



Digitized Automation for a Changing World

# Delta Power Regenerative Unit REG2000 Series User Manual



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(Original instructions)

## Before Use

READ PRIOR TO INSTALLATION FOR SAFETY.



- ☑ Ensure the power is OFF before wiring or installing the Power Regenerative Unit.
- ☑ Turn OFF the Power Regenerative Unit power before doing any wiring. A charge with hazardous voltages may remain in the DC bus capacitors even after the power has been turned off for a short time. Do not touch the internal circuits and components before the POWER LED (behind the digital keypad) is OFF.
- ☑ For your safety, measure the remaining voltage with a DC voltmeter on +1/DC+ and DC- and do not start wiring before the voltage drops to a safe level (less than 25 V<sub>DC</sub>). Installing wiring with a residual voltage may cause personal injury, sparks and short circuit.
- ☑ There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. Please do not touch these components or the circuit boards before taking anti-static measures.
- ☑ Never reassemble internal components or wiring.
- ☑ Ground the Power Regenerative Unit using the ground terminal. The grounding method must comply with the laws of the country where the Power Regenerative Unit is to be installed. The 230V series uses Type 3 grounding; the 460V series uses special grounding.
- ☑ Do NOT install the Power Regenerative Unit in a place subjected to high temperature, direct sunlight and inflammables.



- ☑ After finishing the wiring of the Power Regenerative Unit, check if R/L1, S/L2 and T/L3 are short-circuited to ground with a multimeter. Do NOT power the Power Regenerative Unit if short circuits occur. Eliminate the short circuits before the Power Regenerative Unit is powered.
- ☑ The power system voltage rating onto which the Power Regenerative Unit is installed must not be higher than 240 V for the 230V series (480 V for the 460V series), and the current must not be greater than 5000 A RMS [10000 A RMS for models of 40 HP (30 kW) or more].
- ☑ Only qualified persons are allowed to install, wire and maintain the Power Regenerative Unit.
- ☑ Even if the Power Regenerative Unit is stopped, a charge may still remain in the main circuit terminals of the Power Regenerative Unit with hazardous voltages.
- ☑ Due to prolonged operation and poor environmental conditions, the enclosure temperature may become excessively high; operators should avoid contact to ensure personal safety.
- ☑ If unopened and unused for more than three months, the ambient storage temperature must not be higher than 30°C. The electrolytic capacitors are likely to deteriorate if stored without power at high ambient temperatures. Do not leave the unit without power for more than one year.

- ☑ Pay attention to the following precautions when transporting and installing this package (including wooden crate and wood stave).
  1. If you need to deworm the wooden crate, do not use fumigation or you will damage the Power Regenerative Unit. Any damage to the Power Regenerative Unit caused by using fumigation voids the warranty.
  2. Use other methods, such as heat treatment or any other non-fumigation treatment, to deworm the wood packaging material.
  3. If you use heat treatment to deworm, leave the packaging materials in an environment of over 56°C for a minimum of thirty minutes.

**NOTE:**

1. In the figures in this manual, the cover or safety shield is disassembled only when explaining the details of the product. During operation, install the top cover and wiring correctly according to the provisions. Refer to the operation descriptions in the manual to ensure safety.
2. The figures in this instruction are only for reference and may be slightly different depending on your model, but it will not affect your customer rights.
3. The content of this manual may be revised without prior notice. Consult our distributors or download the latest version at [http://www.deltaww.com/iadownload\\_acmotordrive](http://www.deltaww.com/iadownload_acmotordrive).

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**Issued Date: 2025/11**

# Chapter 1 Product Overview

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1-1 Nameplate

1-2 Model Number

1-3 Serial Number

1-4 Apply for After-sales Service by Mobile Device

1-5 Operating Principle

1-6 RFI Jumper

1-7 Dimensions

Follow these steps before using the product to ensure safety during use.

1. After opening the packaging, first check that the product has not been damaged during shipment. Inspect and ensure that the nameplate labels on the product match the labels on the box.
2. Make sure the wiring is suitable for the Power Regenerative Unit voltage range. Follow the instructions in the installation manual when installing the Power Regenerative Unit.
3. When wiring the Power Regenerative Unit, be aware of the wiring positions of the main circuit terminals "R/L1, S/L2, T/L3, DC+, DC-", and make sure the terminals are wired correctly to prevent any damage.

### 1-1 Nameplate

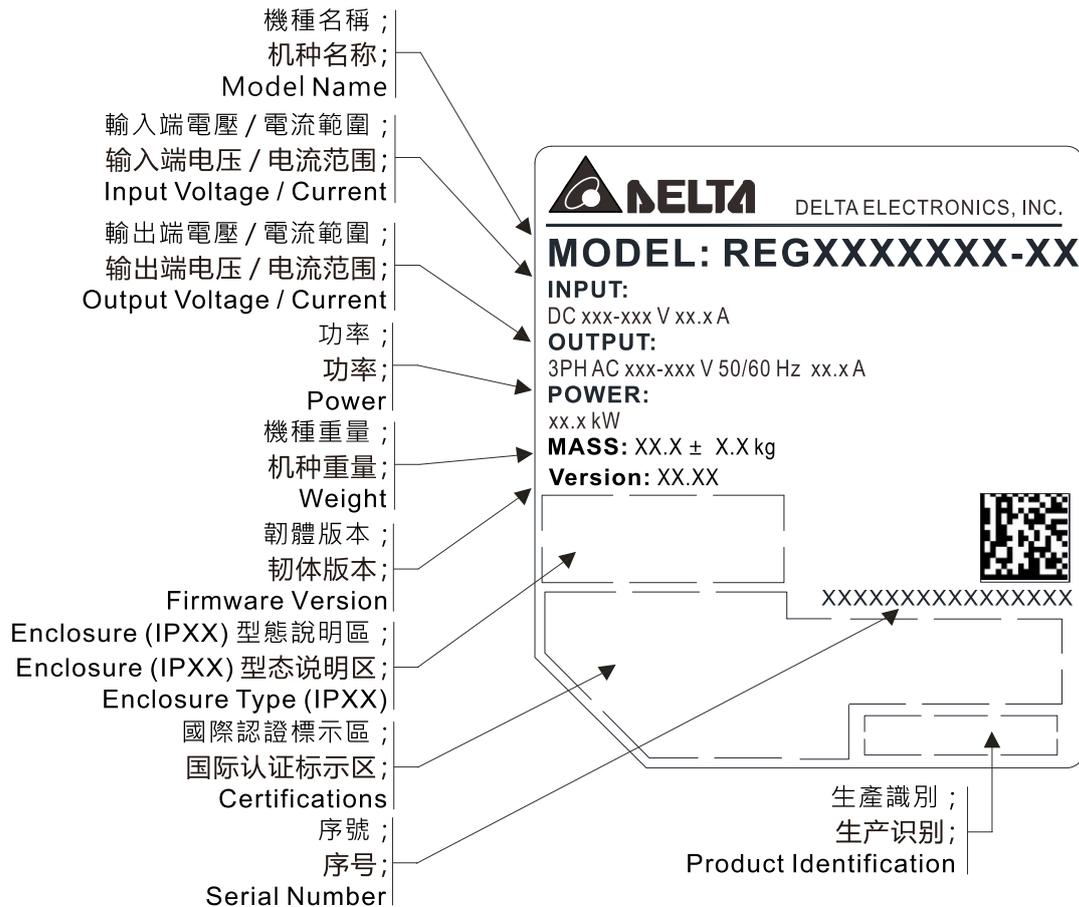
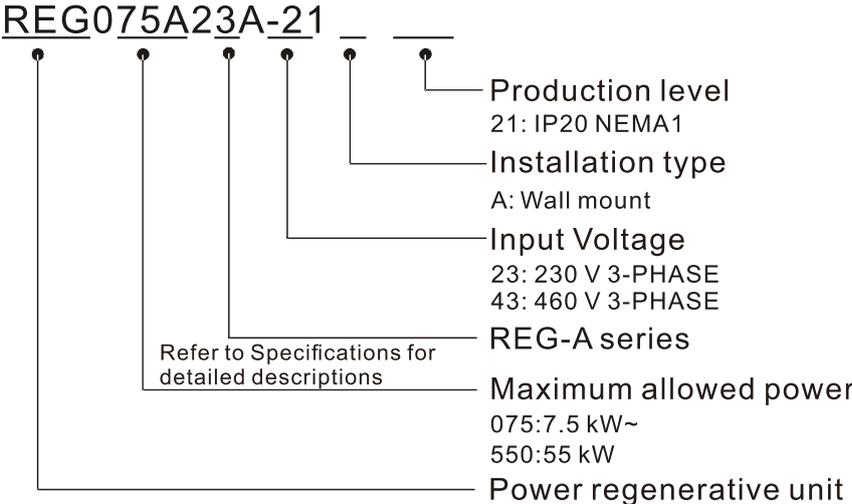
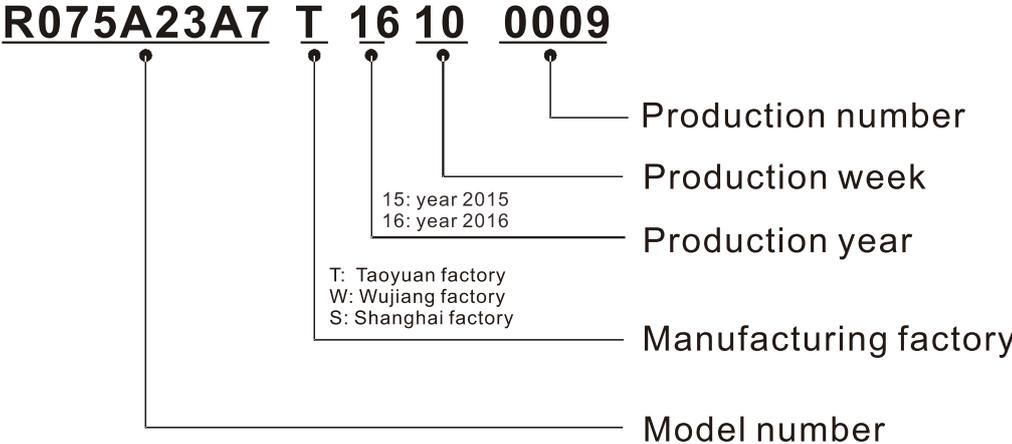


Figure 1-1

### 1-2 Model Number



### 1-3 Serial Number



## 1-4 Apply for After-sales Service by Mobile Device

### 1-4-1 Location of Service Link Label

#### Frame A–C

Remove the display panel to find the service link label (service label), located in the upper-right corner of the case (see the following figure).

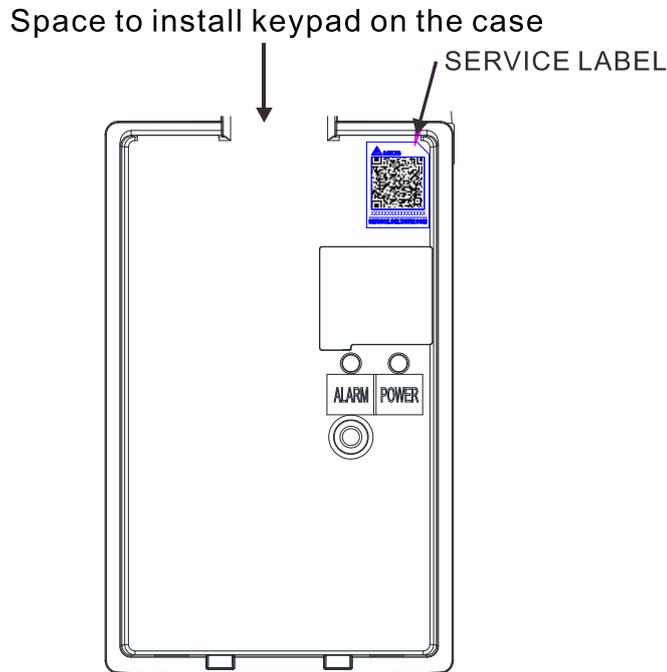


Figure 1-2

### 1-4-2 Service Link Label



Figure 1-3

#### Scan QR Code to apply

1. Find the QR code sticker (as shown above).
2. Start the QR code reader app on your smartphone.
3. Point your camera at the QR Code. Hold your camera steady until the QR code comes into focus.
4. Access the Delta After-Sales Service website.
5. Fill in the information into the fields marked with an orange star.
6. Enter the CAPTCHA and click "Submit" to complete the application.

#### Cannot find the QR Code

1. Open a web browser on your computer or smartphone.
2. In the browser address bar, enter <https://service.deltaww.com/us/Repair/Request?type=IA> and press "Enter".
3. Fill in the information into the fields marked with an orange star.
4. Enter the CAPTCHA and click "Submit" to complete the application.

### 1-5 Operating Principle

In a variable-frequency drive system, the motor is in a power generating state due to the high inertia in a drive system such as centrifuges and washing machines, or applications requiring fast braking such as machine tool spindles. In other words, because the rotor is rotated by external forces, the actual motor speed exceeds the drive-controlled synchronous speed, quickly feeding the energy generated by the motor back to the DC BUS. This results in a rapid rise in the DC BUS voltage and endangers the drive. This excess energy must be quickly consumed to keep the DC BUS voltage within a safe range; otherwise, the drive will either malfunction or enter over-voltage protection mode.

The traditional method is to convert the excess energy into heat with a brake resistor. This method has the advantages of simpler wiring and lower total cost, but has the disadvantages of a large brake resistor, requiring additional cooling devices, a limited braking capability, and inefficient energy use. On the other hand, the Power Regenerative Unit (REG2000) converts the power generated by the motor into electric energy, and then returns it to the electrical grid for other electrical applications, thereby conserving energy. Installing the Power Regenerative Unit can increase the motor's braking capability.

