	220	B	200	1	A	220	20P7	70 W 200 Ω	1	B	220	200	
0.75	ND	2004	B004	201	200	1	A	125	B	200	1	A	125	20P7	70 W 200 Ω	1	B	125	200	
	HD	2006	B006	201	200	1	A	125	B	200	1	A	125	20P7	70 W 200 Ω	1	B	125	120	
1.1	ND	2006	B006	201	200	1	A	85	B	200	1	A	85	20P7	70 W 200 Ω	1	B	85	120	
	HD	2008	—	101	100	1	A	150	C	100	1	A	150	21P5	260 W 100 Ω	1	B	150	60	
1.5	ND	2008	—	101	100	1	A	125	C	100	1	A	125	21P5	260 W 100 Ω	1	B	125	60	
	HD	2010	B010																	
2.2	ND	2010	B010	700	70	1	A	120	D	70	1	A	120	22P2	260 W 70 Ω	1	B	120	60	
	HD	2012	B012																	
3	ND	2012	B012	620	62	1	A	100	E	62	1	A	100	22P2	260 W 70 Ω	1	B	90	60	
	HD	2018	—	620	62	1	A	100	E	62	1	A	100	23P7	390 W 40 Ω	1	B	150	32	
3.7	ND	2018	—	620	62	1	A	80	E	62	1	A	80	23P7	390 W 40 Ω	1	B	125	32	
	HD	2021	B018																	
5.5	ND	2021	—	—	—	—	—	—	—	—	—	—	—	23P7	390 W 40 Ω	1	B	85	32	
	HD	2030	—	—	—	—	—	—	—	—	—	—	—	25P5	520 W 30 Ω	1	B	115	9.6	
7.5	ND	2030	—	—	—	—	—	—	—	—	—	—	—	27P5	780 W 20 Ω	1	B	125	9.6	
	HD	2042	—																	
11	ND	2042	—	—	—	—	—	—	—	—	—	—	—	2011	2400 W 13.6 Ω	1	B	125	9.6	
	HD	2056	—																	
15	ND	2056	—	—	—	—	—	—	—	—	—	—	—	2015	3000 W 10 Ω	1	B	125	9.6	
	HD	2070	—																	
18.5	ND	2070	—	—	—	—	—	—	—	—	—	—	—	2015	3000 W 10 Ω	1	B	100	9.6	
	HD	2082	—																	
22	ND	2082	—	—	—	—	—	—	—	—	—	—	—	2015	3000 W 10 Ω	1	B	85	9.6	

### Three-Phase 400 V Class

Max. Motor Capacity (kW)	ND/HD	GA500		Braking Resistor (Duty Factor: 3% ED, 10 s max.)*1										Braking Resistor Unit (Duty Factor : 10% ED, 10 s max.)*1						Min*2 Connectable Resistor (Ω)
		Catalog Code GA50A	No Fuse					With Fuse												
			Model ERF 150WJ	Resistance (Ω)	Qty.	Diagram	Braking Torque*3 (%)	Model CF120-B579	Resistance (Ω)	Qty.	Diagram	Braking Torque*3 (%)	Model LKEB-	Resistor Specifications (per unit)	Qty.	Diagram	Braking Torque*3 (%)			
0.2	HD	4001	751	750	1	A	230	F	750	1	A	230	40P7	70 W 750 Ω	1	B	230	750		
0.4	ND	4001	751	750	1	A	230	F	750	1	A	230	40P7	70 W 750 Ω	1	B	230	750		
	HD	4002																		
0.75	ND	4002	751	750	1	A	130	F	750	1	A	130	40P7	70 W 750 Ω	1	B	130	750		
	HD	4004	751	750	1	A	130	F	750	1	A	130	40P7	70 W 750 Ω	1	B	130	510		
1.5	ND	4004	751	750	1	A	70	F	750	1	A	70	40P7	70 W 750 Ω	1	B	70	510		
	HD	4005	401	400	1	A	125	G	400	1	A	125	41P5	260 W 400 Ω	1	B	125	240		
2.2	ND	4005	301	300	1	A	115	H	300	1	A	115	42P2	260 W 250 Ω	1	B	135	240		
	HD	4007	301	300	1	A	115	H	300	1	A	115	42P2	260 W 250 Ω	1	B	135	200		
3.0	ND	4007	401	400	2	A	125	J	250	1	A	100	42P2	260 W 250 Ω	1	B	100	200		
	HD	4009	401	400	2	A	125	J	250	1	A	100	43P7	390 W 150 Ω	1	B	150	100		
3.7	ND	4009																		
	HD	4012	401	400	2	A	105	J	250	1	A	83	43P7	390 W 150 Ω	1	B	135	100		
5.5	ND	4012	201	200	2	A	135	J	250	2	A	105	45P5	520 W 100 Ω	1	B	135	100		
	HD	4018	—	—	—	—	—	—	—	—	—	—	45P5	520 W 100 Ω	1	B	135	32		
7.5	ND	4018																		
	HD	4023	—	—	—	—	—	—	—	—	—	—	47P5	780 W 75 Ω	1	B	130	32		
11	ND	4023	—	—	—	—	—	—	—	—	—	—	4011	1040 W 50 Ω	1	B	135	32		
	HD	4031	—	—	—	—	—	—	—	—	—	—	4011	1040 W 50 Ω	1	B	135	20		
15	ND	4031	—	—	—	—	—	—	—	—	—	—	4015	1560 W 40 Ω	1	B	125	20		
	HD	4038																		
18.5	ND	4038	—	—	—	—	—	—	—	—	—	—	4018	4800 W 32 Ω	1	B	125	20		
	HD	4044	—	—	—	—	—	—	—	—	—	—	4018	4800 W 32 Ω	1	B	125	19.2		
22	ND	4044																		
	HD	4060	—	—	—	—	—	—	—	—	—	—	4022	4800 W 27.2 Ω	1	B	125	19.2		
30	ND	4060	—	—	—	—	—	—	—	—	—	—	4030	6000 W 20 Ω	1	B	125	19.2		

\*1: Refers to a motor coasting to stop with a constant torque load. Constant output and regenerative braking will reduce the duty factor.

\*2: The braking unit should have a resistance higher than the minimum connectable resistance value and be able to generate enough braking torque to stop the motor.

