

# YASKAWA AC Drive

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 outstanding performance and total cost reduction, the GA500 helps to improve the added value of our customers' machinery and equipment.

### **Innovative PM Motor Control**

Reduce System Costs by Incorporating Peripheral Devices

Continuous Operation of Machinery and Equipment with the Predictive Failure Detection Function in Real-Time

Improve Efficiency of Production Management with Sensing Technology and IoT Support



# Contents

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





# 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.



# **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.



\*: Yaskawa's measurement data Note: The capacity of the drive and motor must be taken into account with output at 200% torque.



Compressor (Freezer)
• Stable drive even with residual

- pressure Startup possible with any
- refrigerants

### Speed Change with a High-impact Load\*



### 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\*1

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.



Operation frequency



### **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>

Maximum Energy Savings

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%

torque applications

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



Comparison of overall efficiency of drive and motor in constant

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.

### Note: Motor Speed: 100% (60 Hz)

### 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.

# Reduce System Costs by Incorporating Peripheral Devices

To minimize initial investment, the functions of the peripheral devices are incorporated into the GA500. This eliminates the need for these devices, and saves space, wiring, and labor.



## **Peripheral Device Functions Incorporated into the Drive**

Peripheral device functions are incorporated into the drive to minimize work-hours and the installation area of the control panel. Note: Refer to page 14 for more information.





# Sensing Machinery Operation with the Drive

The operation of machinery and equipment can be easily detected by customizing the drive. Note: The drive must be customized with the visual programming tool DriveWorksEZ.



## Control Multiple Drives with a Single Communication Option Card

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 (gateway connection method). We recommend this system for fans, pumps, and compressors that must control multiple drives and do not require fast communication speeds.



# Continuous Operation of Machinery and Equipment

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

# Predictive Failure Detection in Real-Time Using Drives\*

The GA500 helps users build machinery and production lines to ensure continuous operation. The drive detects and informs users about unusual operations in machinery and equipment in real-time.

st : Refer to "Predictive Failure Detection with YASKAWA AC Drives (CHEP C710617 38)" for details.





# Achieves Stable Operation and Improvement of Operating Rates

# **Predict Drive Service Life\***

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



Predicted service life of component	Replacement
Cooling fan	Replacement of cooling fan (By user)
Main circuit capacitor	Replacement of components
Soft charge bypass relay	Yaskawa distributor or sales rep.)
IGBT (Power module)	Drive replacement (Please send inquiries to a Yaskawa distributor or sales rep.)

Predicts deterioration of essential parts of drives!

# **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

# 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 predictive failure detection and also connect to the host controllers to share the data so that it improves the efficiency of production management.



*i*<sup>3</sup>-Mechatronics

Note: Refer to "i<sup>3</sup>-Mechatronics (KAEP A000024 00)" for more information.

Controller

## 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

Edge computer (YASKAWA Cockpit\*)

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

Power consumption

Torque

## **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.



Note: DeviceNet is a trademark of Open DeviceNet Vendor Association, Inc. (ODVA). EtherCAT is a trademark of Beckhoff Automation GmbH. PROFIBUS is a trademark of PROFIBUS Nutzerorganisation e.V.

# Reduce Machinery and Control Panel Footprint

The world's smallest class drive, the GA500, minimizes the installation area of the control panel. By incorporating the functions of peripheral devices, the GA500 achieves the most outstanding results in space savings.

## The World's Smallest Drive for Smaller Machinery



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

# **Higher Degree of Freedom in Designing Control Panels**

### **External Heatsink**

The drive heatsink can be installed outside of the panel, and the control panel can be minimized.



### Side-by-Side Installation

Multiple drives can be installed in close proximity (side-by-side installation). The control panel can be designed compactly.



\*: At least 30 mm of space is needed if installed near a wall. Note: Derating must be considered.

## Smaller Control Panel with Integrated Peripheral Device Functions



- **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 multifunction 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 37.





Moistureresistant

Gasresistant

Oil-

resistant

Reduced

Downtime

# Closed-Door Operations and Monitoring<sup>\*1</sup>

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

IGBT Main cire

Main circuit capacitors



Soft charge bypass relays

Cooling fans

Vibrationresistant

Dustresistant

### Highly-Reliable Design

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

# **Quick Response**

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

DriveWizard Mobile P.20-21

Method 1: Supply power from 24 Vdc external power supply



Method 2: Supply power from a computer or a smartphone via USB cable<sup>\*2</sup>



lpha2: 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 predictive failure detection 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**



Dancer tension control

Contact Yaskawa for details on other solutions.

Load unbalance detection

# 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.



### Web Product Management Service YASKAWA Drive Cloud

## **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



# 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.







DC reactor







Zero-Phase Braking resistor reactor

Fuses



### 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> <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> <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> <li>Induction motor</li> <li>SPM motor</li> </ul>		<ul> <li>Induction motor</li> <li>IPM/SPM motor</li> <li>Synchronous reluctance motor</li> </ul>
Starti Maxii Frequ	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> <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>		V/f Control: 590 Hz     Open Loop Vector Control: 590 Hz     Open Loop Vector Control for PM: 590 Hz     Advanced Open Loop Vector Control for PM: 270 Hz
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**

	Thre	e-Phase	200 V Cla	iss	Single-Phase 200 V Class Three-Phase				e-Phase	e 400 V Class			
Motor Capacity	Heavy	Duty	Norma	Duty	Heavy	Duty		Normal	Duty	Heavy	Duty	Norma	l Duty
kW	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.



No	Description	No	Description
1	Product series • GA500 series	9	Control circuit terminal board · C: Screw clamp terminal board type (Standard)
2	Region code • A: Japan		Option • A: No option (Standard)
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	10	<ul> <li>F: SI-C3 (CC-Link)*2</li> <li>G: SI-ET3 (MECHATROLINK-III)*2</li> <li>H: SI-N3 (DeviceNet)*2</li> <li>J: SI-P3 (PROFIBUS-DP)*2</li> <li>K: SI-T3 (MECHATROLINK-II)*2</li> </ul>
4	Output Current*1		· M: SI-S3 (CANopen)*2
5	EMC noise filter • A: No internal EMC filter (Standard) • E: Internal EMC filter		N: SI-ES3 (EtherCAT)* <sup>2</sup> P: SI-EM3 (Modbus TCP/IP)* <sup>2</sup> R: SI-EN3 (EtherNet/IP)* <sup>2</sup> S: SI-EP3 (PBOFINET)* <sup>2</sup>
6	Protection Design • B: IP20/UL Open Type • F: IP20/UL Type 1	11	Option • A: No option (Standard)
	Environmental specification • A: Standard	12	Option • A: No option (Standard)
7	<ul> <li>K: Gas-resistant</li> <li>M: Humidity-resistant and dust-resistant</li> <li>N: Oil-resistant</li> <li>P: Humidity-resistant, dust-resistant, and vibration-resistant</li> <li>R: Gas-resistant and vibration-resistant</li> <li>S: Vibration-resistant</li> <li>T: Oil-resistant and vibration-resistant</li> <li>Note: Drives with these specifications do not guarantee complete protection for the environmental conditions indicated.</li> </ul>	13	<ul> <li>Keypad</li> <li>A: LCD keypad*<sup>3</sup></li> <li>B: LCD keypad (humidity-resistant and dust-resistant)*<sup>3</sup></li> <li>D: Bluetooth Keypad*<sup>3</sup></li> <li>E: Bluetooth Keypad (humidity-resistant and dust-resistant)*<sup>3</sup></li> <li>F: LED keypad (humidity-resistant and dust-resistant)*<sup>3</sup></li> <li>G: LED keypad (humidity-resistant and dust-resistant)*<sup>3</sup></li> <li>L: Blank cover</li> <li>S: Half-Size LED Keypad(Standard)(humidity-resistant and dust-resistant)</li> </ul>
8	Design revision order		
*1: Inc rou	dicates the rated output current of the Normal Duty rating unded off to the nearest whole number.	14	Special applications <ul> <li>A: Standard</li> <li>C: High frequency</li> </ul>

- 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.
- \*4: This model is subject to export regulations. Contact Yaskawa for more information.

### 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

### **Basic Instructions**

Outstanding operability and quick setup

### Keypad Names and Functions

(1) LED Display Displays data, parameters, and errors.

② REV LED Lit when a reserve Run command is active.

③ DWEZ LED Lit when DriveWorksEZ is in operation.

 DO/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.

In the second second

10 STOP Key Stops drive operation.



#### Keypad LED

Indicator LED	Lit	
REV	The drive received a reverse Run command.	The driv Run cor
DWEZ	The user is using DriveWorksEZ.	The use DriveWo
LORE	Sets the Run command source to the keypad (LOCAL).	Sets the to a nor comman

OFF
he drive received a forward lun command.
he user is not using

### veWorksEZ.

Sets the Run command source to a non-keypad external command (REMOTE).

### 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.

#### ⑧Com port

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

① Front Cover Lock Slide to the left to unlock, and then remove the front cover.

#### 2 QR code

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

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

### LED Status Ring



LED Status Ring		State	Content
	ALM/ERR	Lit	The drive detected a fault.
A	READY ALARE	Flashing	<ul> <li>The drive has detected:</li> <li>An Alarm</li> <li>An oPE</li> <li>A fault or error during Auto-Tuning</li> <li>Note: If the drive detects a fault and an error at the same time, this LED will be lit to indicate the fault.</li> </ul>
		OFF	The drive is in normal operation. There are no alarms of faults present.
	READY	Lit	The drive is operating or is ready for operation.
В	RUN ALME	Flashing	The drive is in STo [Safe Torque Off] mode.
	READY	OFF	<ul> <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>
	RUN	Lit	The drive is in operation.
	aun Almera	Flashing	<ul> <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>
С	READY	Flashing Quickly	<ul> <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 LED works:

Drive output frequency	during stop	RUN		STOP		RUN	STOP
Frequency reference							
RUN LED	OFF		Lit	Flashing	OFF	Flashing Quickly	OFF

### Basic Instructions (continued)

### Keypad Example

	Display Content	Key Operation	Display	Function							
Drive Mode	• Frequency Reference (Drive Mode)		F 0.00	Displays the frequency reference (default display).							
	• Auto-Tuning Mode									- Rf Un	Measures the motor characteristics required for vector control and sets those to the drive automatically.
	Parameter Settings Menu		P8r	Sets the drive functions.							
Programming Mode	· Setup Mode		SEUP	Automatically sets the optimal parameter settings for the set application.							
	• Verify Menu	⋒⋕⋓	urfy	Displays all parameters that have been edited or changed from their default settings in Programming Mode or in Auto-Tuning.							
	• Monitor Menu		- P9 <sub>en</sub>	Displays the drive status, fault details and fault history.							
	Output Voltage		0.0 u	Displays the output voltage							
Drive Mode	Output Current		0.008	Displays the output current.							
	Output Frequency		0.00	Displays the output frequency.							
	Direction (forward)		For	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



### **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



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

Power				20	0 V	V				400 V			
Supply		Three-	Phase			Single-Phase				Three-Phase			
Model	Heavy Du	uty Rating	Normal D	uty Rating	Heavy Du	ity Rating	Normal D	uty Rating	Heavy Du	ity Rating	Normal D	uty Rating	
Max. Applicable Motor Capacity kW	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	