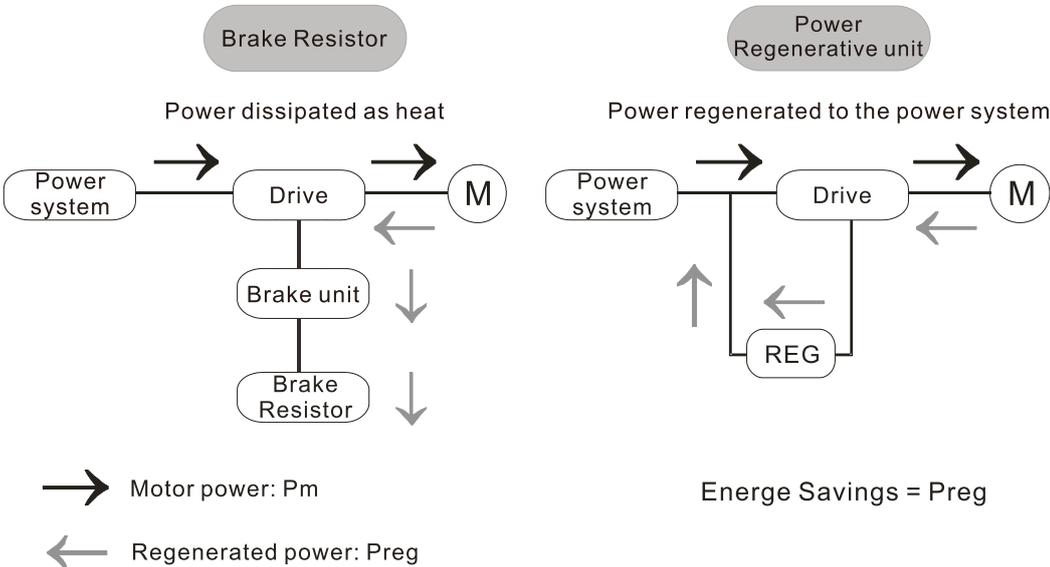


Figure 1-4

When you set the DC BUS voltage activation level (Pr.01-08), the Power Regenerative Unit (REG2000) determines the motor drive's DC BUS voltage regenerative trigger point to satisfy the regenerative demands in various industrial applications. When the DC BUS voltage is higher than the voltage activation level, the Power Regenerative Unit (REG2000) starts regenerating power. The capacitance clamping voltage is set as the activation level and the excess energy generated by the motor is converted to three-phase AC current to regenerate the mains power (AC).

The Power Regenerative Unit (REG2000) stops the power regeneration immediately and continues to operate (RUN) when either of the following conditions occurs. The DC BUS voltage triggers the DC-side voltage activation level until the motor brakes for the next time.

- (1) When the DC BUS voltage is lower than the activation voltage level (default value = 10 V) or
- (2) When the output current ( $A_{AC}$ ) of the Power Regenerative Unit (REG2000) is 10% lower than the rated output current for 1 second.

### The Working Principle of Power Regenerative Unit

(1) The DC BUS voltage is lower than the activation voltage level.

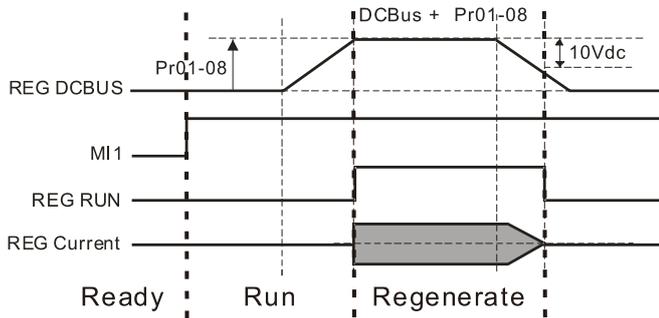


Figure 1-5

(2) The output current ( $A_{AC}$ ) of the Power Regenerative Unit (REG2000) is 10% lower than the rated output current for 1 second.

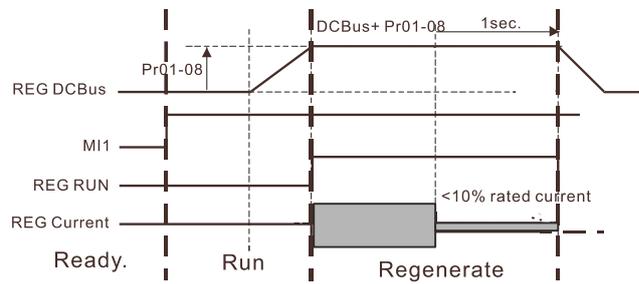


Figure 1-6

## 1-6 RFI Jumper

RFI (Radio Frequency Interference): The Power Regenerative Unit generates electrical noise, resulting in frequency interference on the AC power cable.

### Frame A–C

Screw torque: 6–8 kg-cm / (5.2–6.9 lb-in.)

After loosening the screws, remove the RFI jumper (MOV-PLATE / RFI jumper) as shown in the figure below. Make sure to tighten the screw again after removing the RFI jumper.

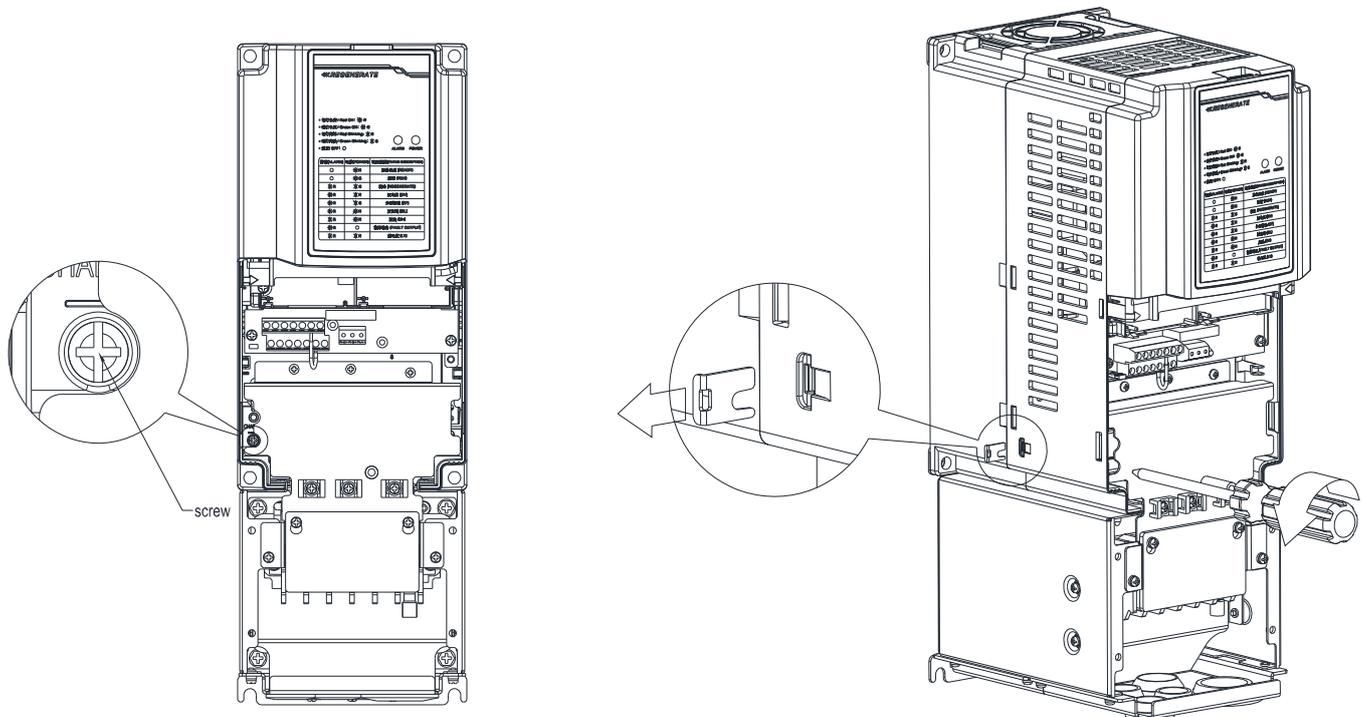


Figure 1-7

## Isolating main power from ground

Voltage of any phase to the ground for either system may be larger than the voltage specifications of the Power Regenerative Unit 's built-in surge absorber and common-mode capacitance. In this case, connecting RFI jumper to the ground may cause damage to the Power Regenerative Unit.

### Important points regarding ground connection:

- ☑ To ensure the safety of personnel, proper operation, and to reduce electromagnetic radiation, the Power Regenerative Unit must be properly grounded during installation.
- ☑ The diameter of the cables must meet the size specified by safety regulations.
- ☑ The shielded cable must be connected to the Power Regenerative Unit ground to meet safety regulations.
- ☑ The shielded cable can only be used as the ground for equipment when the above points are met.
- ☑ When installing multiple sets of Power Regenerative Units, do not connect the Power Regenerative Units grounds in series, as shown below.

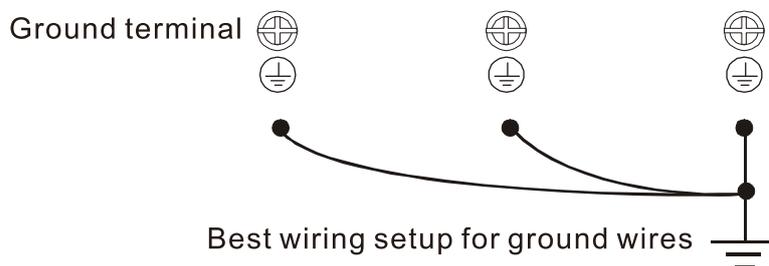


Figure 1-8

### Pay particular attention to the following points:

- ☑ After turning on the main power, do not remove the RFI jumper while the power is on.
- ☑ Make sure the main power is turned off before removing the RFI jumper.
- ☑ Removing the RFI jumper also cuts off the capacitor electrical conductivity, the transient voltage surge suppressor, and the common-mode capacitor. The Power Regenerative Unit no longer guarantees that the electromagnetic compatibility conforms to regulations.
- ☑ Do not remove the RFI jumper if the main power is a grounded power system.
- ☑ Do not remove the RFI jumper while conducting high voltage tests. When conducting a high voltage test to the entire facility, disconnect the main power and the motor if the leakage current is too high.

### Floating Ground System (IT Systems)

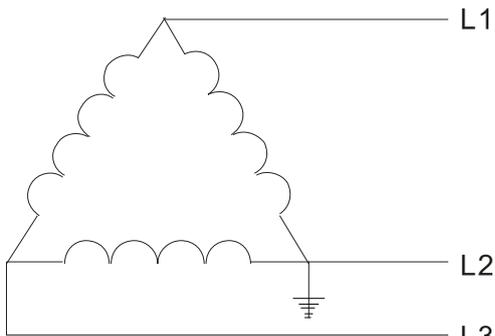
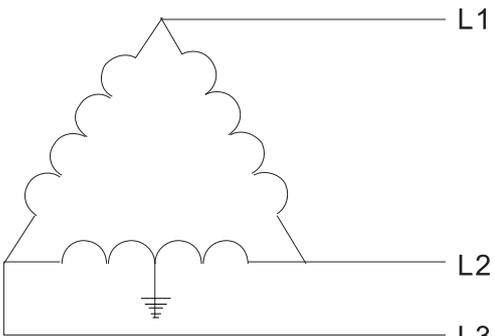
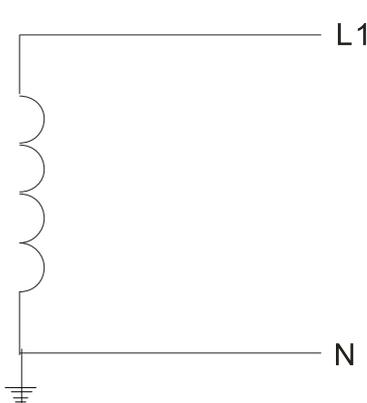
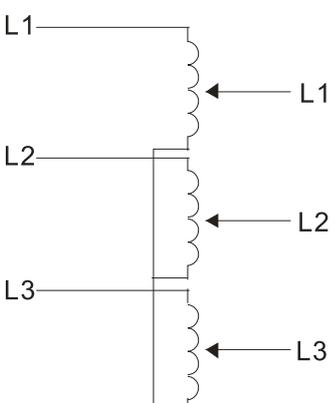
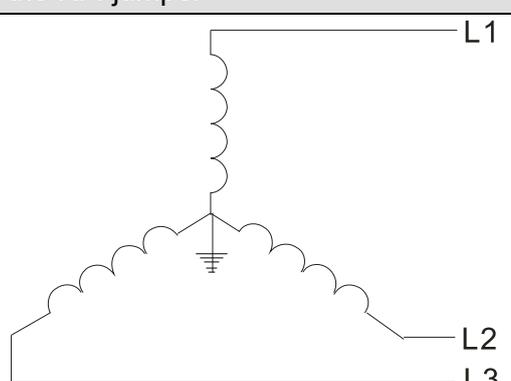
A floating ground system is also called IT system, ungrounded system, or high impedance / resistance (greater than 30  $\Omega$ ) grounding system.