\*3: Applications with a relatively large amount of regenerative power (elevators, hoists, etc.) may require more braking power than is possible with only the standard braking unit and braking resistor. If the braking torque exceeds the value shown in the table, a braking resistor of a higher capacity must be selected.

Note: If the built-in fuse on a braking resistor blows, then the entire braking resistor should be replaced.

# Peripheral Devices and Options (continued)

## Keypad



LCD Keypad

Specification	Model	Code No.
Standard	JVOP-KPLCA04AEA	100-245-993
Humidity, dust	JVOP-KPLCA04MEA	100-245-994



Bluetooth LCD Keypad

Specification	Model	Code No.
Standard	JVOP-KPLCC04ABA	100-225-008
Humidity, dust	JVOP-KPLCC04MBA	100-225-009

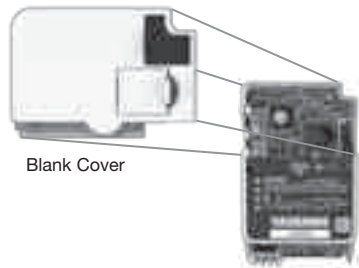
Note: 1. Certified international standards: CE, FCC, IC (Industry Canada), CMIIT, MIC Japan  
2. This keypad is equipped with a wireless device. The usage of wireless devices may be restricted in accordance with the Radio Law in each country. Check relevant laws and regulations in each country before using the product.

Note: To attach the LCD keypad to the drive body, install an attachment option sold separately. Contact Yaskawa for details.



LED Keypad

Specification	Model	Code No.
Standard	JVOP-KPLEA04AAA	100-206-377
Humidity, dust	JVOP-KPLEA04MAA	100-206-378

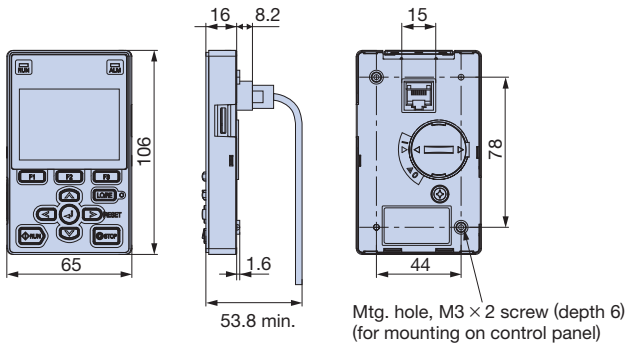


Blank Cover

Specification	Model	Code No.
Blank Cover	JVOP-KPBCH04AAA	100-247-125

## Keypad Extension Cable

Dimensions (mm)



Keypad Extension Cable

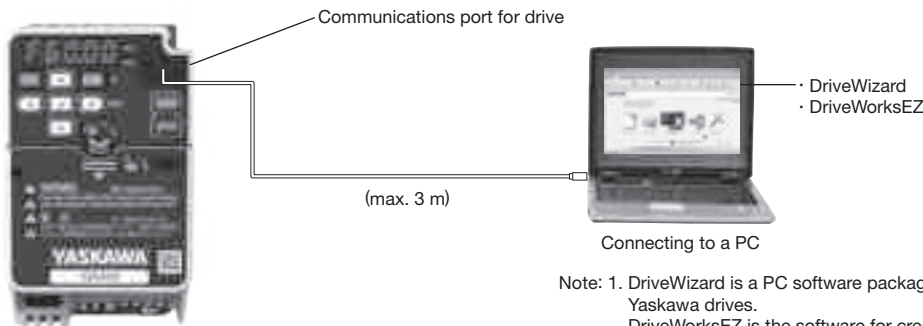
Model	Code No.	Remarks
WV001 (1 m)	WV001	· RJ-45, 8-pin straight-through · UTP CAT5e cable (1 m/3 m) Note: Use straight-through cable. Other cables will cause drive failure.
WV003 (3 m)	WV003	

Note: 1. Never use this cable for connecting the drive to a PC. Doing so may damage the PC.  
2. You can also use a commercially-available LAN cable (straight cable).

## PC Cable

Cable to connect the drive to a PC with DriveWizard or DriveWorksEZ installed.  
Use a commercially available USB 2.0 cable (A-miniB connectors, max. 3 m).

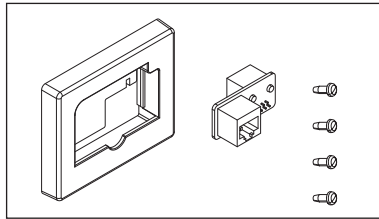
Connection



Note: 1. DriveWizard is a PC software package for managing parameters and functions in Yaskawa drives. DriveWorksEZ is the software for creating custom application programs for the drive through visual programming.  
2. The USB Copy Unit (Model: JVOP-181) which can be used for the conventional product line is not available.

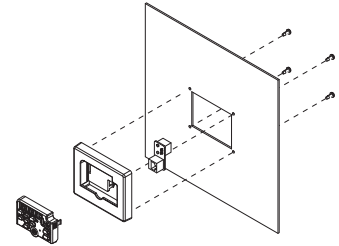
## ● Compact Keypad Panel Mounting Kit

Attachment for Half-Size LED Keypad



Model	Code No.	Notes
ZPBA-GA500	100-243-165	For use with holes through the panel

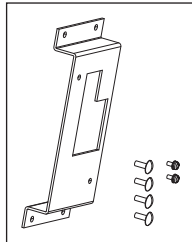
Installation



Attachment for LED Keypad, LCD Keypad, and Bluetooth LCD Keypad

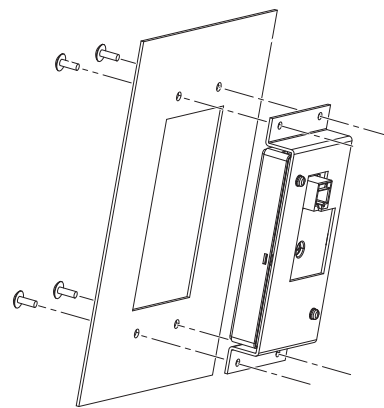
An installation support set is needed to install the LED keypad, LCD keypad, or Bluetooth LCD keypad on the control panel.

Installation Support Set A

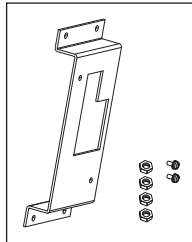


Model	Code No.	Notes
900-192-933-001	100-203-008	For use with holes through the panel

Installation Using Set A



Installation Support Set B



Model	Code No.	Notes
900-192-933-002	100-203-009	For use with panel mounted threaded studs

Note: If there are weld studs on the interior of the control panel, use the installation support set B (nut clamp).

