

YASKAWA R1000 Series

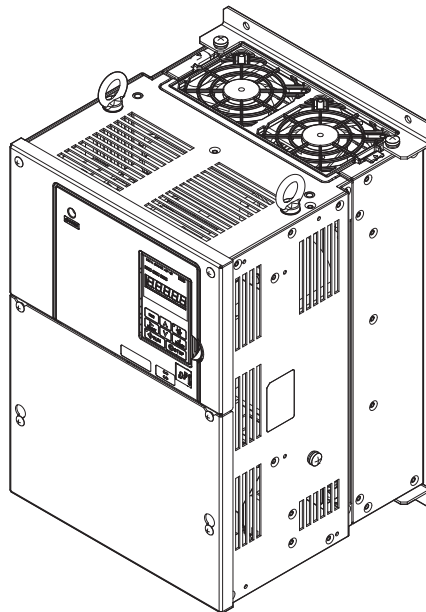
Power Regenerative Unit

Quick Start Guide

Type: CIMR-R

Models: 200 V Class, Three-Phase Input: 3.5 to 105 kW
400 V Class, Three-Phase Input: 3.5 to 300 kW

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



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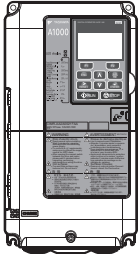
1 Preface

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

This manual is designed to ensure correct and suitable application of R1000-Series Power Regenerative Units. Read this manual before attempting to install, operate, maintain, or inspect a regenerative unit and keep it in a safe, convenient location for future reference. Be sure you understand all precautions and safety information before attempting application.

◆ Applicable Documentation

The following manuals are available for R1000 series:

	YASKAWA R1000 Series Power Regenerative Unit Quick Start Guide (TOEP C710656 09) (This document)
	This guide is packaged together with the product and contains basic information required to install and wire the regenerative unit, in addition to an overview of fault diagnostics, maintenance, and parameter settings. It is meant to get the regenerative unit ready for a trial run with the application and for basic operation.
	YASKAWA R1000 Series Power Regenerative Unit Technical Manual (SIEP C710656 09)
	This manual is available for download on our documentation website, www.yaskawa.eu.com . It provides detailed information on parameter settings, functions, and MEMOBUS/Modbus specifications. Use this manual to expand the functionality of the regenerative unit and to take advantage of higher performance features.

◆ General Warnings

⚠ WARNING

Read and understand this manual before installing, operating or servicing this unit. The unit must be installed according to this manual and local codes.

The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or fatal injury or damage to the products or to related equipment and systems.

⚠ DANGER

Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a property damage message.

◆ Safety Messages

⚠ DANGER

Heed the safety messages in this manual.

Failure to comply will result in death or serious injury.

The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

Electrical Shock Hazard

Do not install, wire, maintain, or inspect the product or replace parts while the power supply is turned on.

Failure to comply will result in death or serious injury.

Disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the regenerative unit before touching any components.

⚠ WARNING**Sudden Movement Hazard**

System may start unexpectedly upon application of power, resulting in death or serious injury.

Clear all personnel from the regenerative unit, drive, motor and machine area before applying power to the regenerative unit. Secure covers, couplings, shaft keys and machine loads.

Electrical Shock Hazard

Do not attempt to modify or alter the regenerative unit in any way not explained in this manual.

Failure to comply could result in death or serious injury.

Yaskawa is not responsible for any modification of the product made by the user. This product must not be modified.

Do not allow unqualified personnel to perform work on the regenerative unit.

Failure to comply could result in death or serious injury.

Installation, maintenance, inspection, and servicing must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of regenerative units.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

Always use a ground wire that complies with technical standards on electrical equipment and minimize the length of the ground wire.

Improper equipment grounding may cause dangerous electrical potentials on equipment chassis, which could result in death or serious injury.

Use appropriate equipment for residual current monitoring/detection (RCM/RCD).

This regenerative unit can cause a residual current with a DC component in the protective earthing conductor. Where a residual current operated protective or monitoring device is used for protection in case of direct or indirect contact, always use an RCM or RCD of type B according to IEC/EN 60755.

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

WARNING

Fire Hazard

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire.

Verify that the rated voltage of the regenerative unit matches the voltage of the incoming power supply before applying power.

When installing an IP00/IP20 regenerative unit in a closed panel or cabinet, sufficiently cool the panel or cabinet with a cooling fan or air conditioner so that the air temperature entering the regenerative unit is 50°C or cooler.

Failure to comply could result in overheating and fire.

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Do not use improper combustible materials.

Failure to comply could result in death or serious injury by fire.

Do not install the regenerative unit to a combustible surface. Never place combustible materials on the regenerative unit.

Crush Hazard

Only allow qualified personnel to operate a crane or hoist to transport the regenerative unit.

Failure to comply may result in serious injury or death from falling equipment.

CAUTION

Do not carry the regenerative unit by the front cover or the terminal cover.

Failure to comply may result in minor or moderate injury from the main body of the regenerative unit falling.

Carry all standard configuration and peripheral devices in a method suitable for the weight of the device.

Incorrectly handling devices could cause them to fall and result in injury or damage to the device.

NOTICE

Do not disconnect the wiring to the regenerative unit while the regenerative unit is outputting a voltage.

Improper equipment sequencing could result in damage to the regenerative unit.

Connect a power supply with a capacity (kVA) that is larger than the rated input capacity (kW) of the regenerative unit.

Failure to comply could result in damage to the regenerative unit.

Observe proper electrostatic discharge procedures (ESD) when handling the regenerative unit, circuit boards, and CMOSIC.

Failure to comply may result in ESD damage to the regenerative unit circuitry.

Do not perform a withstand voltage test on any part of the regenerative unit.

Failure to comply could result in damage to the sensitive devices within the regenerative unit.

Do not operate damaged equipment.

Failure to comply could result in further damage to the equipment.

Do not connect or operate any equipment with visible damage or missing parts.

NOTICE**Install adequate branch circuit short circuit protection per applicable codes.**

Failure to comply could result in damage to the regenerative unit.

The regenerative unit is suitable for circuits capable of delivering not more than 100,000 RMS symmetrical Amperes, 240 Vac maximum (200 V Class) and 480 Vac maximum (400 V Class).

Prevent foreign matter such as metal shavings or wire clippings from falling into the regenerative unit during installation and project construction.

Failure to comply could result in damage to the regenerative unit. Place a temporary cover over the top during installation. Be sure to remove the temporary cover before start-up, as the cover will reduce ventilation and cause the regenerative unit to overheat.

Never lift the regenerative unit up while the cover is removed.

This can damage the terminal board and other components.

Do not perform signal checks during operation.

Failure to comply could result in damage to the regenerative unit.

Check the following items before you turn on the power supply.

Failure to comply could result in damage to the regenerative unit.

- Is the power supply voltage correct?
200 V Class: AC200 to 240 V 50/60 Hz
400 V Class: AC380 to 480 V 50/60 Hz
- Are the regenerative unit and the control devices connected properly (e.g., is the phase order correct)?
- Is the phase order correct between the main circuit terminals (R/L1, S/L2, and T/L3) on the regenerative unit and the power supply voltage detection terminals (r1/l11, s1/l21, and t1/l31).
- Are the control circuit terminals on the regenerative unit connected properly to the control devices?
- Are the Run Commands for the regenerative unit and the control devices turned off?

Replace the cooling fan correctly according to instructions in this manual.

Incorrect cooling fan mounting direction will prevent sufficient cooling of the regenerative unit and could damage internal circuits.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance.

Use shielded, twisted-pair wires and ground the shield to the ground terminal of the regenerative unit.

Do not modify the circuitry of the regenerative unit.

Failure to comply could result in damage to the regenerative unit and will void warranty.

Yaskawa is not responsible for any modification of the product made by the user. This product must not be modified.

Check all the wiring to ensure that all connections are correct after installing the regenerative unit and connecting any other devices.

Failure to comply could result in damage to the regenerative unit.

To get the full performance life out of the electrolytic capacitors and circuit relays, refrain from switching the regenerative unit power supply off and on more than once every 30 minutes.

If a fuse is open or equipment for residual current monitoring/detection (RCM/RCD) is tripped, check the wiring and the selection of the peripheral devices.

Contact your supplier if the cause cannot be identified after checking the above.

NOTICE

Do not restart the regenerative unit or immediately operate the peripheral devices if a fuse is open or an RCD is tripped.

Check the wiring and the selection of peripheral devices to identify the cause.

Contact your supplier before restarting the regenerative unit or the peripheral devices if the cause cannot be identified.

Do not expose the regenerative unit to halogen group disinfectants.

Failure to comply may cause damage to the electrical components in the regenerative unit.

Do not pack the regenerative unit in wooden materials that have been fumigated or sterilized.

Do not sterilize the entire package after the product is packed.

◆ Precautions for CE Low Voltage Directive Compliance

This regenerative unit has been tested according to European standard IEC/EN 61800-5-1, and it fully complies with the Low Voltage Directive.

Do not use regenerative unit in areas with pollution higher than degree 2 and overvoltage category 3 in accordance with IEC/EN 664.

Ground the neutral point of the main power supply for 400 V Class regenerative units.

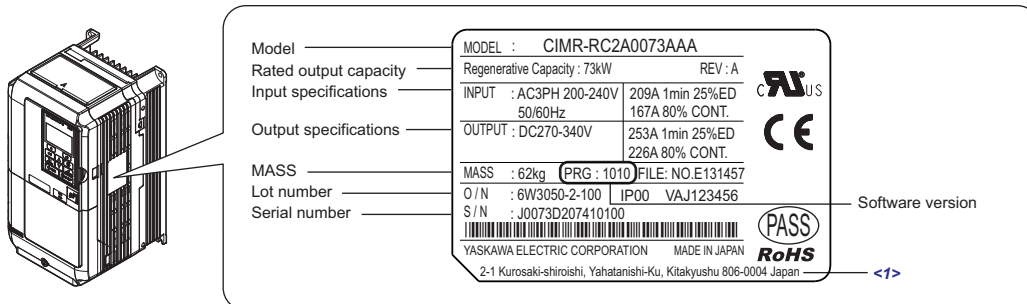
2 Mechanical Installation

◆ Upon Receipt

Perform the following tasks after receiving the regenerative unit:

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

◆ Nameplate



<1> The address of the head office of Yaskawa Electric Corporation (responsible for product liability) is shown on the nameplate.

Figure 1 Regenerative Unit Nameplate Information Example

2 Mechanical Installation

◆ Installation Environment

Install the regenerative unit in an environment matching the specifications in *Table 1* to help prolong the optimum performance life of the regenerative unit.

Table 1 Installation Environment

Environment	Conditions
Installation Area	Indoors
Ambient Temperature	IP00/Open Type enclosure: -10°C to +50°C IP20/NEMA Type 1 enclosure: -10°C to +40°C Regenerative unit reliability improves in environments without wide temperature fluctuations. When using the regenerative unit in an enclosure panel, install a cooling fan or air conditioner in the area to ensure that the air temperature inside the enclosure does not exceed the specified levels. Do not allow ice to develop on the regenerative unit .
Humidity	95% RH or less and free of condensation
Storage Temperature	-20°C to +60°C
Surrounding Area	Install the regenerative unit in an area free from: <ul style="list-style-type: none"> • oil mist and dust • metal shavings, oil, water, or other foreign materials • radioactive materials • combustible materials (e.g., wood) • harmful gases and liquids • excessive vibration • chlorides • direct sunlight.
Altitude	1000 m or lower, up to 3000 m with derating. Refer to the Technical Manual for details.
Vibration	10 to 20 Hz at 9.8 m/s ² , 20 to 55 Hz at 5.9 m/s ² (2A03P5 to 2A0053, 4A03P5 to 4A0073) 10 to 20 Hz at 9.8 m/s ² , 20 to 55 Hz at 2.0 m/s ² (2A0073, 2A0105, 4A0105 to 4A0300)
Orientation	Install the regenerative unit vertically to maintain maximum cooling effects.

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

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

◆ Installation Orientation and Spacing

Figure 2 shows the installation distance required to maintain sufficient space for airflow and wiring. Install the heatsink against a closed surface to avoid diverting cooling air around the heatsink.

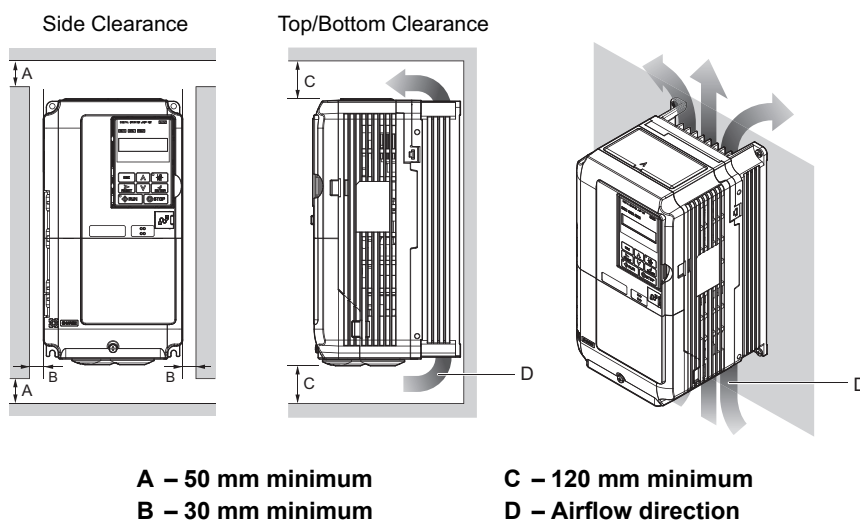


Figure 2 Correct Installation Spacing (Single)

■ Installation Screws

Refer to *Exterior and Mounting Dimensions on page 12* for the sizes of the installation screws.

◆ Precautions and Instructions for Installation

Read the following precautions and instructions before installing models 2A0073, 2A0105, and 4A0210 to 4A0300.

WARNING! *Crush Hazard. Observe the following instructions and precautions. Failure to comply could result in serious injury or death from falling equipment.*

- Only use vertical suspension to temporarily lift the regenerative unit during installation to an enclosure panel.
- Do not use vertical suspension to transport the regenerative unit.
- Use screws to securely affix the regenerative unit front cover, terminal blocks, and other regenerative unit components prior to vertical suspension.
- Do not subject the regenerative unit to vibration or impact greater than 1.96 m/s^2 (0.2 G) while it is suspended by the wires.
- Do not attempt to flip the regenerative unit over while it is suspended by the wires.
- Do not leave the regenerative unit unattended while it is suspended by the wires.

■ Horizontal Suspension of Models 2A0073, 2A0105, and 4A0210 to 4A0300

To make a wire hanger or frame for use when lifting the regenerative unit with a crane, lay the regenerative unit in a horizontal position and pass a wire through the holes of the four eye bolts.

NOTICE: *Damage to Equipment. When lifting the regenerative unit, confirm that the spring washer is fully closed. Failure to comply may deform or damage the regenerative unit when lifted.*

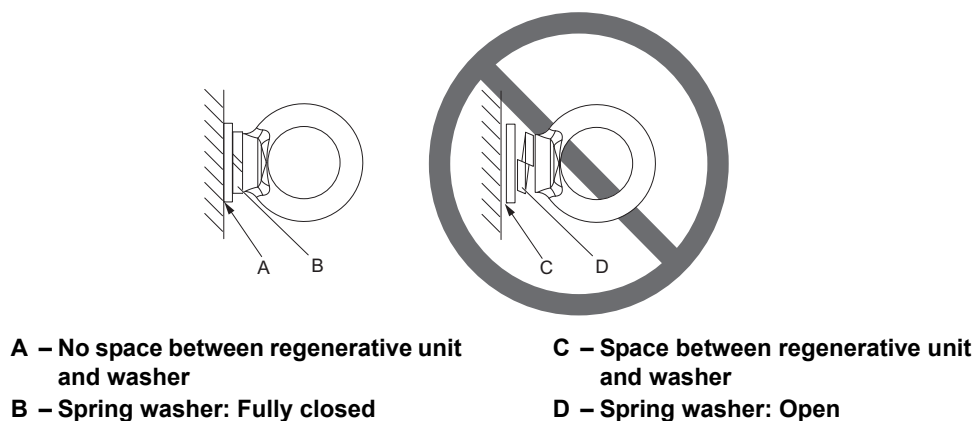


Figure 3 Details of Spring Washers

■ Vertical Suspension of Models 2A0073, 2A0105, and 4A0210 to 4A0300

When vertical suspension of the regenerative unit is required in an enclosure panel, the orientation of the eye bolts for these regenerative unit models can be easily changed by turning the eye bolts counterclockwise 90 degrees.