- ☑ Remove the RFI jumper to cut off the transient voltage suppressor and the common-mode capacitance connecting to the ground.
- ☑ When installing an external capacitor or an external EMI filter, you form a circuit through the capacitor / EMI filter common capacitors' grounding. That circuit might damage the capacitor and the EMI filter.
- ☑ In situations where EMC is required, install an EMI filter specially designed for IT Systems. Removing the EMI filter might avoid damage but might also not conform to EMC regulations.
- ☑ In situations where EMC is required, check for excess electromagnetic radiation affecting nearby low-voltage circuits. In some situations, the adapter and cable naturally provide enough suppression. If in doubt, install an extra electrostatic shielded cable on the power supply side between the main circuit and the control terminals to increase security.

**Asymmetric Ground System (Corner Grounded TN Systems)**

Caution: Do not remove the RFI jumper while the input terminal of the Power Regenerative Unit carries power.

In the following four situations, you must remove the RFI jumper, because the phase to ground voltage is not symmetrical in the power system. This prevents the Power Regenerative Unit from grounding through the RFI jumper and damaging the Power Regenerative Unit.

Corner Grounded TN Systems: remove the RFI jumper	
<p>1. Grounding at a corner in a triangle configuration</p>  <p style="text-align: center;">Figure 1-9</p>	<p>2. Grounding at a midpoint in a polygonal configuration</p>  <p style="text-align: center;">Figure 1-10</p>
<p>3. Grounding at one end in a single-phase configuration</p>  <p style="text-align: center;">Figure 1-11</p>	<p>4. No stable neutral grounding in a three-phase autotransformer configuration</p>  <p style="text-align: center;">Figure 1-12</p>
Symmetrical Power System: Can use the RFI jumper	
<p>Connect a symmetrical grounding power system to a RFI jumper to maintain the efficiency of the transient voltage surge suppressor. For reference, the diagram on the right is a symmetrical grounding power system.</p>	 <p style="text-align: center;">Figure 1-13</p>

# 1-7 Dimensions

## Frame A

REG075A23A-21; REG075A43A-21; REG110A43A-21; REG150A43A-21

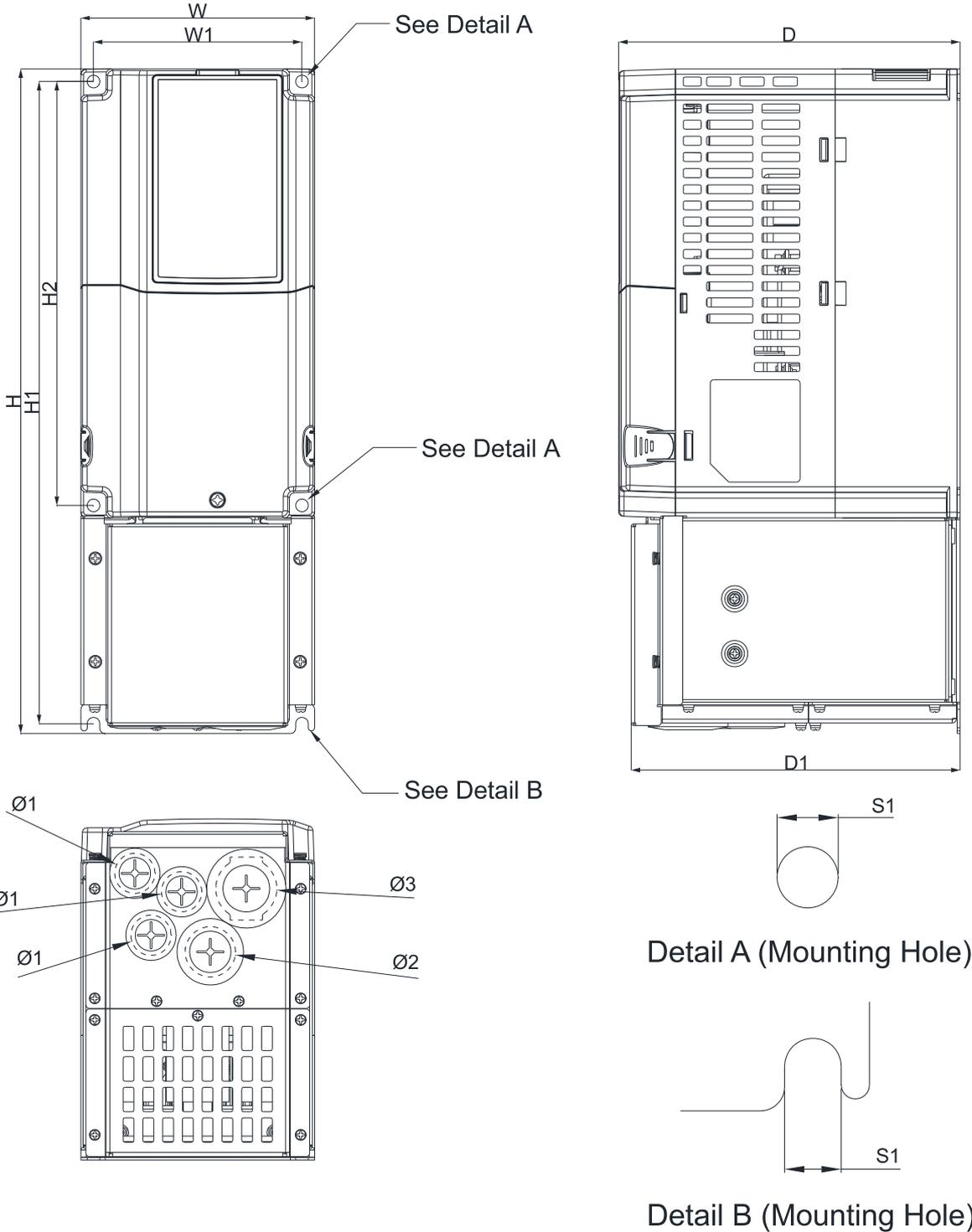


Figure 1-14

Unit: mm (inch)

Frame	W	H	D	W1	H1	H2	D1	S1	Ø1	Ø2	Ø3
A	130.0 (5.12)	370.0 (14.56)	190.0 (7.48)	116.0 (4.57)	357.5 (14.07)	236.0 (9.29)	183.0 (7.20)	7.0 (0.28)	22.2 (0.87)	28.0 (1.10)	34.0 (1.34)

Table 1-1

Frame B

REG150A23A-21; REG220A23A-21; REG185A43A-21; REG220A43A-21; REG300A43A-21

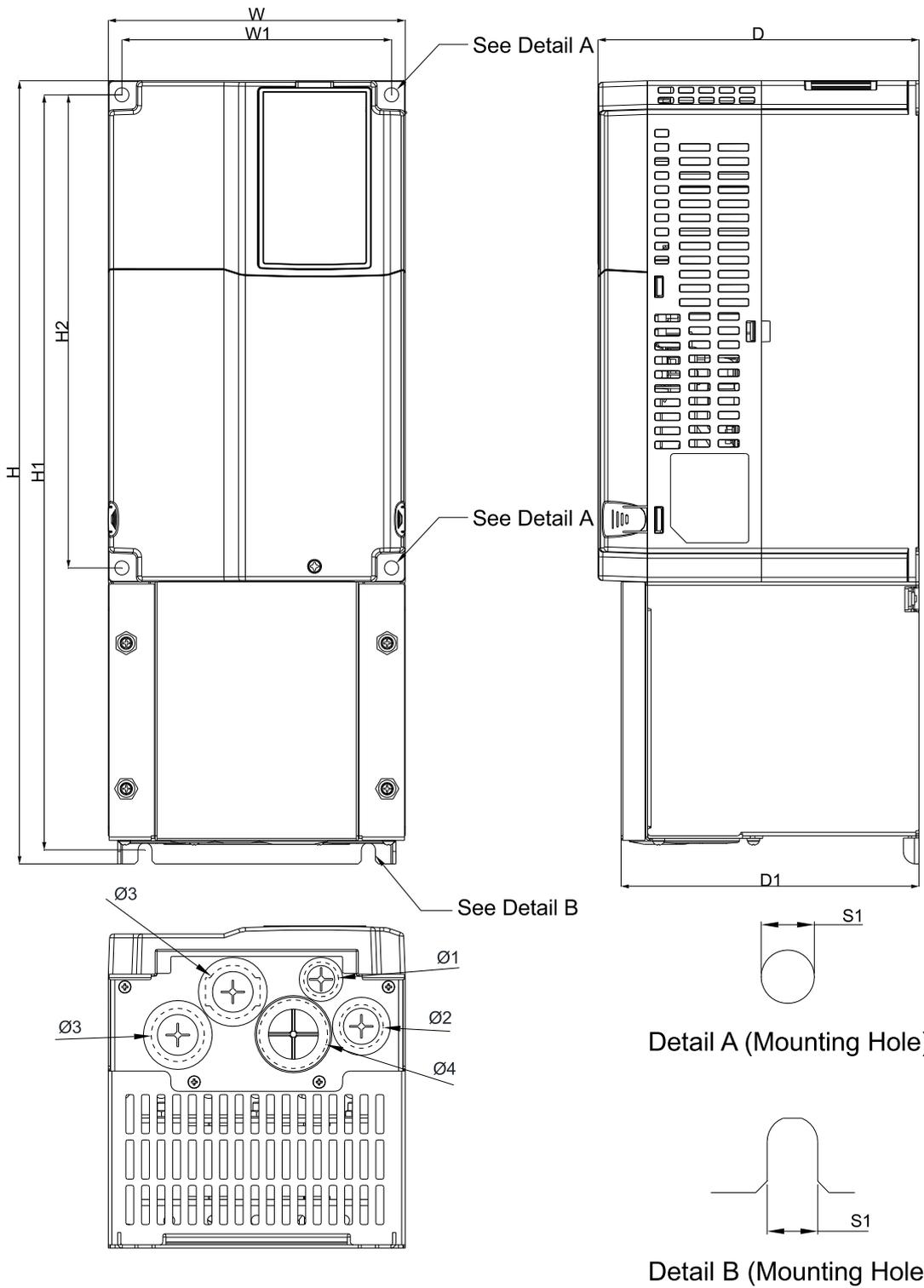


Figure 1-15

Unit: mm (inch)

Frame	W	H	D	W1	H1	H2	D1	S1	Ø1	Ø2	Ø3	Ø4
B	190.0 (7.48)	500.0 (19.68)	205.0 (8.09)	172.5 (6.79)	482.0 (18.98)	302.0 (11.89)	190.5 (7.50)	9.0 (0.35)	22.2 (0.87)	28.0 (1.10)	34.0 (1.34)	43.8 (1.72)

Table 1-2

Frame C

REG370A23A-21; REG370A43A-21; REG450A43A-21; REG550A43A-21

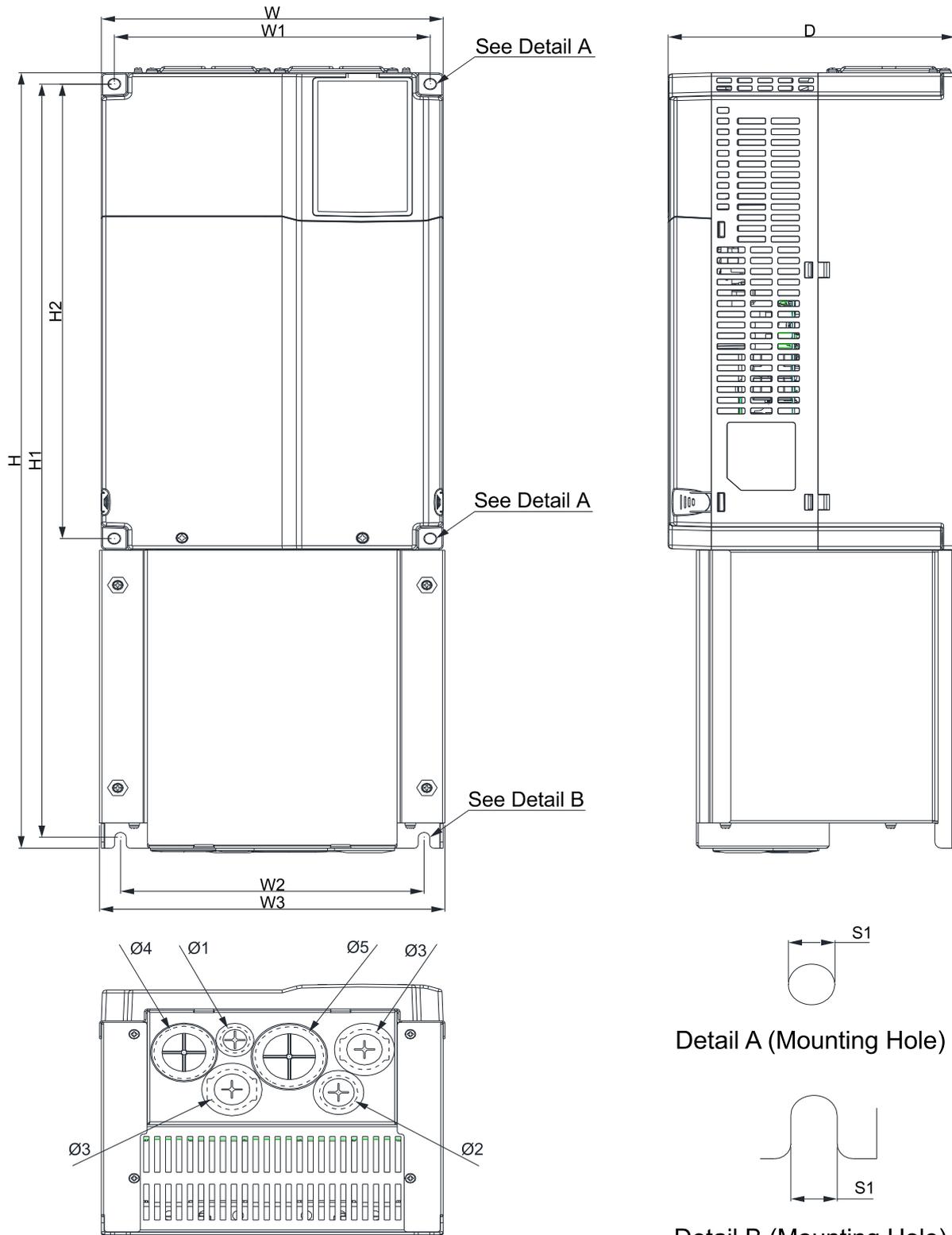


Figure 1-16

Unit: mm (inch)