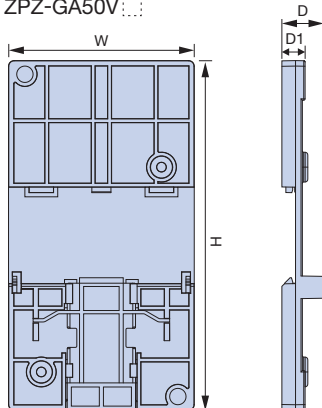
## ● DIN Rail Attachment

Use a DIN rail attachment option to easily mount or remove the drive. The attachment is applicable to models with dimensions of 170 mm (W) and 128 mm (H) max.

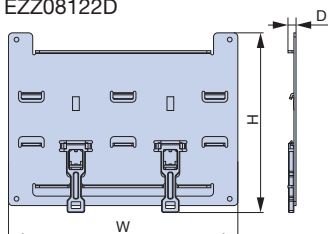
Not for use with finless-type models (models without a heatsink).

Dimension (Heatsink for a 200 V 0.4 kW drive)

ZPZ-GA50V□



EZZ08122D



Catalog Code GA50A□	Dimensions mm				Model	Code No.
	W	H	D	D1		
2001	68	128	15.3	8.5	ZPZ-GA50V1	100-242-246
2002						
2004						
2006						
2008	106	128	15.3	8.5	ZPZ-GA50V2	100-242-247
2010						
2012						
2018						
2021	138	128	15.3	8.5	ZPZ-GA50V3	100-242-248
B001						
B002						
B004						
B006	106	128	15.3	8.5	ZPZ-GA50V2	100-242-247
B010						
B012						
B018						
B018	170	133	-	6	EZZ08122D	100-146-899
4001	106	128	15.3	8.5	ZPZ-GA50V2	100-242-247
4002						
4004						
4005						
4007						
4009						
4012						
4012	138	128	15.3	8.5	ZPZ-GA50V3	100-242-248

## Peripheral Devices and Options (continued)

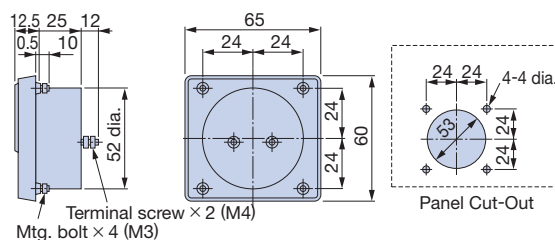
### Frequency Meter/Current Meter



Model	Code No.
Scale-75 Hz full-scale: DCF-6A	100-250-730
Scale-65/130 Hz full-scale: DCF-6A	100-250-728
Scale-5 A full-scale: DCF-6A	100-252-699
Scale-10 A full-scale: DCF-6A	100-252-695
Scale-20 A full-scale: DCF-6A	100-252-696
Scale-30 A full-scale: DCF-6A	100-252-697
Scale-50 A full-scale: DCF-6A	100-252-698

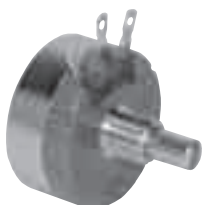
Note: DCF-6A specifications are 3 V, 1 mA, and 3 k $\Omega$  inner impedance. Because the GA500 multifunction analog monitor output default setting is 0 to 10 V, set frequency meter adjusting potentiometer (20 k $\Omega$ ) or parameter H4-02 (analog monitor output gain) within the range of 0 to 3 V. Installation

#### Dimensions (mm)



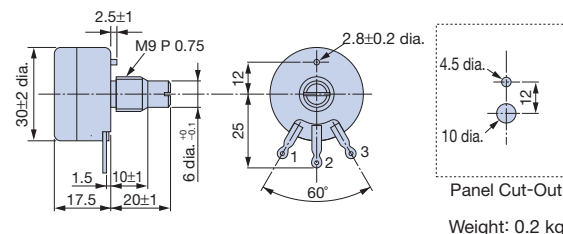
Weight: 0.3 kg

### Frequency Setting Potentiometer/Frequency Meter Adjusting Potentiometer



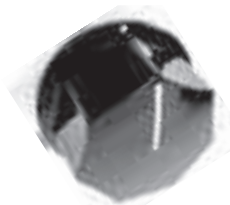
Model	Code No.
2 k $\Omega$ : RV30YN	100-250-722
20 k $\Omega$ : RV30YN20S	100-250-723

#### Dimensions (mm)



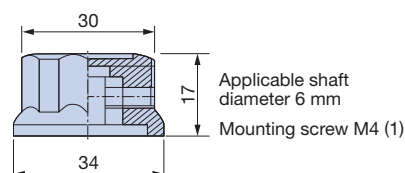
Weight: 0.2 kg

### Control Dial for Frequency Setting Potentiometer/Frequency Meter Adjusting Potentiometer



Model	Code No.
K-2901-M	100-250-544

#### Dimensions (mm)

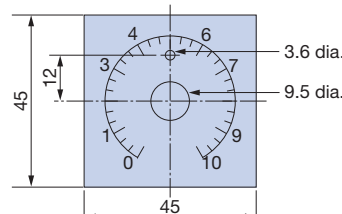


### Meter Plate for Frequency Setting Potentiometer/Frequency Meter Adjusting Potentiometer



Model	Code No.
NPJT41561-1	100-250-701

#### Dimensions (mm)



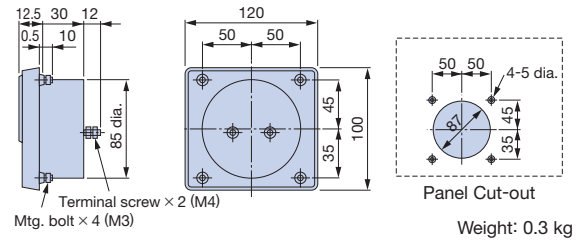
## ● Output Voltage Meter



Model	Code No.
Scale-300 V full-scale (Rectification Type Class 2.5: SCF-12NH)	100-250-739
Scale-600 V full-scale (Rectification Type Class 2.5: SCF-12NH)	100-250-740

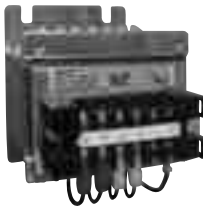
Note: When using a scale-600 V full-scale meter, connect a potential transformer.