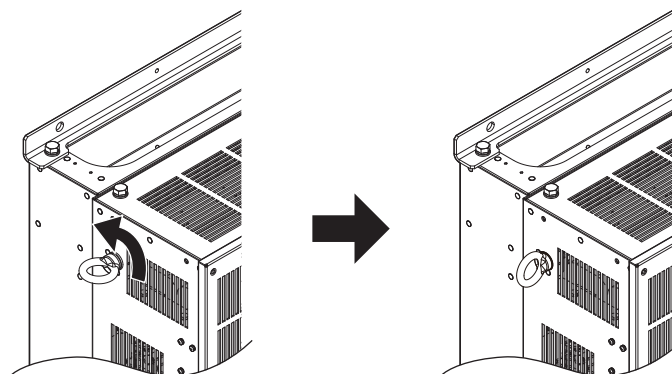


Figure 4 Adjusting Angle of Eye Bolts

1. Gradually take up the slack in the wires and hoist the unit after the wires are stretched tight.
2. Lower the unit when ready to install in the enclosure panel. Stop lowering the unit when it is near the floor then begin lowering the unit again very slowly until the unit is placed correctly.

◆ Exterior and Mounting Dimensions

■ IP20/NEMA Type 1 Enclosure Models

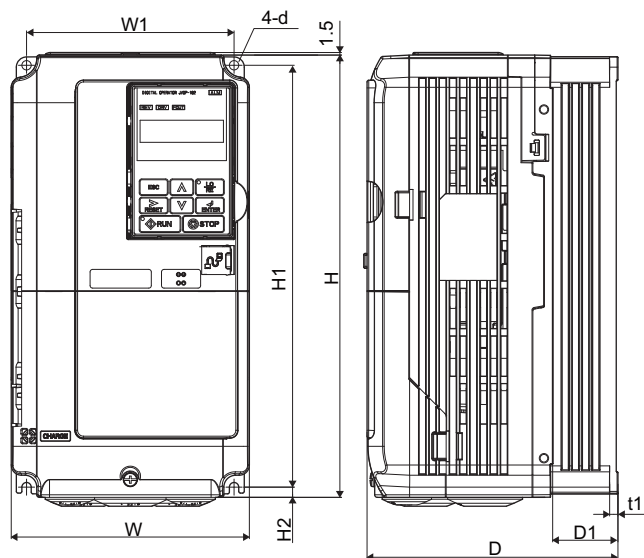


Figure 1

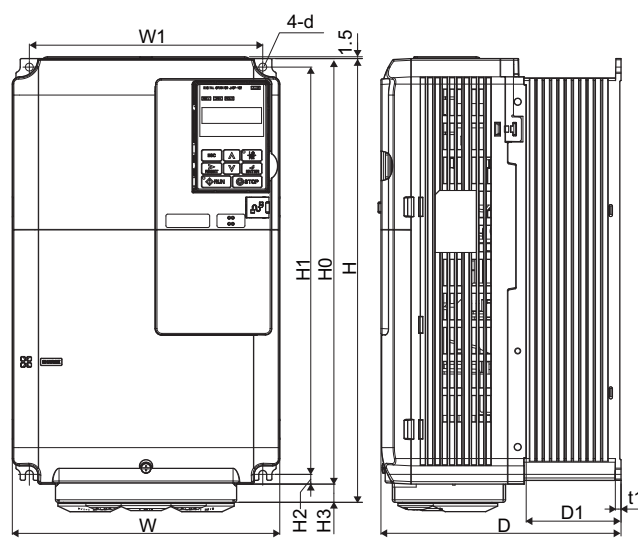


Figure 2

Table 2 Dimensions for IP20/NEMA Type 1 Enclosure: 200 V Class

Model	Figure	Dimensions mm											Weight kg
		W	H	D	W1	H0	H1	H2	H3	D1	t1	d	
2A03P5	1	140	260	167	122	–	248	6	–	55	5	M5	4
2A0005	1	140	260	167	122	–	248	6	–	55	5	M5	4
2A0007	1	140	260	167	122	–	248	6	–	55	5	M5	4
2A0010	1	180	300	187	160	–	284	8	–	75	5	M5	6
2A0014	1	180	300	187	160	–	284	8	–	75	5	M5	6
2A0017	2	220	365	197	192	350	335	8	15	78	5	M6	9
2A0020	2	220	365	197	192	350	335	8	15	78	5	M6	9
2A0028	2	220	385	197	192	350	335	8	35	78	5	M6	9

Table 3 Dimensions for IP20/NEMA Type 1 Enclosure: 400 V Class

Model	Figure	Dimensions mm											Weight kg
		W	H	D	W1	H0	H1	H2	H3	D1	t1	d	
4A03P5	1	140	260	167	122	–	248	6	–	55	5	M5	4
4A0005	1	140	260	167	122	–	248	6	–	55	5	M5	4
4A0007	1	140	260	167	122	–	248	6	–	55	5	M5	4
4A0010	1	180	300	187	160	–	284	8	–	75	5	M5	5
4A0014	1	180	300	187	160	–	284	8	–	75	5	M5	5
4A0017	2	220	365	197	192	350	335	8	15	78	5	M6	8
4A0020	2	220	365	197	192	350	335	8	15	78	5	M6	8
4A0028	2	220	365	197	192	350	335	8	15	78	5	M6	8

■ IP00/Open Type Enclosure Models

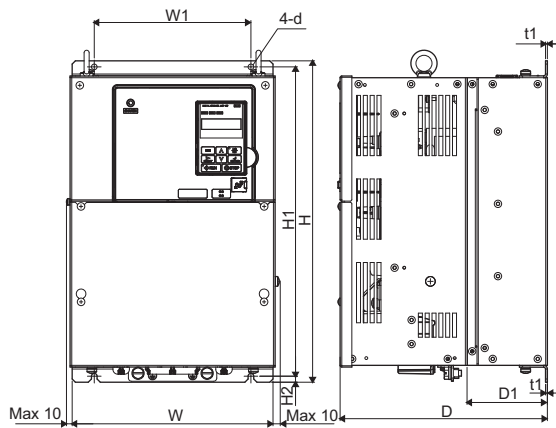


Figure 1

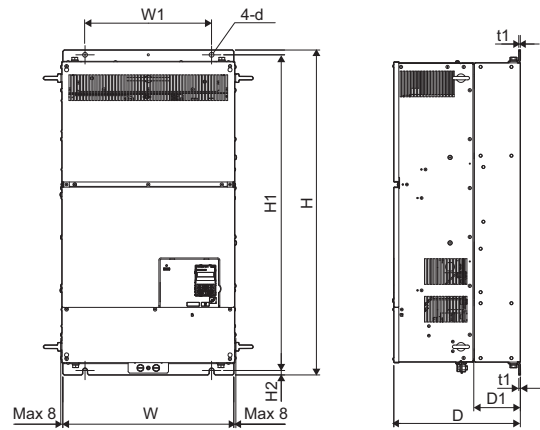


Figure 2

Table 4 Dimensions for IP00/Open Type Enclosure: 200 V Class

Model	Figure	Dimensions mm									Weight kg
		W	H	D	W1	H1	H2	D1	t1	d	
2A0035	1	275	450	258	220	435	7.5	100	2.3	M6	21
2A0053	1	325	550	283	260	535	7.5	110	2.3	M6	33
2A0073	2	450	705	330	325	680	12.5	130	3.2	M10	62
2A0105	2	500	800	350	370	773	13	130	4.5	M12	81

Table 5 Dimensions for IP00/Open Type Enclosure: 400 V Class

Model	Figure	Dimensions mm									Weight kg
		W	H	D	W1	H1	H2	D1	t1	d	
4A0035	1	275	450	258	220	435	7.5	100	2.3	M6	20
4A0043	1	275	450	258	220	435	7.5	100	2.3	M6	20
4A0053	1	325	550	283	260	535	7.5	110	2.3	M6	33
4A0073	1	325	550	283	260	535	7.5	110	2.3	M6	33
4A0105	2	450	705	330	325	680	13	130	3.2	M10	62
4A0150	2	450	705	330	325	680	13	130	3.2	M10	62
4A0210	2	500	800	350	370	773	13	130	4.5	M12	86
4A0300	2	500	800	350	370	773	13	130	4.5	M12	87

3 Electrical Installation

The figure below shows the main and control circuit wiring.

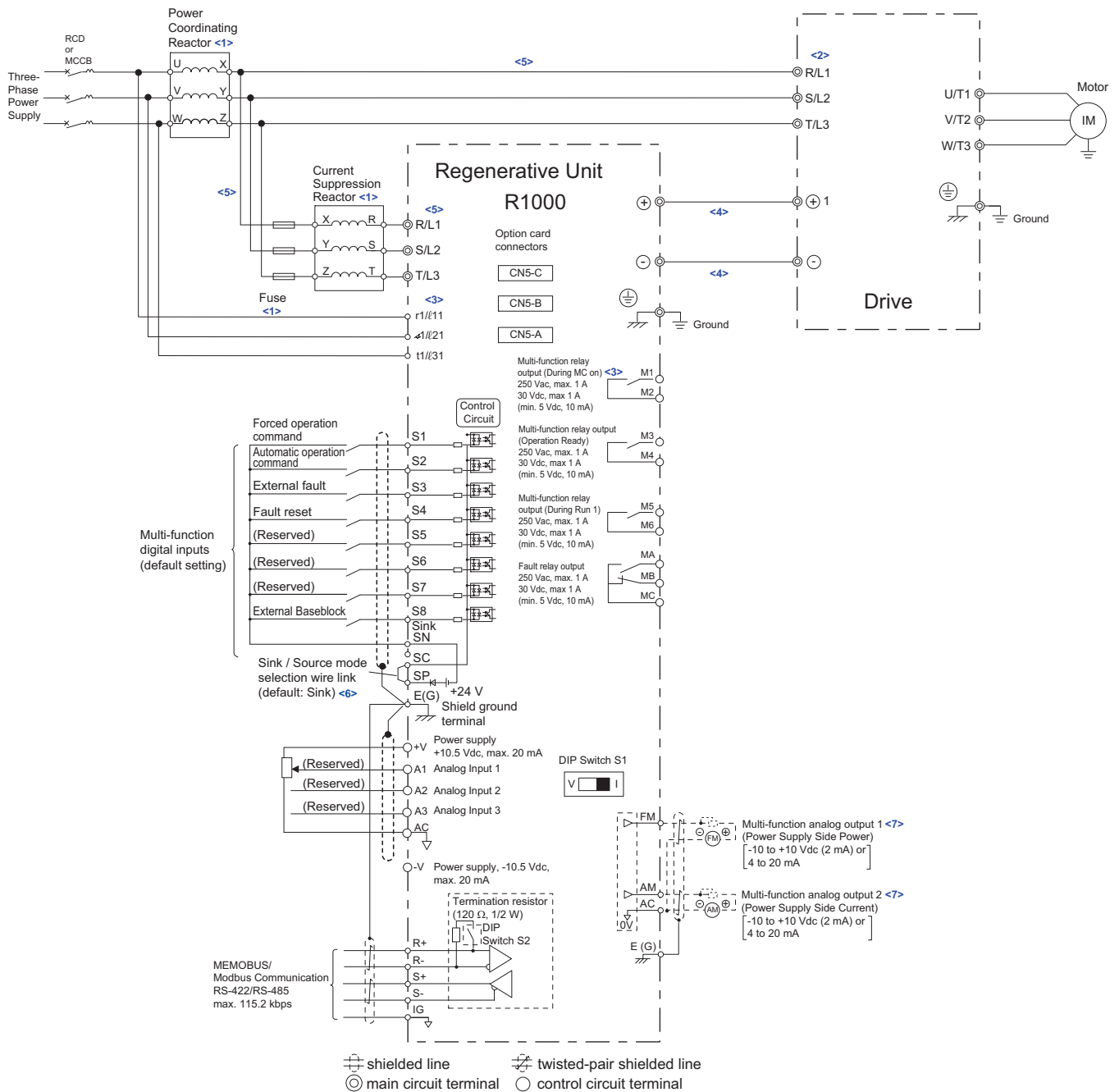


Figure 5 Standard Connection Diagram

- <1> Use the specified AC reactor and fuse. Non-specified devices may cause erroneous operation.
- <2> Always take the power supply for the drive's AC power supply terminals (R/L1, S/L2, and T/L3) from the secondary side of the power coordinating reactor.
- <3> Always take the power supply for the regenerative unit's power supply voltage detection inputs (r1/l11, a1/l21, and t1/l31) from the primary side of the power coordinating reactor.
- <4> Do not use a DC bus line that is longer than 5 m to connect the regenerative unit and drive.
- <5> Do not use a line longer than 10 m to connect the power coordinating reactor and the regenerative unit.
- <6> This figure shows an example of a sequence input to S1 through S8 using a non-powered relay or an NPN transistor. Install the wire link between terminals SC-SP for Sink mode and SC-SN for Source mode. Leave it out for external power supply. Never short terminals SP and SN as doing so will damage the regenerative unit.
- <7> Multi-function analog outputs work with devices such as analog frequency meters, ammeters, voltmeters, and wattmeters. They are not intended for use as a feedback-type signal.

◆ Wiring Specification

■ Main Circuit

Use the EMC filters and input fuses listed in the table below when wiring the main circuit. Make sure not to exceed the given tightening torque values.

Table 6 Wiring Specification and Input Fuses

Model	Main Circuit Recom. Cable (mm ²)				Fuse			
	R/L1, S/L2, T/L3	⊖, ⊕	r1/ℓ11, s1/ℓ21, t1/ℓ31	⊕	Model	Rating Ampere (A)	Fuse Holder	Manufacturer
2A03P5	4	4	2.5	4	350GH-20ULTC	20	HT4017	HINODE
2A0005	4	4	2.5	4	350GH-25ULTC	25	HT4017	HINODE
2A0007	4	4	2.5	4	350GH-32ULTC	32	HT4017	HINODE
2A0010	4	16	2.5	4	350GH-50ULTC	50	HT4017	HINODE
2A0014	6	16	2.5	6	350GH-63ULTC	63	HT4017	HINODE
2A0017	10	16	2.5	10	350GH-80ULTC	80	HT4017	HINODE
2A0020	10	16	2.5	10	350GH-100ULTC	100	HT4017	HINODE
2A0028	16	25	2.5	16	350GH-125ULTC	125	HT5723	HINODE
2A0035	25	35	2.5	16	350GH-160ULTC	160	HT5723	HINODE
2A0053	50	70	2.5	25	350GH-200ULTC	200	HT5723	HINODE
2A0073	70	120	2.5	35	170M2620	350	170H1007	BUSSMANN
2A0105	95 × 2P	150 × 2P	2.5	70	170M3021	500	170H3003	BUSSMANN
4A03P5	4	4	2.5	4	660GH-16ULTC	16	HT6017	HINODE
4A0005	4	4	2.5	4	660GH-16ULTC	16	HT6017	HINODE
4A0007	4	4	2.5	4	660GH-16ULTC	16	HT6017	HINODE
4A0010	4	6	2.5	4	660GH-25ULTC	25	HT6017	HINODE
4A0014	4	6	2.5	4	660GH-40ULTC	40	HT6017	HINODE
4A0017	10	16	2.5	10	660GH-40ULTC	40	HT6017	HINODE
4A0020	10	16	2.5	10	660GH-50ULTC	50	HT6017	HINODE
4A0028	10	16	2.5	10	660GH-63ULTC	63	HT6017	HINODE
4A0035	10	16	2.5	10	660GH-80ULTC	80	HT6017	HINODE
4A0043	10	16	2.5	10	660GH-100ULTC	100	HT6017	HINODE
4A0053	16	25	2.5	16	660GH-125ULTC	125	HT7723	HINODE
4A0073	25	50	2.5	16	660GH-160ULTC	160	HT7723	HINODE
4A0105	50	70	2.5	25	170M1371	250	170H1007	BUSSMANN
4A0150	95	150	2.5	25	170M2620	350	170H1007	BUSSMANN
4A0210	95 × 2P	95 × 2P	2.5	95	170M3021	500	170H3003	BUSSMANN
4A0300	95 × 2P	120 × 2P	2.5	95	170M4016	630	170H3003	BUSSMANN

■ CE Standards Compliance for DC Power Supply Input

Factory Recommended Branch Circuit Protection

Install appropriate input fuses to the input side to protect regenerative unit wiring and prevent other secondary damage. Select fuses according to [Table 6](#).