Frame	W	H	D	W1	W2	W3	H1	H2	S1	Ø1	Ø2	Ø3	Ø4	Ø5
C	250.0 (9.84)	650.0 (25.59)	210.0 (8.27)	231.0 (9.09)	220.0 (8.74)	252.5 (9.94)	631.5 (24.86)	381.0 (15.00)	8.5 (0.33)	22.2 (0.87)	28.0 (1.10)	34.0 (1.34)	44.0 (1.73)	50.1 (1.97)

Table 1-3

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# Chapter 2 Checking & Recommendations

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2-1 Installation Distances

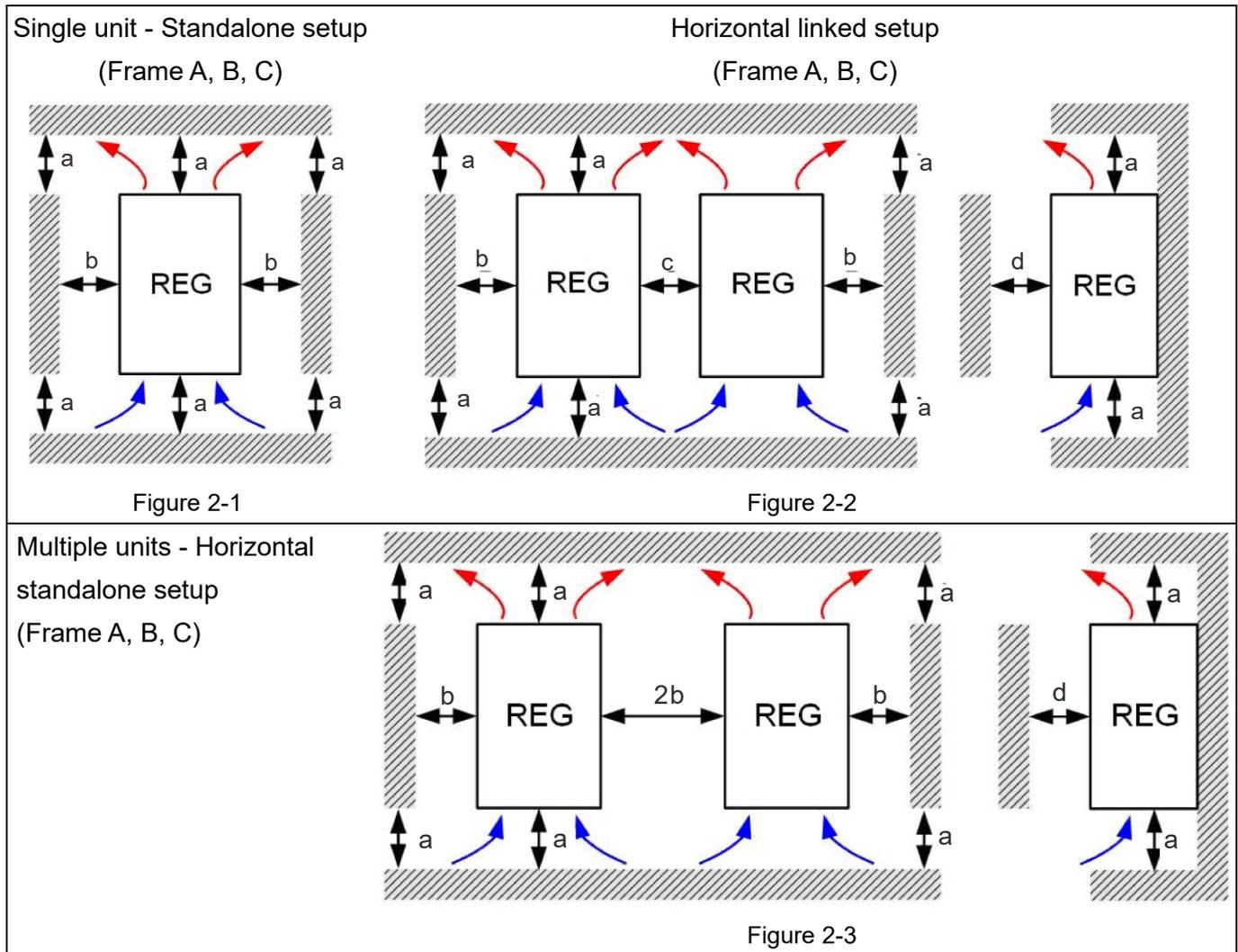
2-2 Airflow Rate for Cooling & Power Dissipation of REG

## 2-1 Installation Distances

- ☑ Install this product upright.
- ☑ Do not allow foreign materials such as fibers, paper, wood chips / dust, or scrap metal to enter the Power Regenerative Unit or stick to the cooling fan.
- ☑ Connect the unit to a metallic or other nonflammable control panel to prevent causing a fire.
- ☑ Install the Power Regenerative Unit in an environment that complies with pollution degree 2 with clean circulating air. Clean circulating air is defined as air without polluting substances or electronically contaminated dust.

The following figures are for demonstration purposes only, and may differ from the actual product.

← (Blue arrow) Air intake      ← (Red arrow) Air outflow



Multiple units - Vertical linked setup (Frame A, B, C)

Frame A, B, C

When setting up multiple units in a vertical standalone setup, install dividers between the levels. Determine the divider dimensions on the principle that the temperature at the intake fans should be lower than the operating temperature as shown in the figure below. Operating temperature is defined as the temperature measured 50 mm in front of the fan inlet.

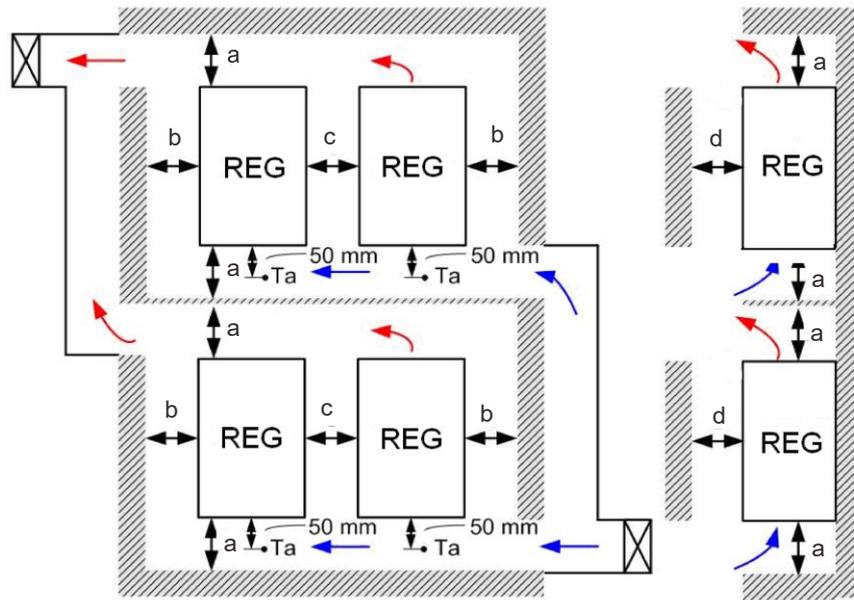


Figure 2-4

Required minimum distances

Frame	A (mm)	B (mm)	C (mm)	D (mm)
A, B, C	60	30	10	0

Table 2-1

Frame A	REG075A23A-21; REG075A43A-21; REG110A43A-21; REG150A43A-21
Frame B	REG150A23A-21; REG220A23A-21; REG185A43A-21; REG220A43A-21; REG300A43A-21
Frame C	REG370A23A-21; REG370A43A-21; REG450A43A-21; REG550A43A-21

Table 2-2

**NOTE:** Frames A–C above are all required minimum distances; any distance less than these values will affect the cooling fan's function.

## 2-2 Airflow Rate for Cooling & Power Dissipation of REG

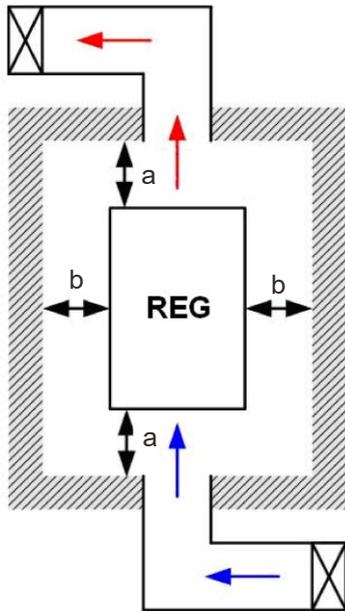


Figure 2-5

**NOTE:**

- The specified distances are only applicable in open spaces. As shown in the figure on the left, if the units are being installed in an enclosed space, such as distribution channel or chassis, install ventilation or air conditioning systems to keep the ambient temperature under the operating temperature.
- The table shows the required airflow rate for each model when installing single units in an enclosed space.
- For multiple units, multiply the required airflow rate by the number of units installed.
- Refer to the “Airflow Rate for Cooling” table below when selecting and designing ventilation systems.
- Refer to the “Power Dissipation of REG” table below for the design of air conditioning systems.

Model No.	Airflow Rate for Cooling						Power Dissipation of REG		
	Flow rate (cfm)			Flow rate (m <sup>3</sup> /hr)			Power Dissipation		
	External	Internal	Total	External	Internal	Total	Loss External (Heat sink)	Internal	Total
REG075A23A-21	44	-	44	75	-	75	127	86	213
REG150A23A-21	92	-	92	155	-	155	219	161	380
REG220A23A-21	92	-	92	155	-	155	336	216	552
REG370A23A-21	118	15	133	201	25	226	678	220	898
REG075A43A-21	44	-	44	75	-	75	128	76	204
REG110A43A-21	44	-	44	75	-	75	198	93	291
REG150A43A-21	44	-	44	75	-	75	240	122	362
REG185A43A-21	92	-	92	155	-	155	291	138	429
REG220A43A-21	92	-	92	155	-	155	368	158	526
REG300A43A-21	92	-	92	155	-	155	446	211	657
REG370A43A-21	121	-	121	206	-	206	508	184	692
REG450A43A-21	118	15	133	201	25	226	664	218	882
REG550A43A-21	118	15	133	201	25	226	919	257	1176

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>● The table shows the required airflow rate for each model when installing single units in an enclosed space.</li> <li>● For multiple units, multiply the required airflow rate for single-unit installation by the number of units installed.</li> </ul> | <ul style="list-style-type: none"> <li>● The table shows the required heat dissipation rate due to heat loss for each model when installing single units in an enclosed space.</li> <li>● For multiple units, multiply the heat dissipation rate for single units by the number of units installed.</li> </ul> |
|--|--|

- The heat dissipation data are calculated based on each model operating under rated voltage, current, and default carrier wave.

Table 2-3

**NOTE:**

- Normal Control Ambient Temperature Derating Factor Curve

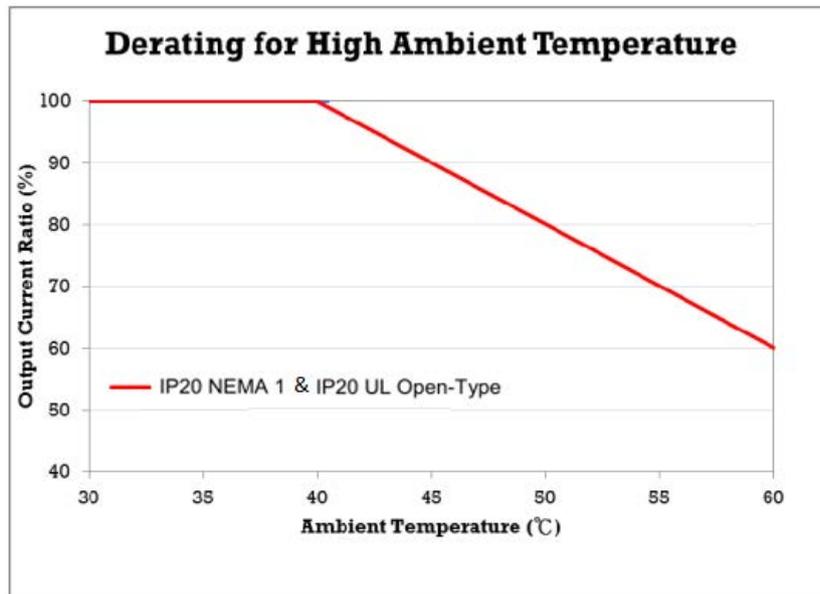


Figure 2-6

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# Chapter 3 Specifications

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3-1 230V Series

3-2 460V Series

3-3 General Specifications

3-4 Operation, Storage and Transportation Environment

3-5 Operating Temperature and Protection Level Specifications

### 3-1 230V Series

Frame		A		B		C			
Model REG__A23A-21		0.75		150		220		370	
Rated power (kW)		7.5		15		22		37	
DC BUS	Rated input current ( $A_{DC}$ )	24.0		46.0		73.2		122	
	Range of voltage activation level	270–390 $V_{DC}$ (Specify in Pr.01-08)							
Mains	Output current ( $A_{AC}$ )	20		38		60		100	
	Rated voltage / frequency	Three-phase 200–240 $V_{AC}$ (-15%–10%), 50 / 60 Hz							
	Operation voltage range	170–265 $V_{AC}$							
	Frequency range	47–63 Hz							
Net weight (kg)		7.5 ± 0.5		16.5 ± 0.5		28.0 ± 0.5			