Basic

Application Notes

### **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		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
Motor Capaci	ty*1	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 A Current	HD	0.7	1.5	2.9	5.8	7	7.5	11	15.6	18.9	24	37	52	68	96
input		ND	1.1	2.6	3.9	7.3	8.8	10.8	13.9	18.5	24	37	52	68	80	114
	Rated Output	HD	0.8	1.6	3	5	6.9	8	11	14	17.6	25	33	47	60	75
	Current	ND	1.2	1.9	3.5	6	8	9.6	12.2	17.5	21	30	42	56	70	82
	Overload Tolerance		<ul> <li>HD Rating: 150% of rated output current for 60 s.</li> <li>ND Rating: 110% of rated output current for 60 s.</li> <li>Note: Derating may be required for applications that start and stop frequently.</li> </ul>													
Output	Carrier Frequency		Deratin enables to be s current ND rati rating u	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 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	asures for Reactor		External options													
Braking Function	Braking Transistor		Built-in Built-in													
EMC filter	er EMC filter (IEC61800-3)		C61800-3) Internal (factory option)													
	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													
Devuer	Allowable Voltage Fluctuation		-15% to 10%													
TOWER	Allowable Frequer Fluctuation	псу	±5%													
	Power Supply*2	HD	0.3	0.7	1.3	2.7	3.2	3.4	5	7.1	8.7	11	17	24	31	44
	kVA	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. Applicat	ole IVV	HD	0.1	0.2	0.4	0.75	1.5	2.2	3.7		
Motor Capaci	ty*1*2 KVV	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	20.6	35		
		ND	2	5	7.3	13.8	20.2	24	—		
	Rated Output _	HD	0.8	1.6	3	5	8	11	17.6		
	Current	ND	1.2	1.9	3.5	6	9.6	12.2	—		
	Overload Tolerance		<ul> <li>HD Rating: 150% of rated output current for 60 s.</li> <li>ND Rating: 110% of rated output current for 60 s.</li> <li>Note: Derating may be required for applications that start and stop frequently.</li> </ul>								
Output	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 10 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								
Measures for Harmonics	Reactor		External option	s (AC reactor)							
Braking Function	Braking Transistor		ig Transistor Built-in								
EMC filter	EMC Filter (IEC6180	00-3)	Internal (factory option) External options								
	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								
Devuer	Allowable Voltage Fluctuation		-15% to 10%								
Power	Allowable Frequency Fluctuation		±5%								
	Power Lun	HD	0.4	0.7	1.5	2.9	3.7	5.4	9.2		
	Supply*3 KVA	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		HD	0.2	0.4	0.75	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22
Motor Capaci	ty*1 KVV	ND	0.4	0.75	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22.0	30.0
laput	Rated Input A Current	HD	1.2	1.8	3.2	4.4	6	8.2	10.4	15	20	29	39	50.5	59.7
input		ND	1.2	2.1	4.3	5.9	8.1	9.4	14	20	24	38	44	59.7	80.7
	Rated Output _	HD	1.2	1.8	3.4	4.8	5.6	7.3	9.2	14.8	18	24	31	39	45
	Current /	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		<ul> <li>HD Rating: 150% of rated output current for 60 s.</li> <li>ND Rating: 110% of rated output current for 60 s.</li> <li>Note: Derating may be required for applications that start and stop frequently.</li> </ul>												
Output	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	sures for Reactor		External options												
Braking Function	Braking Transistor		aking Transistor Built-in												
EMC filter	EMC Filter (IEC61800-3)	EMC Filter (IEC61800-3) Internal (factory option)													
	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%												
Power	Allowable Frequer Fluctuation	псу	±5%												
	Power Supply*2	HD	1.1	1.6	2.9	4	5.5	7.5	9.5	14	18	27	36	47	55
	kVA	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 Method	The following controls are selected by parameters. • V/f Control (V/f) • Open Loop Vector Control (OLV) • Open Loop Vector Control for PM (OLV/PM) • Advanced Open Loop Vector Control for PM (AOLV/PM) • EZ Open Loop Vector Control (EZOLV)
	Frequency Control Range	<ul> <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°C to +40°C) Analog reference: within $\pm 0.1\%$ of the max. output frequency (25°C $\pm 10°$ 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 Signal	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> <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*1</sup></li> <li>EZ Open Loop Vector Control: 100%/10% speed</li> <li>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.</li> </ul>
ntrol Unaracteristics	Speed Control Range	<ul> <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> <li>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.</li> <li>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.</li> </ul>
5	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	<ul> <li>Approx. 20%</li> <li>Approx. 125% with a dynamic braking option <ul> <li>Short-time average deceleration torque</li> </ul> </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> <li>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. <ul> <li>Failure to obey could prevent the drive from stopping in the specified deceleration time and cause serious injury or death.</li> <li>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.</li> <li>Continuous regenerative torque and short-time deceleration torque for motors 2.2 kW and larger vary depending on motor characteristics.</li> </ul></li>
	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
	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
tion	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
tection Functi	Momentary Power Loss Ride-Thru	<ul> <li>Stops when power loss is longer than 15 ms.</li> <li>Continues operation if power loss is shorter than 2 s (depending on parameter settings).</li> <li>Note: 1. Stop time may be shortened depending on the load and motor speed.</li> <li>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.</li> </ul>
Pre	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.
	Area of Use	Indoors
	Power Supply	Overcurrent Category III
	Ambient Temperature	<ul> <li>IP20/UL Open Type: -10°C to +50°C</li> <li>IP20/UL Type 1: -10°C to +40°C</li> <li>When installing the drive in an enclosure, use a cooling fan or air conditioner to keep the internal air temperature in the permitted range.</li> <li>Do not let the drive freeze.</li> <li>To install IP20/UL Open Type drives in areas with ambient temperatures ≤ 60°C (140°F), derate the output current and output voltage.</li> <li>To install IP20/UL Type 1 drives in areas with ambient temperatures ≤ 50°C (122°F), derate the output current and output voltage.</li> </ul>
nen	Humidity	95% RH or less (no condensation)
ron	Storage Temperature	-20 to +70°C (short-term temperature during transportation)
Envir	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	<ul> <li>10 Hz to 20 Hz, 1 G (9.8 m/s<sup>2</sup>)</li> <li>20 Hz to 55 Hz, 0.6 G (5.9 m/s<sup>2</sup>)</li> </ul>
	Installation Orientation	Install the drive vertically for sufficient cooling airflow.
Sta	andards Compliance	<ul> <li>· UL61800-5-1</li> <li>· EN61800-3</li> <li>· IEC/EN61800-5-1</li> <li>· Two Safe Disable inputs and 1EDM output according to ISO/EN13849-1 Cat.3 PLe, IEC/EN61508 SIL3</li> </ul>
Pro	otection 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.

Product Lineup

Model Number / Catalog Code

Basic Instructions

Model Selection

Standard Specificatio<u>ns</u>

Standard Connection Diagram

Terminal Specifications

Dimensions

Fully-Enclosed Design and Drive Watt Loss Data

Peripheral Devices and Options

Application Notes

### 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 deenergize 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.
- $\pm 17^{\rm :}$  Disconnect the jumpers between H1 and HC, and H2 and HC to use the Safe Disable input.

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### **Terminal Specifications**

### Terminal Functions

### Main Circuit Terminals

Terminal	Terminal Name	Function					
R/L1	Main circuit power supply input.						
S/L2	Three-phase	Connects line power to the drive.					
T/L3	(Use only for three-phase power supply)						
L/L1	Main circuit power supply input,	Connecte line power to the drive					
N/L2	(Use only for single-phase power supply)	Connects line power to the arive.					
U/T1							
V/T2	Drive output	Connects to the motor.					
W/T3							
B1	Proking register	Available for connecting a braking register or braking register unit					
B2	Braking resistor	Available for connecting a braking resistor of braking resistor unit.					
+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						
-	Do power supply input	r of connecting a DC power supply.					
		Grounding terminal					
Two terminals	Ground	Grounding resistance for 200 V class: 100 $\Omega$ or less					
		Grounding resistance for 400 V class: 10 $\Omega$ or less					

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

Terminal Type	Terminal	Signal Function (default)	Description (Signal Level)						
	S1	MFDI selection 1 (ON: Forward run OFF: Stop)							
	S2	MFDI selection 2 (ON: Reverse run OFF: Stop)	<ul> <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 supp</li> </ul>						
	S3	MFDI selection 3 (External fault, N.O.)							
Multi Function	S4 MFDI selection 4 (Fault reset)		for multi-function digital input. • Sinking Mode: Install a jumper between terminals SP and SC. • Sourcing Mode: Install a jumper between terminals SN and SC.						
Digital Input (MFDI)	S5	MFDI selection 5 (Multi-step speed reference 1)	<ul> <li>External power supply: No jumper necessary.</li> <li>NOTICE: Do not close the circuit between terminals SP and SN. Failure to obey will c;</li> </ul>						
	S6	MFDI selection 6 (Multi-step speed reference 2)	damage to the drive.						
	S7	MFDI selection 7 (Jog command)							
	SN	MFDI power supply 0V	MEDL power supply 24 V (maximum 150 mA)						
	SC	MFDI selection common	NOTICE: Do not close the circuit between terminals SP and SN. Failure to obey will cause damage to the drive.						
	SP	MFDI power supply +24 Vdc							
	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						
Sofo Diophla	H2	Safe Disable input 2							
Safe Disable Input	HC	Safe Disable function common	· OFF: Coasting motor · Internal impedance 4.7 k $\Omega$ · Minimum OFF time of 3 ms.						
	RP	Master frequency reference pulse train input (Master frequency reference)	<ul> <li>Input frequency: 0 Hz to 32 kHz</li> <li>Duty cycle: 30% to 70%</li> <li>H level voltage: 3.5 V to 13.2 V</li> <li>L level voltage: 0.0 V to 0.8 V</li> <li>Input impedance: 3 kΩ</li> </ul>						
Master	+V	Power supply for frequency setting	10.5 V (allowable current 20 mA max.)						
Frequency Reference	A1	Multi-function analog input 1 (Master frequency reference)	Voltage input $\cdot$ 0 V to 10 V/100% (input impedance: 20 k $\Omega$ )						
	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 k Ω) • 4 mA to 20 mA/100%, 0 mA to 20 mA/100% (input impedance: 250 Ω)						
	AC	Frequency reference common	0 V						
Multi-Function	MA	N.O. output (Fault)	· Relay output						
Digital Output	MB	N.C. output (Fault)	• 30 Vdc, 10 mA to 1 A						
(MFDO)	MC	Digital output common	Minimum load: 5 Vdc, 10 mA (Reference value)						
#### Control Circuit Terminals (200 V/400 V Class) (continued)

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

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

Туре	Terminal	Terminal Name (Default)	Function
External Power Supply	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
Input Terminals	AC	External 24 V power supply ground	0 V

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

Classification	Terminal	Signal Function	Description (Signal Level)								
	D+	Communications input (+)	MEMOBUS/Modbus (RTU mode) communications:	• RS-485							
MEMOBOS/ Modbus (RTU mode) Communications	D-	Communications input (-)	Note: Set DIP switch S2 to ON to enable the termination resistor in the last drive in a MEMOBUS/Modbus (RTU mode) network	<ul> <li>MEMOBUS/Modbus (RTU mode) communications protocol</li> <li>Max. 115.2 kbps</li> </ul>							
	AC	Shield ground	0 V								

