

YASKAWA AC Drive GA700

High Performance Type

200 V CLASS, 0.4 to 110 kW
400 V CLASS, 0.4 to 630 kW

Best Value for Your Applications



Certified for
ISO9001 and
ISO14001



JQA-QMA14913 JQA-EM0202

Best Value for Your Applications

Yaskawa Electric Corporation are here to provide “the answer” for your company.

We Yaskawa Electric Corporation always consider customer's perspective as our number one priority as we provide and fulfill the demands with our uncompromising quality and trust ahead of others in the industry.

Our brand new GA700 inverter series inherits the genealogy of the product concepts: FLEXIBLE, EASY, SUSTAINABLE.

New motor control with high efficiency, total cost down from incorporating peripheral equipments and outstanding environmental compatibility allows usage at anywhere in the world.





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Our GA700 offers a revolution for your facilities and machines. It will increase productivity, save energy efficiently, reduce total cost and enhance environmental compatibility.





Are You Fully Using the Machines to the Maximum Efficient Limits?

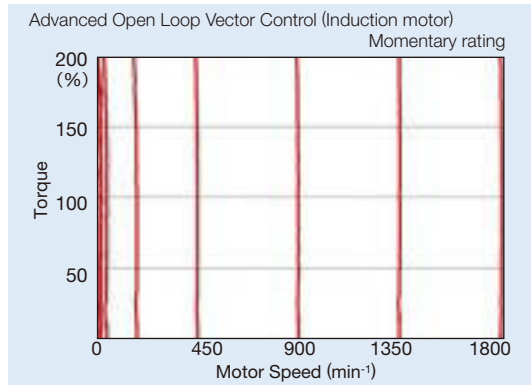
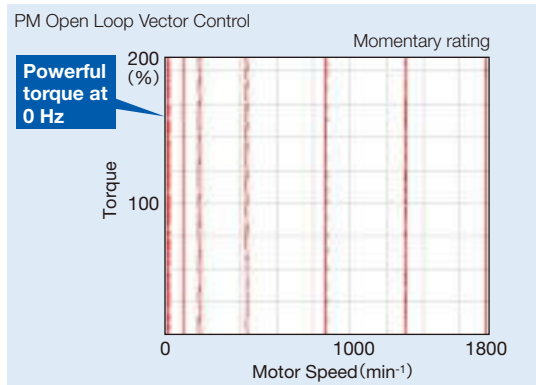
Yaskawa Electric Corporation has been constantly developing the motor controls for years, which can become the key to success for your machines that will undermine your expectations.

Powerful Starting Torque without Encoder

By applying the IPM motor, output of a zero speed at 200% torque without encoder are possible. This will lead to miniaturization of the constant torque machine and system cost down. When utilizing the induction motors with the advanced open loop vector control, tension control of the winder can be done without encoders, which will improve the wire savings and reliabilities.



Torque characteristics



Torque Control without Encoder

With the improvement performance of advanced vector controls, it can be installed without mounting the encoders. Reliabilities has increased due to needless of the encoders.



Encoder
Needless



PG Option Card
Needless



PG Cable
Needless

EZ Open Loop Vector Control Tuning-less even for Synchronous Motors!

Yaskawa's brand new EZ open loop vector control can drive both synchronous motors and induction motors and does not require any complicated tuning processes. Simply input the information on the motor nameplate.

EZ open loop vector control can reduce trial operation time and minimize the number of pieces of equipment used by the same drive to run the induction and synchronous motors.

Energy-saving control also makes it possible to operate with better efficient in comparison with the conventional drives.*

* Refer to "The Fourth Energy Saving Choice" on page 5.



High-speed Operation

With the significant improvement in the basic performances, induction motor and synchronous motor can drive up to 590 Hz*.

As a result, miniaturization of the machine from gear-less and motor miniaturization are possible.

* Varies with the control modes. Apply for PM/non PG vector control and V/f control.



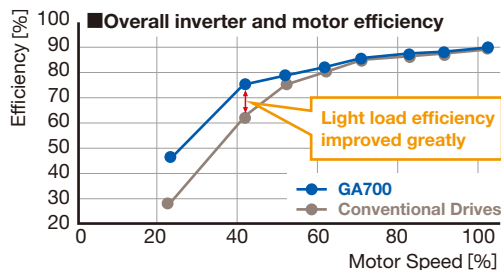
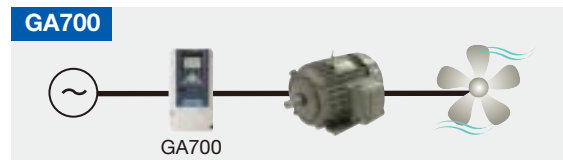
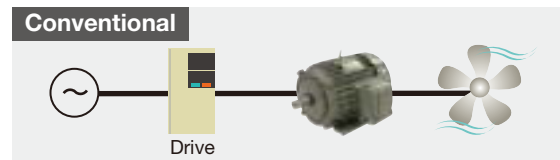


Are You Having Trouble with Power Efficiently?

Inverter for the machines, applying high efficient motors and usage of the regenerative energy has been the trend. Now in addition, with the new technology of "maximizing the motor efficiency", it achieves energy saving more than ever for the inverters.

The Fourth Energy Saving Choice: Maximizing the Motor Efficiency

Higher energy savings with new function that monitors the power consumption for maximum energy efficiency.



Performance (Annual)

● Annual power savings

Approx. **1,000 kWh**

● Annual CO₂ reduction effect:

Approx. **410 kg**

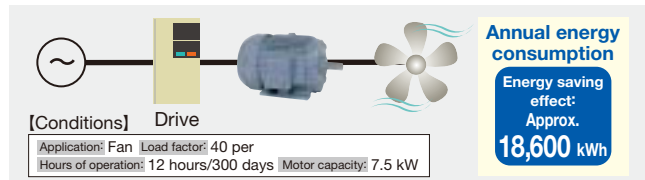
[Conditions]

Application: Air-conditioning fan
(high-efficiency motor IE3 applied)
Number of operating units: 7.5 kW
Load factor: 40%
Annual number of days of operation:
24h per day/365 days per year
CO₂ coefficient: 0.412 (kg/kWh)



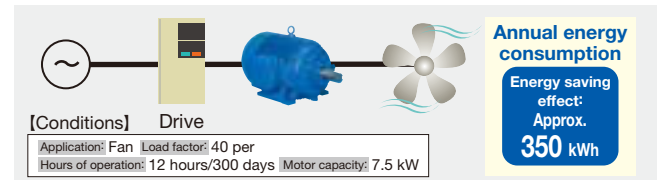
The First Energy Saving Choice: Inverters for the Machine

Energy savings due to inverter controlling the air flow of the fan with the damper.



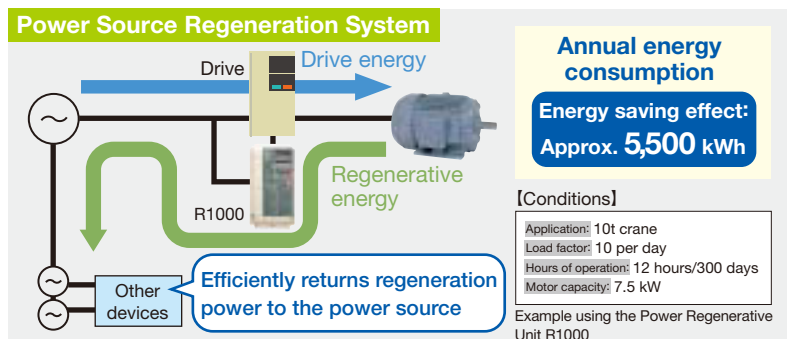
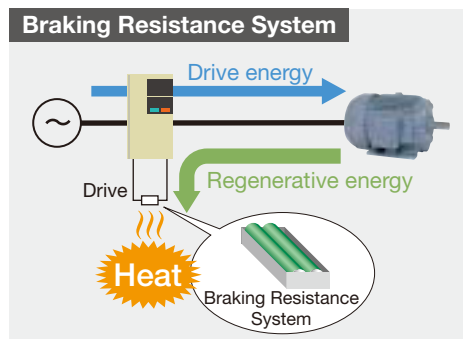
The Second Energy Saving Choice: Applying High Efficiency Motors

Energy savings by applying a high-efficiency motor (IE3 / IE4).



The Third Energy Saving Choice: Usage of the Regenerative Energy

Returning the regenerative energy that has been wasted as heat in the braking resistor to the power supply for energy savings. (when installed with the energy saving unit: D1000 or R1000)



Energy Saving Effect Simulation

You can check the investment effectiveness of energy saving when switching a fan/pump to an inverter and with power supply regeneration.

* You can download Drive Select from the e-mecha website.



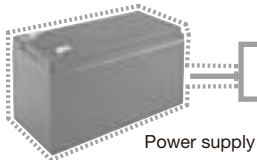


Are You Considering Cost Down?

To minimize the initial investment, function of the peripheral devices are incorporated in the inverter which will save space, wiring and labor.

Built-in Power Supply for the Sensor

Being 24 Vdc output (150 mA), it does not require separate power supply.



24 Vdc Control Power Input Terminal Standard Equipped

Backs up control power supply without any additional options.



Braking Transistor Built-in

Correspondence:
200 V-class up to 37 kW (ND)
400 V-class up to 90 kW (ND)



DC Reactor Built-in

A DC reactor minimizes harmonic distortion. (corresponds to 200 V class/400 V class 30 kW (ND) or more)

EMC Filter (C2, C3) Built-in*

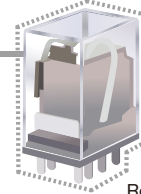
* Factory option



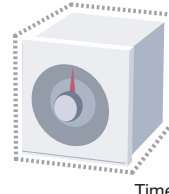
High Performance Even Without an Encoder

Peripheral Parts Reduction

With the function enhancement of the support tool DriveWorksEZ, timers and relays are unnecessary.



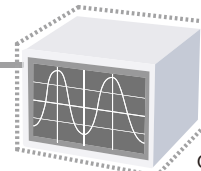
Relay



Timer

Oscilloscope Function

With the oscilloscope performance improvement of the inverter support tool DriveWizard, adjustments can be made without any measuring instruments



Oscilloscope

Voltage/Current Switching Analog Output

Conversion circuit is unnecessary for the analog output voltage of 0 to 10 V and electric current of 4 to 20 mA.



Converter

SIL3* Correspondence STO Standard Equipped

The two contactor is now unnecessary.

* The safety performance measurement under IEC/EN61800-5-1

Horizontal Placement

Choice of horizontal or vertical placement of the inverter for space saving. (for up to 75 kW)

Note: Secure and derating of the airflow are required.

Control Panels for IP55 Compatible Line Up is Unnecessary*

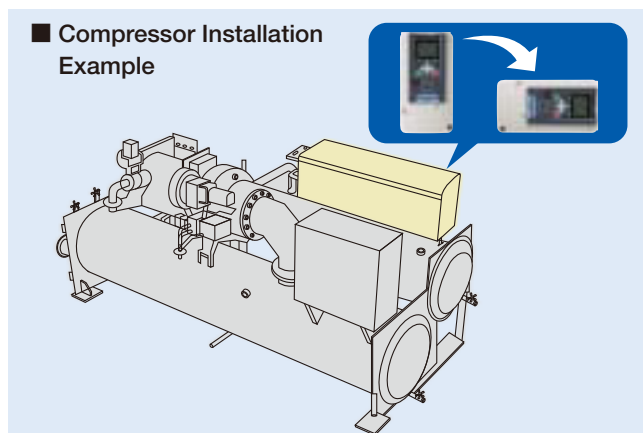
Can be installed without using control panels due to protective structure being correspondence with the IP55.

IP55: The IP Code in JIS need to be "dust/jet-proof".

* Factory option (In preparation)



Compressor Installation Example





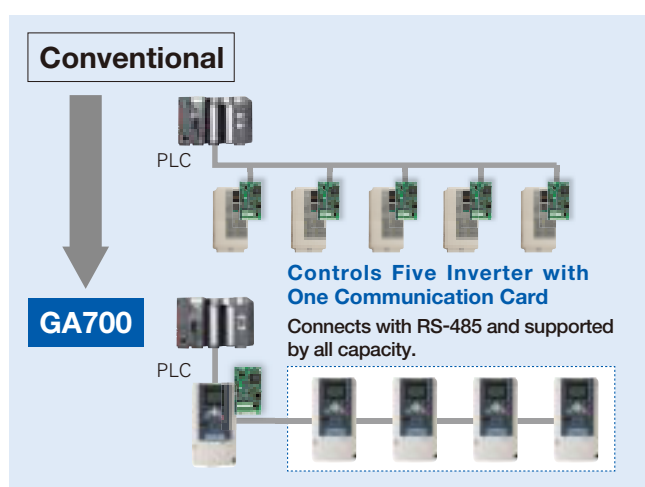
Are you ready for the IoT?

We have assembled option cards compatible with the main industrial networks.

Gateway Connection System

Able to control up to maximum of five inverters with one communication card by converting the industrial network protocol to RS-485.

We recommend this system for fans, pumps, compressors and other devices that require multi-axis control.



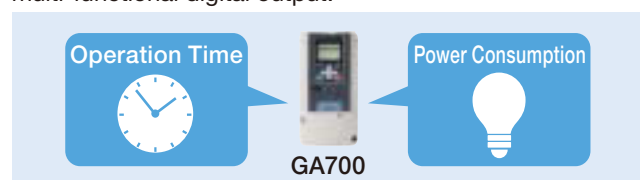
Enhanced Communication Option Card

Able to support variety of field networks by equipping a communications option card. These includes: MECHATROLINK-II, MECHATROLINK-III, PROFIBUS-DP, DeviceNet, CC-Link, CANopen, LONWORKS, and various fields for communication and industrial Ethernet such as EtherNet/IP.

Note: Product names are registered trademarks of the respective owners.

Monitor Output of Various Types of Data

Can output various data via communication network. By constantly monitoring these data, you can visualize the factory. Values set to the parameters can be outputted as multi-functional digital output.



Flexibility Improvement of I/O

The PG option cards and input/output option cards for the 1000 series can still be used.

DI-A3 input terminals that are conventionally used as digital frequency reference cards can also be used as multi-function input terminals.



Is "Customizing is Difficult" on Your Mind?

Programming Tool "DriveWorksEZ" Standard Equipped

Inverters can be easily customized to suit the needs for the customers by drag-and-drop operation using a PC. For example, special operations and new detection function, pressure sensor-less control of the compressor, vibration detection of the conveyor and abnormal symptom diagnosis, such as clogging sensing for fans can be programmed.

* In preparation



Program Capacity Expansion!

Number of connections: **200**

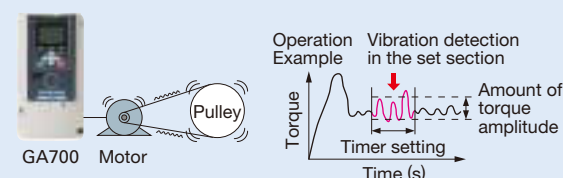
Function Blocks: 419*

Note: For DriveWorksEZ Pro.

Please contact our agency for the usage of DriveWorksEZ Pro.

Program Detection Function

Ex.) Function deterioration diagnosis (machine torque pulsation detection) function



Registration of Favorites For The Monitor

Maximum of 12 monitors can be registered.

The registered monitors can be displayed with minimum keystrokes.





Taking Long Time to Setup and Recover from Malfunction?

With the renewed wizard function of the interactive system and redesigned key pad, it has significantly achieved reduction of the the setup/downtime.

Downtime: Non-operating time from equipment trouble

Condition Confirmation of Malfunction Without The Main Circuit Power Supply

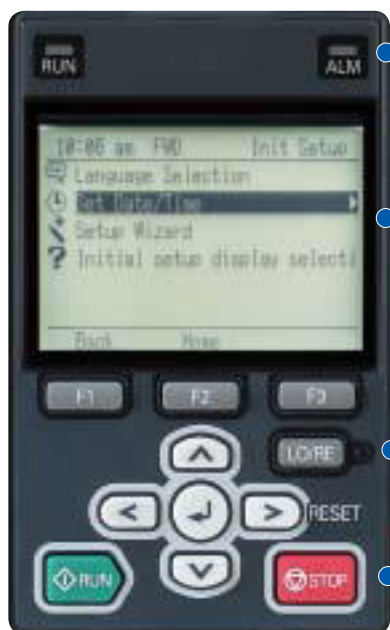
By inputting the 24 Vdc control power, without turning on main circuit power supply, you can safely perform the restoration work and able to confirm the malfunction.

Parameter Settings Without Any Main Circuit Power Supply*

Manage the parameter information of the inverter with the keypad alone.

With the USB connection of the keypad and the PC, parameter editing can be made without an inverter. Even when unable to prepare the main circuit supply, you can make settings in advance.

* In preparation.



Build-in Clock Functions

Easily identify the time of the malfunction with the build-in clock function.

Note: Requires a Hitachi Maxell "CR2016 Lithium Manganese Dioxide Battery" or equivalent.

microSD Slot*

Able to save the log data to the microSD card.

Waveform display using the support tool

DriveWizard makes malfunction analysis simple.

* In preparation.



Capable of Storing Parameter of the Four Inverters

Now, the keypad can store up to parameter of four inverters.

Auto Backup Function

Even when the inverter have trouble, you can replace the keypad and copy the parameters using the auto backup function.

European Terminal

European terminal are applied to the main circuit terminal.

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



Compatible Models:
200 V-class:
GA70□2211 and under
400 V-class:
GA70□4168 and under

For use of the tools, see P.29.
Screw terminal options, cable clamp options is in preparation.

■ Wiring Work Time

Conventional Products

Approx. 4 min 30 sec

Approx.
1 min 30 sec
GA700

Approx.
70% reduction!
(conventional ratio)

Conditions

Input terminal: RST, the output terminal: If you wire the UVW
Existing products: Crimping, wiring (screw terminal)
GA700: wiring work (European terminal)

Equipped with Set-Up Wizard Function

Complete the initial setting by responding to the questions that appear on the keypad.

● Parameters Set by Set-Up Wizard Function

- Frequency reference source
- Run command source
- Motor class
- Maximum frequency
- Stopping method
- Input signal level
- Duty rating
- Control mode
- Input/output setting
- Acceleration/deceleration time etc.

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

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

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

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

2 Select the item you want to set. Operate according to the display of the keypad.

3 Check the modified parameters and select "Next".

4 Select "Yes" and settings are complete.

Status Ring

You can see the operation conditions even from a distance.



Reduction of the Installation Space

45% reduced from the conventional inverters.

You can design a compact control board.

(ex. 400 V 45 kW)



Bell-Shaped Holes

Easily installed to the walls.



Removable Terminal Block

Even if you are installing the inverter at a narrow and small space, you can remove the terminal block and wire work where you have more space. In addition, the wire that is connected to the inverter at the time of trouble can be connected as it is to the new inverter.

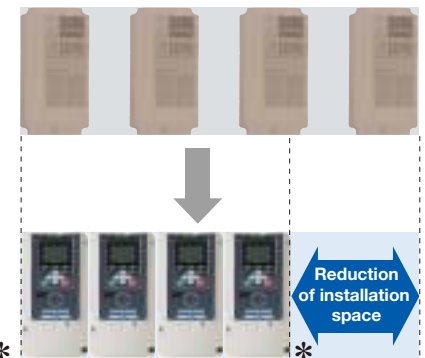


Side-by-Side Installation

Side-by-Side installation makes design of the control panel compact.

Note: 18.5 kW models need derating.

(ex. 200 V 0.4 kW)



* Need at least 30 mm of space if side is a wall.



Taking Time with Initial Response at the Time of Trouble?

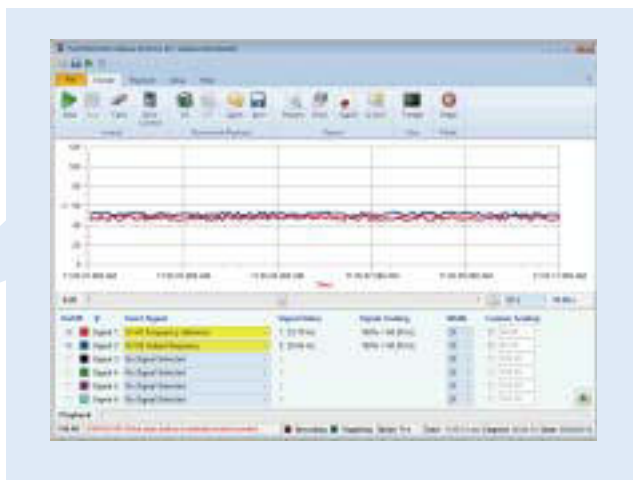
Linked with smartphone applications and PC support tools via cloud management, there has been significant improvements in its maintainability.

Support Tool “DriveWizard”*

Wireless connection and cloud management through smartphone made maintenance simple and easy. Equipped with various monitors, parameter editing, pattern operation and oscilloscope function.

Adjustment and maintenance work of the inverter can be executed more easily.

* In preparation



Smartphone Application “DriveWizard Mobile”

New form of support utilizing the smartphone such as Cloud management of the wireless connection and parameters of the inverter.

[Parameter Management via Cloud]

Saving and reading the parameters are feasible via Cloud.



Cloud

Read

Save

Wireless Access
Bluetooth®



Press Machine

Drive

[Access From Distance]

You can access the inverters remotely located out of reach without opening any panels.

Note: Bluetooth built-in keypad is in preparation.

* “Bluetooth®” is a trademark/registered trademark of Bluetooth SIG, Inc. USA.

Smartphone DriveWizard Mobile (exclusive app)

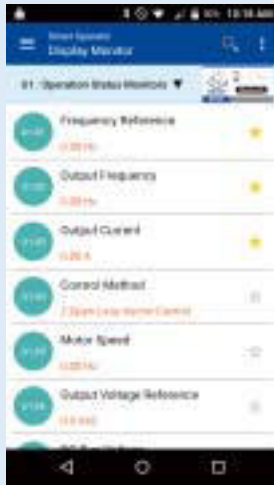
[Parameter Setting Change/Drive Operation]

- Easy to change the parameter settings.
- Operational status can be viewed in real time.
- Quick access to troubleshoot.

Variety of Functions and Services of the DriveWizard Mobile



Change of
parameter changes



Monitor display



Troubleshoot

Download DriveWizard Mobile at Android terminal content providing service "Google Play Store" for free.*
Google Play Store hyper-link are available at the Yaskawa Electric Corporation product and technology informational website "e-mecha site".

Note: "Android" and "Google Play" is a trademark/registered trademark of Google Inc.

* In preparation

Thoroughgoing After Sales Services

Call center and after service division will support the customers 24/7, 365 days.

Deliver According to the Customer's Request

Drives can be customized according to your specifications.

- Shipped after installing option to the drive at factory.
- Terminal board with multi-function relay outputs

Multi-Function Photocoupler Output Type (Standard)	Multi-Function Digital Output Type
Relay: 2, Photocoupler: 2	Relay: 3, Photocoupler: 0

- Optional LED keypad
Five-digit displaying keypad.



LCD keypad (standard)
(JVOP-KPLCA04AAA)



LED keypad
(JVOP-KPLEA04AAA)

Contact Yaskawa for details.



Struggling with Standards and Adapting to Environmental Friendly?

Corresponds to international standards and are designed to cope with various applications.

Certified Standards



International Standards

Name	Country
UL/cUL	U.S.A
CSA*1	Canada
CE*2	Europe
RCM *1,*2	Australia

Vessel Standards

Name	Country
NK*1	Japan
DNV GL*1	Germany/Norway
ABS*1	U.S.A
BV*1	France
CCS*1	China
KR*1	South Korea

Products used in ships requires reliability and durability to withstand the harsh environmental conditions. The acquisition of the standard authentication from the corresponding countries are required.

Others
RoHS directive compliant

*1: Applying

*2: Please use EMC filter
(select GA700 EMC built-in model, or use external EMC filter together.)
For CE, RCM Marking compliant models, refer to GA700 Technical Manual.

Wide range of environmental specifications lineups

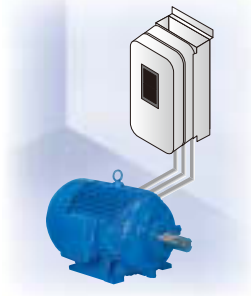
[IP55 Compatible*]

Able to install in harsh environments because there are no control panels. More variation in installment locations.



IP55: The IP Code in JIS need to be "dust/jet-proof".

* Factory option (In preparation)



[Standard Varnish Coated Base]

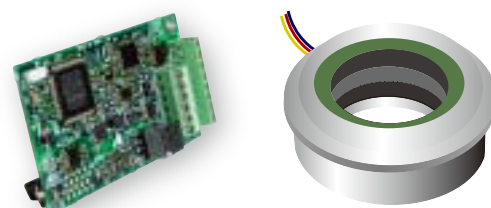
Printed base are varnish coated enabling the use under harsh environmental conditions. (IEC 60721-3-3: 3 C2, 3 S2)



[Resolver Compatible]

Corresponds to resolver which is an higher environmental resistance detector than the encoders.