Table 3-1

### 3-2 460V Series

Frame		A			B			C			
Model REG__A43A-21		075	110	150	185	220	300	370	450	550	
Rated power (kW)		7.5	11	15	18.5	22	30	37	45	55	
DC BUS	Rated input current ( $A_{DC}$ )	12.8	20.7	24.4	30.5	39.0	52.5	59.8	73.0	91.5	
	Range of voltage activation level	516–780 $V_{DC}$ (Specify in Pr.01-08)									
Mains	Output current ( $A_{AC}$ )	10.5	17	20	25	32	43	49	60	75	
	Rated voltage / frequency	Three-phase 380–480 $V_{AC}$ (-15%–10%), 50 / 60 Hz									
	Operation voltage range	323–528 $V_{AC}$									
	Frequency range	47–63 Hz									
Net weight (kg)		7.5 ± 0.5			17.0 ± 0.5			26.5 ± 0.5		29.0 ± 0.5	29.5 ± 0.5

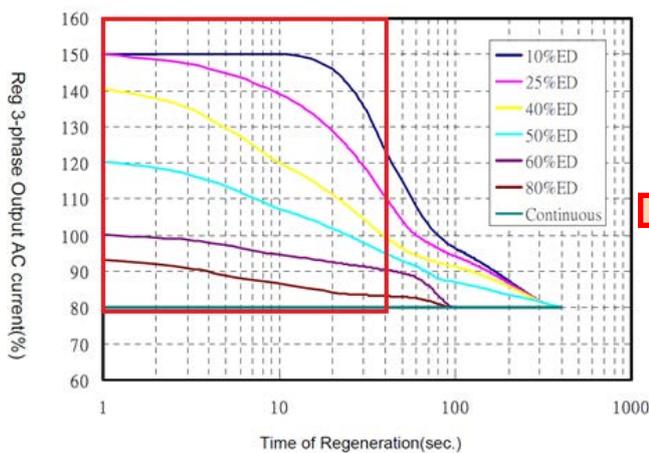
Table 3-2

### 3-3 General Specifications

Item		Specification
Control Characteristics	Control method	SVPWM
	Brake torque	80% rated output current when regenerating continuously; 100% rated output current when regenerating for 60 seconds at 25% ED. See REG2000 Performance Curve below for more information.
	Overload capacity	150% rated output current when regenerating for 10 seconds at 10% ED
	Generic input signal	Five channels of signal terminals, 24 V <sub>DC</sub> 6 mA
	Generic output signal	Two channels of signal terminals, 48 V <sub>DC</sub> 50 mA; one channel of signal terminal, relay output
	Cooling method	Forced air cooling (Fan cooling)
Certifications		     

Table 3-3

REG2000 Performance Curve



Magnified Performance Curve in Red Rectangle

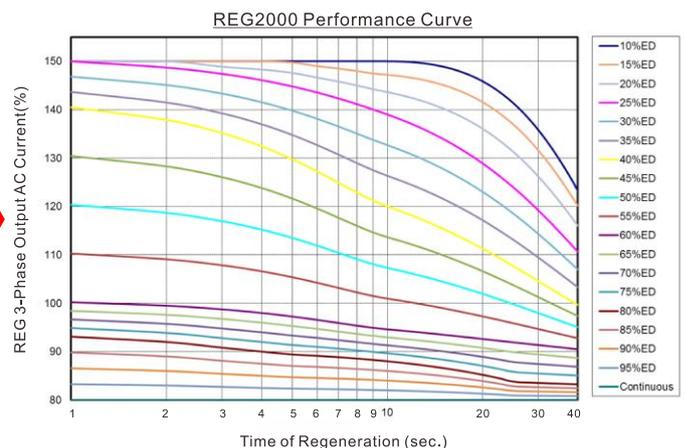
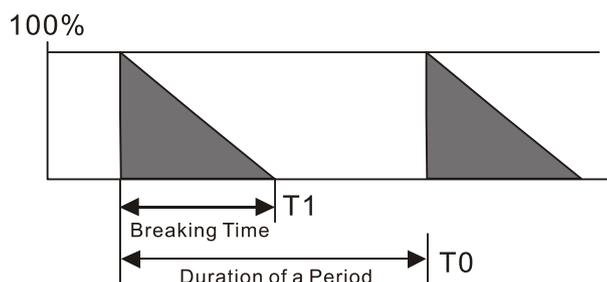


Figure 3-1

- The plots above show the measurement by combining a Power Regenerative Unit with a DC choke.
- Regardless of the ED%, if the Power Regenerative Unit has a regeneration output for more than 400 seconds, the Power Regenerative Unit is performing a continuous regeneration.
- The LED indicators on the standard keypad display the operating status of the Power Regenerative Unit. If you need to set up the unit from a keypad, you can buy an optional keypad. See Chapter 5 Optional Accessories for more information.
- Definition of the brake utilization rate ED%:



Utilization Rate  
 $ED\% = T1 / T0 \times 100 (\%)$

Figure 3-2

### 3-4 Operation, Storage and Transportation Environment

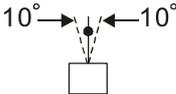
DO NOT expose the Power Regeneration Unit to environmental conditions such as dust, direct sunlight, corrosive / inflammable gasses, oil, humidity, liquid, or vibration. The salt in the air must be less than 0.01 mg/cm <sup>2</sup> every year.			
Environmental	Installation Location		IEC 60364-1 / IEC 60664-1 Pollution degree 2. Indoor use only.
	Surrounding Temperature	Operation	-10–40°C
		Storage / Transportation	-25–70°C
		Non-condensing, non-freezing	
	Rated Humidity	Operation	Maximum 90%
		Storage / Transportation	Maximum 95%
		Non-condensing, non-freezing	
	Air Pressure	Operation / Storage	86–106 kPa
		Transportation	70–106 kPa
	Pollution Level	IEC 60721-3-3	
		Operation	Class 3C2; Class 3S2
Storage		Class 2C2; Class 2S2	
Transportation		Class 1C2; Class 1S2	
No concentrate			
Altitude	Operation	If the Power Regeneration Unit is installed at altitude of 0–1000 m, follow normal operation restrictions. If it is installed at altitude of 1000–3000 m, decrease the rated current by 2% or lower 0.5°C of temperature for every 100 m increase in altitude. Maximum altitude for Corner Grounded installation is 2000 m.	
Package Drop	Storage	ISTA procedure 1A (based on weight) IEC 60068-2-31	
	Transportation		
Vibration	[Frame A & B] 2–13.2 Hz, 1.0 mm; 13.2–55 Hz, 0.7–1.5 G; 55–512 Hz, 1.5 G (Complies with IEC 60068-2-6) [Frame C] 2–13.2 Hz, 1.0 mm; 13.2–55 Hz, 0.7–1.0 G; 55–512 Hz, 1.0 G (Complies with IEC 60068-2-6)		
Impact	IEC / EN 60068-2-27		
Operating position	Maximum allowed offset angle ±10° (under normal installation position)		

Table 3-4

### 3-5 Operating Temperature and Protection Level Specifications

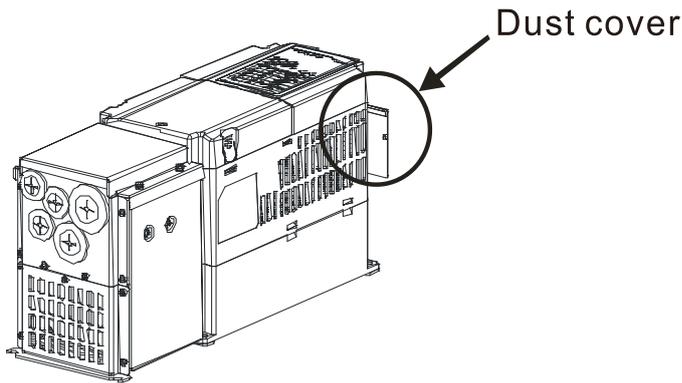


Figure 3-3

IP20 UL Open-Type

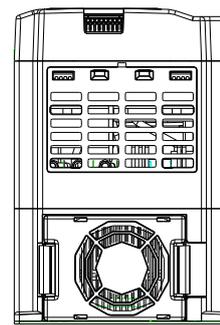


Figure 3-4

IP20 NEMA 1

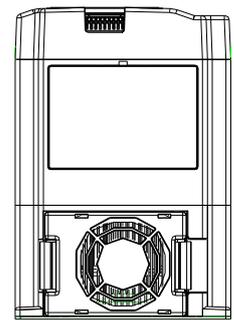


Figure 3-5

Dust cover	Protection Level	Operating Temperature
with	IP20 NEMA 1	When operating at rated current, the surrounding temperature must be between -10–40°C. When the surrounding temperature is over +40°C, decrease the rated current by 2% for every 1°C increase in temperature. The maximum allowable surrounding temperature is 60°C.
without	IP20 UL Open-Type	

Table 3-5

● Normal Control Ambient Temperature Derating Factor Curve

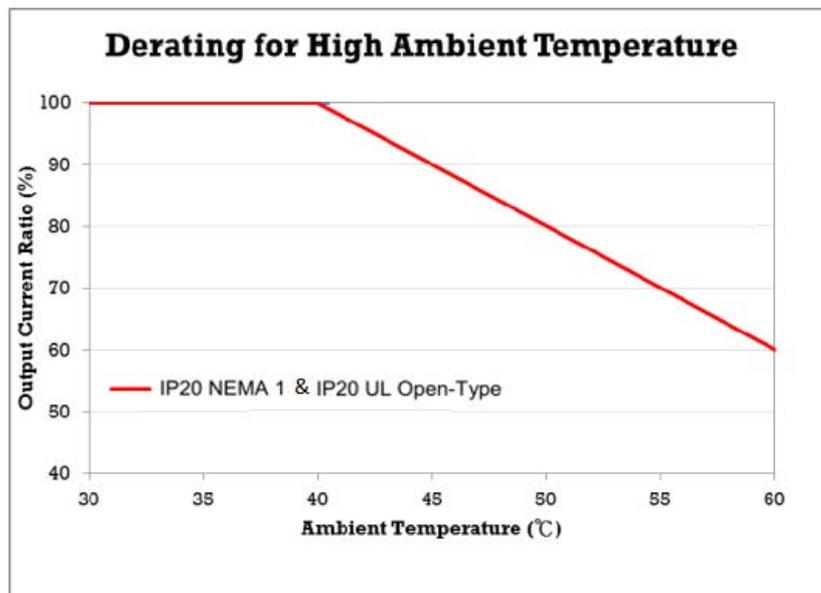


Figure 3-6

1. Derating of the Power Regenerative Unit decreases by multiplication.
2. Derating is required not only when there is a continuous regeneration, but in addition the conditions covered by the Performance Curve are required to have the same derating ratio.

**Calculation 1:**

When the ambient temperature = 40°C, ED = 10%, the braking capacity of the Power Regenerative Unit = 150%, 10 seconds (See REG2000 Performance Curve).

When the ambient temperature = 45°C, see Normal Control Ambient Temperature Derating Factor Curve, and the Power Regenerative Unit needs a derating of 10% = (45°C - 40°C) x 2%. Therefore, when ED is at 10%, the braking capacity of the Power Regenerative Unit = 150% x (100% - 10%) = 135%, 10 seconds.

**Calculation 2:**

When the ambient temperature = 40°C and the regeneration is continuous, the braking capacity of the Power Regenerative Unit = 80% of the rated output current.

When the ambient temperature = 55°C and the regeneration is continuous, the braking capacity of the Power Regenerative Unit is 56% =  $[80\% \times (100\% - 30\%)]$  of the rated output current.

# Chapter 4 Wiring

---

4-1 Wiring Diagram

4-2 Main Circuit Terminals

4-3 Control Circuit Terminals

4-4 Display Panel Indicators

After removing the front cover, verify that the power and control terminals are clearly noted. Read the following precautions before wiring.

- ☑ Make sure that power is only applied to the R/L1, S/L2, T/L3, DC+, and DC- terminals. Failure to comply may result in damage to the equipment. The voltage and current should be within the specified range on the nameplate (Section 1-1).
- ☑ All the units must be grounded directly to a common ground terminal to prevent lightning strike or electric shock and reduce interference.
- ☑ Securely tighten the main circuit terminal screws to prevent sparks caused by screws loosened by vibration.
- ☑ If a braking resistor is already installed in the existing system, keep the braking resistor for future use. Set Pr.01-08 to the reasonable power regenerative level when equipping with a braking resistor:
- ☑  $(V_{AC} \text{ Voltage Level} \times 1.414) < \text{REG DC BUS voltage activation level (Pr.01-08)} < \text{braking resistor trigger level}$ . Use a reasonable margin to ensure that DC ripple does not trigger Pr.01-08 setting by mistake.
- ☑ If the Power Regenerative Unit is NOT equipped with a braking resistor, pay attention to the **DFMEA** (Design Failure Mode and Effect Analysis). The Power Regenerative Unit provides full status indication. Signals can be provided by external terminals to ensure system integration reliability.
- ☑ If a Power Regenerative Unit is malfunctioning, it can send signals through communication and MOx terminals.