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

Bit

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. • Bit [ PHOENIX CONTACT] Model: SF-BIT-SL 0,5X3,0-70 • Torque screwdriver [PHOENIX CONTACT] Model: TSD-M 1,2NM (0.3 to 1.2 N·m)
M4	Slot	Prepare the following two tools. • Bit [ PHOENIX CONTACT] Model: SF-BIT-SL 1,0X4,0-70 • Torque screwdriver [PHOENIX CONTACT] Model: TSD-M 3NM (1.2 to 3 N·m)
M5	Slot ⊖	When wiring drive models GA50A2056 and GA50A4060 or earlier models, be sure to correctly select tools based on the wire gauges. Wiring Gauge: 25 mm <sup>2</sup> or AWG10 · Bit [ PHOENIX CONTACT] Model: SF-BIT-SL 1,2X6,5-70 · Torque screwdriver [PHOENIX CONTACT] Model: TSD-M 3NM (1.2 to 3 N·m) Wiring Gauge: 30 mm <sup>2</sup> or AWG8 · Torque wrench that includes a torque measurement range of 4.5 N·m · Bit socket holder of 6.35 mm
M6	Hex socket (WAF: 5)	Prepare the following three tools. Bit [ PHOENIX CONTACT] Model: SF-BIT-HEX 5-50 · Torque wrench that includes a torque measurement range of 9 N·m · Bit socket holder of 6.35 mm

Model Tip of Bit Code No. Application screw slot SF-BIT-SL 0,5X3,0-70 Slot Tip, M3 100-247-064  $\ominus$ ۲ SF-BIT-SL 1,0X4,0-70 Slot Tip, M4 100-250-491 I SF-BIT-SL 1,2X6,5-70 Slot Tip, M5 100-250-492 Hexagon Tip, M6 100-250-488 SF-BIT-HEX 5-50 Ô ß Torque screwdriver Model surement Range Code No. Me TSD-M 1,2NM 0.3 to 1.2 N·m 100-265-347 TSD-M 3NM 1.2 to 3 N·m 100-250-493

Torque wrench

Bit socket holder



BIL SOCKEL HOIDER
Bit socket holder

Model Number / Product Lineup Catalog Code

> Basic Instructions

### Terminal Specifications (continued)

### Terminal Size / Wire Gauge

#### Three-Phase 200 V Class

Symbols indicating the shape of the terminal screws:  $\bigoplus$ : (+/-),  $\bigoplus$ : Slot (-), (B: Hex socket (WAF: 5)

Catalog		Recommended	Wire Denge	Wire	Term	ninal Screw	Tightening	Catalog		Recommended		Wire	Terminal Screw		Tightening
code GA50A□	Terminal	Gauge mm <sup>2</sup>	mm <sup>2</sup>	Length*1 mm	Size	Shape	Torque N∙m	code GA50A□	Terminal	Gauge mm <sup>2</sup>	mm <sup>2</sup>	Length*1	Size	Shape	Torque N∙m
	R/L1, S/L2, T/L3	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	3.5	2 to 5.5	10	M4	$\ominus$	1.5 to 1.7
0004	U/T1, V/T2, W/T3	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6	0010	U/T1, V/T2, W/T3	3.5	2 to 5.5	10	M4	$\ominus$	1.5 to 1.7
2001	-,+1,+2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6	2018	-,+1,+2	5.5	3.5 to 8	10	M4	$\ominus$	1.5 to 1.7
	B1, B2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	5.5	3.5 to 8	10	M4	$\ominus$	1.5 to 1.7
0000	U/T1, V/T2, W/T3	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6	0001	U/T1, V/T2, W/T3	3.5	3.5 to 5.5	10	M4	$\ominus$	1.5 to 1.7
2002	-,+1,+2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6	2021	-,+1,+2	8	2 to 14	10	M4	$\ominus$	1.5 to 1.7
	B1, B2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	8	2 to 14	10	M4	$\ominus$	1.5 to 1.7
0004	U/T1, V/T2, W/T3	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6	0000	U/T1, V/T2, W/T3	8	2 to 14	10	M4	$\ominus$	1.5 to 1.7
2004	-,+1,+2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6	2030	-,+1,+2	14	3.5 to 14	10	M4	$\ominus$	1.5 to 1.7
	B1, B2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		B1, B2	3.5	2 to 5.5	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 2	8	M3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	14	3.5 to 14	10	M4	$\ominus$	1.5 to 1.7
2006	U/T1, V/T2, W/T3	2	2 to 2	8	M3	$\ominus$	0.5 to 0.6	2042	U/T1, V/T2, W/T3	14	3.5 to 14	10	M4	$\ominus$	1.5 to 1.7
2000	-,+1,+2	2	2 to 2	8	M3	$\ominus$	0.5 to 0.6	2042	-,+1,+2	22	5.5 to 30	18	M5	$\ominus$	2.3 to 2.5*2 4.1 to 4.5*3
	B1, B2	2	2 to 2	8	M3	$\ominus$	0.5 to 0.6		B1, B2	5.5	3.5 to 8	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	22	5.5 to 30	18	M5	$\ominus$	2.3 to 2.5*2 4.1 to 4.5*3
2002	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	2056	U/T1, V/T2, W/T3	14	5.5 to 22	18	M5	$\ominus$	2.3 to 2.5*2
2006	-,+1,+2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	2000	-,+1,+2	30	8 to 30	18	M5	$\ominus$	2.3 to 2.5*2 4.1 to 4.5*3
	B1, B2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		B1, B2	14	2 to 14	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	30	8 to 38	20	M6	6	5 to 5.5
2010	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	2070	U/T1, V/T2, W/T3	22	5.5 to 30	20	M6	6	5 to 5.5
2010	-,+1,+2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	2070	-, +1	28	14 to 50	20	M6	6	5 to 5.5
	B1, B2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		B1, B2	14	5.5 to 14	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	38	14 to 50	20	M6	6	5 to 5.5
2012	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	2092	U/T1, V/T2, W/T3	30	8 to 38	20	M6	6	5 to 5.5
2012	-,+1,+2	3.5	2 to 5.5	8	M3	$\ominus$	0.5 to 0.6	2002	-,+1	50	22 to 60	20	M6	6	5 to 5.5
	B1, B2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		B1, B2	14	5.5 to 14	10	M4	$\ominus$	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: $\bigoplus$ : (+/ -), $\bigoplus$ : Slot (-), B : Hex socket (WAF: 5)

Catalog		Recommended	Mine Deven	Wire	Term	inal Screw	Tightening	Catalog		Recommended	Wine Demos	Wire	Terminal Screw		Tightening
code GA50A□	Terminal	Gauge mm <sup>2</sup>	mm <sup>2</sup>	Stripping Length <sup>*1</sup>	Size	Shape	Torque N∙m	code GA50A□	Terminal	Gauge mm <sup>2</sup>	mm <sup>2</sup>	Stripping Length*1	Size	Shape	Torque N∙m
	L/L1, N/L2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		L/L1, N/L2	3.5	2 to 5.5	8	M3	$\ominus$	0.5 to 0.6
P001	U/T1, V/T2, W/T3	2	2 to <sup>2</sup>	6.5	M3	$\ominus$	0.5 to 0.6	P010	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6
DUUT	-, +1	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6	DUIU	-,+1	3.5	2 to 5.5	8	М3	$\ominus$	0.5 to 0.6
	B1, B2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		B1, B2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6
	L/L1, N/L2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		L/L1, N/L2	5.5	3.5 to 8	10	M4	$\ominus$	1.5 to 1.7
P002	U/T1, V/T2, W/T3	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6	P012	U/T1, V/T2, W/T3	2	2 to 3.5	10	M4	$\ominus$	1.5 to 1.7
8002	-,+1	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6	BUIZ	-,+1	5.5	3.5 to 8	10	M4	$\ominus$	1.5 to 1.7
	B1, B2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	$\ominus$	1.5 to 1.7
	L/L1, N/L2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		L/L1, N/L2	8	3.5 to 14	10	M4	$\ominus$	1.5 to 1.7
P004	U/T1, V/T2, W/T3	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6	D019	U/T1, V/T2, W/T3	3.5	2 to 5.5	10	M4	$\ominus$	1.5 to 1.7
8004	-,+1	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6	BUID	-, +1	8	3.5 to 14	10	M4	$\ominus$	1.5 to 1.7
	B1, B2	2	2 to 2	6.5	M3	$\ominus$	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	$\ominus$	1.5 to 1.7
	L/L1, N/L2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	*1: Ren	nove the insulator fr	om the tip:	s of wires to t	he length	n shown	in "Wire Stripp	oing Length."
B006	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	Note: II	sing 75°C 600 V	d wire ga class 2 h	uges basec eat resistan	t on driv t indoo	r PVC	tinuous curre wire.	ent ratings
0000	-,+1	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	A	ssume the follow Ambient tempera	ring usag ature: 40	e condition C or lower	s:			
	B1, B2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		Wiring distance: Normal Duty rate	100 m o ed curren	r shorter t value				

