Low-Voltage Regenerative Converter for Systems FSDrive-LC1HS

Instruction Manual

Type: CIMR-LC1HSR□4□□□□
400 V class: 200 to 1000 kW
: CIMR-LC1HSRA6□□□□
690 V class: 350 to 1750 kW

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

YASKAWA

MANUAL NO. EZZ010905

Table of Contents

i

Preface

i.1 Preface

Thank you for purchasing the Yaskawa regenerative converter for system applications FSDrive-LC1HS series.

This manual is designed to ensure correct and suitable application of the Yaskawa FSDrive-LC1HS series regenerative converter (hereinafter referred to as FSDrive-LC1HS). As soon as this product is delivered, read this manual before attempting to install, operate, maintain, or inspect an FSDrive-LC1HS and handle the FSDrive-LC1HS according to the instructions described in this manual. Be sure you understand all precautions and safety information before attempting to use the FSDrive-LC1HS.

This manual is required for maintenance management of the FSDrive-LC1HS including daily maintenance as well as checking and troubleshooting. Keep this manual in a safe place for further reference.

i.2 General Safety

◆ General Precautions

- All diagrams in this manual may show the product without covers or safety shields to show details. Replace covers and shields before operating the product and operate the product according to the instructions given in this manual.
- The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual. Such changes are implemented by updating the document number to indicate a revised edition.
- When ordering a new copy of the manual due to damage or loss, contact the nearest Yaskawa sales office.
- Modification of the product by the end user is not subject to Yaskawa's quality assurance, and we can therefore accept no responsibility for such modifications.
- This manual must be safely delivered into the hands of the end user of the product.
- This manual is also required for daily maintenance and inspection and other processes, so keep it in a safe place.

◆ Supplemental Safety Information

The conventions and signal words presented from here on are used for different types of safety information in this document. The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or possibly even 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.

IMPORTANT: *Indicates important information that should be memorized.*

◆ Safety Messages

■ General

⚠ WARNING

For correct use, be sure to read this manual and other attached documents thoroughly before use (installation, operation, maintenance, inspection, etc.). Also, be sure to use the equipment after having acquired a thorough knowledge of the equipment, the safety information, and all of the precautions. Be sure to keep the documents in a place where they are readily available for anyone using the device.

■ Storage and Transportation

NOTICE

If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.

Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.

If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogens, which includes chlorine, fluorine, bromine and iodine, can contribute to the erosion of the capacitors.

■ Confirmations upon Receipt

⚠ DANGER

If there is any damage or any missing components, cease using the device immediately and contact Yaskawa representative.

Failure to comply may result in injury while wiring the device, or electric shock or fire due to a fault while the unit is powered up.

■ Wiring

⚠ DANGER

Do not connect or disconnect wiring while the power is on.

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

Prior to wiring, make sure the input power supply is shut off.

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

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

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

Make sure ground terminals are properly grounded with resistance of less than 10Ω. Grounding line gauge for 400 V class units should be at least 1.66 mm, and 690 V class units should use a gauge of at least 2.66 mm.

Improper grounding can result in electric shock or fire.

Do not forget to include an emergency stop circuit in the application.

Failure to comply could result in death or serious injury.

A communication error between the digital operator keypad and the drive's internal control board may make it impossible to stop the drive with the digital operator.

Once an emergency stop circuit has been wired, check to make sure it is operating properly.

Failure to comply could result in death or serious injury.

The emergency stop circuit may fail to operate if left unchecked. The user is fully responsible for properly wiring the emergency circuit.

Never touch the output terminals or allow the output lines to come into contact with the control panel or any other metallic device or materials.

Never short the output terminals.

Failure to comply will result in death or serious injury by fire because of electric shock or a grounding short, and is extremely dangerous.

⚠ CAUTION

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 drive matches the voltage of the incoming power supply before applying power.

Do not perform a voltage withstand test on the device.

Failure to comply may damage semiconductor components.

Never connect a power supply to output terminals PN.

Applying voltage to the output terminals will damage power cells in the regenerative converters.

Do not connect a phase-forward capacitor or an LC/RC noise filter to the output circuit.

Connecting such devices can damage internal components or cause them to overheat.

■ Test Run

⚠ DANGER

Make sure that the panel door is properly closed before turning on the input power supply.

Failure to comply could result in electric shock.

Prepare a separate emergency stop switch.

Only the stop button should be enabled when the emergency switch has been triggered.

In the event of a fault, first clear the Run command and then reset the fault.

If the Run command is present, the regenerative converters will disregard any attempts to reset the fault. The Run command must first be removed before a fault situation can be cleared.

⚠ CAUTION

After the power has been shut off, allow time to pass before touching the main circuit.

Failure to wait can result in personal injury.

Do not attempt to connect any measuring devices to check signals from the control board while the drive is running.

Failure to comply may result in electric shock and damage drive components.

NOTICE

Refrain from making unnecessary parameter setting changes.

Unnecessary parameter settings can lead to equipment damage and personal injury.

Default settings are often the most appropriate values.

■ Maintenance and Inspection

⚠ DANGER

Do not attempt to modify or alter the regenerative converters.

Failure to comply could damage regenerative converters components, or result in death or serious injury.

Refrain from touching the terminals unnecessarily. The regenerative converters has high voltage terminals, which are extremely dangerous.

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

⚠ DANGER

Make sure that the panel door is properly closed while the regenerative converters are powered up. When opening the door, make sure power to the main circuit has been shut off.

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

Perform maintenance and regenerative converters inspection after first shutting off power to the main circuit, then waiting for the CHARGE LED to go out.

Residual voltage in regenerative converters capacitors can cause electric shock.

Failure to comply could result in death or serious injury.

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

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

Maintenance, inspection, and replacing components must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of regenerative converters.

Remove any and all metal accessories (rings, wristwatch, etc.) prior to performing any work on the drive, and take proper steps to ensure insulation from electric shock.

Failure to comply could result in electric shock.

NOTICE

The control board contains a CMOS IC, and must be handled with care.

Touching the board directly may result in the transfer of static electricity, which can destroy the CMOS IC.

Never remove any connectors or attempt to change any wiring on the control circuit while the drive is on.

Failure to comply may damage electrical components.

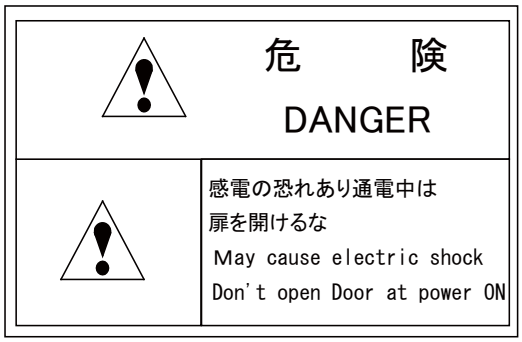
■ Restrictions

- This product was not designed or manufactured for use in devices or systems that may directly affect or threaten human lives or health.
  End users who intend to use the product described in this manual for devices or systems relating to transportation, health care, space aviation, nuclear power control applications, or underwater use must contact their Yaskawa representatives or the nearest Yaskawa sales office beforehand.
- This product has been manufactured under strict quality-control guidelines. However, if this product is to be installed in any location where its failure could involve or result in a life-and-death situation or loss of human life, or in a facility where failure may cause a serious accident or physical injury, safety devices must be installed to minimize the likelihood of any accident.

i.3 Danger Information and Position

Danger information is shown on the panel. Always heed the danger sign when handling the regenerative converters.

Danger information



i.4 Warranty Information

◆ Free Warranty Period and Scope

■ Warranty Period

This product is warranted for twelve months after being delivered to the end user or if applicable eighteen months from the date of shipment from Yaskawa's factory, whichever comes first.

■ Scope of Warranty

Inspections

Periodic inspections must be conducted by the end user.

However, upon request, Yaskawa or one of Yaskawa's Service Centers can inspect the product for a fee.

In this case, if after conferring with the end user, a Yaskawa product is found to be defective due to Yaskawa workmanship or materials and the defect occurs during the warranty period, then this fee will be waived and the problem remedied free of charge.

Repairs

If a Yaskawa product is found to be defective due to Yaskawa workmanship or materials and the defect occurs during the warranty period, Yaskawa will bear the cost of repairing the unit, replacing it, or dispatching a repair technician.

However, if the Yaskawa Authorized Service Center determines that the problem with a Yaskawa product is not due to defects in Yaskawa's workmanship or materials, then the end user will be responsible for the cost of any necessary repairs. Some problems that are outside the scope of this warranty are:

- Problems due to improper maintenance or handling, carelessness, or other reasons where the end user is determined to be responsible.
- Problems due to additions or modifications made to a Yaskawa product by the end user without Yaskawa's understanding.
- Problems due to the use of a Yaskawa product under conditions that do not meet the recommended specifications.
- Problems caused by natural disaster or fire.
- Or other problems not due to defects in Yaskawa workmanship or materials.

Warranty service is only applicable within Japan.

However, after-sales service is available for end users outside of Japan for a reasonable fee. Contact your local Yaskawa representative for more information.

◆ Exceptions

Any inconvenience to the end user or damage to non-Yaskawa products due to Yaskawa's defective products whether within or outside the warranty period are NOT covered by this warranty.

◆ Restrictions

- This product was not designed or manufactured for use in devices or systems that may directly affect or threaten human lives or health.
  End users who intend to use the product described in this manual for devices or systems relating to transportation, health care, space aviation, atomic or electric power, or underwater use must contact their Yaskawa representatives or the nearest Yaskawa sales office beforehand.
- This product has been manufactured under strict quality-control guidelines. However, if this product is to be installed in any location where failure or this product could involve or result in a life-and-death situation or loss of human life, or in a facility where failure may cause a serious accident or physical injury, safety devices must be installed to minimize the likelihood of any accident.

1

Handling Regenerative Converters

This chapter describes the confirmations upon receiving or installing an FSDrive-LC1HS.

1.1 Confirmations upon Delivery

◆ Item

Check the following points as soon as the product has been delivered.

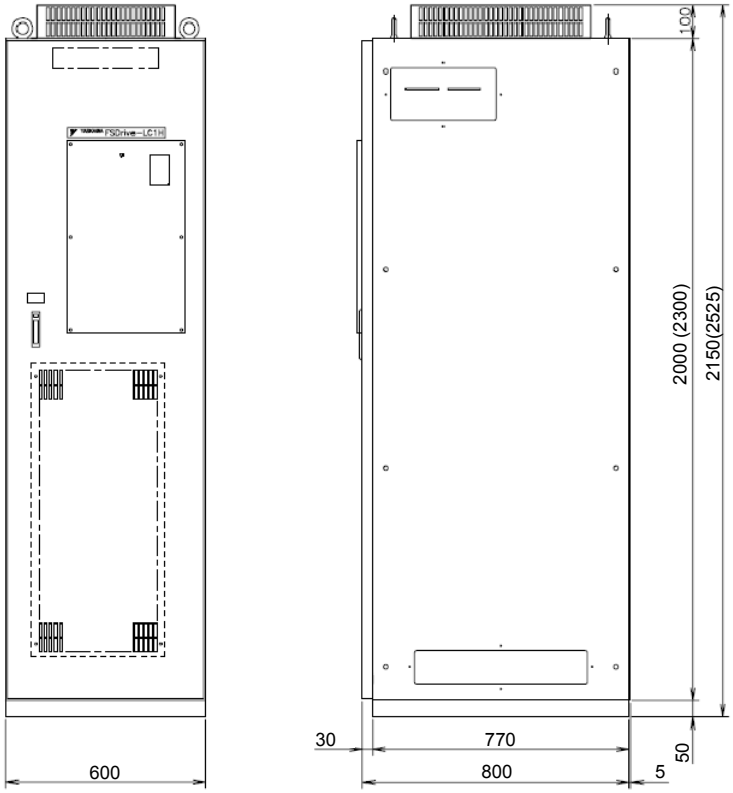
Table 1.1 Items to be Checked

Item	Method
Has the correct regenerative converter model been delivered?	Confirm the order number on the “ORDER NO” column on the nameplate inside the control panel door.
Is the regenerative converter damaged in any way?	Inspect the entire exterior of the product to see if there are any scratches or other damage resulting from shipping. Open the control panel door, and inspect the interior of the control panel to see if there is any damage or displacement, and to confirm that there are no missing parts.
Are any screws or other components loose?	Use a screwdriver or other tool to check for tightness. In particular, check the tightening torque of all terminal screws on the electrical connections.

If you find any irregularities in the above items, contact your supplier or Yaskawa representatives or the nearest Yaskawa sales office immediately.

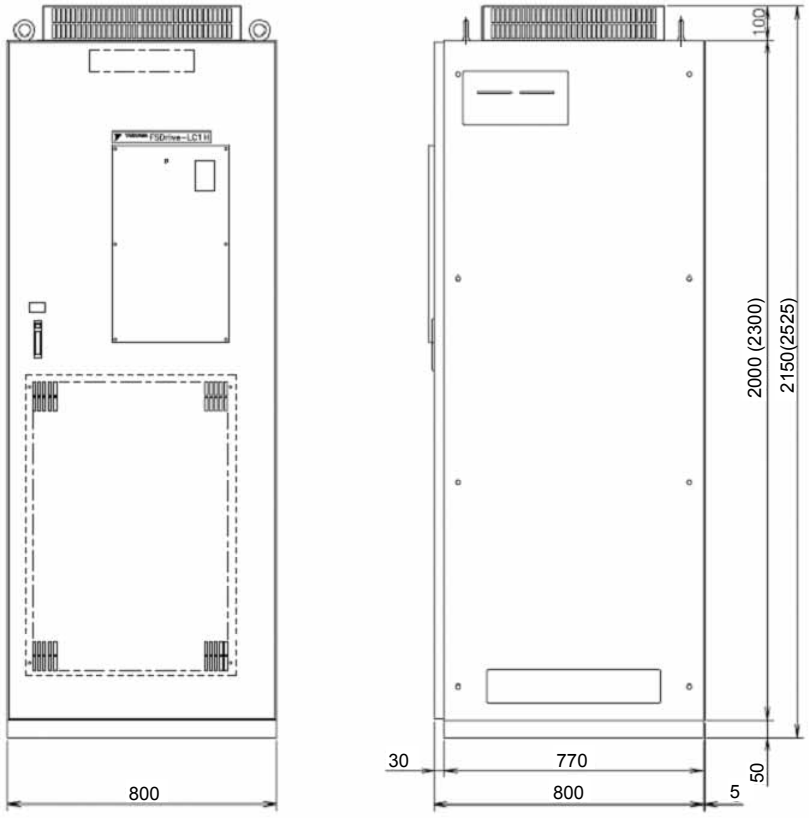
1.2 Dimensions

◆ For 400 V class 200 kW (690 V class 350 kW)



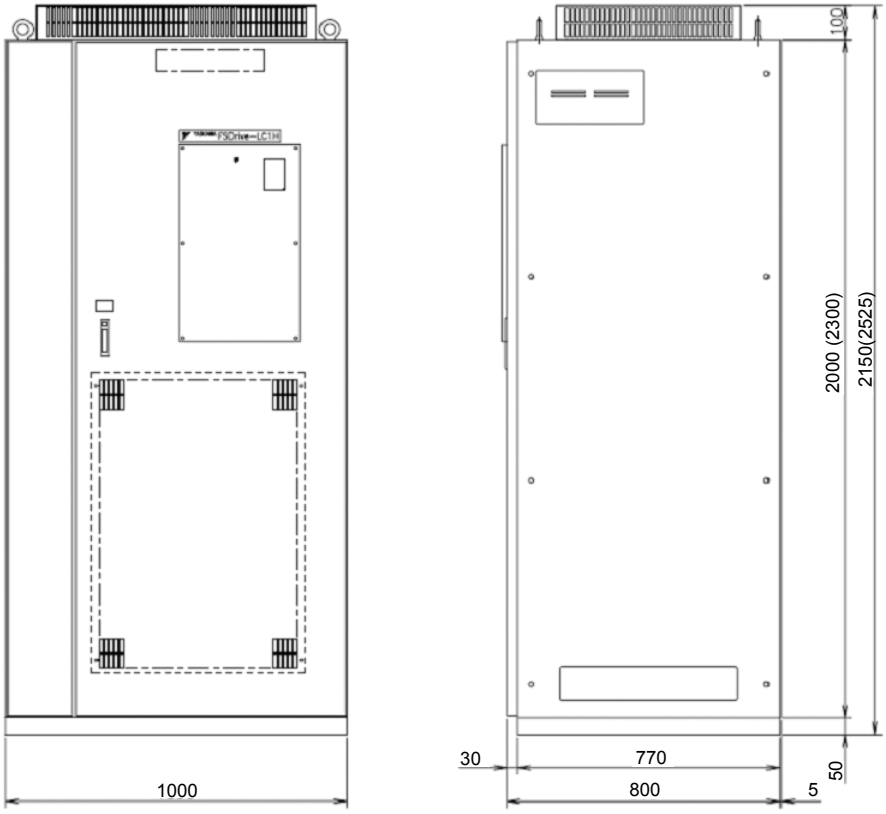
Approximate weight: 450 kg (500 kg)

◆ For 400 V class 400 kW (690 V class 700 kW)



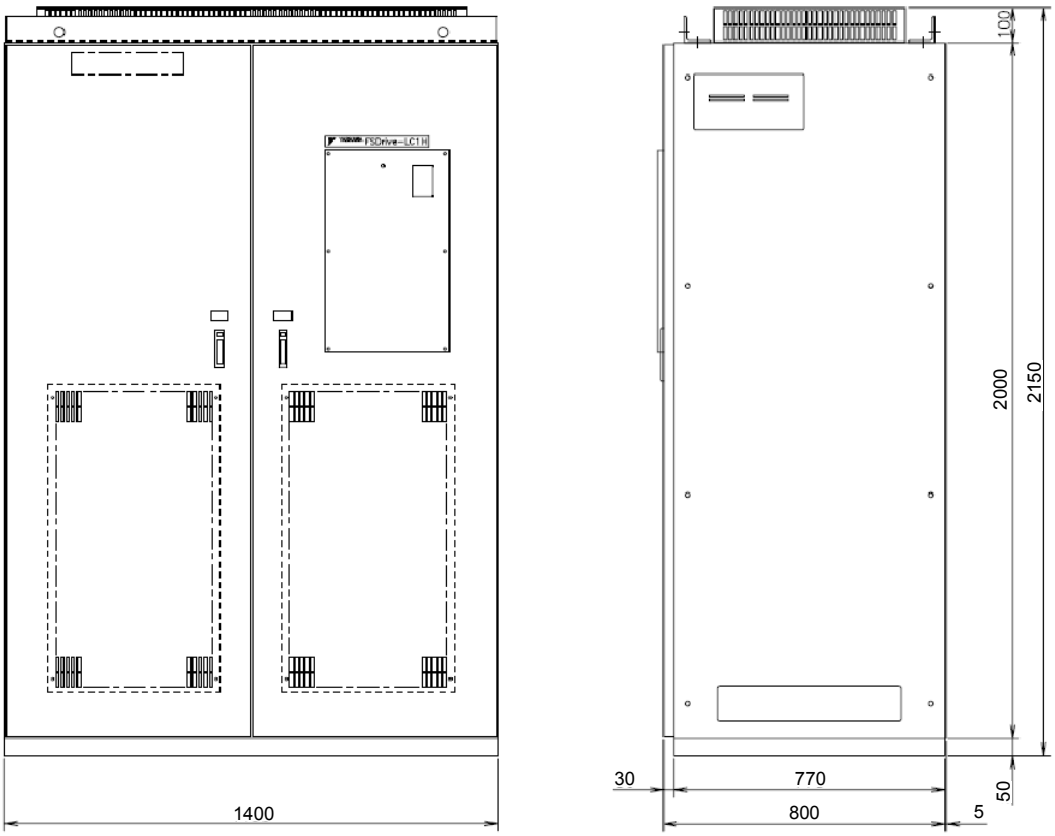
Approximate weight: 650 kg (700 kg)

◆ For 400 V class 600 kW (690 V class 1050 kW)



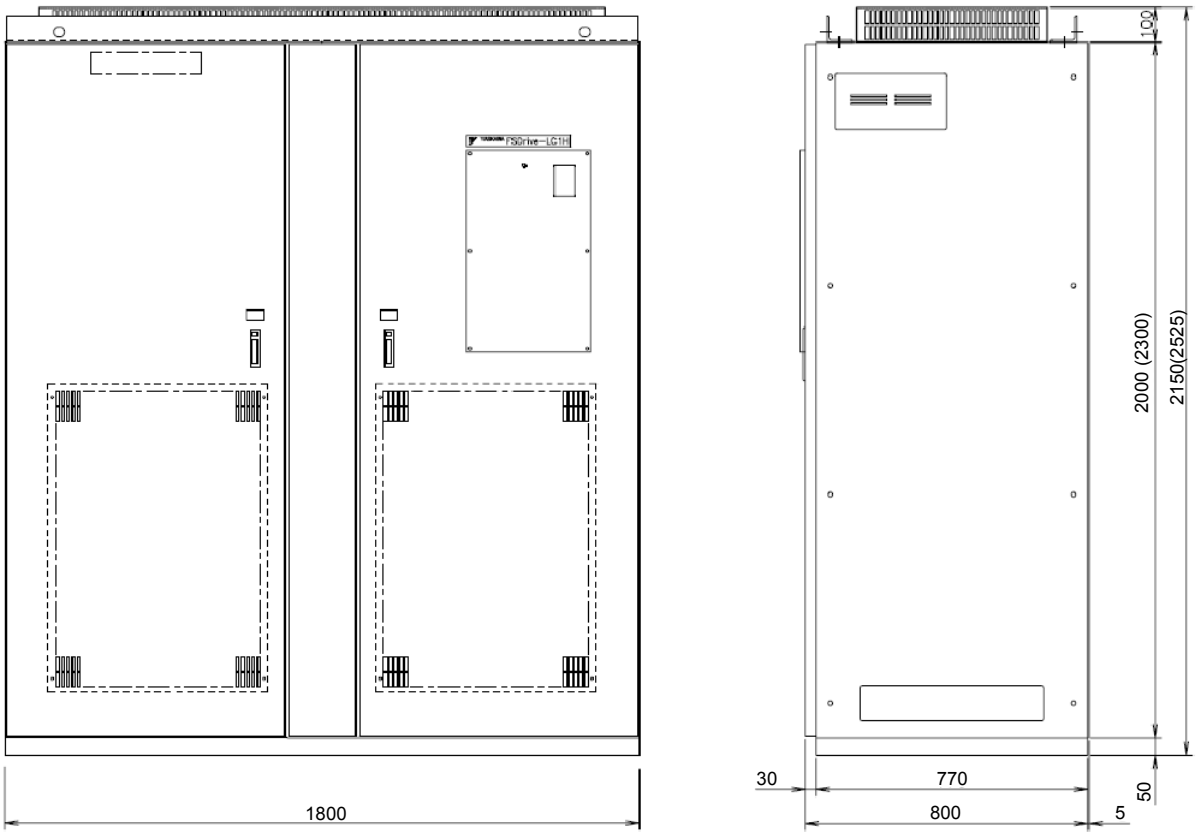
Approximate weight: 900 kg (950 kg)

◆ For 400 V class 800 kW (690 V class 1400 kW)



Approximate weight: 1200 kg (1300 kg)

◆ For 400 V class 1000 kW (690 V class 1750 kW)



Approximate weight: 1400 kg (1500 kg)

1.3 Confirmation and Control of Installation Site

Install the control panel at a location that satisfies the following requirements and maintain the optimum operation conditions.

◆ Installation Site

Install the control panel on the following site.

- Altitude: 1000 m or less
- Ambient temperature:–5 to +40°C
- Relative humidity: 85%RH max. without condensation
- Free from dripping water
- Free from corrosive liquid or gas
- Not subjected to excessive dust and iron powder
- Not subjected to excessive vibration or impact

For the space required for installation, see the dimension drawing of each capacity class. If the control panel must be installed in a location subject to excessive vibration caused by machines such as cranes, contact your Yaskawa representatives or the nearest Yaskawa sales office. The control panel generates noise, including radio noise, to some extent. This should be considered when selecting the installation location.

■ Precautions for Control Panel Periphery Space for Installation

Be sure to observe the following instructions and secure the space indicated in the product dimension drawings when installing the control panel, to maintain sufficient cooling of the control panel.

If the installation space is so limited that the described space cannot be reserved around the control panel, contact your Yaskawa representatives.

1. Space above the control panel
   Secure a distance of at least 1000 mm between the top of the control panel and the room's ceiling.
   Air is expelled to four directions through the cooling fans on top of the control panel. If the cooling fans are too close to the ceiling, expelled air may be returned to the control panel and lower the cooling fan capacity.
   Additionally, sufficient space to remove the cooling fan from the top of the control panel by withdrawing in the upward direction is required for replacement.
2. Space in front of the control panel
   Secure a space of 2000 mm or more in front of the control panel to allow for maintenance.
   Space for a lifter to draw out the units from the control panel is required.
3. Space behind the control panel
   No access from the back of the control panel is necessary.

◆ Controlling the Ambient Temperature

To enhance reliability of operation, the regenerative converter should be installed in an environment free from extreme temperature variations. The ambient temperature and the temperature of incoming air to the control panel must be 40°C or below.

If the regenerative converter is installed in a room of limited space, such as a small electric room, where the room temperature may easily increase, use a cooling fan or air conditioner to maintain the room temperature at 40°C or below.

◆ Protecting the Product from Foreign Matter

Take measures to prevent foreign matter such as metal chips or powder from entering the control panel during installation.

Make sure that any tool or parts are left around/in the control panel after installing it. Carefully check the power flow sections, their surroundings, the air filter section, and the ventilation louver on the top of the control panel, and confirm that there are no foreign objects or obstacles.

1.4 Transportation and Installation

◆ Transporting the Control Panel

- To lift the control panel, use the hanging bolts or angle bars for lifting on top of the control panel.
- Do not ride on the top of the control panel during transportation.