Note: Option card is required.



[Compatible with vibration, anti-gas*, moisture, dust and oil resistance.]

* Factory option





AbN automation Are Reliability of Your Equipment Enough?

Even at sudden power failures, it will continue to run the production line.

With the life diagnostic prediction, preventive maintenance of life parts can be performed at a perfect time.

Momentary Power Loss Countermeasures

Synchronous motor and induction motor, control of the encoderless synchronous motors are possible.

[Speed Search Function]

Easy restart with the search of the rotational speed of the coasting. Ideal for machines with a rotating body rive such as fans and blowers.



[Momentary Power Loss Recovery to continue operation through a 2 s power loss.*]

- GA700 automatically restarts the motor and keeps the application running in the event of a power loss.
- Easy transition to SEMI (Semiconductor Equipment and Materials International).
- Reduction of special equipments such as UPS (Uninterruptible power supply).

* Momentary power failure compensation unit (option) are required for certain capacity.

[KEB Function]

During the power outage, the inverter decelerate then stops quickly and safely without free running the motors. This function is called the KEB, known as Kinetic Energy Back-up. Ideal for machineries with power outage countermeasures such as machine tool spindle motor and film production line.

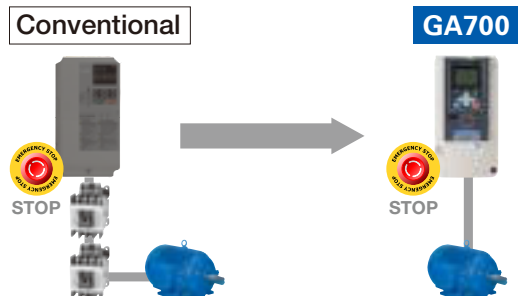


Standard Correspondence to SIL3 Without a Contactor

STO from two-terminal input (safety shut-off torque) are standard equipped.

Fulfills: IEC/EN61508 SIL3 and ISO13849-1 Cat.3 PLe

With this function, a high degree of safety system can be build without any additional equipment such as an electromagnetic contactor system. Saves wiring and space.



IP20 Corresponds to All Capacity

All capacity corresponds to IP20.

Since there is no risk of exposures to high-voltage portion of the main circuit, additional safety measures such as installing a terminal cover in the board is unnecessary.

Auto-Backup Function

Even when the inverter have trouble, you can replace the keypad and copy the parameters using the auto backup function.

Long Life Time

With the selection of long-life parts for fan, condenser and relay, design life of 10 years has been achieved.

Note: The value was measured under ambient temperature of 40 °C (mount type panels), load factor of 80% and 24-hour continuous operation. The value varies depending on the conditions of use.

Performance Life Monitors

With the performance life monitors, the approximate maintenance period of parts can be outputted as a alarm signal to notice the users in advance.

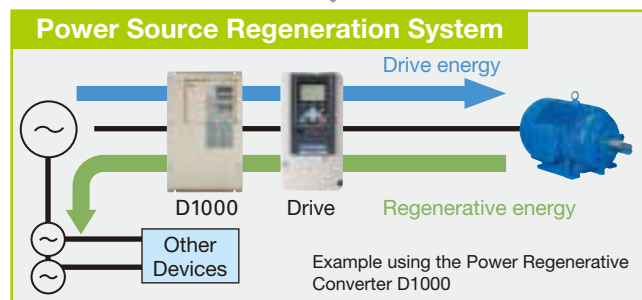
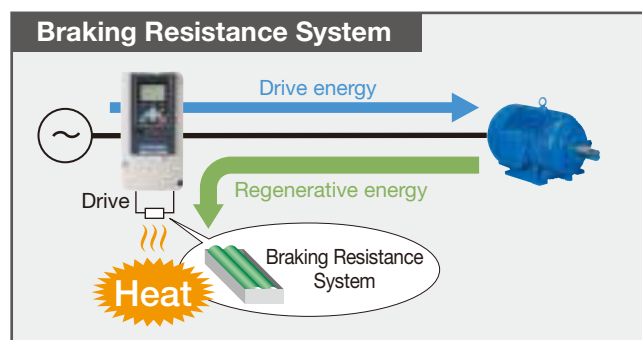
In addition, you can monitor the deterioration situation of the parts so that planning for the maintenance plan can be conducted easily.

■ GA700 outputs the alarm signal to the PLC controller



Minimum Heat Generation (when using energy saving unit: D1000, R1000)

To effectively use the regenerative energy that has been treated as conventional heat, it can minimizes the generation of heat and able to avoid trouble of the surroundings caused by heat.

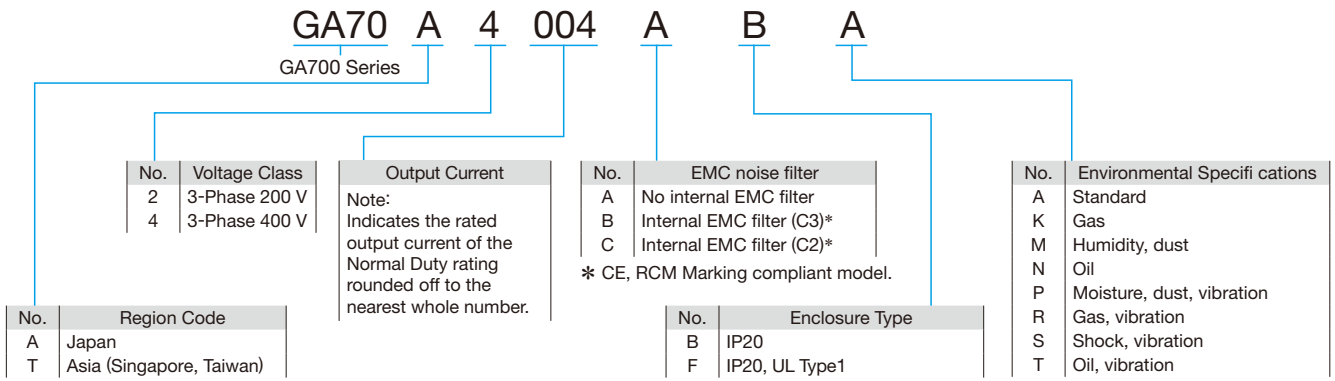


Product Lineup

Motor Capacity kW	Three-Phase 200 V				Three-Phase 400 V			
	Heavy Duty		Normal Duty		Heavy Duty		Normal Duty	
	Catalog Code GA70A□□	Rated Output	Catalog Code GA70A□□	Rated Output	Catalog Code GA70A□□	Rated Output	Catalog Code GA70A□□	Rated Output
0.4	2004	3.2 A			4002	1.8 A		
0.75	2006	5 A	2004	3.5 A	4004	3.4 A	4002	2.1 A
1.1	2008	6.9 A	2006	6 A				
1.5	2010	8 A	2008	8 A	4005	4.8 A	4004	4.1 A
2.2	2012	11 A	2010	9.6 A	4007	5.5 A	4005	5.4 A
3	2018	14 A	2012	12.2 A	4009	7.2 A	4007	7.1 A
3.7	2021	17.5 A	2018	17.5 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	2110	88 A	2082	82 A	4060	45 A	4044	44 A
30	2138	115 A	2110	110 A	4075	60 A	4060	59.6 A
37	2169	145 A	2138	138 A	4089	75 A	4075	74.9 A
45	2211	180 A	2169	169 A	4103	91 A	4089	89.2 A
55	2257	215 A	2211	211 A	4140	112 A	4103	103 A
75	2313	283 A	2257	257 A	4168	150 A	4140	140 A
90	2360	346 A	2313	313 A	4208	180 A	4168	168 A
110	2415	415 A	2360	360 A	4250	216 A	4208	208 A
132					4296	260 A	4250	250 A
160					4371	304 A	4296	296 A
200					4389	371 A	4371	371 A
220					4453	414 A	4389	389 A
250					4568	453 A	4453	453 A
315					4675	605 A	4568	568 A
355					4726	642 A	4675	675 A
400					4810	726 A	4726	726 A
450					4930	810 A	4810	810 A
500							4930	930 A
560					4H12	1090 A		
630							4H12	1200 A

Note: The GA70A 2360 to GA70A 2415, GA70A 4371 to GA70A 4H12 are in preparation.

Catalog Code



The following specifications can also be supported. Refer to page 11.

- Terminal board (multi-function digital output type)
- Shipped after installing option to the drive at factory.
- LED keypad

Note: Refer to the GA700 instruction manual for more information on model numbers.

Model Selection

Optimizing Control for Each Application

GA700 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 (default)	C6-01=1
Overload tolerance	150% 60s	110% 60s
Carrier frequency	Low carrier frequency	Low carrier frequency (SwingPWM) *

* Use Swing PWM to quiet undesirable motor noise generated when operating with a low carrier frequency. Available for models less than 450 kW.

Heavy Duty Applications

● Applications



● Selecting a Drive

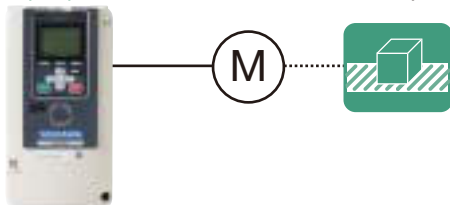
For a conveyor application using an 11 kW motor, select GA70A2056 and set it for Heavy Duty performance (C6-01=0: default).

Catalog code: GA70A2056

Heavy Duty : 11 kW

11 kW

Conveyor



Normal Duty Applications

● Applications



● Selecting a Drive

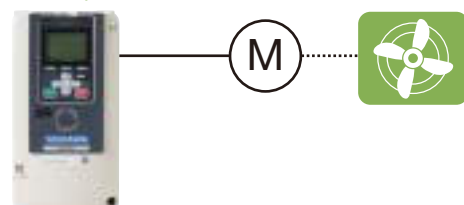
For a fan application using a 11 kW motor, select GA70A2042 and set it for Normal Duty performance (C6-01=1).

Catalog code: GA70A2042

Normal Duty : 11 kW

11 kW

Fan



Basic Instructions

Outstanding operability and quick setup

Keypad Names and Functions

- ①RUN LED
Lit while the drive is operating the motor.
- ②Function Keys
F1, F2, F3
The functions of the function key depend on the menu that is being displayed.
The name of each function appears in the lower half of the display window.
- ③LEFT Arrow Key
 - Moves the cursor to the left.
 - Returns to the previous screen.

UP Arrow Key /
DOWN Arrow Key
 - Scrolls up to display the next item.
 - Scrolls down to display the previous item.
 - Selects parameter numbers.
 - Increments setting values.
 - Decrements setting values.

RIGHT Arrow (RESET) Key
 - Moves the cursor to the right.
 - Proceeds to the next screen.
 - Resets the drive to clear a fault.
 - Used as the start key in Auto-Tuning Mode.

ENTER Key
 - Inputs parameter numbers and setting values. Press to enter values, edit parameters and set the control mode.
 - Switches between displays with selection of menu items.
-
- ④RUN Key
Starts the drive in LOCAL mode.

⑤ALM LED
The drive lights up if a fault is detected.
Flashes when minor faults, tuning errors and operational errors occur.

⑥LO/RE Selection Key
Switches drive control between the keypad (LOCAL) and an external source (REMOTE) for the Run command and frequency reference.

⑦LO/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).

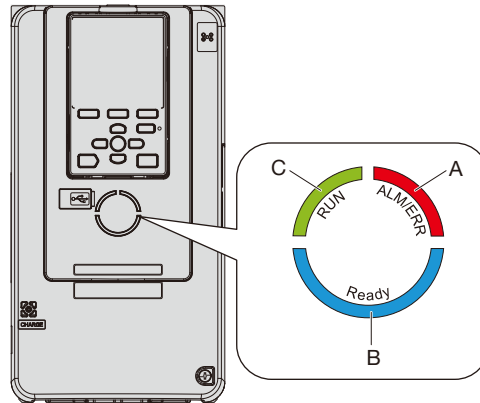
⑧STOP Key
Stops drive operation.

⑨Com port
For connecting to a PC (DriveWizard or DriveWorksEZ), a USB copy unit or a LCD keypad.

⑩LED Status Ring
The corresponding lamp lights depending on the operation status.

⑪QR cord
Import the dedicated smartphone application "DriveWizard Mobile" and use it to retrieve product information.
- #### Keypad LED
- | Indicator LED | ON | Flashing | Flashing Quickly | OFF |
|---------------|--|--|---|--|
| | Motor running. | <ul style="list-style-type: none">The motor is performing ramp to stop.The Run command was inputted when the frequency reference was 0 Hz | <ul style="list-style-type: none">With a Run command inputted from an external command when the Run command source was in LOCAL, the Run command source switched to REMOTE.When the drive was not in the Drive Ready (READY) state, a Run command was inputted from an external command.An emergency stop command has been inputted.The Safe Disable input function was running and the drive output was shut off.When the Run command source was REMOTE, the STOP key on the keypad was pressed and the motor was stopped.The power supply for the drive is turned on when the Run command is inputted from an external source. | Drive is stopped. |
| | A fault was detected. | <ul style="list-style-type: none">Minor fault was detected.Operation error was detected.Auto-Tuning was detected. | — | Normal operation |
| | Sets the Run command source to the keypad (LOCAL). | — | — | Sets the Run command source to a non-keypad external command (REMOTE). |
- #### How the RUN light works:
-
- 16 YASKAWA | YASKAWA AC Drive GA700 Catalog

LED Status Ring LED



A – ALM/ERR

B – Ready

C – RUN

LED		State	Content
A	ALM/ERR	ON	The drive detected a fault.
		Flashing	The drive has detected: <ul style="list-style-type: none"> • an error • an oPE • an error during Auto-Tuning. Note: If the drive detects a fault and an error at the same time, this LED will be lit to indicate the fault.
		OFF	The drive is in normal operation. There are no alarms or faults present.
B	Ready	ON	The drive is operating or is ready for operation.
		Flashing	When the drive is in STo [Safe Torque Off] mode. The drive is in STo [Safe Torque Off] mode.
		OFF	<ul style="list-style-type: none"> • The drive detected a fault. • The drive received an operation command and no fault is present, but the drive is inoperable.
C	RUN	ON	The drive is operating the motor.
		Flashing	<ul style="list-style-type: none"> • The drive is decelerating to stop. • The drive was issued a Run command and the frequency reference is 0 Hz. • A DC injection braking command is input via a multi-function digital input terminal while the drive is stopped.
		Flashing Quickly	<ul style="list-style-type: none"> • Entering a Run command via the input terminals, then switching to REMOTE while the drive is set to LOCAL. • Entering a Run command via the input terminals when the drive is not in Drive Mode. • Entering a Fast Stop command. • The safety function shuts off the drive output. • Pushing STOP on the keypad while the drive is running in REMOTE mode. • Setting b1-17 = 0 [Run Command at Power Up = Accept existing RUN command] and powering up the drive while the Run command is active.
		OFF	The motor is stopped.

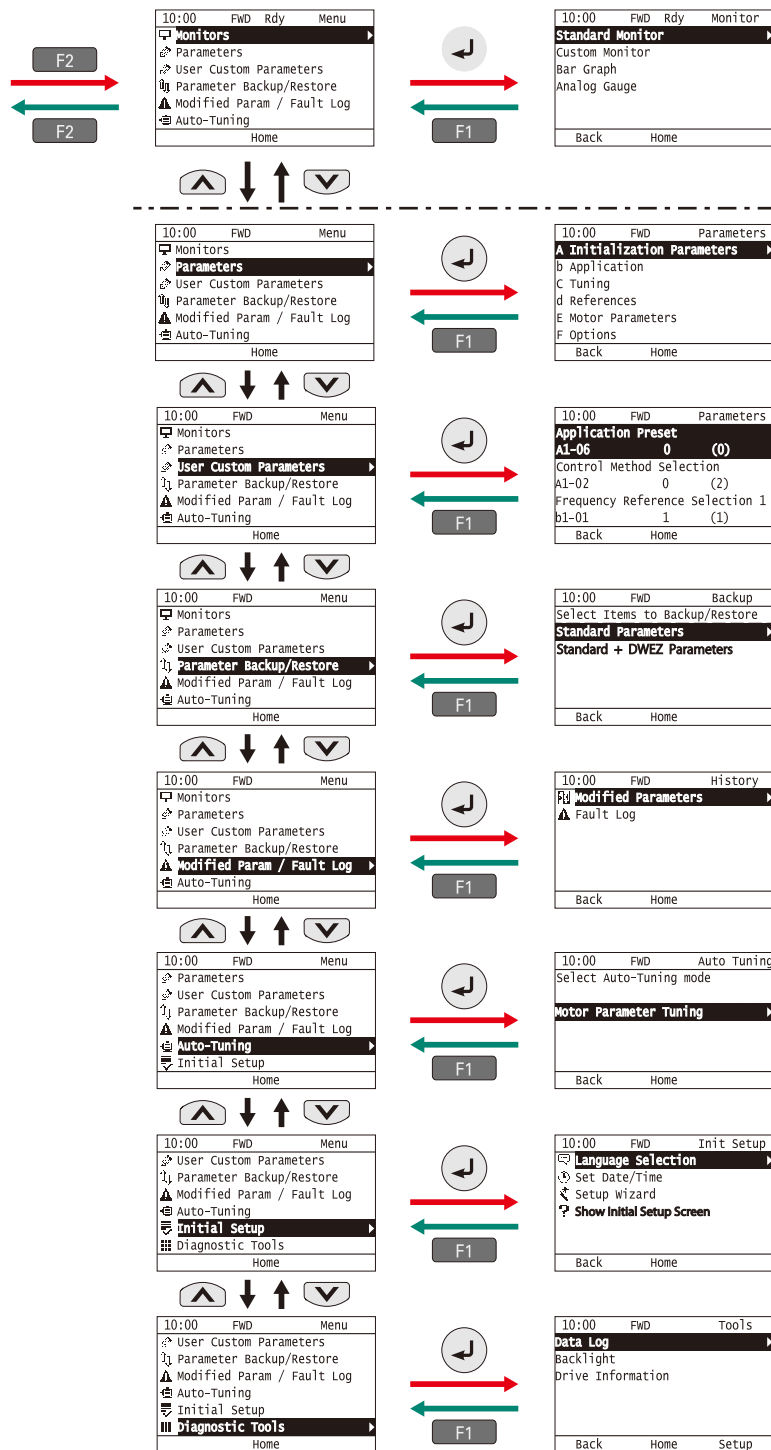
Basic Instructions (continued)

Keypad Example

Turn the power on

10:00	FWD	Rdy	Home
Freq Reference (AI)			0.00
U1-01 Hz			0.00
Output Frequency			0.00
U1-02 Hz			0.00
Output Current			0.00
U1-03 A			0.00
JOG	Menu	FWD/REV	

HOME



Drive Mode

Program Mode

Note:

- Energizing the drive with factory defaults will display the initial start-up screen. Press F2 Key (Home) to display the HOME screen.
–To prevent the drive from displaying the initial start-up screen, Select [No] from the [Initial Setup Display Select] setting.
- Press Left Arrow Key from the Home screen to display the monitors.
- When U1-01 [Freq. Reference] is displayed on the Home screen in LOCAL mode, press ENTER Key to change parameter d1-01 [Frequency Reference].
- The keypad will display [Rdy] when the drive is in Drive Mode and ready to accept a Run command.

- The drive will not accept a Run command while in Programming Mode.
Set b1-08 [Run Command Select in PRG Mode] to accept or reject a Run command from an external source while in Programming Mode.
–Set b1-08 = 0 [Do not accept RUN at Programming] (default) to reject the Run command from an external source while in Programming Mode.
–Set b1-08 = 1 [Accept RUN while Programming] to accept the Run command from an external source while in Programming Mode.
–Set b1-08 = 2 [Allow Programming only at Stop] to block changes from Drive Mode to Programming Mode while the drive is in operation.

Features
Product Lineup
Catalog Code
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Peripheral Devices and Options
Application Notes
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Standard Specifications

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

200 V Class

HD: Heavy Duty, ND: Normal Duty

Catalog Code GA70A2			004	006	008	010	012	018	021	030	042	056	070	082	110	138	169	211	257	313	
Max. Applicable Motor Capacity*1		kW	HD	0.4	0.75	1.1	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
			ND	0.75	1.1	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
Input	Rated Input Current*2	A	HD	3.6	4.8	6.7	8.9	12.7	17	20.7	30	40.3	58.2	78.4	96	82	111	136	164	200	271
			ND	4.8	6.7	8.9	12.7	17	20.7	30	40.3	52	78.4	96	114	111	136	164	200	271	324
Output	Rated Output Current	A	HD	3.2	5	6.9	8	11	14	17.5	25	33	47	60	75	88	115	145	180	215	283
			ND	3.5	6	8	9.6	12.2	17.5	21	30	42	56	70	82	110	138	169	211	257	313
	Overload Tolerance		· HD Rating: 150% of rated output current for 60 s · ND Rating: 110% of rated output current for 60 s Note: Derating may be required for applications that start and stop frequently.																		
	Carrier Frequency		Derating the output current enables a maximum of 15 kHz to be set. (Derating the output current is not necessary for an ND rating of 2 kHz and an HD rating up to 8 kHz.)														5 kHz Note: Can be selected between 1 kHz to 10 kHz by setting C6-02.				
	Max. Output Voltage V		Three-phase 200 to 240 V Note: The maximum output voltage is proportional to the input voltage.																		
	Max. Output Frequency Hz		590 Hz The frequencies that can be set vary depending on the control mode used.																		
Measures for Harmonics	DC Reactor		External options													Built-in					
Braking Function	Braking Transistor		Built-in													External options					
EMC filter	EMC filter EN61800-3, C2/C3		Internal (factory option)																		
Power	Rated Voltage/ Rated Frequency		• Three-phase AC power supply 200 V to 240 V 50/60 Hz • DC power supply 270 V to 340 V																		
	Allowable Voltage Fluctuation		-15% to 10%																		
	Allowable Frequency Fluctuation		±5%																		
	Power Supply	kVA	HD	1.5	2.0	2.8	3.7	5.3	7.1	8.6	12.5	16.8	24.2	32.6	39.9	34.1	46.1	56.5	68.2	83.1	113
ND			2.0	2.8	3.7	5.3	7.1	8.6	12.5	16.8	21.6	32.6	39.9	47.4	46.1	56.5	68.2	83.1	113	135	

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

*2: The value displayed is the input current when operating standard Yaskawa motors at the maximum applicable capacity with the rated load at the rated motor speed. This value may fluctuate based on the power supply side impedance, as well as the input current, power supply transformer, input side reactor, and wiring conditions.

400 V Class

HD: Heavy Duty, ND: Normal Duty

Catalog Code GA70A4			002	004	005	007	009	012	018	023	031	038	044	060	075	089	103	140	168	208	250	296		
Max. Applicable Motor Capacity*1			kW	HD	0.4	0.75	1.5	2.2	3.0	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132
				ND	0.75	1.5	2.2	3.0	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160
Input	Rated Input Current*2	A	HD	1.9	3.5	4.7	6.7	8.9	11.7	15.8	21.2	30.6	41.3	50.5	43.1	58.3	71.5	86.5	105	142	170	207	248	
			ND	2.5	4.7	6.7	8.9	11.7	15.8	21.2	30.6	41.3	50.5	59.7	58.3	71.5	86.5	105	142	170	207	248	300	
Output	Rated Output Current	A	HD	1.8	3.4	4.8	5.5	7.2	9.2	14.8	18	24	31	39	45	60	75	91	112	150	180	216	260	
			ND	2.1	4.1	5.4	7.1	8.9	11.9	17.5	23.4	31	38	44	59.6	74.9	89.2	103	140	168	208	250	296	
	Overload Tolerance		· HD Rating: 150% of rated output current for 60 s · ND Rating: 110% of rated output current for 60 s Note: Derating may be required for applications that start and stop frequently.																					
	Carrier Frequency		Derating the output current enables a maximum of 15 kHz to be set. (Derating the output current is not necessary for an ND rating of 2 kHz and an HD rating up to 8 kHz.)																5 kHz Note: Can be selected between 1 kHz to 10 kHz by setting C6-02.					
	Max. Output Voltage V		Three-phase 380 to 480 V Note: The maximum output voltage is proportional to the input voltage.																					
Max. Output Frequency		Hz	590 Hz The frequencies that can be set vary depending on the control mode used.																					
Measures for Harmonics	DC Reactor		External options											Built-in										
Braking Function	Braking Transistor		Built-in																		—			
EMC filter	EMC filter EN61800-3, C2/C3		Internal (factory option)																					
Power	Rated Voltage/ Rated Frequency		• Three-phase AC power supply 380 V to 480 V 50/60 Hz • DC power supply 510 V to 680 V																					
	Allowable Voltage Fluctuation		- 15% to 10%																					
	Allowable Frequency Fluctuation		±5%																					
	Power Supply	kVA	HD	1.5	2.8	3.7	5.3	7.1	9.3	13	17	24	33	40	34	46	57	69	84	113	136	165	198	
ND			2.0	3.7	5.3	7.1	9.3	13	17	24	33	40	48	46	57	69	84	113	136	165	198	239		

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

*2 : The value displayed is the input current when operating standard Yaskawa motors at the maximum applicable capacity with the rated load at the rated motor speed. This value may fluctuate based on the power supply side impedance, as well as the input current, power supply transformer, input side reactor, and wiring conditions.