#### Three-Phase 400 V Class

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

Catalog		Recommended	Wire Pongo	Wire	Tern	ninal Screw	Tightening	Catalog		Recommended	Wire Penge	Wire	Term	inal Screw	Tightening
code GA50A⊡	Terminal	Gauge mm <sup>2</sup>	mm <sup>2</sup>	Stripping Length*1	Size	Shape	Torque N∙m	code GA50A □	Terminal	Gauge mm <sup>2</sup>	mm <sup>2</sup>	Stripping Length <sup>*1</sup>	Size	Shape	Torque N∙m
	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	3.5	2 to 5.5	10	M4	$\ominus$	1.5 to 1.7
4001	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	4010	U/T1, V/T2, W/T3	3.5	2 to 5.5	10	M4	$\ominus$	1.5 to 1.7
4001	-, +1, +2	2	2 to 3.5	8	М3	$\ominus$	0.5 to 0.6	4018	-, +1, +2	5.5	3.5 to 8	10	M4	$\ominus$	1.5 to 1.7
	B1, B2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	5.5	3.5 to 8	10	M4	$\ominus$	1.5 to 1.7
4000	U/T1, V/T2, W/T3	2	2 to 3.5	8	М3	$\ominus$	0.5 to 0.6	4000	U/T1, V/T2, W/T3	5.5	3.5 to 8	10	M4	$\ominus$	1.5 to 1.7
4002	-,+1,+2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	4023	-,+1,+2	5.5	2 to 8	10	M4	$\ominus$	1.5 to 1.7
	B1, B2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		B1, B2	2	2 to 3.5	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 3.5	8	М3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	14	2 to 14	10	M4	$\ominus$	1.5 to 1.7
4004	U/T1, V/T2, W/T3	2	2 to 3.5	8	М3	$\ominus$	0.5 to 0.6	4001	U/T1, V/T2, W/T3	8	2 to 14	10	M4	$\ominus$	1.5 to 1.7
4004	-,+1,+2	2	2 to 3.5	8	М3	$\ominus$	0.5 to 0.6	4031	-,+1,+2	14	3.5 to 22	18	M5	$\ominus$	2.3 to 2.5*2
	B1, B2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		B1, B2	3.5	2 to 5.5	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 3.5	8	М3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	14	5.5 to 14	10	M4	$\ominus$	1.5 to 1.7
4005	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	4029	U/T1, V/T2, W/T3	14	3.5 to 14	10	M4	$\ominus$	1.5 to 1.7
4005	-,+1,+2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	4036	-,+1,+2	14	5.5 to 22	18	M5	$\ominus$	2.3 to 2.5*2
	B1, B2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		B1, B2	5.5	3.5 to 8	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	14	5.5 to 22	18	M5	$\ominus$	2.3 to 2.5*2
4007	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	4044	U/T1, V/T2, W/T3	14	5.5 to 22	18	M5	$\ominus$	2.3 to 2.5*2
4007	-, +1, +2	2	2 to 3.5	8	М3	$\ominus$	0.5 to 0.6	4044	-, +1, +2	22	5.5 to 30	18	M5	$\ominus$	2.3 to 2.5*2 4.1 to 4.5*3
	B1, B2	2	2 to 3.5	8	М3	$\ominus$	0.5 to 0.6		B1, B2	8	2 to 14	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		R/L1, S/L2, T/L3	22	5.5 to 30	18	M5	$\ominus$	$\begin{array}{c} 2.3 \text{ to } 2.5^{*2} \\ 4.1 \text{ to } 4.5^{*3} \end{array}$
4000	U/T1, V/T2, W/T3	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6	4000	U/T1, V/T2, W/T3	14	5.5 to 22	18	M5	$\ominus$	2.3 to 2.5*2
4009	-,+1,+2	2	2 to 3.5	8	М3	$\ominus$	0.5 to 0.6	4060	-, +1	30	8 to 30	18	M5	$\ominus$	2.3 to 2.5*2 4.1 to 4.5*3
	B1, B2	2	2 to 3.5	8	M3	$\ominus$	0.5 to 0.6		B1, B2	14	3.5 to 14	10	M4	$\ominus$	1.5 to 1.7
	R/L1, S/L2, T/L3	2	2 to 3.5	10	M4	$\ominus$	1.5 to 1.7	*1: Rer	nove the insulate	or from t	he tips of w	vires to	the leng	th shown i	n "Wire
4010	U/T1, V/T2, W/T3	2	2 to 3.5	10	M4	$\ominus$	1.5 to 1.7	Stri Note: Th	pping Length." ne recommended	*2: 22 d wire ga	mm <sup>2</sup> maxir uges based	num : d on dri	*3: 30 ve cont	mm <sup>2</sup> minim inuous curr	um ent ratings
4012	-,+1,+2	3.5	2 to 5.5	10	M4	$\ominus$	1.5 to 1.7	us As	sing 75°C 600 V of ssume the follow	class 2 h ing usac	eat resistar le conditior	nt indoo ns:	or PVC \	wire.	-
	B1, B2	2	2 to 3.5	10	M4	$\ominus$	1.5 to 1.7	· .	Ambient tempera	ature: 40 ed currer	°C or lower t value	• Wiri	ng dista	ance: 100 n	n or shorter

Basic Instructions

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### Dimensions

#### Enclosures

HD: Heavy Duty, ND: Normal Duty         Three-Phase Catalog CodeGA50A::       2001       2002       2004       2006       2008       2010       2012       2018       2021       2030       2042       2056       2070       2082         Three-Phase Catalog CodeGA50A::       B001       B002       B004       B006       —       B010       B012       —       B018       —       …       …       18.5       11       1.5       2.2       3       3.7       5.5       7.5       11       15       18.5       22       22       3       3.7       5.5       7.5       11       15       18.5       22       22       21															
Three-Phase Catalog Code	A50A	2001	2002	2004	2006	2008	2010	2012	2018	2021	2030	2042	2056	2070	2082
Three-Phase Catalog CodeG	A50A	B001	B002	B004	B006	—	B010	B012	—	B018	—	—	—	—	—
Max. Applicable	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
Motor Capacity	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 su	pported	with stan	dard mod	del									
IP20/UL Type 1		Option	supporte	d (Install	UL Type	1 Kit on I	P20/UL (	avT neaC	e Drive)						

400 V Class HD: Heavy Duty, ND: Normal Duty Catalog Code GA50A 4005 4012 4018 4044 4001 4002 4004 4007 4009 4023 4031 4038 4060 HD 0.2 0.4 0.75 1.5 2.2 3 3.7 5.5 7.5 11 15 18.5 22 Max. Applicable Motor Capacity kW 30 ND 0.4 0.75 1.5 2.2 3 3.7 5.5 7.5 15 18.5 22 11 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	Figure					Dimensi	ons mm					Woight kg
GA50A	Figure	W	Н	D	D1	W1	W2	H1	H2	t1	d	weight kg
2001	-1	69	100	76	e e	EG	e	110	F	2	ME	0.5
2002	1	00	120	70	0.5	50	0	110	5	3	IVID	0.5
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	0	109	100	100	56 5	06	e	110	5	5	ME	1.5
2010	2	108	120	129	00.0	90	0	110	Э	Э	CIVI	1.5
2012	2	108	128	137.5	56.5	96	6	118	5	5	M5	1.5
2018	2	140	100	140	65	100	e	110	F	5	ME	2.0
2021	2	140	120	143	05	120	0	110	5	5	IVID	2.0
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	Figure	Dimensions mm										Wojaht ka	
GA50A	Figure	W	Н	D	D1	W1	W2	H1	H2	t1	d	weight kg	
B001	-1	69	100	76	6 5	56	e	110	F	2	ME	0.5	
B002	'	00	120	70	0.5	50	0	110	5	3	IVID	0.5	
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	Figure											
GA50A	Figure	W	н	D	D1	W1	W2	H1	H2	t1	d	weight kg
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												
4007	2	108	128	154	56.5	96	6	118	5	5	M5	1.5
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	0	100	050	004	0.4	100	45	000	7	-	140	0.5
4060	3	190	350	204	94	160	15	336	/	5	IVIO	0.5

Note: External and mounting dimensions are different for standard mounting and panel through mounting. Please refer to P.46 - 49 for panel through mounting.

Model Selection

Basic Instructions

Standard Standard Connection Diagram Specifications

Terminal Specifications

Dimensions

### Dimensions

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



Figure 3

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

Catalog Code	Figure					Dimensi	ons mm					Woight kg
GA50A	Figure	W	Н	D	D1	W1	W2	H1	H2	t1	d	weight kg
2001	4	60	100	116	6.5	EG	e	110	5	2	ME	0.6
2002	1	00	120	110	0.5	50	0	110	5	3	IVID	0.0
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	0	100	100	174	EC E	06	C	110	F	F	ME	1.0
2010	2	108	120	174	00.0	90	0	110	Э	Э	CIVI	1.0
2012	2	108	128	182.5	56.5	96	6	118	5	5	M5	1.6
2018	2	140	100	102	65	100	e	110	F	F	ME	2.4
2021	2	140	120	193	05	120	0	110	5	5	IVID	2.4
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	Eiguro					Dimensio	ons mm					Woight kg
GA50A	rigure	W	н	D	D1	W1	W2	H1	H2	t1	d	weight kg
B001	4	60	100	110	c F	FG	e	110	5	2	ME	0.7
B002	1	00	120	110	6.5	50	0	110	5	3	IVIO	0.7
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	Figure					Dimensi	ons mm					
GA50A	Figure	w	н	D	D1	W1	W2	H1	H2	t1	d	weight kg
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												
4007	2	108	128	199	56.5	96	6	118	5	5	M5	1.9
4009												
4012	2	140	128	193	65	128	6	118	5	5	M5	2.6
4018	2	140	260	106	55	100	0	248	6	5	M5	2.0
4023	5	140	200	190	55	122	9	240	0	5	IVIJ	5.9
4031	0	100	200	100	66	100	10	004	0	F	ME	F
4038	3	180	300	190	55	100	10	264	0	5	CIVI	5.5
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.46 - 49 for panel through mounting.

Model Number / Product Lineup Catalog Code

Basic Instructions

Model Selection

### Dimensions

■IP20/UL Type 1



Figure 1

Figure 2



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

Catalog Code	Fierwa				E	Dimensio	ons mn	n				Weight	UL Type 1 Kit
GA50A:	Figure	W	Н	D	W1	W2	H1	H2	H3	t1	d	kg	Model (Code No.)
2001	-1	60	1/0	76	FG	6	110	5	10	2	ME	0.7	7844 0450/(1 1 (100 242 240)
2002	1	00	140	70	50	0	110	5	10	3	IVID	0.7	ZBAA-GASOVI-1 (100-243-340)
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	0	109	170	100	06	6	110	5	10	5	ME	1.0	7844 0450//2 2 (100 242 244)
2010	2	100	170	129	90	0	110	5	10	5	IVID	1.9	ZBAA-GASUV2-3 (100-243-344)
2012	2	108	178	137.5	96	6	118	5	10	5	M5	1.9	ZBAA-GA50V2-1 (100-243-342)
2018	2	140	179	1/2	100	6	110	5	10	5	ME	2.5	7844-6450/2-2 (100-242-246)
2021	2	140	170	143	120	0	110	5	10	5	IVIJ	2.0	ZBAA-GA3003-2 (100-243-340)
2030	2	140	208	140	100	0	2/19	6	15	5	ME	4.0	7844-6450/5-1 (100-242-248)
2042	5	140	290	140	122	9	240	0	1.5	5	IVIJ	4.2	ZBAA-GA3003-1 (100-243-346)
2056	3	180	340	143	160	10	284	8	1.5	5	M5	6.4	ZBAA-GA50V6-1 (100-243-349)
2070	2	220	403	197	102	14	226	7	1.5	5	MG	8.9	7844-6450/7-1 (100-242-250)
2082	3	220	403	107	192	14	530	/	1.5	3	1010	9.4	ZBAA-GASOVI-1 (100-243-330)

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

Catalog Code	Figure				I	Dimensio	ons mn	n				Weight	UL Type 1 Kit
GA50A	rigure	W	Н	D	W1	W2	H1	H2	H3	t1	d	kg	Model (Code No.)
B001	-1	69	1/0	76	56	6	110	F	10	2	ME	0.7	7844 0450//1 1 (100 242 240)
B002	1	00	140	70	50	0	110	5	10	3	IVID	0.7	ZBAA-GASUVI-1 (100-243-340)
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	Figure				[	Dimensio	ons mr	۱				Weight	UL Type 1 Kit
GA50A	rigure	W	Н	D	W1	W2	H1	H2	H3	t1	d	kg	Model (Code No.)
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													
4007	2	108	178	154	96	6	118	5	10	5	M5	2.0	ZBAA-GA50V2-2 (100-243-343)
4009													
4012	2	140	178	143	128	6	118	5	10	5	M5	2.5	ZBAA-GA50V3-2 (100-243-346)
4018	2	140	200	140	100	0	049	6	1.5	5	ME	3.6	7044 0460/6 1 (100 242 249)
4023	3	140	290	140	122	9	240	0	1.5	5	IVID	3.8	ZBAA-GA30V3-1 (100-243-346)
4031	2	190	240	142	160	10	094	0	15	F	ME	5.5	7044 0450/6 1 (100 242 240)
4038	3	100	340	143	100	10	204	0	1.5	5	IVID	5.7	ZBAA-GAS0V0-1 (100-245-549)
4044	2	100	402	204	160	15	226	7	1.5	5	MG	7.6	7844-6450/8-1 (100-242-251)
4060	3	190	403	204	100	15	550	1	1.5	3	IVIO	7.0	ZDAA-GA30V0-1 (100-243-331)