CAUTION! *Movement of the control panel with a crane must be performed only by a qualified crane operator. Otherwise, injury or a dropping the control panel may occur.*

◆ Side-by-Side Installation Method

There are eight holes for side-by-side installation at each side of the control panel. (***Figure 1.1***)

Use M10×25L bolts, washers, S washers, and nuts to join the sections.

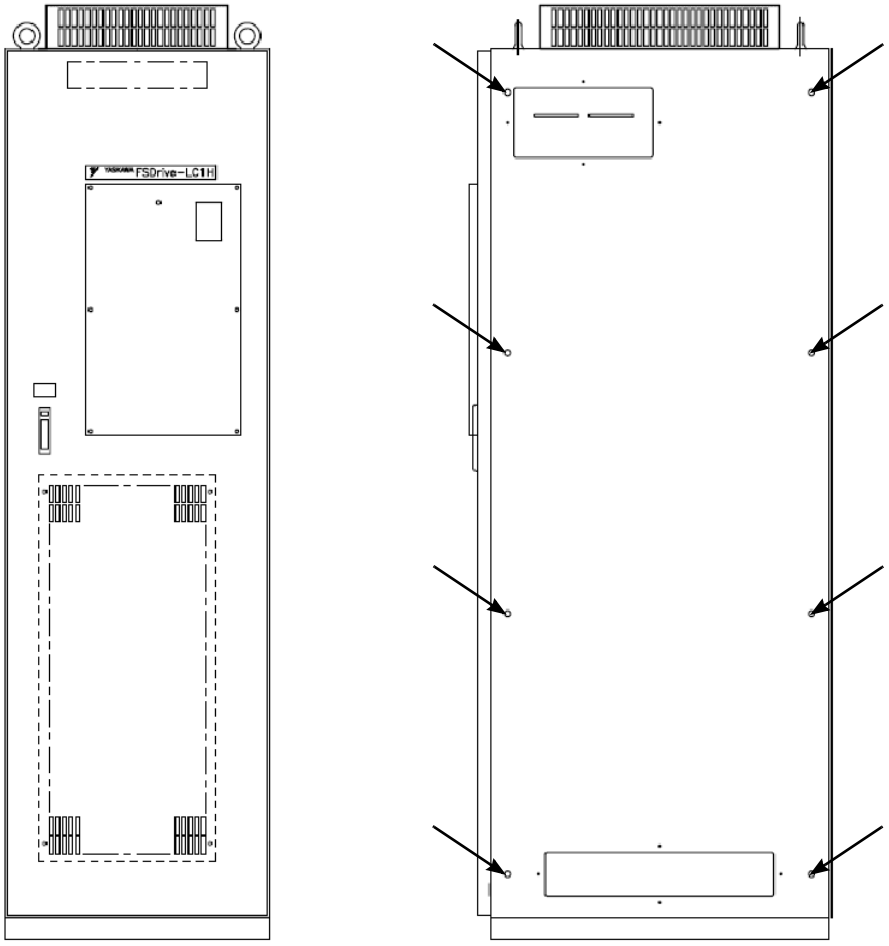


Figure 1.1 Mounting Holes for Side-by-Side Installation Drawing

◆ Installing a Regenerative Converter on a Floor

The table below shows the dimensions of mounting holes when installing the control panel on the floor.

Use mounting screws of M12 diameter to secure the regenerative converter.

Note that all holes should be used even if installing on a normal installation environment without vibration.

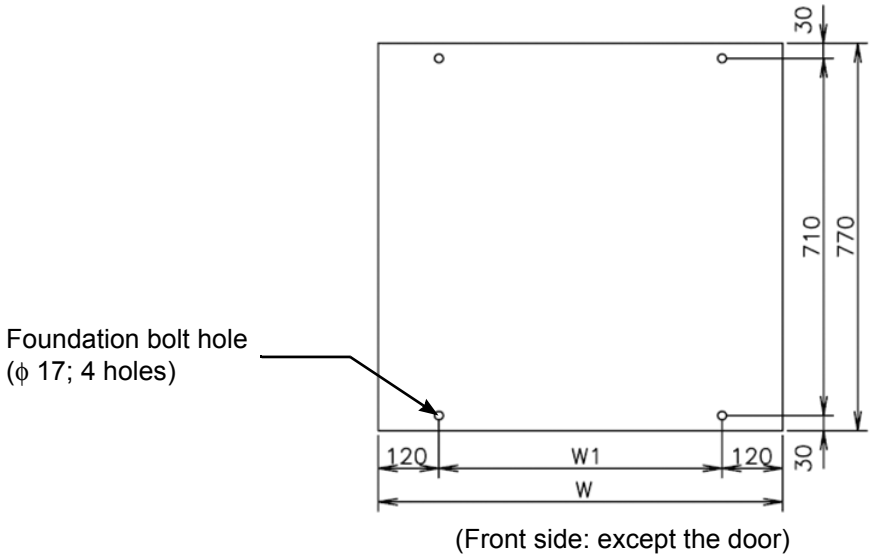


Figure 1.2 Bottom Dimension Drawing

Product Capacity	W (mm)	W1 (mm)	Panel Height (mm)	Approximate Weight (kg)
400 V 200 kW	600	360	2000	450
			2300	500
690 V 350 kW				500
400 V 400 kW	800	560	2000	650
			2300	700
690 V 700 kW				700
400 V 600 kW	1000	760	2000	900
			2300	900
690 V 1050 kW				950
400 V 800 kW	1400	1160	2000	1200
			2300	1250
690 V 1400 kW				1300
400 V 1000 kW	1800	1560	2000	1400
			2300	1450
690 V 1750 kW				1500

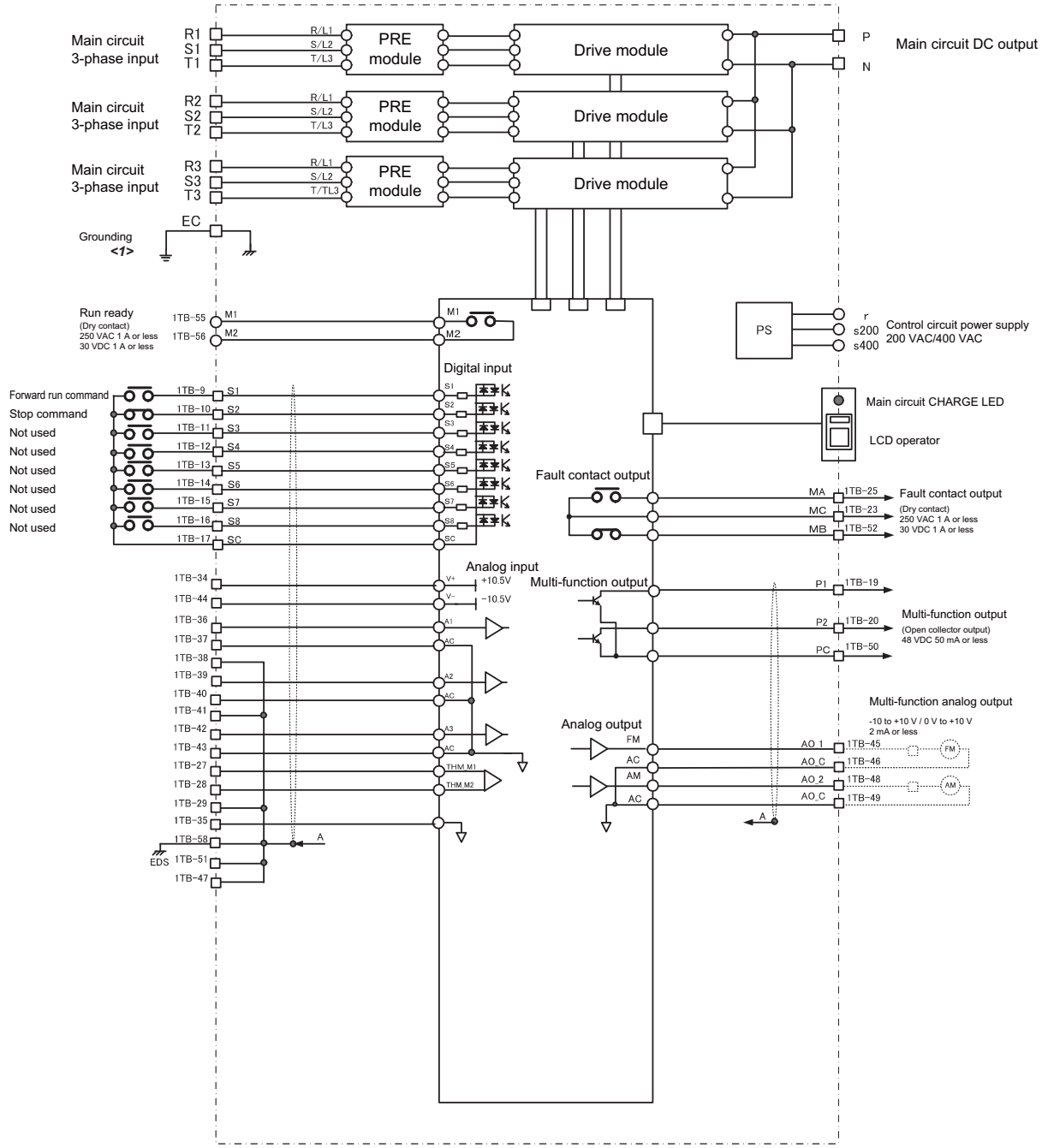
2

Wiring

This chapter describes terminal wirings, main circuit terminal connections and specifications, and control circuit terminal connections and specifications.

2.1 Standard Connection Diagram

Figure 2.1 and *Figure 2.2* shows the standard connection diagram of the control panel.



<1> 400 VAC class (Ground resistance 10 Ω or less, wire size ϕ1.6 mm min.),
690 VAC class (Ground resistance 10 Ω or less, wire size ϕ2.6 mm min.)

Figure 2.1 Standard Connection Diagram (400 V Class/690 V Class, Height: 2300 mm)

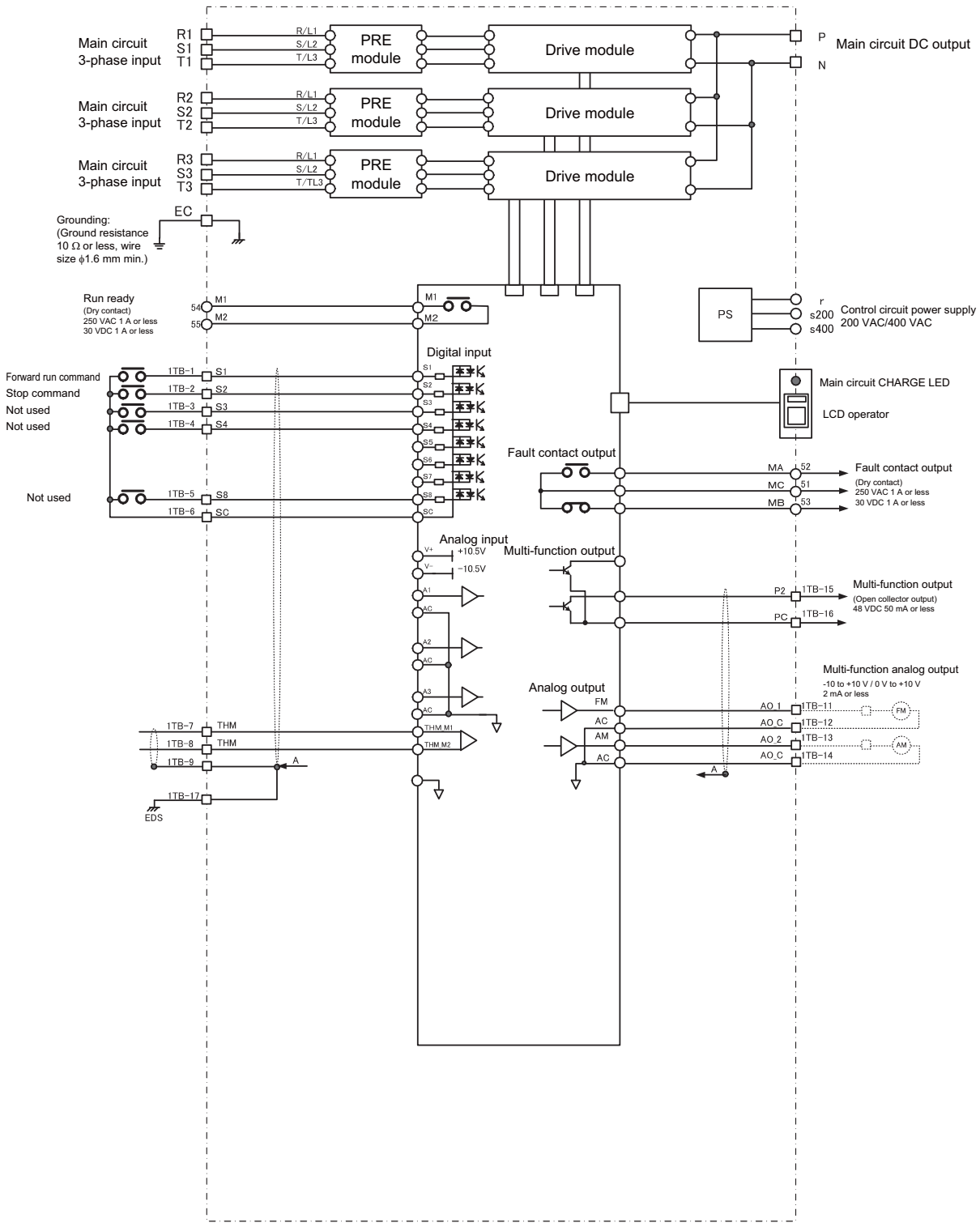


Figure 2.2 Standard Connection Diagram (400 V Class, Height: 2000 mm)

2.2 Terminals

Figure 2.3 shows the terminals provided on the control panel.

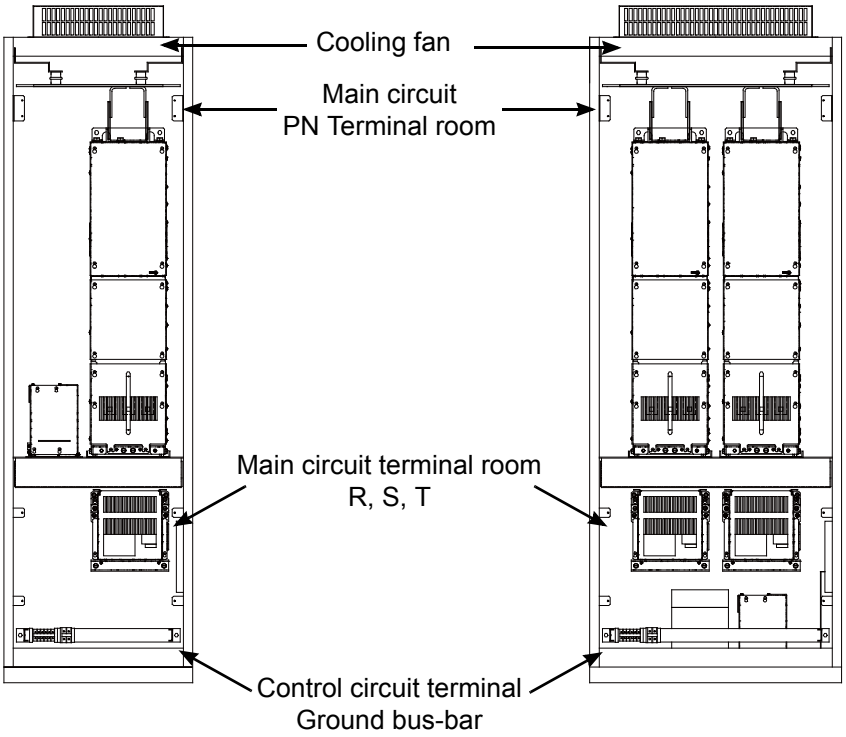


Figure 2.3 Terminal Locations

Note: Drive modules are positioned from left to right, with the 1st module furthest to the left, followed by the 2nd module. Each drive module will display markings to indicate what the module is: 1CNV, 2CNV, and so on.

2.3 Wiring Main Circuit Terminals

◆ Terminal Layout

■ Input Terminals

Table 2.1 Main Circuit Input Terminals

Terminal Code	Signal	Specifications
R	Main circuit phase-R input	Main circuit three-phase input
S	Main circuit phase-S input	
T	Main circuit phase-T input	

■ Output Terminals

Table 2.2 Main Circuit Output Terminals

Terminal Code	Signal	Specifications
P	Main circuit phase-P output	Main circuit DC output
N	Main circuit phase-N output	

◆ Applicable Wire Sizes and Crimp Terminals

Refer to ***Table 2.3*** to select appropriate wires and crimp terminals for main circuit wiring and grounding.

Table 2.3 Terminal Screw Size and Applicable Wire Sizes

Product Capacity	Terminal		Terminal Screw Size	Tightening Torque [N•m]	Applicable Wire Size [mm²]
	Function	Code			
400 V 200 kW 690 V 350 kW	Input	R1, S1, T1	M12	31.5 to 39.5	180 × 2P
400 V 400 kW 690 V 700 kW	Input	R1, S1, T1 R2, S2, T2	M12	31.5 to 39.5	180 × 2P
400 V 600 kW 690 V 1050 kW	Input	R1, S1, T1 R2, S2, T2 R3, S3, T3	M12	31.5 to 39.5	180 × 2P
400 V 800 kW 690 V 1400 kW	Input	R1, S1, T1 R2, S2, T2 R3, S3, T3 R4, S4, T4	M12	31.5 to 39.5	180 × 2P
400 V 1000 kW 690 V 1750 kW	Input	R1, S1, T1 R2, S2, T2 R3, S3, T3 R4, S4, T4 R5, S5, T5	M12	31.5 to 39.5	180 × 2P

IMPORTANT: *A line-to-line voltage drop must be taken into consideration when selecting wire size.*
Determine the wire size for the main circuit so that the line-to-line voltage drop is within 2% of the rated voltage.
In conditions where a voltage drop may arise, increase the wire size depending on the cable length. The line-to-line voltage drop is calculated as follows.
Line-to-line voltage drop (V) = $\sqrt{3}$ × Wire resistance (Ω/km) × Wire length (m) × Current (A) × 10^{-3}

◆ Wiring the Main Circuits

This section describes wiring for the main circuit inputs, and grounding.

For each terminal code, be sure to correctly connect the input terminals.

CAUTION! *Incorrect wiring of input and output terminals will damage the control panel when the power supply is turned on. Otherwise, injury or a dropping the control panel may occur.*

■ Wiring the Main Circuit Input Terminals

Observe the following points when wiring the main circuit input terminals.

Connecting the Control Panel to Power Supply

Connect the input terminals R, S, and T to the power supply lines R, S, and T so that each code of the input terminals and that of power supply lines match.

Never ground fault or short circuit the input terminal

Do not touch the input terminals directly with your hands or do not bring the input wires into contact with the control panel case or metal parts.

These are dangerous because an electric shock and/or a ground fault may occur. In addition, do not short circuit the input wires.

■ Ground Wiring

Observe the following points when wiring grounding lines.

Always ground the ground terminals.

Control circuit (600 V min.): Ground resistance 10 Ω or less, wire size ϕ 2.6 mm min.

Control circuit (400 V max.): Ground resistance 10 Ω or less, wire size ϕ 1.6 mm min.

- Do not share the ground wire with other devices, such as welding machines or power tools.
- Always use a ground wire that complies with the applicable electric code, and always minimize the length of the ground wire.
- When using more than one panel, ground to one point and be careful not to loop the ground wire.

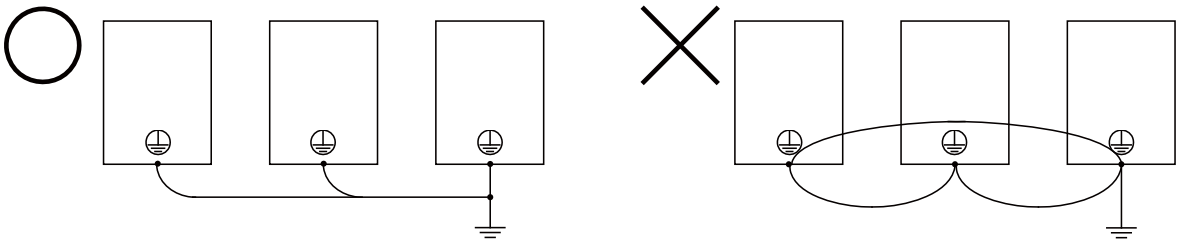


Figure 2.4 Ground Wiring: Wiring Control Circuit Terminals

2.4 Wiring Control Circuit Terminals

◆ Control Circuit Terminal Layout and Specifications

Figure 2.5, ***Figure 2.6***, ***Table 2.4*** and ***Table 2.5*** explains control circuit terminal layout and function respectively. Use appropriate terminals according to the application.

Figure 2.5 Layout of Control Circuit Terminals (400 V Class/690 V Class, Height: 2300 mm)

Figure 2.6 Layout of Control Circuit Terminals (400 V Class, Height: 2000 mm)

■ Terminal Code and Specifications

Table 2.4 Output Terminals (400 V Class/690 V Class, Height: 2300 mm)

Control Circuit Terminal					
Terminal	No.	Signal	Terminal Function	I/O	Signal Level
1TB	1	—			
	2	—			
	3	—			
	4	—			
	5	—			
	6	—			
	7	—			
	8	—			
	9	S1	Sequence input (Forward run command)	Input	24 VDC 8 mA Photocoupler input
	10	S2	Sequence input (Stop command)	Input	
	11	S3	Not used.	Input	
	12	S4	Not used.	Input	
	13	S5	Not used.	Input	
	14	S6	Not used.	Input	
	15	S7	Not used.	Input	
	16	S8	Not used.	Input	
	17	SC		Input	
	18	—			
	19	P1	Multi-function output	Output	48 VDC 50 mA Open collector output
	20	P2	Multi-function output	Output	
	21	—			
	22	—			
	23	MC	Fault contact output: Common	Output	Dry contact 250 VAC, from 1 A or less 30 VDC, from 1 A or less
	24	—	—	—	
	25	MA	Fault contact output (NO contact)	Output	
	26	—			
	27	—			
	28	—			
	29	EDS	Shield sheath	—	
	30	—			
	31	—			
	32	—			
	33	—			
	34	—			
	35	—			
	36	—			
	37	—			
	38	EDS	Shield sheath	—	
	39	—			
	40	—			
	41	EDS	Shield sheath	—	
	42	—			
	43	—			
	44	—			
	45	AO_1	Multi-function analog monitor 1	Output	From –10 V to +10 V/from 0 V to +10 V 2 mA or less
	46	AO_C	Analog monitor: Common	Output	
	47	EDS	Shield sheath	—	
	48	AO_2	Multi-function analog monitor 2	Output	From –10 V to +10 V/from 0 V to +10 V 2 mA or less
	49	AO_C	Analog monitor: Common	Output	
	50	PC	Multi-function output: Common	Output	
	51	EDS	Shield sheath	—	

Control Circuit Terminal					
Terminal	No.	Signal	Terminal Function	I/O	Signal Level
1TB	52	MB	Fault contact output (NC contact)	Output	
	53	—			
	54	—			
	55	M1	Ready (NO contact)	Output	Dry contact 250 VAC, 1 A or less 30 VDC, 1 A or less
	56	M2		Output	
	57	—			
	58	EDS	Shield sheath	—	

Table 2.5 Output Terminals (400 Class, Height 2000 mm)

Control Circuit Terminal					
Terminal	No.	Signal	Terminal Function	I/O	Signal Level
1TB	1	S1	Sequence input (Forward run command)	Input	24 VDC 8 mA Photocoupler input
	2	S2	Sequence input (Stop command)	Input	
	3	S3	Not used.	Input	
	4	S4	Not used.	Input	
	5	S8	Not used.	Input	
	6	SC	Sequence input: Common	Input	
	7	—	—	—	
	8	—	—	—	
	9	EDS	Shield sheath	—	
	10	—	—	—	
	11	AO_1	Multi-function analog monitor 1	Output	From –10 V to +10 V/from 0 V to +10 V 2 mA or less
	12	AO_C	Analog monitor: Common	Output	
	13	AO_2	Multi-function analog monitor 2	Output	
	14	AO_C	Analog monitor: Common	Output	
	15	P2	Multi-Function output 2	Output	48 VDC 50 mA Open collector output
	16	PC	Multi-Function output: Common	Output	
	17	EDS	Shield sheath	—	
	18	—	—	—	
	19	—	—	—	
	20	—	—	—	

■ Control Power Supply Input Terminals

Table 2.6 Control Power Supply Input Terminal

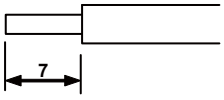
Type	Signal	Terminal Function	Terminal Code	Remarks
For control power supply input	R	100/220 VAC 50 Hz/60 Hz	r	
	S		s200	
	R	100/440 VAC 50 Hz/60 Hz	r	
	S		s400	

◆ Applicable Wire Sizes

Table 2.7 shows the terminal code and wire size of each terminal. Select an appropriate wire size considering the current capacity.

Table 2.7 Wire Size

Terminal Type	Terminal Code	Applicable Wire Size	Conduction Current	Terminal Treatment
Control circuit	1 to 58	2 mm^2 or less	0.5 A	7 mm



◆ Control Circuit Wiring Precautions

Observe the following precautions when wiring control circuits.

- For the control circuit wiring, separate the wirings among the analog I/O, relay sequence I/O, and other power lines.
- Use shielded twisted-pair wires for analog I/O wirings to prevent malfunctions caused by noise.
- Lay the shielded wires so that they will not have contact with other signal lines and devices.
- Tighten the screws with the specified tightening torque.
- Use round crimp terminals to connect cables to the terminal block.
- Use a Phillips screw driver to tighten terminal screws.

2.5 Wiring Check

◆ Checks

Check all wiring after wiring work has been completed. If using a buzzer to check wiring, make sure the buzzer has a surge absorber installed in order to prevent damage to semi-conductor components and other control-related devices. Confirm the following items.