Standard Specifications

Common Specifications

Item		Specifications
Control Characteristics	Control Method	The following controls are selected by parameters. <ul style="list-style-type: none"> · V/f Control · Closed Loop V/f Control · Open Loop Vector Control · Closed Loop Vector Control · Advanced Open Loop Vector Control · PM Open Loop Vector Control · PM Advanced Open Loop Vector Control · PM Closed Loop Vector Control · EZ Open Loop Vector Control
	Maximum Output Frequency	<ul style="list-style-type: none"> · Advanced Open Loop Vector Control, EZ Open Loop Vector Control: 120 Hz · Closed Loop V/f Control, Closed Loop Vector Control, PM Advanced Open Loop Vector Control, PM Closed Loop Vector Control: 400 Hz · V/f Control, Open Loop Vector Control, PM Open Loop Vector Control: 590 Hz
	Frequency Accuracy (Temperature Fluctuation)	Digital reference: within ± 0.01 of the max. output frequency (-10°C to $+40^{\circ}\text{C}$) Analog reference: within $\pm 0.1\%$ of the max. output frequency ($25^{\circ}\text{C} \pm 10^{\circ}\text{C}$)
	Frequency Setting Resolution	Digital reference: 0.01 Hz Analog reference: 1/2048 of the maximum output frequency setting (11 bit plus sign)
	Output Frequency Resolution	0.001 Hz
	Frequency Setting Resolution	Main frequency reference: -10 to $+10$ Vdc, 0 to 10 Vdc (20 k Ω), 4 to 20 mA (250 Ω), 0 to 20 mA (250 Ω) Main speed reference : Pulse train input (max. 32 kHz)
	Starting Torque	V/f Control: 150%/3 Hz Closed Loop V/f Control: 150%/3 Hz Open Loop Vector Control: 200%/0.3 Hz Closed Loop Vector Control: 200%/0 min ⁻¹ Advanced Open Loop Vector Control: 200%/0.3 Hz PM Open Loop Vector Control: 100%/5% speed PM Advanced Open Loop Vector Control: 200%/0 min ⁻¹ PM Closed Loop Vector Control: 200%/0 min ⁻¹ EZ Open Loop Vector Control: 100%/1% speed Note: Select a drive capacity sufficient to provide starting torque under Open Loop Vector Control, Closed Loop Vector Control, Advanced Open Loop Vector Control, PM Advanced Open Loop Vector Control, PM Closed Loop Vector Control.
	Speed Control Range	V/f Control 1:40 Closed Loop V/f Control 1:40 Open Loop Vector Control 1:200 Closed Loop Vector Control 1:1500 Advanced Open Loop Vector Control 1:200 PM Open Loop Vector Control 1:20 PM Advanced Open Loop Vector Control 1:100 PM Closed Loop Vector Control 1:1500 EZ Open Loop Vector Control 1:100 Note: · PM Advanced Open Loop Vector Control is valid when high frequency injection is enabled (n8-57=1). · For PM Advanced Open Loop Vector Control contact your Yaskawa or nearest agent when not using SSR1 series or SST4 series motors manufactured by Yaskawa Motor Co., Ltd.
	Zero Speed Control	Closed Loop Vector Control, PM Advanced Open Loop Vector Control, PM Closed Loop Vector Control
	Torque Limit	Parameter settings allow separate limits in four quadrants in Open Loop Vector Control, Closed Loop Vector Control, Advanced Open Loop Vector Control, PM Advanced Open Loop Vector Control, PM Closed Loop Vector Control, 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	Approx. 20% Approx. 125% with a dynamic braking option <ul style="list-style-type: none"> • Short-time average deceleration torque Motor capacity 0.4/0.75 kW: over 100% Motor capacity 1.5 kW: over 50% Motors 2.2 kW and larger: over 20%, Overexcitation Braking / High Slip Braking allow for approx. 40% • Continuous regenerative torque: Approx. 20%. Dynamic braking option allows for approx. 125%, 10% ED, 10 s Note: <ul style="list-style-type: none"> • Catalog codes 2004 to 2138 and 4002 to 4168 have a built-in braking transistor. • Set L3-04 (Stall Prevention Selection during Deceleration) to 0 (Disabled) to disable Stall Prevention when using a regenerative converter, regenerative unit, dynamic braking unit, braking resistor, or braking resistor unit. The drive may not stop within the designated deceleration time if Stall Prevention is not disabled. • 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. • Continuous regenerative torque and short-time deceleration torque for motors 2.2 kW and larger vary depending on motor characteristics.
	V/f Characteristics	Select from 15 predefined V/f patterns, or a user-set V/f pattern.
	Main Control Functions	Torque Control, Droop Control, Speed/Torque Control switch, Feed Forward Control, Zero Servo 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 communications. (RS-485/422, max. 115.2 kbps), Fault Restart, Application Presets, DriveWorksEZ (customized functions), Parameter Backup Function, Online Tuning, KEB, Overexcitation Deceleration, Inertia Tuning and ASR Tuning, Overvoltage Suppression, High Frequency Injection, etc.

Item		Specifications
Protection Function	Motor Protection	Motor overheat protection based on output current
	Momentary Overcurrent Protection	Drive stops when output current exceeds 200% of the HD output current.
	Overload Protection	Drive stops after 60 s at 150% of rated HD output current and at 110% of rated ND output current. Note: The drive may trigger the overload protection function at 150% of the drive rated output in under 60 s if the output frequency is less than 6 Hz.
	Overvoltage Protection	200 V class: Stops when DC bus exceeds approx. 410 V 400 V class: Stops when DC bus exceeds approx. 820 V
	Undervoltage Protection	200 V class: Stops when DC bus exceeds approx. 190 V 400 V class: Stops when DC bus exceeds approx. 380 V
	Momentary Power Loss Ride-Thru	Stops when power loss is longer than approximately 15 ms (default setting). Continues operation if power loss is shorter than 2 s (depending on parameter settings). Note: 1. Stop time may be shortened depending on the load and motor speed. 2. Continuous operation time varies by drive capacity. Catalog codes 2004 to 2056 and 4002 to 4031 require a Momentary Power Loss Recovery Unit to continue operation through a 2 s power loss.
	Heatsink Overheat Protection	Thermistor
	Braking Resistance Overheat Protection	Overheat sensor for braking resistor (optional ERF-type, 3% ED)
	Stall Prevention	Stall prevention during acceleration/deceleration and constant speed operation
	Ground Fault Protection	Protection by electronic circuit Note: Protection may not be provided under the following conditions as the motor windings are grounded internally during run: Low resistance to ground from the motor cable or terminal block. Drive already has a short-circuit when the power is turned on.
	Charge LED	Charge LED remains lit until DC bus has fallen below approx. 50 V
Environment	Area of Use	Indoors · chemical gas: IEC60721-3-3: 3 C2 · solid particle: IEC60721-3-3: 3 S2
	Ambient Temperature	Open-chassis(IP20) : -10 °C to +50 °C Enclosure panel(UL Type 1) : -10 °C to +40 °C
	Humidity	95% RH or less (no condensation)
	Storage Temperature	Short-term temperature during transportation is -20 °C to +60 °C
	Altitude	1000 m or less Note: Altitudes over 1000 m and up to 3000 m are possible by derating the output current by 1% for every 100 m. Rated voltage derating is not required if the altitude of the area where the drive is installed is less than 2000 m. If the altitude of the area is 2000 m to 3000 m, neutral grounding of the power supply voltage is not required. If no neutral grounding is done, contact Yaskawa or your nearest sales representative.
	Shock	· 10 Hz to 20 Hz: 1 G (9.8 m/s ²) Note: 0.2 G for AG70X4930/AG70X4H12 · 20 Hz to 55 Hz, Catalog code GA70□2004 to 2211, 4002 to 4168: 0.6 G (5.9 m/s ²), Catalog code GA70□2257 to 2415, 4208 to 4675: 0.2 G (2.0 m/s ²)
Standards Compliance		<ul style="list-style-type: none"> · UL61800-5-1*1 · EN61800-3:2004+A1:2012*1 · IEC/EN61800-5-1*1 · Two Safe Disable inputs and 1EDM output according to ISO/EN13849-1 Cat.3 Ple, IEC/EN61508 SIL3*1 Note: Used by setting functions to multi-function digital output terminals. · RCM*2 · EAC*2 · CSA*2 [Vessel Standards] · Germanischer Lloyd*2 · DNV*2 · ABS*2 · NK*2 · BV*2 · CCS*2 · KR*2
Protection Design		Open-chassis type (IP20), Enclosure panel (UL Type 1) Note: Installing the UL Type 1 kit to a drive in an open chassis type (IP20) makes the drive compliant with an enclosure panel (UL Type 1).

*1: Approval pending for catalog code GA70□2070, GA70□4044 and larger.

*2: Approval pending.

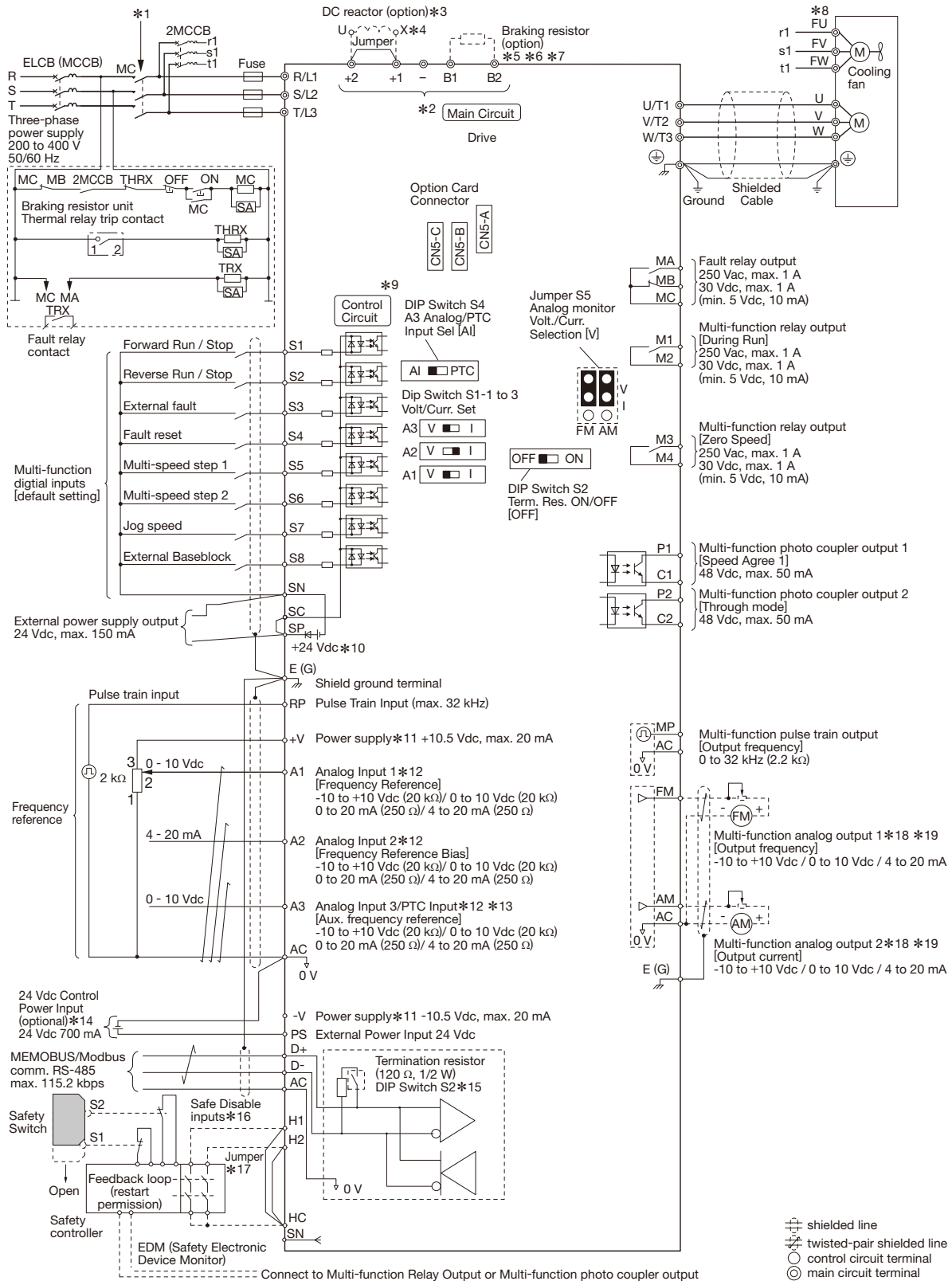
Note: 1 Perform Rotational Auto-Tuning to achieve specifications listed for Open Loop Vector Control and Advanced Open Loop Vector Control.

2 Install the drive in an environment matching the specifications in the table above for optimum performance life.

Standard Connection Diagram

Standard Connection Diagram

Multi-Function Photocoupler Output Type (Standard)

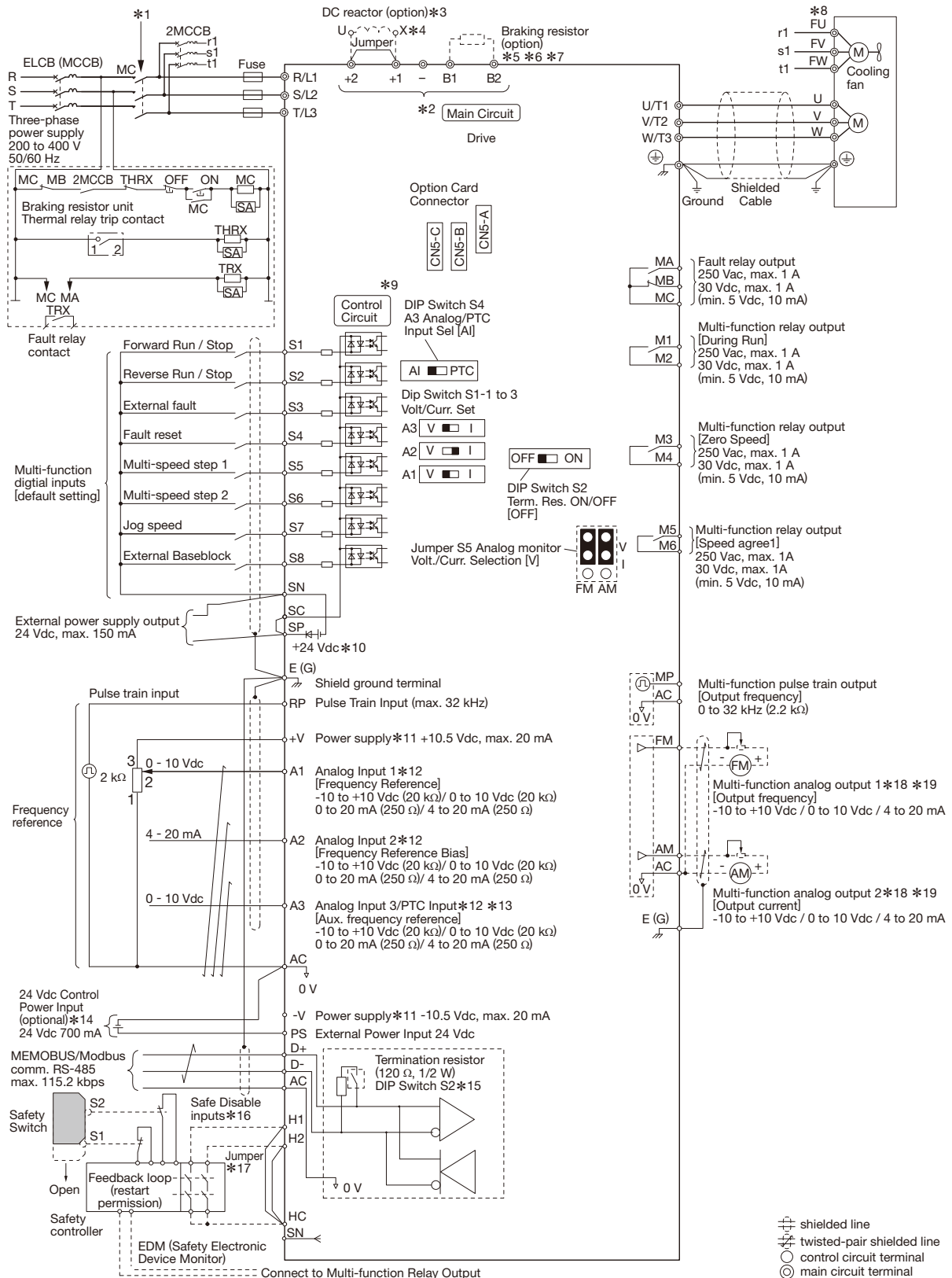


- *1: The wiring sequence should shut off the power supply upon drive fault. When using the fault restart function, the power will turn OFF when the drive outputs a fault during fault restart if L5-02 = 1 (Fault output active) is used. Take care when using a cut-off sequence. The default setting of L5-02 is 0 (Fault output not active).
- *2: Use terminals -, +1, +2, B1, and B2 to connect options to the drive. Never connect power supply lines to these terminals.
- *3: Remove the jumper between terminals +1 and +2 when installing a DC reactor.
- *4: Catalog codes GA70A2110 to 2415 and 4060 to 4675 come with a built-in DC reactor.
- *5: Set L8-55 = 0 (Disable) to disable the protection function of the built-in braking transistor of the drive when using an optional regenerative converter, regenerative unit, or braking unit. Leaving L8-55 enabled may cause a braking resistor fault (rF).
- *6: Set L3-04 = 0 (Disabled) when using a regenerative converter, regenerative unit, braking unit, braking resistor, or braking resistor unit. Leaving L3-04 enabled may prevent the drive from stopping within the specified deceleration time.
- *7: When using an ERF-type braking resistor, set L8-01 = 1 (Provided) and set up a sequence to shut off the power supply using the fault relay output.
- *8: Self-cooling motors do not require wiring that would be necessary with motors using a cooling fan.
- *9: Input 24 V power into terminal PS-AC while the power to the control circuit of the drive is ON and only the main circuit is OFF.
- *10: Install a jumper between terminals SC-SP-SN to select the type of the power supply of multi-function digital inputs. Do not install a jumper between terminals SP and SN. Failure to comply will damage the drive.
 - Sink mode: Install a jumper between terminals SC and SP.
 - Source mode: Install a jumper between terminals SC and SN.
 - External power supply: No jumper necessary.
- *11: The maximum output current capacity for the +V and -V terminals on the control circuit is 20 mA. Never short terminals +V, -V, and AC, as this can cause erroneous operation or damage the drive.
- *12: The maximum output current capacity for the +V and -V terminals on the control circuit is 20 mA. Never short terminals +V, -V, and AC, as this can cause erroneous operation or damage the drive.
- *13: Select the voltage command input or current command input for terminals A1 to A3 by using DIP switches S1-1 to S1-3. The default setting for S1-1 and S1-3 is voltage input ("V" side). The default setting for S1-2 is current input ("I" side).
- *14: Do not connect terminals PS and AC inversely. Failure to comply will damage the drive.
- *15: Set DIP switch S2 to the ON position to enable the termination resistor in the last drive in a MEMOBUS/Modbus network.
- *16: Use Source mode when using an internal power supply for Safe Disable input.
- *17: Disconnect the jumper between H1-HC and H2-HC when using the Safe Disable input.
- *18: Monitor outputs work with devices such as analog frequency meters, ammeters, voltmeters, and wattmeters. Do not use these outputs in a feedback loop.
- *19: Jumper switch S5 can be used to set the voltage or current output for terminals FM and AM. The default setting for jumper switch S5 is "V" side (voltage output).

Standard Connection Diagram

Standard Connection Diagram

Multi-Function Digital Output Type (Factory Option)




- *1: The wiring sequence should shut off the power supply upon drive fault. When using the fault restart function, the power will turn OFF when the drive outputs a fault during fault restart if L5-02 = 1 (Fault output active) is used. Take care when using a cut-off sequence. The default setting of L5-02 is 0 (Fault output not active).
- *2: Use terminals -, +1, +2, B1, and B2 to connect options to the drive. Never connect power supply lines to these terminals.
- *3: Remove the jumper between terminals +1 and +2 when installing a DC reactor.
- *4: Catalog codes GA70A2110 to 2415 and 4060 to 4675 come with a built-in DC reactor.
- *5: Set L8-55 = 0 (Disable) to disable the protection function of the built-in braking transistor of the drive when using an optional regenerative converter, regenerative unit, or braking unit. Leaving L8-55 enabled may cause a braking resistor fault (rF).
- *6: Set L3-04 = 0 (Disabled) when using a regenerative converter, regenerative unit, braking unit, braking resistor, or braking resistor unit. Leaving L3-04 enabled may prevent the drive from stopping within the specified deceleration time.
- *7: When using an ERF-type braking resistor, set L8-01 = 1 (Provided) and set up a sequence to shut off the power supply using the fault relay output.
- *8: Self-cooling motors do not require wiring that would be necessary with motors using a cooling fan.
- *9: Input 24 V power into terminal PS-AC while the power to the control circuit of the drive is ON and only the main circuit is OFF.
- *10: Install a jumper between terminals SC-SP-SN to select the type of the power supply of multi-function digital inputs. Do not install a jumper between terminals SP and SN. Failure to comply will damage the drive.
 - Sink mode: Install a jumper between terminals SC and SP.
 - Source mode: Install a jumper between terminals SC and SN.
 - External power supply: No jumper necessary.
- *11: The maximum output current capacity for the +V and -V terminals on the control circuit is 20 mA. Never short terminals +V, -V, and AC, as this can cause erroneous operation or damage the drive.
- *12: The maximum output current capacity for the +V and -V terminals on the control circuit is 20 mA. Never short terminals +V, -V, and AC, as this can cause erroneous operation or damage the drive.
- *13: Select the voltage command input or current command input for terminals A1 to A3 by using DIP switches S1-1 to S1-3. The default setting for S1-1 and S1-3 is voltage input ("V" side). The default setting for S1-2 is current input ("I" side).
- *14: Do not connect terminals PS and AC inversely. Failure to comply will damage the drive.
- *15: Set DIP switch S2 to the ON position to enable the termination resistor in the last drive in a MEMOBUS/Modbus network.
- *16: Use Source mode when using an internal power supply for Safe Disable input.
- *17: Disconnect the jumper between H1-HC and H2-HC when using the Safe Disable input.
- *18: Monitor outputs work with devices such as analog frequency meters, ammeters, voltmeters, and wattmeters. Do not use these outputs in a feedback loop.
- *19: Jumper switch S5 can be used to set the voltage or current output for terminals FM and AM. The default setting for jumper switch S5 is "V" side (voltage output).

Standard Connection Diagram

Terminal Functions

Main Circuit Terminals

Max. Applicable Motor Capacity indicates Heavy Duty

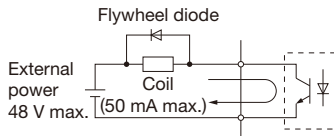
Voltage	200 V Class			400 V Class			
Catalog Code GA70A	2004 to 2082	2110 to 2138	2169 to 2415	4002 to 4044	4060 to 4168	4208 to 4389	4453 to 4675
Max. Applicable Motor Capacity	0.4 to 18.5	22. 30	37 to 110	0.4 to 18.5	22 to 75	90 to 220	260 to 355
R/L1, S/L2, T/L3	Main circuit input power supply			Main circuit input power supply			
R1/L11, S1/L21, T1/L31	-			-			
U/T1. V/T2. W/T3	Drive output			Drive output			
B1, B2	Braking resistor unit		-	Braking resistor unit		-	
+2	DC reactor (+1,+2) DC power supply (+1,-)	-		DC reactor (+1, +2) DC power supply (+1,-)	DC power supply (+1,-)	-	
+1		DC power supply (+1,-)	DC power supply (+1,-)			DC power supply (+1,-)	
-			Braking unit (+3,-)			Braking unit (+3,-)	
+3		-				-	
	Ground terminal (100 Ω or less)			Ground terminal (10 Ω or less)			

Note: Use terminals B1 and - to connect a CDBR braking unit to drive models 2004 to 2138 and 4002 to 4168 with built-in braking transistors.