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 G	A50A[[]]]]	2001	2002	2004	2006	2008	2010	2012	2018	2021	2030	2042	2056	2070	2082
Rated Output Co	urrent A	0.8	1.6	3	5	6.9	8	11	14	17.6	25	33	47	60	75
Carrier Frequence	cy kHz	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Internal	6	7	9	13	14	17	23	26	36	45	55	77	108	132
Watt Loss*	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 G	A50A		B001	B002	B004	B006	B010	B012	B018
Rated Output Cu	urrent	А	0.8	1.6	3	5	8	11	17.6
Carrier Frequence	су У	kHz	2	2	2	2	2	2	2
	Internal		7	10	13	17	30	40	49
Watt Loss*	Heatsink		4	7	13	23	37	48	72
	Total Watt Los	s	11	17	26	40	67	88	121

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

Catalog Code G	A50A[[[[]]]]	4001	4002	4004	4005	4007	4009	4012	4018	4023	4031	4038	4044	4060
Rated Output C	urrent A	1.2	1.8	3.4	4.8	5.6	7.3	9.2	14.8	18	24	31	39	45
Carrier Frequen	cy kHz	2	2	2	2	2	2	2	2	2	2	2	2	2
	Internal	8	10	13	15	16	21	27	48	53	68	81	109	114
Watt Loss*	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 G	A50A	2001	2002	2004	2006	2008	2010	2012	2018	2021	2030	2042	2056	2070	2082
Rated Output C	urrent A	1.2	1.9	3.5	6	8	9.6	12.2	17.5	21	30	42	56	70	82
Carrier Frequence	cy kHz	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Internal	7	9	11	14	18	25	30	35	52	63	84	109	142	160
Watt Loss*	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 G	A50A	B001	B002	B004	B006	B010	B012
Rated Output Co	urrent A	1.2	1.9	3.5	6	9.6	12.2
Carrier Frequence	xy kHz	2	2	2	2	2	2
	Internal	8	14	14	17	36	48
Watt Loss*	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 G	A50A	4001	4002	4004	4005	4007	4009	4012	4018	4023	4031	4038	4044	4060
Rated Output C	urrent A	1.2	2.1	4.1	5.4	7.1	8.9	11.9	17.5	23.4	31	38	44	60
Carrier Frequence	cy kHz	2	2	2	2	2	2	2	2	2	2	2	2	2
	Internal	8	13	14	16	20	28	39	52	86	101	108	137	176
Watt Loss*	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.



				Dimensi	ons mm				
Catalog Code GA50A	(wit	IP20/UL ( h/without Bu	Open Type ıilt-in EMC Fi	lter)	IP20/UL ( (with Built-i	Open Type n EMC Filter)	IP20/UL ( (without Built	Open Type -in EMC Filter)	Heatsink External Mounting Kit Model (Code No.)
	W	Н	W1	H1	D1	D2	D1	D2	
2001	68	160	56	1/18	109.5	6.5	69.5	65	ZPSA-GA50\/1-1 (100-242-250)
2002	00	100	50	140	100.0	0.0	00.0	0.5	
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					117.5		72 5		
2010	108	158	96	144	117.5	56.5	12.0	56.5	ZPSA-GA50V2-3 (100-242-255)
2012					126		81		
2018	140	158	128	144	128	65	78	65	ZPSA-GA50V3-1 (100-242-256)
2021	140	100	120	144	120	00	10	00	
2030	158	286	122	272	1/1	55	85	55	ZPSA-GA50V5-1 (100-242-258)
2042	100	200	122	212	141	55	00	00	
2056	198	322	160	308	141	55	88	55	ZPSA-GA50V6-1 (100-242-259)
2070	2/1	380	102	362	138	78	109	78	7854-6450\/7-1 (100-242-260)
2082	241	500	152	502	150	70	103	70	2134 443077 1 (100 242 200)
B001	68	160	56	1/18	109.5	65	69.5	65	ZPSA-CA50V1-1 (100-242-250)
B002	00	100	50	140	103.5	0.5	03.5	0.5	2137 473011 1 (100 242 230)
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	100	150	06	144	117.5	26.5	72.5	26.5	7004 04501/0 0 (100 040 054)
4004	100	100	90	144	126	56.5	81	56.5	ZPSA-GA30VZ-2 (100-242-254)
4005									
4007	108	158	96	144	142.5	56.5	97.5	56.5	ZPSA-GA50V2-3 (100-242-255)
4009									
4012	140	158	128	144	128	65	78	65	ZPSA-GA50V3-1 (100-242-256)
4018	150	000	100	070	4.44		05		7004 0450//5 1 (100 040 050)
4023	158	286	122	272	141	55	85	55	ZPSA-GA5UV5-1 (100-242-258)
4031	100	000	100	000	1.11		00		7004 04501/0 1 (100 040 050)
4038	198	322	160	308	141	55	88	55	ZPSA-GA5UV6-1 (100-242-259)
4044	011	000	100	000	157	04	110	0.4	7004 04501/0 1 (100 055 170)
4060	211	380	160	362	157	94	110	94	ZPSA-GA5UV8-1 (100-255-479)

#### Panel Modification for Heatsink External Mounting Kit









Figure 3

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 2	Irree-Phase 200 V Class Guarantee a wider and higher gasket width space than the following W and H information												
Catalog Code	Figuro					Di	mensions n	nm					
GA50A:	rigure	W1	W2	W3	W4	H1	H2	H3	H4	А	В	d	
2001	1	56	_	30.5	_	1/18	_	30	1/2	60	136	_	
2002		50		50.5		140		52	142	03	150		
2004	1	56	—	30.5	—	148	-	32	142	69	136	_	
2006	1	56	-	30.5	-	148	-	32	142	69	136	_	
2008													
2010	2	96	-	27	80	144	-	27	128	106	146	-	
2012													
2018	2	108	_	27	110	144	_	27	108	138	1/6	_	
2021	2	120		21	112	144		21	120	100	140		
2030	3	100	0	0	_	272	8.5	7		140	255	5	
2042	5	122	5	5		212	0.0	1		140	200	5	
2056	3	160	10	9	-	308	10.5	7	-	180	287	5	
2070	4	102	1/	10.5	_	362	10.5	0	_	220	3/1	6	
2082	4	192	14	10.5		302	10.5	9		220	341	0	

#### Single-Phase 200 V Class

Catalog Code	Figure					Dir	mensions n	nm				
GA50A:	Figure	W1	W2	W3	W4	H1	H2	H3	H4	А	В	d
B001	-1	FG		20 F		140		20	140	60	106	
B002	1	00	—	30.5	—	140	_	32	142	69	130	_
B004	1	56	—	30.5	—	148	-	32	142	69	136	—
B006	2	96	—	27	80	144	—	27	128	106	146	_
B010	2	96	—	27	80	144	-	27	128	106	146	—
B012	2	128		27	112	144	_	27	128	138	146	_
B018	2	158	_	27	142	144	_	27	128	168	146	_

#### Three-Phase 400 V Class

Catalog Code	Figure					Di	mensions n	nm				
GA50A	Figure	W1	W2	W3	W4	H1	H2	H3	H4	А	В	d
4001	2	96	—	27	80	144	—	27	128	106	146	—
4002	0	00		07	00	144		07	100	100	140	
4004	2	96	_	27	80	144	_	27	128	106	140	_
4005												
4007	2	96	_	27	80	144	_	27	128	106	146	-
4009												
4012	2	128	-	27	112	144	-	27	128	138	146	-
4018	0	100	0	0		070	0.5	7		140	055	F
4023	3	122	9	9	_	212	8.5	1	_	140	200	Э
4031	0	100	10	0		000	10.5	7		100	0.07	F
4038	3	160	10	9	_	308	10.5	1	_	180	287	Э
4044	4	160	14	10.5		260	10.5	0		100	0.41	6
4060	4	102	14	10.5	_	302	10.5	9	_	190	341	0

Standard Model Selection

Basic Instructions

Standard Connection Diagram

### 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.52
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.52
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.53
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.53
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.     Suppresses harmonic current	UZDA series	P.54
AC Reactor	Improves the power factor of the input power supply	UZBA series	P.56
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.59
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.58
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.60
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.61
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.63
Braking Resistor	Used to shorten the deceleration time by dissipating regenerative energy through a resistor. (3% ED)	ERF150WJ series CF120-B579 series	P.64
Braking Resistor Unit	Used to shorten the deceleration time by dissipating regenerative energy through a resistor unit (10% ED). A thermal overload relav is built in (10% ED).	LKEB series	P.64
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.66
LCD Keypad	Keypad that displays text.	JVOP-KPLCA04AEA, KPLCA04MEA	P.66
Bluetooth LCD Keypad	Bluetooth connection enables the drive to be operated from a smartphone.	JVOP-KPLCC04ABA, KPLCC04MBA	P.66
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.66
LCD Keypad Attachment	Use this attachment when you install the LCD keypad and a communication option to the drive.	JZSP-GA500	P.66
Blank Cover	Attach the blank cover when you remove the half-size LED keypad from the drive.	JVOP-KPBCH04AAA	P.66
Compact Keypad Panel Mounting Kit	Use this attachment when you install the keypad on the surface of a control panel.	ZPBA-GA500 900-192-933-001 900-192-933-002	P.67
Keypad Extension Cable	It is used as an extension cable when operating the keypad remotely.	WV001: 1 m WV003: 3 m	P.66
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.60
Frequency Meter, Current Meter		DCF-6A	P.68
Frequency Setting Potentiometer (2 k $\Omega$ )		RV30YN	P.68
Frequency Meter Adjusting Potentiometer (20 $k\Omega)$	Allows the user to set and monitor the frequency, current,	RV30YN20S	P.68
Control Dial for Frequency Setting Potentiometer	and torage doing an external device.	K-2901-M	P.68
Output Voltage Meter		SCF-12NH	P.69
Heatsink External	Required for heatsink installation. Current derating may be	-	P.48
UL Type 1 Kit	To change an IP20/UL Open Type drive to an IP20/UL Type 1 drive.	-	P.44
DIN Rail Attachment	Use this attachment when you install the drive inside the	-	P.67
Low Voltage Manual	Prevents shock from the voltage created on the terminals board from a coasting PM motor	AICUT, LB series* by Aichi	-

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

### Communication Options

Туре	Name	Model	Function	Manual No.
	MECHATROLINK-II	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 bact controller.	TOEPC73060086
	Interface		Note: Use options with software versions of 6108 or later.	SIEPC73060086
	MECHATROLINK-III	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	TOEPC73060088
	Interface	0I-LT0	communication with the host controller. Note: Use options with software versions of 6202 or later.	SIEPC73060088
	CC-Link Interface	SI-C3	Used for running or stopping the drive, setting or referencing parameters, and monitoring	TOBPC73060083
		01 00	host controller.	SIEPC73060083
SU	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	TOBPC73060084
Optio		01110	host controller. Note: Use options with software versions of 1114 or later.	SIEPC73060084
ons (	PPOEIRI IS-DR Interface	SI-D2	Used for running or stopping the drive, setting or referencing parameters, and monitoring	TOBPC73060082
nicati	FROMBUS-DF Intenace	31-F3	with the host controller.	SIEPC73060082
umur		51-53	Used for running or stopping the drive, setting or referencing parameters, and monitoring	TOBPC73060085
Con	O/Nopen intendee	01 00	the host controller.	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	TOEPC73060092
		OF EINO	the host controller.	SIEPC73060092
	Modbus TCP/IP Interface	SI-EM3	Used for running or stopping the drive, setting or referencing parameters, and monitoring	TOEPC73060091
	incode for /ir intende		with the host controller.	SIEPC73060091
	PROFINET Interface	SI-EP3	Used for running or stopping the drive, setting or referencing parameters, and monitoring	TOEPC73060089
	THORNET Intendoe		the host controller.	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.