- ☑ It is crucial to turn off the Power Regeneration Unit power before wiring. A charge with hazardous voltages may still remain in the DC BUS capacitors even if the power has been turned off. Always measure the remaining voltage before wiring. For your safety, do not perform any wiring before the voltage drops to a safe level  $< 25 V_{DC}$ . Wiring while voltage remains can cause sparks and short circuits.
- ☑ Only qualified personnel familiar with the Power Regeneration Unit are allowed to perform installation, wiring and commissioning. Make sure the power is turned off before wiring to prevent electric shock.



- ☑ When wiring, use wires that comply with local regulations for your safety.
- ☑ Check following items after finishing the wiring:
  1. Are all connections correct?
  2. Are there any loosen wires?
  3. Are there any short circuits between the terminals or to ground?

# 4-1 Wiring Diagram

## 4-1-1 Normal Wiring Diagram

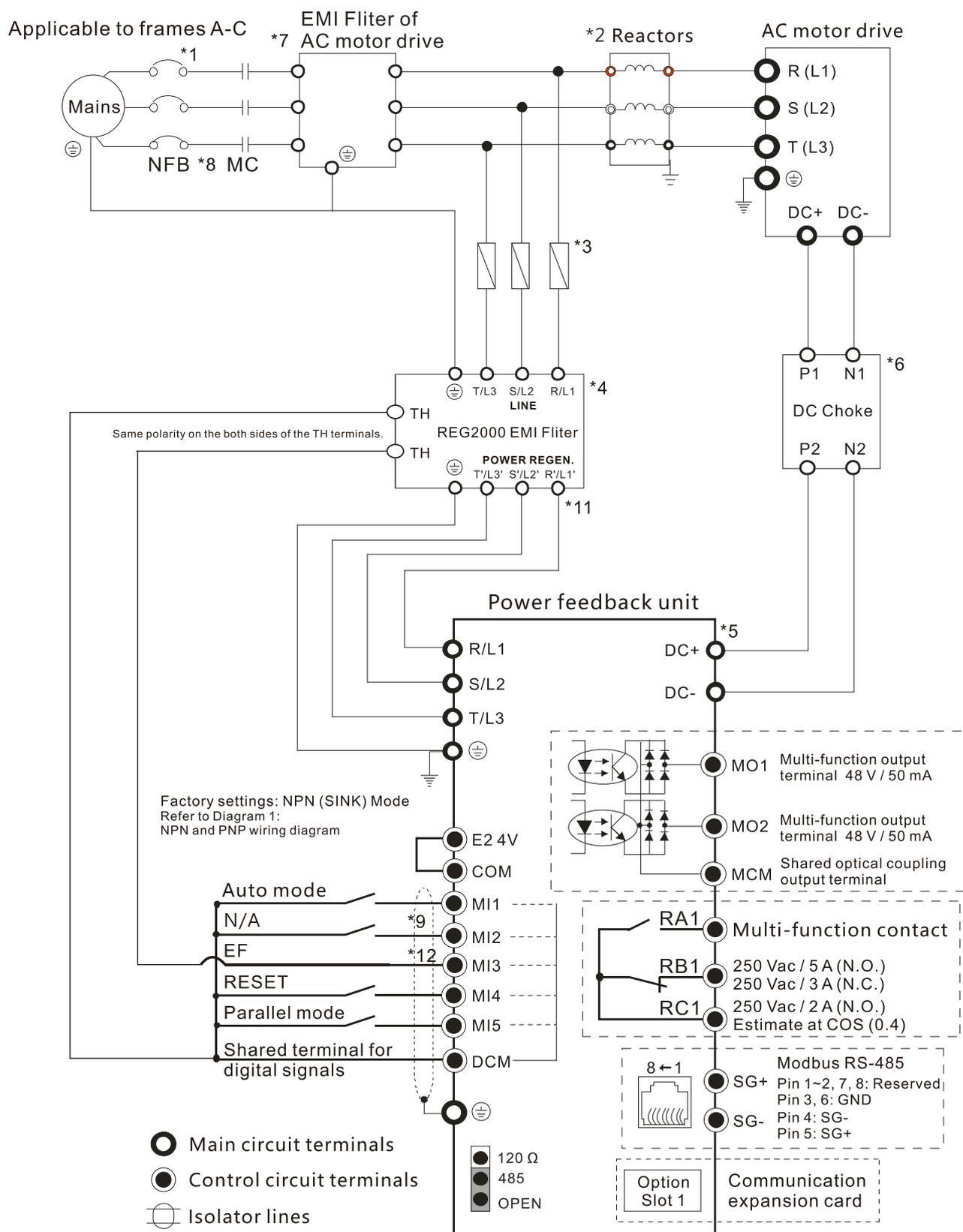


Figure 4-1

**NOTE:**

- \*1 Select the NFB based on the drive type.
- \*2 If a reactor is connected to the drive, install the reactor here (optional).
- \*3 Refer to Chapter 5 Optional Accessories for the selection of fuses.
- \*4 The cable length between REG2000 EMI filter and the Power Regenerative Unit must be less than 10 m, and cannot provide power to other equipment from here. While using the REG2000 EMI filter, remove the RFI jumper on the Power Regenerative Unit.
- \*5 The length of the DC+ / DC- wires must be less than 5 m, and twisted wires are highly recommended.
- \*6 There is an attached DC choke shipped with the unit; install it as shown in the above wiring diagram. The P1, P2, N1, N2 in Normal Wiring Diagram is equal to the terminal 1, 2, 3, 4 in the Dimensions of DC Choke (Section 4-1-1-2). Installing the included DC choke can increase the regenerative efficiency and prevent electromagnetic interference. The DC choke part numbers in the REG2000 series are in Table 4-3.
- \*7 If there is no REG2000 EMI filter, we recommend using inductors (without capacitors) as the EMI filter for AC motor drives in order to prevent capacitors from being damaged by current ripples. If you have any concern about phase sequence protection, install Delta's EMI filter.
- \*8 If you need to provide power to other instruments, we recommend using the magnetic contactor (MC) terminals or NFB to connect to other instruments.
- \*9 If there is no keypad for the unit, refer to Pr.02-00–Pr.02-04 for detailed wiring of the multi-function input terminal (Mlx, default setting is MI1). Wiring for auto mode is shown below.

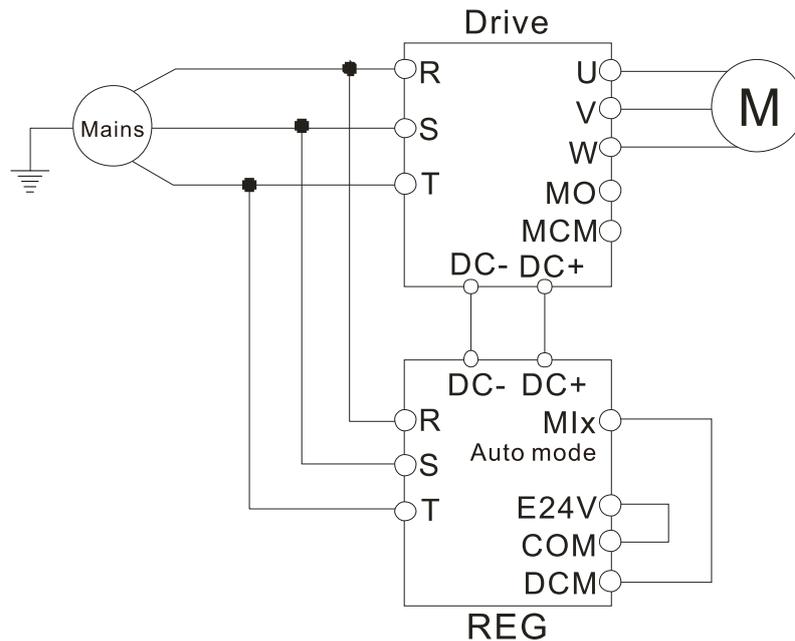
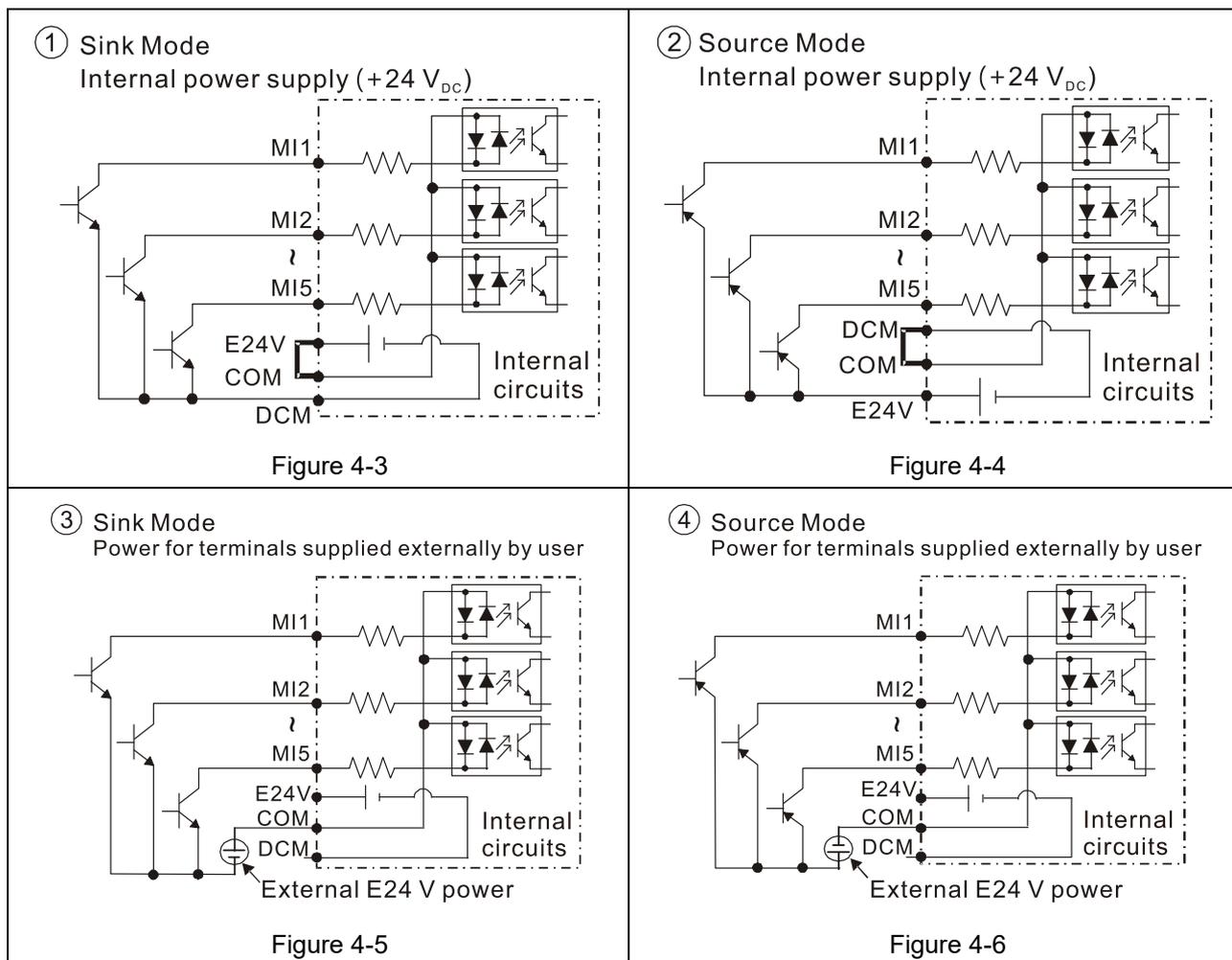


Figure 4-2

- \*10 There are two wiring methods of multi-function input terminal (Mlx). Refer to the Section 4-1-1-1.
- \*11 Shielded cables must be used for the wiring between EMI filter and REG2000.
- \*12 Before operating the REG2000, please confirm the following two points:
  - (1) Remove the MI3 shorting wire: Ensure that the system does not trigger a malfunction (EF) due to the shorting wire not being removed.
  - (2) EMI Filter Wiring: When using an EMI filter, MI3 and TH must be connected correctly.