- All wiring is correct.
- No foreign matter such as wire chips or unnecessary screws remain.
- All screws are securely tightened.
- No wire ends have contact with terminals other than the ones they are connected to.

3

Basic Operation and Test Run

This chapter describes the performance of LCD operator, each mode of LCD operator and the operation of an FSDrive-LC1HS.

3.1 Section Safety

⚠ DANGER

Electrical Shock Hazard

Be sure to close the front door before turning on the regenerative converter.

Do not open the front door while power is being supplied.

Failure to comply could result in death or serious injury.

Do not connect or disconnect wiring while the power is on.

Failure to comply could result in death or serious injury.

Do not operate the LCD operator, switches and so on with wet hands.

Failure to comply could result in death or serious injury.

⚠ WARNING

Electrical Shock Hazard

Do not operate equipment with the front door of the regenerative converter panel open or with the covers of the control panel removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may illustrate equipment without covers or safety shields to display details. Be sure to reinstall covers or shields before operating the regenerative converter and run the regenerative converter according to the instructions described in this manual.

Do not remove covers in the regenerative converter panel or touch any internal modules or terminals while the power is on.

Failure to comply could result in death or serious injury.

Fire Hazard

Do not touch the heatsink because it becomes very hot.

Failure to comply could result in a burn injury.

NOTICE

Equipment Hazard

Do not perform signal check during operation.

Incorrect sequence of operations could result in damage to the regenerative converter.

Confirm the following before turning on the power supply.

Incorrect sequence of operations could result in damage to the regenerative converter.

- Confirm that the power supply voltage is correct.
  400 V class: 380 to 480 VAC, 50/60 Hz
  690 V class: 600 to 690 VAC, 50/60 Hz
- Confirm that the regenerative converter and the controller are correctly connected. (Confirm that the phase sequence correct.)
- Confirm that the phases connection between the main circuit terminals of the regenerative converter (R/L1, S/L2, and T/L3) and the terminals of the power supply voltage detection (r1/I11, s1/I21, and t1/I31) are correct.
- Confirm that the control circuit terminals of the regenerative converter and the controller are correctly connected.
- Confirm that Run commands of both the regenerative converter and the controller are turned off.

3.2 Using the LCD Operator

Use the LCD operator to enter run and stop commands, display data, edit parameters, as well as display fault, minor fault, and error, etc.

◆ Keys and Displays

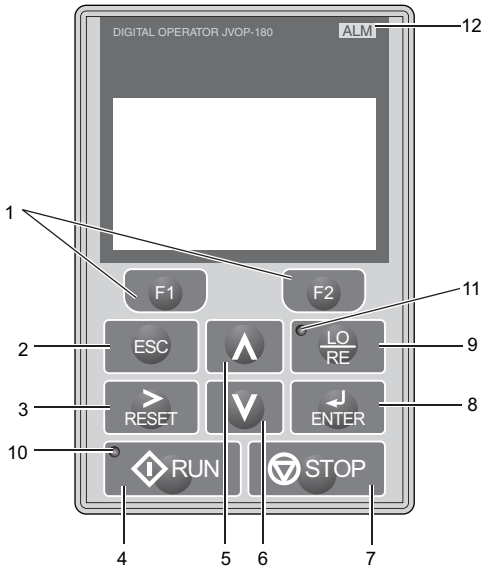


Figure 3.1 Keys and Displays on the LCD Operator

No.	Key	Name	Function
1	F1 F2	Function Key (F1, F2)	The functions assigned to F1 and F2 vary depending on the menu that is currently displayed. The name of each function appears in the lower half of the display window. Refer to ***LCD Display on page 3-4*** for the details of the functions assigned.
2	ESC	ESC Key	• Returns to the previous display. • Moves the cursor one space to the left. • Pressing and holding this button will return to the Voltage Reference display.
3	RESET	RESET Key	• Moves the cursor to the right. • Resets the regenerative converter to clear a fault situation.
4	RUN	RUN Key	Runs the regenerative converter in the LOCAL mode. The Run LED • is on, when the regenerative converter is operating the motor. • flashes during deceleration to stop or when the frequency reference is 0. • flashes quickly the regenerative converter is disabled by a DI, the regenerative converter was stopped using a fast stop DI or a run command was active during power up.
5	∧	Up Arrow Key	• Scrolls up to display the next item. • Selects parameter numbers and increments setting values.
6	∨	Down Arrow Key	• Scrolls down to display the next item. • Selects parameter numbers and increments setting values.
7	STOP	STOP Key <1>	Stops regenerative converter operation.
8	ENTER	ENTER Key	• Enters parameter values and settings. • Selects a menu item to move between displays.
9	LO RE	LO/RE Selection Key <2>	Switches regenerative converter control between the LCD operator (LOCAL) and the control circuit terminals (REMOTE).
10	RUN	RUN Light	Lit while the regenerative converter is operating the motor. Refer to page ***3-5*** for flashing of the indicator.
11	LO RE	LO/RE Light	Lit while the operator is selected to run the regenerative converter (LOCAL mode).
12	ALM	ALM LED Light	Refer to ***ALARM (ALM) LED Displays on page 3-5*** for the details.

<1> The STOP key has highest priority.
Pressing the STOP key will always cause the regenerative converter to stop the motor, even if a Run command is active at any external Run command source. To disable the STOP key priority, set parameter o2-02 to 0.
<2> The LO/RE key can only switch between LOCAL and REMOTE when the regenerative converter is stopped.
To disable the LO/RE key to prohibit switching between LOCAL and REMOTE, set parameter o2-01 to 0.

◆ LCD Display

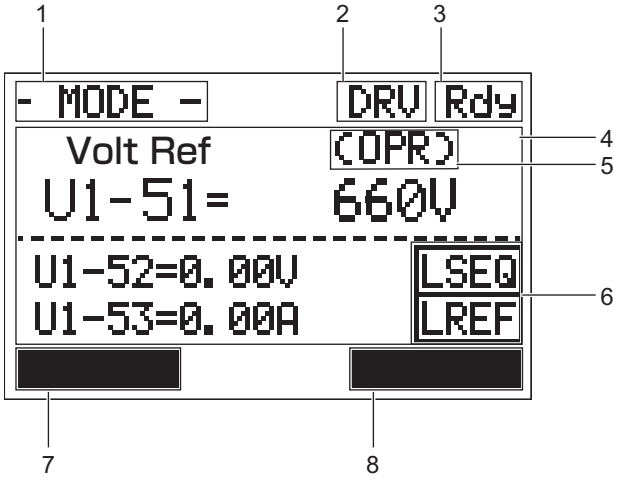


Figure 3.2 LCD Display

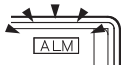
Table 3.1 Display and Contents

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.
2	Mode Display Area	DRV	Displayed when in Drive Mode.
		PRG	Displayed when in Programming Mode.
3	Ready	Rdy	Indicates the regenerative converter is ready to run.
4	Data Display	–	Displays specific data and operation data.
5	Voltage Reference Assignment <1>	OPR	Displayed when the voltage reference is assigned to the LCD Operator Option.
6	LO/RE Display <2>	RSEQ	Displayed when the run command is supplied from a remote source.
		LSEQ	Displayed when the run command is supplied from the LCD operator keypad.
		RREF	Displayed when the frequency reference is supplied from a remote source.
		LREF	Displayed when the frequency reference is supplied from the LCD operator keypad.
7	Function Key 1 (F1)	HELP	Pressing F1 displays the Help menu.
		←	Pressing F1 scrolls the cursor to the left.
		HOME	Pressing F1 returns to the top menu (Voltage Reference).
		ESC	Pressing F1 returns to the previous display.
8	Function Key 2 (F2)	DATA	Pressing F2 scrolls to the next display.
		→	Pressing F2 scrolls the cursor to the right.
		RESET	Pressing F2 resets the existing regenerative converter fault or error.

<1> Displayed when in Voltage Reference Mode.
<2> Displayed when in Voltage Reference Mode and Monitor Mode.

◆ ALARM (ALM) LED Displays

Table 3.2 ALARM (ALM) LED Status and Contents

Status	Content	Display
Lit	When the regenerative converter detects a fault.	
Flashing	• When an alarm occurs. • When oPE is detected.	
Off	Normal operation (no fault or alarm).	

◆ LO/RE LED and RUN LED Indications

Table 3.3 LO/RE LED and RUN LED Indications

LED	Lit	Flashing	Flashing Quickly <1>	Off
	When source of the Run command is assigned to the LCD operator (LOCAL)	–	–	Run command to be given from a device other than the LCD operator (REMOTE)
	During run	–	During stop by operation interlock <2>	During stop
Examples				

<1> Refer to ***Figure 3.3*** for the difference between flashing and flashing quickly regarding the RUN indicator.
<2> The LED will flash quickly in the following cases.

- While the regenerative converter is set for LOCAL, a Run command was entered to the input terminals after which the regenerative converter was then switched to REMOTE.
- A Run command was entered via the input terminals while not in the Drive Mode.
- During deceleration when a Fast Stop command was entered.
- While the regenerative converter was running in the REMOTE mode, the STOP key was pushed.

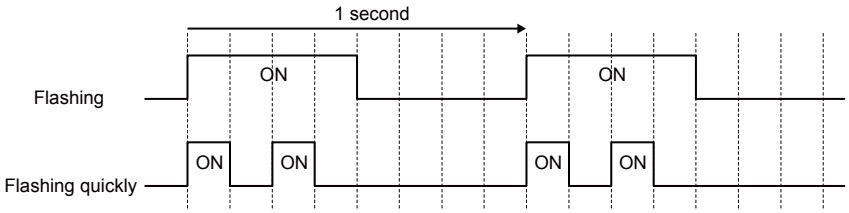


Figure 3.3 RUN LED Status and Meaning

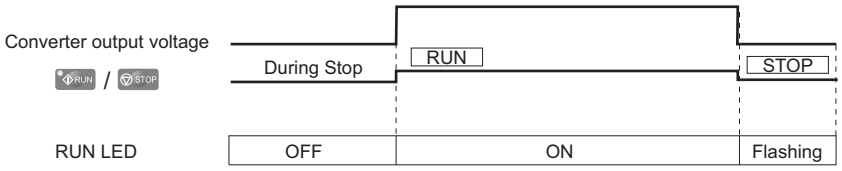
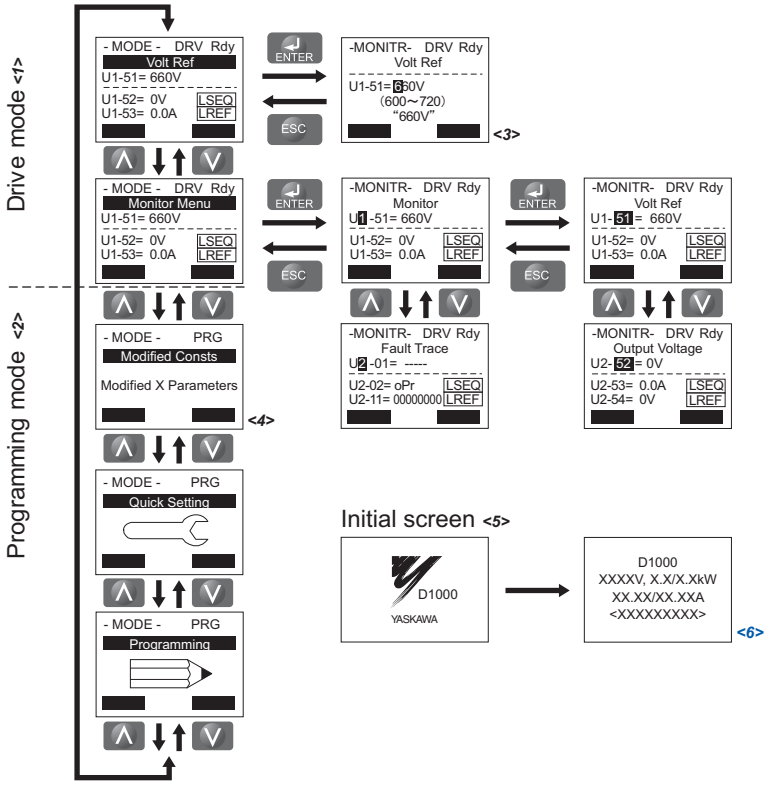


Figure 3.4 RUN LED and Regenerative Converter Operation

◆ Menu Structure for LCD Operator



<1> Pressing RUN will start the motor.
<2> The regenerative converter cannot operate the motor.
<3> Flashing characters are shown as 0.
<4> X characters are shown in this manual. The LCD Operator will display the actual setting values.
<5> The Voltage Reference appears after the initial display which shows the product name.
<6> The information that appears on the display will vary depending on the regenerative converter.

Figure 3.5 LCD Operator Menu and Screen Structure

3.3 The Drive and Programming Modes

The regenerative converter has a Programming Mode to program the regenerative converter for operation, and a Drive Mode used to actually run the motor.

Drive Mode: In the Drive Mode, the user can start the motor and observe operation status with the monitors that are available. Parameter settings cannot be edited or changed when in the Drive Mode.

Programming Mode: The Programming Mode allows access to edit, adjust, and verify parameters. Unless set to allow a Run command, the regenerative converter will not accept a Run command when the LCD operator is in the Programming Mode.

Table 3.4 describes the functions accessible by pressing the ∧ · ∨ keys of the LCD operator.

Note: To allow the regenerative converter to run the motor while in the Programming Mode, set b1-08 to 1.

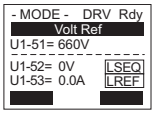
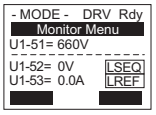
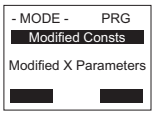
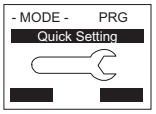
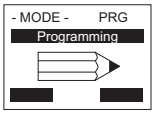
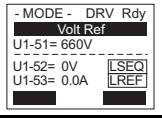
Table 3.4 Modes

Mode	Contents	Key	LCD display
Drive Mode (Operation/Operation Status Monitor of the Regenerative Converter)	Output Voltage Reference	∧ · ∨	- MODE - DRV Rdy Volt Ref U1-51= 660V U1-52= 0V LSEQ U1-53= 0.0A LREF
	Monitor Display	∧ · ∨	- MODE - DRV Rdy Monitor Menu U1-51= 660V U1-52= 0V LSEQ U1-53= 0.0A LREF
Programming Mode (Parameter Setting)	Verify Menu	∧ · ∨	- MODE - PRG Modified Consts Modified X Parameters
	Setup Group	∧ · ∨	- MODE - PRG Quick Setting
	Parameter Setting Mode	∧ · ∨	- MODE - PRG Programming

◆ Navigating the Drive and Programming Modes

NOTICE: Hazard Equipment
Confirm the following before turning on the power supply.
Confirm that the power supply voltage is correct.
400 V class: 380 to 480 VAC 50/60 Hz
690 V class: 600 to 690 VAC 50/60 Hz
Confirm that the regenerative converter and the controller are correctly connected. (Confirm that the phase sequence is correct.) Confirm that the phases connection between the main circuit terminals of the regenerative converter (R/L1, S/L2, and T/L3) and the terminals of the power supply voltage detection (r1/I11, s1/I21, and t1/I31) are correct.
Confirm that the control circuit terminals of the regenerative converter and other controllers are correctly connected.
Confirm that Run commands of both the regenerative converter and the controller are turned off.

The regenerative converter is set to operate in Drive Mode when it is first powered up. Switch between display screens by using the ∧ or ∨ keys.

Power Up	**Output Voltage Reference**  **Default Setting**	This display screen allows the user to monitor and change the Output Voltage Reference. Refer to ***The Drive and Programming Modes on page 3-7*** for the procedure to change the voltage set value. **Note:** The user can select the data displayed when the regenerative converter is first powered up with parameter o1-02.
Drive Mode		
	Monitor Display  	Lists the monitor parameters (U☐-☐☐ parameters) available in the regenerative converter.
Programming Mode		
	Verify Menu  	Lists all parameters that have been edited or changed from default settings. ➡ ***Verifying Parameter Changes: Verify Menu on page 3-11***
		
Programming Mode	**Setup Group**  	Lists parameters necessary to get the regenerative converter operating quickly. ➡ Refer to ***Simplified Setup Using the Setup Group on page 3-10***.
		
	Parameter Setting Mode  	Allows the user to access and edit all parameter settings.
		
Drive Mode	**Output Voltage Reference**  	Returns to the output voltage reference screen.

■ Drive Mode Details

The following actions are possible in the Drive Mode:

- Run and stop the regenerative converter
- Monitor the operation status of the regenerative converter (output voltage reference, output voltage, output current, etc.)
- View information on an alarm
- View a history of alarms that have occurred

Note: To run the regenerative converter, select the Drive Mode. Other modes are selectable while the regenerative converter is stopped but only the Drive Mode can start operation of the regenerative converter.

Key operations in the Drive Mode are shown in the following figure.

Figure 3.6 illustrates how to change the output voltage reference from 600 (600 V) to 720 (720 V) while in the Drive Mode. This example assumes the regenerative converter is set to LOCAL.

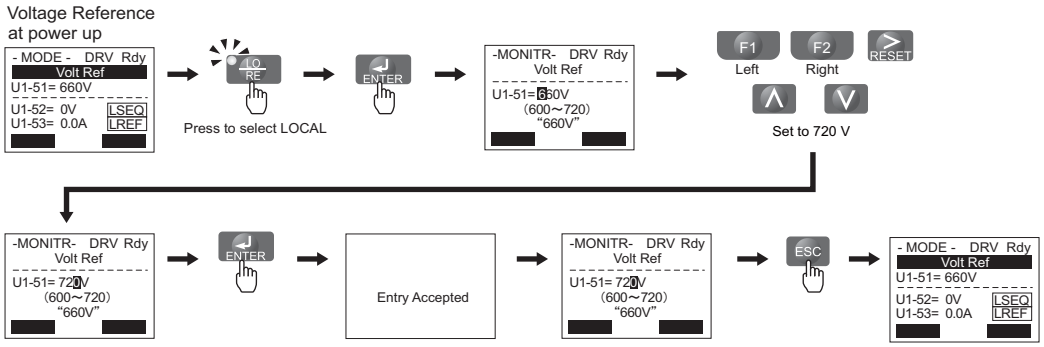


Figure 3.6 Setting the Voltage Reference while in the Drive Mode

Note: The regenerative converter will not accept a change to the output voltage reference until the ENTER key is pressed after the output voltage reference is entered. This feature prevents accidental setting of the voltage reference. To have the regenerative converter accept changes to the voltage reference as soon as changes are made without requiring the ENTER key, set o2-05 to 1.

■ Programming Mode Details

In the programming mode, parameter setting is enabled. The following actions are possible in the Programming Mode:

- **Verify Menu**: Check a list of parameters that have been changed from their original default values
- **Parameter Setting Mode**: Access and edit all parameter settings

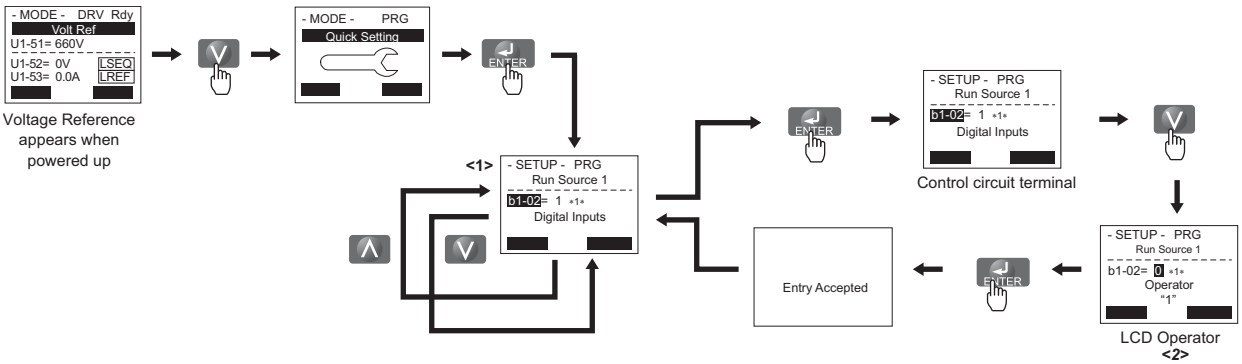
Simplified Setup Using the Setup Group

In the Setup Group, the regenerative converter lists the basic parameters needed to set up the regenerative converter for the application. It provides a simplified way to get the application running right away by showing only the most important parameters. Refer to ***Figure 3.7*** as an operation example.

Note: Refer to Appendix for the parameters of the setup mode. The parameters indicated with the access level "S" can be set/ monitored.

Key operations in the setup mode are shown in the following figure.

In this example, the Setup Group is accessed to change b1-02 from 1 to 0. This changes the source of the Run Command from the control circuit terminals to the LCD operator.



<1> Use the ∧ and ∨ arrow keys to scroll through the Setup Group. Press the ENTER key to view or change parameter settings.
<2> To return to the previous menu without saving changes, press the ESC key.

Figure 3.7 Setup Group Example

◆ Changing Parameter Settings or Values

Key operations are shown in the following using Voltage up Times (C1-20) for an example.

This example explains changing C1-20 (Voltage up Times) setting from 10.0 seconds (default) to 20.0 seconds.

	Operating Procedure		LCD Display
1	Display the Output Voltage Reference screen.	→	- MODE - DRV Rdy Volt Ref U1-51= 660V U1-52= 0V LSEQ U1-53= 0.0A LREF
2	Press ∧ or ∨ to display the parameter setting mode screen.	→	- MODE - PRG Programming
3	Press ENTER to enter the parameter menu tree.	→	-PRMSET- PRG Initialization A1-00= 1 Select Language
4	Select C1-20 by ∧ , ∨ , F1 or F2 , and press ENTER .	→	-PRMSET- PRG VRef Up Rate C1-20= 0010.0sec (0.0～100.0) "10.0sec"
5	Press the ∧ , ∨ , F1 or F2 key and enter 0020.0.	→	-PRMSET- PRG VRef Up Rate C1-20= 0020.0sec (0.00～100.0) "10.0sec"
6	Press ENTER and the regenerative converter will confirm the change.	→	Entry Accepted

◆ Verifying Parameter Changes: Verify Menu

The Verify Menu lists edited parameters from the Programming Mode. It helps determine which settings have been changed, and is particularly useful when replacing a regenerative converter. If no settings have been changed, the Verify Menu will read "nonE." The Verify Menu also allows users to quickly access and re-edit any parameters settings that have been changed. The procedure is shown below.

	Operating Procedure		LCD Display
1	Turn on the power to the regenerative converter. The initial display appears.	→	- MODE - DRV Rdy Volt Ref U1-51= 660V U1-52= 0V LSEQ U1-53= 0.0A LREF
2	Press ∧ or ∨ until the verify screen is displayed.	→	- MODE - PRG Modified Consts Modified X Parameters
3	Press ENTER to enter the list of parameters that have been edited from their original default settings. Press ∧ or ∨ displays the changed parameters. Press ∧ or ∨ until C1-20 is displayed.	→	- VERIFY - PRG VRef Up Rate C1-20 = 20.0sec (0.0~100.0) "10.0sec"
4	Press ENTER to verify the changed set values (The leftmost digit flashes.).	→	- VERIFY - PRG VRef Up Rate C1-20=0020.0sec (0.0~100.0) "10.0sec"

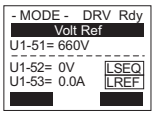
◆ Switching between LOCAL and REMOTE

When the regenerative converter is set to accept the Run command from the LCD operator RUN key, this is referred to as LOCAL mode. When the regenerative converter is set to accept the Run command from an external device (via the input terminals, serial communications, etc.) this is referred to as REMOTE mode.

The operation can be switched between LOCAL and REMOTE either by using the LO/RE key on the LCD operator or a digital input.

Note: **1.** After selecting LOCAL, the LO/RE light will remain lit.
2. The regenerative converter will not allow the user to switch between LOCAL and REMOTE during run.

■ Using the LO/RE Key on the LCD Operator

Operating Procedure			LCD Display
1	Turn on the power to the regenerative converter. The initial display appears.	→	
2	Press LO/RE. The LO/RE light will light up. To set the regenerative converter for REMOTE operation, press the LO/RE key again. The LO/RE light will turn off.	→	

■ Using Digital Input Terminals S1 through S8 to Switch between LO/RE

The user can also switch between LOCAL and REMOTE modes using one of the digital input terminals S1 through S8 (set the corresponding parameter H1-□□ to "1").

The following section describes the procedure of configuring the multi-function digital input terminals.

Note: Setting H1-□□ to 1 disables the LO/RE key on the LCD operator.

◆ Setup Group Parameters

■ Setup Group (STUP)

Parameters used in this regenerative converter are categorized into A to U. In order to simplify the regenerative converter's setup, only the frequently used parameters are selected into the setup mode.

1. Display the "Setup Group" screen first. Press the ∧ or ∨ key until the "Setup Group" screen is displayed.
2. Select a parameter, and change the setting. *Table 3.5* shows the parameters that can be used in the Setup Group. If a parameter to set is not found in the Setup Group, use the "Parameter Setting Mode" screen.

Note: This manual explains also the parameters that are not displayed in the setup mode. Use the "Par" menu in the programming mode when setting a parameter that is not displayed in the setup mode.

Table 3.5 Setup Group Parameters

No.	Name
b1-02	Run Command Selection 1
b1-18	Voltage Reference Source Selection 1
d8-01	DC Bus Voltage Reference

3.4 Power Up and Checking the Operation Display Status

◆ Power Up the Regenerative Converter and Checking the Operation Display Status

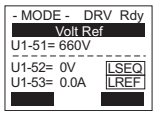
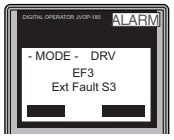
■ Power Up

Confirm the following before turning on the power supply.