Refer to the Technical Manual for details on the regenerative unit Input Current and Rated Output Current.

NOTICE: If a fuse is open or a Residual Current Device (RCD) is tripped, check the wiring and the selection of peripheral devices to identify the cause. Contact Yaskawa before restarting the regenerative unit or the peripheral devices if the cause cannot be identified.

3 Electrical Installation

■ Control Circuit

The control terminal board is equipped with screwless terminals. Always use wires within the specification listed below. For safe wiring it is recommended to use solid wires or flexible wires with ferrules. The stripping length respectively ferrule length should be 8 mm.

Wire Type	Wire Size (mm ²)
Solid	0.2 to 1.5
Flexible	0.2 to 1.0
Flexible with ferrule	0.25 to 0.5

■ EMC Filter Installation

The following conditions must be met to ensure continued compliance with guidelines.

Connection Diagram

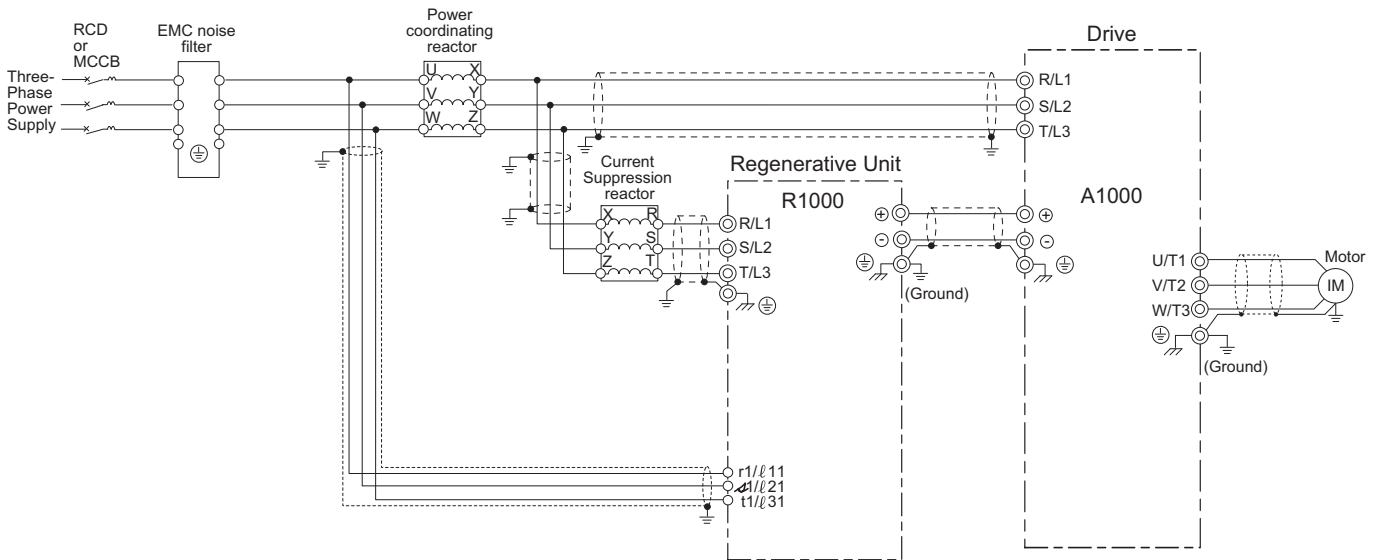


Figure 6 Wiring Diagram for EMC Filter (2A03P5 to 2A0105, 4A03P5 to 4A0300)

■ Main Circuit Terminal Functions

Table 7 Main Circuit Terminal Functions

Terminal	Type	Function
	2A03P5 to 2A0105 4A03P5 to 4A0300	
R/L1	Main circuit power supply input	These are the power supply input terminals that connect to the input reactor.
S/L2		
T/L3		
r1/ℓ11	Power supply voltage detection inputs	These terminals are to detect the power supply voltage order and voltage levels.
Δ1/ℓ21		
t1/ℓ31		
⊖	DC voltage input	These terminals input a DC voltage.
⊕		
⊕	For 200 V class: 100 Ω or less For 400 V class: 10 Ω or less	Grounding terminal

■ Control Circuit Terminals

The control circuit terminals are arranged as shown in *Figure 7*.

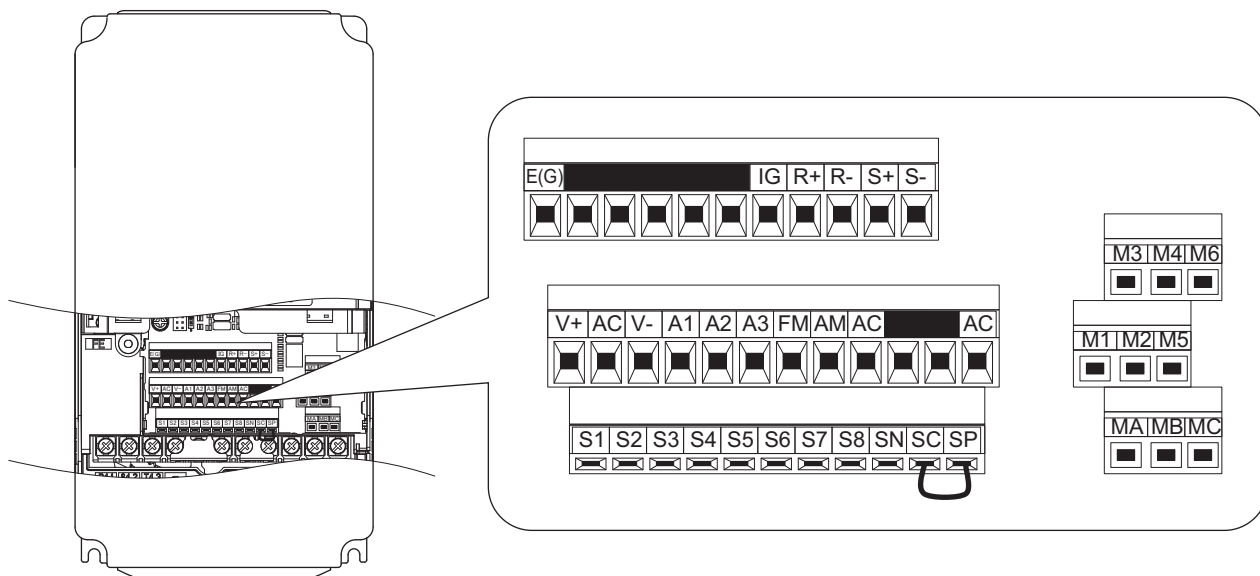


Figure 7 Control Circuit Terminal Arrangement

There are three DIP Switches and one Slide Switch and two jumpers, S1, S2, and S6, located on the terminal board.

<p>S1</p>	<p>Terminal A2 Signal Selection</p>	<p>Current Voltage</p>
<p>S2</p>	<p>RS-422/RS-485 Termination Resistor</p>	<p>Off On</p>
<p>S5</p>	<p>Terminal FM/AM Signal Selection</p>	<p>FM/AM: Voltage Output FM: Current Output AM: Voltage Output</p>

■ Control Circuit Terminal Functions

Table 8 Control Circuit Input Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Multi-Function Digital Inputs	S1	Multi-function input 1 (Forced operation command)	<ul style="list-style-type: none"> • Photocoupler • 24 Vdc, 8 mA • Set the S3 jumper to select between sinking, sourcing mode, and the power supply.
	S2	Multi-function input 2 (Automatic operation command)	
	S3	Multi-function input 3 (External fault)	
	S4	Multi-function input 4 (Fault reset)	
	S5	Multi-function input 5 (Reserved)	
	S6	Multi-function input 6 (Reserved)	
	S7	Multi-function input 7 (Reserved)	
	S8	Multi-function input 8 (External Baseblock)	
	SC	Multi-function input common	
	SP	Digital input power supply +24 Vdc	
SN	Digital input power supply 0 V		
Analog Inputs	+V	Analog reference input	10.5 Vdc (max allowable current 20 mA)
	-V	Analog reference input	-10.5 Vdc (max allowable current 20 mA)
	A1	Multi-function analog input 1 (Reserved)	-10 to 10 Vdc, 0 to 10 Vdc (input impedance: 20 kΩ)
	A2	Multi-function analog input 2 (Reserved)	<ul style="list-style-type: none"> • -10 to 10 Vdc, 0 to 10 Vdc (input impedance: 20 kΩ) • 4 to 20 mA, 0 to 20 mA (input impedance: 250 Ω) • Voltage or current input must be selected by DIP switch S1 and H3-09.
	A3	Multi-function analog input 3 (Reserved)	<ul style="list-style-type: none"> • -10 to 10 Vdc, 0 to 10 Vdc (input impedance: 20 kΩ) • Use DIP switch S4 on the terminal board to select between analog and PTC input.
	AC	Frequency reference common	0 V
	E (G)	Ground for shielded lines and option cards	—

Table 9 Control Circuit Output Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Fault Relay Output	MA	N.O. output (Fault)	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA
	MB	N.C. output (Fault)	
	MC	Fault output common	
Multi-Function Digital Output <1>	M1	Multi-function digital output (During MC on)	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA
	M2		
	M3	Multi-function digital output (Operation Ready)	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA
	M4		
	M5	Multi-function digital output (During Run 1)	Minimum load: 5 Vdc, 10 mA
	M6		
Monitor Output	FM	Analog monitor output 1 (Power Supply Side Power)	-10 to +10 Vdc, or 0 to +10 Vdc
	AM	Analog monitor output 2 (Power Supply Side Current)	
	AC	Monitor common	0 V

<1> Refrain from assigning functions to digital relay outputs 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).

4 Using the Digital Operator

◆ LCD Display

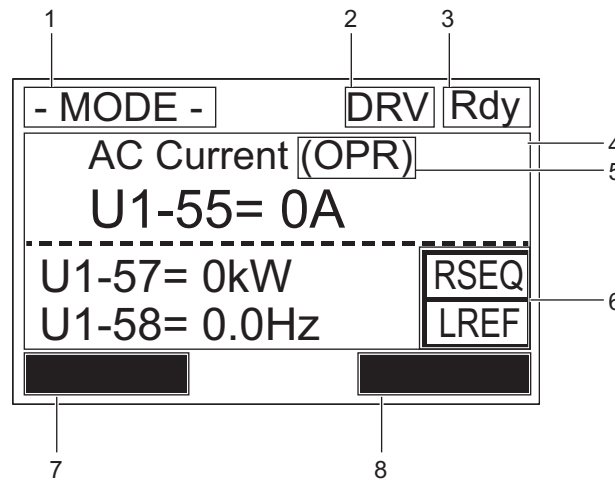









Figure 8 LCD Display

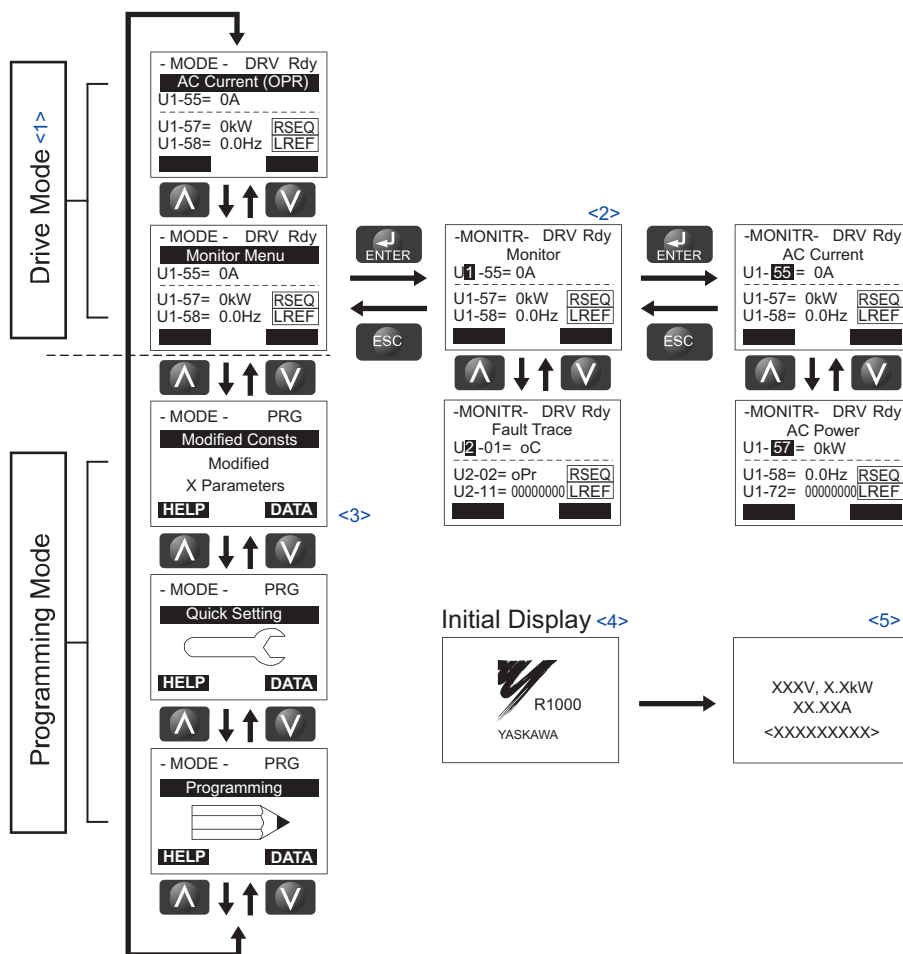
Table 10 Display and Contents

No.	Name	Display	Content
1	Operation Mode Menus	MODE	Displayed when in Mode Selection.
		MONITR	Displayed when in Monitor Mode.
		VERIFY	Indicates the Verify Menu.
		PRMSET	Displayed when in Parameter Setting Mode.
		SETUP	Displayed when in Setup Mode.
2	Mode Display Area	DRV	Displayed when in Drive Mode.
		PRG	Displayed when in Programming Mode.
3	Ready	Rdy	Indicates the regenerative unit is ready to run.
4	Data Display	-	Displays specific data and operation data.
5	DC Bus Voltage Feedback Reference Assignment <1>	OPR	Displayed when the DC Bus Voltage Feedback Reference is assigned to the LCD Operator Option.
		AI	Displayed when the DC Bus Voltage Feedback Reference is assigned to the regenerative unit Analog Input.
		COM	Displayed when the DC Bus Voltage Feedback Reference is assigned to the regenerative unit MEMOBUS/Modbus Communication Inputs.
		OP	Displayed when the DC Bus Voltage Feedback Reference is assigned to a regenerative unit Option Unit.
6	LO/RE Display <2>	RSEQ	Displayed when the reference is supplied from a remote source.
		LSEQ	Displayed when the reference is supplied from the operator keypad.
		RREF	Displayed when the frequency reference is supplied from a remote source.
		LREF	Displayed when the frequency reference is supplied from the operator keypad.
7	Function Key 1 (F2)	HELP	Pressing  displays the Help menu.
		←	Pressing  scrolls the cursor to the left.
		HOME	Pressing  returns to the top menu (DC Bus Voltage Feedback Reference).
		ESC	Pressing  returns to the previous display.
8	Function Key 2 (F1)	DATA	Pressing  scrolls to the next display.
		→	Pressing  scrolls the cursor to the right.
		RESET	Pressing  resets the existing regenerative unit fault or error.

<1> Displayed when in DC Bus Voltage Feedback Reference Mode.

<2> Displayed when in DC Bus Voltage Feedback Reference Mode and Monitor Mode.

◆ Menu Structure for Digital Operator




- <1> Pressing  will start the regenerative unit operation.
- <2> Flashing characters are shown as **0**.
- <3> “X” characters are used as examples in this manual. The LCD Operator will display the actual setting values.
- <4> The DC Bus Voltage Feedback Reference appears after the initial display that shows the product name.
- <5> The information that appears on the display will vary depending on the regenerative unit.