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

Terminal Type	Terminal	Signal Function (default)	Description (Signal Level)
Multi-Function Digital Input	S1	Multi-function input selection 1 (ON: Forward run OFF: Stop)	<ul style="list-style-type: none"> • Photocoupler • 24 V, 6 mA <p>Note: Install a jumper between terminals SC-SP-SN to select the type of power supply for multi-function digital input.</p> <ul style="list-style-type: none"> • Sink mode: Install a jumper between terminals SC and SP. • Source mode: Install a jumper between terminals SC and SN. • External power supply: No jumper necessary.
	S2	Multi-function input selection 2 (ON: Reverse run OFF: Stop)	
	S3	Multi-function input selection 3 (External fault, N.O.)	
	S4	Multi-function input selection 4 (Fault reset)	
	S5	Multi-function input selection 5 (Multi-step speed reference 1)	
	S6	Multi-function input selection 6 (Multi-step speed reference 2)	
	S7	Multi-function input selection 7 (Jog frequency)	
	S8	Multi-function input selection 8 (Baseblock(N.O.))	
	SN	Digital input power supply 0V 24V transducer power supply 0V	Multi-function digital input power supply 24 V, maximum 150 mA Note: Do not install a jumper between terminals SP and SN. Failure to comply will damage the drive.
	SC	Multi-functions input common	
Safety Input	SP	Multi-function input power supply +24 Vdc	
	H1	Safety Input1	Remove the jumper between terminals H1-HC and H2-HC when using the Safe Disable input. <ul style="list-style-type: none"> • 24 Vdc 6 mA • ON: Normal operation • OFF: Output disabled • Internal impedance 4.7 kΩ • Switching time at least 2 ms
	H2	Safety Input2	
Main Frequency Reference Input	HC	Safety input common	Safety input common Note: Do not install a jumper between terminals HC and SN. Failure to comply will damage the drive.
	RP	Multi-function pulse train input (Main frequency reference)	<ul style="list-style-type: none"> • Scaling: 0.1 Hz to 32 kHz • H duty: 30% to 70% • H level voltage: 3.5 V to 13.2 V • L level voltage: 0.0 V to 0.8 V • impedance: 3 kΩ
	+V	Setting power supply	10.5 V (20 mA max.)
	-V	Setting power supply	-10.5 V (20 mA max.)
	A1	Multi-function analog input 1 (Main frequency reference)	Voltage input or current input DIP switch S1-1 and H3-01 can be used to set the voltage or current output for terminal A1 (Terminal A1 Signal Level Select.) DIP switch S1-2 and H3-09 can be used to set the voltage or current output for terminal A2 (Terminal A2 Signal Level Select.) <ul style="list-style-type: none"> • -10 to +10 Vdc for -100 to +100% • 0 to 10 Vdc for 0 to 100% (impedance 20 kΩ) • 4 to 20 mA for 0 to 100%, 0 to 20 mA for 0 to 100% (impedance 250 Ω)
	A2	Multi-function analog input 2 (Frequency reference bias with terminal A1)	
	A3	Multi-function analog input 3/PTC input (Auxiliary frequency reference)	Voltage input or current input Selected with dip switches S1-3 and H3-05 (Terminal A3 Signal Level Select.) <ul style="list-style-type: none"> • -10 to +10 Vdc for -100 to +100% • 0 to 10 Vdc for 0 to 100% (impedance 20 kΩ) • 4 to 20 mA for 0 to 100%, 0 to 20 mA for 0 to 100% (impedance 250 Ω) PTC input (For motor overheat protection) Set DIP switch S4 to "PTC" and set DIP switch S1-3 to "V" to set terminal A3 for PTC input.
Fault Relay Output	AC	Frequency reference common	0 V
	E (G)	Connection to wire shielding and option card ground wire	-
	MA	N.O. output (Fault)	<ul style="list-style-type: none"> • Relay output • 30 Vdc or less, 10 mA to 1 A • 250 Vac or less, 10 mA to 1 A • Minimum load: 5 Vdc, 10 mA (Values only for reference)
	MB	N.C. output (Fault)	
	MC	Digital output common	

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

Terminal Type	Terminal	Signal Function (default)	Description (Signal Level)
Multi-Function Digital Output	M1	Multi-function digital output	<ul style="list-style-type: none"> Relay output 30 Vdc or less, 10 mA to 1 A 250 Vac or less, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA (Values only for reference) Note: Refrain from assigning functions to terminals M1 and M2, M3 and M4, and M4 and M5 that involve frequent switching, as doing so may shorten relay performance life. Switching life is estimated at 200,000 times (assumes 1 A, resistive load).
	M2	(During run)	
	M3	Multi-function digital output	
	M4	(zero speed)	
	M5*1	Multi-function digital output	
Multi-Function Photocoupler Output*2	M6*1	(Speed agree1)	<ul style="list-style-type: none"> Photocoupler output 48 Vdc or less, 2 to 50 mA Note: Connect a flywheel diode as shown below when driving a reactive load such as a relay coil. Diode must be rated higher than the circuit voltage. 
	P1	Multi-Function Photocoupler Output	
	C1	(Speed agree1)	
	P2	Multi-Function Photocoupler Output	
Monitor Output	C2	(Through mode)	Max. 32 kHz Voltage or current output <ul style="list-style-type: none"> 0 to 10 Vdc for 0 to 100% -10 to 10 Vdc for -100 to 100% 4 to 20 mA Note: Set jumper S5, and H4-07 (Terminal FM Signal Level Select.) and H4-08 (Terminal AM Signal Level Select.) to select the signal type for terminals AM and FM.
	MP	Pulse train input (Output frequency)	
	FM	analog monitor (1) (Output frequency)	
	AM	analog monitor (2) (Output current)	
	AC	Monitor common	0 V

*1: Multi-function digital output type is compatible.

*2: Multi-function photocoupler output type (standard) is compatible.

External Power Supply Input Terminals

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

Serial Communication Terminals (200 V/400 V Class)

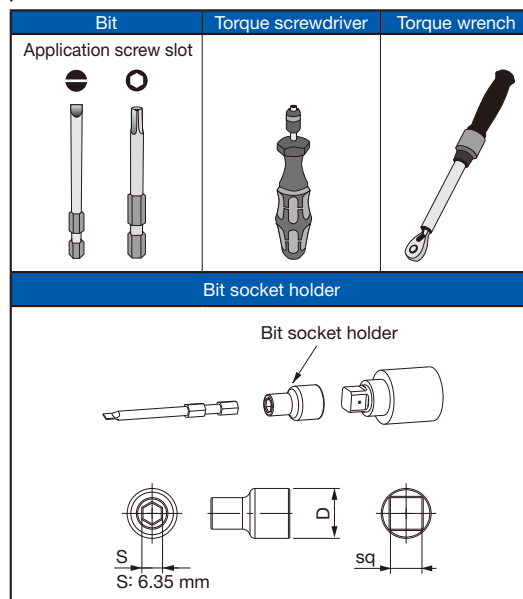
Classification	Terminal	Signal Function	Description (Signal Level)
MEMOBUS / Modbus communications	D+	Communications input (+)	MEMOBUS/Modbus communications: Use a RS-485 cable to connect the drive. Note: Set DIP switch S2 to ON to enable the termination resistor in the last drive in a MEMOBUS/Modbus network. <ul style="list-style-type: none"> RS-485 MEMOBUS/Modbus communications protocol 115.2 kbps (max.)
	D-	Communications input (-)	
	AC	Shield ground	0 V

Screw Terminal

The screw terminal type for the main circuit terminal (factory option) is being prepared. Contact Yaskawa.

Tools for Wiring European Style Terminal Blocks (Recommended product)

Screw size	Screw type	Recommended Product
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 3N · m)
M5	Slot	When wiring drive models GA70□2056 and GA70□4075 or earlier models, be sure to correctly select tools based on the wire gauges. Wiring Gauge: ≤25 mm ² or AWG10 • Bit [PHOENIX CONTACT] Model: SF-BIT-SL 1,2X6,5-70 • Torque screwdriver [PHOENIX CONTACT] Model: TSD-M 3NM (1.2 to 3N · m) Wiring Gauge: ≥30 mm ² 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
M7	Hex socket (WAF: 6)	Prepare the following three tools. • Bit [PHOENIX CONTACT] Model: SF-BIT-HEX 6-50 • Torque wrench that includes a torque measurement range of 12 N·m • Bit socket holder of 6.35 mm
M8	Hex socket (WAF: 8)	Prepare the following three tools. • Bit [PHOENIX CONTACT] Model: SF-BIT-HEX 8-50 • Torque wrench that includes a torque measurement range of 14 N·m • Bit socket holder of 6.35 mm



Dimensions

Enclosures

200 V Class

HD: Heavy Duty, ND: Normal Duty

Catalog Code GA70A□		2004	2006	2008	2010	2012	2018	2021	2030	2042	2056	2070	2082	2110	2138	2169	2211	2257	2313
Max. Applicable Motor Capacity (kW)	HD	0.4	0.75	1.1	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
	ND	0.75	1.1	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
Open-Chassis [IP20]		IP20 supported with standard model																	
Enclosure Panel [UL Type1]		Option supported (Install UL Type 1 kit for IP20)																	

400 V Class

HD: Heavy Duty, ND: Normal Duty

Catalog Code GA70A□		4002	4004	4005	4007	4009	4012	4018	4023	4031	4038	4044	4060	4075	4089	4103	4140	4168	4208	4250	4296
Max. Applicable Motor Capacity (kW)	HD	0.4	0.75	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132
	ND	0.75	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160
Open-Chassis [IP20]		IP20 supported with standard model																			
Enclosure Panel [UL Type1]		Option supported (Install UL Type 1 kit for IP20)																			

■ Open-Chassis [IP20]

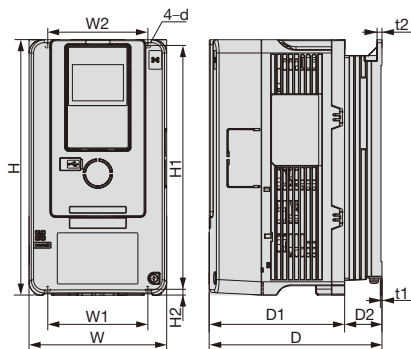


Figure 1

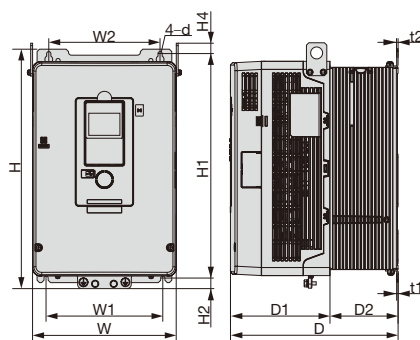


Figure 2

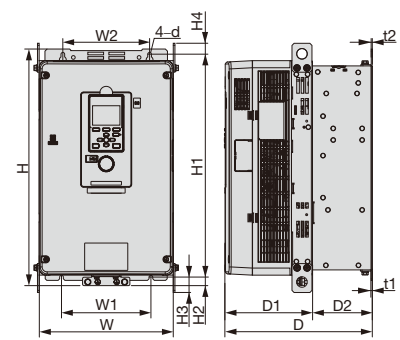


Figure 3

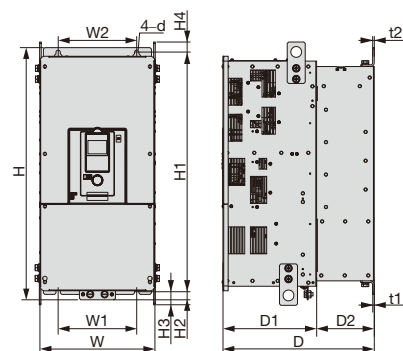


Figure 4

200 V Class

Catalog Code GA70A	Figure	Dimensions mm														Weight kg				
		W	H	D	D1	D2	W1	W2	H1	H2	H3	H4	t1	t2	d					
2004	1	140	260	176	138	38	102	102	248	6	-	-	1.6	5	M5	3.5				
2006																				
2008																				
2010																				
2012																				
2018																				
2021																				
2030																				
2042				211	73	4.2														
2056		1.6	6.0																	
2070																				
2082				2.3	2.3	M6	8.5 9													
2110	2	240	400					280	166	114	195	186	375	17.5	-	17.5	2.3	2.3	M6	22
2138	3	255	450					280	166	114	170	165	424	16	29	21	2.3	2.3	M6	24
2169		264	543	335	186	149	190	182	516	17.5	28.5	20.5	M8	39						
2211														40						
2257		4	312	700	420	260	160	218	218	659	28	43.5	28.5	4.5	4.5	M10			67	
2313																				

400 V Class

Catalog Code GA70A	Figure	Dimensions mm														Weight kg														
		W	H	D	D1	D2	W1	W2	H1	H2	H3	H4	t1	t2	d															
4002	1	140	260	176	138	38	102	102	248	6	-	-	1.6	5	M5	3.5														
4004				211		73										102	102	248	6	-	-	1.6	5	M5						
4005																														
4007																														
4009																														
4012																														
4018																														
4023																														
4031		180	300	202	134	68	140	140	284	8			2.3	2.3	M6	6.0														
4038		220	350	227	140	87	192	192	335							2.3	2.3	M6	7.5											
4044				246		106				192			192	335	2.3				2.3	M6	12									
4060	2	240	400	280	166	114	195	186	375		17.5	-				17.5	2.3	2.3			M6	17								
4075	3	255	450	280	166	114	170	165	424	16	29	21	2.3	2.3	M6	22														
4089																264	543	335	186	149	190	182	516	17.5	28.5	20.5	2.3	2.3	M8	25
4103																														38
4140		4	312	700	420	260	160	218	218	659	28	43.5	28.5	4.5	4.5	M10	39													
4168																	71													
4208																														
4250																														
4296																														

Note: External and mounting dimensions are different for standard mounting and panel through mounting.
Please refer to P.35 for panel through mounting.

Dimensions

■ Enclosure Panel [UL Type1]

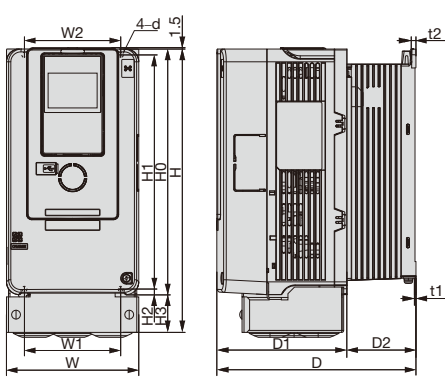


Figure 1

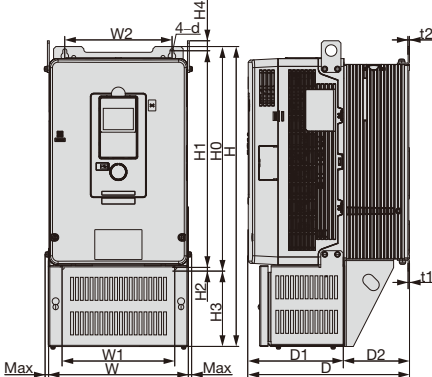


Figure 2

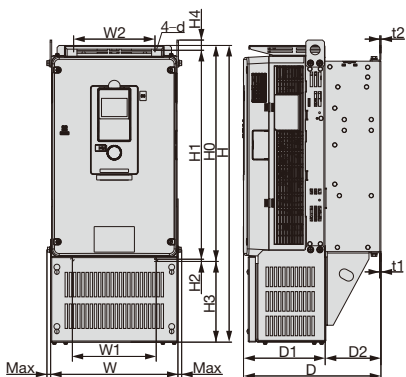


Figure 3

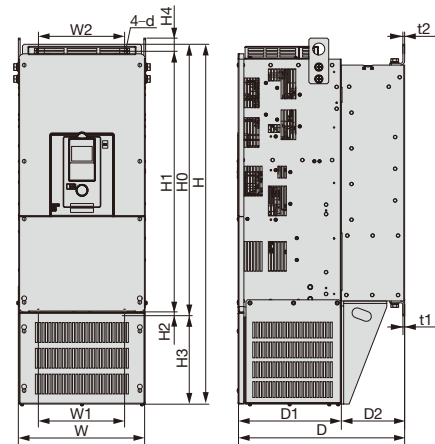


Figure 4

200 V Class: UL Type 1

Catalog Code GA70A	Figure	Dimensions mm															Weight kg	UL Type1 Kit Code No. (Model No.)									
		W	H	D	D1	D2	W1	W2	H0	H1	H2	H3	H4	t1	t2	d											
2004	1	140	300	176	138	38	102	102	260	248	6	40	-	1.6	5	M5	4.1	900-192-121-001 (100-202-326)									
2006				211		73											102		102	260	248	6	40	1.6	5	M5	4.5
2008																											
2010																											
2012																											
2018		220	400	227	140	87	192	192	350	335	8	50		2.3	2.3	M6	9	900-192-121-003 (100-202-328)									
2021																											
2030																											
2042																											
2056	180	340	202	134	68	140	140	300	284	8	40	2.3	2.3	M6	7.0	900-192-121-002 (100-202-327)											
2070	435	227	140	87	192	192	350	335	8		50				2.3	2.3	M6	10	900-192-121-004 (100-202-329)								
2082										244		500	280	166				114	195	186	400	375	17.5	100	17.5	2.3	2.3
2110	3	259	580	280	166	114	170	165	450	424	16	130	21	2.3	2.3	M6	27	900-192-121-006 (100-208-526)									
2138		268	700	335	186	149	190	182	543	516	157	20.5	M8			44	900-192-121-007 (100-208-527)										
2169			770								227					46	900-192-121-008 (100-208-528)										
2211	4	316	915	420	260	160	218	218	700	659	28	215	28.5	4.5	4.5	M10	72	900-192-121-009 (100-208-549)									
2257																											
2313																											

400 V Class: UL Type 1

Catalog Code GA70A	Dimensions mm																Weight kg	UL Type1 Kit Code No. (Model No.)																			
	Figure	W	H	D	D1	D2	W1	W2	H0	H1	H2	H3	H4	t1	t2	d																					
4002	1	140	300	176	138	38	102	102	260	248	6	40	-	1.6	5	M5	4.1	900-192-121-001 (100-202-326)																			
4004				211		73											102		102	260	248	6	40	1.6	5	M5	4.5										
4005																											211	73	102	102	260	248	6	40	1.6	5	M5
4007																211																					
4009		211	73	102	102	260	248	6	40	1.6	5	M5		8.5																							
4012														211	73		102	102	260	248	6	40	1.6	5	M5	13											
4018																211										73	102	102	260	248	6	40	1.6	5	M5	8.5	
4023		211	73	102	102	260	248	6	40	1.6	5	M5																								8.5	
4031	211												73	102	102		260	248	6	40	1.6	5	M5	8.5													
4038																211								73	102	102	260	248	6	40	1.6	5	M5	8.5			
4044		211	73	102	102	260	248	6	40	1.6	5	M5																						8.5			
4060	211												73	102	102		260	248	6	40	1.6	5	M5											8.5			
4075																2								244	500	280	166	114	195	186	400	375	17.5	100	17.5	2.3	2.3
4089		3	259	580	280	166	114	170	165	450	424	16				130								21	2.3	2.3	M6	25	900-192-121-006 (100-208-526)								
4103	268												700	335	186		149	190	182	543	516	17.5	157					20.5		M8	29						
4140			268	700	335	186	149	190	182	543	516	17.5				157								20.5	M8	43	900-192-121-007 (100-208-527)										
4168	268												700	335	186		149	190	182	543	516	17.5	157			20.5		M8	44								
4208		4	316	915	420	260	160	218	218	700	659	28				215								28.5	4.5		4.5		M10	76	900-192-121-009 (100-208-549)						
4250																																					
4296																																					

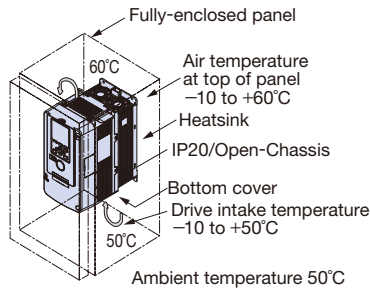
Note: UL Type 1 kit (option) is required. The values in the table are the dimensions of the UL Type 1 kit mounted to the IP20 open chassis type.

Fully-Enclosed Design

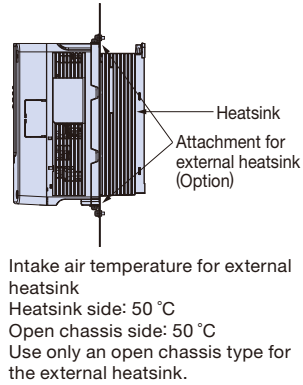
The Open-Chassis type drive can be installed in a fully-enclosed panel.

An open-chassis model in a protective enclosure with the heatsink inside the panel allows for intake air temperature up to 50°C. The heatsink can alternatively be mounted outside the enclosure panel, thus reducing the amount of heat inside the panel and allowing for a more compact set up.

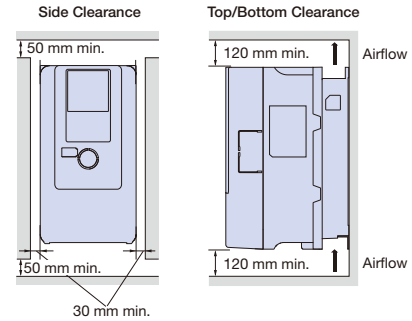
• Cooling Design for Fully-Closed Enclosure Panel



• Mounting the External Heatsink



• Ventilation Space



Drive Watts Loss Data

200 V Class Heavy Duty Ratings

Catalog Code GA70A2		004	006	008	010	012	018	021	030	042	056	070	082	110	138	169	211	257	313	
Rated Output Current		A	3.2	5	6.9	8	11	14	17.5	25	33	47	60	75	88	115	145	180	215	283
Carrier Frequency		kHz	8	8	8	8	8	8	8	8	8	8	8	8	8	5	5	5	5	5
Heat Loss	Internal	W	23	26	30	34	42	51	56	66	73	90	108	128	138	192	227	256	329	392
	Heatsink	W	9	16	24	30	45	79	103	170	201	299	413	516	642	862	960	1106	1349	1726
	Total Heat Loss	W	32	42	54	64	87	130	159	236	274	389	521	644	780	1054	1187	1362	1678	2118

400 V Class Heavy Duty Ratings

Catalog Code GA70A4		002	004	005	007	009	012	018	023	031	038	044	060	075	089	103	140	168	208	250	296	
Rated Output Current		A	1.8	3.4	4.8	5.5	7.2	9.2	14.8	18	24	31	39	45	60	75	91	112	150	180	216	260
Carrier Frequency		kHz	8	8	8	8	8	8	8	8	8	8	8	8	8	8	5	5	5	5	5	
Heat Loss	Internal	W	25	31	36	36	37	41	59	68	80	92	111	120	164	172	207	230	310	351	382	443
	Heatsink	W	14	26	37	57	64	86	140	181	260	317	452	542	730	745	971	986	1491	1520	1662	2097
	Total Heat Loss	W	39	57	73	93	101	127	199	249	340	409	563	662	894	917	1178	1216	1801	1871	2044	2540

200 V Class Normal Duty Ratings

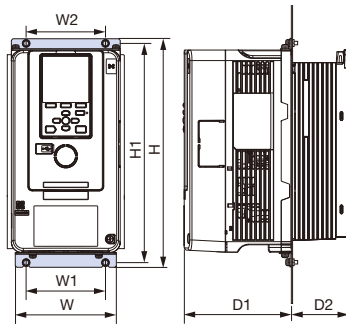
Catalog Code GA70A2		004	006	008	010	012	018	021	030	042	056	070	082	110	138	169	211	257	313	
Rated Output Current		A	3.5	6	8	9.6	12.2	17.5	21	30	42	56	70	82	110	138	169	211	257	313
Carrier Frequency		kHz	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Heat Loss	Internal	W	23	27	31	37	44	52	61	72	83	96	114	128	153	201	250	283	377	416
	Heatsink	W	10	17	24	32	44	83	119	205	255	341	442	503	752	956	1121	1286	1695	1914
	Total Heat Loss	W	33	44	55	69	88	135	180	277	338	437	556	631	905	1157	1371	1569	2072	2330

400 V Class Normal Duty Ratings

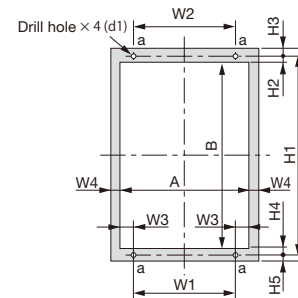
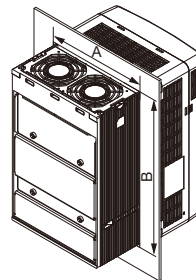
Catalog Code GA70A4		002	004	005	007	009	012	018	023	031	038	044	060	075	089	103	140	168	208	250	296	
Rated Output Current		A	2.1	4.1	5.4	7.1	8.9	11.9	17.5	23.4	31	38	44	59.6	74.9	89.2	103	140	168	208	250	296
Carrier Frequency		kHz	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Heat Loss	Internal	W	24	29	34	35	37	41	58	72	80	90	100	120	153	168	190	263	314	367	401	457
	Heatsink	W	10	20	27	52	59	86	139	200	274	307	390	584	729	757	927	1243	1571	1675	1810	2252
	Total Heat Loss	W	34	49	61	87	96	127	197	272	354	397	490	704	882	925	1117	1506	1885	2042	2211	2709

● Attachment for External Heatsink

When the heatsink is installed outside the drive, additional attachments are required.
Additional attachments are not required for models GA70A2110 and above, and GA70A4075 and above because installing a heatsink outside the drive can be performed on these models by replacing their standard mounting feet.
Contact Yaskawa if an instruction manual is needed.