### Dimensions (mm)



## ● Potential Transformer

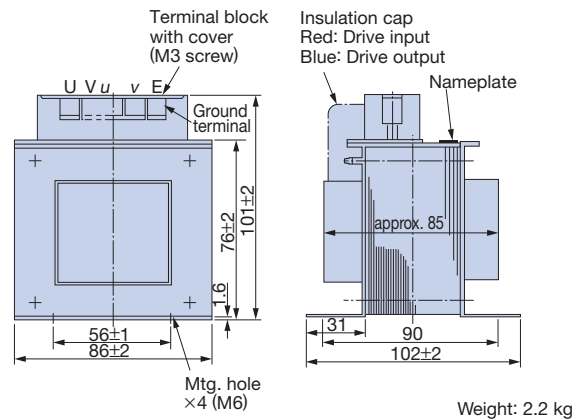
Use potential transformer when using scale-600 V full-scale output voltage meter.



Model	Code No.
600 V meter for voltage transformer UPN-B 440/110 V (400/100 V)	100-250-548

Note: For use with a standard voltage regulator.  
A standard voltage regulator may not match the drive output voltage. Select a regulator specifically designed for the drive output (100-250-548), or a voltmeter that does not use a transformer and offers direct read out.

### Dimensions (mm)





## ● Application Notes

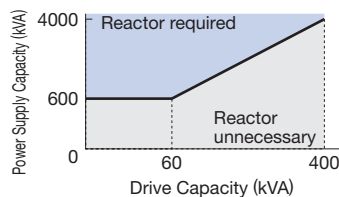
### Selection

#### ■ Installing a Reactor

An AC or DC reactor can be used for the following situations:

- when the power supply is 600 kVA or more.
- to smooth peak current that results from switching a phase advance capacitor.
- to improve the power supply power factor.

Use an AC reactor when also connecting a thyristor converter to the same power supply system, regardless of the conditions of the power supply.



#### ■ Drive Capacity

The rated output current of the drive output amps should be equal to or greater than the motor rated current. When running a specialized motor or more than one motor in parallel from a single drive, the capacity of the drive should be larger than 1.1 times of the total motor rated current.

#### ■ Starting Torque

The overload rating for the drive determines the starting and accelerating characteristics of the motor. Expect lower torque than when running from line power. To get more starting torque, use a larger drive or increase both the motor and drive capacity.

#### ■ Emergency Stop

When the drive faults out, a protective circuit is activated and drive output is shut off. This, however, does not stop the motor immediately. Some type of mechanical brake may be needed if it is necessary to halt the motor faster than the Fast Stop function is able to.

#### ■ Options

The B1, B2, -, +1, and +2 terminals are used to connect optional devices. Connect only GA500-compatible devices.

#### ■ Repetitive Starting/Stopping

Cranes (hoists), elevators, punching presses, and other such applications with frequent starts and stops often exceed 150% of their rated current values. Heat stress generated from repetitive high current can shorten the lifespan of the IGBTs. The expected lifespan for the IGBTs is about 8 million start and stop cycles with a 2 kHz carrier frequency and a

150% peak current.

Yaskawa recommends lowering the carrier frequency, particularly when audible noise is not a concern. The user can also choose to reduce the load, increase the acceleration and deceleration times, or switch to a larger drive. This will help keep peak current levels under 150%. Be sure to check the peak current levels when starting and stopping repeatedly during the initial test run, and make adjustments accordingly. For cranes and other applications using the inching function in which the drives starts and stops the motor repeatedly, Yaskawa recommends the following steps to ensure torque levels:

- Select a large enough drive so that peak current levels remain below 150%.
- The drive should be one frame size larger than the motor.

- As the carrier frequency of the drive is increased above the factory default setting, the drive's rated output current must be derated. Refer to the instruction manual of the drive for details on this function.

### Installation

#### ■ Enclosure Panels

Keep the drive in a clean environment by either selecting an area free of airborne dust, lint, oil mist, corrosive gas, and flammable gas, or install the drive in an enclosure panel. Leave the required space between the drives to provide for cooling, and take steps to ensure that the ambient temperature remains within allowable limits. Keep flammable materials away from the drive. If the drive must be used in an area where it is subjected to oil mist and excessive vibration, protective designs are available. Contact Yaskawa for details.

#### ■ Installation Direction

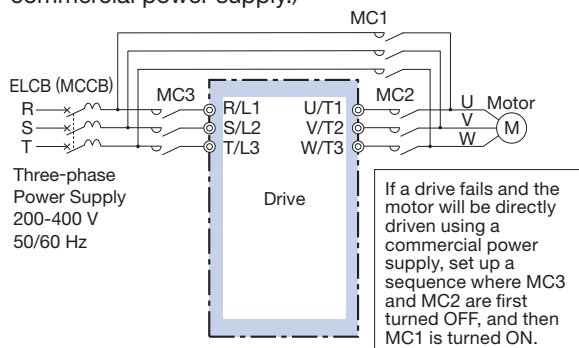
Install either vertically or horizontally. Refer to the Technical Manual for information about installation conditions.

#### ■ Installation of Bypass Circuit

If the fuse blows or the molded case circuit breaker (MCCB) trips, check the cable wiring and selection of peripheral devices and identify the cause. If the cause cannot be identified, do not turn ON the power supply or operate the device. Contact your Yaskawa representative.

If a drive fails and the motor will be directly driven using a commercial power supply, install the bypass circuit shown in the diagram below. If this bypass circuit is not installed, remove the drive and then connect the motor to a commercial power supply. (In other words, after

disconnecting the cables connected to the main circuit terminals, such as main circuit power supply input terminals R/L1, S/L2, and T/L3 and drive output terminals U/T1, V/T2, and W/T3, connect the motor to a commercial power supply.)