Basic Model Number / Product Lineup Instructions Catalog Code

Model Selection

Standard gram Specifications

Standard connection Diagram

Code No.

100-246-575

Model

JOHB-GA50

#### 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 shortcircuit 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

		E	Earth Leakage	Circuit Break	ker				Molded Case	Circuit Break	er	
Motor	Wit	hout Reac	tor*1	V	ith Reacto	or*1	Wit	thout Reac	tor*1	N	/ith Reacto	or*1
Capacity (kW)	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

		E	Earth Leakage	Circuit Breal	ker				Molded Case (	Circuit Break	er	
Motor	Wit	thout Reac	tor*1	V	Vith Reacto	or*1	Wit	thout Reac	tor*1	W	ith Reacto	r*1
Capacity (kW)	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics <sup>*2</sup>	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

		E	arth Leakage	Circuit Break	er				Molded Case (	Circuit Break	er	
Motor	Wit	hout Reac	tor*1	W	ith Reacto	or*1	Wit	hout Reac	tor*1	W	/ith Reacto	<b>r</b> *1
Capacity (kW)	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 <sup>*2</sup>
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.

Model Number / Product Lineup Catalog Code

### 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.

		Three-Phase	200 V Clas	s		Single-Phase	200 V Clas	s		400 V	Class	
Motor	Without	Reactor*	With R	eactor*	Without	Reactor*	With R	eactor*	Without	Reactor*	With R	eactor*
(kW)	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

Periph	eral De	Surge Protector	Model	Specifications	Code No.
200 V to 230 V	Large- (other t	Capacity Coil han relay)	DCR2-50A22E	AC 220V 0.5 $\mu$ F+200 $\Omega$	100-250-545
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 μ F+100 Ω	100-250-546
	38	30 to 480 V	RFN3AL504KD	DC 1000V 0.5 $\mu$ F+220 $\Omega$	100-250-547

Application Notes

### 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.

Dimensions (mm)







**Connection Diagram** 

ELCB or MCCB

between +1 and +2,

and wire as shown in

R→×

Note: Remove jumper

the diagram.

S

т

DC Reactor

Drive

γX

U/T1

V/T2

W/T3

М

U

BR/L1

∮S/L2

∮T/L3

200 V Class Three-Phase Input Series

Figure 1

Motor Capacity	(A) (mH)		Code No.	Figure					Dimer (m	nsions m)					Weight	Watt Loss	Wire Gauge*
(kW)	(~)	(1111)			Х	Y2	Y1	Z	В	Н	K	G	d1	d2	(ing)	(W)	(mm²)
0.4	ΕA	0	100 050 670	4	05			50	74			20			0.9	0	0
0.75	5.4	0	100-250-072	'	60	-	-	55	74	-	-	32	1014	-	0.0	0	2
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	26	1	100-250-669	0	105	00	16	02	64	80	26		MG	MG	2.0	22	0
7.5	30	I	100-250-008	2	105	90	40	93	04	80	20	-	IVIO	IVIO	3.2	22	0
11	70	0.5	100-250-677	2	105	105	56	02	64	100	26		MG	140	4.0	20	20
15	12	0.5	100-250-077	2	105	105	50	93	04	100	20	-	IVIO	IVIO	4.9	29	30
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. DC reactors cannot be connected to drives with catalog codes GA50AB001 to B018 (200 V class single-phase input series). Use an AC reactor. Technical documentation is available. Contact Yaskawa or your nearest sales representative for more details.

2. Use an AC reactor for a motor capacities less than 0.2 kW or 22 kW.

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

Motor Capacity	Current	Inductance	Code No.	Figure					Dimer (m	nsions m)					Weight	Watt Loss	Wire Gauge*
(kW)	(A)	(1117)			Х	Y2	Y1	Z	В	Н	K	G	d1	d2	(rg)	(W)	(mm²)
0.4	2.0	20	100-250-664	1	95			52	74			20	M4		0.0	0	0
0.75	3.2	20	100-250-004	1	60	-	-	55	74	-	-	32	1114	-	0.0	9	2
1.5	57	11	100-250-674	1	00			60	80			30	M4		1	11	2
2.2	5.7	11	100 230 074		30	-	_	00	00	-	-	52	1014	-	'		2
3.7	12	6.3	100-250-658	2	86	80	36	76	60	55	18	-	M4	M5	2	16	2
5.5	23	3.6	100-250-662	2	105	00	46	03	64	80	26		Me	M5	3.0	27	5 5
7.5	20	5.0	100-230-002	2	105	30	40	30	04	00	20	-	1010	1015	0.2	21	5.5
11	33	1.0	100-250-666	2	105	95	51	03	64	00	26		MG	MG	4	26	8
15	55	1.5	100 230 000	2	105	55	51	55	04	50	20	-	1010	IVIO	4	20	0
18.5	47	1.3	100-250-670	2	115	125	57.5	100	72	90	25	-	M6	M6	6	42	14

Note: Use an AC reactor for a motor capacities of 0.2 kW, 22 kW, or 30 kW.

**Terminal Type** 



Dimensions (mm)







d2

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

Motor Capacity		Inductance	Code No.	Figure					Dimer (m	nsions m)					Weight	Watt Loss
(kW)	(A)	(1111)			Х	Y2	Y1	Z	В	Н	K	G	d1	d2	(ky)	(W)
0.4	E A	0	100 050 672	4	05		_	01	74	_	_	20	N44	N44	0.9	0
0.75	5.4	0	100-250-673	I	60			01	74			32	IVI4	1014	0.0	0
1.5																
2.2	18	3	100-250-661	2	86	84	36	101	60	55	18	-	M4	M4	2	18
3.7																
5.5	26	4	100 050 660	0	105	0.4	46	100	64	00	06		MG	N44	2.0	00
7.5	30	I	100-250-669	2	105	94	40	129	04	00	20	-	IVIO	1014	3.2	22
11	70	0.5	100.050.070	0	105	104	50	105	64	100	00		140	MC	4.0	00
15	72	0.5	100-230-678	2	105	124	96	135	04	100	20		IVID	IVID	4.9	29
18.5	90	0.4	100-250-680	2	133	147.5	52.5	160	86	80	25	-	M6	M6	6.5	44

Note: DC reactors cannot be connected to drives with catalog codes GA50AB001 to B018 (200 V class single-phase input series). Use an AC reactor. Technical documentation is available. Contact Yaskawa or your nearest sales representative for more details.

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

Motor Capacity	Current	Inductance	Code No.	Figure					Dimer (m	nsions m)					Weight	Watt Loss
(kW)	(A)	(1117)			Х	Y2	Y1	Z	В	Н	К	G	d1	d2	(ky)	(W)
0.4	2.0	20	100-250-665	1	95	_	_	01	74	_	_	20	MA	MA	0.9	0
0.75	3.2	20	100-250-005	I	65			01	74			32	1114	1014	0.8	9
1.5	57	11	100-250-675	1	90	_	_	88	80	_	_	32	M4	MA	1	11
2.2	0.7		100 200 070		50			00	00			02	101-4	101-4		
3.7	12	6.3	100-250-659	2	86	84	36	101	60	55	18	-	M4	M4	2	16
5.5	23	3.6	100-250-663	2	105	10/	46	118	64	80	26	_	M6	MA	3.2	27
7.5	20	0.0	100 200 000	2	100	104	40	110	04	00	20		IVIO	101-4	0.2	21
11	33	1.0	100-250-667	2	105	100	51	120	64	90	26	_	MG	M4	4	26
15		1.9	100 230-007	2	105	109	51	129	04	30	20		1010	1014	4	20
18.5	47	1.3	100-250-671	2	115	142.5	57.5	136	72	90	25	-	M6	M5	6	42

Basic Instructions

Application Notes

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

Base device selection on motor capacity. Lead Wire Type



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	Current	Inductance	Code No.	Figure						Di	mensio (mm)	ns						Weight	Watt Loss
(kW)	(A)	(MH)			Α	В	B1	С	D	Е	F	н	I	J	К	L	М	(Kg)	(W)
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	Current	Inductance	Code No.	Figure						Di	mensio (mm)	ns						Weight	Watt Loss
(kW)	(A)	(mn)			А	В	B1	С	D	Е	F	Н	I	J	K	L	М	(K <u>g</u> )	(W)
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

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

Motor Capacity	Current	Inductance	Code No.	Figure						Dir	nensio (mm)	ns						Weight	Watt Loss
(kW)	(A)	(mH)			А	В	B1	С	D	Е	F	Н	1	J	К	L	М	(K <u>g</u> )	(W)
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

Figure 2

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

Motor Capacity	Current	Inductance	Code No.	Figure						Dir	nensio (mm)	ns						Weight	Watt Loss
(kW)	(A)				Α	В	B1	С	D	Е	F	Н	1	J	К	L	М	(K <u></u> g)	(W)
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

Basic Instructions

#### 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 34.



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.

#### Three-Phase 200 V Class

Catalog		AC Power Supply /	DC Pov	ver Supp	ly	
Code		Fuse		Fu	se Hold	er
GA50A	Model	Rated Short-Circuit Breaking Current (kA)	Qty.*1	Model	Qty.*1	Figure
2001						
2002	CR6L-20/UL	100	3	CMS-4	3	1
2004						
2006	CR6L-30/UL	100	3	CMS-4	3	1
2008						
2010	CR6L-50/UL	100	3	CMS-4	3	1
2012						
2018		100	2	CMS 5	2	2
2021	UNUL-75/UL	100	3	01013-5	3	2
2030	CR6L-100/UL	100	3	CMS-5	3	2
2042		100	2	CMC F	2	0
2056	CHOL-150/UL	100	3	CIVIS-5	3	2
2070	CR6L-200/UL	100	3		*2	
2082	CR6L-250*3	100	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		AC Power Supply /	DC Pov	wer Supp	oly	
Code		Fuse		Fu	use Holo	der
GA50A	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		100	0	CMC F	0	4
B012	CR01-100/01	100	2	CIVIS-5	2	1
B018	CR6L-150/UL	100	2	CMS-5	2	1

#### Fuse Holder Dimensions (mm)



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

#### Three-Phase 400 V Class

Catalog		AC Power Supply /	DC Pov	ver Supp	ly	
Code		Fuse		Fu	se Hold	er
GA50A	Model	Rated Short-Circuit Breaking Current (kA)	Qty.*1	Model	Qty.*1	Figure
4001		100	2	CM8-4	2	1
4002	CHOL-20/UL	100	3	01013-4	3	1
4004						
4005						
4007		100	2	CMS-4	2	1
4009	CHOL-30/UL	100	3	01013-4	3	1
4012						
4018						
4023	CR6L-75/UL	100	3	CMS-5	3	2
4031	CR6L-100/UL	100	3	CMS-5	3	2
4038		100	2	CMC E	2	0
4044	CHOL-150/UL	100	3	CIVIS-5	3	2
4060	CR6L-200/UL	100	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.