Figure 9 Digital Operator Menu and Screen Structure

5 Powering Up the Regenerative Unit

◆ Powering Up the Regenerative Unit

Review the following checklist before turning the power on.

Item to Check	Description
Power supply voltage	Check the power supply voltage. 200 V class: Three-phase 200 to 240 Vac 50/60 Hz 400 V class: Three-phase 380 to 480 Vac 50/60 Hz
	Properly wire the power supply input terminals (R/L1, S/L2, and T/L3).
	Properly wire the phase order of the power supply input terminals (R/L1, S/L2, and T/L3) and the power supply voltage detection terminals (r1/l11, \sphericalangle 1/l21, and t1/l31).
	Check for proper grounding of regenerative unit.
Regenerative unit output terminals and drive terminals	Properly connect the DC voltage output terminals (\oplus/\ominus) on the regenerative unit to the DC power supply input terminals (\oplus/\ominus) on the drive. Be particularly careful to correctly connect the \oplus and \ominus terminals.
Control circuit terminals	Properly connect the control circuit terminals on the regenerative unit to other control devices.
Regenerative unit control terminal status	Turn off the Run Commands for the regenerative unit and the peripheral control devices.
Power coordinating reactor, current suppression reactor, and fuse connections to regenerative unit	Properly connect the Power coordinating reactor, current suppression reactor, and fuse to regenerative unit as shown in the Standard Connection Diagram.

6 Operation with the Drive Connected

◆ Drive Connection Example

Refer to *Standard Connection Diagram on page 14* for details.

◆ Timing Chart for Turning the Power Supply On and Off

Figure 10 is a timing chart for turning the power supply on and off.

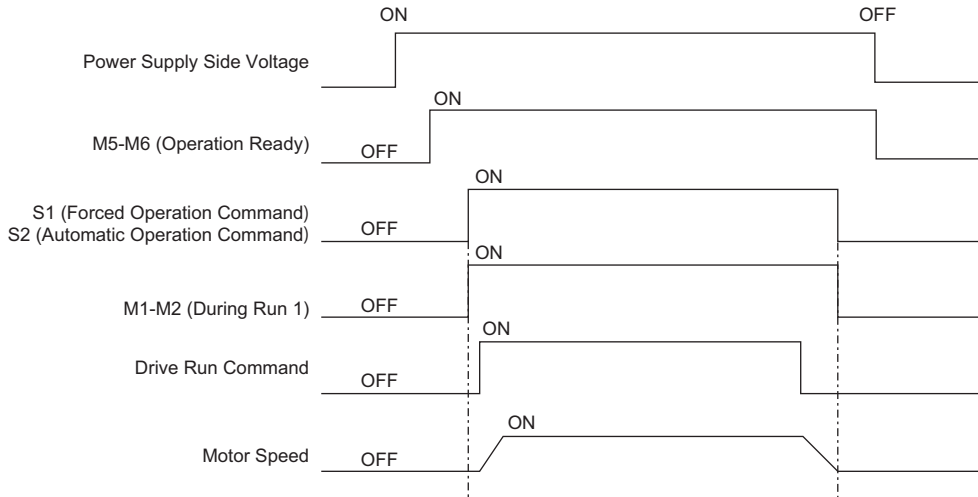


Figure 10 Timing Chart for Power ON and Run Command Sequence

Observe the following precautions when you perform operation with the regenerative unit connected to the drive.

- After turning on the power supply to the regenerative unit, wait for the operation ready signal on the multi-function contact output to turn on and then input the Run Command for the regenerative unit.
- Confirm that the regenerative unit is operating (i.e., confirm that During Run 1 is on) and then turn on the Run Command for the drive.
- To stop the regenerative unit, turn off the Run Command to the drive, confirm that the motor has stopped, and then input the Stop Command.
- Wait for the regenerative unit to stop and the During Run 1 multi-function contact output to turn off, then turn off the power supply.

◆ Operation Command Selection

The automatic operation command and forced operation command are available in the regenerative unit.

Select one of the operation commands according to the application.

Note: Select forced operation command when the motor vibrates during automatic operation.

■ Automatic Operation Command

When the multifunction input terminal S2 (H1-02 = 3D (default setting)) is “closed”, the regenerative unit detects any increase/decrease of the bus voltage and performs an automatic run/stop.

The regenerative unit stops after the minimum operation time set to C7-16 has passed when the bus voltage is less than the acceptable voltage set to the operation start/stop level.

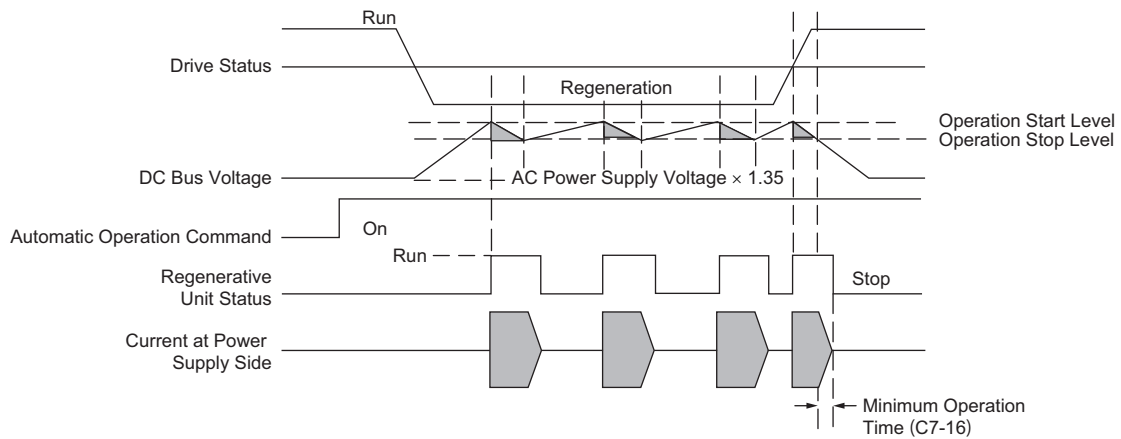


Figure 11 Automatic Operation Command Time Chart

■ Forced Operation Command

When the multi-function input terminal S1 (H1-01 = 3C (default setting)) is “closed”, the regenerative unit starts operation. When the terminal S1 is “open”, the regenerative unit stops operation after the minimum operation time has passed.

Note: When forced operation command is selected, use a sequence so that the operation commands of the regenerative unit and the drive are input at the same time.

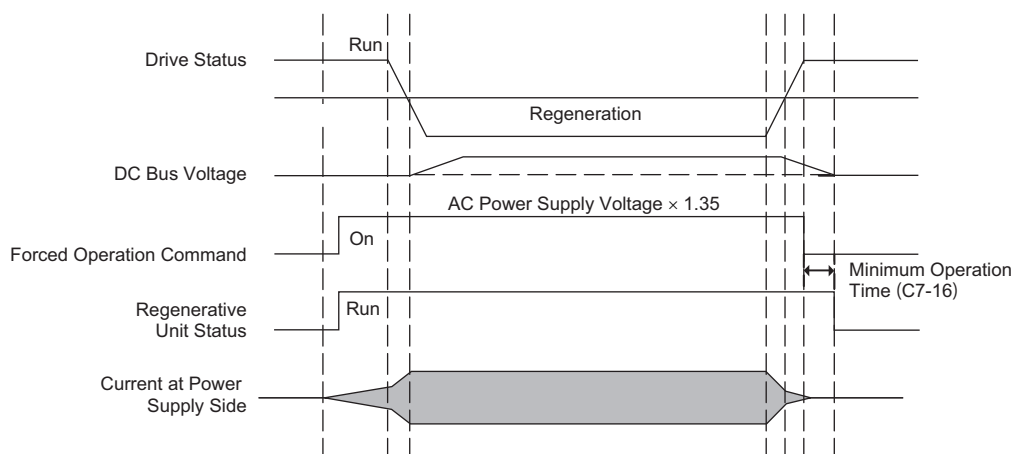


Figure 12 Forced Operation Command Time Chart

◆ Interlocks

■ Stopping the Regenerative Unit for Faults in Peripheral Devices

If an external device fails or a fault occurs, the fault contact output on the regenerative unit is activated to stop operation. To use an external fault, set H1-□□ (terminal S1 to S8 function selection) to one of the values from [Table 11](#).

When an external fault is input, EF□ is displayed on the digital operator.

The □ in EF□ is the number of the terminal where the external fault signal was input.

Example: If an external fault signal is input to the S3 terminal, EF3 is displayed.

Select the number to set for H1-□□ according to the combination of the following three conditions:

- Use an input contact for a signal from the peripheral device.
- Use detection of an external fault.
- Stop operation (as the operation selection when an external fault is detected).

6 Operation with the Drive Connected

Table 11 shows the relationship between the combination of conditions and the set value of H1-□□.

Table 11 Combination of Conditions

Setting Value	Input contact <1>		Detection <2>		Operation selection	
	N.O. contact	N.C. contact	Always detect	Detect only during operation	Stop Unit (fault)	Continue operation (minor fault)
24	○	–	○	–	○	–
25	–	○	○	–	○	–
26	○	–	–	○	○	–
27	–	○	–	○	○	–
2C	○	–	○	–	–	○
2D	–	○	○	–	–	○
2E	○	–	–	○	–	○
2F	–	○	–	○	–	○

<1> When using an input contact, set whether to detect a fault when the signal opens or closes. (N.O.: External fault when closed, N.C.: External fault when open)

<2> When using detection of a fault, set whether to always detect faults or to detect them only during operation.

◆ I/O Setup

Note: The default setting functions can be seen in the connection diagram on page 14.

■ Multi-Function Digital Inputs (H1-□□)

The function of each digital input can be assigned in the H1-□□ parameters.

■ Multi-Function Digital Outputs (H2-□□)

The function of each digital output can be assigned in the H2-□□ parameters. The setting value of these parameters consist of 3 digits, where the middle and right digit set the function and the left digit sets the output characteristics (0: Output as selected; 1: Inverse output).

■ Multi-Function Analog Inputs (H3-□□)



The function of each analog input can be assigned in the H3-□□ parameters.

■ Multi-Function Analog Outputs (H4-□□)

Use the H4-□□ parameters to set up the output value of the analog monitor outputs and to adjust the output signal levels.

◆ Test Run Checklist

Review the checklist before performing a test run. Check each item that applies.

<input checked="" type="checkbox"/>	No.	Checklist
<input type="checkbox"/>	1	Thoroughly read the manual before performing a test run.
<input type="checkbox"/>	2	Check the wiring.
<input type="checkbox"/>	3	Set the correct power supply voltage.
<input type="checkbox"/>	4	Turn on the power supply to the regenerative unit and drive.
<input type="checkbox"/>	5	Correctly sequence the Run commands.
<input type="checkbox"/>	6	The DRV should light after giving a Run command.
<input type="checkbox"/>	7	To give Run command and DC bus voltage feedback reference from the digital operator, press  key to set to LOCAL.
<input type="checkbox"/>	8	To give Run command and DC bus voltage feedback reference from the control circuit terminals, press the  to set REMOTE. (The LO/RE indicator is lit off while REMOTE is set.)

7 Parameter Table

This parameter table shows the most important parameters. Default settings are bold type. Refer to the Technical Manual for a complete list of parameters.

No. (Addr. Hex)	Name	Description
A1: Initialization		
A1-00 (100H)	Language Selection	0: English 1: Japanese 7: Chinese
A1-01 (101H)	Access Level Selection	0: View and set A1-01 and A1-04. U□-□□ parameters can also be viewed. 1: User Parameters (access to a set of parameters selected by the user, A2-01 to A2-32) 2: Advanced Access (access to view and set all parameters)
A1-03 (103H)	Initialize Parameters	0: No initialization 1110: User Initialize (parameter values must be stored using parameter o2-03) 2220: 2-Wire initialization 3330: 3-Wire initialization 5550: oPE04 error reset
A1-04 (104H)	Password	When the value set into A1-04 does not match the value set into A1-05, parameters A1-01 through A1-03, A1-06, and A2-01 through A2-33 cannot be changed.
A1-05 (105H)	Password Setting	
A2: User Parameters		
A2-01 to A2-32 (106H to 125H)	User Parameters 1 to 32	Recently edited parameters are listed here. The user can also select parameters to appear here for quicker access.
A2-33 (126H)	User Parameter Automatic Selection	0: Parameters A2-01 to A2-32 are reserved for the user to create a list of User Parameters. 1: Save history of recently viewed parameters. Recently edited parameters will be saved to A2-17 through A2-32 for quicker access.
b1: Operation Mode Selection		
b1-02 (181H)	Run Command Selection 1	0: Digital operator 1: Digital input terminals 2: MEMOBUS/Modbus communications 3: Option PCB
b1-06 (185H)	Digital Input Reading	0: Input status is read once and processed immediately (for quicker response) 1: Input is read twice and processed only if the status is the same in both readings (robust against noisy signals)
b1-08 (187H)	Run Command Selection in Programming Mode	0: Run command is not accepted while in Programming Mode. 1: Run command is accepted while in Programming Mode. 2: Prohibit entering Programming Mode during run.
b1-17 (1C6H)	Run Command at Power Up	0: Disregarded. A new Run Command must be issued. 1: Allowed. Regenerative Unit will start immediately if Run Command is present at power up.

No. (Addr. Hex)	Name	Description
b4: Timer Function		
b4-01 (1A3H)	Timer Function On-Delay Time	Sets the on-delay times for a digital timer output (H2-□□=12). The output is triggered by a digital input programmed to H1-□□=18.
b4-02 (1A4H)	Timer Function Off-Delay Time	Sets the off-delay times for a digital timer output (H2-□□=12). The output is triggered by a digital input programmed to H1-□□=18.
H1: Multi-Function Digital Inputs		
H1-01 to H1-08 (438H to 405H)	Multi-Function Digital Input Terminal S1 to S8 Function Selection	Assigns a function to the multi-function digital inputs S1 to S8. Note: Set unused terminals to F.
H2: Multi-Function Relay Outputs		
H2-01 (40BH)	Terminal M1-M2 Function Selection (Relay)	Set the functions for the relay outputs. Refer to the Technical Manual for a description of setting values. Note: Set unused terminals to F.
H2-02 (40CH)	Terminal M3-M4 Function Selection (Relay)	
H2-03 (40DH)	Terminal M5-M6 Function Selection (Relay)	
H3: Multi-Function Analog Inputs		
H3-01 (410H)	Terminal A1 Signal Level Selection	0: 0 to 10 V 1: -10 to 10 V
H3-02 (434H)	Terminal A1 Function Selection	Sets the function of terminal A1.
H3-03 (411H)	Terminal A1 Gain Setting	Sets the level of the input value selected in H3-02 when 10 V is input at terminal A1.
H3-04 (412H)	Terminal A1 Bias Setting	Sets the level of the input value selected in H3-02 when 0 V is input at terminal A1.
H3-05 (413H)	Terminal A3 Signal Level Selection	0: 0 to 10 V 1: -10 to 10 V
H3-06 (414H)	Terminal A3 Function Selection	Sets the function of terminal A3.
H3-07 (415H)	Terminal A3 Gain Setting	Sets the level of the input value selected in H3-06 when 10 V is input at terminal A3.
H3-08 (416H)	Terminal A3 Bias Setting	Sets the level of the input value selected in H3-06 when 0 V is input at terminal A3.