● Panel Modification for External Heatsink



Panel cut out dimensions

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.

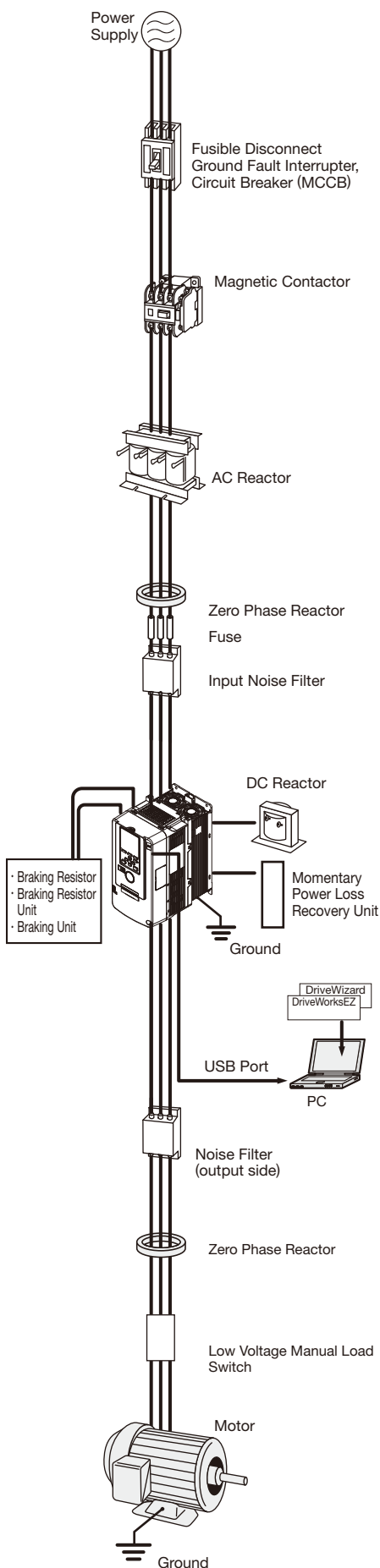
200 V Class

Catalog Code GA70	Dimensions mm																Attachment for External Heatsink Code No. (Model No.)
	W	H	D1	D2	W1	W2	W3	W4	H1	H2	H3	H4	H5	A	B	d1	
2004	140	294	138	38	102	102	16	3	282	23	6	26	6	134	233	M5	900-193-209-001 (100-203-229)
2006																	
2008																	
2010																	
2012																	
2018																	
2021																	
2030	73																
2042																	
2056	180	329	134	68	140	140	17	3	318	23.5	5	24.5	6	174	270	M5	900-193-209-002 (100-203-230)
2070	220	384	140	87	192	192	11	3	371	27	7	25	6	214	319	M6	900-193-209-003 (100-203-231)
2082																	
2110	240	400	166	114	195	204	14.5	8	385	19.5	7.5	19.5	7.5	224	346	M6	—
2138	255	450	166	114	170	210	34.5	8	436	20	8	20	6	239	396	M6	—
2169	264	543	186	149	190	220	29	8	527	19.5	8.5	20.5	7.5	248	487	M8	—
2211																	
2257	312	700	260	160	218	263	39	8	675	33	12	32	13	296	610	M10	—
2313																	

400 V Class

Catalog Code GA70	Dimensions mm																Attachment for External Heatsink Code No. (Model No.)
	W	H	D1	D2	W1	W2	W3	W4	H1	H2	H3	H4	H5	A	B	d1	
4002	140	294	138	38	102	102	16	3	282	23	6	26	6	134	233	M5	900-193-209-001 (100-203-229)
4004																	
4005																	
4007																	
4009																	
4012																	
4018																	
4023	180	329	134	68	140	140	17	3	318	23.5	5	24.5	6	174	270	M5	900-193-209-002 (100-203-230)
4031																	
4038																	
4044	220	384	140	87	192	192	11	3	371	27	7	25	6	214	319	M6	900-193-209-003 (100-203-231)
4060				106													
4075	240	400	166	114	195	204	14.5	8	385	19.5	7.5	19.5	7.5	224	346	M6	—
4089	255	450	166	114	170	210	34.5	8	436	20	8	20	6	239	396	M6	—
4103																	
4140	264	543	186	149	190	220	29	8	527	19.5	8.5	20.5	7.5	248	487	M8	—
4168																	
4208	312	700	260	160	218	263	39	8	675	33	12	32	13	296	610	M10	—
4250																	
4296																	

Peripheral Devices and Options



Name	Purpose	Model, Manufacturer	Page
Ground Fault Interrupter (GFI)	Always install a GFI 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 a GFI is installed for the upper power supply system, an MCCB can be used instead of a GFI. Choose a GFI designed to minimize harmonics specifically for AC drives. Use one GFI per drive, each with a current rating of at least 30 mA.	NV series* by Mitsubishi Electric Corporation	P.38
Circuit Breaker	Always install a circuit breaker 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.38
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.39
AC Reactor	Improve the input power ratio of the drive. The DC reactor is a built-in model of 22 kW or more. Option: 18.5 kW or less.	UZBA series	P.40
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 Improves the power factor of the input power supply	UZDA series	P.42
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.43
Fuse / Fuse Holder	Protects internal circuitry in the event of component failure. Fuse should be connected to the input terminal of the drive. Note: Refer to the instruction manual for information on UL approval.	FWH series by BUSSMANN	P.44
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.49
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.	LNFD series LNFB series FN series	P.46
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.48
Braking Resistor	Used to shorten the deceleration time by dissipating regenerative energy through a resistor. Usage 3% ED, requires a separate attachment.	ERF-150WJ series CF120-B579 series	P.50
Attachment for Braking Resistor	A braking resistor can be attached to the drive.	900-192-126-001	P.55
External Heatsink Attachment for Braking Unit	Use the external heatsink attachment for installation with the heatsink outside the enclosure.	EZZ021711A	P.55
Braking Resistor Unit	Used to shorten the deceleration time by dissipating regenerative energy through a resistor unit (10% ED). A thermal overload relay is built in (10% ED).	LKEB series	P.50
Braking Unit	Shortened deceleration time results when used with a Braking Resistor Unit.	CDBR series	P.50
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/B cable.	P.57
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.56
Bluetooth Built-in Keypad	Bluetooth connection enables the drive to be operated from a smartphone.	In Preparation	—
Keypad Extension Cable	It is used as an extension cable when operating the keypad remotely.	WV001: 1 m WV003: 3 m	P.56
Momentary Power Loss Recovery Unit	Ensures continuous drive operation for a power loss of up to 2 s.	P0010 Type (200 V class) P0020 Type (400 V class)	P.49
Frequency Meter, Current Meter	Allows the user to set and monitor the frequency, current, and voltage using an external device.	DCF-6A	P.58
Frequency Setting Potentiometer (2 kΩ)		RV30YN20S 2 kΩ	P.58
Frequency Meter Adjusting Potentiometer (20 kΩ)		RV30YN20S 20 kΩ	P.58
Control Dial for Frequency Setting Potentiometer		CM-3S	P.58
Output Voltage Meter		SCF-12NH	P.59
Potential Transformer		UPN-B	P.59
Attachment for External Heatsink	Required for heatsink installation. Current derating may be needed when using a heatsink.	—	P.35
Low Voltage Manual Load Switch	Prevents shock from the voltage created on the terminals board from a coasting synchronous motor.	AICUT, LB series* by Aichi Electric Works Co., Ltd	—

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

Option Cards

RoHS compliant. Shipment of factory installed option is available. Contact Yaskawa.

Type	Name	Model	Function	Manual No.
Speed Reference Card	Analog Input	AI-A3	Enables high-precision and high-resolution analog speed reference setting. · Input signal level: -10 to +10 Vdc (20 kΩ), 4 to 20 mA (250 Ω) · Input channels: 3 channels, DIP switch for input voltage/input current selection · Input resolution: Input voltage 13 bit signed (1/8192) Input current 1/4096	TOBPC73060078
	Digital Input	DI-A3	Enables 16-bit digital speed reference setting. · Input signal: 16 bit binary, 2 digit BCD +sign signal +set signal · Input voltage: 24 V (isolated) · Input current: 8 mA User-set: 8 bit, 12 bit, 16 bit	TOBPC73060080
Communications Option Card	MECHATROLINK- II Interface	SI-T3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through MECHATROLINK- II communication with the host controller. Note: Use options with software versions of 6108 or later.	TOBPC73060086 SIEPC73060086
	MECHATROLINK- III Interface	SI-ET3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through MECHATROLINK- III communication with the host controller. Note: Use options with software versions of 6202 or later.	TOBPC73060088 SIEPC73060088
	CC-Link Interface	SI-C3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through CC-Link communication with the host controller.	TOBPC73060083 SIEPC73060083
	DeviceNet Interface	SI-N3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through DeviceNet communication with the host controller. Note: Use options with software versions of 1114 or later.	TOBPC73060084 SIEPC73060084
	LONWORKS Interface	SI-W3	Used for HVAC control, running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through LONWORKS communications with the host controller.	TOBPC73060093 SIEPC73060093
	PROFIBUS-DP Interface	SI-P3*	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through CANopen communication with the host controller.	TOBPC73060082 SIEPC73060082
	CANopen Interface	SI-S3	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through CANopen communication with the host controller.	TOBPC73060085 SIEPC73060085
	EtherCAT Interface	SI-ES3*	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through EtherCAT communication with the host controller.	-
	EtherNet/IP Interface	SI-EN3*	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through EtherNet/IP communication with the host controller.	-
	Modbus TCP/IP Interface	SI-EM3*	Used for running or stopping the drive, setting or referencing parameters, and monitoring output frequency, output current, or similar items through Modbus TCP/IP communication with the host controller.	-
Monitor Option Card	Analog Monitor	AO-A3	Outputs analog signal for monitoring drive output state (output freq., output current etc.). · Output resolution: 11 bit signed (1/2048) · Output voltage: -10 to +10 Vdc (non-isolated) · Terminals: 2 analog outputs	TOBPC73060079
	Digital Output	DO-A3	Outputs isolated type digital signal for monitoring drive run state (alarm signal, zero speed detection, etc.) · Terminals: 6 photocoupler outputs (48 V, 50 mA or less) 2 relay contact outputs (250 Vac, 1 A or less 30 Vdc, 1 A or less)	TOBPC73060081
PG Speed Controller Card	Complimentary Type PG	PG-B3	For control modes requiring a PG encoder for motor feedback. · Phase A, B, and Z pulse (3-phase) inputs (complementary type) · Max. input frequency: 50 kHz · Pulse monitor output: Open collector, 24 V, max. current 30 mA · Power supply output for PG: 12 V, max. current 200 mA Note: Not available in Advanced Open Loop Vector for PM.	TOBPC73060075
	Line Driver PG	PG-X3	For control modes requiring a PG encoder for motor feedback or PM motor feedback. · Phase A, B, and Z pulse (differential pulse) inputs (RS-422) · Max. input frequency: 300 kHz · Pulse monitor output: RS-422 · Power supply output for PG: 5 V or 12 V, max. current 200 mA	TOBPC73060076
	Motor Encoder Feedback (EnDat, HIPERFACE) Interface	PG-F3	For control modes requiring a PG encoder for PM motor feedback. Encoder type: EnDat 2.1/01, EnDat 2.2/01, and EnDat 2.2/22 (HEIDENHAIN), HIPERFACE (SICK STEGMANN) Maximum input frequency: 20 kHz (Used with low-speed gearless motors.) Note: EnDat 2.2/22 does not have maximum input frequency. Wiring length: 20 m max. for the encoder, 30 m max. for the pulse monitor Pulse monitor: Matches RS-422 level Note: EnDat 2.2/22 is not available. [Encoder power supply: 5 V, max current 330 mA or 8 V, max current 150 mA] Use one of the following encoder cables. EnDat2.1/01, EnDat2.2/01 : 17-pin cable from HEIDENHAIN EnDat2.2/22 : 8-pin cable from HEIDENHAIN HIPERFACE : 8-pin cable from SICK STEGMANN	TOBPC73060077
	Resolver Interface for TS2640N321E64	PG-RT3	For control modes requiring a PG encoder for motor feedback or PM motor feedback. Can be connected to the TS2640N321E64 resolver made by Tamagawa Seiki Co., Ltd. and electrically compatible resolvers. The representative electrical characteristics of the TS2640N321E64 are as follows. · Input voltage: 7 Vac rms 10 kHz · Transformation ratio: 0.5 ± 5% · maximum input current: 100 mArms · Wiring length: 10 m max. (100 m max. for the SS5 and SS7 series motor manufactured by Yaskawa Motor Co., and PG cables manufactured by Yaskawa Controls Co., Ltd.)	TOBPC73060087

* Under development.

Note: 1. Each communication option card requires a separate configuration file to link to the network.

2. PG speed controller card is required for PG control.

Peripheral Devices and Options (continued)

● Ground Fault Interrupter, Circuit Breaker

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



Ground Fault Interrupter
[Mitsubishi Electric Corporation]



Circuit Breaker
[Mitsubishi Electric Corporation]

200 V Class

Motor Capacity (kW)	Ground Fault Interrupter						Circuit Breaker					
	Without Reactor*1			With Reactor*1			Without Reactor*1			With Reactor*1		
	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2
0.4	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
1.1	NV32-SV	15	10/10	NV32-SV	10	10/10	NF32-SV	15	7.5/7.5	NF32-SV	10	7.5/7.5
1.5												
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	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												
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	150	85/85	—	—	—	NF250-SV	150	85/85
30	—	—	—	NV250-SV	175	85/85	—	—	—	NF250-SV	175	85/85
37	—	—	—	NV250-SV	225	85/85	—	—	—	NF250-SV	225	85/85
45	—	—	—	NV400-SW	250	85/85	—	—	—	NF400-CW	250	50/25
55	—	—	—	NV400-SW	300	85/85	—	—	—	NF400-CW	300	50/25
75	—	—	—	NV400-SW	400	85/85	—	—	—	NF400-CW	400	50/25
90	—	—	—	NV630-SW	500	85/85	—	—	—	NF630-CW	500	50/25

*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

Note: 200 V models 22 kW and above come with a built-in DC reactor that improves the power factor.

400 V Class

Motor Capacity (kW)	Ground Fault Interrupter						Circuit Breaker					
	Without Reactor*1			With Reactor*1			Without Reactor*1			With Reactor*1		
	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2	Model	Rated Current (A)	Interrupt Capacity (kA) Icu/Ics*2
0.4	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	NV32-SV	20	5/5	NV32-SV	15	5/5	NF32-SV	20	2.5/2.5	NF32-SV	15	2.5/2.5
3.7												
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	—	—	—	NV125-SV	75	25/25	—	—	—	NF125-SV	75	25/25
30	—	—	—	NV125-SV	100	25/25	—	—	—	NF125-SV	100	25/25
37	—	—	—	NV250-SV	125	36/36	—	—	—	NF250-SV	125	36/36
45	—	—	—	NV250-SV	150	36/36	—	—	—	NF250-SV	150	36/36
55	—	—	—	NV250-SV	175	36/36	—	—	—	NF250-SV	175	36/36
75	—	—	—	NV250-SV	225	36/36	—	—	—	NF250-SV	225	36/36
90	—	—	—	NV400-SW	250	42/42	—	—	—	NF400-CW	250	25/13
110	—	—	—	NV400-SW	300	42/42	—	—	—	NF400-CW	300	25/13
132	—	—	—	NV400-SW	350	42/42	—	—	—	NF400-CW	350	25/13
160	—	—	—	NV400-SW	400	42/42	—	—	—	NF400-CW	400	25/13

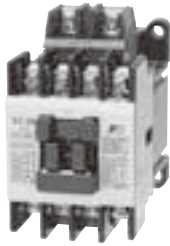
*1: The AC or DC reactor is connected to the drive.

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

Note: 400 V models 22 kW and above come with a built-in DC reactor that improves the power factor.

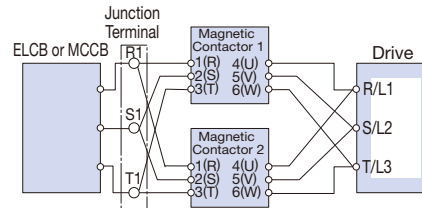
● Magnetic Contactor

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.

200 V Class

Motor Capacity (kW)	Without Reactor*		With Reactor*	
	Model	Rated Current (A)	Model	Rated Current (A)
0.4	SC-03	11	SC-03	11
0.75	SC-05	13	SC-03	11
1.1	SC-4-0	18	SC-05	13
1.5	SC-4-0	18	SC-05	13
2.2	SC-N1	26	SC-4-0	18
3	SC-N2	35	SC-N1	26
3.7	SC-N2	35	SC-N1	26
5.5	SC-N2S	50	SC-N2	35
7.5	SC-N3	65	SC-N2S	50
11	SC-N4	80	SC-N4	80
15	SC-N5A	93	SC-N4	80
18.5	SC-N5	93	SC-N5	93
22	—	—	SC-N6	125
30	—	—	SC-N7	152
37	—	—	SC-N8	180
45	—	—	SC-N10	220
55	—	—	SC-N11	300
75	—	—	SC-N12	400
90	—	—	SC-N12	400

Note: 200 V models 22 kW and above come with a built-in DC reactor that improves the power factor.

400 V Class

Motor Capacity (kW)	Without Reactor*		With Reactor*	
	Model	Rated Current (A)	Model	Rated Current (A)
0.4	SC-03	7	SC-03	7
0.75	SC-03	7	SC-03	7
1.5	SC-05	9	SC-05	9
2.2	SC-4-0	13	SC-4-0	13
3	SC-4-1	17	SC-4-1	17
3.7	SC-4-1	17	SC-4-1	17
5.5	SC-N2	32	SC-N1	25
7.5	SC-N2S	48	SC-N2	32
11	SC-N2S	48	SC-N2S	48
15	SC-N3	65	SC-N2S	48
18.5	SC-N3	65	SC-N3	65
22	—	—	SC-N4	80
30	—	—	SC-N4	80
37	—	—	SC-N5	90
45	—	—	SC-N6	110
55	—	—	SC-N7	150
75	—	—	SC-N8	180
90	—	—	SC-N10	220
110	—	—	SC-N11	300
132	—	—	SC-N11	300
160	—	—	SC-N12	400

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

Note: 400 V models 22 kW and above come with a built-in DC reactor that improves the power factor.

Peripheral Devices and Options (continued)

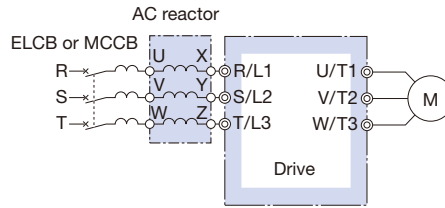
● AC Reactor (UZBA-B for 50/60 Hz Input)

Base device selection on motor capacity.

Lead Wire Type



Connection Diagram



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

Dimensions (mm)

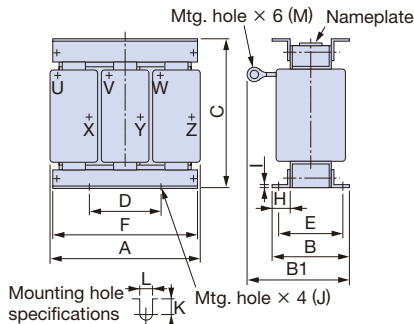


Figure 1

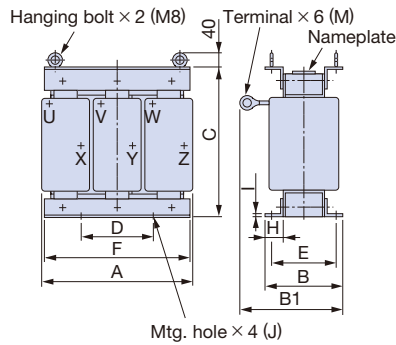


Figure 2

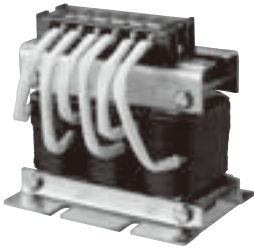
200 V Class

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)														Weight (kg)	Watt Loss (W)										
					A	B	B1	C	D	E	F	H	I	J	K	L	M													
3	20	0.53	X002491	1	130	88	114	105	50	70	130	22	3.2	M6	11.5	7	M5	3	35											
3.7							119								9					45										
5.5	40	0.265	X002493				98			139					80		11.5		M6	4	50									
7.5	60	0.18	X002495				160			105					147.5		130		75	85	160	25	2.3	M6	10	7	M6	6	65	
15	80	0.13	X002497				155										M8		75											
18.5	90	0.12	X002498		180	100	150	150	75	80	180	25	2.3	M6	10	7	M8	8	90											
22	120	0.09	X002555				155										M10													
30	160	0.07	X002556														170													
37	200	0.05	X002557				115										182.5		175	75	80	95	205	25	3.2	M6	10	7	M10	12
45	240	0.044	X002558		2	210	100	170	175	75	80	205	25	3.2	M6	10	7	M10	12	100										
55	280	0.039	X002559	115				182.5													175	75	80	95	205	25	3.2	M6	10	7
75	360	0.026	X002560	240		126	218	215	150	110	240	25	3.2	M8	8	7	M10	23	125											
90	500	0.02	X010145				218													231	175	75	80	95	205	25	3.2	M8	8	10
				270		162	241	230	150	130	260	40	5	M8	16	10	M12	32	145											
							241													270	150	130	320	40	4.5	M10	16	10	M12	55
				2		330	162	281	270	150	130	320	40	4.5	M10	16	10	M12	55	200										

400 V Class

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)														Weight (kg)	Watt Loss (W)
					A	B	B1	C	D	E	F	H	I	J	K	L	M			
7.5	20	1.06	X002502	1	160	90	115	130	75	70	160	25	2.3	M6	10	7	M5	5	50	
11	30	0.7	X002503			105	132.5			85								6	65	
15	40	0.53	X002504		180	100	140	150	75	80	180	25	2.3	M6	10	7	M6	8	90	
18.5	50	0.42	X002505				145											150		8.5
22	60	0.36	X002506		210	100	150	175	75	80	205	25	3.2	M6	10	7	M8	12	95	
30	80	0.26	X002508				115			177.5								95	15	110
37	90	0.24	X002509		240	126	193	205	150	110	240	25	3.2	M8	8	10	M10	23	130	
45	120	0.18	X002566				198											150	150	150
55	150	0.15	X002567		270	162	231	230	150	130	260	40	5	M8	16	10	M10	32	135	
75	200	0.11	X002568				246										M12			
90	250	0.09	X002569		2	320	165	253	275	150	130	320	40	4.5	M10	17.5	12	M12	55	200
110	250	0.09	X002569																	
132	330	0.06	X002570																	
160	330	0.06	X002570																	

Terminal Type



Dimensions (mm)

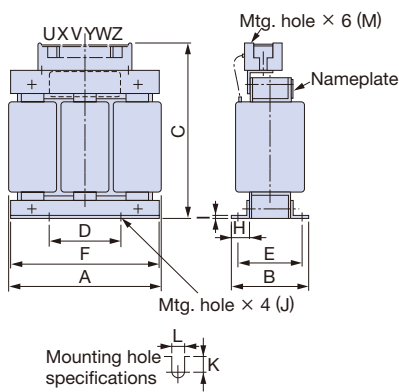


Figure 1

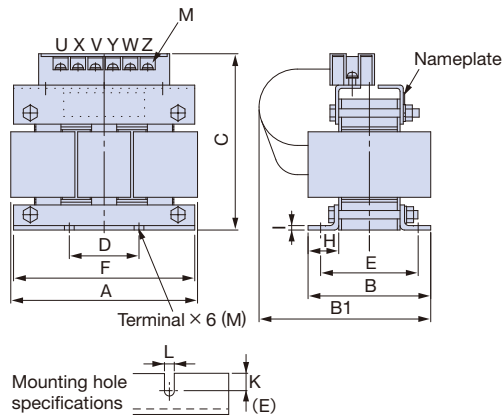


Figure 2

200 V Class

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)												Weight (kg)	Watt Loss (W)	
					A	B	B1	C	D	E	F	H	I	J	K	L			M
0.4	2.5	4.2	X002553	1	120	71	—	120	40	50	105	20	2.3	M6	10.5	7	M4	2.5	15
0.75	5	2.1	X002554		120	71		120	40	50	105	20	2.3		10.5			2.5	15
1.1	10	1.1	X002489		130	88		130	50	70	130	22	3.2		9			3	25
1.5					130	88		130	50	70	130	22	3.2		9			3	30
2.2	15	0.71	X002490	2	135	88	140	130	50	70	130	22	3.2	M6	9	7	M4	3	35
3	20	0.53	300-027-120		135	88	150	130	50	70	130	22	3.2		9			3	45
3.7					135	98	160	140	50	80	130	22	3.2		9			4	50
5.5	30	0.35	300-027-121		135	98	160	140	50	80	130	22	3.2		9			4	50
7.5	40	0.265	300-027-122		165	105	185	170	75	85	160	25	2.3		10	M6	6	65	
11	60	0.18	300-027-123		165	105	185	170	75	85	160	25	2.3		10		6	65	
15	80	0.13	300-027-124		185	100	180	195	75	80	180	25	2.3		10	M6	8	75	
18.5	90	0.12	300-027-125															90	

400 V Class

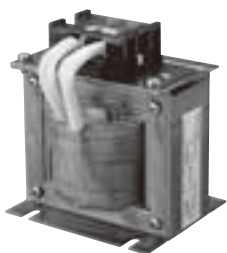
Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)														Weight (kg)	Watt Loss (W)									
					A	B	B1	C	D	E	F	H	I	J	K	L	M												
0.4	1.3	18	X002561	1	120	71	—	120	40	50	105	20	2.3	M6	10.5	7	M4	2.5	15										
0.75	2.5	8.4	X002562		130	88		130	50	70	130	22	3.2		9			3	25										
1.5	5	4.2	X002563																										
2.2	7.5	3.6	X002564																										
3	10	2.2	X002500																										
3.7																													
5.5																				15	1.42	X002501							
7.5	20	1.06	300-027-126	2	165	90	160	155	75	70	160	25	2.3	10	7	M4	5	50											
11	30	0.7	300-027-127														185	100	175	185	80	180	25	2.3	10	7	M4	6	65
15	40	0.53	300-027-128																										
18.5	50	0.42	300-027-129																										

Peripheral Devices and Options (continued)

● DC Reactor (UZDA-B for DC circuit)

Base device selection on motor capacity.