4-1-1-1 SINK (NPN) / SOURCE (PNP) Mode switching terminal descriptions



4-1-1-2 Dimensions of DC choke

Terminals: #1 = P1, #2 = P2, #3 = N1, #4 = N2

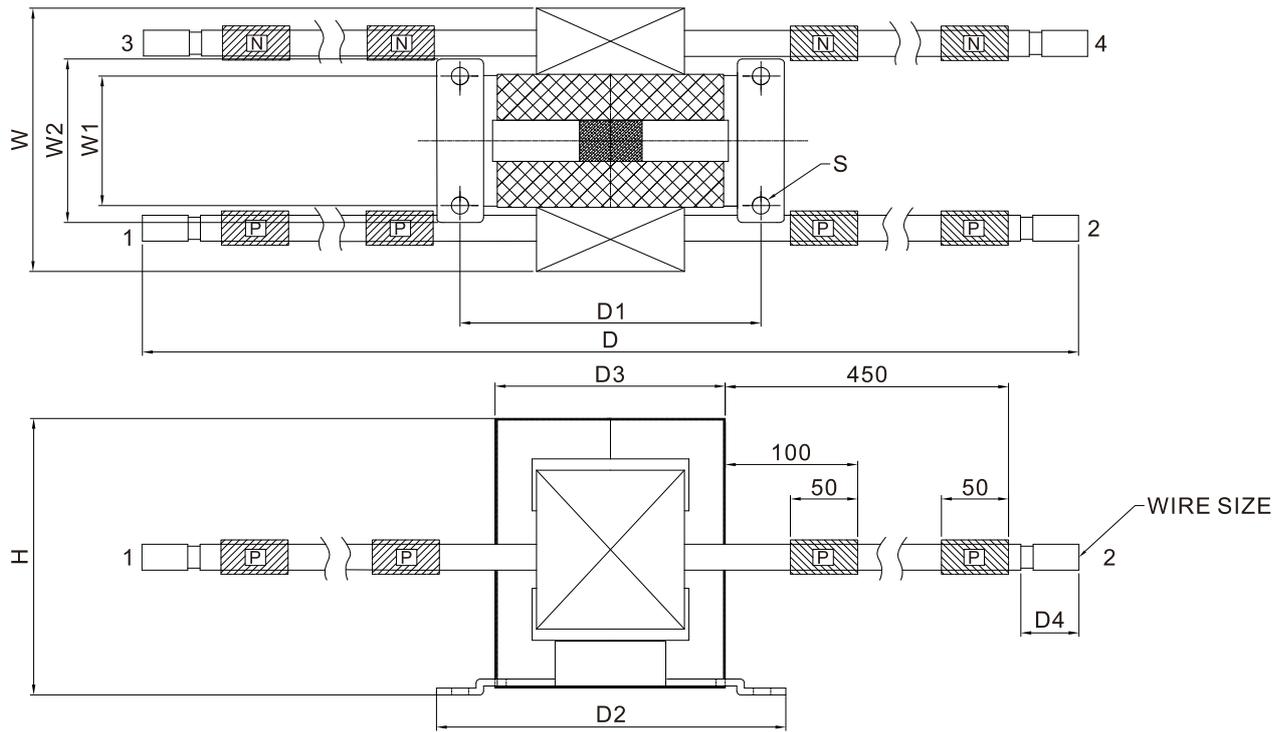


Figure 4-7

Unit: mm (inch)

Model Name	H	W	W1	W2	D	D1	D2	D3	D4	S	Wire Size
RG-RC110F2	86 (3.39)	75 (2.95)	32 (1.26)	42 (1.65)	1045 (41.14)	83 (3.27)	95 (3.74)	67.4 (2.65)	18 (0.71)	5.5 (0.22)	8 AWG
RG-RC150F4	86 (3.39)	75 (2.95)	32 (1.26)	42 (1.65)	1045 (41.14)	83 (3.27)	95 (3.74)	67.4 (2.65)	18 (0.71)	5.5 (0.22)	12 AWG
RG-RC185F2	96 (3.78)	75 (2.95)	20 (0.79)	32.5 (1.28)	1080 (42.52)	93 (3.66)	105 (4.13)	77 (3.03)	18 (0.71)	5.5 (0.22)	6 AWG
RG-RC300F4	100 (3.94)	90 (3.54)	20 (0.79)	32.5 (1.28)	1060 (41.73)	106.5 (4.19)	120 (4.72)	89 (3.50)	18 (0.71)	5.5 (0.22)	6 AWG

Table 4-1

- 📖 Make sure that P, N terminals (DC BUS) do not short through while installing DC chokes.
- 📖 The DC choke wiring sizes are defined in the user manual. See Section 4-2-3 for recommended wire sizes for different frames.

Terminals: #1 = P1, #2 = P2, #3 = N1, #4 = N2

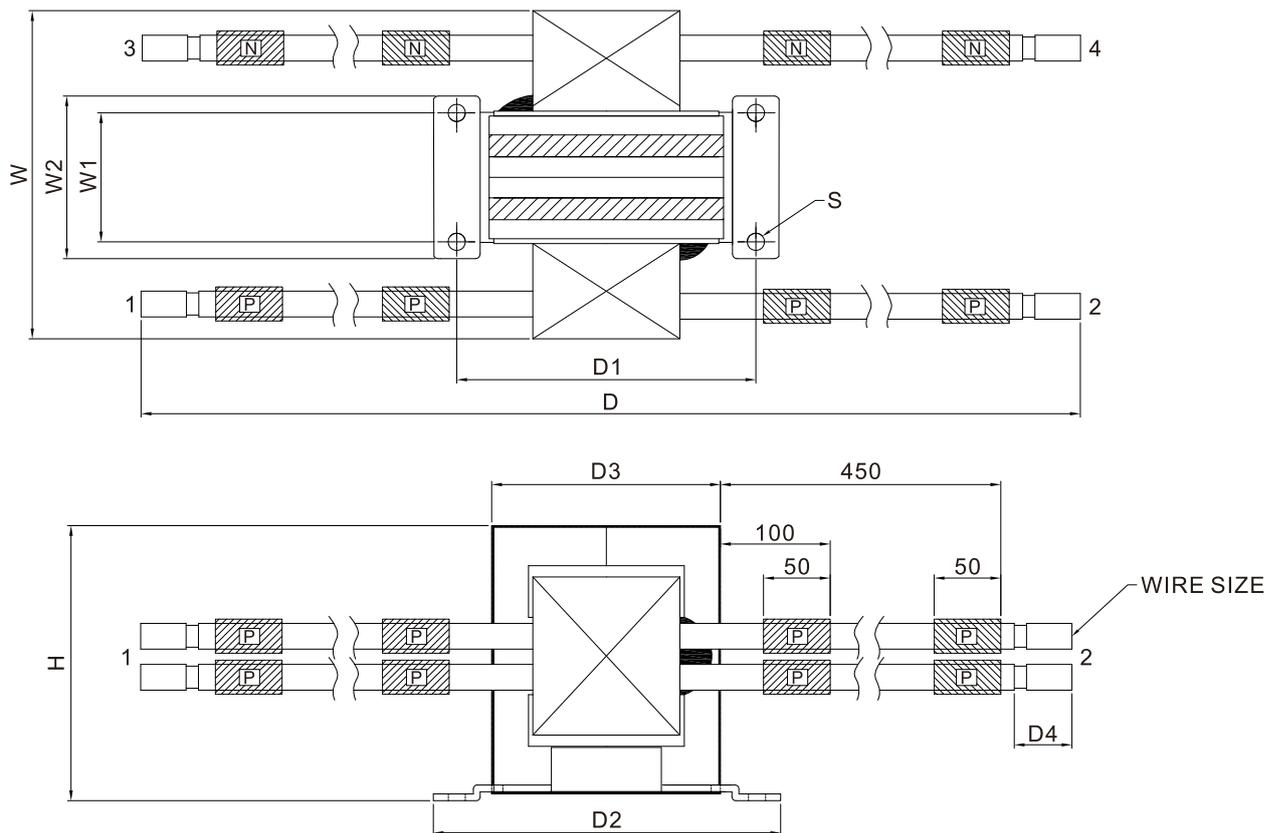


Figure 4-8

Unit: mm (inch)

Model Name	H	W	W1	W2	D	D1	D2	D3	D4	S	Wire Size
RG-RC220F2	96 (3.78)	75 (2.95)	20 (0.79)	32.5 (1.28)	1060 (41.73)	93 (3.66)	105 (4.13)	77 (3.03)	18 (0.71)	5.5 (0.22)	8 AWG
RG-RC370F2	96 (3.78)	85 (3.35)	20 (0.79)	32.5 (1.28)	1060 (41.73)	93 (3.66)	105 (4.13)	77 (3.03)	18 (0.71)	5.5 (0.22)	6 AWG
RG-RC550F4	96 (3.78)	100 (3.94)	20 (0.79)	45 (1.77)	1060 (41.73)	93 (3.66)	105 (4.13)	77 (3.03)	18 (0.71)	5.5 (0.22)	8 AWG

Table 4-2

- 📖 Make sure that P, N terminals (DC BUS) do not short through while installing DC chokes.
- 📖 The DC choke wiring sizes are defined in the user manual. See Section 4-2-3 for recommended wire sizes for different frames.

4-1-1-3 Part numbers of DC choke in REG2000 series

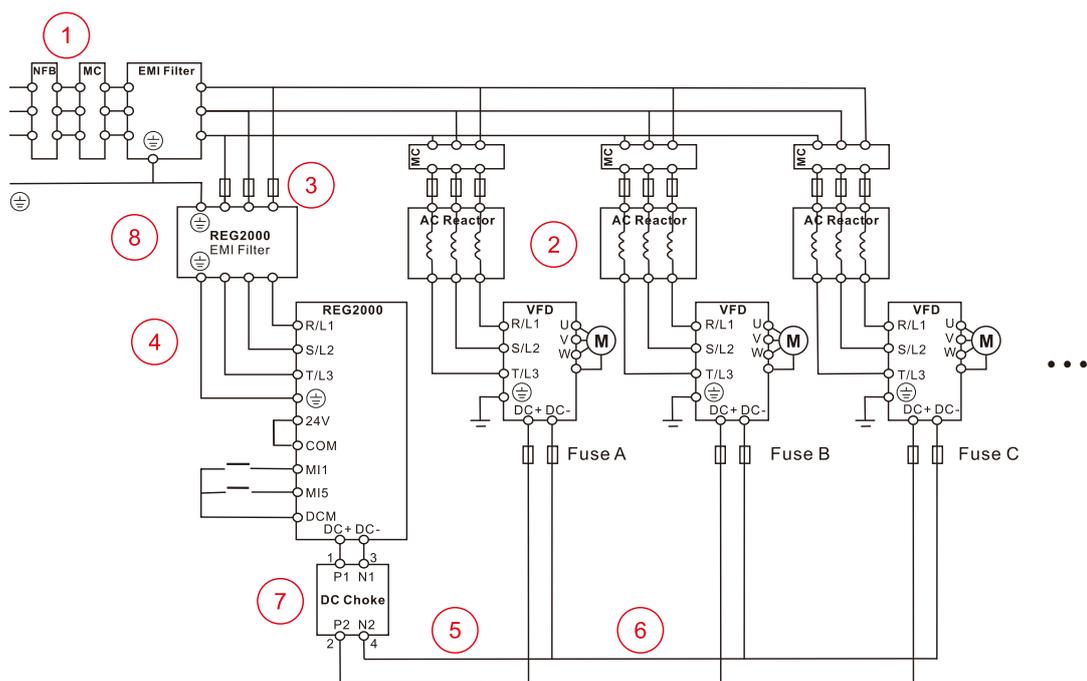
REG Model Name	Model of DC Choke (standard accessory)	Weight (g/unit)
REG075A23A-21	RG-RC110F2	836
REG150A23A-21	RG-RC185F2	900
REG220A23A-21	RG-RC220F2	
REG370A23A-21	RG-RC370F2	1086
REG075A43A-21	RG-RC150F4	838
REG110A43A-21		
REG150A43A-21		
REG185A43A-21	RG-RC300F4	1448
REG220A43A-21		
REG300A43A-21		
REG370A43A-21	RG-RC550F4	1734
REG450A43A-21		
REG550A43A-21		

Table 4-3

### 4-1-2 Multiple AC Motor Drives Wiring

The following are important points for your attention.

1. Refer to the diagram below to wire the unit.
  - (1) Follow the motor drive specifications to choose the appropriate non-fuse breaker (NFB) and the magnetic contactor (MC).
  - (2) Connect an input reactor to a motor drive following the instructions in the user manual. A 3% AC input reactor is recommended. Connect an input reactor to the motor drive with the shortest distance possible.
  - (3) See Section 5-3 to choose an appropriate fuse.
  - (4) The maximum cable length between a REG2000 and an EMI filter cannot be more than 10 m. Remove the RFI jumper before you install an EMI filter.
  - (5) DO NOT install any other Power Regenerative Unit on the common DC BUS.
  - (6) The maximum cable length between DC+ and DC- cannot be more than 5 m. Twisted pair is recommended.
  - (7) Follow the wiring diagram to install the DC reactor (standard accessory) to reduce the electromagnetic interference (EMI) and to increase the work efficiency.
  - (8) Follow the specifications in Section 5-4 to choose an appropriate EMI filter to avoid strong electromagnetic interference (EMI).
2. Make sure that your AC motor drives can operate on a common DC BUS at first. Verify that the AC motor drives have the correct specifications.
3. In order to choose the proper Power Regenerative Unit, first confirm the maximum regenerative energy while all AC motor drives work at the same time.
4. For one-to-many installation, install a fuse (Fuse A / B / C..., as shown in the figure below) at the DC input side of every drive. Calculate and select a suitable fuse for every drive: Fuse type = (Rated input current of the drive) x 2.5.



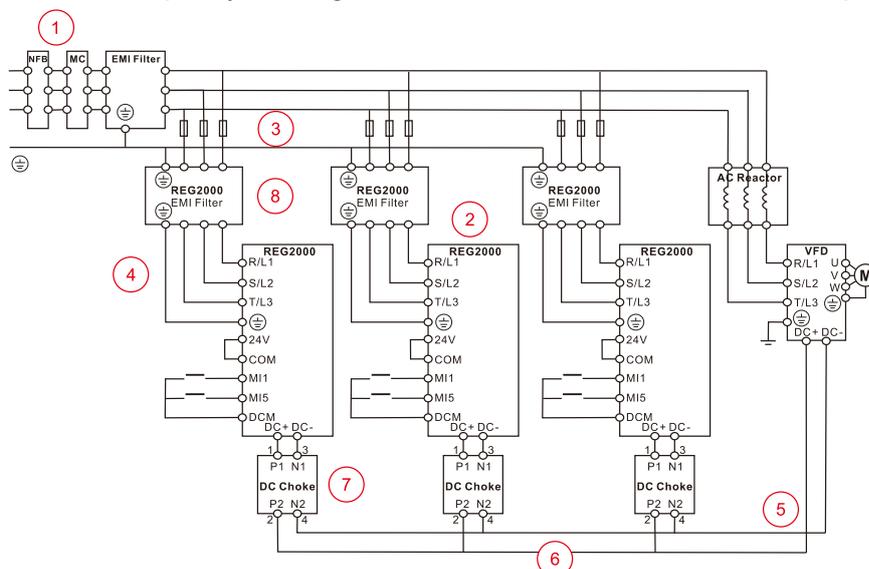
Multiple AC Motor Drives Wiring Diagram

Figure 4-9

### 4-1-3 Multiple REG2000 Wiring in Parallel

The following are important points for your attention.

