

RCU Series Regenerative Converter Unit Instruction Manual

NOTE: REFER ALSO TO APPLICABLE
INVERTER INSTRUCTION MANUAL



Manual Number: HAL1057C

May 2012

After reading this manual,
keep it handy for future
reference.

Hitachi America, Ltd.

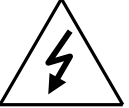
Revision History

Rev A, May 2010 – Miscellaneous corrections throughout. Added cooling clearance drawing.


Rev B, June 2010 – Significant updated information.

Rev C May 2012– Redesigned manual format


1. SAFETY




	ONLY A COMPETENT ELECTRICIAN SHOULD CARRY OUT THE ELECTRICAL INSTALLATION.
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1.1 WARNINGS


	1	Internal Components and circuit boards (excepting the isolated I/O terminals) apply an electric current when the RCU is connected to the main voltage. This voltage is extremely dangerous and may cause death or severe injury if you come in contact with it.
	2	When the RCU is connected to the main power, current is flowing in the DC-Link (P, N) and output terminals (R, S, T) even if the RCU is not operating.
	3	RCU has a large capacitive leakage current.
	4	The control I/O terminals are isolated from the I/O voltage but the relay outputs and other I/Os may have dangerous voltage even if the power is disconnected from the RCU
	5	User should install Fuse which can be blown fast between output terminals (R, S, T) and main power source of the RCU
	6	Spare parts can be delivered only by Hitachi America, Ltd.

1.2 SAFETY INSTRUCTIONS

	1	Do NOT make any connections when the RCU is connected to main voltage.
	2	Do NOT make any measurements when the RCU is connected to main voltage.
	3	After disconnecting main power, wait until the cooling fan stops and the indicator on display goes out. Wait a further 5 minutes before doing any work on the RCU connections. Do NOT open even the cover within this time.
	4	Do NOT make any voltage withstand tests on any parts of the RCU .
	5	Make sure that the cover of the RCU is closed before connecting main voltage.

Ground	Warning Symbols
<p>The ground terminal of the RCU</p>  <p>has to be connected to ground wire .</p> <p>Grounding of the RCU prevents high voltage accidents that are caused by switching.</p>	<p>Please be more cautious for the following warning symbols for user's safety</p>  = Dangerous Voltage  = General Warning

1.3 Wiring

	1	Do not supply overvoltage which over permissible voltage level for the RCU output side terminals (R, S, T)
	2	Link the RCU output-side terminals (R, S, T) to the exact order
	3	Link the RCU output-side terminals (R, S, T) between main input power and input AC reactor of inverter
	4	Only a competent electrician should perform wiring and inspection

This manual explains specifications, installation, operation, features and maintenance of **RCU**. This is a manual for users who have prior experience with RCU. Please read this manual carefully before operating the **RCU**. Retain it for future reference.

2. Upon Receipt of Products

2.1 Initial Inspection

Each **RCU** has been subjected to demanding factory tests before release. After unpacking, check that the unit does not show any signs of damage or missing parts. (Refer to the RCU Label in Figure 2.1 and RCU Type in Figure 2.2).

In the event of damage, or if the product does not correspond with your order, please contact your supplier immediately.

TYPE	RCU4022	RCU Model
Serial No.	0901001P	Serial Number
Power Rating	22[kW], 25[%ED]	RCU Nominal Power(Motor Capacity)
INPUT	DC513~650V, DC43A (AVG)	RCU Rated Input
OUTPUT	3Φ, AC 380~460V rms, 50/60Hz, AC 40A rms 100s	RCU Rated Output
Hitachi America, Ltd.		

Figure 2.1 RCU Label (This is attached to the side of the RCU)