Terminal Type



Dimensions (mm)

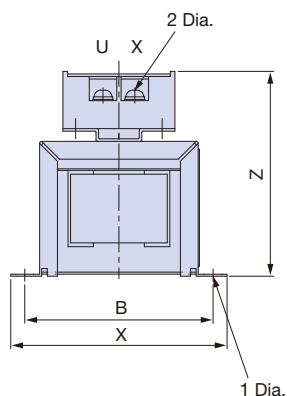


Figure 1

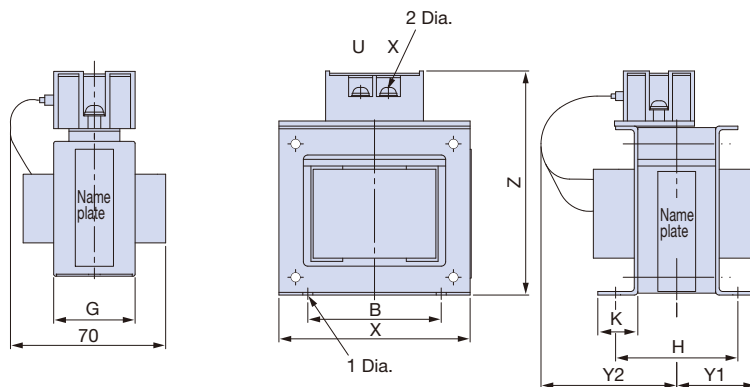


Figure 2

200 V Class

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)										Weight (kg)	Watt Loss (W)
					X	Y2	Y1	Z	B	H	K	G	φ1	φ2		
0.4	5.4	8	300-027-130	1	85	—	—	81	74	—	—	32	M4	M4	0.8	8
0.75																
1.1																
1.5																
2.2	18	3	300-027-131	2	86	84	36	101	60	55	18	—	M4	M4	2	18
3																
3.7																
5.5																
7.5	36	1	300-027-132	2	105	94	46	129	64	80	26	—	M6	M4	3.2	22
11																
15																
18.5																
18.5	90	0.4	300-027-133	2	105	124	56	135	64	100	26	—	M6	M6	4.9	29
18.5	90	0.4	300-027-139	2	133	147.5	52.5	160	86	80	25	—	M6	M6	6.5	44

400 V Class

Motor Capacity (kW)	Current (A)	Inductance (mH)	Code No.	Figure	Dimensions (mm)										Weight (kg)	Watt Loss (W)
					X	Y2	Y1	Z	B	H	K	G	φ1	φ2		
0.4	3.2	28	300-027-134	1	85	—	—	81	74	—	—	32	M4	M4	0.8	9
0.75																
1.5					90	—	—	88	80	—	—	32	M4	M4		
2.2																
3	12	6.3	300-027-136	2	86	84	36	101	60	55	18	—	M4	M4	2	16
3.7																
5.5					105	104	46	118	64	80	26	—	M6	M4		
7.5																
11	23	3.6	300-027-137	2	105	109	51	129	64	90	26	—	M6	M4	4	26
15																
18.5																
18.5	47	1.3	300-027-140	2	115	142.5	57.5	136	72	90	25	—	M6	M5	6	42

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.

Finemet Zero-Phase Reactor to Reduce Radio Noise

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



【Hitachi Metals, Ltd.】

Connection Diagram

Compatible with the input and output side of the drive.

Example: Connection to output terminal

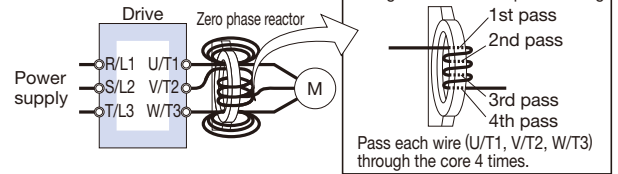
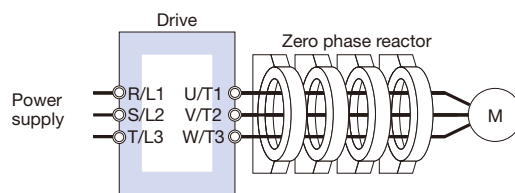
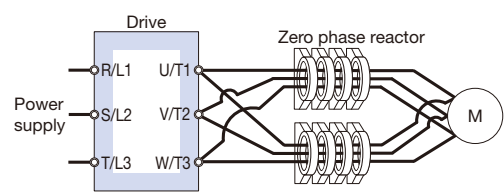


Diagram a



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

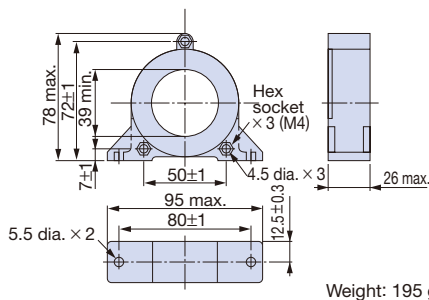
Diagram b



Separate each terminal lead for U/T1, V/T2, and W/T3 in half, passing one half of the wires through a set of four cores and the other half through the other set of four cores as shown.

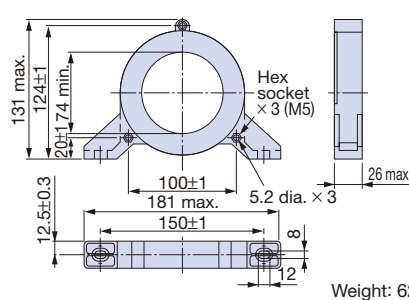
Diagram c

Dimensions (mm)



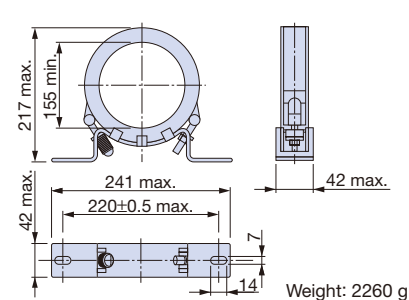
Model F6045GB

Weight: 195 g



Model F11080GB

Weight: 620 g



Model F200160PB

Weight: 2260 g

Wiring Gauge Guide mm ²	Model	Code No.	Qty.	Diagram
~ 5.5	F6045GB	FIL001098	1	a
~ 8	F11080GB	FIL001097	1	
~ 38	F6045GB	FIL001098	4	
~ 200, ~ 50 × 2P	F11080GB	FIL001097	4	b
~ 250, ~ 150 × 4P	F200160PB	300-001-041	4	
~ 150 × 8P	F200160PB	300-001-041	8	c

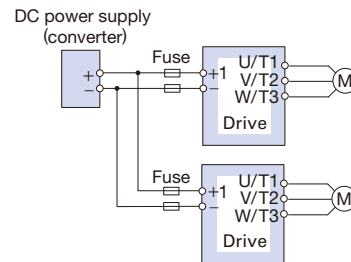
Peripheral Devices and Options (continued)

Fuse and Fuse Holder

Install a fuse to the drive input terminals to prevent damage in case a fault occurs.
Refer to the instruction manual for information on UL-approved components.
[BUSSMANN]

Connection Diagram

This example shows a DC power supply (two drives connected in series).
For an AC power supply, see the connection diagram on page 24.



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.

200 V Class

Catalog Code GA70A	AC Power Supply Input					DC Power Supply Input				
	Fuse			Fuse Holder		Fuse			Fuse Holder	
	Model	Rated Shortcircuit Breaking Current (kA)	Qty.	Model	Qty.	Model	Rated Shortcircuit Breaking Current (kA)	Qty.	Model	Qty.
2004	FWH-45B	200	3	1BS101	6	FWH-45B	200	2	1BS101	4
2006										
2008										
2010										
2012	FWH-50B									
2018	FWH-80B									
2021										
2030	FWH-125B		3	1BS102	6	FWH-125B		2	1BS102	4
2042	FWH-150B									
2056	FWH-200B									
2070	FWH-225A									
2082	FWH-225A									
	FWH-250A									
2110	FWH-225A									
	FWH-250A									
2138	FWH-275A									
	FWH-300A									
2169	FWH-275A									
	FWH-350A									
2211	FWH-325A	3	1BS102	6	FWH-450A	2	1BS103	4		
	FWH-450A	3	1BS103	6	FWH-600A					
2257	FWH-600A	3	1BS103	6	FWH-600A	2	1BS103	4		
2313	FWH-800A				*		FWH-700A	*		
							FWH-800A	*		
					FWH-1000A					

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

400 V Class

Catalog Code GA70A	AC Power Supply Input					DC Power Supply Input										
	Fuse			Fuse Holder		Fuse			Fuse Holder							
	Model	Rated Shortcircuit Breaking Current (kA)	Qty.	Model	Qty.	Model	Rated Shortcircuit Breaking Current (kA)	Qty.	Model	Qty.						
4002	FWH-50B	200	3	1BS101	6	FWH-50B	200	3	1BS101	4						
4004						FWH-50B		2	1BS101	4						
4005						FWH-60B										
4007																
4009																
4012																
4018	FWH-80B															
4023	FWH-90B															
4031	FWH-150B		3	1BS102	6	FWH-150B		2	1BS102	4						
4038	FWH-200B					FWH-200B										
4044						FWH-225A										
4060						FWH-250A										
4075	FWH-275A															
4089	FWH-275A					FWH-275A										
4103						FWH-300A										
4140						FWH-325A										
4168	FWH-400A					2					1BS103	4				
	FWH-400A															
4208	FWH-500A												3	1BS103	6	FWH-500A
4250	FWH-600A					FWH-600A										
						FWH-600A										
						FWH-700A										
4296	FWH-700A												FWH-700A	2	*	
			FWH-800A													
					*											

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

Peripheral Devices and Options (continued)

Input Noise Filter

Base device selection on motor capacity.



Noise Filter without Case



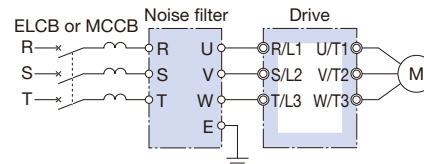
Noise Filter with Case



Noise Filter
[Schaffner EMC K.K.]

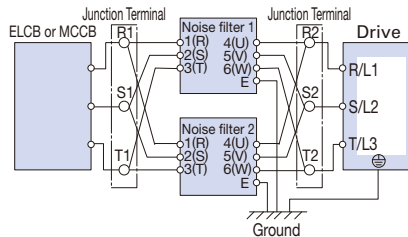
Note: Refer to the instruction manual for information on the CE mark and compliance with the EMC directive.

Connection Diagram



Note: Do not connect the input noise filter to the drive output terminals (U, V, W). Connect in parallel when using two filters.

Connecting Noise Filters in Parallel to the Input or Output Side (examples shows two filters in parallel)



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

Noise filters and grounding wire should be as heavy and as short as possible.

200 V Class

Motor Capacity (kW)	Noise Filter without Case				Noise Filter with Case				Noise Filter by Schaffner EMC K.K.			
	Model	Code No.	Qty.	Rated Current (A)	Model	Code No.	Qty.	Rated Current (A)	Model	Code No.	Qty.	Rated Current (A)
0.4	LNFD-2103DY	FIL000132	1	10	LNFD-2103HY	FIL000140	1	10	—	—	—	—
0.75									—	—	—	—
1.1									—	—	—	—
1.5									—	—	—	—
2.2	LNFD-2153DY	FIL000133	1	15	LNFD-2153HY	FIL000141	1	15	—	—	—	—
3	LNFD-2303DY	FIL000135	1	30	LNFD-2303HY	FIL000143	1	30	—	—	—	—
3.7									—	—	—	—
5.5									FN258L-42-07	FIL001065	1	42
7.5									FN258L-55-07	FIL001066	1	55
11	LNFD-2303DY	FIL000135	2	40	LNFD-2303HY	FIL000142	2	40	FN258L-75-34	FIL001067	1	75
15									FN258L-100-35	FIL001068	1	100
18.5									FN258L-130-35	FIL001069	1	130
22									FN258L-130-35	FIL001069	1	130
30	—	—	—	—	—	—	—	—	FN258L-180-07	FIL001070	1	180
37									FN359P-250-99	FIL001071	1	250
45									FN359P-400-99	FIL001073	1	400
55									FN359P-500-99	FIL001074	1	500
75	—	—	—	—	—	—	—	—	—	—	—	—
90	—	—	—	—	—	—	—	—	—	—	—	—

400 V Class

Motor Capacity (kW)	Noise Filter without Case				Noise Filter with Case				Noise Filter by Schaffner EMC K.K.			
	Model	Code No.	Qty.	Rated Current (A)	Model	Code No.	Qty.	Rated Current (A)	Model	Code No.	Qty.	Rated Current (A)
0.4	LNFD-4053DY	FIL000144	1	5	LNFD-4053HY	FIL000149	1	5	—	—	—	—
0.75									—	—	—	—
1.5									—	—	—	—
2.2									—	—	—	—
3	LNFD-4153DY	FIL000146	1	15	LNFD-4153HY	FIL000151	1	15	—	—	—	—
3.7									—	—	—	—
5.5									—	—	—	—
7.5									—	—	—	—
11	LNFD-4203DY	FIL000147	1	20	LNFD-4203HY	FIL000152	1	20	FN258L-42-07	FIL001065	1	42
15									FN258L-55-07	FIL001066	1	55
18.5									FN258L-75-34	FIL001067	1	75
22									FN258L-100-35	FIL001068	1	100
30	LNFD-4303DY	FIL000148	1	30	LNFD-4303HY	FIL000153	1	30	FN258L-100-35	FIL001068	1	100
37									FN258L-130-35	FIL001069	1	130
45									FN258L-180-07	FIL001070	1	180
55									FN359P-300-99	FIL001072	1	300
75	—	—	—	—	—	—	—	—	FN359P-400-99	FIL001073	1	400
90									—	—	—	—
110									—	—	—	—
132									—	—	—	—
160	—	—	—	—	—	—	—	—	—	—	—	—

Peripheral Devices and Options (continued)

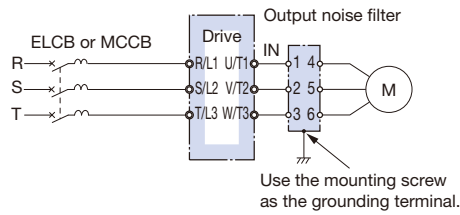
Output Noise Filter

Base device selection on motor capacity.

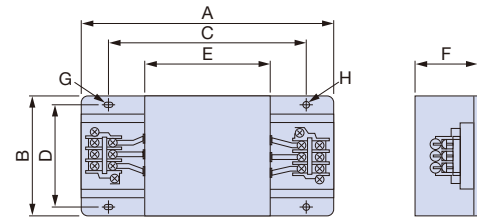


[NEC Tokin Corporation]

Connection Diagram



Dimensions (mm)



200 V Class

Motor Capacity (kW)	Model	Code No.	Qty.*1	Rated Current (A)	Dimensions (mm)								Terminal	Weight*2 (kg)
					A	B	C	D	E	F	G	H		
0.4	LF-310KA	FIL000068	1	10	140	100	100	90	70	45	7×φ4.5	φ4.5	TE-K5.5 M4	0.5
0.75														
1.1														
1.5														
2.2	LF-320KA	FIL000069	1	20	140	100	100	90	70	45	7×φ4.5	φ4.5	TE-K5.5 M4	0.6
3														
3.7														
5.5														
7.5	LF-350KA	FIL000070	1	50	260	180	180	160	120	65	7×φ4.5	φ4.5	TE-K22 M6	2.0
11			2	100										
15														
18.5														
22	LF-350KA*3	FIL000070	3	150	260	180	180	160	120	65	7×φ4.5	φ4.5	TE-K22 M6	2.0
	LF-3110KB*3	FIL000076	1	110	540	340	480	300	340	240	9×φ6.5	φ6.5	TE-K60 M8	19.5
	LF-350KA*3	FIL000070	3	150	260	180	180	160	120	65	7×φ4.5	φ4.5	TE-K22 M6	2.0
	LF-375KB*3	FIL000075	2	150	540	320	480	300	340	240	9×φ6.5	φ6.5	TE-K22 M6	12.0
37	LF-3110KB	FIL000076	2	220	540	320	480	300	340	240	9×φ6.5	φ6.5	TE-K60 M8	19.5
45														
55														
75														
90	LF-3110KB	FIL000076	3	330	540	320	480	300	340	240	9×φ6.5	φ6.5	TE-K60 M8	19.5
			4	440										

*1: Connect in parallel when using more than one filter. Refer to the Connecting Noise Filters in Parallel to the Input or Output Side on page 46.

*2: Weight of one filter.

*3: Either noise filter model can be used.

400 V Class

Motor Capacity (kW)	Model	Code No.	Qty.*1	Rated Current (A)	Dimensions (mm)								Terminal	Weight*2 (kg)
					A	B	C	D	E	F	G	H		
0.4	LF-310KB	FIL000071	1	10	140	100	100	90	70	45	7×φ4.5	φ4.5	TE-K5.5 M4	0.5
0.75														
1.5														
2.2														
3	LF-320KB	FIL000072	1	20	140	100	100	90	70	45	7×φ4.5	φ4.5	TE-K5.5 M4	0.6
3.7														
5.5														
7.5														
11	LF-335KB	FIL000073	1	35	260	180	180	160	120	65	7×φ4.5	φ4.5	TE-K22 M6	2.0
15														
18.5														
22														
30	LF-375KB	FIL000075	1	75	540	320	480	300	340	240	9×φ6.5	φ6.5	TE-K22 M6	12.0
37	LF-3110KB	FIL000076	1	110	540	340	480	300	340	240	9×φ6.5	φ6.5	TE-K60 M8	19.5
45														
55														
75														
90	LF-3110KB	FIL000076	2	220	540	320	480	300	340	240	9×φ6.5	φ6.5	TE-K60 M8	19.5
110			3	330										
132			4	440										
160														

*1: Connect in parallel when using more than one filter. Refer to the Connecting Noise Filters in Parallel to the Input or Output Side on page 46.

*2: Weight of one filter.

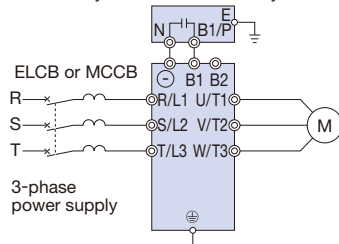
● Momentary Power Loss Recovery Unit



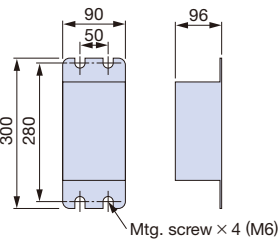
Weight: 2 kg

Connection Diagram

Momentary Power Loss Recovery Unit



Dimensions (mm)



Model	Code No.
200 V Class: P0010	P0010
400 V Class: P0020	P0020

Note: Functions as a back-up power supply for drives up to 11 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.

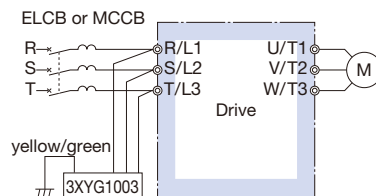
For both 200 V and 400 V classes, the noise filter can be used with a zero-phase reactor.

Note: The capacitor-type noise filter can be used for drive input only. Do not connect the noise filter to the output terminals.

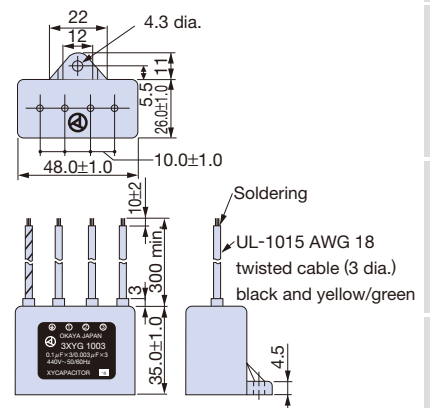


[Okaya Electric Industries Co., Ltd.]

Connection Diagram



Dimensions (mm)



Specifications

Model	Code No.
3XYG 1003	C002889

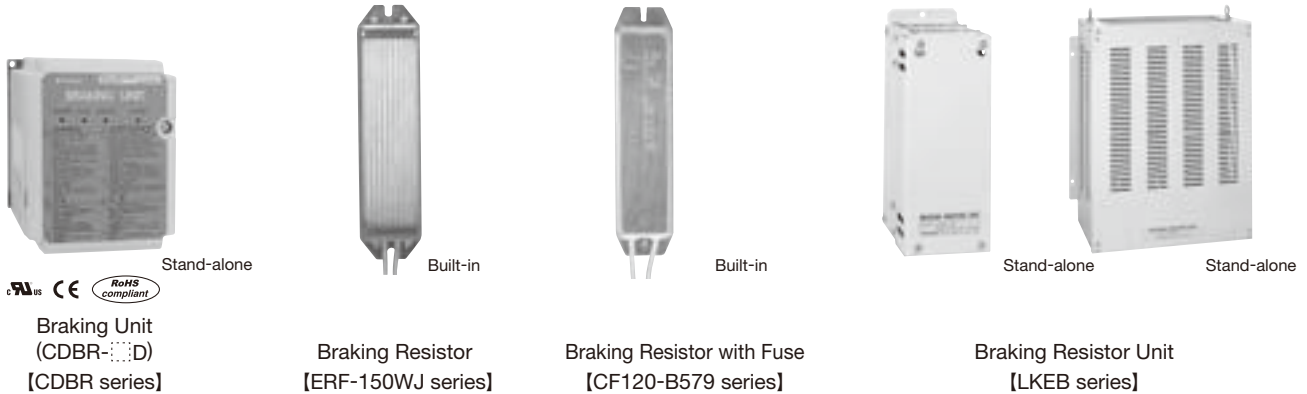
Rated Voltage	Capacitance (3 devices each)	Operating Temperature (°C)
440 V	X (Δ connection) : 0.1 μ F \pm 20 % Y (λ connection) : 0.003 μ F \pm 20 %	-40 to +85

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

Braking Unit, Braking Resistor, Braking Resistor Unit

Braking units and braking resistors are required to brake the drive.

However, the braking unit for drives with catalog codes GA70□2004 through 2138 and GA70□4002 through 4168 is not required since these drives have built-in braking transistors. If the application requires a braking resistor or braking unit, choose from built-in and stand-alone types in accordance with motor capacity.



200 V Class

Footnotes are listed on page 51.