7 Parameter Table

No. (Addr. Hex)	Name	Description
H3-09 (417H)	Terminal A2 Signal Level Selection	0: 0 to 10 V 1: -10 to 10 V 2: 4 to 20 mA 3: 0 to 20 mA Note: Use DIP switch S1 to set input terminal A2 for a current or a voltage input signal.
H3-10 (418H)	Terminal A2 Function Selection	Sets the function of terminal A2.
H3-11 (419H)	Terminal A2 Gain Setting	Sets the level of the input value selected in H3-10 when 10 V (20 mA) is input at terminal A2.
H3-12 (41AH)	Terminal A2 Bias Setting	Sets the level of the input value selected in H3-10 when 0 V (0 or 4 mA) is input at terminal A2.
H3-13 (41BH)	Analog Input Filter Time Constant	Sets a primary delay filter time constant for terminals A1, A2, and A3. Used for electrical noise filtering.
H3-14 (41CH)	Analog Input Terminal Enable Selection	1: Terminal A1 only 2: Terminal A2 only 3: Terminals A1 and A2 only 4: Terminal A3 only 5: Terminals A1 and A3 6: Terminals A2 and A3 7: All terminals enabled
H4: Analog Outputs		
H4-01 (41DH)	Terminal FM Monitor Selection	Selects the data to be output through terminal FM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter "154" for U1-54.
H4-02 (41EH)	Terminal FM Monitor Gain	Sets the signal level at terminal FM that is equal to 100% of the selected monitor value.
H4-03 (41FH)	Terminal FM Monitor Bias	Sets the signal level at terminal FM that is equal to 0% of the selected monitor value.
H4-04 (420H)	Terminal AM Monitor Selection	Selects the data to be output through terminal AM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter "154" for U1-54.
H4-05 (421H)	Terminal AM Monitor Gain	Sets the signal level at terminal AM that is equal to 100% of the selected monitor value.
H4-06 (422H)	Terminal AM Monitor Bias	Sets the signal level at terminal AM that is equal to 0% of the selected monitor value.
H4-07 (423H)	Terminal FM Signal Level Selection	0: 0 to 10 V 1: -10 to 10 V 2: 4 to 20 mA
H4-08 (424H)	Terminal AM Signal Level Selection	0: 0 to 10 V 1: -10 to 10 V 2: 4 to 20 mA
L2: Momentary Power Loss Ride-Thru		
L2-01 (485H)	Momentary Power Loss Operation Selection	0: Disabled. Regenerative unit trips on Uv1 fault when power is lost. 1: Recover within the time set in L2-02. Uv1 will be detected if power loss is longer than L2-02. 2: Recover as long as CPU has power. Uv1 is not detected.

No. (Addr. Hex)	Name	Description
L2-02 (486H)	Momentary Power Loss Ride-Thru Time	Sets the Power Loss Ride-Thru time. Enabled only when L2-01 = 1 or 3.
L5: Fault Restart		
L5-01 (49EH)	Number of Auto Restart Attempts	Sets the number of times the regenerative unit may attempt to restart after the following faults occur: GF, oC, oL2, ov, Uv1.
L5-02 (49FH)	Auto Restart Fault Output Operation Selection	0: Fault output not active. 1: Fault output active during restart attempt.
L5-04 (4A0H)	Fault Reset Interval Time	Sets the amount of time to wait between performing fault restarts.
L5-05 (46CH)	Fault Reset Operation Selection	0: Continuously attempt to restart while incrementing restart counter only at a successful restart. 1: Attempt to restart with the interval time set in L5-04 and increment the restart counter with each attempt.
L8: Drive Protection		
L8-02 (4AEH)	Overheat Alarm Level	An overheat alarm occurs when heatsink temperature exceeds the L8-02 level.
L8-03 (4AFH)	Overheat Pre-Alarm Operation Selection	0: Ramp to stop. A fault is triggered. 3: Continue operation. An alarm is triggered.
L8-10 (4B6H)	Heatsink Cooling Fan Operation Selection	0: During run only. Fan operates only during run for L8-11 seconds after stop. 1: Fan always on. Cooling fan operates whenever the regenerative unit is powered up.
L8-11 (4B7H)	Heatsink Cooling Fan Off Delay Time	Sets a delay time to shut off the cooling fan after the Run command is removed when L8-10 = 0.
L8-12 (4B8H)	Ambient Temperature Setting	Enter the ambient temperature. This value adjusts the oL2 detection level.
L8-35 (4ECH)	Installation Method Selection	0: IP00 Open Type Enclosure 1: Side-by-Side Mounting 2: IP20/NEMA Type 1 Enclosure 3: External Heatsink Installation
L8-41 (4F2H)	High Current Alarm Selection	0: Disabled 1: Enabled. An alarm is triggered at output currents above 150% of regenerative unit rated current.
L8-65 (66FH)	Power Supply Fault Detection Selection	0: No detection 1: Stop operation (fault) 2: Continue operation (minor fault)
L8-66 (670H)	Power Supply Fault Detection Voltage Level	There is normally no need to change this parameter from the default value. The main circuit DC voltage ripple is monitored in a cycle of 200 ms. If the difference between the maximum and minimum values of the ripple exceeds the value that is set in L8-66 for the number of times that is set in L8-67, a power supply fault is detected.
L8-67 (671H)	Number of Times of Power Supply Fault for Detection	

No. (Addr. Hex)	Name	Description	No. (Addr. Hex)	Name	Description
L8-69 (673H)	Input Phase Loss Protection Selection 3	Sets whether to enable or disable the protective function for the regenerative unit when there is an input phase loss. 0: Disabled 1: Enabled (Detect input phase loss and power supply imbalance.)			
U1: Operation Status Monitors					
U1-10 (49H)	Input Terminal Status	Displays the input terminal status. U1 - 10= 00000000 1: ON 0: OFF L Digital input 1 (terminal S1 enabled) Digital input 2 (terminal S2 enabled) Digital input 3 (terminal S3 enabled) Digital input 4 (terminal S4 enabled) Digital input 5 (terminal S5 enabled) Digital input 6 (terminal S6 enabled) Digital input 7 (terminal S7 enabled) Digital input 8 (terminal S8 enabled)	U1-19 (66H)	MEMOBUS/ Modbus Error Code	Displays the contents of a MEMOBUS/ Modbus error. U1 - 19= 00000000 L 1 CRC Error 1 Data Length Error 0 Not Used 1 Parity Error 1 Overrun Error 1 Framing Error 1 Timed Out 0 Not Used
U1-11 (4AH)	Output Terminal Status	Displays the output terminal status. U1 - 11= 00000000 1: ON 0: OFF L Multi-Function Relay Output (terminal M1-M2) Multi-Function Relay Output (terminal M3-M4) Multi-Function Relay Output (terminal M5-M6) Reserved Fault Relay (terminal MA/MB-MC closed MA/MB-MC open)	U1-25 (4DH)	Software Number (Flash)	FLASH ID
U1-12 (4BH)	Drive Status	Verifies the regenerative unit operation status. U1 - 12= 00000000 L Bit 0: During Run Bit 1: Reserved Bit 2: Reserved Bit 3: Fault Reset Signal Input Bit 4: Voltage Established Bit 5: Operation Ready Bit 6: Alarm Detection Bit 7: Fault Detection	U1-26 (5BH)	Software No. (ROM)	ROM ID
U1-13 (4EH)	Terminal A1 Input Level	Displays the signal level to analog input terminal A1.	U1-27 (7A8H)	Message ID (OPR)	Shows the message ID number for OPE.
U1-14 (4FH)	Terminal A2 Input Level	Displays the signal level to analog input terminal A2.	U1-28 (7A9H)	Message ID (INV)	Shows the message ID number for INV.
U1-15 (50H)	Terminal A3 Input Level	Displays the signal level to analog input terminal A3.	U1-52 (1081H)	DC Bus Voltage Feedback	Shows the DC bus voltage feedback value.
U1-18 (61H)	oPE Fault Parameter	Displays the parameter number that caused the oPE02 or oPE08 operation error.	U1-54 (1083H)	Power Supply Voltage	Shows the power supply voltage.
			U1-55 (1084H)	Power Supply Current	Shows the current on the power supply side.
			U1-57 (1086H)	Power Supply Side Power	Shows the power on the power supply side.
			U1-58 (1087H)	Power Supply Frequency	Shows the frequency on the power supply side.
			U1-72 (1095H)	Input Power Supply Information	Shows information on the input power supply. U1 - 72= 00000000 L Bit 0: AUv reset. (0: Not completed, 1: Reset) Bit 1: PF3 reset (0: Not completed, 1: Reset) Bit 2: Rated frequency detection (0: Not completed, 1: Completed) Bit 3: Phase order detection (0: Not completed, 1: Completed) Bit 4: Power supply established (0: Not completed, 1: Completed) Bit 5: Fdv detection (0: Not detected, 1: Detected) Bit 6: PF3 detection (0: Not detected, 1: Detected) Bit 7: Reserved.
U2: Fault Trace					
U2-01 (80H)	Current Fault	Displays the current fault.	U2-11 (8AH)	Input Terminal Status at Previous Fault	Displays the input terminal status at the previous fault. Displayed as in U1-10.
U2-02 (81H)	Previous Fault	Displays the previous fault.	U2-12 (8BH)	Output Terminal Status at Previous Fault	Displays the output status at the previous fault. Displays the same status displayed in U1-11.

7 Parameter Table

No. (Addr. Hex)	Name	Description
U2-13 (8CH)	Drive Operation Status at Previous Fault	Displays the operation status of the regenerative unit at the previous fault. Displays the same status displayed in U1-12.
U2-14 (8DH)	Cumulative Operation Time at Previous Fault	Displays the cumulative operation time at the previous fault.
U2-20 (8EH)	Heatsink Temperature at Previous Fault	Displays the temperature of the heatsink when the most recent fault occurred.
U2-52 (841H)	DC Bus Voltage Feedback at Previous Fault	Shows the DC bus voltage feedback value.
U2-54 (843H)	Power Supply Voltage at Previous Fault	Shows the power supply voltage.
U2-55 (844H)	Power Supply Side Current at Previous Fault	Shows the current on the power supply side.
U2-57 (846H)	Power Supply Side Power at Previous Fault	Shows the power on the power supply side.
U2-58 (847H)	Power Supply Frequency at Previous Fault	Shows the frequency on the power supply side.
U2-64 (84DH)	Avr Input (Voltage Deviation) at Previous Fault	Shows the Avr input.
U3: Fault History		
U3-01 to U3-04 (90H to 93H)	First to 4th Most Recent Fault	Displays the first to the fourth most recent faults.
U3-05 to U3-10 (804H to 809H)	5th to 10th Most Recent Fault	Displays the fifth to the tenth most recent faults. After ten faults, data for the oldest fault is deleted. The most recent fault appears in U3-01, with the next most recent fault appearing in U3-02. The data is moved to the next monitor parameter each time a fault occurs.
U3-11 to U3-14 (94H to 97H)	Cumulative Operation Time at 1st to 4th Most Recent Fault	Displays the cumulative operation time when the first to the fourth most recent faults occurred.
U3-15 to U3-20 (80EH to 813H)	Cumulative Operation Time at 5th to 10th Most Recent Fault	Displays the cumulative operation time when the fifth to the tenth most recent faults occurred.

No. (Addr. Hex)	Name	Description
U4: Maintenance Monitors		
U4-01 (4CH)	Cumulative Operation Time	Displays the cumulative operation time of the regenerative unit. The value for the cumulative operation time counter can be reset in parameter o4-01. Use parameter o4-02 to determine if the operation time should start as soon as the power is switched on or only while the Run command is present. The maximum number displayed is 99999, after which the value is reset to 0. Note: The MEMOBUS/Modbus communications data is in 10 h units. If data in 1 h units are also required, refer to register number 0099H.
U4-02 (75H)	Number of Run Commands	Displays the number of times the Run command is entered. Reset the number of Run commands using parameter o4-13. This value will reset to 0 and start counting again after reaching 65535.
U4-03 (67H)	Cooling Fan Operation Time	Displays the cumulative operation time of the cooling fan. The default value for the fan operation time is reset in parameter o4-03. This value will reset to 0 and start counting again after reaching 99999. Note: The MEMOBUS/Modbus communications data is in 10 h units. If data in 1 h units are also required, refer to register number 009BH.
U4-04 (7EH)	Cooling Fan Maintenance	Displays main cooling fan usage time as a percentage of its expected performance life. Parameter o4-03 can be used to reset this monitor. Replace the fan when this monitor reaches 90%.
U4-05 (7CH)	Capacitor Maintenance	Displays main circuit capacitor usage time as a percentage of their expected performance life. Parameter o4-05 can be used to reset this monitor. Replace the capacitor when this monitor reaches 90%.
U4-06 (7D6H)	Soft Charge Bypass Relay Maintenance	Displays the soft charge bypass relay maintenance time as a percentage of its estimated performance life. Parameter o4-07 can be used to reset this monitor. Replace the soft charge bypass relay when this monitor reaches 90%.
U4-08 (68H)	Heatsink Temperature	Displays the heatsink temperature.
U4-09 (5EH)	LED Check	Lights all segments of the LED to verify that the display is working properly.
U4-13 (7CFH)	Peak Hold Current	Displays the highest current value that occurred during run.
U6: Operation Status Monitors		
U6-80 to U6-99 (7B0H to 7F9H)	Option Monitors 1 to 20	Shows the monitor information for Option Monitor 1 (876 Hex) to 20 (8FF Hex). This information is displayed when option cards are connected. 200 V Class: 100% = 400 Vdc 400 V Class: 100% = 800 Vdc

No. (Addr. Hex)	Name	Description
U9: Operation Status Monitors		
U9-04 (823H)	Regenerative Power (GWh)	Shows the total amount of regenerated power.
U9-05 (824H)	Regenerative Power (MWh)	
U9-06 (825H)	Regenerative Power (kWh)	
U9-11 to U9-14 (82AH to 82DH)	Regenerative Power Rates 1 to 4	These parameters show the regenerative power rate in Power Unit Price (o4-19) that is calculated from the total electrical power consumptions in U9-04 to U9-06. U9-10: Digit 1 to digit 3 U9-09: Digit 4 to digit 6 U9-08: Digit 7 to digit 9 U9-07: Digit 10 to digit 12 The unit price is set in o4-19, and U9-11 to U9-14 are U9-04 to U9-06 times o4-19.

DI/DO Sel.	Description
Digital Input Function Selections	
1	LOCAL/REMOTE selection
8	Baseblock command (N.O.)
9	Baseblock command (N.C.)
C	Analog terminal input selection
F	Through mode
14	Fault reset
18	Timer function input
1B	Program lockout
24 to 27 2C to 2F	External fault
3C	Forced operation command
3D	Automatic operation command
47	Node setup
67	Communications test mode
Digital Output Function Selections	
0	During run
6	Operation ready
7	DC bus undervoltage
8	During baseblock (N.O.)
E	Fault
F	Through mode
10	Minor fault
11	Fault reset command active
12	Timer output
1B	During baseblock (N.C.)
1D	During regeneration
1E	Restart enabled
20	Heatsink overheat (oH) pre-alarm
24	Fuse blowout detection
25	During run 1
26	During MC on
27	Overload (oL2) warning
2F	Maintenance period
3A	kWh monitor pulse output
3B	Alarm 2
3C	LOCAL/REMOTE status
4D	oH Pre-alarm time limit
60	Internal cooling fan alarm
100 to 160	Function 0 to 60 with inverse output

8 Troubleshooting

◆ General Fault and Alarms

Faults and alarms indicate problems in the regenerative unit or in the machine.

An alarm is indicated by a code on the data display and the flashing ALM LED. The output is not necessarily switched off.

A fault is indicated by a code on the data display and the ALM LED is on. The output is always switched off immediately and the motor coast to stop.

To remove an alarm or reset a fault, trace the cause, remove it and reset the regenerative unit by pushing the Reset key on the operator or cycling the power supply.

This lists up the most important alarms and faults only. Please refer to the Technical Manual for a complete list.