2.2 RCU Type

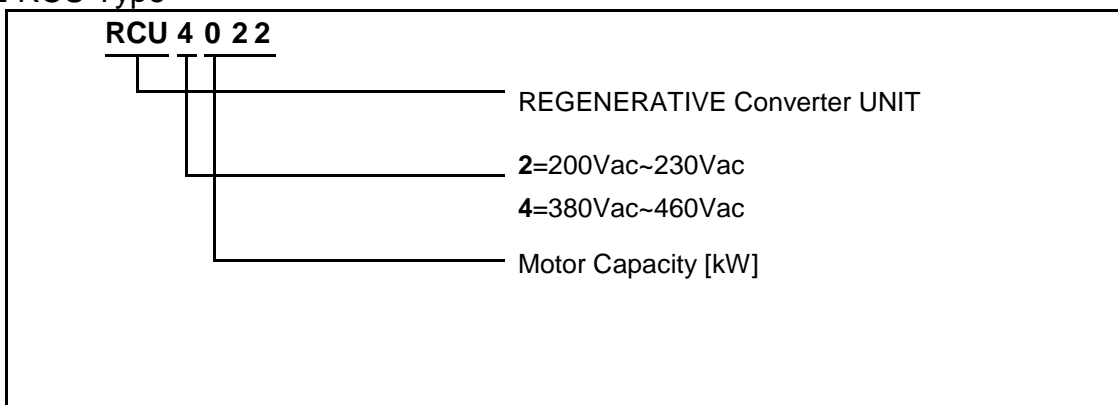


Figure 2.2 RCU Type

2.3 Storage and Warranty

Check the ambient conditions in the storage room before making the first trial run (temperature: -25°C~+60°C, relative humidity: 5~95%, condensation is not allowed).

Hitachi America, Ltd. will not be responsible for the damage caused by ambient conditions.

The period of the product warranty under normal installation and handling conditions is 12 months from the date of installation or 18 months from date of shipment, whichever occurs first. Warranty remedy is limited to either repair at Hitachi's designated service center, or replacement, of the only the RCU in question, at Hitachi America's sole discretion. The warranty does not cover damage to associated equipment, or damage caused by improper installation, unauthorized modification, fire, flood, etc.

Contact Hitachi America for a copy of the complete warranty terms and conditions which govern this sale. If any questions concerning warranty arise, please contact your distributor.

2.4 Power rating

2.4.1 200V RCU output rating

Id = rated DC input current, In = rated AC output current (100sec per 400sec, or 25%ED)

Ic = continuous AC output current, * = ask factory for detail

Main Voltage 200V - 230V, 50/60Hz RCU Series							
RCU Model	Rated power and Rated current				Size	Dimension WxHxD (mm)	Weight (kg)
	P [kW]	Id [Aavg]	In [Arms]	Ic [Arms]			
RCU2011	11	36	30	15	KE3	195x425x210	12
RCU2015	15	48	40	20			
RCU2022	22	72	60	30			

Table 2.4-1 200V series RCU Power ratings and dimensions

2.4.2 400V RCU output rating

Id = rated DC input current, In = rated AC output current (100sec per 400sec,)

Ic = continuous AC output current , * =ask factory for detail

Main Voltage 380V - 460V, 50/60Hz RCU Series							
RCU Model	Rated power and Rated current				Size	Dimension WxHxD (mm)	Weight (kg)
	P [kW]	Id [Aavg]	In [Arms]	Ic [Arms]			
RCU4011	11	22	20	16	KE2	195x425x195	12
RCU4015	15	29	27	21.6			
RCU4022	22	43	40	32	KE3	195x425x210	
RCU4030	30	58	54	43.2	KE4	195x455x210	13.5

Table 2.4-2 400V series RCU Power ratings and dimensions

2.5 Mounting

The RCU should be mounted in a vertical position on the wall or on the back plane of a cubicle. Follow the requirement for cooling. See chapter 3.2 for dimensions.

In order to ensure a safe installation, make sure that the mounting surface is relatively flat.

Fixing is done with four or more screws or bolts depending on the size of the unit. See Figure 2.5-1 ~ 2.5-3.