# n Instructions

Specifications Model Selection

# Application Per Notes a

### 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.

**Connection Diagram** 

Dimensions (mm)

72±1

Ē

39

5.5 dia. × 2

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 trademark of Hitachi Metals, Ltd.



[Hitachi Metals, Ltd.]





Hex socket × 3 (M4)

4.5 dia. × 3

12.5±0.3

26 max.

Weight: 195 g

Sp

Model F6045GB

50±1

95 max

80±1



Diagram b



#### Three-Phase 200 V Class

G	A500	Z	ero Phase Rea	ctor	
Motor Capacity (kW)	Recommended Gauge (mm²)	Model	Code No.	Qty.	Diagram
0.1					
0.2					
0.4	0	F6045OD	100 050 745	4	
0.75	2	F0043GB	100-250-745	I	а
1.5					
2.2					
3.7	3.5	F6045GB	100-250-745	1	а
5.5	5.5	F6045GB	100-250-745	1	а
7.5	8	F11080GB	100-250-743	1	а
11	14	F6045GB	100-250-745	4	b
15	22	F6045GB	100-250-745	4	b
18.5	30	F6045GB	100-250-745	4	b
22	38	F6045GB	100-250-745	4	b

#### Single-Phase 200 V Class

G	A500	Z	ero Phase Rea	ctor	
Motor Capacity (kW)	Recommended Gauge (mm²)	Model	Code No.	Qty.	Diagram
0.1					
0.2					
0.4	2	F6045GB	100-250-745	1	а
0.75					
1.5					
2.2	3.5	F6045GB	100-250-745	1	а
3.7	8	F11080GB	100-250-743	1	а

#### Three-Phase 400 V Class

G	A500	Zero Phase Reactor							
Motor Capacity (kW)	Recommended Gauge (mm²)	Model	Code No.	Qty.	Diagram				
0.2									
0.4									
0.75									
1.5	2	E6045CP	100-250-745	4	-				
2.2	2	F0045GB	100-230-743	1	a				
3.0									
3.7									
5.5									
7.5	5 5	E604ECB	100 050 745	4					
11	5.5	F0043GB	100-200-740	1	a				
15									
18.5	14	E6045CP	100 250 745	4	h				
22	14	F0043GB	100-230-743	4	U				
30									

Momentary Power Loss Recovery Unit

N\_\_\_\_\_B1/P

R/L1 U/T1

S/L2 V/T2

T/L3 W/T3

#### **Connection Diagram** ELCB or MCCB R S Т 3-phase power supply

Weight: 2 kg

### Momentary Power Loss Recovery Unit

M



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

Connection Diagram
ELCB or MCCB
R- S- T- T- M Drive
yellow/green
Junction terminal [OSADA Co.,Ltd. : OK-070-3P-F80]

Capacitance

(3 devices each)

X ( $\Delta$  connection) : 0.1  $\mu$  F±20%

Y (人connection): 0.003 µ F±20%



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

Rated

Voltage

440 V

#### 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.

Model Number / Product Lineup 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

#### **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 3

#### Three-Phase 200 V Class

Motor					Rated			Di	mensio	ons (m	m)			Becommended	Weight
Capacity (kW)	Model	Figure	Code No.	Qty.	Current (A)	Α	в	с	D	Е	F	G	H dia.	Tightening Torque	(kg)
0.1	RTEN-5010	1	300-082-980	1	10	120	63	42	110	53	M4	M4	4.5		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	M4 : 1.27 N·m	0.56
3.7	RTEN-5030	2	300-104-117	1	30	140	70	42	130	60	M4	M4	4.5	M5 : 2.5 N·m	0.56
5.5	RTEN-5040	2	300-104-118	1	40	170	90	54	160	80	M5	M4	4.5	M8 : 7 64 N·m	1.10
7.5	RTEN-5060	2	300-099-885	1	60	170	90	54	160	80	M5	M4	4.5	110 1 1.04 14 11	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		_			Rated	Dimensions (mm)							Becommended	Weight	
Capacity (kW)	Model	Figure	Code No.	Qty.	Current (A)	Α	В	С	D	Е	F	G	H dia.	Tightening Torque	(kg)
0.1	RTEN-5010	1	300-082-980	1	10	120	63	42	110	53	M4	M4	4.5		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	M4 - 1.27 N·m M5 - 2.5 N·m	0.56
1.5	RTEN-5030	2	300-104-117	1	30	140	70	42	130	60	M4	M4	4.5	WIJ - 2.5 W III	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

### Input Noise Filter (continued)

Dimensions (mm)



#### Three-Phase 400 V Class

Motor					Rated			Di	mensio	ons (m	m)			Recommended	Weight
Capacity (kW)	Model	Figure	Code No.	Qty.	Current (A)	А	в	С	D	Е	F	G	H dia.	Tightening Torque	(kg)
0.2	RTEN-5006	1	300-099-882	1	6	120	63	42	110	53	M4	M4	4.5		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	M4∶1.27 N·m	0.56
3.7	RTEN-5020	2	300-099-883	1	20	140	70	42	130	60	M4	M4	4.5	M5∶2.5 N∙m	0.56
5.5	RTEN-5020	2	300-099-883	1	20	140	70	42	130	60	M4	M4	4.5	M6∶4.8 N∙m	0.56
7.5	RTEN-5030	2	300-104-117	1	30	140	70	42	130	60	M4	M4	4.5	M8∶7.64 N∙m	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.





#### Dimensions (mm)





Figure 1

#### Three/Single-Phase 200 V Class

Motor Capacity (kW)	Madal	Code No	Code No. Qty.	Rated	Figure				Din	nension (mm)	S			Terminal I	Block	Weight
(kW)	woder	Code No.	Qty.	(A)	Figure	А	в	с	D	Е	F	G	н	Model	Screw Size	(kg)
0.1																
0.2																
0.4	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
0.75																
1.5																
2.2		100 061 506	4	20	4	150	100	100	00	70	45	7×4 E dia	4.E. dia		M4	0.6
3.7	LF-320KA	100-201-506	I	20	I	150	100	100	90	70	40	7×4.5 ula.	4.5 uia.	018-203	11/14	0.0
5.5		100 061 510	4	50	0	060	100	100	160	100	C.F.	7×4 E dia	4.E. dia		MG	0
7.5	LF-350KA	100-201-510	I	50	2	200	160	100	160	120	60	7×4.5 ula.	4.5 uia.	CINC-005	IVIO	2
11																
15	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
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	Madal	Code No.	0.	Rated	Figure				Din	nension (mm)	S			Terminal I	Block	Weight	
(kW)	woder	Code No.	Qty.	(A)	Figure	А	в	с	D	Е	F	G	н	Model	Screw Size	(kg)	
0.2																	
0.4																	
0.75		100-261-507	1	10	1	150	100	100	90	70	45	7×4.5 dia	4.5 dia	OTB-203	MA	0.5	
1.5	LI STURD	100 201-307	1	10	1	130	100	100	30	10	40	7 ~ 4.5 Uld.	4.5 Uld.	018-203	1114	0.5	
2.2																	
3.7																	
5.5	1 E-320KB	320KB 100-261-508	100-261-508 1		20	1	150	100	100	90	70	45	7×4.5 dia	4.5 dia	OTB-203	MA	0.6
7.5	LI JZUND		1	20	1	150	100	100	30	70	40	7 ×4.5 ula.	4.5 ula.	010 200	1114	0.0	
11	LF-335KB	100-261-500	1	35	1	150	100	100	90	70	45	7×4.5 dia	4.5 dia	OTB-203	M4	0.8	
15		100 201-009	1	35	'	130	100	100	30	10	40	7 ~ 4.5 Uld.	4.5 Uld.	018-203	1114	0.8	
18.5	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	
22	LF-375KB	LE 275KP 1	100-261-512	1	75	2	540	320	480	300	340	240	0×65 dia	6 5 dia		MG	10
30		100-261-512	1	15	2	540	320	400	300	340	240	a∧0.5 0la.	0.5 ula.	0110-005	110	12	

Standard Connection Diagram

Dimensions

Fully-Enclosed Design and Drive Watt Loss Data

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- when using ERF-type resistors. \*3 : Be sure to protect non-Yaskawa braking resistors by thermal overload relay.



#### Braking Resistor Unit





-	aking			DIIII	Insion	15 (111	11)		Allowable
Res I LKE	istor Unit Model B-	It         Figure           7         1           5         1           2         1           5         1           6         1           7         1           5         1           6         1           7         1           6         1           7         1           6         1           7         1           6         1           7         1           6         1           7         2           1         2           2         3	А	в	с	D	MTG Screw	Weight (kg)	Average Power Consumption (W)
	20P7	1	105	275	50	260	M5×3	3	30
	21P5	1	130	350	75	335	M5×4	4.5	60
ass	22P2	1	130	350	75	335	M5×4	4.5	89
ö	23P7	1	130	350	75	335	M5×4	5	150
>	25P5	1	250	350	200	335	M6×4	7.5	220
20(	27P5	1	250	350	200	335	M6×4	8.5	300
	2011	2	266	543	246	340	M8×4	10	440
	2015	2	356	543	336	340	M8×4	15	600
	40P7	1	105	275	50	260	M5×3	3	30
	41P5	1	130	350	75	335	M5×4	4.5	60
	42P2	1	130	350	75	335	M5×4	4.5	89
ŝ	43P7	1	130	350	75	335	M5×4	5	150
las	45P5	1	250	350	200	335	M6×4	7.5	220
>	47P5	1	250	350	200	335	M6×4	8.5	300
00	4011	2	350	412	330	325	M6×4	16	440
4	4015	2	350	412	330	325	M6×4	18	600
	4018	2	446	543	426	340	M8×4	19	740
	4022	2	446	543	426	340	M8×4	19	880
	4030	2	356	956	336	740	M8×4	25	1200

= 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.