Digital Operator	AL	FL	Cause	Corrective Action
Power Supply Overvoltage Aov	○	○	The input power supply voltage is too high.	Reduce the voltage to within the range in the power supply specifications.
Power Supply Undervoltage AUv	○	○	The capacity of the power supply is too small.	Increase the capacity of the power supply.
			The AC fuse burned out.	A transistor inside the regenerative unit was destroyed. The input wiring is ground-faulted or short-circuited. Or, the drive output is ground-faulted or short-circuited, which destroyed the output transistor. Consult with your Yaskawa representative or the nearest Yaskawa sales office.
			The distortion in the power supply is too large.	Lower the impedance of the input power supply wiring.
			A phase loss occurred in the input power supply.	Check the input power supply for phase loss or an imbalance in the interphase voltages. Investigate and correct the cause and then reset the fault.
Baseblock bb	○	-	External baseblock signal was entered via one of the multi-function input terminals (S1 to S8).	Check external sequence and baseblock signal input timing.
			The CE detection time (H5-09) is set shorter than the time required for a communication cycle to take place.	<ul style="list-style-type: none"> • Check the PLC. • Change the software settings in the PLC. • Set a longer CE detection time using parameter H5-09.
			Incompatible PLC software settings or there is a hardware problem.	Check the PLC. Remove the cause of the error on the controller side.
			Communications cable is disconnected or damaged.	Check the connector to make sure the cable has a signal. Replace the communications cable.
Current Offset Fault CoF	○	○	An error occurred in the power supply detection circuit.	Cycle the power supply and check operation. If the fault occurs again, replace the board or regenerative unit. For information on board replacement, consult with your Yaskawa representative or the nearest Yaskawa sales office.
Control Circuit Error <I> CPF00 to CPF45	-	○	There is a self-diagnostic error in the control circuit.	Cycle power to the regenerative unit. If the problem continues, replace the control board or the entire regenerative unit. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
			Connector on the operator is damaged.	Replace the operator.
A/D Conversion Error CPF02	-	○	Control circuit is damaged.	Cycle power to the regenerative unit. If the problem continues, replace the control board or the entire regenerative unit. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.

Digital Operator	AL	FL	Cause	Corrective Action
Control Board Connection Error CPF03	-	○	There is a connection error.	Turn off the power and check the connection between the control board and the regenerative unit. If the problem continues, replace the control board or the entire regenerative unit. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
			Regenerative unit fails to operate properly due to noise interference.	Check the various options available to minimize the effects of noise. <ul style="list-style-type: none"> Counteract noise in the control circuit, main circuit, and ground wiring. Use only recommended cables or other shielded line. Ground the shield on the controller side or the regenerative unit input power side. Ensure that other equipment such as switches or relays do not cause noise. Use surge suppressors if required. Separate all communication wiring from regenerative unit power lines. Install an EMC noise filter to the regenerative unit power supply input.
EEPROM Memory Data Error CPF06	-	○	There is an error in EEPROM control circuit.	Turn off the power and check the connection between the control board and the regenerative unit. If the problem continues, replace the control board or the entire regenerative unit. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
			The power supply was switched off while parameters were being saved to the regenerative unit.	Reinitialize the regenerative unit (A1-03 = 2220, 3330).
Terminal Board Connection Error CPF07 CPF08	-	○	There is a faulty connection between the terminal board and the control board.	Turn off the power and reconnect the terminal board. If the problem continues, replace the control board or the entire regenerative unit. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Control Board Connection Error CPF23	-	○	Hardware is damaged.	If the problem continues, replace the control board or the entire regenerative unit. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Unit Capacity Detect Fault CPF24	-	○	Hardware is damaged.	If the problem continues, replace the control board or the entire regenerative unit. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Cannot Reset CrST	○	-	Fault reset was being executed when a Run command was entered.	<ul style="list-style-type: none"> Ensure that a Run command cannot be entered from the external terminals or option during fault reset. Turn off the Run command.
Option Card External Fault EF0	○	○	An external fault was received from the PLC and F6-03 is set to a value other than 3.	<ul style="list-style-type: none"> Remove the cause of the external fault. Remove the external fault input from the PLC.
			Problem with the PLC program.	Check the PLC program and correct problems.
External Faults EF1 to EF8	○	○	An external device tripped an alarm function.	Remove the cause of the external fault and reset the fault.
			Wiring is incorrect.	<ul style="list-style-type: none"> Properly connect the signal lines to the terminals assigned for external fault detection (H1-□□ = 20 to 2B). Reconnect the signal line.
			Multi-function contact input setting is incorrect.	<ul style="list-style-type: none"> Check for unused terminals set for H1-□□ = 20 to 2B (External Fault). Change the terminal settings.
EEPROM Write Error Err	-	○	Electrical noise has corrupted data while writing to the EEPROM.	<ul style="list-style-type: none"> Press "ENTER" on the digital operator. Correct the parameter setting. Cycle power to the regenerative unit.
			Hardware problem	If the problem continues, replace the control board or the entire regenerative unit. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.

8 Troubleshooting

Digital Operator	AL	FL	Cause	Corrective Action
Internal Circulation Fan Fault Fan	○	○	An internal circulation fan is faulty (2A0105, 4A0210, 4A0300).	<ul style="list-style-type: none"> • Cycle the power supply and see if the fault occurs again. • Check the operation of the internal circulation fans. • Check U4-03 (Cooling Fan Operation Time) and U4-04 (Cooling Fan Maintenance Display). If the life of the internal circulation fans has expired or if a fan is faulty, perform fan replacement according to instructions in this manual.
			An internal circulation fan or MC power supply is faulty (2A0105, 4A0210, 4A0300).	Cycle the power supply and see if the fault occurs again. If the fault occurs repeatedly, replace the board or the regenerative unit. For information on board replacement, consult with your Yaskawa representative or the nearest Yaskawa sales office.
Power Supply Frequency Fault Fdv	○	○	A momentary power loss occurred.	Investigate and correct the cause and then reset the fault.
			An input power supply wiring terminal is loose.	
			The fluctuation in the voltage of the input power supply is too large.	
			The AC power supply fuse burned out.	<ul style="list-style-type: none"> • A transistor inside the regenerative unit was destroyed. • The input wiring or drive output has ground faulted or short circuited. Contact your Yaskawa representative or the nearest Yaskawa sales office.
			The phase rotation direction has changed in the input power supply.	Correct the wiring.
The detected power supply frequency exceeded the allowable value.	Improve the power supply.			
AC Fuse Blowout FUA	–	○	The power supply fuse burned out.	<ul style="list-style-type: none"> • A transistor inside the regenerative unit was destroyed. • The input wiring or drive output has ground faulted or short circuited. Contact your Yaskawa representative or the nearest Yaskawa sales office.
DC Fuse Blowout FUd	–	○	The main transistor failed.	Replace the regenerative unit.
			The DC circuit fuse burned out.	
Current Alarm HCA	○	–	The drive failed.	Replace the drive. For information on drive replacement, consult with your Yaskawa representative or the nearest Yaskawa sales office.
			Load is too heavy.	Reduce the load for applications with repetitive operations (i.e., stops and starts), or replace the regenerative unit.
Overcurrent oC	–	○	One of the cables has shorted out or there is a grounding problem.	Check the motor cables. <ul style="list-style-type: none"> • Remove the short circuit and reapply power to the regenerative unit. • Check the resistance between the motor cables and the ground terminal ⊕. • Replace damaged cables. • Reapply power to the regenerative unit.
			The load is too heavy.	<ul style="list-style-type: none"> • Measure the current flowing into the regenerative unit. • Replace the regenerative unit with a larger capacity regenerative unit if the current value exceeds the rated current. • Determine if there is sudden fluctuation in the current level. • Reduce the load to avoid sudden changes in the current level or switch to a larger regenerative unit.
			Regenerative Unit fails to operate properly due to noise interference.	<ul style="list-style-type: none"> • Review the possible solutions provided for handling noise interference. • Check the control circuit lines, main circuit lines, and ground wiring.
			The wiring of the power supply voltage detection circuits (r1/ℓ11, s1/ℓ21, and t1/ℓ31) and the wiring of the main circuit terminals (R/L1, S/L2, and T/L3) is not correct.	Correct the wiring.
			The voltage on the power supply side is very low.	Check the wiring. <ul style="list-style-type: none"> • Correct the wiring. Check the load on the power supply of peripheral devices that are connected to the same power supply line. <ul style="list-style-type: none"> • Reduce the load.

Digital Operator	AL	FL	Cause	Corrective Action
Option card error occurred at Option Port CN5-B oFb03 to oFb17	-	○	Option card or hardware is damaged.	Cycle power to the regenerative unit. If the problem continues, replace the control board or the entire regenerative unit. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Heatsink Overheat oH	○	○	Surrounding temperature is too high.	Check the surrounding temperature. • Improve the air circulation within the enclosure panel. • Install a fan or air conditioner to cool surrounding area. • Remove anything near regenerative unit that may cause extra heat.
			Airflow around the regenerative unit is restricted.	• Provide proper installation space around the regenerative unit as indicated in the manual. Refer to <i>Installation Orientation and Spacing on page 10</i> for details. • Allow for the proper space and ensure that there is sufficient circulation around the control panel. • Check for dust or other foreign materials clogging the cooling fan. • Clear debris caught in the fan that restricts air circulation.
			The ambient temperature is too high.	Check the ambient temperature. • Improve ventilation in the control panel. • Install a cooling device (e.g., a cooling fan or air conditioner) and lower the ambient temperature. • If there are heat-generating objects nearby, remove them.
			The load is too large.	Measure the output current. Lower the load.
			Internal cooling fan has stopped.	Replace the cooling fan. After replacing the regenerative unit, set parameter o4-03 to 0 to reset the cooling fan operation time.
Overheat 1 oH1	-	○	Surrounding temperature is too high.	Check the temperature surrounding the regenerative unit. • Improve the air circulation within the enclosure panel. • Install a fan or air conditioner to cool the surrounding area. • Remove anything near the regenerative unit that might be producing excessive heat.
			Load is too heavy.	Measure the output current. Reduce the load.
			Internal cooling fan is stopped.	Replace the cooling fan. After replacing the cooling fan, set parameter o4-03 to 0 to reset the cooling fan maintenance.
Overload oL2	○	○	Load is too heavy.	Reduce the load.
			Regenerative Unit capacity is too small.	Replace the regenerative unit with a larger model.
			The regenerative unit does not operate.	Start regenerative unit operation first, and then start regenerative unit operation.
Operator Connection Fault oPr	-	○	External operator is not properly connected to the regenerative unit.	Check the connection between the operator and the regenerative unit. • Replace the cable if damaged. • Turn off the input power and disconnect the operator. Reconnect the operator and reapply regenerative unit input power.

8 Troubleshooting

Digital Operator	AL	FL	Cause	Corrective Action
Overvoltage OV	○	○	The regenerative load is too large.	Reduce the regenerative load.
			Input power voltage is too high.	Check the voltage. Lower input power voltage within the limits listed in the specifications.
			Regenerative Unit fails to operate properly due to noise interference.	<ul style="list-style-type: none"> Review the list of possible solutions provided for controlling noise. Review the section on handling noise interference and check the control circuit lines, main circuit lines, and ground wiring.
			The wiring of the power supply voltage detection circuits (r1/ℓ11, 1/ℓ21, and t1/ℓ31) and the wiring of the main circuit terminals (R/L1, S/L2, and T/L3) is not correct.	Correct the wiring.
			Electrical noise interference causes the regenerative unit to operate incorrectly.	<ul style="list-style-type: none"> Review possible solutions for handling noise interference. Review section on handling noise interference and check control circuit lines, main circuit lines and ground wiring. If the magnetic contactor is identified as a source of noise, install a surge protector to the MC coil.
			There is a regenerative load while the regenerative unit is stopped.	Set number of fault restarts (L5-01) to a value other than 0. Operate the regenerative unit.
Power Supply Undervoltage Pre-Alarm PAUv	○	-	The power supply voltage is low.	Increase the power supply voltage.
			A phase loss occurred in the input power supply.	Check the input power supply for phase loss or an imbalance in the interphase voltages. Investigate and correct the cause and then reset the fault.
			Voltage detection failed.	Check r1/ℓ11, 1/ℓ21, and t1/ℓ31 to see if they are wired correctly.
Input Power Supply Fault PF2	-	○	The fluctuation in the voltage of the input power supply is too large.	Investigate and correct the cause and then reset the fault.
			A phase loss occurred in the input power supply.	
			The capacity of the power supply is too small.	
			The wiring is too long.	
			The phase imbalance is too large.	
Input Phase Loss Detection PF3	○	○	The fluctuation in the voltage of the input power supply is too large.	Investigate and correct the cause and then reset the fault.
			A phase loss occurred in the input power supply.	
			The capacity of the power supply is too small.	
			The wiring is too long.	
			The phase imbalance is too large.	
IGBT Short Circuit or Ground Fault SC	-	○	IGBT fault	<ul style="list-style-type: none"> Check the wiring to the drive. Turn the power supply off and then on again to check operation. If the problem continues, contact your Yaskawa representative or nearest Yaskawa sales office.
			IGBT short circuit detection circuit fault.	
Phase Order Fault SRC	○	○	The power supply phase order changed during operation.	Investigate and correct the cause and then reset the fault.
			A momentary power loss occurred.	
			An input power supply wiring terminal is loose.	
			The fluctuation in the voltage of the input power supply is too large.	


Digital Operator	AL	FL	Cause	Corrective Action
Undervoltage Uv	○	-	Phase loss in the regenerative unit input power.	Check for wiring errors in the main circuit input power. Correct the wiring.
			Loose wiring in the regenerative unit input power terminals.	<ul style="list-style-type: none"> Ensure the terminals have been properly tightened. Apply the tightening torque to the terminals as specified.
			There is a problem with the regenerative unit input power voltage.	<ul style="list-style-type: none"> Check the voltage. Lower the voltage of the regenerative unit input power so that it is within the limits listed in the specifications.
			A power loss occurred.	Improve the power supply.
			Internal circuitry is worn.	Check the maintenance time for the capacitors (U4-05). Replace either the control board or the entire regenerative unit if U4-05 exceeds 90%. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
			The regenerative unit input power transformer is too small and voltage drops when the power is switched on.	<ul style="list-style-type: none"> Check for an alarm when the magnetic contactor, line breaker, and leakage breaker are closed. Check the capacity of the regenerative unit input power transformer.
			Air inside the regenerative unit is too hot.	Check the temperature inside the regenerative unit.
			The CHARGE light is broken or disconnected.	Replace either the control board or the entire regenerative unit. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Main Circuit Undervoltage Uv1	-	○	A phase loss occurred in the input power supply.	Check the wiring of the main circuit power supply for broken wires and wiring mistakes. Correct the wiring.
			An input power supply wiring terminal is loose.	Check the terminals for looseness. Tighten the terminals to the tightening torque that is given in this manual.
			Fluctuation occurred in the power supply voltage.	Check the voltage. <ul style="list-style-type: none"> Correct the voltage so that it is within the range given in the power supply specifications of the regenerative unit. If there is no problem with the main circuit power supply, check the magnetic contactor in the main circuit for faults.
			A power loss occurred.	Improve the power supply.
			The main circuit capacitor circuit in the regenerative unit has deteriorated.	Check the maintenance period for the capacitor in U4-05 (Capacitor Maintenance). If the value of U4-05 has exceeded 90%, replace the board or the regenerative unit. For information on board replacement, consult with your Yaskawa representative or the nearest Yaskawa sales office.
			The operation of the relay or contactor in the inrush current protection circuit in the regenerative unit failed.	Cycle the power supply and see if the fault occurs again. <ul style="list-style-type: none"> If the fault occurs repeatedly, replace the board or the regenerative unit. For information on board replacement, consult with your Yaskawa representative or the nearest Yaskawa sales office. Check the maintenance period for the inrush prevention relay in U4-06 (Soft Charge Bypass Relay Maintenance). If the value of U4-06 has exceeded 90%, replace the board or the regenerative unit. For information on board replacement, consult with your Yaskawa representative or the nearest Yaskawa sales office.
			A fault occurred in the power supply device.	Check the wiring of the power supply device. Correct the wiring.
			A fault occurred in the power supply.	A fault occurred in the power supply.
			A fault occurred in power supply voltage detection.	Check the wiring. Correct the wiring.
Control Power Supply Undervoltage Uv2	-	○	Internal circuitry is damaged.	<ul style="list-style-type: none"> Cycle power to the regenerative unit. Check if the fault reoccurs. If the problem continues, replace either the control board or the entire regenerative unit. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.
Soft Charge Circuit Fault Uv3	-	○	The relay or contactor on the soft-charge bypass circuit is damaged.	<ul style="list-style-type: none"> Cycle power to the regenerative unit and see if the fault reoccurs. If the problem continues, replace either the control board or the entire regenerative unit. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative. Check monitor U4-06 for the performance life of the soft-charge bypass. Replace either the control board or the entire regenerative unit if U4-06 exceeds 90%. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.

8 Troubleshooting

<1> If the fault occurs when starting the regenerative unit, CPF00 or CPF20 is displayed. If it occurs during operation, CPF01 or CPF21 is displayed.