2.5.1 KE2

class	Model
400V	RCU4011
	RCU4015

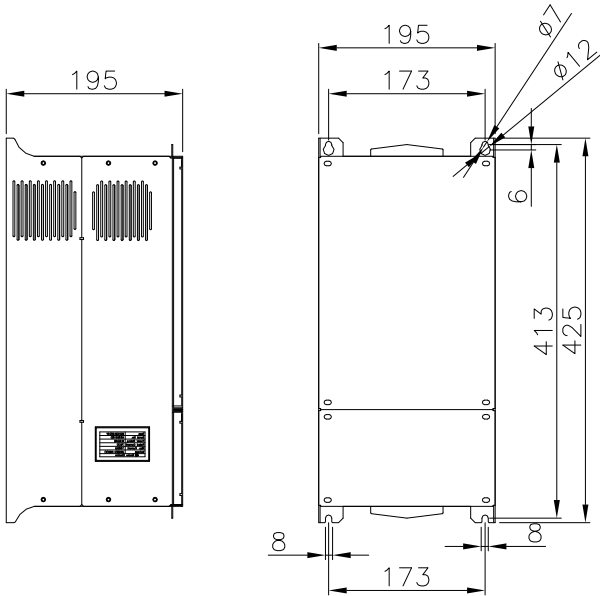


Figure 2.5-1 KE2 Mounting dimension

2.5.2 KE3

Class	Model
400V	RCU4022

Class	Model
200V	RCU2011
200V	RCU2015
200V	RCU2022

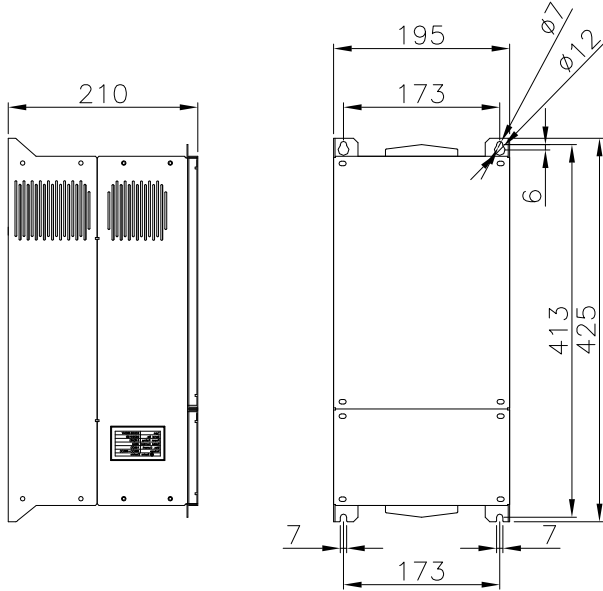


Figure 2.5-2 KE3 Mounting dimension.

2.5.3 KE4

Class	Model
400V	RCU4030

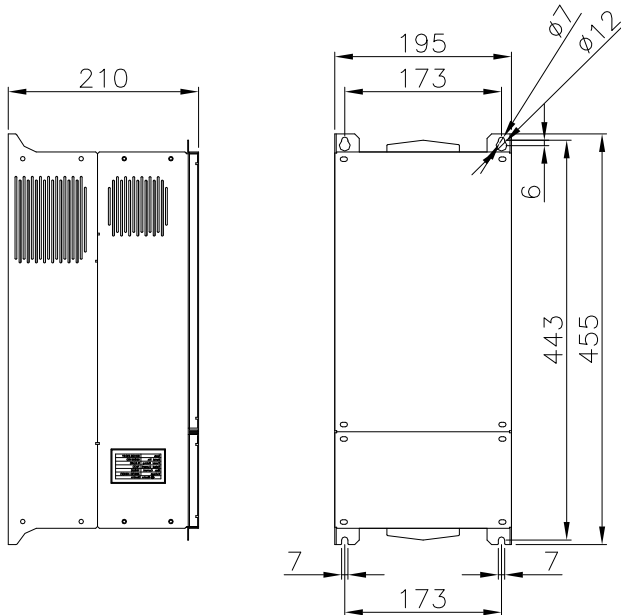


Figure 2.5-3 KE4 Mounting dimension.

2.6 Specification

Main Connection	Output (AC Source)	(R, S, T) 3-phase 200V _{ac} ~230V _{ac} , 380V _{ac} ~460V _{ac} /45~65Hz
		allowable voltage fluctuation $\pm 10\%$
	allowable imbalance rate between phase $\leq 2\%$	
	Input (DC Source)	AC line voltage X 1.414
Rated Output	Regenerative Torque	150% for 30sec, 100% for 100sec, 80% continuous
	%ED Rating	25% ED
Terminal Characteristics	Control Method	PWM current control method
	Input Signal	Run / Enable / Ex. Fault / Fault Reset
	Fault Relay Output 1(DO1)	AC 250V, 1A or DC 30V, 1A / N.O/N.C output
	Healthy Relay Output 2(DO2)	AC 250V, 1A or DC 30V, 1A / N.O/N.C output
Protection Function	Instantaneous over current	Stops at ~ 200% of the current on power side (Protected by Software)
	Blown fuse	Motor stops by blown fuse (when over current occurred)
	Overvoltage (DC)	Stops at ~ 800 VDC
	Overload	Stops after 100% for 100sec, 150% for 30sec
	Current limitation	Stops at 150% of rated current operating condition
	Overheat	Protected by thermistor at overheat condition (95°C)
	Imbalance between phases	In case that imbalance rate between three phases (R, S, T) exceeds 2%.
	External Emergency Stop Signal	Protected by external input signal
Environmental Conditions	Location	Indoor (Protected from corrosive gases and dust)
	Ambient temperature	-10°C ~ +40°C (operating temperature), -20°C ~ +65°C (storage temperature)
	Humidity	< 90%, (non-condensing)
	Vibration	Up to 9.8 m/s ² (1G), less than 15Hz, up to 1.96 m/s ² (0.2G) at 15 to 60Hz