## Settings

- Use V/f Control when running multiple induction motors at the same time.
- If using Open Loop Vector Control designed for permanent magnet motors, make sure that the proper motor code has been set to parameter E5-01 before performing a trial run.
- Upper Limits  
Because the drive is capable of running the motor at up to 590 Hz, be sure to set the upper limit for the frequency to control the maximum speed. The default setting for the maximum output frequency is 60 Hz.
- Pay close attention as follows when using DriveWorksEZ.  
I/O terminal function of the drive will change with the function of the default terminal depending on the setting. Before test running the drive based on programs created by DriveWorksEZ, always check the I/O signal of the drive and the internal sequence. Failure to check may result in death or serious injury.
- Pay attention to the following points when using the Virtual I/O function.  
This function virtually wires the I/O terminal of the drive internally.  
Consequently, the behavior of the drive may differ from its defaults, even if there is no wiring in the I/O terminal. Before conducting a test operation, always check the setting values for the parameter of the Virtual I/O function. Failure to check may result in death or serious injury.

## DC Injection Braking

Motor overheat can result if there is too much current used during DC Injection Braking, or if the time for DC Injection Braking is too long.

## Acceleration/Deceleration Times

Acceleration and deceleration times are affected by how much torque the motor generates, the load torque, and the inertia moment ( $GD^2/4$ ). Set a longer accel/decel time when Stall Prevention is enabled. The accel/decel times are lengthened for as long as the Stall Prevention function is operating. For faster acceleration, increase the capacity of both the motor and the drive. For faster deceleration, use a braking resistor or a power regenerative unit.

## General Handling

### Electrical Shock Hazard

Failure to comply may result in death or serious injury. Do not allow unqualified personnel to perform work on the drive. Installation, maintenance, inspection, and servicing must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of AC drives.

### Wiring Check

Never short the drive output terminals or apply voltage to output terminals (U/T1, V/T2, W/T3), as this can cause serious damage to the drive. Doing so will destroy the drive. Be sure to perform a final check of all sequence wiring and other connections before turning the power on. Make sure there are no short circuits on the control terminals (+V, AC, etc.), as this could damage the drive. Retighten the screws for the wiring terminals periodically.

### European Terminal

- For European terminals, do not shake the wires excessively or pull on the wires too much.
- When connecting uninsulated wire and when crimping wire to the solderless terminal, do not let the wire protrude past the conductor section. Pay close attention to this because it could cause a short circuit.
- Check for any unsuitable wire size connections.
- Tighten at the specified torque.

## Application Notes (continued)

### ■ European Terminal Wiring Work

Heed the following points. Follow the procedure in the manual concerning all points except the following.

- Use the torque driver or a torque wrench and ratchet. The tip of a straight-edge screwdriver or a hex socket tool is required for wiring the European terminal.
- Wiring tools can be purchased from Yaskawa. Contact Yaskawa. The torque wrench should be supplied by the customer.
- To replace a previous model, the wires that are used may be partially out of connection range. Contact Yaskawa beforehand about the available wire gauges.

### ■ Magnetic Contactor Installation

Avoid switching a magnetic contactor on the power supply side more frequently than once every 30 minutes.

Frequent switching can cause damage to the drive.

### ■ Optional Keypad

[microSD card]

- The microSD supports microSD, and microSD HC with a capacity of up to 32 GB.
- Plug in and remove the microSD card after turning off the power supply for the drive. Do not remove the microSD card or de-energize the keypad when accessing the microSD card. This may cause data loss and failure.
- If there are many files and folders on the SD card or if the free space on the microSD card is low, the microSD may not run properly.

[Connection via USB]

- Use a miniUSB cable. The USB connection between the PC and keypad is not possible while the drive and keypad are connected. First remove the keypad from the drive and then connect with the PC.
- While connected to the USB, it is not possible from a PC to access the files on a microSD card that is inserted.

### ■ Inspection and Maintenance

After shutting off the drive, make sure the CHARGE light has gone out completely before performing any inspection or maintenance. Residual voltage in drive capacitors can cause serious electric shock.

The heatsink can become quite hot during operation, and proper precautions should be taken to prevent burns. When replacing the cooling fan, shut off the power and wait at least 15 minutes to be sure that the heatsink has cooled down.

### ■ Wiring on UL- and cUL-certified drives

When performing wiring work on UL/cUL-certified drives, wire the drives at their recommended tightening torques using UL/cUL-compliant wires. For drives that require connection with closed-loop crimp terminals, use closed-loop crimp terminals and perform closed-loop crimping work using the crimping tools specified by the terminal manufacturer.

### ■ Replacing an existing model

If replacing an existing model with GA500, the wire connection method should be changed. Cut off the crimp terminal and remove the covering to expose the wires. If an uninsulated wire is already connected to it, check the condition of the tip of the wire. After peeling of the dressing as necessary, wire again.

### ■ Transporting the Drive

Never steam clean the drive. During transport, keep the drive from coming into contact with salts, fluorine, bromine and other such harmful chemicals.

## Storage

The drive contains electrolytic capacitors and fine electronic components that undergo chemical changes. Observe the following precautions to help maintain the expected performance life and reliability during long-term storage.

### ■ Storage Location

- Temperature and humidity  
Storage temperatures between  $-20$  to  $+70^{\circ}\text{C}$  are allowed when storing the drive for approximately one month. During transport, store and pack the drive so that it is isolated from as much vibration and shock as possible. Store the drive in a location with a relative humidity of 95% or less. Do not store the drive in direct sunlight or where condensation or ice will form.
- Dust and oil mist  
Do not store the drive in dusty locations or locations that are susceptible to oil mist, such as the site of a cement factory or cotton mill.
- Corrosive gas  
Do not store the drive in an area that may contain corrosive gas or in a location like a chemical plant, refinery, or sewage facility.
- Salt-air damage  
Do not store the drive in locations that are subject to salt damage, such as near the ocean, and salt damage-designated zones, in particular.

Do not store the drive in adverse environments. Store all drives in storage rooms that are not subjected to adverse environmental elements.

#### ■ Periodic Power Application

Try to apply power to the drive once per year for at least 30 minutes to prevent the capacitors from deteriorating.

When applying power after power has not been applied for more than two years, Yaskawa recommends using a variable power source and gradually increasing the power over a period of 2 to 3 minutes. Apply power for at least 1 hour with no load to age the main circuit electrolytic capacitor.

Wire the drive normally and check for drive faults, overcurrents, motor vibration, speed fluctuations, and other abnormalities during operation after performing the above procedure.

#### ■ Environmental Specifications

The drive must not be used in the above mentioned environments. However, if it is difficult to avoid running the drive in these environments, Yaskawa offers special drives that are resistant to moisture, gas, vibrations, and salt. Contact Yaskawa for details.

Be aware that drives with these specifications do not guarantee complete protection for the environmental conditions indicated.