◆ Operator Programming Errors

An Operator Programming Error (oPE) occurs when an inapplicable parameter is set or an individual parameter setting is inappropriate. When an oPE error is displayed, press the ENTER button to display U1-18 (oPE fault constant). This monitor will display the parameter that is causing the oPE error.

Digital Operator	Cause	Corrective Action
EEPROM Write Error Err	The data was corrupted by noise when writing data to the EEPROM.	<ul style="list-style-type: none"> Press . Set the parameters again. Cycle the power supply.
	EEPROM Hardware Failure	Replace the board or regenerative unit. For information on board replacement, consult with your Yaskawa representative or the nearest Yaskawa sales office.
Unit Capacity Setting Error oPE01	The Unit Model Selection (o2-04) and the actual capacity of the regenerative unit are not the same.	Correct the value set to o2-04.
Parameter Setting Range Error oPE02	Parameters were set outside the possible setting range.	Set parameters to the proper values. Note: When multiple errors occur simultaneously, other errors are given precedence over oPE02.
Multi-Function Input Setting Error oPE03	The same function is assigned to two multi-function inputs. Excludes “Not used” and “External Fault.”	<ul style="list-style-type: none"> Ensure all multi-function inputs are assigned to different functions. Re-enter the multi-function settings to ensure this does not occur.
Terminal Board Mismatch Error oPE04	The regenerative unit was replaced (but the removable terminal block with parameter backup was not replaced).	Set A1-03 to 5550 to load the parameter settings stored in the terminal board to the regenerative unit. Initialize parameters after regenerative unit replacement by setting A1-03 to 2220.
	The removable terminal block with parameter backup was replaced.	
Run Command Selection Error oPE05	The Run command is assigned to an option card (b1-18 = 3) and an input option card is not connected to the regenerative unit.	Reconnect the input option card to the regenerative unit.
	The Run command is assigned to an option card (b1-02 = 3) and an input option card is not connected to the regenerative unit.	
Multi-Function Analog Input Selection Error oPE07	At least two of these parameters have the same setting: H3-02, H3-10, or H3-06.	Change the settings to H3-02, H3-10, and H3-06 so that functions no longer conflict. Note: Both 1F (Through mode) and F (Through mode) can be set to H3-02, H3-10, or H3-06 simultaneously.
Incorrect Input Voltage Adjustment oPE30	<ul style="list-style-type: none"> The setting of o2-04 (Unit Model Selection) changed. EEPROM failed for the input voltage offset. 	For information on clearing the fault, consult with your Yaskawa representative or the nearest Yaskawa sales office.

9 UL Standards

◆ UL Standards

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



Figure 13 RU Mark

◆ UL Standards Compliance

This regenerative unit is tested in accordance with UL standard UL508C and complies with UL requirements. To ensure continued compliance when using this regenerative unit in combination with other equipment, meet the following conditions:

■ Installation Area

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

■ Ambient Temperature

IP00/Open Type enclosure: -10°C to +50°C

IP20/NEMA Type 1 enclosure: -10°C to +40°C

■ Main Circuit Terminal Wiring

Yaskawa recommends using closed-loop crimp terminals on all regenerative unit models. To maintain UL/cUL approval, UL Listed closed-loop crimp terminals are specifically required when wiring the regenerative unit main circuit terminals on models 2A0035 to 2A0105, 4A0035 to 4A0300. Use only the tools recommended by the terminal manufacturer for crimping. Refer to [Closed-Loop Crimp Terminal Recommendations on page 40](#) for closed-loop crimp terminal recommendations. The wire gauges listed in the following tables are Yaskawa recommendations. Refer to local codes for proper wire gauge selections.

Note: The mark ⊕ indicates the terminals for protective ground connection as defined in IEC/EN 60417-5019.

Grounding impedance:

200 V: 100 Ω or less

400 V: 10 Ω or less

Wire Gauges and Tightening Torques

Table 12 Wire Gauge and Torque Specifications (Three-Phase 200 V Class)

Model	Terminal	Recommended Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb·in.)
2A03P5	R/L1, S/L2, T/L3	12	12 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	⊖, ⊕	12	12 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	12	12 to 8	M5	2.0 to 2.5 (17.7 to 22.1)
2A0005	R/L1, S/L2, T/L3	12	12 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	⊖, ⊕	10	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	12	12 to 8	M5	2.0 to 2.5 (17.7 to 22.1)
2A0007	R/L1, S/L2, T/L3	12	12 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	⊖, ⊕	10	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	10	10 to 8	M5	2.0 to 2.5 (17.7 to 22.1)

Model	Terminal	Recommended Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb·in.)
2A0010	R/L1, S/L2, T/L3	10	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	⊖, ⊕	6	6	M4	2.1 to 2.3 (18.6 to 20.4)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	8	8 to 6	M6	2.0 to 2.5 (17.7 to 22.1)
2A0014	R/L1, S/L2, T/L3	8	8 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	⊖, ⊕	6	6	M4	2.1 to 2.3 (18.6 to 20.4)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	8	8 to 6	M6	2.0 to 2.5 (17.7 to 22.1)
2A0017	R/L1, S/L2, T/L3	8	8 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	⊖, ⊕	4	4 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	8	8 to 4	M6	5.4 to 6.0 (47.8 to 53.1)
2A0020	R/L1, S/L2, T/L3	6	6 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	⊖, ⊕	4	4 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	6	6 to 4	M6	5.4 to 6.0 (47.8 to 53.1)
2A0028	R/L1, S/L2, T/L3	4	4 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	⊖, ⊕	2	2 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	6	6 to 4	M6	5.4 to 6.0 (47.8 to 53.1)
2A0035	R/L1, S/L2, T/L3	2	2 to 2/0	M8	5.4 to 6.0 (47.8 to 53.1)
	⊖, ⊕	1/0	1/0 to 2/0	M8	5.4 to 6.0 (47.8 to 53.1)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	4	4	M8	9.0 to 11.0 (79.7 to 97.4)
2A0053	R/L1, S/L2, T/L3	2/0	2/0 to 250	M8	13.5 to 15.0 (119.5 to 132.8)
	⊖, ⊕	4/0	4/0 to 250	M8	13.5 to 15.0 (119.5 to 132.8)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	3	3 to 2	M10	18.0 to 23.0 (159 to 204)
2A0073	R/L1, S/L2, T/L3	1/0 × 2P	1/0 to 300	M12	32.0 to 40.0 (283 to 354)
	⊖, ⊕	3/0 × 2P	3/0 to 300	M12	32.0 to 40.0 (283 to 354)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	1/0	1/0 to 300	M12	32.0 to 40.0 (283 to 354)
2A0105	R/L1, S/L2, T/L3	3/0 × 2P	3/0 to 600	M12	32.0 to 40.0 (283 to 354)
	⊖, ⊕	300 × 2P	300 to 600	M12	32.0 to 40.0 (283 to 354)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	1/0	1/0 to 300	M12	32.0 to 40.0 (283 to 354)

Table 13 Wire Gauge and Torque Specifications (Three-Phase 400 V Class)

Model	Terminal	Recommended Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb·in.)
4A03P5	R/L1, S/L2, T/L3	10	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	⊖, ⊕	12	12 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	12	12 to 10	M5	2.0 to 2.5 (17.7 to 22.1)
4A0005	R/L1, S/L2, T/L3	10	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	⊖, ⊕	12	12 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	12	12 to 10	M5	2.0 to 2.5 (17.7 to 22.1)

Model	Terminal	Recommended Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb·in.)
4A0007	R/L1, S/L2, T/L3	12	12 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	⊖, ⊕	12	12 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	10	10	M5	2.0 to 2.5 (17.7 to 22.1)
4A0010	R/L1, S/L2, T/L3	12	12 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	⊖, ⊕	10	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	10	10 to 6	M6	2.0 to 2.5 (17.7 to 22.1)
4A0014	R/L1, S/L2, T/L3	10	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	⊖, ⊕	10	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	10	10 to 6	M6	2.0 to 2.5 (17.7 to 22.1)
4A0017	R/L1, S/L2, T/L3	10	10 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	⊖, ⊕	6	6 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	8	8 to 6	M6	5.4 to 6.0 (47.8 to 53.1)
4A0020	R/L1, S/L2, T/L3	8	8 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	⊖, ⊕	6	6 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	8	8 to 6	M6	5.4 to 6.0 (47.8 to 53.1)
4A0028	R/L1, S/L2, T/L3	8	8 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	⊖, ⊕	6	6 to 1	M6	3.6 to 4.0 (31.9 to 35.4)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	⊕	8	8 to 6	M6	5.4 to 6.0 (47.8 to 53.1)
4A0035	R/L1, S/L2, T/L3	6	6 to 2/0	M8	5.4 to 6.0 (47.8 to 53.1)
	⊖, ⊕	3	3 to 2/0	M8	5.4 to 6.0 (47.8 to 53.1)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	6	6	M8	9.0 to 11.0 (79.7 to 97.4)
4A0043	R/L1, S/L2, T/L3	4	4 to 2/0	M8	5.4 to 6.0 (47.8 to 53.1)
	⊖, ⊕	2	2 to 2/0	M8	5.4 to 6.0 (47.8 to 53.1)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	6	6	M8	9.0 to 11.0 (79.7 to 97.4)
4A0053	R/L1, S/L2, T/L3	4	4 to 2/0	M8	13.5 to 15.0 (119.5 to 132.8)
	⊖, ⊕	2	2 to 2/0	M8	13.5 to 15.0 (119.5 to 132.8)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	6	6 to 4	M10	18.0 to 23.0 (159 to 204)
4A0073	R/L1, S/L2, T/L3	2	2 to 2/0	M8	13.5 to 15.0 (119.5 to 132.8)
	⊖, ⊕	1/0	1/0 to 2/0	M8	13.5 to 15.0 (119.5 to 132.8)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	4	4	M10	18.0 to 23.0 (159 to 204)
4A0105	R/L1, S/L2, T/L3	2/0	2/0 to 300	M10	18.0 to 23.0 (159 to 204)
	⊖, ⊕	4/0	4/0 to 300	M10	18.0 to 23.0 (159 to 204)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	1	1 to 300	M10	18.0 to 23.0 (159 to 204)
4A0150	R/L1, S/L2, T/L3	250	250 to 300	M12	32.0 to 40.0 (283 to 354)
	⊖, ⊕	3/0 × 2P	3/0 to 600	M12	32.0 to 40.0 (283 to 354)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	1/0	1/0 to 300	M12	32.0 to 40.0 (283 to 354)
4A0210	R/L1, S/L2, T/L3	3/0 × 2P	3/0 to 600	M12	32.0 to 40.0 (283 to 354)
	⊖, ⊕	4/0 × 2P	4/0 to 600	M12	32.0 to 40.0 (283 to 354)
	r1/ℓ11, ⓐ1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	2/0	2/0 to 350	M12	32.0 to 40.0 (283 to 354)

Model	Terminal	Recommended Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb·in.)
4A0300	R/L1, S/L2, T/L3	250 × 2P	250 to 600	M12	32.0 to 40.0 (283 to 354)
	⊖, ⊕	400 × 2P	400 to 600	M12	32.0 to 40.0 (283 to 354)
	r1/ℓ11, s1/ℓ21, t1/ℓ31	14	14 to 10	M4	1.1 to 1.2 (9.7 to 10.6)
	⊕	4/0	4/0 to 350	M12	32.0 to 40.0 (283 to 354)

Closed-Loop Crimp Terminal Recommendations

Yaskawa recommends UL Listed crimp terminals made by JST and Tokyo DIP (or equivalent) for the insulation cap. **Table 14** matches the wire gauges and terminal screw sizes with Yaskawa-recommended crimp terminals, tools, and insulation caps. Refer to the appropriate Wire Gauge and Torque Specifications table for the wire gauge and screw size for your regenerative unit model. Place orders with a Yaskawa representative or the Yaskawa sales department. The closed-loop crimp terminal sizes and values listed in **Table 14** are Yaskawa recommendations. Wire gauge values shown in **Table 14** are the recommended values. Refer to local codes for proper selections.

Table 14 Closed-Loop Crimp Terminal Size

Model	Wire Gauge (AWG, kcmil)		Screw Size	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code <1>
	R/L1·S/L2·T/L3	⊖, ⊕			Machine No.	Die Jaw		
200 V Class								
2A03P5	12		M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	10			R5.5-4	YA-4	AD-900	TP-005	100-054-029
	8			8-4	YA-4	AD-901	TP-008	100-054-031
	6			14-NK4	YA-4	AD-902	TP-014	100-054-033
2A0005	12		M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	10			R5.5-4	YA-4	AD-900	TP-005	100-054-029
	8			8-4	YA-4	AD-901	TP-008	100-054-031
	6			14-NK4	YA-4	AD-902	TP-014	100-054-033
2A0007	12		M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	10			R5.5-4	YA-4	AD-900	TP-005	100-054-029
	8			8-4	YA-4	AD-901	TP-008	100-054-031
	6			14-NK4	YA-4	AD-902	TP-014	100-054-033
2A0010	10		M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	8			8-4	YA-4	AD-901	TP-008	100-054-031
	6			14-NK4	YA-4	AD-902	TP-014	100-054-033
2A0014	8		M4	8-4	YA-4	AD-901	TP-008	100-054-031
	6			14-NK4	YA-4	AD-902	TP-014	100-054-033
2A0017	8		M6	R8-6	YA-4	AD-901	TP-008	100-092-620
	6			R14-6	YA-4	AD-902	TP-014	100-051-261
	4			R22-6	YA-5	AD-953	TP-022	100-051-262
	3			38-6	YA-5	AD-954	TP-038	100-092-577
	2			38-6	YA-5	AD-954	TP-038	100-092-577
	1			60-6	YA-5	AD-955	TP-060	100-092-578
2A0020	6		M6	R14-6	YA-4	AD-902	TP-014	100-051-261
	4			R22-6	YA-5	AD-953	TP-022	100-051-262
	3			38-6	YA-5	AD-954	TP-038	100-092-577
	2			38-6	YA-5	AD-954	TP-038	100-092-577
	1			60-6	YA-5	AD-955	TP-060	100-092-578
2A0028	4		M6	R22-6	YA-5	AD-953	TP-022	100-051-262
	3			38-6	YA-5	AD-954	TP-038	100-092-577
	2			38-6	YA-5	AD-954	TP-038	100-092-577
	1			60-6	YA-5	AD-955	TP-060	100-092-578

Model	Wire Gauge (AWG, kcmil)		Screw Size	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code <1>
	R/L1·S/L2·T/L3	⊖, ⊕			Machine No.	Die Jaw		
2A0035	2	–	M8	R38-8	YA-5	AD-954	TP-038	100-051-264
	1	–		R60-8	YA-5	AD-955	TP-060	100-051-265
	1/0			R60-8	YA-5	AD-955	TP-060	100-051-265
	2/0			80-8	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-092-579
2A0053	2/0	–	M8	80-8	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-092-579
	3/0	–		80-8	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-092-579
	4/0			100-8	YF-1 YET-300-1	TD-324 TD-312	TP-100	100-068-032
	250			150-8	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-113-129
2A0073	1/0 × 2P	–	M12	R60-12	YA-5	AD-955	TP-060	100-066-160
	2/0 × 2P	–		80-L12	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-051-558
	3/0 × 2P			80-L12	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-051-558
	4/0	4/0 × 2P		R100-12	YF-1 YET-300-1	TD-324 TD-312	TP-100	100-051-560
	250	250 × 2P		150-L12	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-562
	300			150-L12	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-562
2A0105	3/0 × 2P	–	M12	80-L12	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-051-558
	4/0 × 2P			100-L12	YF-1 YET-300-1	TD-324 TD-312	TP-100	100-051-560
	250 × 2P			150-L12	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-562
	300 × 2P			150-L12	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-562
	350	350 × 2P		200-L12	YF-1 YET-300-1	TD-327 TD-314	TP-200	100-051-564
	400	400 × 2P		200-L12	YF-1 YET-300-1	TD-327 TD-314	TP-200	100-051-564
	500	500 × 2P		325-12	YF-1 YET-300-1	TD-328 TD-315	TP-325	100-051-277
	600			325-12	YF-1 YET-300-1	TD-328 TD-315	TP-325	100-051-277
400 V Class								
4A03P5	–	12	M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	10			R5.5-4	YA-4	AD-900	TP-005	100-054-029
	8			8-4	YA-4	AD-901	TP-008	100-054-031
	6			14-NK4	YA-4	AD-902	TP-014	100-054-033
4A0005	–	12	M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	10			R5.5-4	YA-4	AD-900	TP-005	100-054-029
	8			8-4	YA-4	AD-901	TP-008	100-054-031
	6			14-NK4	YA-4	AD-902	TP-014	100-054-033
4A0007	12		M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	10			R5.5-4	YA-4	AD-900	TP-005	100-054-029
	8			8-4	YA-4	AD-901	TP-008	100-054-031
	6			14-NK4	YA-4	AD-902	TP-014	100-054-033