Item to Check	Description
Power Supply Voltage	Confirm that the power supply voltage is correct. 400 V class: 380 to 480 VAC, 50/60 Hz 690 V class: 600 to 690 VAC, 50/60 Hz
	Be sure to connect to power supply input terminals R/L1, S/L2 and T/L3 respectively.
	Confirm that the phase connection between the power supply input terminals (R/L1, S/L2, and T/L3) and the power supply voltage detection lines (r1/I11, s1/I21, and t1/I31) is correct.
	Confirm that the regenerative converter is grounded correctly.
Connection between Regenerative Converter Output Terminals and Controller Input Terminals	Confirm that the regenerative converter output terminals (+ and –) and the controller DC power supply input terminals (+ and –) are securely and correctly connected.
Connection to Control Circuit Terminals of the Regenerative Converter	Confirm that the control circuit terminals of the regenerative converter and the controllers of periphery equipment are correctly connected.
Status of Run Command	Confirm that Run command of the regenerative converter and that of the controller of periphery equipment are turned off.

■ Checking the Display Status

When the power is turned on, the LCD operator in the normal status displays the following.

No	Name	Description
Normal Operation		Monitor of the Output Voltage Reference is displayed on the data display section.
Fault	 (Example) External fault	The display content depends on the details of fault. Take appropriate measures by referring to ***Troubleshooting on page 4-1***. ALM lights.

3.5 Operating with the AC Drive

◆ Standard Connection Diagram with AC Drive

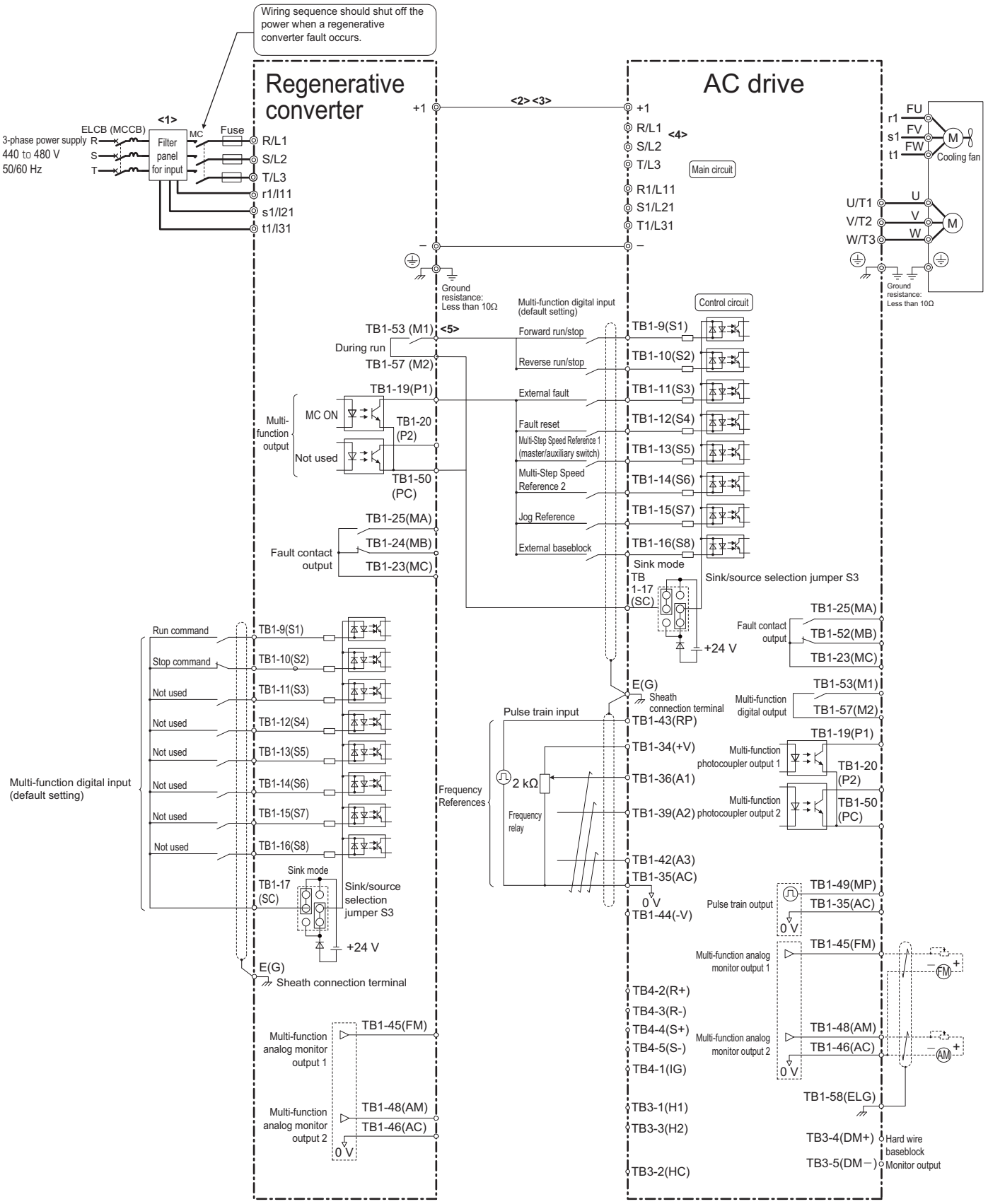


Figure 3.8 Standard Connection Diagram with AC Drive

<1> Be sure to install an input filter panel. Using any other components can lead to erroneous operation.
<2> Keep the DC bus wiring between the regenerative converter and the drive under 5 m.
<3> Note the following when wiring an emergency switch that shuts off power. These points concern a magnetic contactor and a circuit breaker installation on the output side of the regenerative converter.
・Always make sure that the CHARGE indicator on both the regenerative converter and the AC drive has gone out before attempting any wiring or installation. Failure to do so may result in excessive current flow, damaging the AC drive and regenerative converter.
・Make sure that the magnetic contactor and the circuit breaker on the output side of the regenerative converter are open before switching the power on to the regenerative converter.
<4> Never connect power lines to the AC output terminals on the AC drive (R/L1, S/L2, T/L3).
<5> After the regenerative converter is turned on, the run sequence should start with the regenerative converter followed by the AC drive. When shutting off power, the sequence should start with the AC drive, followed by the motor, and finally the regenerative converter. Never operate the AC drive without also using the regenerative converter, and never shut off power while operating the regenerative converter. This can cause a fault in the regenerative converter.

◆ Power Up and Shut Down Time Chart

Figure 3.9 shows the operation of the AC drive and regenerative converter during power up and shut down.

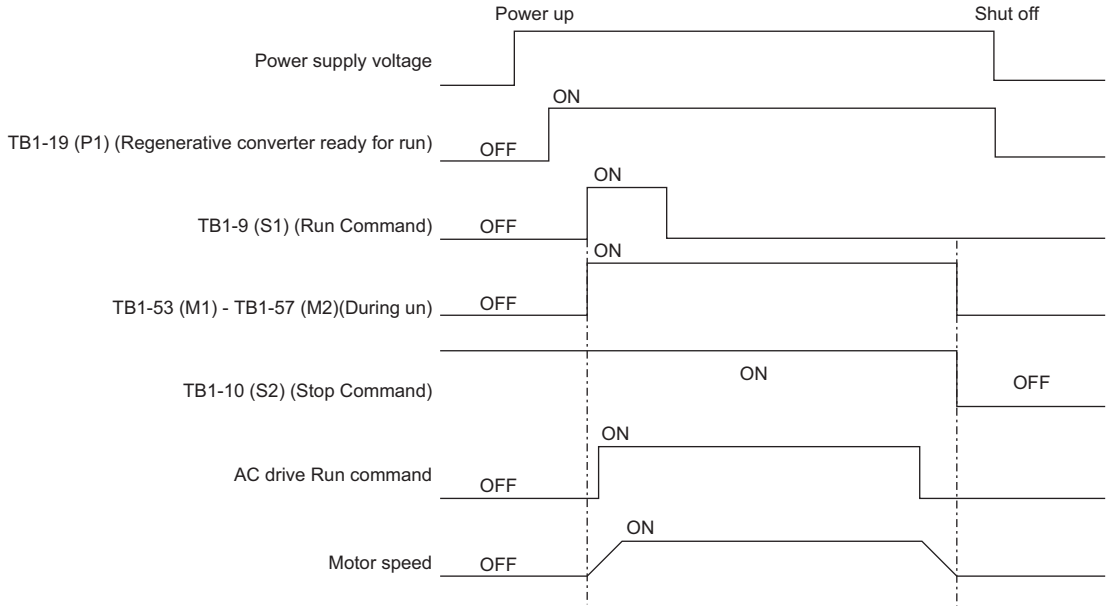


Figure 3.9 Power Up and Shut Down Time Chart

Note the following when operating the AC drive and regenerative converter together.

- After the regenerative converter is turned on, the “converter ready” signal set to one of the output terminals should be on before the Run command is issued.
- The AC drive Run command should be issued after verifying that the regenerative converter is operating.
- When switching off the regenerative converter, first make sure that the drive’s Run command has been cleared and that the motor has stopped. Afterwards a Stop command can be issued.
- Shut off power to the regenerative converter after the “converter ready” signal is off.

◆ Interlock

■ Interlocking AC Drive Operation

The AC drive and regenerative converter should be interlocked, so the AC drive will stop if a fault signal is sent from the regenerative converter. It is also necessary to make sure the restart timing is correct when the AC drive restarts from a momentary power loss.

The AC drive and regenerative converter can be interlocked by using the “MC ON” output signal from one of the control terminals in the regenerative converter. The “MC ON” signal from the regenerative converter should trigger external baseblock set to one of the drive’s input terminals, after which the AC drive output should shut off.

No Ride-Thru After Momentary Power Loss (AC drive stops after power loss is detected)

Connect the "MC ON" signal from the regenerative converter to one of the AC drive's input terminals set for "External fault."

The external fault input (N.C.) on the AC drive should accept a signal only during run in order to prevent a fault being triggered during power up (H1-☐☐ = 26, 27, 2E, and 2F).

Restarting the System After Momentary Power Loss

- Restarting FSDrive-LV1HS Only
  Connect the "MC ON" signal from the regenerative converter to one of the AC drive's input terminals set for "Baseblock (N.C.)." Enable the Momentary Power Loss Ride-Thru function in the AC drive.
- System with Other Than FSDrive-LV1HS.
  Connect the "MC ON" signal from the regenerative converter to one of the drive's input terminals set for "External search command 2." (Contact Yaskawa if your AC drive does not have this input terminal setting available.)

■ Stopping the Converter by a Fault in a Peripheral Device

When a fault or an error occurs in an external device, the fault output on the regenerative converter will be triggered and the regenerative converter stopped.
To have the AC drive respond to an external fault, set parameters H1-01 to H1-08 for the S1 to S8 terminals to setting values 24 to 27 and 2C to 2F. When and external fault has been triggered, EF☐ will appear on the LCD operator. The ☐ indicates which terminal has received the fault signal.

Example: If the terminal S3 receives a fault signal input, then the LCD operator will show "EF3."

When setting an external fault to one of the H1-☐☐ parameters, the following three conditions must also be specified.

- Input contact type from a peripheral device
- External fault detection method
- Stop method (action to take when an external fault has been triggered)

The table below lists the setting combinations possible when H1-☐☐ is set for an external fault.

Setting Value	Input Contact Type <1>		Detection Enabled <2>		Operation	
	N.O.	N.C.	Always Detected	Detected During Run Only	Regenerative Converter Stop (normal)	Continue Operation (minor fault)
24	○		○		○	
25		○	○		○	
26	○			○	○	
27		○		○	○	
2C	○		○			○
2D		○	○			○
2E	○			○		○
2F		○		○		○

<1> Select whether the input terminal for an external fault is N.O. (indicates a fault when the terminal closes) or N.C. (indicates a fault when the terminal opens).
<2> Select whether a fault condition can occur only during run or at any time.

3.6 Verifying Parameter Settings and Backing Up Changes

Use the verify mode to check all changes to parameter settings (Refer to ***Verifying Parameter Changes: Verify Menu on page 3-11***).

Confirm that the parameter setting is correctly configured, and save the setting. Changing the parameter access level and setting a password are also possible to prevent the set parameters from being carelessly changed.

◆ User Parameter Default Value (o2-03)

By setting o2-03 (User Parameter Default Value) to 1 (Set defaults. Saves parameter settings as default values for a User Initialization), the edited parameters can be saved in the regenerative converter. After the parameter setting is saved, the set value of o2-03 returns to 0 (No change) automatically. The set value of A1-03 (Initialize Parameters) automatically displays 1110 (User Initialize), and initialization by user parameter set values becomes enabled.

No.	Name	Description	Setting Range	Default Setting
o2-03	User Parameter Default Value	Saves/clears the default values used for A1-03 (Initialize Parameters). 0: No change 1: Set defaults. Saves parameter settings as default values for a User Initialization. 2: Clear all. Clears the default settings that have been saved for a User Initialization. After the user parameter set values are saved, 1110 (User Parameter Set Values) can be selected from A1-03 (Initialize Parameters).	0 to 2	0
A1-03	Initialize Parameters	Selects a method to initialize the parameter. 0: No initialization 1110: User Initialize (User parameter set values must be stored using o2-03.) 2220: Initialization	0, 0110, 2220	0

◆ Access Level Selection (A1-01)

It is possible to display only A1-☐☐ and U☐-☐☐ by setting A1-01 (Access Level Selection) to 0 (Operation Only). After that, parameter setting change becomes disabled.

Setting A1-01 (Access Level Selection) to 1 (User Parameters) allows the user to access only the parameters that have been previously saved as User Parameters. This is helpful when displaying only the relevant parameters for a specific application.

No.	Name	Description	Setting Range	Default Setting
A1-01	Access Level Selection	Selects an access level of parameter (set/monitor). 0: Operation Only (View and set A1-01 and A1-04. U☐-☐☐ parameters can also be viewed.) 1: User Parameters (Can access to view and set A2-01 through A2-16 and A2-17 through A2-32) 2: Advanced Access (Can access to view and set all parameters)	0 to 2	2
A2-01 to A2-32	User Parameters 1 to 32	Function that automatically saves the parameters and their values edited recently and allows the user to select the parameters that are used frequently When A2-33 is set to 1, the parameters and their values edited recently are automatically selected for A2-17 through A2-32 in sequence. (A2-01 through A2-16 must be set manually.) When A2-33 is 0, automatic selection of edited parameters is not performed. User must register all in A2-01 through A2-32.	A1-00 to o4-13	–

No.	Name	Description	Setting Range	Default Setting
A2-33	User Parameter Automatic Selection	0: Do not save list of recently viewed parameters. (Parameters of A2-01 through A2-32 must be selected by the user.) 1: Save history of recently viewed parameters. (Recently edited parameters will be saved to A2-17 through A2-32. The most recently edited parameter is automatically selected for A2-17. The one edited following the most recently edited parameter is selected for A2-18.)	0, 1	1

◆ Password (A1-04, A1-05)

If a password is set up in A1-05, the password must be verified by A1-04. Unless password verification is passed, parameters in A1-01, A1-03 and A2-01 through A2-33 cannot be changed.

Note: A1-05 is normally not displayed. To display and configure settings, display A1-04, and press ∧ while pressing STOP of the LCD operator.

◆ Copy Function

The parameter settings in the regenerative converter can be copied to another regenerative converter using the main operator or options. This function makes saving of the parameter settings easier and enables easy setup of multiple regenerative converters.

- **LED Operator (Option)**
  This enables to read/copy/verify the parameters in addition to the basic operation of the regenerative converter. Refer to the LED Operator Installation Manual (TOBP C730600 35) for details on operation method.
- **LCD Operator (Supplied with This Product)**
  This enables to remotely operate the regenerative converter with the LCD display and also has the copy function. Refer to ***Operation Procedure of Copy Function (LCD Operator) on page 3-18*** for the details of operation method.
- **USB Copy Unit**
  This enables to connect with the regenerative converter, read its parameter settings and copy the settings to another regenerative converter. Refer to the USB Copy Unit Installation Manual for details of operation method.
  Note: Connect to the LCD operator connector of the regenerative converter.
- **CopyUnitManager**
  This can manages multiple parameter settings read by the USB Copy Unit. Improves the efficiency of parameter writing into a regenerative converter with a different capacity or type. Refer to the CopyUnitManager Instruction Manual for details of operation method.

■ Operation Procedure of Copy Function (LCD Operator)

LCD operator can execute the following operations by editing the parameter o3-01 (Copy Function Selection) of the regenerative converter.

INV → OP READ (o3-01 = 1)

Reads the parameter settings from the regenerative converter and saves them in the LCD operator. The LCD operator can save as much as all the parameters of a single regenerative converter.

Note: The number of the read operations of the LCD operator is limited. As a guide, the maximum number of times of read operations available is about 100,000 times.

OP → INV WRITE (o3-01 = 2)

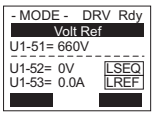
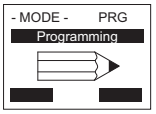
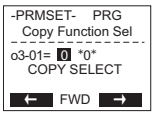
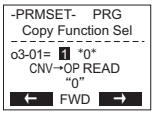
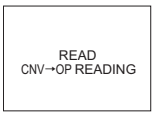
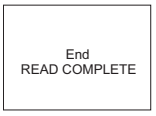
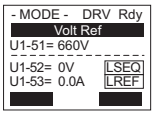
Writes the parameter settings saved in the LCD operator into another regenerative converter.

OP → INV VERIFY (o3-01 = 3)

Verifies whether the parameters in the regenerative converter match the parameters saved in the LCD operator.

Here describes the read procedure.

Note: When performing read, o3-02 (Copy Allowed Selection) must be set to 1 (Enabled). Setting o3-02=0 can protect the parameters saved in the LCD operator.

Operating Procedure			LCD display
1	Turn on the power supply.	➡	 Initial screen
2	Press ∧ or ∨ to display the parameter setting mode screen, and then press ENTER.	➡	
3	Select o3-01 (Copy Function Selection) by ∧, ∨ or RESET, and press ENTER.	➡	
4	Press ∧ or ∨ to select an operation. Select "01" (INV → OP Read) in this example. 1: CNV→OP READ 2: OP→CNV WRITE 3: OP←→CNV VERIFY	➡	
5	Press ENTER to start the operation.	➡	
6	After the operation finishes, the screen automatically returns to the Copy Function Selection screen.	➡	
7	Press ESC until the screen returns to the initial screen.	➡	 Initial screen

3.7 Test Run Checklist

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

☑	No.	Checklist
☐	1	Thoroughly read the manual before performing a test run.
☐	2	Check the power supply voltage setting.
☐	3	Turn the regenerative converter and the AC drive on.
☐	4	Check the Run command sequence.

Proceed to the following checklist after checking items 1 through 4.

☑	No.	Checklist
☐	5	To give a Run command and Voltage Reference from the LCD operator, press LO/RE to set to LOCAL. The LO/RE key will light.
☐	6	If the Run command and Voltage Reference are provided via the control circuit terminals, set the regenerative converter for REMOTE and be sure the LO/RE light is out.

4

Troubleshooting

This chapter provides descriptions of the regenerative converter faults, alarms, errors, related displays, and guidance for troubleshooting. And this chapter also provides descriptions of troubles due to fault of the regenerative converter and guidance for troubleshooting.

4.1 Section Safety

⚠ DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply could result in death or serious injury.

⚠ WARNING

Electrical Shock Hazard

Do not operate the regenerative converter with covers in the control panel removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may illustrate the regenerative converters without covers or safety shields to display details. Be sure to reinstall covers or shields before operating the regenerative converter and run the regenerative converter according to the instructions described in this manual.

Do not touch terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the input power of the regenerative converter is turned off. After shutting off the power, wait for at least the amount of time specified on the regenerative converter before touching any components.

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

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 converters.

Do not perform work on the regenerative converter while wearing loose clothing, jewelry, or without eye protection.

Failure to comply could result in death or serious injury.
Remove all metal objects such as watches and rings, secure loose clothing and wear eye protection before beginning work on the regenerative converter.

Do not remove covers in the regenerative converter panel or touch any internal modules or circuit boards while the power is on.

Failure to comply could result in death or serious injury.

Fire Hazard

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.

Verify that the rated voltage of the regenerative converter matches the rated voltage of the AC drive before applying power.

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

Do not use improper combustible materials.

Failure to comply could result in death or serious injury by fire. Attach the regenerative converter to metal or other noncombustible material.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the regenerative converter.

Failure to comply may result in ESD damage to the regenerative converter.

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 converter.

Do not allow unqualified personnel to use the regenerative converter.

Failure to comply could result in damage to the regenerative converter circuitry.

Do not modify the regenerative converter circuitry.

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

Do not attempt to modify or alter the regenerative converter.

Yaskawa is not responsible for modification of the regenerative converter made by the user.

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

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

4.2 Regenerative Converter Alarms, Faults, and Errors

◆ Types of Alarms, Faults, and Errors

Check the LCD operator for information about possible faults if the regenerative converter fails to operate.
Refer to ***Using the LCD Operator on page 3-3***.

When troubles still remain after consulting this manual, confirm the following items in advance and contact the nearest Yaskawa sales office or your Yaskawa representatives.

- Regenerative converter model
- Software version
- Date of purchase
- Description of the problem

Table 4.1 contains descriptions of the various types of alarms, faults, and errors that may occur while operating the regenerative converter.

Table 4.1 Types of Alarms, Faults, and Errors

Type	Drive Response
Faults	When the regenerative converter detects a fault: • The LCD operator displays text that indicates the specific fault and the ALM indicator LED remains lit until the fault is reset. • Some faults allow the user to select how the regenerative converter should stop when the fault occurs. • Fault output terminals MA-MC will close, and MB-MC will open. The regenerative converter will remain inoperable until that fault has been cleared. Refer to ***Fault Reset Methods on page 4-25*** for the reset operations.
Minor Faults and Alarms	When the regenerative converter detects an alarm or a minor fault: • The LCD operator displays text that indicates the specific alarm or minor fault, and the ALM indicator LED flashes. • One of the multi-function contact outputs closes if set to be tripped by a minor fault (H2-□□ = 10), but not by an alarm. To reset the a minor fault or alarm, remove whatever is causing the problem.
Operator Programming Errors	When parameter settings conflict with one another or do not match hardware settings (such as with an option card), it results in an Operator Programming Error. When the regenerative converter detects an Operator Programming Error: • The LCD operator displays text that indicates the specific error. • Multi-function contact outputs do not operate. The regenerative converter will not operate the motor until the error has been reset. Correct the settings that caused the Operator Programming Error to clear the error.
Copy Function Errors	These are the types of errors that can occur when using the LCD operator or the USB Copy Unit to copy, read, or verify parameter settings. • The LCD operator displays text indicating the specific error. • Multi-function contact outputs do not operate. Pressing any key on the LCD operator will clear the fault. Find out what is causing the problem (such as model incompatibility) and try again.

◆ Alarm and Error Displays

■ Faults

Table 4.2 gives an overview of possible fault codes. As conditions such as overvoltage can trip both a fault and an alarm, it is important to distinguish between faults and alarms in order to find the right corrective action.

When the regenerative converter detects a fault, the ALM indicator LEDs lights and the fault code appears on the display. If the ALM LED blinks and the code appearing on the operator screen is flashes, then an alarm has been detected. Refer to ***Minor Faults and Alarms on page 4-6***. For example, two types of indications, fault and minor fault, are allocated to the ov (Overvoltage).

Table 4.2 Fault Displays

Digital Operator Display		Name	Page
LED	LCD		
Aou	Aov	Power Supply Input Overvoltage	*4-8*
AUu	AUv	Power Supply Input Undervoltage	*4-8*
CoF	CoF	Current Offset Fault	*4-8*
CPF00, CPF01 <1>	CPF00, CPF01	Control Circuit Error	*4-8*
CPF02	CPF02	A/D Conversion Error	*4-8*
CPF06	CPF06	EEPROM Memory Data Error	*4-8*
CPF08	CPF08	Hardware Fault	*4-9*
CPF20, CPF21 <1>	CPF20, CPF21	Control Circuit Error	*4-9*
CPF22	CPF22	Hybrid IC Error	*4-9*
CPF23	CPF23	Control Board Connection Error	*4-9*
CPF24	CPF24	Regenerative Converter Unit Signal Fault	*4-9*
CPF26 to CPF34	CPF26 to CPF34	Control Circuit Error	*4-9*
CPF40 to CPF45	CPF40 to CPF45		
EF1 to EF8	EF1 to EF8	External Fault (input terminal S1 to S8)	*4-10*
EFAn	EFAn	Panel Fan Fault	*4-10*
Err	Err	EEPROM Write Error	*4-10*
FAn	FAn	Regenerative Converter Cooling Fan Fault	*4-10*

Digital Operator Display		Name	Page
LED	LCD		
Fdu	Fdv	Power Supply Frequency Fault	*4-11*
GF	GF	Ground Fault	*4-11*
oC	oC	Overcurrent	*4-11*
oH	oH	Heatsink Overheat	*4-12*
oH1	oH1	Overheat 1 (Heatsink Overheat)	*4-12*
oL2	oL2	Regenerative Converter Overload	*4-12*
oPr	oPr	External Digital Operator Connection Fault	*4-12*
ou	ov	Overvoltage	*4-13*
PF2	PF2	Input Power Supply Fault	*4-13*
PF3	PF3	Input Phase Loss Detection	*4-13*
PUF	PUF	Fuse Blowout	*4-13*
SC	SC	IGBT Upper Arm and Lower Arm Short Circuit	*4-13*
SrC	SrC	Phase Order Fault	*4-14*
UnbC	UnbC	Current Unbalance	*4-14*
Uu1	Uv1	DC Bus Undervoltage	*4-14*
Uu2	Uv2	Control Power Supply Voltage Fault	*4-14*
Uu3	Uv3	Undervoltage 3 (Soft-Charge Bypass Circuit Fault)	*4-15*
Uu4	Uv4	Gate Drive Board Undervoltage	*4-15*
Uu5	Uv5	MC/FAN Power Supply Fault	*4-15*
voF	voF	Output Voltage Detection Fault	*4-15*
-	-	-	-

<1> Displayed as CPF00 or CPF20 when occurring at power up of the regenerative converter. When one of the faults occurs after successfully starting the regenerative converter, the display will show CPF01 or CPF21.