#### ■ Contact Yaskawa when running an isolation test with a drive.

## ● Peripheral Devices

### ■ Installing an ELCB or an MCCB

- Be sure to install an MCCB or an ELCB that is recommended by Yaskawa at the power supply side of the drive to protect internal circuitry.
  - The type of MCCB is selected depending on the power supply power factor (power supply voltage, output frequency, load characteristics, etc.). Sometimes a fairly large MCCB may be required due to the affects of harmonic current on operating characteristics. If you do not use a recommended ELCB, use one fitted for harmonic suppression measures and designed specifically for drives. A malfunction may occur due to high-frequency leakage current, so the rated current of the ELCB must be 30 mA or higher per drive unit. If a malfunction occurs in an ELCB without any countermeasures, reduce the carrier frequency of the drive, replace the ELCB with one that has countermeasures against high frequency, or use an ELCB which has a rated current of 200 mA or higher per drive unit.
- Select an MCCB or an ELCB with a rated capacity greater than the short-circuit current for the power supply. For a fairly large power supply transformer, a fuse can be added to the ELCB or MCCB in order to handle the short-circuit current level.

### ■ Magnetic Contactor for Input Power

Use a magnetic contactor (MC) to ensure that power to the drive can be completely shut off when necessary. The MC should be wired so that it opens when a fault output terminal is triggered.

Even though an MC is designed to switch to a momentary power loss, frequent MC use can damage other components.

Avoid switching the MC more than once every 30 minutes. The MC will not be activated after a momentary power loss if using the keypad to run the drive. This is because the drive is unable to restart automatically when set for LOCAL.

Although the drive can be stopped by using an MC installed on the power supply side, the drive cannot stop the motor in a controlled fashion, and it will simply coast to stop. If a braking resistor or dynamic braking unit has been installed, be sure to set up a sequence that opens the MC with a thermal protector switch connected to the braking resistor device.

## Application Notes (continued)

### ■ Magnetic Contactor for Motor

As a general principle, the user should avoid opening and closing the magnetic contactor during run when the contactor is installed between the motor and the drive. Doing so can cause high peak currents and overcurrent faults. If magnetic contactors are used to bypass the drive by connecting the motor to the power supply directly, make sure to close the bypass only after the drive is stopped and fully disconnected from the motor. The Speed Search function can be used to start a coasting motor.

Use an MC with delayed release if momentary power loss is a concern.

### ■ Motor Thermal Over Load Relay Installation

Although the drive comes with built in electrothermal protection to prevent damage from overheat, a thermal relay should be connected between the drive and each motor if running several motors from the same drive. For a multi-pole motor or some other type of nonstandard motor, Yaskawa recommends using an external thermal relay appropriate for the motor. Be sure to disable the motor protection selection parameter (L1-01 = 0), and set the thermal relay or thermal protection value to 1.1 times the motor rated current listed on the motor nameplate. When long motor cables and high carrier frequency are used, nuisance tripping of the thermal relay may occur due to increased leakage current. Therefore, reduce the carrier frequency or increase the tripping level of the thermal overload relay.

### ■ Improving the Power Factor

Install a DC reactor, AC reactor, or Power Regenerative Converter D1000 to the drive input side to improve the power factor.

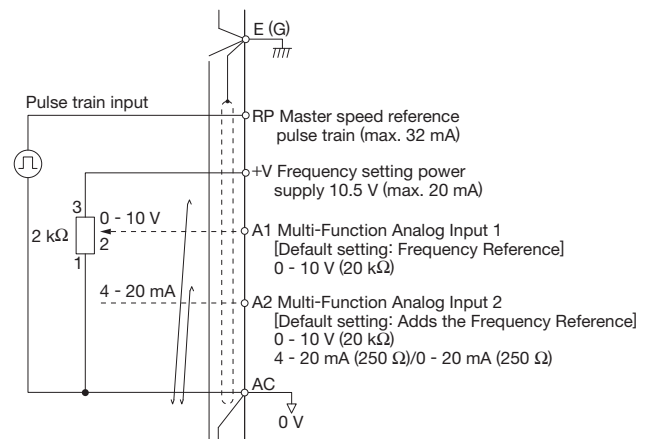
Refrain from using a capacitor or surge absorber on the output side as a way of improving the power factor, because high-frequency contents on the output side can lead to damage from overheat. This can also lead to problems with overcurrent.

### ■ Radio Frequency Interference

Drive output contains high-frequency contents that can affect the performance of surrounding electronic instruments such as an AM radio. These problems can be prevented by installing a noise filter, as well as by using a properly grounded metal conduit to separate wiring between the drive and motor.

### ■ Wire Gauges and Wiring Distance

Motor torque can suffer as a result of voltage loss across a long cable running between the drive and motor, especially when there is low frequency output. Make sure that a large enough wire gauge is used. The keypad requires an extensional cable for remote operation. If an analog signal is used to operate the drive via the input terminals, make sure that the wire between the analog operator and the drive is no longer than 50 m, and that it is properly separated from the main circuit wiring. Use reinforced circuitry (main circuit and relay sequence circuitry) to prevent inductance from surrounding devices. To run the drive with a frequency potentiometer via the external terminals, use twisted shielded pair cables and ground the shield.

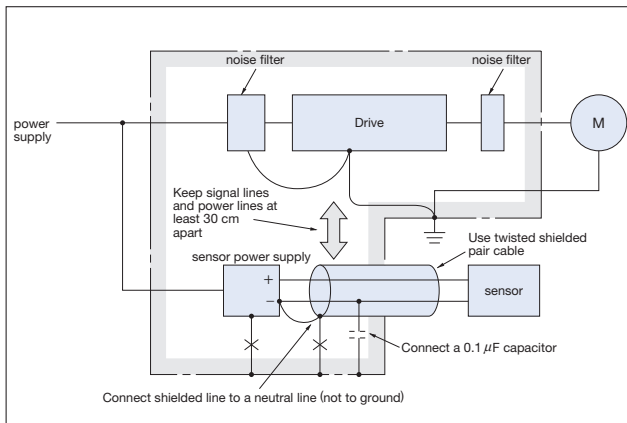




## ■ Counteracting Noise

Because GA500 is designed with PWM control, a low carrier frequency tends to create more motor flux noise than using a higher carrier frequency. Keep the following points in mind when considering how to reduce motor noise:

- Lowering the carrier frequency (C6-02) minimizes the effects of noise.
- A line noise filter can reduce the affects on AM radio frequencies and poor sensor performance. See "Peripheral Devices and Options" on page 48.
- Make sure the distance between signal and power lines is at least 10 cm (up to 30 cm is preferable), and use twisted pair cable to prevent induction noise from the drive power lines.