Max. Applicable Motor (kW)	ND/HD	GA700	Braking Unit		Braking Resistor (Duty Factor: 3% ED, 10 s max.)*1										Braking Resistor Unit (Duty Factor: 10% ED, 10 s max.)*1						Min.*2 Connectable Resistance (Ω)
		Catalog Code GA70A <div></div>	Model CDBR- <div></div>	Qty.	No Fuse					With Fuse											
					Model ERF-150WJ <div></div>	Resistance (Ω)	Qty.	Diagram	Braking Torque*3 (%)	Model CF120-B579 <div></div>	Resistance (Ω)	Qty.	Diagram	Braking Torque*3 (%)	Model LKEB- <div></div>	Resistor Specifications (per unit)	Qty.	Diagram	Braking Torque*3 (%)		
0.4	HD	2004	Built-in		201	200	1	A	220	B	200	1	A	220	20P7	70 W 200 Ω	1	B	220	48	
0.75	ND	2004			201	200	1	A	125	B	200	1	A	125	20P7	70 W 200 Ω	1	B	125	48	
	HD	2006			201	200	1	A	85	B	200	1	A	85	20P7	70 W 200 Ω	1	B	85	48	
1.1	ND	2006			101	100			150	C	100	1		150	21P5	260 W 100 Ω			150		
	HD	2008			101	100	1	A	125	C	100	1	A	125	21P5	260 W 100 Ω	1	B	125	48	
1.5	ND	2008			700	70	1	A	120	D	70	1	A	120	22P2	260 W 70 Ω	1	B	120	48	
	HD	2010			620	62	1	A	100	E	62	1	A	100	23P7	390 W 40 Ω	1	B	150	16	
2.2	ND	2010			620	62	1	A	80	E	62	1	A	80	23P7	390 W 40 Ω	1	B	125	16	
	HD	2012			620	62	2	A	110	E	62	2	A	110	25P5	520 W 30 Ω	1	B	115	16	
3	ND	2012			—					—					27P5	780 W 20 Ω	1	B	125	16	
	HD	2018			—					—					2011	2400 W 13.6 Ω	1	B	125	9.6	
3.7	ND	2018			—					—					2015	3000 W 10 Ω	1	B	125	9.6	
	HD	2021			—					—					2022	4800W 6.8 Ω	1	B	85	9.6	
5.5	ND	2021			—					—					2022	4800 W 6.8 Ω			1	B	90
	HD	2030			—					—					2022	4800 W 6.8 Ω	1	B	70	6.4	
7.5	ND	2030			—					—					2015	3000 W 10 Ω	2	E	100	5.0	
	HD	2042			—					—					2022	4800 W 6.8 Ω	2	D	120	6.4	
11	ND	2042			—					—					2022	4800 W 6.8 Ω	2	D	100	6.4	
	HD	2056			—					—					2022	4800 W 6.8 Ω	3	E	110	1.6	
15	ND	2056			—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
	HD	2070			—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
18.5	ND	2070			—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
	HD	2082			—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
22	ND	2082			—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
	HD	2110			—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
30	ND	2110			—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
	HD	2138			—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
37	ND	2138			—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
	HD	2169	2037D	1	—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
45	ND	2169	2037D	1	—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
	HD	2211	2022D	2	—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
55	ND	2211	2022D	2	—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
	HD	2257	2110D	1	—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
75	ND	2257	2110D	1	—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
	HD	2313	2110D	1	—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	
90	ND	2313	2110D	1	—					—					2022	4800 W 6.8 Ω	4	E	120	1.6	

Note: 1. Braking resistor (ERF-150WJ and CF120-B579) requires a separate attachment for installation. See attachment for braking resistor unit on page 55.

2. Use the retrofit attachment when replacing an older model CDBR braking unit (CDBR-□B, CDBR-□C). Refer to TOBP C720600 01 1000-Series Option CDBR, LKEB Installation Manual for more details.

3. Use the External Heatsink Attachment for installation with the heatsink outside the enclosure. Refer to page 55 for details.

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

5. See the connection diagram on page 52.

400 V Class

Max. Applicable Motor (kW)	ND/HD	GA700	Braking Unit		Braking Resistor (Duty Factor: 3% ED, 10 s max.)*1										Braking Resistor Unit (Duty Factor: 10% ED, 10 s max.)*1						Min.*2
		Catalog Code GA70A □□□□	Model CDBR- □□□□	Qty.	No Fuse					With Fuse											Connectable Resistance (Ω)
					Model ERF-150WJ □□□□	Resistance (Ω)	Qty.	Diagram	Braking Torque*3 (%)	Model CF120-B579 □□□□	Resistance (Ω)	Qty.	Diagram	Braking Torque*3 (%)	Model LKEB- □□□□	Resistor Specifications (per unit)	Qty.	Diagram	Braking Torque*3 (%)		
0.4	HD	4002	Built-in		751	750	1	A	230	F	750	1	A	230	40P7	70 W 750 Ω	1	B	230	165	
0.75	ND	4002			751	750	1	A	130	F	750	1	A	130	40P7	70 W 750 Ω	1	B	130	165	
	HD	4004																			
1.5	ND	4004			401	400	1	A	125	G	400	1	A	125	41P5	260 W 400 Ω	1	B	125	110	
	HD	4005																			
2.2	ND	4005			301	300	1	A	115	H	300	1	A	115	42P2	260 W 250 Ω	1	B	135	110	
	HD	4007																			
3	ND	4007			201	200	1	A	125	J	250	1	A	100	42P2	260 W 250 Ω	1	B	100	110	
	HD	4009												43P7	390 W 150 Ω	150		55			
3.7	ND	4009			201	200	1	A	105	J	250	1	A	83	43P7	390W 150 Ω	1	B	135	55	
	HD	4012																			
5.5	ND	4012			201	200	2	A	135	J	250	2	A	105	45P5	520 W 100 Ω	1	B	135	55	
	HD	4018			—					—										32	
7.5	ND	4018			—					—					47P5	780 W 75 Ω	1	B	130	32	
	HD	4023																			
11	ND	4023			—					—					4011	1040 W 50 Ω	1	B	135	32	
	HD	4031																	20		
15	ND	4031			—					—					4015	1560 W 40 Ω	1	B	125	20	
	HD	4038																			
18.5	ND	4038			—					—					4018	4800 W 32 Ω	1	B	125	20	
	HD	4044																	19.2		
22	ND	4044			—					—					4022	4800 W 27.2 Ω	1	B	125	19.2	
	HD	4060																			
30	ND	4060			—					—					4030	6000 W 20 Ω	1	B	125	19.2	
	HD	4075																			
37	ND	4075			—					—					4030	6000 W 20 Ω	1	B	100	19.2	
	HD	4089													4037	9600 W 16 Ω		C	125	10.6	
45	ND	4089			—					—					4045	9600 W 13.6 Ω	1	C	125	10.6	
	HD	4103																	8.7		
55	ND	4103			—					—					4045	9600 W 13.6 Ω	1	C	100	8.7	
	HD	4140													4030	6000 W 20 Ω	2	D	135	7.2	
75	ND	4140			—					—					4030	6000 W 20 Ω	2	D	100	7.2	
	HD	4168													4045	9600 W 13.6 Ω			145	5.2	
90	ND	4168			—					—					4045	9600 W 13.6 Ω	2	D	100	5.2	
	HD	4208	4045D	2														12.8			
110	ND	4208	4220D	1	—					—					4030	6000 W 20 Ω	3	E	100	3.2	
	HD	4250																			
132	ND	4250	4220D	1	—					—					4045	9600 W 13.6 Ω	4	E	140	3.2	
	HD	4296																			
160	ND	4296	4220D	1	—					—					4045	9600 W 13.6 Ω	4	E	140	3.2	

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

*2 : Assumes the use of a single braking unit. 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, the capacity of the braking resistor must be increased.

Note: 1. Braking resistor (ERF-150WJ and CF120-B579) requires a separate attachment for installation. See attachment for braking resistor unit on page 55.

2. Use the retrofit attachment when replacing an older model CDBR braking unit (CDBR-□B, CDBR-□C). Refer to TOBP C720600 01 1000-Series Option CDBR, LKEB Installation Manual for more details.

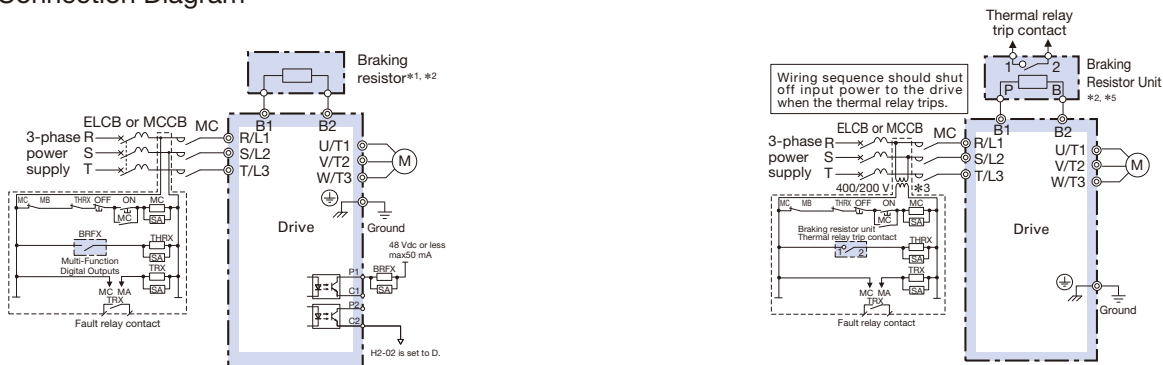
3. Use the External Heatsink Attachment for installation with the heatsink outside the enclosure. Refer to page 55 for details.

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

5. See the connection diagram on page 52.

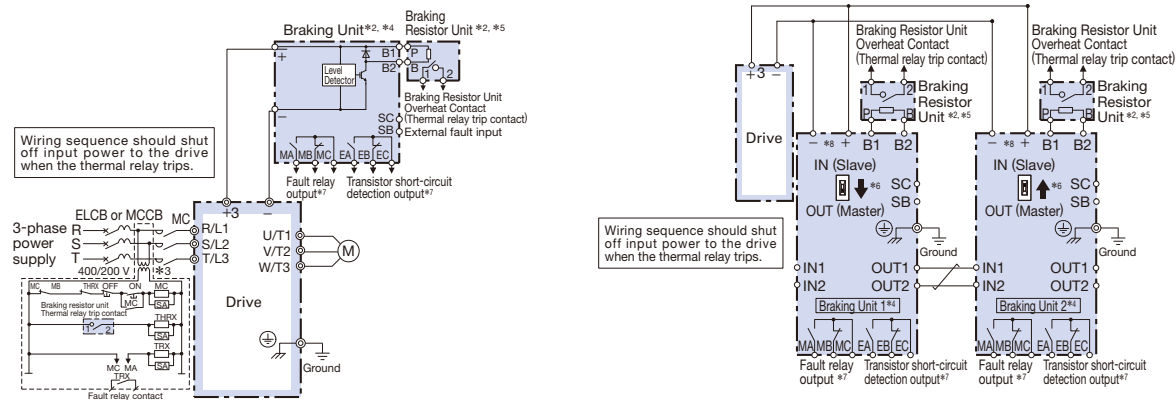
Peripheral Devices and Options (continued)

Connection Diagram



Connection Diagram A

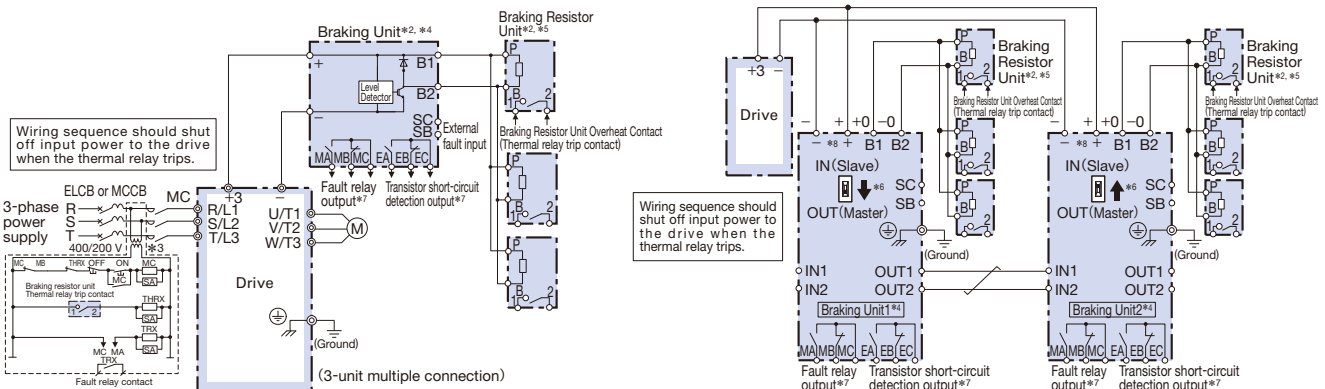
Connection Diagram B



Connection Diagram C

Connection Diagram D

(Braking Units in Parallel)*9



Connection Diagram E

Connection Diagram F

(Braking Units in Parallel)*9

- *1: Set L8-01 to 1 to enable braking resistor overload protection in the drive when using braking resistors, and set a multi-function input to "Braking Resistor Fault" (H1-□□□□ = D). Wiring sequence should shut off power to the drive when a fault output is triggered. CF120-B579 series does not need to be wired an external sequence.
 - *2: Set L3-04 to 0 or 3 to disable stall prevention when using a braking unit, a braking resistor, or a braking resistor unit. If the function is enabled under these conditions, the drive may not stop within the specified deceleration time.
 - *3: 200 V class drives do not require a control circuit transformer.
 - *4: Set L8-55 to 0 to disable the protection function for the built-in braking transistor when using a regenerative unit or another type of braking option in lieu of the built-in braking transistor. If the protection function is enabled under these conditions, it may cause a braking resistor fault (rF).
- When connecting a separately-installed type braking resistor unit (model

- CDBR) to drives with a built-in braking transistor (200 V/400 V 30 kW or less), connect the B1 terminal of the drive to the positive terminal of the braking resistor unit and connect the negative terminal of the drive to the negative terminal of the braking resistor unit. The B2 terminal is not used in this case.
- *5: Be sure to protect non-Yaskawa braking resistors by thermal overload relay.
 - *6: When using more than one braking unit connected in parallel, set one of the braking units as the master, and set the others as slaves.
 - *7: Connect fault relay output to multi-function digital input S□□ (External Fault). Connect the CDBR transistor short-circuit detection output to disconnect main input power to the drive.
 - *8: Connect directly to the drive terminal or install a terminal block.
 - *9: Contact your Yaskawa or nearest agent when using the braking unit (CDBR-□□D) with earlier models (CDBR-□□B or CDBR-□□C).
 - *10: Connect fault relay output to multi-function digital input S□□ (External Fault).

Model, Code No.
Braking Unit
200 V Class

Model CDBR-□□□□□	Protection Design	Code No.
2022D	IP20	100-091-707
	UL Type 1	100-091-754
2037D	IP20	100-091-712
	UL Type 1	100-091-759
2110D	IP00	100-091-524
	UL Type 1	100-091-530

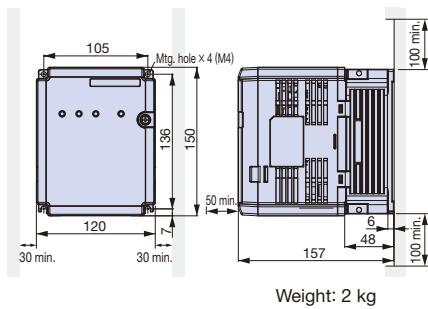
400 V Class

Model CDBR-□□□□□	Protection Design	Code No.
4045D	IP20	100-091-722
	UL Type 1	100-091-769
4220D	IP00	100-091-526
	UL Type 1	100-091-532

Dimensions (mm)
Braking Unit

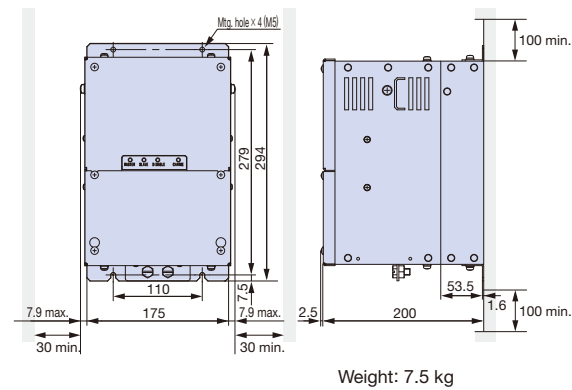
Open-Chassis [IP20]

CDBR-2022D, -2037D, -4045D



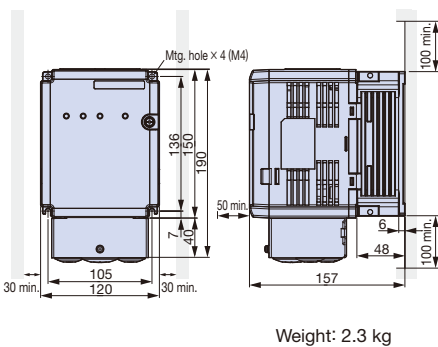
Open-Chassis [IP00]

CDBR-2110D, -4220D

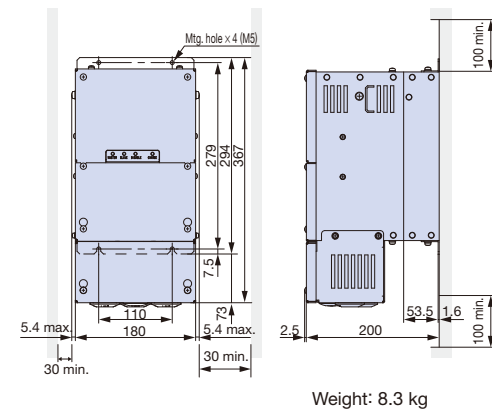


Enclosure Panel [UL Type 1]

CDBR-2022D, -2037D, -4045D



CDBR-2110D, -4220D



Heat Loss

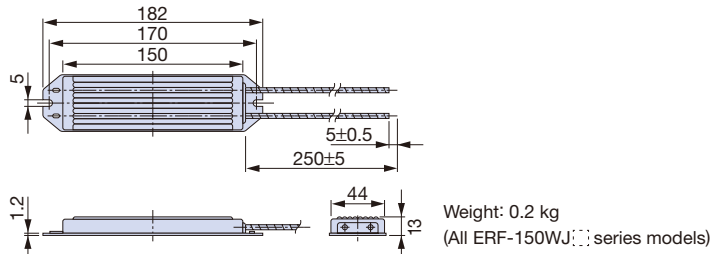
Model CDBR-□□□□□	Heat Loss (W)
2022D	27
2037D	38
2110D	152
4045D	36
4220D	152

Peripheral Devices and Options (continued)

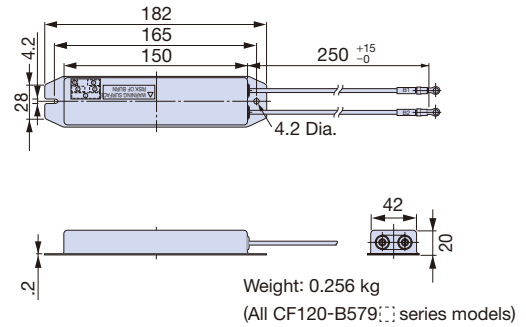
Braking Resistor

An optional separate attachment is need to install the braking resistor to the drive.

Refer to the Attachment for Braking Resistor on page 55.



ERF-150WJ series



CF120-B579 series

Braking Resistor Unit (stand-alone)

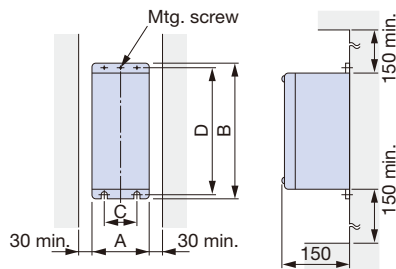


Figure 1

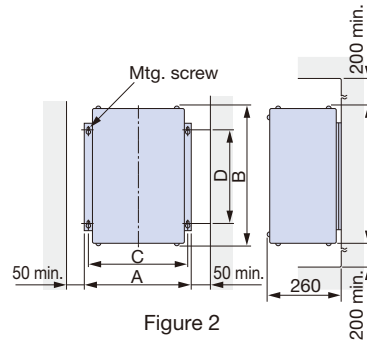
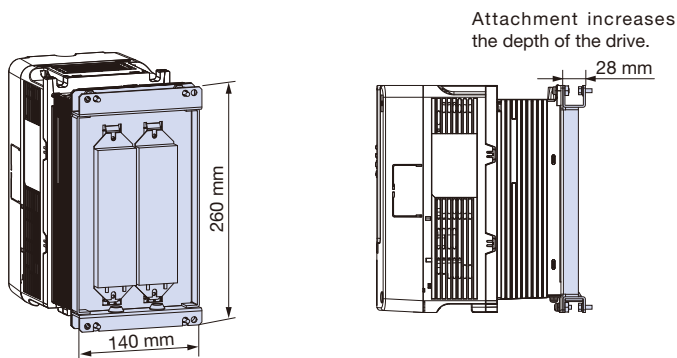


Figure 2

Applicable Voltage Class	Braking Resistor Unit Model LKEB-□□□□□□	Figure	Dimensions (mm)					Weight (kg)	Allowable Average Power Consumption (W)	
			A	B	C	D	MTG Screw			
200 V Class	20P7	1	105	275	50	260	M5×3	3.0	30	
	21P5	1	130	350	75	335	M5×4	4.5	60	
	22P2							4.5	89	
	23P7							5.0	150	
	25P5	1	250	350	200	335	M6×4	7.5	220	
	27P5							8.5	300	
	2011	2	266	543	246	336	340	M8×4	10	440
	2015								15	600
	2018								19	740
	2022								19	880

Applicable Voltage Class	Braking Resistor Unit Model LKEB-□□□□□□	Figure	Dimensions (mm)					Weight (kg)	Allowable Average Power Consumption (W)
			A	B	C	D	MTG Screw		
400 V Class	40P7	1	105	275	50	260	M5×3	3.0	30
	41P5	1	130	350	75	335	M5×4	4.5	60
	42P2							4.5	89
	43P7							5.0	150
	45P5	1	250	350	200	335	M6×4	7.5	220
	47P5							8.5	300
	4011	2	350	412	330	325	M6×4	16	440
	4015							18	600
	4018							19	740
	4022	2	446	543	426	340	M8×4	19	880
	4030							25	1200
	4037							33	1500
	4045	2	446	956	426	740	M8×4	33	1800

● Attachment for Braking Resistor



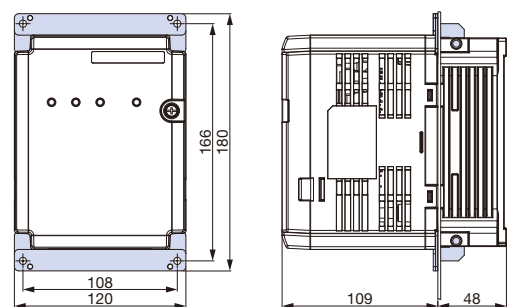
Model	Code No.
900-192-126-001	100-202-333

● Braking Unit External Heatsink Attachment

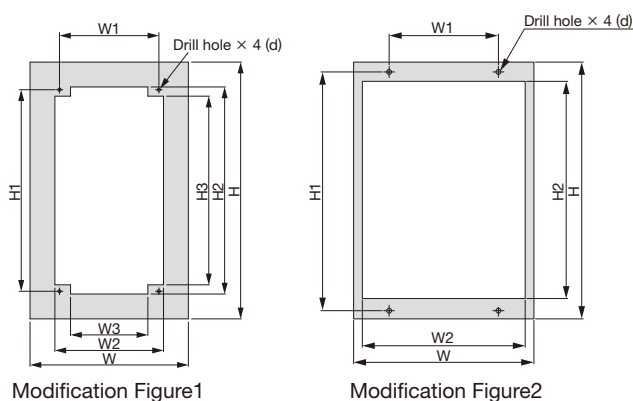
Use the external heatsink attachment for installation with the heatsink outside the enclosure.

Attachment	Model CDBR- []	Model (Code No.)
	2022D	EZZ021711A (100-066-355)
	2037D	
	4030D	
	4045D	

Dimensions (mm)



● Braking Unit Panel Cutout Dimensions



Model CDBR- []	Modification Figure	Dimensions (mm)								
		W*	H*	W1	W2	W3	H1	H2	H3	d1
2022D	1	172	226	108	118	84	166	172	152	M4
2037D	1	172	226	108	118	84	166	172	152	M4
2110D	2	175	294	110	159	—	279	257.8	—	M5
4045D	1	172	226	108	118	84	166	172	152	M4
4220D	2	175	294	110	159	—	279	257.8	—	M5

* The following W, H information is the size when in installing the gasket.

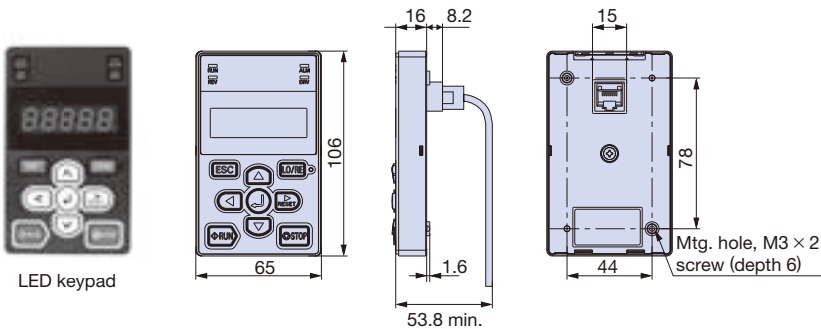
Peripheral Devices and Options (continued)

LED Keypad

The LED keypad offers a five-digit LED display.
Shipment of LED keypad as standard prepared is available. Contact Yaskawa.