9 UL Standards

Model	Wire Gauge (AWG, kcmil)		Screw Size	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code <1>
	R/L1·S/L2·T/L3	⊖, ⊕			Machine No.	Die Jaw		
4A0010	12	–	M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	10			R5.5-4	YA-4	AD-900	TP-005	100-054-029
	8			8-4	YA-4	AD-901	TP-008	100-054-031
	6			14-NK4	YA-4	AD-902	TP-014	100-054-033
4A0014	10		M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	8			8-4	YA-4	AD-901	TP-008	100-054-031
	6			14-NK4	YA-4	AD-902	TP-014	100-054-033
4A0017	10	–	M6	R5.5-6	YA-4	AD-900	TP-005	100-068-029
	8	–		R8-6	YA-4	AD-901	TP-008	100-092-620
	6			R14-6	YA-4	AD-902	TP-014	100-051-261
	4			R22-6	YA-5	AD-953	TP-022	100-051-262
	3			38-6	YA-5	AD-954	TP-038	100-092-577
	2			38-6	YA-5	AD-954	TP-038	100-092-577
	1			60-6	YA-5	AD-955	TP-060	100-092-578
4A0020	8	–	M6	R8-6	YA-4	AD-901	TP-008	100-092-620
	6			R14-6	YA-4	AD-902	TP-014	100-051-261
	4			R22-6	YA-5	AD-953	TP-022	100-051-262
	3			38-6	YA-5	AD-954	TP-038	100-092-577
	2			38-6	YA-5	AD-954	TP-038	100-092-577
	1			60-6	YA-5	AD-955	TP-060	100-092-578
4A0028	8	–	M6	R8-6	YA-4	AD-901	TP-008	100-092-620
	6			R14-6	YA-4	AD-902	TP-014	100-051-261
	4			R22-6	YA-5	AD-953	TP-022	100-051-262
	3			38-6	YA-5	AD-954	TP-038	100-092-577
	2			38-6	YA-5	AD-954	TP-038	100-092-577
	1			60-6	YA-5	AD-955	TP-060	100-092-578
4A0035	6	–	M8	R14-8	YA-4	AD-902	TP-014	100-051-035
	4			R22-8	YA-5	AD-953	TP-022	100-051-263
	3			R38-8	YA-5	AD-954	TP-038	100-051-264
	2			R38-8	YA-5	AD-954	TP-038	100-051-264
	1			R60-8	YA-5	AD-955	TP-060	100-051-265
	1/0			R60-8	YA-5	AD-955	TP-060	100-051-265
	2/0			80-8	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-092-579
4A0043	4	–	M8	R22-8	YA-5	AD-953	TP-022	100-051-263
	3	–		R38-8	YA-5	AD-954	TP-038	100-051-264
	2			R38-8	YA-5	AD-954	TP-038	100-051-264
	1			R60-8	YA-5	AD-955	TP-060	100-051-265
	1/0			R60-8	YA-5	AD-955	TP-060	100-051-265
	2/0			80-8	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-092-579
4A0053	4	–	M8	R22-8	YA-5	AD-953	TP-022	100-051-263
	3	–		R38-8	YA-5	AD-954	TP-038	100-051-264
	2			R38-8	YA-5	AD-954	TP-038	100-051-264
	1			R60-8	YA-5	AD-955	TP-060	100-051-265
	1/0			R60-8	YA-5	AD-955	TP-060	100-051-265
	2/0			80-8	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-092-579
4A0073	2	–	M8	R38-8	YA-5	AD-954	TP-038	100-051-264
	1	–		R60-8	YA-5	AD-955	TP-060	100-051-265
	1/0			R60-8	YA-5	AD-955	TP-060	100-051-265
	2/0			80-8	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-092-579

Model	Wire Gauge (AWG, kcmil)		Screw Size	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code <1>
	R/L1·S/L2·T/L3	⊖, ⊕			Machine No.	Die Jaw		
4A0105	2/0	–	M10	80-L10	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-051-557
	3/0	–		80-L10	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-051-557
	4/0			R100-10	YF-1 YET-300-1	TD-324 TD-312	TP-100	100-051-559
	250			R150-10	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-272
	300			R150-10	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-272
4A0150	–	3/0 × 2P	M12	80-L12	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-051-558
	–	4/0 × 2P		100-L12	YF-1 YET-300-1	TD-324 TD-312	TP-100	100-051-560
	250	250 × 2P		150-L12	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-562
	300	300 × 2P		150-L12	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-562
	–	350 × 2P		200-L12	YF-1 YET-300-1	TD-327 TD-314	TP-200	100-051-564
	–	400		200-L12	YF-1 YET-300-1	TD-327 TD-314	TP-200	100-051-564
	–	500		325-12	YF-1 YET-300-1	TD-328 TD-315	TP-325	100-051-277
	–	600		325-12	YF-1 YET-300-1	TD-328 TD-315	TP-325	100-051-277
4A0210	3/0 × 2P	–	M12	80-L12	YF-1 YET-300-1	TD-323 TD-312	TP-080	100-051-558
	4/0 × 2P			100-L12	YF-1 YET-300-1	TD-324 TD-312	TP-100	100-051-560
	250 × 2P			150-L12	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-562
	300 × 2P			150-L12	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-562
	350 × 2P			200-L12	YF-1 YET-300-1	TD-327 TD-314	TP-200	100-051-564
	400	400 × 2P		200-L12	YF-1 YET-300-1	TD-327 TD-314	TP-200	100-051-564
	500	500 × 2P		325-12	YF-1 YET-300-1	TD-328 TD-315	TP-325	100-051-277
	600	600 × 2P		325-12	YF-1 YET-300-1	TD-328 TD-315	TP-325	100-051-277
4A0300	250 × 2P	–	M12	150-L12	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-562
	300 × 2P	–		150-L12	YF-1 YET-300-1	TD-325 TD-313	TP-150	100-051-562
	350 × 2P	–		200-L12	YF-1 YET-300-1	TD-327 TD-314	TP-200	100-051-564
	400 × 2P			200-L12	YF-1 YET-300-1	TD-327 TD-314	TP-200	100-051-564
	500 × 2P			325-12	YF-1 YET-300-1	TD-328 TD-315	TP-325	100-051-277
	600 × 2P			325-12	YF-1 YET-300-1	TD-328 TD-315	TP-325	100-051-277

9 UL Standards

<1> Codes refer to a set of three crimp terminals and three insulation caps. Prepare input and output wiring using two sets for each connection.
 Example 1: Model 4A0105 with 300 kcmil for both input and output require one set for input terminals and one set for output terminals, so the user should order two sets of [100-051-272].
 Example 2: Model 4A0210 with 300 kcmil × 2P for both input and output require two sets for input terminals and two sets for output terminals, so the user should order four sets of [100-051-562].

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

Model	Wire Gauge (AWG, kcmil)	Screw Size	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code
	r1/ℓ11, r1/ℓ21, t1/ℓ31			Machine No.	Die Jaw		
2A03P5 to 2A0028, 4A03P5 to 4A0028	14	M3.5	R2-3.5	YA-4	AD-900	TP-003	100-106-516
2A0035 to 2A0105, 4A0035 to 4A0300	14	M4	R2-4	YA-4	AD-900	TP-003	100-106-517

◆ Power Coordinating Reactor/Current Suppression Reactor

To conform to UL508C, connect the power coordinating reactor to the input side of the drive, and the current suppression reactor to the input side of the regenerative unit.

Table 15 Power Coordinating Reactor/Current Suppression Reactor

Reactor	Power Coordinating Reactor				Current Suppression Reactor		
Manufacturer	Shanghai Eagtop Electronic Technology Co. Ltd				SAO Electric Corporation		
Model	Model	Rated Voltage (V)	Rated Current (A)	Inductance (mH)	Rated Voltage (V)	Rated Current (A)	Inductance (mH)
200 V Class							
2A03P5	ACL-0020-EISC-9353BBH	264	20	0.53	264	15	0.31
2A0005	ACL-0030-EISC-9353BBH	264	30	0.35	264	15	0.31
2A0007	ACL-0040-EISC-9353BBH	264	40	0.265	264	20	0.15
2A0010	ACL-0060-EISC-9353BBH	264	60	0.18	264	40	0.1
2A0014	ACL-0080-EISC-9353BBH	264	80	0.13	264	40	0.1
2A0017	ACL-0090-EISC-9353BBH	264	90	0.12	264	50	0.06
2A0020	ACL-0120-EISC-9353BBH	264	120	0.09	264	60	0.05
2A0028	ACL-0160-EISC-9353BBH	264	160	0.07	264	80	0.04
2A0035	ACL-0200-EISC-9353AH	264	200	0.05	264	100	0.03
2A0053	ACL-0280-EISC-9353BBH	264	280	0.038	264	153	0.02
2A0073	ACL-0360-EISC-9353BBH	264	360	0.026	264	209	0.015
2A0105	ACL-0500-EISC-9353BBH	264	500	0.02	264	306	0.01
400 V Class							
4A03P5	ACL-0010-EISC-9353ABH	528	10	2.2	528	7.5	1.2
4A0005	ACL-0015-EISC-9353ABH	528	15	1.42	528	7.5	1.2
4A0007	ACL-0020-EISC-9353ABH	528	20	1.06	528	10	0.6
4A0010	ACL-0030-EISC-9353ABH	528	30	0.7	528	15	0.4
4A0014	ACL-0040-EISC-9353ABH	528	40	0.53	528	25	0.3
4A0017	ACL-0050-EISC-9353ABH	528	50	0.42	528	25	0.3
4A0020	ACL-0060-EISC-9353ABH	528	60	0.36	528	30	0.2
4A0028	ACL-0080-EISC-9353ABH	528	80	0.26	528	40	0.15
4A0035	ACL-0090-EISC-9353ABH	528	90	0.24	528	50	0.12
4A0043	ACL-0120-EISC-9353BH	528	120	0.18	528	60	0.1
4A0053	ACL-0150-EISC-9353ABH	528	150	0.15	528	75	0.08
4A0073	ACL-0200-EISC-9353ABH	528	200	0.11	528	100	0.06
4A0105	ACL-0250-EISC-9353ABH	528	250	0.09	528	161	0.04
4A0150	ACL-0330-EISC-9353ABH	528	330	0.06	528	237	0.03
4A0210	ACL-0490-EISC-9353ABH	528	490	0.04	528	326	0.02
4A0300	ACL-0660-EISC-9353ABH	528	660	0.03	528	466	0.013

Note: 1. When a reactor that is not recommended in [Table 15](#) is used, the power coordinating reactor should meet the following conditions:

- The reactor is certified by UL.

- The inductance and the rated current are greater than the value shown in [Table 15](#).
- The rated voltage is not less than 240 V for 200 V class models, or not less than 480 V for 400 V class models.
- The inductance of the reactor (L) is not less than the value calculated by the following formula:

$$L = (\%Z \times E) / (\sqrt{3} \times 2 \times \pi \times f \times I)$$

E: Rated voltage

f: Frequency

I: Rated current

%Z: Impedance of the power coordinating reactor (0.03)

2. When a reactor that is not recommended in [Table 15](#) is used, the current suppression reactor should meet the following conditions:
 - The reactor is certified by UL.
 - The inductance and the rated current are greater than the value shown in [Table 15](#).
 - The rated voltage is not less than 240 V for 200 V class models, and not less than 480 V for 400 V class models.

◆ Installing Input Fuses

NOTICE: If a fuse is open or a Residual Current Device (RCD) is tripped, check the wiring and the selection of the peripheral devices. Check the wiring and the selection of peripheral devices to identify the cause. Contact Yaskawa before restarting the regenerative unit or the peripheral devices if the cause cannot be identified.

■ Recommended Branch Circuit Protection

Yaskawa recommends installing appropriate input fuses and fuse holders to the input side of the current suppression reactor to maintain compliance with UL508C.

The fuses are listed in [Table 6](#).

■ Low Voltage Wiring for Control Circuit Terminals

Wire low voltage wires with NEC Class 1 circuit conductors. Refer to national state or local codes for wiring. The external power supply shall be a UL listed Class 2 power supply source or equivalent only.

Table 16 Control Circuit Terminal Power Supply

Input/Output	Terminal Signal	Power Supply Specifications
Multi-function digital inputs	S1, S2, S3, S4, S5, S6, S7, S8, SC, SN, SP	Use the internal LVLC power supply of the regenerative unit. Use class 2 for external power supply.
Multi function analog inputs	+V, -V, A1, A2, A3, AC	

■ Regenerative Unit Short-Circuit Rating

This regenerative unit is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 240 Vac for 200 V class regenerative units and 480 Vac for 400 V class regenerative units, when protected by fuses as specified on the [Table 6](#).

Connect the regenerative unit to an AC drive which has built-in semiconductor short-circuit protection and conforms to UL short-circuit test.

◆ **Precautionary Notes on External Heatsink (IP00/Open Type Enclosure)**

When using an external heatsink, UL compliance requires that exposed capacitors in the main circuit are covered to prevent injury to surrounding personnel.

The portion of the external heatsink that projects out can either be protected with the enclosure, or with the appropriate capacitor cover after regenerative unit installation is complete. Use the table below to match regenerative unit models and capacitor cover. Capacitor covers can be ordered from a Yaskawa representative or directly from the Yaskawa sales department. The table below lists available capacitor covers.

Table 17 Capacitor Cover

Model	Code Number	Figure
2A0035	100-061-274	<i>Figure 14</i>
2A0053	100-061-275	
2A0073	100-061-277	
2A0105	100-061-278	
4A0035	100-061-274	
4A0043	100-061-274	
4A0053	100-061-275	
4A0073	100-061-275	
4A0105	100-061-277	
4A0150	100-061-277	
4A0210	100-061-278	
4A0300	100-061-278	

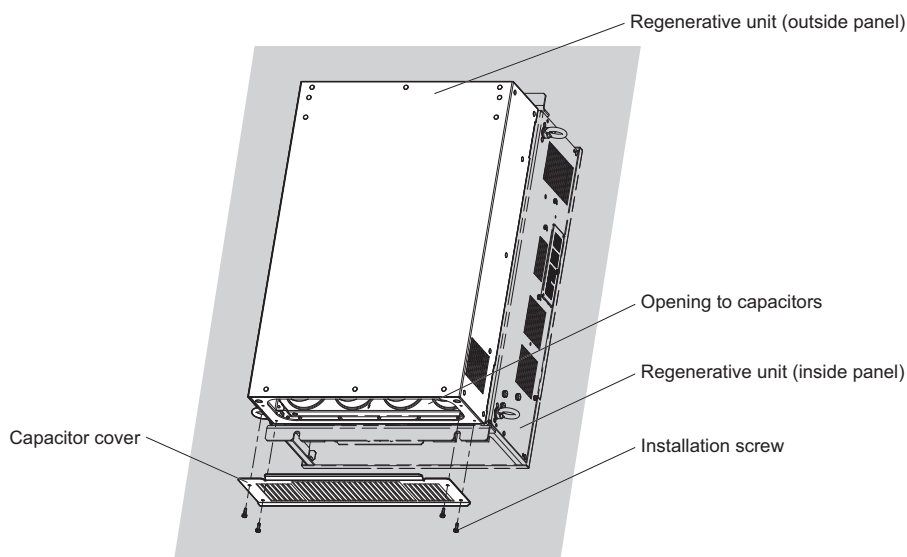


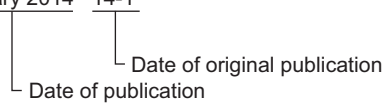
Figure 14 Capacitor Cover

Revision History

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

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YASKAWA R1000 Series

Power Regenerative Unit

Quick Start Guide

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

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

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