***Caution:**

1. RCU cannot be used with single-phase power supply. Use three-phase power supply.
2. RCU capacity is used to select the motor with the same capacity.

3. Installation

3.1 Installation Conditions

Please install the **RCU** in a location satisfying the following conditions.

	1	Avoid rain, high temperature and high humidity.
	2	Avoid direct sunlight.
	3	The RCU should be protected from dirt, metal dust, and welding flame.
	4	Avoid mounting where excessive vibration exists.
	5	Defective main power may cause the RCU damages. - Using the same power source with welding machine. - Using a generator as the power source. - Sudden changes in the main voltage.
	6	Keep away from flammable materials.
	7	Install on nonflammable surfaces only.

3.2 Cooling

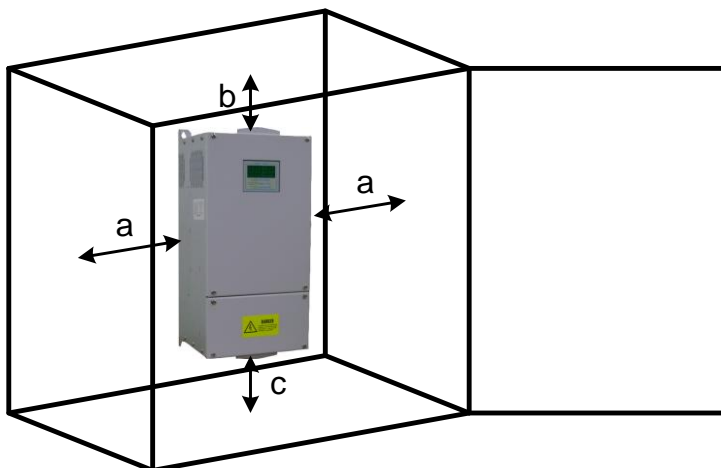


Figure 3.2 Installation space


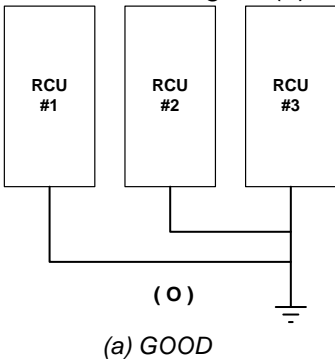
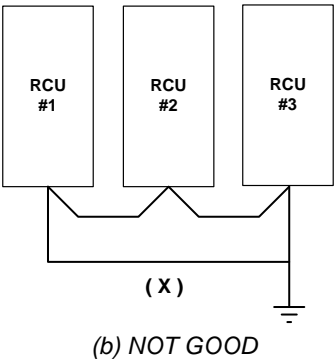
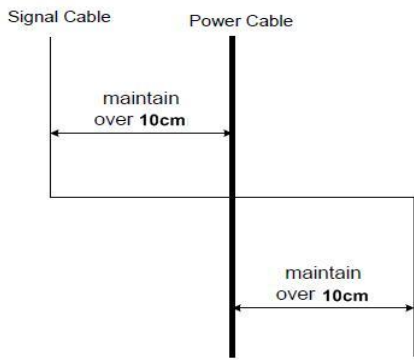
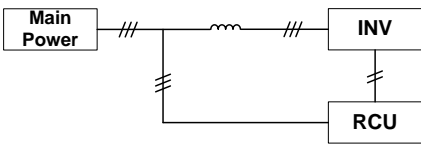
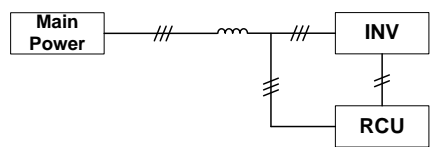
The specified space around the **RCU** ensures proper cooling air circulation. See table 3.2 for dimensions. If multiple units are to be installed above each other, the distance between the units must be $b+c$ and air from the outlet of the lower unit must be directed away from the inlet of the upper unit.