Note: Use parameter U2-28 to verify the drive module where the fault occurred.

■ Minor Faults and Alarms

Table 4.3 gives an overview of possible fault codes. As conditions such as overvoltage can trip both a fault and an alarm, it is important to distinguish between faults and alarms in order to find the right corrective action.

When the regenerative converter detects a fault, the ALM indicator LEDs will blink and the alarm code display flashes. If the ALM LED lights without blinking, this means that a fault has been detected (not an alarm). Information on fault codes can be found in ***Faults on page 4-5***. For example, two types of indications, fault and minor fault, are allocated to the ov (Overvoltage).

Table 4.3 Minor Fault and Alarm Displays

Digital Operator Display		Name	Minor Fault Output(H2-□□ = 10)	Page
LED	LCD			
Aov	Aov	Power Supply Input Overvoltage	Yes	*4-16*
AUv	AUv	Power Supply Input Undervoltage	Yes	*4-16*
bb	bb	Regenerative Converter Baseblock	No	*4-16*
CoF	CoF	Current Offset Fault	Yes	*4-16*
CrST	CrST	Cannot Reset	Yes	*4-17*
EF1 to EF8	EF1 to EF8	External Fault (input terminal S1 to S8)	Yes	*4-17*
CoF	EFAn	Panel Fan Fault	Yes	*4-17*
FAn	FAn	Regenerative Converter Cooling Fan Fault	Yes	*4-18*
Fdv	Fdv	Power Supply Frequency Fault	Yes	*4-18*
LT-1	LT-1	Cooling Fan Maintenance Time	No <1>	*4-18*
LT-2	LT-2	Capacitor Maintenance Time	No <1>	*4-18*
LT-3	LT-3	Soft Charge Bypass Relay Maintenance Time	No <1>	*4-18*
LT-4	LT-4	IGBT Maintenance Time (50%)	No <1>	*4-18*
oH	oH	Heatsink Overheat	Yes	*4-19*
oL2	oL2	Regenerative Converter Overload	Yes	*4-12*
ov	ov	DC Bus Overvoltage	Yes	*4-19*
PF3	PF3	Input Phase Loss Detection	Yes	*4-19*
SrC	SrC	Phase Order Fault	Yes	*4-20*
TrPC	TrPC	IGBT Maintenance Time (90%)	Yes	*4-20*
Uv	Uv	Undervoltage	Yes	*4-20*
voF	voF	Output Voltage Detection Fault	Yes	*4-20*

<1> Output when H2-□□ = 2F.

■ Operator Programming Errors

Table 4.4 Operator Programming Error Displays

Digital Operator Display		Name	Page
LED	LCD		
oPE01	oPE01	Regenerative Converter Setting Fault	*4-21*
oPE02	oPE02	Parameter Range Setting Error	*4-21*
oPE03	oPE03	Multi-Function Input Selection Error	*4-21*

■ Errors and Displays When Using the Copy Function

Table 4.5 Copy Errors

Digital Operator Display		Name	Page
CoPy	CoPy	Writing Parameter Settings (flashing)	*4-22*
CPyE	CPyE	Error Writing Data	*4-22*
CSEr	CSEr	Copy Unit Error	*4-22*
dFPS	dFPS	Drive Model Mismatch	*4-22*
End	End	Task Complete	*4-22*
iFEr	iFEr	Communication Error	*4-22*
ndAT	ndAT	Model, Voltage Class, Capacity Mismatch	*4-23*
rdEr	rdEr	Error Reading Data	*4-23*
rEAd	rEAd	Reading Parameter Settings (flashing)	*4-23*
vAEr	vAEr	Voltage Class, Capacity Mismatch	*4-23*
vFyE	vFyE	Parameter settings in the regenerative converter and those saved to the copy function are not the same	*4-23*
vrFy	vrFy	Comparing Parameter Settings (flashing)	*4-23*

4.3 Fault Detection

◆ Fault Displays, Causes, and Possible Solutions

Table 4.6 Detailed Fault Displays, Causes, and Possible Solutions

Digital Operator Display		Fault Name
Aou	Aov	Power Supply Input Overvoltage
		The input power supply voltage exceeds the input power supply overvoltage detection level. • For 400 V class: approximately 554 VAC • For 690 V class: approximately 796 VAC
Cause		**Possible Solution**
The input power supply voltage is too high.		Lower the voltage to a level within the power supply specification.
Digital Operator Display		**Fault Name**
AUu	AUv	Power Supply Input Undervoltage
		The input power supply voltage falls below the Input Undervoltage (AUv) Detection Level (L2-21). • For 400 V class: approximately 300 VAC • For 690 V class: approximately 500 VAC
Cause		**Possible Solution**
The power supply capacity is small.		Increase the power supply capacity.
Digital Operator Display		**Fault Name**
CoF	CoF	Current Offset Fault
		There is a problem with the current detection circuit, or the regenerative converter started to operate the motor with induced voltage still remaining in the motor (such as when the motor is coasting, or after sudden deceleration).
Hardware is damaged.		Cycle power to the regenerative converter. ⇒If the problem continues, replace the regenerative converter. For instructions on replacing the regenerative converter, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Fault Name**
CPF00, CPF01 <I>	CPF00, CPF01	Control Circuit Error
Cause		**Possible Solution**
There is a self diagnostic error in control circuit.		Cycle power to the regenerative converter. ⇒If the problem continues, replace either the control board or control module. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Connector on the operator is damaged.		⇒Replace the operator.
Digital Operator Display		**Fault Name**
CPF02	CPF02	A/D Conversion Error
		An A/D conversion error or control circuit error occurred.
Cause		**Possible Solution**
Control circuit is damaged.		Cycle power to the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.*** ⇒If the problem continues, replace either the control board or control module. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Fault Name**
CPF06	CPF06	EEPROM Memory Data Error
		There is an error in the data saved to EEPROM.
Cause		**Possible Solution**
There is an error in EEPROM control circuit.		Cycle power to the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.*** ⇒If the problem continues, replace either the control board or control module. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
The power supply was switched off when parameters were being saved to the regenerative converter.		⇒Reinitialize the Initialize Parameters (A1-03).

Digital Operator Display		Fault Name
CPF08	CPF08	Hardware Fault
Cause		**Possible Solution**
Control board part fault		Cycle power to the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.*** ⇒If the problem continues, replace the control board. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Fault Name**
CPF20, CPF21 <I>	CPF20 or CPF21	Control Circuit Error
Cause		**Possible Solution**
Control circuit self-diagnosis error		Cycle power to the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.*** ⇒If the problem continues, replace either the control board or control module. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Connector on the operator is damaged.		⇒Replace the operator.
Digital Operator Display		**Fault Name**
CPF22	CPF22	Hybrid IC Error
		Hybrid IC has an error.
Cause		**Possible Solution**
Hybrid IC on the main circuit is damaged.		Cycle power to the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.*** ⇒When the fault occurs again, replace the control board or control module. Contact your Yaskawa representatives or Yaskawa sales office for replacement of boards. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Fault Name**
CPF23	CPF23	Control Board Connection Error
		Connection error between the control board and the regenerative converter
Cause		**Possible Solution**
Hardware is damaged.		Turn the power off and check the connection between the control board and the regenerative converter. ⇒If the problem continues, replace either the control board or control module. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Fault Name**
CPF24	CPF24	Regenerative Converter Unit Signal Fault
		Signal of the drive module changed after power up.
Cause		**Possible Solution**
Connection error with the drive module		Check the connection with the drive module. ⇒If the problem continues, replace either the control board or control module. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Fault Name**
CPF26 to CPF34 CPF40 to CPF45	CPF26 to CPF34 CPF40 to CPF45	Control Circuit Error
		Control circuit error
Cause		**Possible Solution**
Hardware is damaged.		Cycle power to the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.*** ⇒If the problem continues, replace either the control board or control module. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.

Digital Operator Display		Fault Name
EF1	EF1	External Fault (input terminal S1) External fault at multi-function input terminal S1.
EF2	EF2	External Fault (input terminal S2) External fault at multi-function input terminal S2.
EF4	EF4	External Fault (input terminal S4) External fault at multi-function input terminal S4.
EF5	EF5	External Fault (input terminal S5) External fault at multi-function input terminal S5.
EF6	EF6	External Fault (input terminal S6) External fault at multi-function input terminal S6.
EF7	EF7	External Fault (input terminal S7) External fault at multi-function input terminal S7.
EF8	EF8	External Fault (input terminal S8) External fault at multi-function input terminal S8.
Cause		**Possible Solution**
An external device has tripped an alarm function.		⇒Remove the cause of the external fault and reset the fault. Refer to ***Diagnosing and Resetting Faults on page 4-24*** for details.
Wiring is incorrect.		Ensure the signal lines have been connected properly to the terminals assigned for external fault detection (H1-□□ = 24 to 27, or 2C to 2F). ⇒Reconnect the signal line. Refer to ***Diagnosing and Resetting Faults on page 4-24*** for details.
Incorrect setting of multi-function contact inputs.		Check if the any unused terminals have been set for H1-□□ = 24 to 27, or 2C to 2F (External Fault). ⇒Change the terminal settings. Refer to ***Diagnosing and Resetting Faults on page 4-24*** for details.
Digital Operator Display		**Fault Name**
EFAn	EFAn	Panel Fan Fault A problem has occurred with the panel fan.
Cause		**Possible Solution**
The power supply for the panel fan does not have enough voltage.		Check the status of the panel fan. ⇒ After finding the cause of the fault and taking corrective action, reset the fault status of the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24***.
The input power supply terminals for the panel fan are loose.		
There is too much voltage fluctuation in the input power supply of the panel fan.		
The power supply for the panel fan is damaged.		
The panel fan is damaged.		
Digital Operator Display		**Fault Name**
Err	Err	EEPROM Write Error Data cannot be written to the EEPROM.
Cause		**Possible Solution**
Noise has corrupted data while writing to the EEPROM.		⇒Press the ENTER button. ⇒Correct the parameter setting. ⇒Cycle power to the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.***
Hardware problem.		⇒Replace either the control board or the control module. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Fault Name**
FAn	FAn	Regenerative Converter Cooling Fan Fault The internal cooling fan of the regenerative converter failed.
Cause		**Possible Solution**
Undervoltage of fan power supply occurred.		⇒ After finding the cause of the fault and taking corrective action, reset the fault status of the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.***
The wiring terminal of the fan power supply is loosened.		
There is excessive fluctuation in the input power voltage of the regenerative converter.		
Fan power supply failure occurred.		

Digital Operator Display		Fault Name
Fdv	Fdv	Power Supply Frequency Fault
		The input power supply frequency exceeds the allowable frequency fluctuation value.
Cause		**Possible Solution**
Momentary power loss occurred. There is loose wiring in the input power terminals of the regenerative converter. There is excessive fluctuation in the input power voltage of the regenerative converter.		⇒ After finding the cause of the fault and taking corrective action, reset the fault status of the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.***
Digital Operator Display		**Fault Name**
GF	GF	Ground Fault
		A current short to ground exceeded approximately 50% of the rated current on the input side of the regenerative converter.
Cause		**Possible Solution**
The motor has been damaged due to overheating or the motor insulation is damaged.		Check the insulation resistance of the motor. ⇒Replace the motor.
One of the motor cables has shorted out or there is a grounding problem.		Check the motor cable. ⇒Remove the short circuit and turn the power back on.
		Check the resistance between the motor cables and the ground terminal ⏚. ⇒Replace damaged cables.
The leakage current at the regenerative converter input ⏚ is too high.		⇒Reduce the amount of stray capacitance.
Hardware problem.		⇒Replace the drive module.
Wiring of the voltage detection circuit (R1, S1, and T1) on the power supply side and wiring of the main circuit (R, S, and T) are incorrect.		⇒Correct the wiring.
Digital Operator Display		**Fault Name**
oC	oC	Overcurrent
		Sensors of the regenerative converter have detected an input current greater than the specified overcurrent level.
Cause		**Possible Solution**
The motor has been damaged due to overheating or the motor insulation is damaged.		Check the insulation resistance of the motor. ⇒Replace the motor.
One of the motor cables has shorted out or there is a grounding problem.		Check the motor cables. ⇒Remove the short circuit and turn the power back on.
		Check the resistance between the motor cables and the ground terminal ⏚. ⇒Replace damaged cables.
Load is too heavy.		Measure the current flowing into the regenerative converter. ⇒Replace the regenerative converter with a larger capacity unit if the current value exceeds the rated current of the regenerative converter. 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 converter.
Regenerative converter fails to operate properly due to noise interference.		Check the various options available to minimize the effects of noise. ⇒Review the section on handling noise interference and check the control circuit lines, main circuit lines, and ground wiring.
Wiring of the voltage detection circuit (R1, S1, and T1) on the power supply side and wiring of the main circuit (R, S, and T) are incorrect.		⇒Correct the wiring.
Undervoltage on the power supply side is excessive.		Check the wiring. ⇒Correct the wiring. Check the load of periphery devices connected to the same power supply line. ⇒Check whether the load is too large again.

Digital Operator Display		Fault Name
oH	oH	Heatsink Overheat
		The temperature of the heatsink of the regenerative converter exceeded the overheat alarm level set to L8-02. **Note:** Default value for L8-02 is determined by the Regenerative Converter Model Selection (o2-04).
Cause		**Possible Solution**
Surrounding temperature is too high.		Check the temperature surrounding the regenerative converter. ⇒Improve the air circulation within the enclosure control panel. ⇒Install a fan or air conditioner to cool the surrounding area. ⇒Remove anything near the regenerative converter that might be producing excessive heat.
Load is too heavy.		Measure the output current. ⇒Reduce the load.
Internal cooling fan in the regenerative converter has stopped.		⇒Replace the cooling fan. **Note:** After replacing the cooling fan, reset the Cooling Fan Operation Time setting (o4-03 = 0) and start to remeasure the fan's operating time.
Digital Operator Display		**Fault Name**
oH1	oH1	Overheat 1 (Heatsink Overheat)
		The temperature of the regenerative converter heatsink exceeded the allowable value. **Note:** The Overheat Alarm Level (L8-02) is determined by the Regenerative Converter Model Selection (o2-04).
Cause		**Possible Solution**
Surrounding temperature is too high.		Check the temperature surrounding the regenerative converter. ⇒Improve the air circulation within the enclosure control panel. ⇒Install a fan or air conditioner to cool the surrounding area. ⇒Remove anything near the regenerative converter that might be producing excessive heat.
Load is too heavy.		Measure the output current. ⇒Reduce the load.
Digital Operator Display		**Fault Name**
oL2	oL2	Regenerative Converter Overload
		The thermal sensor of the regenerative converter triggered overload protection.
Cause		**Possible Solution**
Load is too heavy.		Check the size of the load. ⇒Reduce the load.
Regenerative converter capacity is too small.		⇒Add the drive module.
Digital Operator Display		**Fault Name**
oPr	oPr	External Digital Operator Connection Fault
		The external digital operator has been disconnected from the regenerative converter. (When LOCAL (operation using the digital operator) is selected) **Note:** An oPr fault will occur when all of the following conditions are true: • Output is interrupted when the operator is disconnected (o2-06 = 1). • The Run command is assigned to the digital operator (b1-02 = 0 or LOCAL has been selected).
Cause		**Possible Solution**
External digital operator is not properly connected to the regenerative converter.		Check the connection between the digital operator and the regenerative converter. ⇒Replace the cable if damaged. ⇒Turn off the regenerative converter input power and disconnect the digital operator. Next reconnect the digital operator and turn the input power of the regenerative converter back on.

Digital Operator Display		Fault Name
ou	ov	Overvoltage
		Voltage in the DC bus has exceeded the overvoltage detection level. For 400 V class: approximately 820 VDC For 690 V class: approximately 1200 VDC
Cause		**Possible Solution**
Excess load of regeneration		Check the motor and the regeneration load.
Ground fault of load (Ground current has over-charged the main circuit capacitors via the regenerative converter input power.)		Check the power cable, relay terminals, motor terminal box, etc., of the regenerative converter. ⇒Correct grounding shorts and turn the power back on.
The input power voltage of the regenerative converter is too high.		Check the voltage. ⇒Lower input power voltage of the regenerative converter within the limits listed in the specifications.
Regenerative converter fails to operate properly due to noise interference.		Check the various options available to minimize the effects of noise. ⇒Review the section on handling noise interference and check the control circuit lines, main circuit lines, and ground wiring.
Wiring of the voltage detection circuit (R1, S1, and T1) on the power supply side and wiring of the main circuit (R, S, and T) are incorrect.		⇒Correct the wiring.
Digital Operator Display		**Fault Name**
PF2	PF2	Input Power Supply Fault
		Abnormal oscillation of the main circuit DC bus voltage has continued (when L8-65 is set to 1 or 2).
Cause		**Possible Solution**
There is excessive fluctuation in the input power voltage of the regenerative converter.		⇒ After finding the cause of the fault and taking corrective action, reset the fault status of the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24***.
There is phase loss in the regenerative converter input power.		
The power supply capacity is small.		
The cable is too long.		
There is poor balance between voltage phases.		
Digital Operator Display		**Fault Name**
PF3	PF3	Input Phase Loss Detection
		Abnormal oscillation of the input power supply voltage has continued. (Detected when L8-69 is set to 1)
Cause		**Possible Solution**
There is excessive fluctuation in the input power voltage of the regenerative converter.		⇒ After finding the cause of the fault and taking corrective action, reset the fault status of the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24***.
There is phase loss in the regenerative converter input power.		
The power supply capacity is small.		
The cable is too long.		
There is poor balance between voltage phases.		
Digital Operator Display		**Fault Name**
PUF	PUF	Fuse Blowout
		The fuse inserted in the main circuit was blown.
Cause		**Possible Solution**
Main transistor failed.		Check U2-28 (Malfunctioned Module) and replace the drive module.
The DC circuit fuse was blown.		
Digital Operator Display		**Fault Name**
SC	SC	IGBT Upper Arm and Lower Arm Short Circuit
		Insufficient power for the control power supply in the power supply module.
Cause		**Possible Solution**
IGBTs failed.		• Cycle power to the regenerative converter. ⇒If the problem continues, replace either the control board or the drive module. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
The IGBT short-circuit detection sensor failed.		

Digital Operator Display		Fault Name
SrC	SrC	Phase Order Fault
		The detection direction of the phase order for the input power supply has changed after powering up.
Cause		**Possible Solution**
The power supply phase order changed during operation.		⇒ After finding the cause of the fault and taking corrective action, reset the fault status of the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24***.
Momentary power loss occurred.		
There is loose wiring in the input power terminals of the regenerative converter.		
There is excessive fluctuation in the input power voltage of the regenerative converter.		
Digital Operator Display		**Fault Name**
UnbC	UnbC	Current Unbalance
		Current flow among modules has become unbalanced.
Cause		**Possible Solution**
Imbalance of output current of each drive module occurred.		Check the wiring. Check if any transistors are damaged. Check whether a short circuit or ground fault occurs at the load side.
Fuses in the drive module were blown.		
Digital Operator Display		**Fault Name**
Uv1	Uv1	DC Bus Undervoltage
		One of the following conditions occurred while the regenerative converter was stopped (a RUN command was not entered): • Voltage in the DC bus fell below the Undervoltage Detection Level (Uv) (L2-05) • For 400 V class: approximately 380 VDC • For 690 V class: approximately 570 VDC
Cause		**Possible Solution**
There is phase loss in the regenerative converter input power.		The main circuit input power of the regenerative converter is wired incorrectly. ⇒Correct the wiring.
There is loose wiring in the input power terminals of the regenerative converter.		Check if the terminals are loosened. ⇒Apply the tightening torque specified in this manual to fasten the terminals.
There is a problem with the voltage from the regenerative converter input power.		Check the voltage. ⇒Correct the voltage to be within the range listed in specifications of the regenerative converter input power. ⇒If there is no problem with the power supply to the main circuit, check for problems with the main circuit magnetic contactor.
The power has been interrupted.		⇒Correct the regenerative converter input power.
The main circuit capacitors are worn.		Check the maintenance time for the Capacitor Maintenance (U4-05). ⇒Replace the drive module if U4-05 exceeds 90%.
The relay or contactor on the soft-charge bypass circuit is damaged.		Cycle power to the regenerative converter and see if the fault reoccurs. ⇒If the problem continues, replace the drive module. Check the Soft Charge Bypass Relay Maintenance (U4-06) for the performance life of the soft-charge bypass. ⇒Replace the drive module if U4-06 exceeds 90%.
There is a fault in the devices on the power supply side.		Check the wiring of the devices on the power supply side. ⇒Correct the wiring.
There is a fault in the power supply.		Improve the power supply voltage.
The voltage detection circuit on the power supply side is damaged.		Check wiring. ⇒Correct the wiring.
Digital Operator Display		**Fault Name**
Uv2	Uv2	Control Power Supply Voltage Fault
		Voltage is too low for the control power supply.
Cause		Possible Solution
Voltage is too low for the control power supply.		Cycle power to the regenerative converter and see if the fault reoccurs. Check if the fault reoccurs. Refer to ***Diagnosing and Resetting Faults on page 4-24***. If the problem continues, replace the drive module.

Digital Operator Display		Fault Name
Uv3	Uv3	Undervoltage 3 (Soft-Charge Bypass Circuit Fault)
		The soft-charge bypass circuit has failed.
Cause		**Possible Solution**
The relay or contactor on the soft-charge bypass circuit is damaged.		Cycle power to the regenerative converter and see if the fault reoccurs. Refer to ***Diagnosing and Resetting Faults on page 4-24***. ⇒If the problem continues, replace the drive module. Check the Soft Charge Bypass Relay Maintenance (U4-06) for the performance life of the soft-charge bypass. ⇒Replace the drive module if U4-06 exceeds 90%.
Digital Operator Display		**Fault Name**
Uv4	Uv4	Gate Drive Board Undervoltage
		Voltage is too low for the control power supply within the drive module.
Cause		**Possible Solution**
Voltage is too low for the control power supply within the drive module.		Cycle power to the regenerative converter and see if the fault reoccurs. Refer to ***Diagnosing and Resetting Faults on page 4-24***. ⇒If the problem continues, replace either the internal control board or drive module.
Digital Operator Display		**Fault Name**
Uv5	Uv5	MC/FAN Power Supply Fault
		Voltage is too low for the MC/FAN power supply within the drive module.
Cause		**Possible Solution**
Voltage is too low for the MC/FAN power supply within the drive module.		Cycle power to the drive and see if the fault reoccurs. Refer to ***Diagnosing and Resetting Faults on page 4-24***. ⇒If the problem continues, replace the internal board or drive module.
Digital Operator Display		**Fault Name**
voF	voF	Output Voltage Detection Fault
		Problem detected with the voltage on the output side of the regenerative converter.
Cause		**Possible Solution**
Hardware is damaged.		⇒Replace the drive module.

<1> When a fault occurred at the startup of the regenerative converter, CPF00 or CPF20 is displayed. When a fault occurred after the startup, CPF01 or CPF21 is displayed.

4.4 Alarm Detection

◆ Alarm Codes, Causes, and Possible Solutions

Alarms are regenerative converter protection functions that do not necessarily cause the regenerative converter to stop. Once the cause of an alarm is removed, the regenerative converter will return to the same status as before the alarm occurred.

When an alarm has been triggered, the ALM light on the digital operator display blinks and the alarm code display flashes. If a multi-function output is set for an alarm (H2- □□ = 10), that output terminal will be triggered.

Note: If a multi-function output is set to close when an alarm occurs (H2- □□ = 10), it will also close when maintenance periods are reached, triggering alarms LT-1 through LT-4 (triggered only if H2- □□ = 2F).

After detecting the minor fault and alarm, refer to ***Table 4.7*** to take proper measures and remove the cause.

Table 4.7 Alarm Codes, Causes, and Possible Solutions

Digital Operator Display		Minor Fault Name	
Aou	Aov	Power Supply Input Overvoltage	
		The input power supply voltage excesses the input power supply overvoltage detection level. • For 400 V class: approximately 554 VAC • For 690 V class: approximately 796 VAC	
Cause		**Possible Solutions**	**Minor Fault Output H2-□□=10**
The input power supply voltage is too high.		Lower the voltage to a level within the power supply specification.	Yes
Digital Operator Display		**Minor Fault Name**	
AUu	AUv	Power Supply Input Undervoltage	
		The input power supply voltage exceeds the Input Undervoltage (AUv) Detection Level (L2-21). • For 400 V class: approximately 300 VAC • For 690 V class: approximately 500 VAC	
Cause		**Possible Solutions**	**Minor Fault Output H2-□□=10**
The power supply capacity is small.		Increase the power supply capacity.	Yes
Digital Operator Display		**Minor Fault Name**	
bb	bb	Regenerative Converter Baseblock	
		Regenerative converter output interrupted as indicated by an external baseblock signal.	
Cause		**Possible Solutions**	**Minor Fault Output H2-□□=10**
External baseblock signal was entered via one of the multi-function input terminals (S1 to S8).		⇒Check external sequence and baseblock signal input timing.	No
Digital Operator Display		**Minor Fault Name**	
CoF	CoF	Current Offset Fault	
		There is a problem with the current detection circuit, or the regenerative converter started to operate the motor with induced voltage still remaining in the motor (such as when the motor is coasting, or after sudden deceleration).	
Cause		**Possible Solutions**	**Minor Fault Output H2-□□=10**
Hardware Fault		Cycle power to the regenerative converter. ⇒If the problem continues, replace the regenerative converter. For instructions on replacing the regenerative converter, contact Yaskawa or your nearest sales representative.	Yes

Digital Operator Display		Minor Fault Name	
CrST	CrST	Cannot Reset	
		A fault reset command was entered while the Run command was still present.	
Cause		**Possible Solutions**	**Minor Fault Output H2-□□=10**
A fault reset command was entered while the Run command was still present.		Ensure that a Run command cannot be entered from the external terminals during fault reset. ⇒Turn off the Run command.	Yes
Digital Operator Display		**Minor Fault Name**	
EF1	EF1	External Fault (input terminal S1)	
		External fault at multi-function input terminal S1.	
EF2	EF2	External Fault (input terminal S2)	
		External fault at multi-function input terminal S2.	
EF3	EF3	External Fault (input terminal S3)	
		External fault at multi-function input terminal S3.	
EF4	EF4	External Fault (input terminal S4)	
		External fault at multi-function input terminal S4.	
EF5	EF5	External Fault (input terminal S5)	
		External fault at multi-function input terminal S5.	
EF6	EF6	External Fault (input terminal S6)	
		External fault at multi-function input terminal S6.	
EF7	EF7	External Fault (input terminal S7)	
		External fault at multi-function input terminal S7.	
EF8	EF8	External Fault (input terminal S8)	
		External fault at multi-function input terminal S8.	
Cause		**Possible Solutions**	**Minor Fault Output H2-□□=10**
An external device has tripped an alarm function.		⇒ Remove the cause of the external fault and reset the multi-function input value. Refer to ***Diagnosing and Resetting Faults on page 4-24*** for details.	Yes
Wiring is incorrect.		Ensure the signal lines have been connected properly to the terminals assigned for external fault detection (H1-□□ = 24 to 27, and 2C to 2F). ⇒ Reconnect the signal line. Refer to ***Diagnosing and Resetting Faults on page 4-24*** for details.	
Digital Operator Display		**Minor Fault Name**	
EFAn	EFAn	Panel Fan Fault	
		A problem has occurred with the panel fan.	
Cause		**Possible Solutions**	**Minor Fault Output H2-□□=10**
The power supply for the panel fan does not have enough voltage.		Check the status of the panel fan.	Yes
The input power supply terminals for the panel fan are loose.			
There is too much voltage fluctuation in the input power supply of the panel fan.			
The power supply for the panel fan is damaged.			
The panel fan is damaged.			