<Provided by JEMA>

## ■ Leakage Current

High-frequency leakage current passes through stray capacitance that exists between the power lines to the drive, ground, and the motor lines. Consider using the following peripheral devices to prevent problems with leakage current.

	Problem	Solution
Ground Leakage Current	MCCB is mistakenly triggered	<ul style="list-style-type: none"> <li>• Lower the carrier frequency set to parameter C6-02.</li> <li>• Try using a component designed to minimize harmonic distortion for the MCCB such as the NV series by Mitsubishi.</li> </ul>
Current Leakage Between Lines	Thermal relay connected to the external terminals is mistakenly triggered by harmonics in the leakage current	<ul style="list-style-type: none"> <li>• Lower the carrier frequency set to parameter C6-02.</li> <li>• Use the drive's built-in thermal motor protection function.</li> </ul>

The following table shows the guidelines for the set value of the carrier frequency relative to the wiring distance between the drive and the motor when using V/f control.

Wiring Distance*	50 m or less	100 m or less	100 m or more
C6-02: Carrier Frequency Selection	1 to A (15 kHz or less)	1, 2, 7 to A (5 kHz or less)	1, 7 to A (2 kHz or less)

\*: When a single drive is used to run multiple motors, the length of the motor cable should be calculated as the total distance between the drive and each motor.

When the wiring distance exceeds 100 m, use the drive observing the following conditions.

- Select V/f control mode (A1-02=0)
  - To start a coasting motor
    - a) Use the current detection type (b3-24=0) when using the speed search function, or
    - b) Set the DC injection braking time at start (b2-03=0.01 to 10.00 sec) to stop a coasting motor and restart it.
- More than one PM motor cannot be connected to a single drive. The maximum wiring distance between the drive and the PM motor must be 100 m.

## ● Notes on Motor Operation

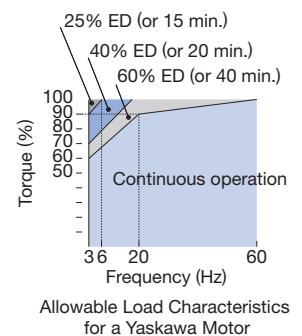
### ■ Motor Bearing Life

In applications involving constant speed over long periods, such as fans, pumps, extruders, and textile machinery, the life of the motor bearing may be shortened. This is called bearing electrolytic corrosion. The installation of a zero-phase reactor between the drive and motor, and the utilization of a motor with insulated bearings are effective countermeasures. Details can be found in the technical documentation. Contact your Yaskawa or nearest sales representative for more information.

### Using a Standard Motor

#### ■ Low Speed Range

There is a greater amount of loss when operating a motor using an drive than when running directly from line power. With a drive, the motor can become quite hot due to the poor ability to cool the motor at low speeds. The load torque should be reduced accordingly at low speeds. The figure above shows the allowable load characteristics for a Yaskawa standard motor. A motor designed specifically for operation with a drive should be used when 100% continuous torque is needed at low speeds.



#### ■ Insulation Tolerance

Consider voltage tolerance levels and insulation in applications with an input voltage of over 440 V or particularly long wiring distances. Use a drive motor that has been equipped with isolation countermeasures.

#### ■ High Speed Operation



## Application Notes (continued)

Problems may occur with the motor bearings and dynamic balance in applications operating at over 60 Hz. Contact Yaskawa for consultation.

### ■ Torque Characteristics

Torque characteristics differ when operating directly from line power. The user should have a full understanding of the load torque characteristics for the application.

### ■ Vibration and Shock

The motor may generate vibrations in the following circumstances.

#### (1) Resonance

Take particular caution when using a variable speed drive for an application that is conventionally run from line power at a constant speed. Shock-absorbing rubber should be installed around the base of the motor and the Jump Frequency selection should be enabled to prevent resonance.

#### (2) Any imperfection on a rotating body increases vibration with speed.

Caution should be taken when operating above the motor rated speed.

#### (3) Subsynchronous Resonance

Subsynchronous resonance may occur in fans, blowers, turbines, and other applications with high load inertia, as well as in motors with a relatively long shaft. Use GA700, A1000 or U1000, which you can use Closed Loop Vector Control for PM.

### ■ Audible Noise

Noise created during run varies by the carrier frequency setting. Using a high carrier frequency creates about as much noise as running from line power. Operating above the rated speed (i.e., above 60 Hz), however, can create unpleasant motor noise.

## Using a Highly Efficient Motor

### ■ IE3 Motor

The IE3 motor has superior features compared to the standard IE1 motors. Contact Yaskawa for technical documents.

Refer to "Using a PM Motor" for more information on highly efficient motor using PM motors.

## Using a PM Motor

■ If using a motor other than the Yaskawa PM motor, contact your Yaskawa or nearest sales representative.

■ If the motor must be run using commercial power supply, use an IM motor.

■ A single drive is not capable of running multiple PM motors at the same time. Use a standard induction motor for such setups.

■ When starting in Open Loop Vector Control for PM, the half rotation angle (electrical angle) of the motor may rotate reverse.

■ The starting torque varies depending on the control mode and motor being used. Set up the motor with the drive after verifying the starting torque, allowable load characteristics, impact load tolerance, and speed control range. To use the device beyond these ranges, contact a Yaskawa representative or salesperson.

■ Even with a braking resistor, braking torque is less than 125% when running between 20% to 100% speed, and falls to less than half the braking torque when running at less than 20% speed in Open Loop Vector Control for PM.

■ In Open Loop Vector Control for PM, the allowable load inertia moment is 50 times less than the motor inertia moment. For additional applications, use GA700, A1000 or U1000, which you can use Closed Loop Vector Control for PM.

■ When using a holding brake in Open Loop Vector Control for PM, release the brake prior to starting the motor. Failure to set the proper timing can result in speed loss. Conveyor, transport, and hoist applications using a holding brake should run an IPM motor in Closed Loop Vector Control for PM. Do not use this for conveyor machines and gravity load applications such as elevators in particular.