Dimensions (mm)

Model	Code No.
JVOP-KPLEA04AAA	100-206-377

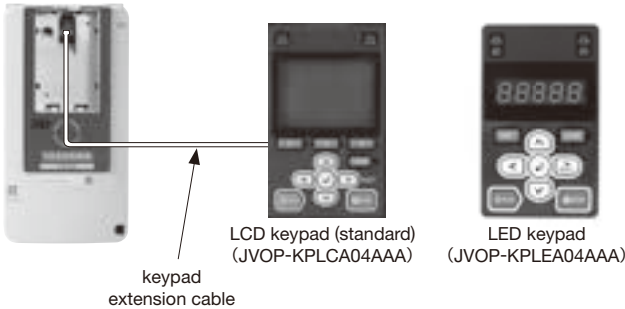


Keypad Extension Cable

Enables remote operation.

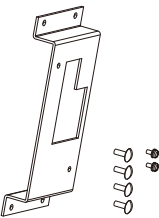
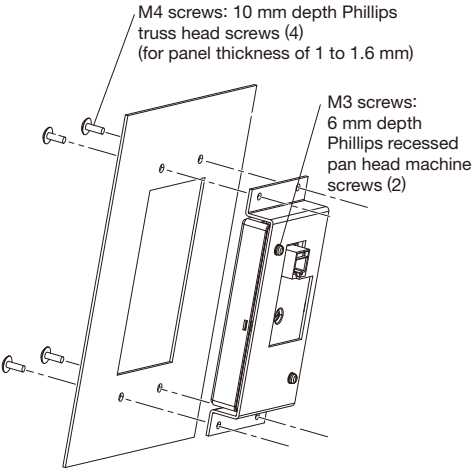
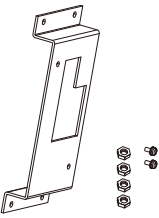
Model	Code No.
WV001 (1 m)	WV001
WV003 (3 m)	WV003

Note: Never use this cable for connecting the drive to a PC. Doing so may damage the PC.



Keypad Mounting Bracket

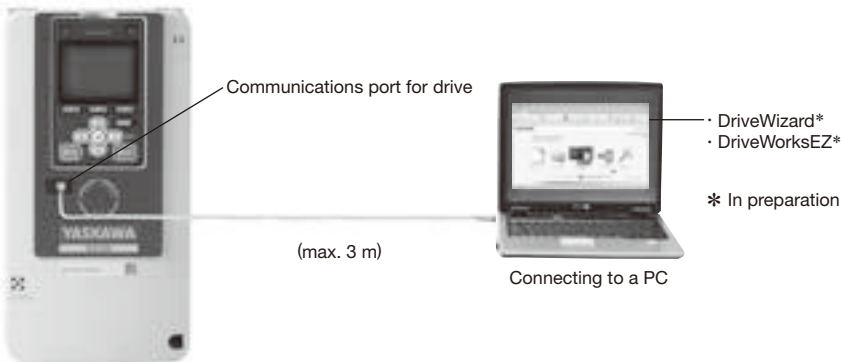
This bracket is required to mount the LED or LCD keypad outside an enclosure panel.

Item	Model	Code No.	Installation	Notes
 Installation Support Set A	900-192-933-001	100-203-008		For use with holes through the panel
 Installation Support Set B	900-192-933-002	100-203-009		For use with panel mounted threaded studs Note: If there are weld studs on the interior of the control panel, use the installation support set B (nut clamp).

● PC Cable

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

Connection



Note: 1. DriveWizard is a PC software package for managing parameters and functions in Yaskawa drives.
DriveWorksEZ is the software for creating custom application programs for the drive through visual programming.
2. Requires USB driver. You can download the driver for free from Yaskawa's product and technical information website (<http://www.e-mechatronics.com>).

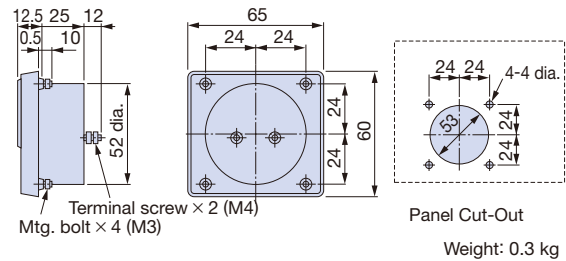
Frequency Meter/Current Meter



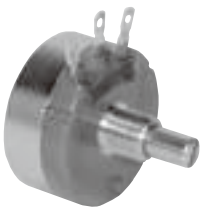
Model	Code No.
Scale-75 Hz full-scale: DCF-6A	FM000065
Scale-60/120 Hz full-scale: DCF-6A	FM000085
Scale-5 A full-scale: DCF-6A	DCF-6A-5A
Scale-10 A full-scale: DCF-6A	DCF-6A-10A
Scale-20 A full-scale: DCF-6A	DCF-6A-20A
Scale-30 A full-scale: DCF-6A	DCF-6A-30A
Scale-50 A full-scale: DCF-6A	DCF-6A-50A

Note: DCF-6A specifications are 3 V, 1 mA, and 3 k Ω inner impedance. Because the GA700 multi-function analog monitor output default setting is 0 to 10 V, set frequency meter adjusting potentiometer (20 k Ω) or parameter H4-02 (analog monitor output gain) within the range of 0 to 3 V.

Dimensions (mm)

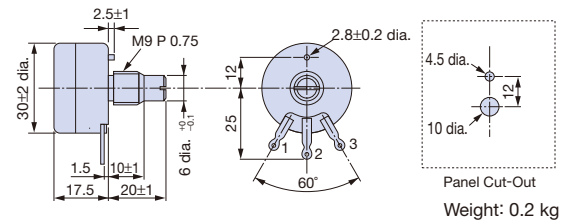


Frequency Setting Potentiometer/Frequency Meter Adjusting Potentiometer



Model	Code No.
RV30YN20S 2 k Ω	RH000739
RV30YN20S 20 k Ω	RH000850

Dimensions (mm)

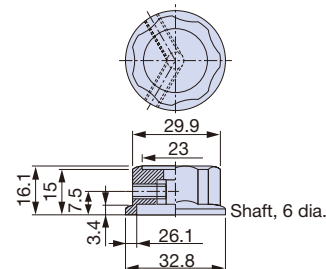


Control Dial for Frequency Setting Potentiometer/Frequency Meter Adjusting Potentiometer



Model	Code No.
CM-3S	HLNZ-0036

Dimensions (mm)

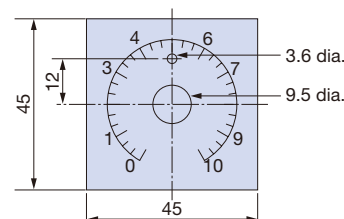


Meter Plate for Frequency Setting Potentiometer/Frequency Meter Adjusting Potentiometer



Model	Code No.
NPJT41561-1	NPJT41561-1

Dimensions (mm)

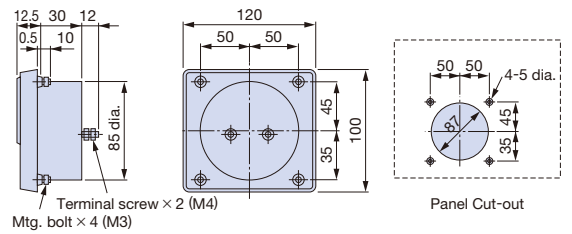


● Output Voltage Meter



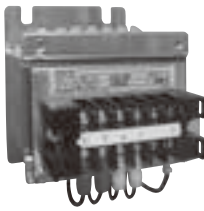
Model	Code No.
Scale-300 V full-scale (Rectification Type Class 2.5: SCF-12NH)	VM000481
Scale-600 V full-scale (Rectification Type Class 2.5: SCF-12NH)	VM000502

Dimensions (mm)



Weight: 0.3 kg

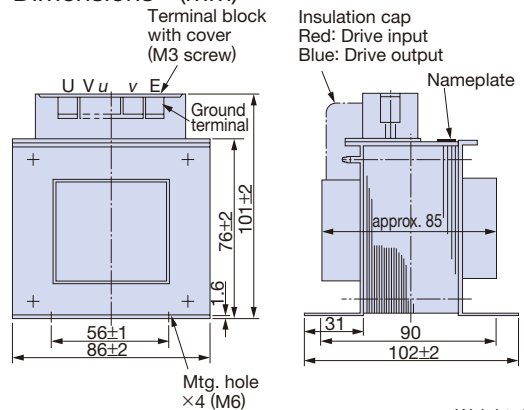
● Potential Transformer



Model	Code No.
600 V meter for voltage transformer UPN-B 440/110 V (400/100 V)	100-011-486

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 (100-011-486), or a voltmeter that does not use a transformer and offers direct read out.

Dimensions (mm)



Weight: 2.2 kg

Application Notes

Selection

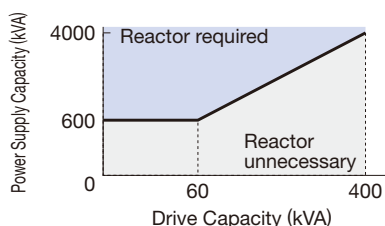
■ Installing a Reactor

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

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

A DC reactor comes standard with 200 V and 400 V class models with a capacity of 22 kW or more.

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, +2 and +3 terminals are used to connect optional devices. Connect only GA700-compatible devices.

■ Repetitive Starting/Stopping

Cranes (hoists), elevators, punching presses, and other such applications with frequent starts and stops often exceed 150% of their rated current values. Heat stress

generated from repetitive high current can shorten the lifespan of the IGBTs. The expected lifespan for the IGBTs is about 8 million start and stop cycles with a 2 kHz carrier frequency and a 150% peak current.

Yaskawa recommends lowering the carrier frequency, particularly when audible noise is not a concern. The user can also choose to reduce the load, increase the acceleration and deceleration times, or switch to a larger drive. This will help keep peak current levels under 150%. Be sure to check the peak current levels when starting and stopping repeatedly during the initial test run, and make adjustments accordingly.

For cranes and other applications using the inching function in which the drives starts and stops the motor repeatedly, Yaskawa recommends the following steps to ensure torque levels:

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

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

Installation

■ Enclosure Panels

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

■ Installation Direction

The drive should be installed upright as specified in the manual.

Although the drive can be installed on its side, an appropriate amount of airflow and current derating are required.

Settings

- Use V/f Control when running multiple induction motors at the same time.

- If using Open Loop Vector Control or Closed Loop Vector Control for PM motors, make sure that the proper motor code has been set to parameter E5-01 before performing a trial run.
- Upper Limits
Because the drive is capable of running the motor at up to 590 Hz, be sure to set the upper limit for the frequency to control the maximum speed. The default setting for the maximum output frequency is 60 Hz.
- Pay close attention as follows when using DriveWorksEZ.
I/O terminal function of the drive will change with the function of the default terminal depending on the setting. Before test running the drive based on programs created by DriveWorksEZ, always check the I/O signal of the drive and the internal sequence. Failure to check may result in death or serious injury.
- Pay attention to the following points when using the Virtual I/O function.
This function virtually wires the I/O terminal of the drive internally.
Consequently, the behavior of the drive may differ from its defaults, even if there is no wiring in the I/O terminal. Before conducting a test operation, always check the setting values for the parameter of the Virtual I/O function. Failure to check may result in death or serious injury.
- DC Injection Braking
Motor overheat can result if there is too much current used during DC Injection Braking, or if the time for DC Injection Braking is too long.
- Acceleration/Deceleration Times
Acceleration and deceleration times are affected by how much torque the motor generates, the load torque, and the inertia moment ($GD^2/4$). Set a longer accel/ decel time when Stall Prevention is enabled. The accel/ decel times are lengthened for as long as the Stall Prevention function is operating. For faster acceleration, increase the capacity of both the motor and the drive. For faster deceleration, use a braking resistor or a power regenerative unit.

General Handling

- Screw Terminal Option
Crimp terminal wiring is available as an option. Contact

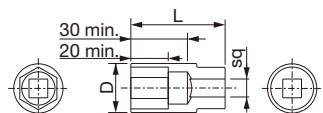
Yaskawa in advance for more information on installation options.

- Cable Clamp Option
An option for mounting a clamping device that fixes power cables to the bottom of the drive. Contact Yaskawa in advance for more information on installation options.
- 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.
- 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.

Application Notes

■ Wiring Using Closed-loop Crimp Terminals

Wrench-type or closed-wrench type tools cannot be used with drives with catalog codes of GA70□2257 and higher or 4208 and higher. Make sure to always use socket-type tools. Use only sockets with a depth of 30 mm or more.



Socket Dimensions (for crimp terminals)

■ 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.

■ Keypad

[microSD card]

- The SD card 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 SD card may not run properly.

[Connection via USB]

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

■ Inspection and Maintenance

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

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

■ Wiring on UL- and cUL-certified drives

When performing wiring work on UL/cUL-certified

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

■ Replacing an existing model

- Wires used in existing models may be out of connection range. Contact Yaskawa beforehand for the available wire gauges.
- If replacing an existing model with drives with catalog codes of GA70□2211 and lower or 4168 and lower, 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 +60°C are allowed when storing the drive for approximately one month. During transport, store and pack the drive so that it is isolated from as much vibration and shock as possible. Store the drive in a location with a relative humidity of 95% or less. Do not store the drive in direct sunlight or where condensation or ice will form.
- Dust and oil mist
Do not store the drive in dusty locations or locations that are susceptible to oil mist, such as the site of a cement factory or cotton mill.
- Corrosive gas
Do not store the drive in an area that may contain corrosive gas or in a location like a chemical plant, refinery, or sewage facility.
- Salt-air damage

Do not store the drive in locations that are subject to salt damage, such as near the ocean, and salt damage-designated zones, in particular.

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

■ Periodic Power Application

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

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

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

■ Environmental Specifications

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

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

- Do not run an isolation test of the drive (uncoupled from the load). Contact Yaskawa when running a combinational test with the machine.

● Peripheral Devices

■ Installing a Ground Fault Interruptor 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 LCD 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.

■ Magnetic Contactor for Motor

As a general principle, the user should avoid opening and closing the magnetic contactor between the motor and the drive during run. 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.

Application Notes

■ 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 non-standard 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. Built-in DC reactors are included with 200 V/400 V class drives and 22 kW or larger drives. 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.

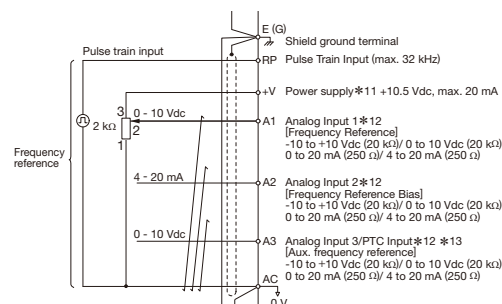
■ Radio Frequency Interference

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 LCD 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

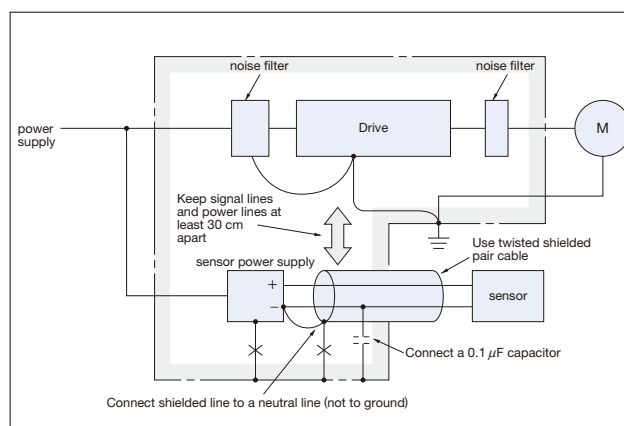
frequency potentiometer via the external terminals, use twisted shielded pair cables and ground the shield.



■ Counteracting Noise

Because GA700 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 "Options and Peripheral Devices" on page 36.
- Make sure the distance between signal and power lines is at least 10 cm (up to 30 cm is preferable), and use twisted pair cable to prevent induction noise from the drive power lines.



<Provided by JEMA>

■ Leakage Current

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

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

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.

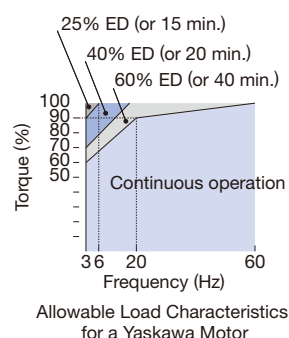
More than one synchronous motor cannot be connected to a single drive. The maximum wiring distance between the drive and the synchronous motor must be 100 m.

● Notes on Motor Operation

Using a Standard Motor

■ Low Speed Range

There is a greater amount of loss when operating a motor using an drive than when running directly from line power. With a drive, the motor can become quite hot due to the poor ability to cool the motor at low speeds. The load torque should be reduced



accordingly at low speeds. The figure above shows the allowable load characteristics for a Yaskawa standard motor. A motor designed specifically for operation with a drive should be used when 100% continuous torque is needed at low speeds.

■ Insulation Tolerance

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

■ High Speed Operation

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.

Application Notes

(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. Yaskawa recommends using Closed Loop Vector Control for such applications.

■ 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 Synchronous Motor" for more information on highly efficient motor using synchronous motors.

Using a Synchronous Motor

- If another motor besides the Yaskawa PM motor is used, contact Yaskawa or your 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 synchronous motors at the same time. Use a standard induction motor for such setups.

- When starting in PM Open Loop Vector Control, 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 PM Open Loop Vector Control.

- In PM Open Loop Vector Control, the allowable load inertia moment is 50 times less than the motor inertia moment. Use PM Closed Loop Vector Control for applications exceeding this value.

- When using a holding brake in PM Open Loop Vector Control, 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 PM Closed Loop Vector Control. 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 200 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 200 Hz. If the motor cable is relatively long, however, the motor should instead be stopped using Short Circuit Braking function and then restarted.

*: 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 PG fails using a PM motor with PG and is replaced, maintain the state where the motor can be rotated and perform Z Pulse Offset Tuning (Rotational Auto-Tuning) and PM Rotational Auto-Tuning.

- 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.

An explosion-proof pulse generators (PG) is used for an explosion-proof with voltage tolerance. Use a specially designed pulse coupler between the drive and the PG when wiring.

■ 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. GA700 is for use only with 3-phase motors.

■ 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.

MEMO



Region	Service Area	Service Location	Service Agency	Telephone/Fax
North America	U.S.A.	Chicago (HQ) Los Angeles San Francisco New Jersey Boston Ohio North Carolina	① YASKAWA AMERICA INC.	Headquarters ☎ +1-847-887-7000 FAX +1-847-887-7310
	Mexico	Mexico City	② PILLAR MEXICANA. S.A. DE C.V.	☎ +52-555-660-5553 FAX +52-555-651-5573
South America	South America	São Paulo	③ YASKAWA ELÉTRICO DO BRASIL LTDA.	☎ +55-11-3585-1100 FAX +55-11-5581-8795
	Colombia	Bogotá	④ VARIADORES LTD.A.	☎ +57-1-428-4225 FAX +57-1-428-2173
Europe	Europe, South Africa	Frankfurt	⑤ YASKAWA EUROPE GmbH	☎ +49-6196-569-300 FAX +49-6196-569-398
Asia	Japan	Tokyo, offices nationwide	⑥ YASKAWA ELECTRIC CORPORATION (Manufacturing, sales)	☎ +81-3-5402-4502 FAX +81-3-5402-4580
			⑦ YASKAWA ELECTRIC ENGINEERING CORPORATION (After-sales service)	☎ +81-4-2931-1810 FAX +81-4-2931-1811
	South Korea	Seoul	⑧ YASKAWA ELECTRIC KOREA CORPORATION (Sales)	☎ +82-2-784-7844 FAX +82-2-784-8495
			⑨ YASKAWA ENGINEERING KOREA CORPORATION (After-sales service)	☎ +82-2-3775-0337 FAX +82-2-3775-0338
	China	Beijing, Guangzhou, Shanghai	⑩ YASKAWA ELECTRIC (CHINA) CO., LTD.	☎ +86-21-5385-2200 FAX +86-21-5385-3299
	Taiwan	Taipei	⑪ YASKAWA ELECTRIC TAIWAN CORPORATION	☎ +886-2-2502-5003 FAX +886-2-2505-1280
	Singapore	Singapore	⑫ YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.	☎ +65-6282-3003 FAX +65-6289-3003
	Thailand	Bangkok	⑬ YASKAWA ELECTRIC (THAILAND) CO., LTD.	☎ +66-2-017-0099 FAX +66-2-017-0090
	Vietnam	Ho Chi Minh	⑭ YASKAWA ELECTRIC VIETNAM CO., LTD.	☎ +84-8-3822-8680 FAX +84-8-3822-8780
		Hanoi		☎ +84-4-3634-3953 FAX +84-4-3654-3954
	India	Bangalore	⑮ YASKAWA INDIA PRIVATE LIMITED	☎ +91-80-4244-1900 FAX +91-80-4244-1901
	Indonesia	Jakarta	⑯ PT. YASKAWA ELECTRIC INDONESIA	☎ +62-21-2982-6470 FAX +62-21-2982-6471
Oceania	Australia	Contact to service agency in Singapore (⑫).		

GA700

DRIVE CENTER (INVERTER PLANT)

2-13-1, Nishimiyaichi, Yukuhashi, Fukuoka, 824-8511, Japan
Phone +81-930-25-2548 Fax +81-930-25-3431
<http://www.yaskawa.co.jp>

YASKAWA ELECTRIC CORPORATION

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

YASKAWA AMERICA, INC.

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

YASKAWA ELÉTRICO DO BRASIL LTDA.

777, Avenida Piraporinha, Diadema, São Paulo, 09950-000, Brasil
Phone +55-11-3585-1100 Fax +55-11-3585-1187
<http://www.yaskawa.com.br>

YASKAWA EUROPE GmbH

185, Hauptstraße, Eschborn, 65760, Germany
Phone +49-6196-569-300 Fax +49-6196-569-398
<http://www.yaskawa.eu.com>

YASKAWA ELECTRIC KOREA CORPORATION

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

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.

151, Lorong Chuan, #04-02A, New Tech Park 556741, Singapore
Phone +65-6282-3003 Fax +65-6289-3003
<http://www.yaskawa.com.sg>

YASKAWA ELECTRIC (THAILAND) CO., LTD.

59, 1st-5th Floor, Flourish Building, Soi Ratchadapisek 18, Ratchadapisek Road, Huaykwang, Bangkok 10310, Thailand
Phone: +66-2-017-0099 Fax: +66-2-017-0799
<http://www.yaskawa.co.th>

PT. YASKAWA ELECTRIC INDONESIA

Secure Building-Gedung B Lantai Dasar & Lantai 1 Jl. Raya Protokol Halim Perdanakusuma, Jakarta 13610, Indonesia
Phone +62-21-2982-6470 Fax +62-21-2982-6471
<http://www.yaskawa.co.id/>

YASKAWA ELETRIC VIETNAM CO., LTD HO CHI MINH OFFICE

Suite 1904A, 19th Floor Centec Tower, 72-74 Nguyen Thi Minh Khai Street, Ward 6, District 3, Ho Chi Minh City, Vietnam
Phone +84-8-3822-8680 Fax +84-8-3822-8780

YASKAWA ELETRIC VIETNAM CO., LTD HA NOI OFFICE

2nd Floor, Somerset Hoa Binh Hanoi, No. 106, Hoang Quoc Viet Street, Cau Giay District, Hanoi, Vietnam
Phone +84-4-3634-3953 Fax +84-4-3654-3954

YASKAWA ELECTRIC (CHINA) CO., LTD.

22F, One Corporate Avenue, No.222, Hubin Road, Shanghai, 200021, China
Phone +86-21-5385-2200 Fax +86-21-5385-3299
<http://www.yaskawa.com.cn>

YASKAWA ELECTRIC (CHINA) CO., LTD. BEIJING OFFICE

Room 1011, Tower W3 Oriental Plaza, No.1 East Chang An Ave.,
Dong Cheng District, Beijing, 100738, China
Phone +86-10-8518-4086 Fax +86-10-8518-4082

YASKAWA ELECTRIC TAIWAN CORPORATION

9F, 16, Nanking E. Rd., Sec. 3, Taipei, 104, Taiwan
Phone +886-2-2502-5003 Fax +886-2-2505-1280
<http://www.yaskawa-taiwan.com.tw>

YASKAWA INDIA PRIVATE LIMITED

#17/A, Electronics City, Hosur Road, Bangalore, 560 100 (Karnataka), India
Phone +91-80-4244-1900 Fax +91-80-4244-1901
<http://www.yaskawaindia.in>

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