Digital Operator Display		Minor Fault Name	
FAn	FAn	Regenerative Converter Cooling Fan Fault	
		The internal cooling fan of the regenerative converter failed.	
Cause		**Possible Solutions**	**Minor Fault Output H2-☐☐=10**
Undervoltage of fan power supply occurred.		⇒ After finding the cause of the fault and taking corrective action, reset the fault status of the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.***	Yes
The wiring terminal of the fan power supply is loosened.			
There is excessive fluctuation in the input power voltage of the regenerative converter.			
Fan power supply failure occurred.			
Digital Operator Display		**Minor Fault Name**	
Fdv	Fdv	Power Supply Frequency Fault	
		The input power supply frequency exceeds the allowable frequency fluctuation value.	
Cause		**Possible Solutions**	**Minor Fault Output H2-☐☐=10**
Momentary power loss occurred.		⇒ After finding the cause of the fault and taking corrective action, reset the fault status of the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.***	Yes
There is loose wiring in the input power terminals of the regenerative converter.			
There is excessive fluctuation in the input power voltage of the regenerative converter.			
Digital Operator Display		**Minor Fault Name**	
LT-1	LT-1	Cooling Fan Maintenance Time	
		The cooling fan has reached its expected maintenance period and may need to be replaced. **Note:** An alarm output (H2- ☐☐ = 10) will only be triggered if H2- ☐☐ = 2F.	
Cause		**Possible Solutions**	**Minor Fault Output H2-☐☐=2F**
The cooling fan has reached 90% of its expected performance life.		⇒Replace the cooling fan and reset the Maintenance Monitor by setting o4-03 to 0.	Yes
Digital Operator Display		**Minor Fault Name**	
LT-2	LT-2	Capacitor Maintenance Time	
		The main circuit and control circuit capacitors are nearing the end of their expected performance life. **Note:** An alarm output (H2- ☐☐ = 10) will only be triggered if H2- ☐☐ = 2F.	
Cause		**Possible Solutions**	**Minor Fault Output H2-☐☐=2F**
The main circuit and control circuit capacitors have reached 90% of their expected performance life.		⇒Replace the drive module.	Yes
Digital Operator Display		**Minor Fault Name**	
LT-3	LT-3	Soft Charge Bypass Relay Maintenance Time	
		The DC bus soft charge relay is nearing the end of its expected performance life. **Note:** An alarm output (H2- ☐☐ = 10) will only be triggered if H2- ☐☐ = 2F.	
Cause		**Possible Solutions**	**Minor Fault Output H2-☐☐=2F**
The DC bus soft charge relay has reached 90% of their expected performance life.		⇒Replace the drive module.	Yes
Digital Operator Display		**Minor Fault Name**	
LT-4	LT-4	IGBT Maintenance Time (50%)	
		IGBTs have reached 50% of their expected performance life. **Note:** An alarm output (H2- ☐☐ = 10) will only be triggered if H2- ☐☐ = 2F.	
Cause		**Possible Solutions**	**Minor Fault Output H2-☐☐=2F**
IGBTs have reached 50% of their expected performance life.		⇒Check the load and output frequency.	Yes

Digital Operator Display		Minor Fault Name	
oH	oH	Heatsink Overheat	
		The temperature of the heatsink exceeded the overheat alarm level set to L8-02 (90-100°C). Default value for L8-02 is determined by regenerative converter capacity.	
Cause		**Possible Solutions**	**Minor Fault Output H2-□□=10**
Surrounding temperature is too high.		Check the surrounding temperature. ⇒Improve the air circulation within the enclosure control panel. ⇒Install a fan or air conditioner to cool surrounding area. ⇒Remove anything near regenerative converter that may cause extra heat.	Yes
Internal cooling fan in the regenerative converter has stopped.		⇒Replace the cooling fan. **Note:** After replacing the cooling fan, reset the Cooling Fan Operation Time Setting parameter (o4-03 = 0). Clear the Cooling Fan Operation Time (U4-03) and start to remeasure the fan's operating time.	
Airflow around the regenerative converter is restricted.		Provide proper installation space around the regenerative converter as indicated in the manual. ⇒Allow for the specified space and ensure that there is sufficient circulation around the control panel.	Yes
		Check for dust or foreign materials clogging cooling fan. ⇒Clear debris caught in the fan that restricts air circulation.	
Digital Operator Display		**Minor Fault Name**	
ov	ov	DC Bus Overvoltage	
		The DC bus voltage exceeded the trip point. For 400 V class: approximately 820 VDC For 690 V class: approximately 1200 VDC	
Cause		**Possible Solutions**	**Minor Fault Output H2-□□=10**
Regenerative converter fails to operate properly due to noise interference.		Check the various options available to minimize the effects of noise. ⇒Review the section on handling noise interference and check the 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.	Yes
		Set the Number of Auto Restart Attempts (L5-01) to a value other than 0.	
Excess load of regeneration.		⇒Check the regeneration load.	
The input power voltage of the regenerative converter is too high.		⇒Lower input power voltage of the regenerative converter within the limits listed in the specifications.	
Wiring of the voltage detection circuit (R1, S1, and T1) on the power supply side and wiring of the main circuit (R, S, and T) are incorrect.		Check the wiring. ⇒Correct the wiring.	
Digital Operator Display		**Minor Fault Name**	
PF3	PF3	Input Phase Loss Detection	
		Abnormal input power supply voltage oscillation continued. (Detected when L8-69 is set to 1)	
Cause		**Possible Solutions**	**Minor Fault Output H2-□□=10**
There is excessive fluctuation in the input power voltage of the regenerative converter.		⇒ After finding the cause of the fault and taking corrective action, reset the fault status of the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.***	Yes
There is phase loss in the regenerative converter input power.			
The power supply capacity is small.			
The cable is too long.			
There is poor balance between voltage phases.			

Digital Operator Display		Minor Fault Name	
SrC	SrC	Phase Order Fault	
		The detection direction of the phase order for the input power supply has changed after powering up.	
Cause		**Possible Solutions**	**Minor Fault Output H2-☐☐=10**
The power supply phase order changed during operation.		⇒ After finding the cause of the fault and taking corrective action, reset the fault status of the regenerative converter. Refer to ***Diagnosing and Resetting Faults on page 4-24.***	Yes
Momentary power loss occurred.			
There is loose wiring in the input power terminals of the regenerative converter.			
There is excessive fluctuation in the input power voltage of the regenerative converter.			
Digital Operator Display		**Minor Fault Name**	
TrPC	TrPC	IGBT Maintenance Time (90%)	
		IGBTs have reached 90% of their expected performance life. **Note:** An alarm output (H2- ☐☐ = 10) will only be triggered if H2- ☐☐ = 10.	
Cause		**Possible Solutions**	**Minor Fault Output H2-☐☐=10**
IGBTs have reached 90% of their expected performance life.		⇒Replace the IGBTs (or the drive module).	Yes
Digital Operator Display		**Minor Fault Name**	
Uv	Uv	Undervoltage	
		One of the following conditions occurred while the regenerative converter was stopped (a Run command was not entered): • Voltage in the DC bus fell below the Undervoltage Detection Level (Uv) (L2-05) • Contactor to suppress inrush current in the regenerative converter was opened. • Low voltage in the input power of the control regenerative converter.	
Cause		**Possible Solutions**	**Minor Fault Output H2-☐☐=10**
There is phase loss in the regenerative converter input power.		The main circuit input power of the regenerative converter is wired incorrectly. ⇒Correct the wiring.	Yes
There is loose wiring in the input power terminals of the regenerative converter.		Check if the terminals are loosened. ⇒Apply the tightening torque specified in this manual to fasten the terminals.	
There is a problem with the voltage from the regenerative converter input power.		Check the voltage. ⇒Correct the voltage to be within the range listed in specifications of the regenerative converter input power.	
The power has been interrupted.		⇒Correct the regenerative converter input power.	
The main circuit capacitors are worn.		Check the maintenance time for the Capacitor Maintenance (U4-05). ⇒Replace the drive module if U4-05 exceeds 90%.	
The input power transformer of the regenerative converter is too small and voltage drops when the power is switched on.		Check for an alarm when the magnetic contactor, line breaker, and leakage breaker are closed. ⇒Check the capacity of the input power transformer of the regenerative converter.	
Air inside the regenerative converter is too hot.		⇒Check the temperature inside the regenerative converter.	
The CHARGE light is broken or disconnected.		⇒Replace the drive module.	
The frequency detection value of the power supply exceeded the allowable value.		⇒Correct the power supply.	
The phase rotation direction of the input side has changed.		⇒Correct the wiring.	
Digital Operator Display		**Minor Fault Name**	
voF	voF	Output Voltage Detection Fault	
		Problem detected with the voltage on the output side of the regenerative converter.	
Cause		**Possible Solutions**	**Minor Fault Output H2-☐☐=10**
Hardware is damaged.		⇒Replace the drive module.	Yes

<1> When a fault occurred at the startup of the regenerative converter, CPF00 or CPF20 is displayed. When a fault occurred after the startup, CPF01 or CPF21 is displayed.

4.5 Operator Programming Errors

◆ oPE Codes, Causes, and Possible Solutions

An Operator Programming Error (oPE) occurs when a contradictory parameter is set or an individual parameter is set to an inappropriate value.
The regenerative converter will not operate until the parameter or parameters causing the problem are set correctly. An oPE, however, does not trigger an alarm or fault output. If an oPE occurs, investigate the cause and refer to ***Table 4.8*** for the appropriate action. When an oPE appears on the operator display, press the ENTER button to view U1-18 and see the parameter that is causing the oPE Fault Parameter (U1-18).

Table 4.8 oPE Codes, Causes, and Possible Solutions

Digital Operator Display		Task
oPE01	oPE01	Regenerative Converter Setting Fault
		Regenerative converter capacity and the value set to the Regenerative Converter Model Selection (o2-04) do not match.
Cause		**Possible Solutions**
The Regenerative Converter Model Selection (o2-04) and the actual capacity of the drive are not the same.		Correct the value set to o2-04.
Digital Operator Display		**Task**
oPE02	oPE02	Parameter Range Setting Error
		Parameters were set outside the possible setting range.
Cause		**Possible Solutions**
Parameters were set outside the possible setting range.		Use the oPE Fault Parameter (U1-18) to find parameters set outside the range. ⇒ Set parameters to the proper values.
Note: When multiple errors occur at the same time, other errors are given precedence over oPE02.		
Digital Operator Display		**Task**
oPE03	oPE03	Multi-Function Input Selection Error
		A contradictory setting is assigned to multi-function contact inputs H1-01 to H1-08.
Cause		**Possible Solutions**
• The same function is assigned to more than one multi-function inputs.(excluding “Not used” and “External Fault”)		Ensure all multi-function inputs are assigned to different functions. ⇒ Re-enter the multi-function settings to ensure this does not occur.

4.6 Copy Function Related Displays

◆ Tasks, Errors, and Troubleshooting

The table below lists the messages and errors that may appear when using the Copy function.
When executing the tasks offered by the Copy function, the LCD operator will indicate the task being performed. When an error occurs, a code appears on the LCD operator to indicate the error. Note that errors related to the Copy function do not trigger a multi-function output terminal that has been set up to close when a fault or alarm occurs. To clear an error, simply press any key on the LCD operator and the error display will disappear.
Table 4.9 lists the corrective action that can be taken when an error occurs.

Note: 1. Whenever using the copy function, the regenerative converter should be fully stopped. The copy function is disabled while the regenerative converter is running.
2. The regenerative converter will not accept a Run command while the Copy function is being executed.
3. Parameters can only be saved to a regenerative converter when the voltage class, capacity, and software version match.

Table 4.9 Copy Function Task and Error Displays

Digital Operator Display		Task
CoPy	CoPy	Writing Parameter Settings (flashing)
Cause		**Possible Solutions**
Parameters are being written to the regenerative converter.		Not an error.
Digital Operator Display		**Error Name**
CPyE	CPyE	Error Writing Data
Cause		**Possible Solutions**
Failed writing parameters.		⇒Try writing parameters again.
Digital Operator Display		**Error Name**
CSEr	CSEr	Copy Unit Error
Cause		**Possible Solutions**
Hardware fault		⇒Replace the LCD operator or the USB Copy Unit.
Digital Operator Display		**Error Name**
dFPS	dFPS	Drive Model Mismatch
Cause		**Possible Solutions**
The regenerative converter from which the parameter were copied and the regenerative converter you are attempting to write to are not the same model. • The regenerative converter the parameters were copied from is a different model of the regenerative converter. • The regenerative converter you attempting to write to is a different model.		Check the model number of the regenerative converter that the parameters were copied from and the model of the regenerative converter you are attempting to write those parameters to. ⇒Make sure the regenerative converter from which the parameter are copied and the regenerative converter to be written to have the same model numbers and software versions.
Digital Operator Display		**Task**
End	End	Task Complete
Cause		**Possible Solutions**
Finished reading, writing, or verifying parameters.		Not an error.
Digital Operator Display		**Task**
iFEr	iFEr	Communication Error
Cause		**Possible Solutions**
A communication error occurred between the regenerative converter and the LCD operator or the USB Copy Unit.		⇒Check the cable connection.
A non-compatible cable is being used to connect the USB Copy Unit and the regenerative converter.		⇒Use the cable originally packaged with the USB Copy Unit.

Digital Operator Display		Error Name
ndAT	ndAT	Model, Voltage Class, Capacity Mismatch
Cause		**Possible Solutions**
The regenerative converter from which the parameters were copied and the regenerative converter to which you are attempting to write to have different electrical specifications, a different capacity, is set to a different control mode, or is a different model number.		⇒Make sure the regenerative converter from which the parameter are copied and the regenerative converter to be written to have the same model numbers and software versions.
The regenerative converter or USB Copy Unit being used to write the parameters is blank and does not have any parameters saved on it.		⇒Make sure all connections are correct, and copy the parameter settings onto the USB Copy Unit or the LCD operator.
Digital Operator Display		**Error Name**
rdEr	rdEr	Error Reading Data
Cause		**Possible Solutions**
Failed while attempting to read parameter settings from the regenerative converter.		⇒Press and hold the READ key on the USB Copy Unit for at least one second to have the unit read parameters from the regenerative converter.
Digital Operator Display		**Task**
rEAd	rEAd	Reading Parameter Settings (flashing)
Cause		**Possible Solutions**
Displayed while the parameter settings are being read onto the USB Copy Unit.		Not an error.
Digital Operator Display		**Error Name**
vAEr	vAEr	Voltage Class, Capacity Mismatch
Cause		**Possible Solutions**
The regenerative converter from which the parameters were copied and the regenerative converter to which you are attempting to write to have different electrical specifications, a different capacity, is set to a different control mode, or is a different model number.		⇒Make sure the regenerative converter from which the parameter are copied and the regenerative converter to be written to have the same model numbers and software versions.
Digital Operator Display		**Error Name**
vFyE	vFyE	Parameter settings in the regenerative converter and those saved to the copy function are not the same
Cause		**Possible Solutions**
Indicates that parameter settings that have been Read and loaded onto the Copy Unit or LCD operator are different.		⇒To have parameters be the same, either copy the parameter settings on the USB Copy Unit or the LCD operator and save them in the regenerative converter. Or, copy the parameter settings on the regenerative converter and save them in the USB Copy Unit or the LCD operator.
Digital Operator Display		**Task**
vrFy	vrFy	Comparing Parameter Settings (flashing)
Cause		**Possible Solutions**
The Verify mode has confirmed that parameters settings on the regenerative converter and parameters read to the copy device are identical.		Not an error.

4.7 Diagnosing and Resetting Faults

When a fault occurs and the regenerative converter stops, follow the instructions below to remove whatever conditions triggered the fault, then restart the regenerative converter.

◆ Fault Occurs Simultaneously with Power Loss

WARNING! *Electrical Shock Hazard.*
Ensure there are no short circuits between the main circuit terminals before restarting the regenerative converter.
Failure to comply may result in serious injury or death and will cause damage to equipment.

1. Turn on the regenerative converter input power.
2. Use monitor parameters U2-☐☐ to display data on the operating status of the regenerative converter just before the fault occurred.
3. Remove the cause of the fault and reset. Refer to ***Fault Displays, Causes, and Possible Solutions on page 4-8*** for more information on how to view fault data.

Note: 1. To find out what faults were triggered, check the fault history in U2-02 (Previous Fault). Information on regenerative converter status when the fault occurred such as the frequency, current, and voltage can be found in U2-03 through U2-20. Refer to ***Viewing Fault Trace Data After Fault on page 4-24*** for more information on how to view fault data.
2. When the fault continues to be displayed after cycling power, remove the cause of the fault and reset.

◆ If the Regenerative Converter Still has Power After a Fault Occurs

1. Look at the LCD operator for information on the fault that occurred.
2. Remove the cause of the fault and reset.
   Refer to ***Fault Displays, Causes, and Possible Solutions on page 4-8*** for more information on how to view fault data.
3. Reset the fault.
   Refer to ***Fault Reset Methods on page 4-25*** for more information on how to reset the fault.

◆ Viewing Fault Trace Data After Fault

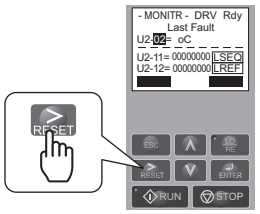
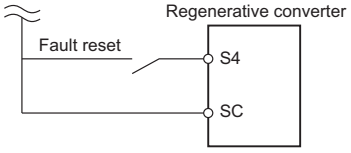
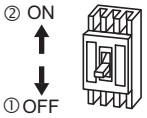
A checking method is shown here using an example in which the regenerative converter detects oC (Overcurrent).

	Step		Display/Result
1	Turn on the regenerative converter input power. The first screen displays.	→	- MODE - DRV Rdy Volt Ref U1-51= 660V U1-52= 0V LSEQ U1-53= 0.0A LREF
2	Press ∧ until the monitor screen is displayed.	→	- MODE - DRV Rdy Monitor Menu U1-51= 660V U1-52= 0V LSEQ U1-53= 0.0A LREF
3	Press ENTER to display the parameter setting screen.	→	-MONITR- DRV Rdy Monitor U1-51= 660V U1-52= 0V LSEQ U1-53= 0.0A LREF
4	Press ∧ and RESET until U2-02 (Previous Fault) is displayed.	→	-MONITR- DRV Rdy Last Fault U2-02= ----- U2-11= 00000000 LSEQ U2-12= 00000000 LREF
5	Press ENTER to view the most recent fault (oC in this example).	→	-MONITR- DRV Rdy Last Fault U2-02= oC U2-11= 00000000 LSEQ U2-12= 00000000 LREF

	Step		Display/Result
6	Press ESC to go back to the U2-02 display.	→	-MONITR- DRV Rdy Last Fault U2-02= oC U2-11= 00000000 LSEQ U2-12= 00000000 LREF
7	Press ∧ to view the status information of the regenerative converter when fault occurred. Parameters U2-03 through U2-20 help determine the cause of a fault.	→	- MONITR - DRV Rdy Input Term Sts U2-11= 00000000 U2-12= 0.00Hz LSEQ U2-05= 0.00A LREF ⇕ - MONITR - DRV Rdy Output Voltage U2-66= XX V U2-01= ----- LSEQ U2-02= ----- LREF

◆ Fault Reset Methods

When a fault occurs, the cause of the fault must be removed and the regenerative converter must be restarted. The table below lists the different ways to restart the regenerative converter.

After the Fault Occurs	Procedure	
After remove the cause of the fault, restart the regenerative converter, and reset the fault.	Press RESET key or the F2 key of the LCD operator.	
Resetting via Multi-Function Digital Input S4	Turn on the fault reset signal from the sequence input. (14 (Fault Reset) must be allocated to the multi-function digital input terminal (H1-□□) in advance.) **Note:** The factory setting of H1-04 (Terminal S4 Function Selection) is 14 (Fault Reset).	
If the above methods do not reset the fault, turn off the regenerative converter main power supply. Resupply power after the LCD operator display is out.		

Note: If the Run command is present, the regenerative converter will disregard any attempts to reset the fault. The Run command must first be removed before a fault situation can be cleared.

5

Periodic Inspection and Maintenance

This chapter describes the method for periodic inspection and maintenance for the control panel and also the part replacement method for the cooling fan, etc.

5.1 Section Safety

The control panel consists of many parts and the designed functions cannot be fully performed unless all of these parts work normally. Therefore, signs of any trouble on parts and devices must be found and treated as in the early stage as possible through periodic inspections. These parts, which cannot be used indefinitely are subject to characteristic variation or malfunction after their service life passes even under normal use conditions. Periodic replacement of needed parts is required for prevention of characteristic variations and failure of the control panel.

This chapter describes items needed for a long use of this control panel with assured reliability.

DANGER! *Confirm that the "CHARGE" indicator LED at the front of the unit is completely turned off, perform voltage detection, then start the work. (Danger: the capacitor will remain charged.)*

DANGER! *Maintenance, inspection, and replacement of parts must be performed only by authorized personnel who has expertise on the control panel structure and circuits.*

DANGER! *After completing the work, make sure that no hand tools or screws are left inside the control panel.*

CAUTION! *A lot of static sensitive parts such as the CMOS IC are used in the control board. Handle them with care. (The product may be damaged by static electricity if touched directly. Remove static electricity before servicing.) Use antistatic envelopes when maintaining or carrying the printed circuit board.*

CAUTION! *When carrying out measurement with an oscilloscope, etc., use an insulated oscilloscope without grounding. Failure to comply could result in damage to the unit or the oscilloscope.*

5.2 Periodic Inspection

Confirm the following items when performing a periodic inspection.

DANGER! *Be sure to wait at least 5 minutes after the power is shut-off, and confirm the CHARGE LED at the front of the unit goes out, then start inspection. Touching the terminals immediately after the power is shut-off may result in death or serious injury.*

Table 5.1 Periodic Inspections (1 time/year)

Location	Inspection Item	Details of Inspection
Control panel	General	Check for loose screws/bolts/connectors.
		Check for trace of overheat on each part.
		Check for cleanness of inside the panel.
		Check for damage or deterioration of the cable sheath.
		Confirm that the fuses in the main circuit and the control circuit are normal.
		Check for accumulation of dirt or dust on the heatsink.
		Check for faults in the protective circuit or in the indication circuit.
	Relay	Check for chattering noise during operation.
		Confirm timer operation.
		Check for damaged contacts.
	Control board	Check for abnormal smells or discoloration.
		Confirm that the power supply voltage is normal.
Cooling system	Air filter	Check for dirt or clogging.
	Cooling fan	Check for abnormal vibration or abnormal noise.
		Confirm that the bearing is normal.

◆ Warranty Period

The warranty period of the control panel is as follows.

Warranty period: This product is warranted for twelve months after being delivered to the end user or if applicable eighteen months from the date of shipment from Yaskawa's factory whichever comes first.

◆ Daily Inspection

Confirm the following items while the system is running.

Table 5.2 Daily Inspections

Location	Inspection Item	Details of Inspection
General	Ambient environment	Confirm the ambient temperature, humidity, dust, toxic gas, oil mist, etc.
	Equipment in general	Check for abnormal vibration or abnormal noise.
	Power supply voltage	Confirm that the voltage of the main circuit power supply and the control voltage are normal (Check using an instrument on the power supply device side.).
Cooling system	Cooling fan	Check for abnormal vibration or abnormal noise.
		Check for cleanness of the air filter.

The following describes the details of periodic inspections.

■ Screws, Bolts, and Connectors

NOTICE: *Periodic inspections should be performed to ensure that all screws, bolts, and connectors are properly fastened.*

NOTICE: *Loose I/O terminal bolts and so on may result in a fault or malfunction. Repetitive heating and cooling that results from current levels when the device is powered up and when the device is stopped can loosen components particularly on the Main circuit.*

Inspect the screws, bolts, and connectors of the following terminals.

- Main circuit input terminals
- Control power supply input terminals
- External input and output terminals

■ Air Filter

If the air filter is soiled or clogged with dirt and dust, the cooling capacity of the regenerative converter will be degraded, resulting in abnormal temperature rise. Check the air filter for dirt and dust at each daily inspection, and periodically clean it with neutral detergent.

■ Control Board

Visually check the control board for the following.