Size	Dimension(mm)			
	a	a2	b	c
KE2 / KE3/ KE4	30	10	160	80

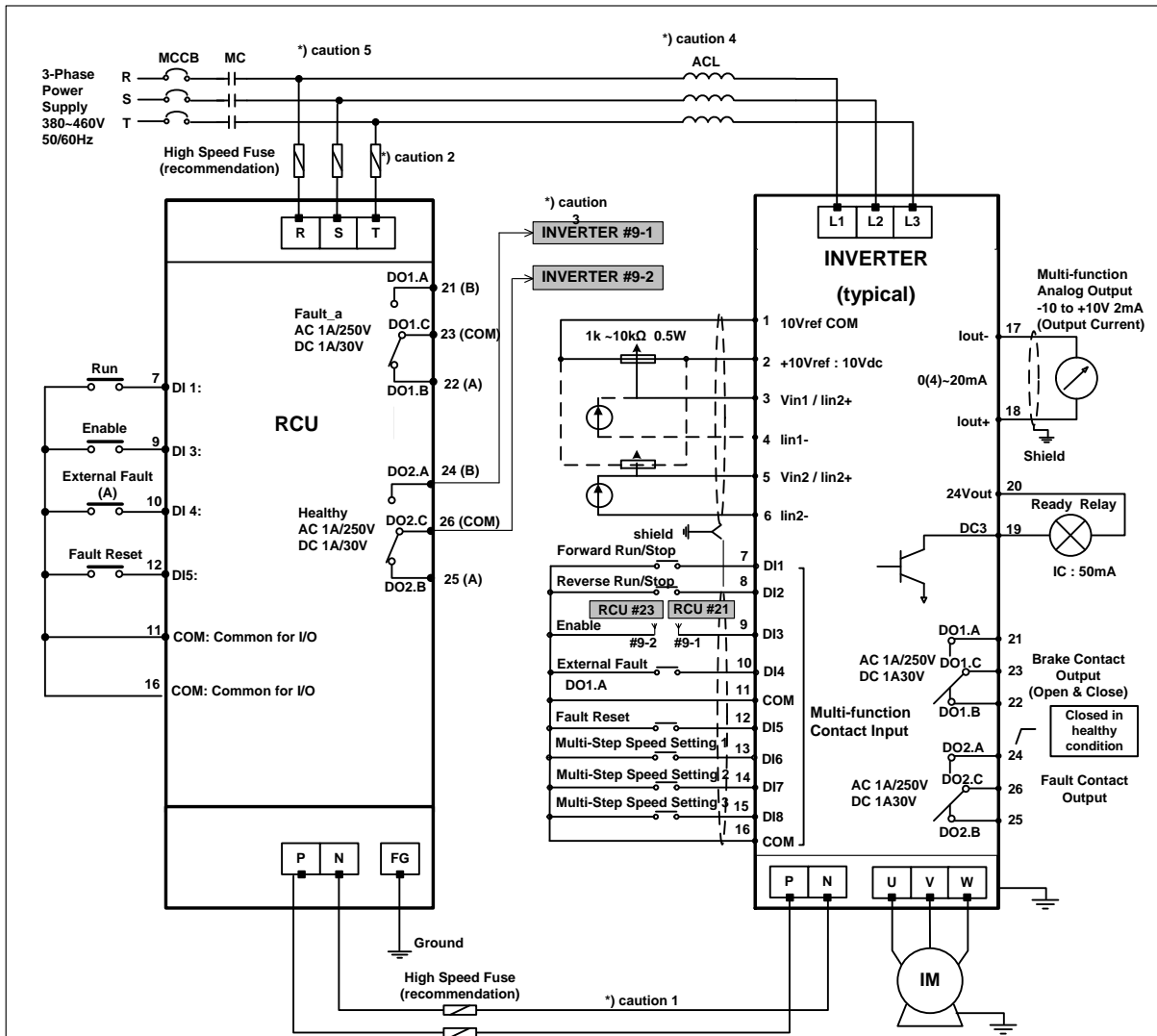
Table 3.2 Installation space dimension
a2 = distance from the RCU to other RCU