#### Specifications Three/Single-Phase 200 V Class

		GA	500		Brak	ing F	Resistor	(Duty Fa	ctor: 3	% ED, 10	s ma	ax.)*1			Braking Re	esisto	or Unit		
Max.		Three-	Single-		N	o Fu	se			Wi	th Fu	ise		(Dut	y Factor : 10%	6 ED	), 10 s n	nax.)*1	Min*2
Motor Capacity (kW)	ND/ HD	Phase Catalog Code GA50A	Phase Catalog Code GA50A	Model ERF 150WJ	Resistance (Ω)	Qty.	Diagram	Braking Torque* <sup>3</sup> (%)	Model CF120- B579	Resistance (Ω)	Qty.	Diagram	Braking Torque* <sup>3</sup> (%)	Model LKEB-	Resistor Specifications (per unit)	Qty.	Diagram	Braking Torque* <sup>3</sup> (%)	Connectable Resistor (Ω)
0.1	HD	2001	B001	401	400	1	А	220	А	400	1	А	220	40P7	$70 \text{ W} 750 \Omega$	1	В	220	300
0.2	ND HD	2001 2002	B001 B002	401	400	1	А	220	А	400	1	А	220	40P7	70 W 750 Ω	1	В	125	300
0.4	ND	2002	B002	401	400	1	А	110	А	400	1	А	110	40P7	70 W 750 $\Omega$	1	В	65	300
0.4	HD	2004	B004	201	200	1	А	220	В	200	1	А	220	20P7	70 W 200 $\Omega$	1	В	220	200
0.75	ND	2004	B004	201	200	1	Α	125	В	200	1	Α	125	20P7	70 W 200 Ω	1	В	125	200
0.75	HD	2006	B006	201	200	1	А	125	В	200	1	А	125	20P7	70 W 200 Ω	1	В	125	120
11	ND	2006	B006	201	200	1	Α	85	В	200	1	А	85	20P7	70 W 200 Ω	1	В	85	120
1.1	HD	2008	-	101	100	1	А	150	С	100	1	А	150	21P5	$260 \text{ W} \ 100 \ \Omega$	1	В	150	60
1.5	ND HD	2008 2010	– B010	101	100	1	А	125	С	100	1	А	125	21P5	260 W 100 Ω	1	В	125	60
2.2	ND HD	2010 2012	B010 B012	700	70	1	А	120	D	70	1	А	120	22P2	260 W 70 Ω	1	В	120	60
0	ND	2012	B012	620	62	1	А	100	Е	62	1	А	100	22P2	260 W 70 Ω	1	В	90	60
3	HD	2018	—	620	62	1	А	100	Е	62	1	А	100	23P7	390 W 40 $\Omega$	1	В	150	32
3.7	ND HD	2018 2021	– B018	620	62	1	А	80	Е	62	1	А	80	23P7	390 W 40 Ω	1	В	125	32
	ND	2021	-	-	-	-	-	-	-	-	-	-	-	23P7	390 W 40 Ω	1	В	85	32
5.5	HD	2030	-	-	-	-	-	-	-	-	-	-	-	25P5	520 W 30 Ω	1	В	115	9.6
7 5	ND	2030	-											0705	790 W 00 0	4	Р	105	0.6
7.5	HD	2042	-	_	-	_	-	-	-	-	_	-	-	2795	700 W 20 12	'	Б	125	9.0
11	ND HD	2042 2056	-	-	-	-	-	-	-	-	-	-	-	2011	2400 W 13.6 Ω	1	В	125	9.6
15	ND HD	2056 2070	-	-	_	-	-	_	-	_	-	-	_	2015	3000 W 10 Ω	1	В	125	9.6
18.5	ND	2070	-	_	_	_	_	_	_	_	_	_	_	2015	3000 W 10 Q	1	в	100	9.6
10.0	HD	2082	-											20.0			-		0.0
22	ND	2082	_	-	-	-	-	-	-	-	-	-	-	2015	3000 W 10 Ω	1	B	85	9.6

#### Three-Phase 400 V Class

		GA500		Brak	king I	Resistor	<sup>-</sup> (Duty Fa	ictor: 3°	% ED, 10	s ma	<b>1x.)</b> *1							
Max.				N	o Fu	se			Wi	th Fu	ise		(Dut	y Factor : 10%	6 ED	,10 s m	nax.)*1	Min*2
Motor Capacity (kW)	ND/ HD	Catalog Code GA50A	Model ERF 150WJ	Resistance (Ω)	Qty.	Diagram	Braking Torque*3 (%)	Model CF120- B579	Resistance (Ω)	Qty.	Diagram	Braking Torque <sup>*3</sup> (%)	Model LKEB-	Resistor Specifications (per unit)	Qty.	Diagram	Braking Torque <sup>*3</sup> (%)	Connectable Resistor (Ω)
0.2	HD	4001	751	750	1	А	230	F	750	1	А	230	40P7	70 W 750 $\Omega$	1	В	230	750
0.4	ND HD	4001 4002	751	750	1	А	230	F	750	1	А	230	40P7	70 W 750 Ω	1	В	230	750
0.75	ND	4002	751	750	1	А	130	F	750	1	А	130	40P7	70 W 750 $\Omega$	1	В	130	750
0.75	HD	4004	751	750	1	А	130	F	750	1	А	130	40P7	$70 \text{ W} 750 \Omega$	1	В	130	510
15	ND	4004	751	750	1	А	70	F	750	1	А	70	40P7	$70 \text{ W} 750 \Omega$	1	В	70	510
1.5	HD	4005	401	400	1	А	125	G	400	1	А	125	41P5	$260 \text{ W } 400 \ \Omega$	1	В	125	240
22	ND	4005	301	300	1	А	115	Н	300	1	А	115	42P2	$260 \text{ W} \ 250 \ \Omega$	1	В	135	240
2.2	HD	4007	301	300	1	А	115	Н	300	1	А	115	42P2	$260 \text{ W} \ 250 \ \Omega$	1	В	135	200
3.0	ND	4007	401	400	2	A	125	J	250	1	A	100	42P2	$260 \text{ W} \ 250 \ \Omega$	1	В	100	200
0.0	HD	4009	401	400	2	A	125	J	250	1	A	100	43P7	390 W 150 Ω	1	В	150	100
3.7	ND HD	4009 4012	401	400	2	А	105	J	250	1	А	83	43P7	390 W 150 Ω	1	В	135	100
5 5	ND	4012	201	200	2	А	135	J	250	2	А	105	45P5	520 W 100 $\Omega$	1	В	135	100
5.5	HD	4018	-	-	-	-	-	-	-	-	-	-	45P5	520 W 100 $\Omega$	1	В	135	32
7.5	ND HD	4018 4023	_	-	-	-	-	-	-	-	-	-	47P5	780 W 75 Ω	1	в	130	32
	ND	4023	-	-	_	-	-	-	-	_	-	-	4011	1040 W 50 Ω	1	В	135	32
11	HD	4031	_	_	-	_	_	-	_	-	_	_	4011	1040 W 50 Ω	1	В	135	20
15	ND	4031	_	_	_	_	_	_	_	_	-	_	4015	1560 W 40 Ω	1	в	125	20
	HD	4038											1010	1000 11/ 00 0			105	00
18.5	ND	4038	-	-	-	-	-	-	-	-	-	-	4018	4800 W 32 Ω	1	В	125	20
	HD	4044	-	-	-	-	-	-	-	-	-	-	4018	4800 W 32 Ω	1	В	125	19.2
22	HD	4044 4060	-	-	-	-	-	-	-	-	-	-	4022	4800 W 27.2 Ω	1	В	125	19.2
30	ND	4060	_	-	-	-	-	-	-	-	-	-	4030	$6000 \text{ W} \ 20 \ \Omega$	1	В	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.

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### Keypad



1000	Specification	Model	Code No.
-	Standard	JVOP-KPLCA04AEA	100-245-993
	Humidity, dust	JVOP-KPLCA04MEA	100-245-994

#### LCD keypad



Specification Model Code No. Standard JVOP-KPLCC04ABA 100-225-008 JVOP-KPLCC04MBA 100-225-009 Humidity, dust Note: 1. Certified international standards: CE, FCC, IC (Industry Canada), CMIIT, MIC Japan 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

Bluetooth LCD keypad



۰.			
3	Specification	Model	Code No.
	Standard	JVOP-KPLEA04AAA	100-206-377
	Humidity, dust	JVOP-KPLEA04MAA	100-206-378

before using the product.

LED keypad

### Keypad Extension Cable

#### Dimensions (mm)



Mtg. hole, M3 × 2 screws (depth 6) (for mounting on control panel)

### LCD Keypad Attachment



#### Blank Cover



JVOP-KPBCH04AAA 100-247-125

Code No.

#### Keynad Extension Cable

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

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



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



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#### 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.

Notes

For use with





#### Installation Support Set B

1.0	Model
I'II	900-192-933-002
	Note: If there are weld panel, use the ins

900-192-933-002	100-203-009	panel mounted threaded studs
ote: If there are weld panel, use the ins	studs on the inte	rior of the control et B (nut clamp).

Code No.

#### Installation Using Set A



**Dimensions mm** 

Catalog Code

### DIN Rail Attachment

Π

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)





EZZ08122D

W



GASUA	W	н	D	D1		
2001						
2002	60	100	15.2	05	707-0450\/1	100-242-246
2004	00	120	10.0	0.0	ZFZ-GASUVI	100-242-240
2006						
2008						
2010	106	128	15.3	8.5	ZPZ-GA50V2	100-242-247
2012						
2018	138	128	15.3	85	ZPZ-GA50V3	100-242-248
2021	100	120	10.0	0.0	212 0/0000	100 242 240
B001						
B002	68	128	15.3	8.5	ZPZ-GA50V1	100-242-246
B004						
B006	106	128	15.3	8.5	7P7-GA50V2	100-242-247
B010						
B012	138	128	15.3	8.5	ZPZ-GA50V3	100-242-248
B018	170	133	-	6	EZZ08122D	100-146-899
4001						
4002						
4004	106	128	15.3	8.5	ZPZ-GA50V2	100-242-247
4005						
4007						
4009						
4012	138	128	15.3	8.5	ZPZ-GA50V3	100-242-248

#### 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)



### Frequency Setting Potentiometer/Frequency Meter Adjusting Potentiometer



Control Dial for Frequency Setting Potentiometer/Frequency Meter Adjusting Potentiometer



		. ,	, 0
Model	Code No.	Dimensions (mm)	
K-2901-M	100-250-544		Applicable shaft diameter 6 mm Mounting screw M4 (1)

Meter Plate for Frequency Setting Potentiometer/Frequency Meter Adjusting Potentiometer



# **Product Lineup** Model Number / Catalog Code

Basic Instructions

### 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.



Insulation cap Red: Drive input Blue: Drive output Nameplate ¢

approx. 85 90 102±2

Weight: 2.2 kg

Global Service Network

### **Application Notes**

#### Application Notes

#### Selection

- Installing a Reactor
  - An AC or DC reactor can be used for the following situations:
  - $\cdot$  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%.
- $\cdot$  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<sup>2</sup>/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 preforming 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 closedloop 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  $+70^{\circ}$ 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.

 $\cdot$  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.
Basic Instructions

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 50.
- 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> <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> <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:	1 to A	1, 2, 7 to A	1, 7 to A						
Carrier Frequency Selection	(15 kHz or less)	(5 kHz or less)	(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



25% ED (or 15 min.)

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:

- 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

# 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.
- $\cdot$  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.

# Basic Instructions

# 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.
- $\cdot$  Only approved personnel should install, wire, maintain, inspect, replace parts, and repair the drive.
- $\cdot$  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.



# **Global Service Network**



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Basic Instructions

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# **YASKAWA**