- Abnormal smell or discoloration of the board
- Loose screws or connectors

◆ Spare Parts

Considering the importance of the system in which the FSDrive-LC1HS is used, it is recommended that spare parts be prepared in advance for all possible measures for maintenance management. ***Table 5.3*** shows the recommended spare parts. Confirm the following items and contact your Yaskawa representatives when ordering the spare parts.

Control panel: Yaskawa order number

Spare parts: Part name, model and quantity

Table 5.3 List of Recommended Spare Parts

Voltage [V]	Capacity [kW]	Precharge (PRE)	Drive Module (CONV)			Power Supply Unit (PS)	Power Supply Transformer (T1)	Control Unit (CONT)		Panel Fan
				Internal Cooling Fan	External Cooling Fan				LCD Operator	Panel Circulation Fan
400	200	EUJ71021x (x1)	EUJ71003x	5920PL-05W-B49-DQ1 (300-030-113)	D1751P24B9DS321 (300-030-131)	EUS70001x	USN-BM 1.0KVA (100-052-853)	EUA71002x	JVOP-180	5920PL-05W-B49-DQ1 (300-030-113) (x1)
	400	EUJ71021x (x2)					USN-BM 1.5KVA (100-052-854)			
	600	EUJ71021x (x3)					USN-BM 2.0KVA (100-052-855)			
	800	EUJ71021x (x4)					USN-BM 2.4KVA (100-052-856)			5920PL-05W-B49-DQ1 (300-030-113) (x2)
	1000	EUJ71021x (x5)					USN-BM 2.9KVA (100-052-831)			
690	350	EUJ71021x (x1)	EUJ71004x			EUS70003x	USN-BM 1.0KVA (100-052-853)			5920PL-05W-B49-DQ1 (300-030-113) (x1)
	700	EUJ71021x (x2)					USN-BM 1.5KVA (100-052-854)			
	1050	EUJ71021x (x3)					USN-BM 2.0KVA (100-052-855)			5920PL-05W-B49-DQ1 (300-030-113) (x2)
	1400	EUJ71021x (x4)					USN-BM 2.4KVA (100-052-856)			
	1750	EUJ71021x (x5)					USN-BM 2.9KVA (100-052-831)			5920PL-05W-B49-DQ1 (300-030-113) (x3)

5.3 Procedure for Removal and Installation of the Drive Module

Drive Module is very heavy. (approx. 120 kg)

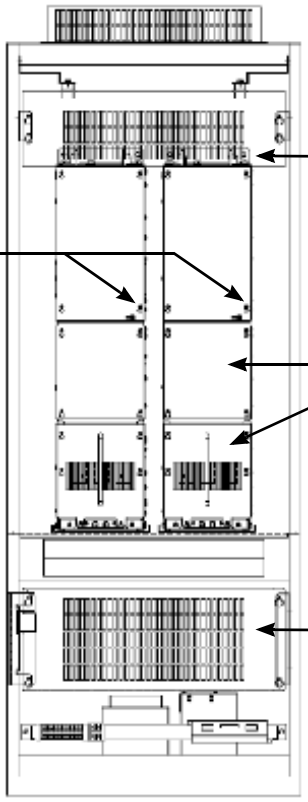
Performing work with 3 persons in total: 1 person for operation of the lifter, 2 for removal and installation of the drive module.

■ Removal

Use the following procedure to remove the drive module. A panel with two drive modules is used as an example.

1. Confirm that the main power supply and the control power supply are turned off.
2. After confirming that the CHARGE indicator on the front side of the door is turned off, unlock the door handle and open the door.
3. After confirming that the CHARGE indicator of the drive module is turned off, remove the protection cover of the drive module and the protection cover of the control panel.
4. Remove the protection cover of the soft charge bypass unit and the mounting bolts of the bus-bar connected to the soft charge bypass unit.
5. Remove the control cables connected to the drive module, the bus-bar and the grounding cables.
6. Remove the support that is fixing the drive module in place and join the dedicated lifter.
7. Loosen the connection bolts of the DC bus.
8. Remove the safety fixing bolts.
9. Pull the pull-out handle and transfer the drive module to the lifter.
   Pulling out the unit is easy because the drive module has casters.
10. Connect the DC bus on the new replacement drive module.

Note: For a specialized lifter, make sure that the lifter is secured firmly to the floor before loading and unloading the drive module.

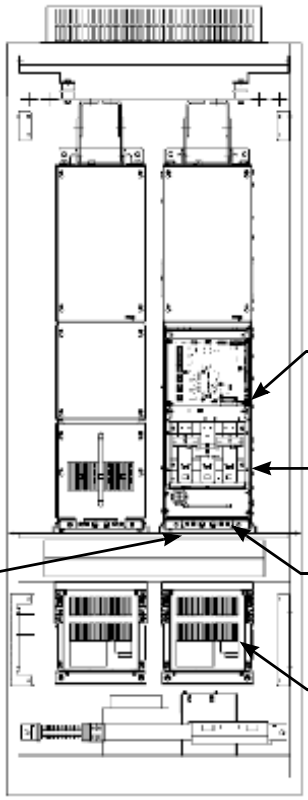


(3) Control Panel Protection Cover
Loosen four M5 mounting screws of the cover, and remove the cover by pulling it upward.

(3) Drive Module CHARGE Indicators

(3) Drive Module Protection Cover
Loosen ten M4 mounting screws of the cover, and remove the cover by pulling it upward.

(3) Control Panel Protection Cover
Loosen four M5 mounting screws of the cover, and remove the cover by pulling it upward.



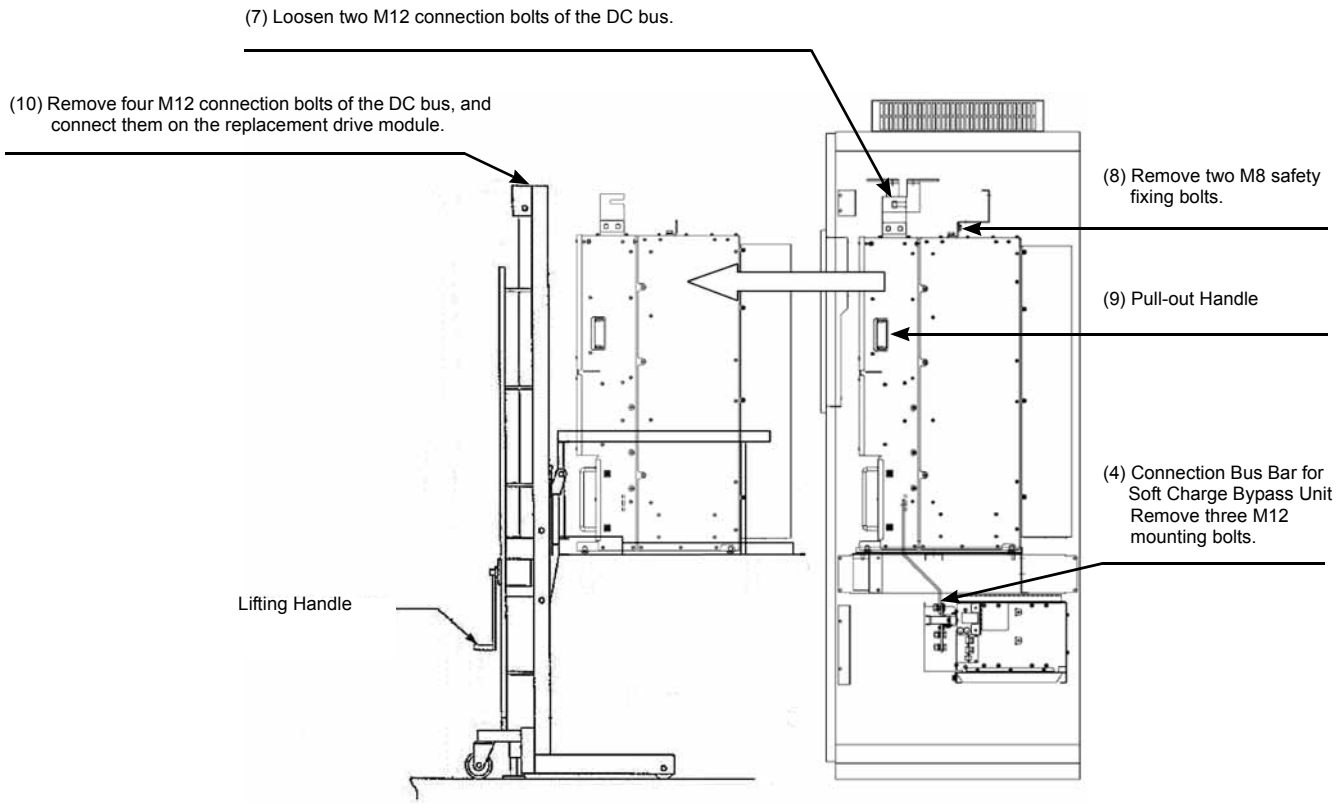
(5) Remove seven control cables.

(5) Remove three M12 bolts of the power supply terminal, and remove three bus-bars.

(6) Remove two M8 bolts and two M5 screws of the drive module support, and remove the drive module support.

(5) Remove one M8 bolt of the ground terminal, and remove the one grounding cable.

(4) Protection Cover for Soft Charge Bypass Unit
Loosen four M4 mounting screws, and remove the cover by pulling it upward.



■ Installation

Install the replacement drive module and component parts in the reverse order of the removal procedure described above.

6

Specifications

This chapter describes the standard specifications for the FSDrive-LC1HS series regenerative converter.

6.1 FSDrive-LC1HS Standard Specifications

The specifications for each model and capacity are listed below.

All models have the same electric specifications such as control specifications.

◆ 400 V Class Models

Model CIMR-LC1HSR□4□□□			200	400	600	800	10C
Rated output capacity		kW	250	500	750	1000	1250
Max. applicable AC drive capacity		kW	200	400	600	800	1000
Input	Rated input current	A	414	800	1200	1600	2000
Output	Rated output current	A	380	760	1140	1520	1900
	Rated output voltage		660 VDC				
	Overload capacity		60 sec. at 150% of rated input current				
	Carrier frequency		2 kHz				
	Maximum output voltage		720 VDC				
Power Supply	Rated voltage and rated frequency		Three-phase 380 VAC to 480 VAC, 50/60 Hz				
	Allowable voltage fluctuation		–15% to 10%				
	Allowable frequency fluctuation		±3%/300 ms (free phase rotation)				
	Power supply equipment capacity	kVA	Power supply capacity not less than the rated input capacity				

◆ 690 V Class Models

Model CIMR-LC1HSRA6□□□			350	700	10C	14C	17C
Rated output capacity		kW	380	760	1140	1520	1900
Max. applicable AC drive capacity		kW	350	700	1050	1400	1750
Input	Rated input current	A	360	700	1050	1400	1750
Output	Rated output current	A	370	740	1110	1480	1850
	Rated output voltage		1020 VDC				
	Overload capacity		60 sec. at 150% of rated input current				
	Carrier frequency		2 kHz				
	Maximum output voltage		1040 VDC				
Power Supply	Rated voltage and rated frequency		Three-phase 600 VAC to 690 VAC, 50/60 Hz				
	Allowable voltage fluctuation		–15% to 10%				
	Allowable frequency fluctuation		±3%/300 ms (free phase rotation)				
	Power supply equipment capacity	kVA	Power supply capacity must be greater than the rated input capacity.				

◆ AC Drive Specifications

Item		Specifications
Control	Control method	Sin ware PWM method
	Input power factor	0.99 min. (at rated current)
	Output voltage accuracy	±5%
Protection Function	Momentary overcurrent protection	Stops with 200% or more of rated input current.
	Blown fuse	Stops by fuse blown.
	Overload protection	Stops after 60 sec. at 150% of rated input current.
	Overvoltage protection	400 V class: Stops with the DC bus voltage approx. 820 V or more. 690 V class: Stops with the DC bus voltage approx. 1200 V or more.
	Undervoltage protection (output)	400 V class: Stops with the DC bus voltage approx. 380 V or less. 690 V class: Stops with the DC bus voltage approx. 570 V or less.
	Undervoltage protection (input)	400 V class: Stops with input voltage approx. 300 V or less. 690 V class: Stops with input voltage approx. 500 V or less.
	Heatsink overheat protection	Protection by thermistor
	Ground fault protection	Protection by electronic circuit
	Indication of charging	Indicates until the DC bus voltage falls to approx. 50 V or less.

◆ Environmental Condition

Item		Specifications
Applicable standards		JIS, JEM and JEC
Operating Environment	Installation location	Indoors
	Ambient temperature	–10 to +40°C
	Humidity	45 to 85 RH% or lower (with no condensation)
	Storage temperature	–20 to +60°C (temperature applicable for a short time of storage such as during transportation)
	Atmosphere	General environment conditions (free from dust or corrosive gas)
	Altitude	1000 m max.
	Vibration	2.0 m/s^2 at 10 to 55 Hz
Cabinet Structure	Shape	Vertically-standalone type
	Coating	Internal and external surface painted in Munsell 5Y7/1
Enclosure		IP51 compliant <1>

<1> The regenerative converter is completely shielded from all sides of the enclosure panel. Gaskets and filters are installed to completely seal shut any openings that would allow air to pass through (such as around the enclosure door), sufficiently protecting the regenerative converter from dust. The design also keeps small amount of dripping water from splashing up and directly entering the enclosure. In regards to ventilation, the standard regenerative converter has an IP20 rating. A protective cover for cables entering the regenerative converter is included.

7

Appendix

This appendix contains a full listing of all parameters and settings available in the FSDrive-LC1HS.

7.1 Parameter Groups

Parameter Group	Name	Parameter Group	Name
A1	Initialization Parameters	L2	Momentary Power Loss Ride-Thru
A2	User Parameters	L5	Fault Restart
b1	Operation Mode Selection	L8	Regenerative Converter Protection
C1	Voltage up/down Times	o1	Digital Operator Display Selection
C6	Carrier Frequency	o2	Digital Operator Keypad Functions
C7	Automatic DC Bus Voltage Regulator (AVR)	o3	Copy Function
d8	DC Bus Voltage	o4	Maintenance Monitor Settings
F6	Communication Option Card	U1	Operation Status Monitors
H1	Multi-Function Digital Inputs	U2	Fault Trace
H2	Multi-Function Digital Outputs	U3	Fault History
H4	Multi-Function Analog Outputs	U4	Maintenance Monitors

7.2 Parameter Table

◆ A: Initialization Parameters

The A parameter group creates the operating environment for the regenerative converter. This includes the parameter Access Level, Password, User Parameters and more.

■ A1: Initialization Parameters

No.	Name	Description	Setting	Change during Run
A1-00 <3>	Language Selection	0: English 1: Japanese	Default: 1 Min: 0 Max: 1	Yes
A1-01	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)	Default: 2 Min: 0 Max: 2	Yes
A1-03	Initialize Parameters	0: No initialization 1110: User Initialize (parameter values must be stored using parameter o2-03) 2220: 2-wire initialization (Resets all parameters to default values.)	Default: 0 Min: 0 Max: 2220	No
A1-04	Password	When the value set into A1-04 does not match the value set into A1-05, parameters A1-01 through A1-03, and A2-01 through A2-33 cannot be changed.	Default: 0000 Min: 0000 Max: 9999	No
A1-05	Password Setting			

<3> Parameter setting value is not reset to the default value when the regenerative converter is initialized by parameter A1-03.

■ A2: User Parameters

No	Name	Description	Setting	Change during Run
A2-01 to A2-32	User Parameters 1 to 32	Parameters that were recently edited are listed here. The user can also select parameters to appear here for quick access.	Default: Min: A1-00 Max: o4-13	No
A2-33	User Parameter Automatic Selection	0: Parameters A2-01 through 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 quick access.	Default: 1 Min: 0 Max: 1	No

◆ b: Application

Application parameters configure the sources of the Run command and voltage reference, and a variety of other application-related settings.

■ b1: Operation Mode Selection

No.	Name	Description	Setting	Change during Run
b1-02	Run Command Selection 1	0: LCD operator 1: Digital input terminals 2: MEMOBUS/Modbus communications 3: Option PCB	Default: 1 Min: 0 Max: 3	No
b1-06	Digital Input Reading	0: Input status is read once every second and processed immediately (for quick response) 1: Input is read twice every second and processed only if the status is the same in both readings (robust against noisy signals)	Default: 1 Min: 0 Max: 1	No
b1-08	Run Command Selection while in Programming Mode	0: Run command not accepted while in the Programming Mode. 1: Run command accepted while in the Programming Mode. 2: Prohibit entering Programming Mode during run.	Default: 0 Min: 0 Max: 2	No
b1-18	Voltage Reference Source Selection 1	0: LCD operator	Default: 0 Min: 0 Max: 0	No

◆ C: Tuning

C parameters are used to adjust the output voltage increase and decrease times, DC bus voltage control, and carrier frequency selections.

■ C1: Output Voltage Increase and Decrease Times

No.	Name	Description	Setting	Change during Run
C1-20	Voltage up Times	Sets the time to increase output voltage in 0.1 s.	Default: 10.0 s Min: 0.0 s Max: 100.0 s	Yes
C1-21	Voltage down Times	Sets the time to decrease output voltage in 0.1 s.	Default: 10.0 s Min.: 0.0 s Max.: 100.0 s	Yes

■ C6: Carrier Frequency

No.	Name	Description	Setting	Change during Run
C6-01	Drive Duty Selection	Always use a regenerative converter with Heavy Duty (default setting) ratings. 0: Heavy Duty (HD) for constant torque applications. 1: Normal Duty (ND) for variable torque applications.	Default: 0 Min: 0 Max: 1	No
C6-02	Carrier Frequency Selection	1: 2.0 kHz	Default: 1 Min: 1 Max: 1	No

■ C7: Automatic DC Bus Voltage Regulator (AVR)

No.	Name	Description	Setting	Change during Run
C7-01	AVR Proportional Gain	Sets the AVR proportional gain.	Default: 20.00 Min: 1.00 Max: 300.00	Yes
C7-02	AVR Integral Time	Sets the AVR integral time.	Default: 0.500 s Min: 0.000 s Max: 10.000 s	Yes
C7-03	AVR Primary Delay Time Constant	Sets the primary delay time for AVR.	Default: 0.000 s Min.: 0.000 s Max.: 0.500 s	No
C7-12	Disabled Current Reference Bias Calculations	Enables automatic current compensation when the current reference is disabled to keep the advance current phase at zero. 0: Disabled 1: Enabled (automatically calculates the bias for the disabled current reference)	Default: 1 Min.: 0 Max.: 1	No

◆ d: Reference

Reference parameters are used to set the DC bus voltage reference value during operation.

■ d8: DC Bus Voltage Reference

No.	Name	Description	Setting
d8-01	DC Bus Voltage Reference	Sets the DC bus voltage reference.	Default: 660 V <4> Min: 600 V Max: 720 V <4>

<4> Values shown here are for 400 V class regenerative converters. For the 690 V class, the setting range is between 900 V and 1040 V, and the default setting is 1020 V.

◆ F: Options

F parameters are used to program the drive to function with communication option cards.

No.	Name	Description	Setting	Change during Run
F6-90	Drive Trace Sampling Rate	Sets the trace sampling rate for the drive.	Default: 0 Min: 0 Max: 60000	No

◆ H: Multi-Function Terminals

H parameters assign functions to the multi-function input and output terminals.

■ H1: Multi-Function Digital Inputs

No	Name	Description	Setting	Change during Run
H1-01	Multi-Function Digital Input Terminal S1 Function Selection	Assigns a function to the multi-function digital inputs. **Note:** Unused terminals should be set to F.	Default: 4B Min: 1 Max: 4C	No
H1-02	Multi-Function Digital Input Terminal S2 Function Selection		Default: 4C Min: 1 Max: 4C	No
H1-03	Multi-Function Digital Input Terminal S3 Function Selection		Default: F Min: 1 Max: 4C	No
H1-04	Multi-Function Digital Input Terminal S4 Function Selection		Default: F Min: 1 Max: 4C	No
H1-05	Multi-Function Digital Input Terminal S5 Function Selection		Default: F Min: 1 Max: 4C	No
H1-06	Multi-Function Digital Input Terminal S6 Function Selection		Default: F Min: 1 Max: 4C	No
H1-07	Multi-Function Digital Input Terminal S7 Function Selection		Default: F Min: 1 Max: 4C	No
H1-08	Multi-Function Digital Input Terminal S8 Function Selection		Default: F Min: 1 Max: 4C	No

H1 Multi-Function Digital Input Selections			
H1-□□ Setting	Function	Description	Change during Run
1	LOCAL/REMOTE Selection	Open: REMOTE (parameter settings determine the source of the voltage reference 1 or 2 (b1-18 or b1-19).) Closed: LOCAL (LCD operator is Run command and reference source.)	No
8	Baseblock Command (N.O.)	Closed: No regenerative converter output	No
9	Baseblock Command (N.C.)	Open: No regenerative converter output	No
F	Not Used	Set this value when not using the terminal.	No
14	Fault Reset	Closed: Resets faults if the cause is cleared and the Run command is removed.	No
1B	Program Lockout	Open: Parameters cannot be edited (except for U1-01 if the reference source is assigned to the LCD operator). Closed: Parameters can be edited and saved.	No
24 to 27, 2C to 2F	External Fault	24: N.O., Always detected, stop 25: N.C., Always detected, stop 26: N.O., During run, stop 27: N.C., During run, stop 2C: N.O., Always detected, alarm only (continue running) 2D: N.C., Always detected, alarm only (continue running) 2E: N.O., During run, alarm only (continue running) 2F: N.C., During run, alarm only (continue running)	No
4B	Run Command	Closed: Run **Note:** After a Run command is received, the input terminal that is assigned to 4B closes, and the regenerative converter starts to run, and continues to run regardless of the input terminal status. Use a Stop command to stop the regenerative converter.	No
4C	Stop Command	Open: Stop **Note**: To stop the regenerative converter, close the input terminal assigned to 4C.	No

■ H2: Multi-Function Digital Outputs

No.	Name	Description	Setting	Change during Run
H2-01 (40BH)	Terminal M1-M2 Function Selection (Relay)	Selects the function of terminal M1-M2, and photocoupler output P1-PC and P2-PC.	Default: F Min: 0 Max: 160	No
H2-02 (40CH)	Terminal P1-PC Function Selection (Photocoupler)		Default: F Min: 0 Max: 160	No
H2-03 (40DH)	Terminal P2-PC Function selection (Photocoupler)		Default: F Min: 0 Max: 160	No

H2 Multi-Function Digital Output Settings			
H2-□□ Setting	Function	Description	Change during Run
0	During Run	Closed: A Run command is active or voltage is output.	No
6	Regenerative Converter Ready	Closed: Power up is complete and the regenerative converter is ready to accept a Run command.	No
7	DC bus Undervoltage	Closed: DC bus voltage is below the Uv trip level set in L2-05.	No
8	During Baseblock (N.O.)	Closed: Regenerative converter has entered the baseblock state (no output voltage).	No
E	Fault	Closed: Fault occurred.	No
F	Not Used	Set this value when not using the terminal.	No
10	Minor Fault	Closed: An alarm has been triggered, or the IGBTs have reached 90% of their expected life span.	No
11	Fault Reset Command Active	Closed: A command has been entered to clear a fault via the input terminals or from the serial network.	No
1B	During Baseblock (N.C.)	Open: Regenerative converter has entered the baseblock state (no output voltage).	No

H2 Multi-Function Digital Output Settings			
H2-☐☐ Setting	Function	Description	Change during Run
1D	During Regeneration	Closed: Motor is regenerating energy into the regenerative converter.	No
1E	Restart Enabled	Closed: An automatic restart is performed	No
20	Regenerative Converter Overheat Pre-alarm (oH)	Closed: Heatsink temperature exceeds the parameter L8-02 value.	No
24	Fuse Blowout (PUF)	Closed: A fuse is blown.	No
25	Drive Ready	Closed: Power up is complete and the drive is ready to accept a Run command.	No
26	Magnetic Contactor (MC) Active	Closed: Magnetic contactor is closed.	No
27	Converter Overload Alarm oL2	Closed: The converter's electric thermostat triggered converter overload protection.	No
2F	Maintenance Period	Closed: Cooling fan, electrolytic capacitors, IGBTs, or the soft charge bypass relay may require maintenance.	No
30	During Current Limit	Closed: When the active current limit has been reached.	No
3C	LOCAL/REMOTE Status	Open: REMOTE Closed: LOCAL	No
4D	oH Pre-alarm Time Limit	Closed: oH pre-alarm time limit has passed.	No
60	Internal Cooling Fan Alarm	Closed: Internal cooling fan alarm	No
100 to 160	Function 0 to 60 with Inverse Output	Inverts the output switching of the multi-function output functions. Set the last two digits of 1☐☐ to reverse the output signal of that specific function. Example: 108: Inverts the output of 8 (During Baseblock)	No

■ H4: Multi-Function Analog Outputs

No.	Name	Description	Setting	Change during Run
H4-01	Multi-Function Analog Output Terminal FM Monitor Selection	Selects the data to be output through multi-function analog output terminal FM. Set the desired monitor parameter to the digits available in U☐-☐☐. For example, enter “153” for U1-53.	Default: 152 Min: 000 Max: 999	No
H4-02	Multi-Function Analog Output Terminal FM Gain	Sets the signal level at terminal FM that is equal to 100% of the selected monitor value.	Default: 100.0% Min: -999.9% Max: 999.9%	No
H4-03	Multi-Function Analog Output Terminal FM Bias	Sets the bias value added to the terminal FM output signal.	Default: 0.0% Min: -999.9% Max: 999.9%	No
H4-04	Multi-Function Analog Output Terminal AM Monitor Selection	Selects the data to be output through multi-function analog output terminal AM. Set the desired monitor parameter to the digits available in U☐-☐☐. For example, enter “153” for U1-53.	Default: 153 Min: 000 Max: 999	No
H4-05	Multi-Function Analog Output Terminal AM Gain	Sets the signal level at terminal AM that is equal to 100% of the selected monitor value.	Default: 50.0% Min: -999.9% Max: 999.9%	No
H4-06	Multi-Function Analog Output Terminal AM Bias	Sets the bias value added to the terminal AM output signal.	Default: 0.0% Min: -999.9% Max: 999.9%	No
H4-07	Multi-Function Analog Output Terminal FM Signal Level Selection	0: 0 to 10 V 1: –10 to 10 V	Default: 0 Min: 0 Max: 1	No
H4-08	Multi-Function Analog Output Terminal AM Signal Level Selection	0: 0 to 10 V 1: –10 to 10 V	Default: 0 Min: 0 Max: 1	No

◆ L: Protection Function

L parameters provide protection to the regenerative converter, such as: control during momentary power loss, fault restarts, and other types of hardware protection.