4. Wiring

4.1 Cautions in wiring

	1	<p>Connect the ground cable surely. If multiple units are to be installed, Do not make the loop with the ground cables like figure (b) below.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>(O) (a) GOOD</p> </div> <div style="text-align: center;">  <p>(X) (b) NOT GOOD</p> </div> </div>
	2	Only a competent electrician should carry out the wiring.
	3	Make sure that the input main voltage is switched off.
	4	Fasten the terminal screws to the relevant torque value and make sure that there are not loose terminals.
	5	<p>The signal cables must be isolated from the power cables. For an unavoidable case, install perpendicular to each other as shown below.</p> <div style="text-align: center;">  </div>
	6	<p>Link the RCU output-side terminals (R, S, T) between main input power and input AC reactor or filter of the inverter. Otherwise, malfunction of the RCU or inverter could result.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>(O) (a) GOOD</p> </div> <div style="text-align: center;">  <p>(X) (b) NOT GOOD</p> </div> </div>

4.2 Wiring Diagram



- *) caution 1 : The cable length between DC Link terminal of inverter and terminal of RCU should be less than 7m. P-N of RCU and DC Link terminal P(+), N(-) of inverter should correspond.
- *) caution 2 : Install Fuse between RCU output terminal (R, S, T) and power supply.
(Refer to chapter 4.5 for wire and fuse specification)
- *) caution 3 : When you want to connect inverter with RCU, Connect Healthy (A_contact) signal of RCU with Enable signal of inverter.
- *) caution 4 : You should install a AC input reactor to prevent the regenerated power from flowing to inverter.
- *) caution 5 : You should link RCU output-side terminals (R, S, T) between main input power and input AC reactor of inverter.

Figure 4.1 RCU typical wiring diagram

4.3 Control terminal specific

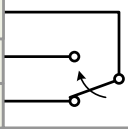
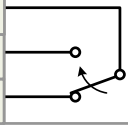
Catalog	No	Terminal	Signal	Content
Contact Output	23	DO1. C	Contact output 1 (common terminal)	 A, B contact common terminal Fault A contact output Fault B contact output AC 1A/250V DC 1A/30V
	21	DO1. A	Contact output 1 (a-contact)	
	22	DO1. B	Contact output 1 (b-contact)	
Contact Output	26	DO2. C	Contact output 1 (common terminal)	 A, B contact common terminal Healthy A contact output Healthy B contact output AC 1A/250V DC 1A/30V
	24	DO2. A	Contact output 1 (a-contact)	
	25	DO2. B	Contact output 1 (b-contact)	
Contact Input	11,16	DI. COM	Contact input (common terminal)	
	7	DI. 01	Contact Input 1	RCU operation signal
	9	DI. 02	Contact Input 2	RCU preparation of operation signal
	10	DI. 03	Contact Input 3	External fault input signal
	12	DI. 04	Contact Input 4	RCU fault reset signal

Figure 4.2 Control terminal specific

Refer to figure 4.1 for basic connection.

The control cables should be at least 0.5mm² shielded cables. The maximum wire size fitting in the terminals is 2.5mm².

4.4 Terminal block and Screw type (According to Mounting Dimension)


SIZE	Input/Output Wiring			
	Terminal Block type	Width (inside)	Screw type	Signed Torque (N·m)
KE2P KE3P KE4P		12mm	M5	3~4

Table 4.1 RCU Terminal Block and Screw type

4.5 I/O Power line and Connection of Fuse

For power lines, use copper wire rated 600V, +75°C. Wire gauge and fuse capacity must be sized based on rated output current of RCU. Please refer to Table 4.2 for the minimum size of power lines (copper) and following fuse capacity. When three or more parallel wires are used, please pay attention to avoid overloading.

Voltage	Capacity [kW]	I/O cable [mm ²]	Ground cable [mm ²]	FUSE [A]	
				P, N (800V _{dc})	R, S, T (500V _{ac})
200V	11	8	4	45	
	15	10	5	60	
	22	16	8	90	
400V	11	4	2	30	
	15	4	2	40	
	22	8	4	60	
	30	8	4	80	

Table 4.2 Wire, according to capacity and Fuse recommendation

C A U T I O N S

- 1) Use copper wire rated for 600V, 75°C.
- 2) Use only fast-blow fuses.