■ In Open Loop Vector Control, use the Short Circuit Braking function to stop the motor so that the motor coasting at a speed of at least 120 Hz can be started. A specialized braking resistor is required to use the Short Circuit Braking function. Contact a Yaskawa representative or salesperson for more information. Speed Search can be used to restart a coasting motor

rotating slower than 120 Hz. If the motor cable is relatively long, however, the motor should instead be stopped using Short Circuit Braking function and then restarted.

Note: Short Circuit Braking creates a short-circuit in the motor windings to forcibly stop a coasting motor.

- EZ Open Loop Vector Control is also able to drive SynRM (synchronous reluctance motor). Contact Yaskawa or your nearest sales representative for details.

- If oC (Overcurrent), STPo (Pull-Out Detection) and LSo (LSo Fault) occur when restarting the motor, use search retry and Short Circuit Braking when starting the motor, and adjust accordingly.

## ● Applications with Specialized Motors

### ■ Multi-Pole Motor

Because the rated current will differ from a standard motor, be sure to check the maximum current when selecting a drive. Always stop the motor before switching between the number of motor poles. If a regenerative overvoltage fault occurs or if overcurrent protection is triggered, the motor will coast to stop.

### ■ Submersible Motor

Because motor rated current is greater than a standard motor, select the drive capacity accordingly. Be sure to use a large enough motor cable to avoid decreasing the maximum torque level on account of voltage drop caused by a long motor cable.

### ■ Explosion-Proof Motor

Both the motor and drive need to be tested together to be certified as explosion-proof. The drive is not for explosion proof areas.

### ■ Geared Motor

Continuous operation specifications differ by the manufacturer of the lubricant. Due to potential problems of gear damage when operating at low speeds, be sure to select the proper lubricant. Consult with the manufacturer for applications that require frequencies in excess of the rated frequency.

### ■ Single-Phase Motor

Variable speed drives are not designed for operating single phase motors. Using a capacitor to start the motor causes high-frequency current to flow into the capacitors, potentially causing damage. A split-phase start or a repulsion start can end up burning out the

starter coils because the internal centrifugal switch is not activated. GA500 is for use only with 3-phase motors.

### ■ Uras Vibrator

Uras vibrator is a vibration motor that gets power from centrifugal force by rotating unbalanced weights on both ends of the shaft. Make the following considerations when selecting a drive for use with an Uras vibrator:

- (1) Uras vibrator should be used within the drive rated frequency
- (2) Use V/f Control
- (3) Increase the acceleration time five to fifteen times longer than would normally be used due to the high amount of load inertia of an Uras vibrator  
Note: A drive with a different capacity must be selected if the acceleration time is less than 5 s.
- (4) Drive may have trouble starting due to undertorque that results from erratic torque (static friction torque at start)

### ■ Motor with Brake

Caution should be taken when using a drive to operate a motor with a built-in holding brake. If the brake is connected to the output side of the drive, it may not release at start due to low voltage levels. A separate power supply should be installed for the motor brake. Motors with a built-in brake tend to generate a fair amount of noise when running at low speeds.

## Power Driven Machinery

Continuous operation at low speeds wears on the lubricating material used in gear box type systems to accelerate and decelerate power driven machinery. Note also that operation at a frequency exceeding the rated frequency can cause problems with the power transmission mechanism, including audible noise, performance life, and durability due to centrifugal force.

## ● Warranty Information

### ■ Warranty Period

The period is 12 months from the date the product is first used by the buyer, or 18 months from the date of shipment, whichever occurs first.

### ■ Post-Warranty Repair Period

The post-warranty repair period applies to products that are not in the standard warranty period.

During the post-warranty repair period, Yaskawa will repair or replace damaged parts for a fee.

There is a limit to the period during which Yaskawa will repair or replace damaged parts.

Contact Yaskawa or your nearest sales representative for more information.

### ■ Warranty Scope

#### Failure diagnosis

The primary failure diagnosis shall be performed by your company as a rule.

By your company's request, however, we or our service sector can execute the work for your company for pay.

In such a case, if the cause of the failure is in our side, the work is free.

#### Repair

When a failure occurred, repairs, replacement, and trip to the site for repairing the product shall be free of charge.

However, the following cases have to be paid.

- Cases of failure caused by inappropriate storing, handling, careless negligence, or system design errors performed by you or your customers.
- Cases of failure caused by a modification performed by your company without our approval.
- Cases of failure caused by using the product beyond the specification range.
- Cases of failure caused by force majeure such as natural disaster and fire.
- Cases in which the warranty period has expired.
- Cases of replacement of consumables and other parts with limited service life.
- Cases of product defects caused by packaging or fumigation processing.
- Cases of malfunction or errors caused by programs created by you using DriveWorksEZ.
- Other failures caused by reasons for which Yaskawa is not liable.

The services described above are available in Japan only. Please understand that failure diagnosis is not available outside of Japan. If overseas after-sales service is desired, consider registering for the optional overseas after-sales service contract.

#### Exception of Guaranteed Duty

Lost business opportunities and damage to your property, including your customers and other compensation for work, is not covered by the warranty regardless of warranty eligibility, except when caused by product failure of Yaskawa products.

### ■ Definition of Delivery

For standard products that are not set or adjusted for a specified application, Yaskawa considers the product delivered when it arrives at your company and Yaskawa is not responsible for on-site adjustments or test runs.

## ● General Safety

### ■ Exclusion of Liability

- This product has been manufactured for variable speed applications of three-phase AC motors for general industry.
- Contact a Yaskawa representative or your Yaskawa sales representative if you are considering the application of this product for special purposes where its failure or malfunction could cause a loss of human life or physical injury, such as machines or systems used for nuclear power, airplanes and aerospace, traffic, medicine, or safety devices.
- Yaskawa has manufactured this product with strict quality-control guidelines. Install applicable safety devices to minimize the risk of accidents when you install the product where its failure could cause a loss of human life, physical injury, or a serious accident.
- Only approved personnel should install, wire, maintain, inspect, replace parts, and repair the drive.
- Use this product only for loads with three-phase AC motors.

### ■ Export Controls

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.

# MEMO

# Global Service Network



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Product Lineup

Model Number / Catalog Code

Basic Instructions

Model Selection

Standard Specifications

Standard Connection Diagram

Terminal Specifications

Dimensions

Fully-Enclosed Design and Drive Watt Loss Data

Peripheral Devices and Options

Application Notes

Warranty

Global Service Network



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ISO14001



JQA-QMA14913



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