■ L2: Momentary Power Loss Ride-Thru

No.	Name	Description	Setting	Change during Run
L2-01	Momentary Power Loss Operation Selection	0: Disabled. Regenerative converter 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.	Default: 0 Min: 0 Max: 2	No
L2-02	Momentary Power Loss Ride-Thru Time	Sets the Power Loss Ride-Thru time. Enabled only when L2-01 = 1.	Default: 2.0 s Min: 0.0 s Max: 25.5 s	No
L2-05	Undervoltage Detection Level (Uv)	Sets the DC bus undervoltage trip level.	Default: 350 V <1> Min: 300 V Max: 420 V <1>	No
L2-13	Input Power Supply Frequency Fault Detection Gain	Sets the gain for input power supply frequency fault (Fdv) detection. Decrease the setting value if Fdv occurs even when no power is lost.	Default: 1.0 Min.: 0.1 Max.: 2.0	No
L2-21	Input Undervoltage (AUv) Detection Level	Sets the input undervoltage (AUv) trip level.	Default: 300 V <2> Min: 200 V Max: 400 V <2>	No

<1> Values shown here are for 400 V class regenerative converters. For the 690 V class, the setting range is between 518 V and 725 V, and the default setting is 570 V.
<2> Values shown here are for 400 V class regenerative converters. For the 690 V class, the setting range is between 350 V and 690 V, and the default setting is 430 V.

■ L5: Fault Restart

No.	Name	Description	Setting	Change during Run
L5-01	Number of Auto Restart Attempts	Sets the number of times the regenerative converter may attempt to restart after the following faults occur: GF, oC, ov, Uv1.	Default: 0 Min: 0 Max: 10	No
L5-02	Auto Restart Fault Output Operation Selection	0: Fault output not active. 1: Fault output active during restart attempt.	Default: 0 Min: 0 Max: 1	No
L5-04	Fault Reset Interval Time	Sets the amount of time to wait between performing fault restarts.	Default: 10.0 s Min: 0.5 s Max: 600.0 s	No
L5-05	Fault Reset Operation Selection	0: Continuously attempt to restart while incrementing restart counter only at a successful restarts. 1: Attempt to restart with the interval time set in L5-04 and increment the restart counter with each attempt.	Default: 0 Min: 0 Max: 1	No

■ L8: Regenerative Converter Protection

No.	Name	Description	Setting	Change during Run
L8-02	Overheat Alarm Level	An overheat pre-alarm will occur if the heatsink temperature exceeds the level set in L8-02.	Default: <6> Min: 50°C Max: 150°C	No
L8-03	Overheat Pre-Alarm Operation Selection	1: Stop 3: Continue operation. An alarm is triggered.	Default: 3 Min: 1 Max: 3	No
L8-09	Output Ground Fault Detection Selection	0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1	No

No.	Name	Description	Setting	Change during Run
L8-10	Heatsink Cooling Fan Operation Selection	0: During run only. Fan operates only during run and for L8-11 seconds after stop. 1: Fan always on. Cooling fan operates whenever the regenerative converter is powered up.	Default: 0 Min: 0 Max: 1	No
L8-11	Heatsink Cooling Fan Off Delay Time	Sets a delay time to shut off the cooling fan after the Run command is removed when L8-10 = 0.	Default: 60 s Min: 0 s Max: 300 s	No
L8-12	Ambient Temperature Setting	Sets the ambient temperature at the air inlet side. This value adjusts the oL2 detection level.	Default: 40°C Min: -10°C Max: 50°C	No
L8-32	Current Unbalance Detection current Level	Determines the action the regenerative converter should take when a fault occurs with the magnetic contactor or internal fan. 1: Stop 3: Continue operation (Alarm only)	Default: 1 Min.: 1 Max.: 3	No
L8-41	High Current Alarm Selection	0: Disabled 1: Enabled. An alarm is triggered at output currents above 150% of the regenerative converter rated current.	Default: 0 Min: 0 Max: 1	No
L8-65	Input Voltage Fault Operation Selection	Determines the action the regenerative converter should take when input voltage falls below the level specified in parameter L8-66. 0: No detection 1: Stop 2: Continue operation. (Alarm only)	Default: 0 Min.: 0 Max.: 2	No
L8-66	Input Voltage Fault Detection Voltage Level	Sets the fault detection level for the input voltage.	Default: 50 V <5> Min: 1 V Max: 200 V <5>	No
L8-67	No. of Times of Input Voltage Fault Detection	Sets the number of times for input voltage fault detection.	Default: 5 Min.: 1 Max.: 10	No
L8-69	Input Phase Loss Protection	Enables or disables the input phase loss and unbalance detection. 0: Disabled 1: Enabled. Detects phase loss and unbalanced three phases of the input power supply.	Default: 1 Min.: 0 Max.: 1	No
L8-86	Operation at Panel Fan Fault	Selects the operation the drive performs when a cooling fan fault has been detected. EFAn will appear on the digital operator screen to indicate a panel fan fault. 1: Coast to stop 3: Alarm only (drives continues operating) 5: Disabled panel fan fault detection (EFAn)	Default: 0 Min.: 1 Max.: 5	No

<5> Values shown here are for 400 V class regenerative converters. For the 690 V class, the setting range is between 1 V to 350 V, and the default setting is 87 V.
<6> Default setting is determined by the Regenerative Converter Model (o2-04).

◆ o: LCD Operator Related Settings

The o parameters are used to set up the LCD operator displays.

■ o1: LCD Operator Display Selection

No.	Name	Description	Setting	Change during Run
o1-01	Drive Mode Unit Monitor Selection	Selects the content of the last monitor that is shown when scrolling through Drive Mode display. Enter the last three digits of the monitor parameter number to be displayed: U□-□□.	Default: 158 (Monitor U1-58) Min: 110 Max: 441	Yes
o1-02	User Monitor Selection after Power Up	1: Output voltage reference(U1-51) 2: Output voltage feedback (U1-52) 3: Output current (U1-53) 4: Input voltage (U1-54) 5: User-selected monitor (set by o1-01)	Default: 1 Min: 1 Max: 5	Yes

■ o2: LCD Operator Keypad Functions

No.	Name	Description	Setting	Change during Run
o2-01	LO/RE Key Function Selection	0: Disabled 1: Enabled. LO/RE key switches between LOCAL and REMOTE operation.	Default: 1 Min: 0 Max: 1	No
o2-02	STOP Key Function Selection	0: Disabled. STOP key is disabled in REMOTE operation. 1: Enabled. STOP key is always enabled.	Default: 1 Min: 0 Max: 1	No
o2-03	User Parameter Default Value	0: No change. 1: Set defaults. Saves parameter settings as default values for a User Initialization. 2: Clear all. Clears the default settings that have been saved for a User Initialization.	Default: 0 Min: 0 Max: 2	No
o2-04	Regenerative Converter Model Selection	Enter the regenerative converter model. Setting required only when replacing the regenerative converter or when changing the power supply voltage.	Default: Determined by regenerative converter capacity Min: – Max: –	No
o2-06	Operation Selection when LCD Operator is Disconnected	0: The regenerative converter continues operating if the LCD operator is disconnected. 1: A fault is triggered (oPr) and the regenerative converter output is shut off.	Default: 0 Min: 0 Max: 1	No
o2-09	Initialize Mode	–	Default: Do not change this setting Min: – Max: –	No

■ o3: Copy Function

No.	Name	Description	Setting	Change during Run
o3-01	Copy Function Selection	0: No action 1: Read parameters from the regenerative converter, saving them onto the LCD operator. 2: Copy parameters from the LCD operator, writing them to the regenerative converter. 3: Verify parameter settings on the regenerative converter to check if they match the data saved on the LCD operator.	Default: 0 Min: 0 Max: 3	No
o3-02	Copy Allowed Selection	0: Read operation prohibited 1: Read operation allowed	Default: 0 Min: 0 Max: 1	No

■ o4: Maintenance Monitor Settings

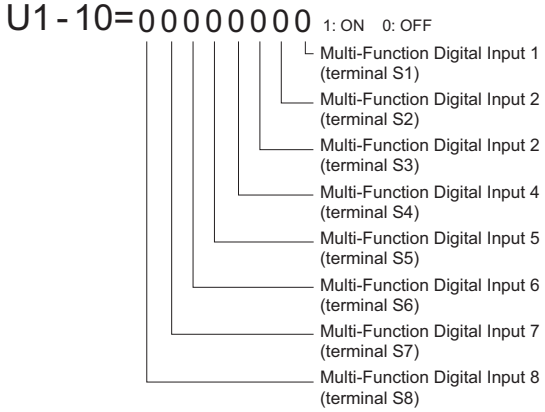
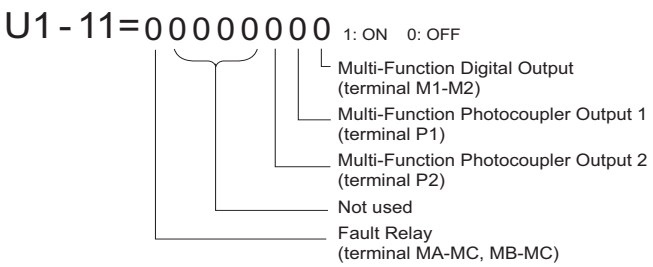
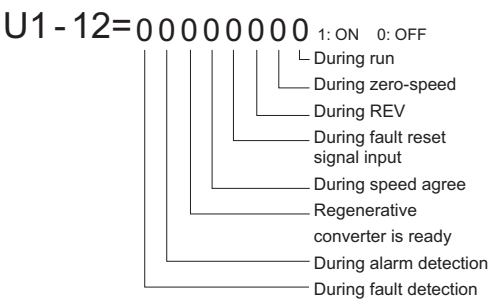
No.	Name	Description	Setting	Change during Run
o4-01	Cumulative Operation Time Setting	Sets the value for the cumulative operation time of the regenerative converter in units of 10 h.	Default: 0 h Min: 0 h Max: 9999 h	No
o4-02	Cumulative Operation Time Selection	0: Logs power-on time 1: Logs operation time when the regenerative converter output is active (output operation time).	Default: 0 Min: 0 Max: 1	No
o4-03	Cooling Fan Operation Time Setting	Sets the value of the fan operation time monitor U4-03 in units of 10 h.	Default: 0 h Min: 0 h Max: 9999 h	No
o4-05	Capacitor Maintenance Setting	Sets the value of the Maintenance Monitor for the capacitors. See U4-05 to check when the capacitors may need to be replaced.	Default: 0% Min: 0% Max: 150%	No
o4-07	DC Bus Pre-Charge Relay Maintenance Setting	Sets the value of the Maintenance Monitor for the soft charge bypass relay. See U4-06 to check when the bypass relay may need to be replaced.	Default: 0% Min: 0% Max: 150%	No

No.	Name	Description	Setting	Change during Run
o4-09	IGBT Maintenance Setting	Sets the value of the Maintenance Monitor for the IGBTs. See U4-07 to check when the IGBTs may need to be replaced.	Default: 0% Min: 0% Max: 150%	No
o4-11	U2, U3 Initialization	0: U2-□□ and U3-□□ monitor data is not reset when the regenerative converter is initialized (A1-03). 1: U2-□□ and U3-□□ monitor data is reset when the regenerative converter is initialized (A1-03).	Default: 0 Min: 0 Max: 1	No
o4-13	Number of Run Commands Counter Initialization	0: Number of Run commands counter is not reset when the regenerative converter is initialized (A1-03). 1: Number of Run commands counter is reset when the regenerative converter is initialized (A1-03).	Default: 0 Min: 0 Max: 1	No

◆ U: Monitors

Monitor parameters allow the user to view regenerative converter status, fault information, and other data concerning regenerative converter operation.

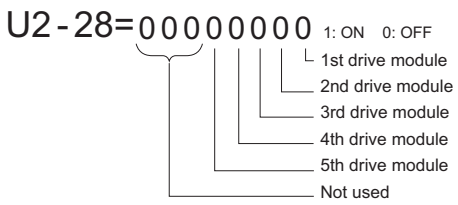
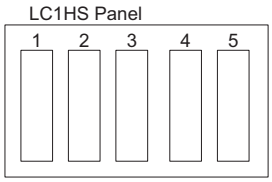
■ U1: Operation Status Monitors

No.	Name	Description	Analog Output Level	Unit
U1-10	Input Terminal Status	Displays the input terminal status. 	No signal output available	–
U1-11	Output Terminal Status	Displays the output terminal status 	No signal output available	–
U1-12	Regenerative Converter Status	Verifies the regenerative converter operation status. 	No signal output available	–
U1-18	oPE Fault Parameter	Displays the parameter number that caused the oPE□□ or Err (EEPROM write error) error.	No signal output available	–
U1-25	Software Number (Flash)	FLASH ID	No signal output available	–
U1-26	Software No. (ROM)	ROM ID	No signal output available	–
U1-27	Message ID (OPR)	OPR ID	No signal output available	–
U1-28	Message ID (Drive)	INV ID	No signal output available	–
U1-29	Software No. (PWM)	PWM ID	No signal output available	–

No.	Name	Description	Analog Output Level	Unit
U1-51	Output Voltage Reference before Soft Starter (SFS)	Displays the output voltage reference value before Soft Starter.	10 V: 800 V (400 V class) 10 V: 1380 V (690 V class)	V
U1-52	Output Voltage Feedback	Displays the output power value during regeneration.	10 V: 800 V (400 V class) 10 V: 1380 V (690 V class)	V
U1-53	Output Current	Displays the output current value.	10 V: Rated output current	1 A
U1-54	Input Voltage	Displays the input voltage value.	10 V: 800 V (400 V class) 10 V: 1380 V (690 V class)	V
U1-55	Input Current	Displays the input current value.	10 V: Rated input current	A
U1-56	DC Side Power	Displays the power (kW) output to the DC bus.	10 V: Rated power (Output)	kW
U1-57	AC Side Power	Displays the power input from the power supply.	10 V: Rated power (Power supply)	kW
U1-58	Input Frequency	Displays the input frequency value.	10 V: Rated frequency	0.1 Hz
U1-59	Primary Current Reference	Displays the primary current reference value.	10 V: Rated input current	A
U1-60	Input Power Factor	Displays the input power factor.	10 V: 100.0%	0.1%
U1-61	Active Current Reference	Displays the active current reference value.	10 V: 100.0%	0.1%
U1-62	Reactive Current Reference	Displays the reactive current reference value.	10 V: 100.0%	0.1%
U1-63	Output Voltage Reference after Soft Starter (SFS)	Displays the voltage reference value after soft starter.	10 V: 800 V (400 V class) 10 V: 1380 V (690 V class)	V
U1-64	AVR Input (Voltage Deviation)	Displays the AVR input value.	10 V: 800 V (400 V class) 10 V: 1380 V (690 V class)	V
U1-65	AVR Output	Displays the AVR output value.	10 V: 100.0%	0.1%
U1-66	Output Voltage Reference (Vq)	Displays the output voltage reference (Vq) value.	10 V: 400 V (400 V class) 10 V: 690 V (690 V class)	V
U1-67	Output Voltage Reference (Vd)	Displays the output voltage reference (Vd) value.	10 V: 400 V (400 V class) 10 V: 690 V (690 V class)	V
U1-68	ACRq Output	Displays the ACRq output value.	10 V: 100.0%	0.1%
U1-69	ACRd Output	Displays the ACRd output value.	10 V: 100.0%	0.1%
U1-72	Input Power Supply Data		No signal output available	–

■ U2: Fault Trace

No.	Name	Description	Analog Output Level	Unit
U2-01 (80H)	Current Fault	Displays the current fault.	No signal output available	–
U2-02 (81H9	Previous Fault	Displays the previous fault.	No signal output available	–
U2-11 (8AH)	Input Terminal Status at Previous Fault	Displays the input terminal status at the previous fault. Displays the same status displayed as in U1-10.	No signal output available	–

No.	Name	Description	Analog Output Level	Unit
U2-12 (8BH)	Output Terminal Status at Previous Fault	Displays the output status at the previous fault. Displays the same status displayed as in U1-11.	No signal output available	–
U2-13 (8CH)	Regenerative Converter Operation Status at Previous Fault	Displays the operation status of the regenerative converter at the previous fault. Displays the same status displayed in U1-12.	No signal output available	–
U2-14 (8DH)	Cumulative Operation Time at Previous Fault	Displays the cumulative operation time at the previous fault.	No signal output available	1 h
U2-20 (8EH)	Heatsink Temperature at Previous Fault	Displays the temperature of the heatsink at the previous fault.	No signal output available	1°C
U2-28	Malfunctioned Module	Displays the drive module where the pervious fault occurred. Drive modules are indicated from right to left, with the bit furthest to the right indicating the 1st module. • When a fault occurs at the 2nd module, U2-28 will display "00000010." • When a fault occurs at the 5th module, U2-28 will display "00010000."  **Note:** Inside an enclosure, the drive module order is reversed so that the 1st drive module appears furthest to the left, followed by the 2nd and 3rd drive modules moving left to right. (1CNV, 2CNV, and so on.) 	No signal output available	–
U2-51	Output Voltage Reference at Previous Fault (before soft starter (SFS))	Displays the output voltage reference at the previous fault.	10 V: 800 V (400 V class) 10 V: 1380 V (690 V class)	V
U2-52	Output Voltage Feedback at Previous Fault	Displays the output voltage feedback at the previous fault.	10 V: 800 V (400 V class) 10 V: 1380 V (690 V class)	V
U2-53	Output Current at Previous Fault	Displays the output current at the previous fault.	10 V: Rated output current	1 A
U2-54	Input Voltage at Previous Fault	Displays the input voltage at the previous fault.	10 V: 800 V (400 V class) 10 V: 1380 V (690 V class)	V
U2-55	Input Current at Previous Fault	Displays the input current at the previous fault.	10 V: Rated input current	A
U2-56	Output Power at Previous Fault	Displays the output power at the previous fault.	10V: Rated power (Output)	kW
U2-57	Input Power at Previous Fault	Displays the input power at the previous fault.	10 V: Rated power (Input)	kW
U2-58	Input Frequency at Previous Fault	Displays the input frequency at the previous fault.	10 V: Rated frequency	0.1 Hz
U2-59	Primary Current at Previous Fault	Displays the primary current at the previous fault.	10 V: Rated input current	A
U2-60	Input Power Factor at Previous Fault	Displays the input power factor at the previous fault.	10 V: 100.0%	0.1%

No.	Name	Description	Analog Output Level	Unit
U2-61	Active Current Reference at Previous Fault	Displays the active current reference at the previous fault.	10 V: 100.0%	0.1%
U2-62	Reactive Current Reference at Previous Fault	Displays the reactive current reference at the previous fault.	10 V: 100.0%	0.1%
U2-63	Output Voltage Reference at Previous Fault (after soft starter (SFS))	Displays the output voltage reference at the previous fault.	10 V: 800 V (400 V class) 10 V: 1380 V (690 V class)	V
U2-64	AVR Input at Previous Fault (Voltage Deviation)	Displays the AVR input at the previous fault.	10 V: 800 V (400 V class) 10 V: 1380 V (690 V class)	V
U2-65	Output Voltage Reference (Vq) at Previous Fault	Displays the output voltage reference (Vq) at the previous fault.	10 V: 400 V (400 V class) 10 V: 690 V (690 V class)	V
U2-66	Output Voltage Reference (Vd) at Previous Fault	Displays the output voltage reference (Vd) at the previous fault.	10 V: 400 V (400 V class) 10 V: 690 V (690 V class)	V

■ U3: Fault History

No.	Name	Description	Analog Output Level	Unit
U3-01 to U3-04	First to 4th Most Recent Fault	Displays the first to the fourth most recent faults.	No signal output available	–
U3-05 to U3-10	5th to 10th Most Recent Fault	Displays the fifth to the tenth most recent faults. After ten faults have occurred in the regenerative converter, 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 every time a fault occurs.	No signal output available	–
U3-11 to U3-14	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.	No signal output available	1 h
U3-15 to U3-20	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 signal output available	1 h

■ U4: Maintenance Monitors

No.	Name	Description	Analog Output Level	Unit
U4-01	Cumulative Operation Time	Displays the cumulative operation time of the regenerative converter. 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.	No signal output available	1 h
U4-02	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.	No signal output available	1 Time
U4-03	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.	No signal output available	1 h
U4-04	Cooling Fan Maintenance	Displays main cooling fan usage time in as a percentage of its expected performance life. Parameter o4-03 can be used to reset this monitor.	No signal output available	1%
U4-05	Capacitor Maintenance	Displays main circuit capacitor usage time in as a percentage of their expected performance life. Parameter o4-05 can be used to reset this monitor.	No signal output available	1%
U4-06	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.	No signal output available	1%
U4-07	IGBT Maintenance	Displays IGBT usage time as a percentage of the expected performance life. Parameter o4-09 can be used to reset this monitor.	No signal output available	1%
U4-08	Heatsink Temperature	Displays the heatsink temperature.	10 V: 100°C	1°C
U4-09	LED Check	Lights all segments of the LED to verify that the display is working properly.	No signal output available	–
U4-13	Peak Hold Current	Displays the highest current value that occurred during run. **Note:** The unit is 1 A in models CIMR-A□4A0930 and 4A1200.	No signal output available	1 A
U4-35	Uv Alarm Location Monitor	Displays the module where the Uv alarm occurred as a binary number.	No signal output available	–
U4-36	ov Alarm Location Monitor	Display the module where the ov alarm occurred as a binary number.	No signal output available	–
U4-37	oH Alarm Location Monitor	Displays the module where the oH alarm occurred as a binary number.	No signal output available	–
U4-38	FAn Alarm Location Monitor	Displays the module where the FAn alarm occurred as a binary number.	No signal output available	–
U4-39	voF Alarm Location Monitor	Displays the module where the voF alarm occurred as a binary number.	No signal output available	–
U4-41	Maximum Imbalanced Current	Displays the largest degree of current unbalance for the drive modules.	No signal output available	–

7.3 Regenerative Converter Model Selection (o2-04) Dependent Parameter Default Values

The tables below list the parameters that depend on Regenerative Converter Model Selection (o2-04). Parameter numbers shown in parenthesis are valid for motor 2.

Table 7.1 Regenerative Converter Model Dependent Parameter Default Values: 400 V Class

No.	Name	Unit	Default Settings				
Model CIMR-LC1HSR□4□□□		–	200	400	600	800	10C
o2-04	Regenerative Converter Model Selection	Hex.	B1H	B2H	B3H	B4H	B5H
E2-11 (E4-11)	Regenerative Converter Rated Output	kW	200.0	400.0	600.0	800.0	1000.0
d8-01	DC Bus Voltage Reference	V	660	660	660	660	660
L2-05	Undervoltage Detection Level (Uv)	V	380	380	380	380	380
L2-21	Input Undervoltage (AUv) Detection Level	V	300	300	300	300	300
L8-02	Overheat Alarm Level	°C	125	125	125	125	125
L8-66	Input Voltage Fault Detection Voltage Level	V	50	50	50	50	50

Table 7.2 Regenerative Converter Model Dependent Parameter Default Values: 690 V Class

No.	Name	Unit	Default Settings				
Model CIMR-LC1HSRA6□□□		–	300	600	900	12C	15C
o2-04	Regenerative Converter Model Selection	Hex.	F1H	F2H	F3H	F4H	F5H
E2-11 (E4-11)	Regenerative Converter Rated Output	kW	300.0	600.0	900.0	1200.0	1500.0
d8-01	DC Bus Voltage Reference	V	860	860	860	860	860
L2-05	Undervoltage Detection Level (Uv)	V	570	570	570	570	570
L2-21	Input Undervoltage (AUv) Detection Level	V	430	430	430	430	430
L8-02	Overheat Alarm Level	°C	130	130	130	130	130
L8-66	Input Voltage Fault Detection Voltage Level	V	87	87	87	87	87

Revision History

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

MANUAL NO. EZZ010905

Published in Japan August 2010 10-8

Date of original publication

Date of publication

Date of Publication	Revision Number	Section	Revised Content
August 2010	–	–	First Edition

Low-Voltage Regenerative Converter for Systems FSDrive-LC1HS

Instruction Manual

TOKYO OFFICE
New Pier Takeshiba South Tower, 1-16-1, Kaigan, Minatoku, Tokyo 105-6891 Japan
Phone 81-3-5402-4502 Fax 81-3-5402-4580

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

YASKAWA ELÉTRICO DO BRASIL LTDA.
Avenida Fagundes Filho, 620 São Paulo-SP CEP 04304-000, Brazil
Phone 55-11-3585-1100 Fax 55-11-5581-8795

YASKAWA ELECTRIC KOREA CORPORATION
7F, Doore Bldg. 24, Yeoido-dong, Yeoungdungpo-gu, Seoul 150-877, Korea
Phone 82-2-784-7844 Fax 82-2-784-8495

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
151 Lorong Chuan, #04-01, New Tech Park 556741, Singapore
Phone 65-6282-3003 Fax 65-6289-3003

YASKAWA ELECTRIC (SHANGHAI) CO., LTD.
No.18 Xizang Zhong Road. 17F, Harbour Ring Plaza Shanghai 200001, China
Phone 86-21-5385-2200 Fax 86-21-5385-3299

YATEC ENGINEERING CORPORATION
No.34,Sihyuan Rd.,Sinjhuang City, Taipei County 242, Taiwan
Phone 886-2-6635-7030 Fax 886-2-6635-7010

YASKAWA ELECTRIC CORPORATION

YASKAWA

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.

MANUAL NO. EZZ010905

Published in Japan August 2010 10-8
10-6-15