5. Operation

5.1 Display description

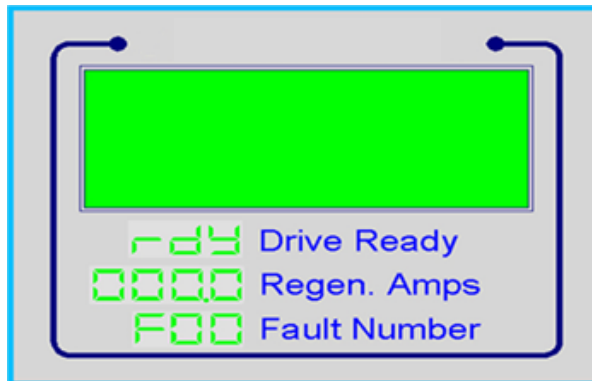


Figure 5.1 keypad display description

5.2 Operation

1	Refer to wiring diagram in Chapter 4.2 and connect inverter, RCU, and control I/O. Check the RCU P (+) terminal is connected to the inverter DC Link (+) and the RCU N (-) terminal is connected to the inverter DC Link (-). If this condition were not satisfied, RCU could be broken.
2	After power is supplied to inverter, Check if RCU display on keypad behaves properly. If the display is not good, please check wiring with the inverter.
3	Enter the DI 1-RUN and DI 2-Enable signal to RCU.
4	When regenerative energy is generated by inverter driving mode, RCU has a regenerative state. If the magnitude of the regenerative current is not displayed or fault code (Fxx) is displayed, check the operation status and the status of the wiring and control signal input, please.

5.3 Fault Codes

When RCU fault occurs, the Fault LED on the keypad will be lit. According to the fault states, fault code is displayed such as below. When Fault occurs, Reset should be performed by DI5.

Fault Code	Function	Fault Description
F 01	Overload Protection	Occurs after 100% for 100sec, 150% for 30sec
F 02	Over current Protection	Occurs at approx, 200% of the current on power side (Protected by Software)
F 07	Over voltage Protection	Threshold at approx, 800 VDC
F 21	Overheating Protection	Protected by thermistor at overheat condition(95°C)
F 22	Short Circuit Protection	Detects over current and protects RCU by hardware
F 25	External Emergency Input Signal	Fault generated by external input signal
F32	AC Supply Open	The RCU detects no, or under voltage at the AC line terminals
F 35	Phase Imbalance Protection	Imbalance between phases (R, S, T) exceeds 2%.

Table 5.1 Fault code / Fault Description

7. Check for Maintenance

Check Part	Check Item	Check Point	Check Period		Check Method	Standards of judgment
			Daily	Regular		
The Whole	Ambient Environment	Ambient temperature, Humidity, Dust, Hazardous gases, Oil residue Etc.	○		seeing tasting thermometer hygrometer	freezing is not allowed (ambient temperature range : -10~40°C) condensation is not allowed at RH (ambient humidity : 20~90 %)
	The whole Equipment	Strange vibration, Strange Sound	○		Seeing, Hearing	No problem
	Voltage Source	Voltage fluctuations and Voltage drop	○		Inverter Input voltage measurement	Within ±10% of rated voltage
Main Circuit	Overall Point	Insulated resistance		○	Main Circuit Terminal to Ground Terminal (500V-Mega use)	No problem
		Screw extracting		○	Seeing	
		Sign of overheating		○	Seeing	
	Terminal Block	Damage		○	Seeing	No damage
	Smoothing Condenser	Leaking, Strain	○		Seeing, Hearing	
	Relay	Trembling phenomenon		○	Hearing	
	Resistor	Crack, Discoloration		○	Seeing	
Cooling Fan	Vibration Strange sound	○		Hearing		

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Check Part	Check Item	Check Point	Check Period		Check Method	Standards of judgment
			Daily	Regular		
Main Circuit	Cooling System	Dust, Stink		○	Seeing	
	Wire	Strain peeled		○	Seeing	
	RCU Output	3phase output		○	TESTER Voltmeter	3 phase output within variation allowed
Control Circuit	Operation	Protection Circuit		○	Random behavior	No problem
	Connection	Captive state		○	Seeing, Touching	No problem
	KEYPAD	Display, Operation state		○	Seeing, Touching	No problem

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