1. Install a maximum of four Power Regenerative Units working in parallel at the same time.
  - (1) Follow the motor drive specifications to choose the appropriate non-fuse breaker (NFB) and the magnetic contactor (MC).
  - (2) Connect an input reactor to a motor drive following the instructions in the user manual. A 3% AC input reactor is recommended. Connect an input reactor to the motor drive with the shortest distance possible.
  - (3) See Section 5-3 to choose an appropriate fuse.
  - (4) The maximum cable length between a REG2000 and an EMI filter cannot be more than 10 m. Remove the RFI jumper before you install an EMI filter.
  - (5) DO NOT install any other Power Regenerative Unit on the common DC BUS.
  - (6) The maximum cable length between DC+ and DC- cannot be more than 5 m. Twisted pair is recommended.
  - (7) Follow the wiring diagram to install the DC reactor (standard accessory) to reduce the electromagnetic interference (EMI) and to increase the work efficiency.
  - (8) Follow the specifications in Section 5-4 to choose an appropriate EMI filter to avoid strong electromagnetic interference (EMI).
2. A DC choke is required. Install the DC choke as close to each Power Regenerative Unit as possible.
3. Refer to the following diagram for wiring in parallel mode. Note that the wiring that connects to Power Regenerative Unit 2 comes from the AC motor drive DC BUS, and not directly from Power Regenerative Unit 1. Using copper bars for wiring is highly recommended.
4. The following diagram shows wiring in parallel mode. Refer to Pr.02-00–Pr.02-04 for detailed wiring of multi-function input terminal (MIx, default setting is MI5) to connect to the terminal DCM. Working in parallel, each Power Regenerative Unit reduces its current limit to 80% automatically. If the Power Regenerative Unit is in parallel mode, and continuous regenerative power is required, you can still select the capacity for single units based on 80% of the rated output.



Multiple REG2000 Wiring Diagram in Parallel

Figure 4-10



#### Main circuit power input terminals

- ☑ Do not connect a three-phase model to single-phase power. R/L1, S/L2 and T/L3 have no phase-sequence requirement.
- ☑ Normally, based on local regulations, installing a non-fuse breaker as system protection on the connection between three-phase input power and main circuit terminal (R/L1, S/L2 and T/L3) is required. However, it is recommended to add a magnetic contactor (MC) to the power input wiring to cut off power quickly and reduce malfunction when activating the Power Regeneration Unit protection function. (Both ends of the MC should have an R-C surge absorber to prevent abnormal voltage surge caused by sudden current breakdown, further causing flashover to damage the equipment.)
- ☑ Tighten the screws in the main circuit terminal to prevent sparks caused by screws loosened by vibration.
- ☑ Use specified voltage and current and pay attention to the maximum allowance.
- ☑ When using a general GFCI (Ground Fault Circuit Interrupter), select a current sensor with sensitivity of 200 mA or above and not less than 0.1-second operation time to avoid nuisance tripping.
- ☑ Use shielded wire or conduit for the power wiring and ground the two ends of the shielded wire or conduit.

## 4-2 Main Circuit Terminals

### 4-2-1 Removing the Outer Cover for Wiring

Remove the top cover before wiring the main circuit terminals.

**NOTE:** The unit shown in the figures are for reference only and your drive may look different.

1. Screw torque: 14–16 kg-cm / (12.15–13.88 lb-in.) / (1.37–1.57 Nm)  
Loosen the screws for the wiring top cover as shown in the figure below.

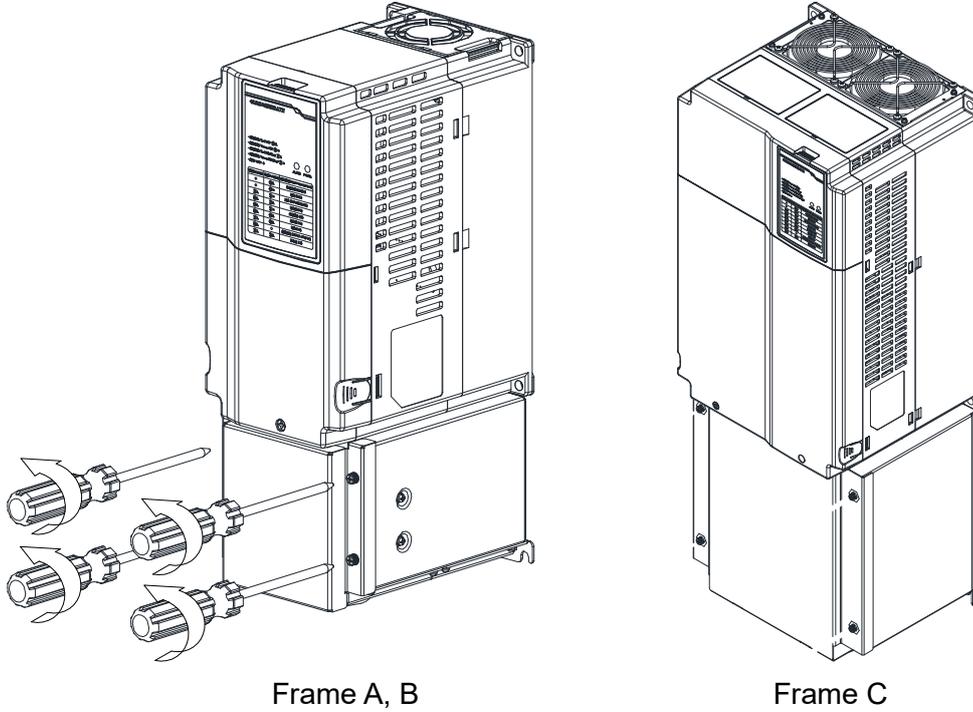


Figure 4-11

2. After loosening the screws, remove the wiring top cover as shown in the figure below.

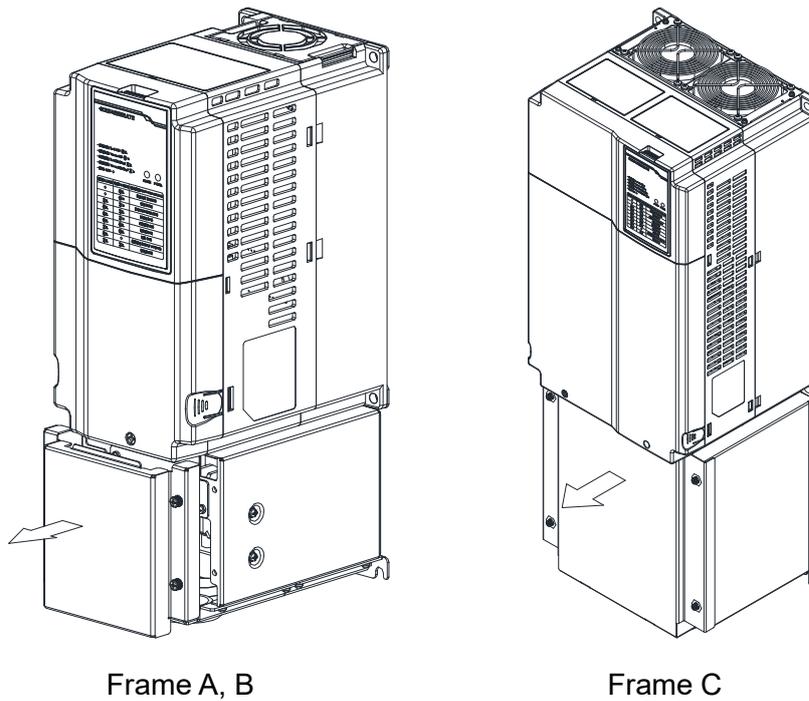


Figure 4-12

3. Loosen the screws to wire the main circuit terminals.  
 Frame A, screw torque: 6–8 kg-cm / (5.2–6.9 lb-in.) / (0.59–0.78 Nm)  
 Frame B, screw torque: 14–16 kg-cm / (12.15–13.88 lb-in.) / (1.37–1.57 Nm)  
 Frame C, screw torque: 10–12 kg-cm / (8.68–10.42lb-in.) / (0.98–1.18 Nm)

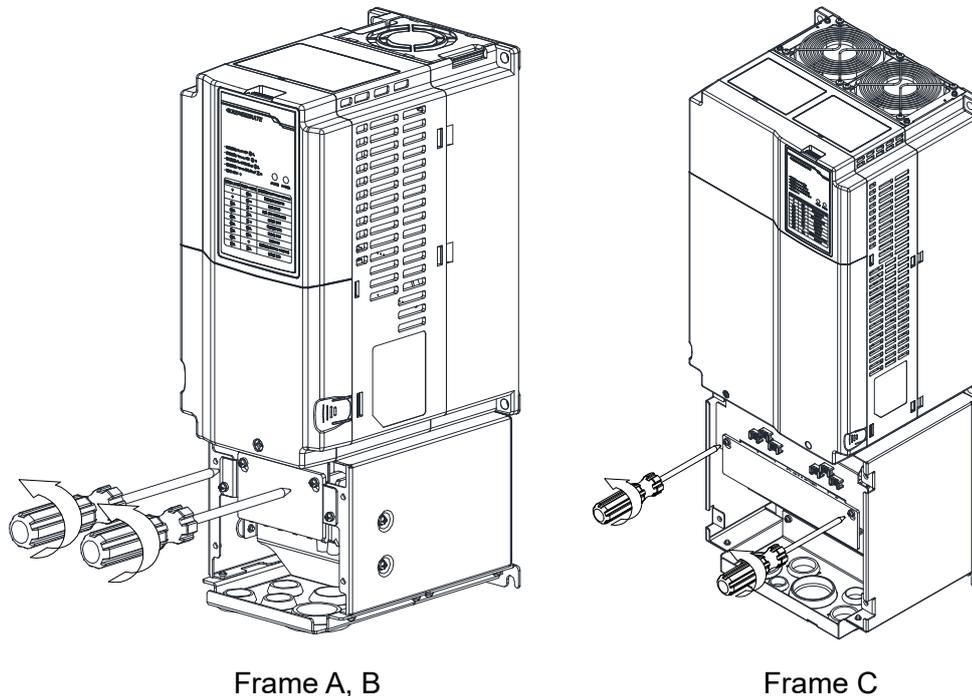


Figure 4-13

### 4-2-2 Main Circuit Terminal Diagram

#### Applicable Circuit Terminal Diagram

Provides three-phase power input

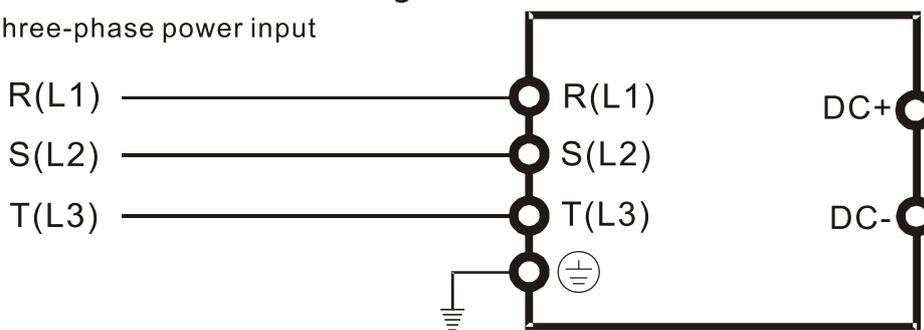


Figure 4-14

Terminal labels	Descriptions
R/L1, S/L2, T/L3	AC power input terminals (three-phase)
DC+, DC-	Connect to the AC motor drive's terminals DC+ and DC- respectively. There is a built-in fuse in the internal hardware circuit, which can prevent damage to the AC motor drive if the REG malfunctions.
⊕	Ground connection. Comply with local regulations, the 230V series should use Type 3 grounding, and the 460V series should use special grounding.

Table 4-4

4-2-3 Main Circuit Terminal Specifications

**Frame A**

Main Circuit Terminals

-/DC- +/DC+ R/L1 S/L2 T/L3 

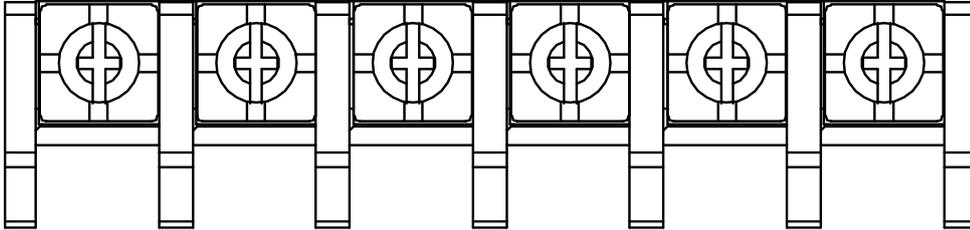


Figure 4-15

REG2000 Frame A						
Model Name	Terminals: R/L1, S/L2, T/L3, -/DC+, +/DC+			Terminals: 		
	Maximum Wire Gauge	Minimum Wire Gauge	Screw Size Tightening Torque (±10%)	Maximum Wire Gauge	Minimum Wire Gauge	Screw Size Tightening Torque (±10%)
REG075A23A-21	10 mm <sup>2</sup> (8 AWG)	6 mm <sup>2</sup> (10 AWG)	M4 12 kg-cm / (10.4 lb-in.) / (1.2 Nm)	6 mm <sup>2</sup> (10 AWG)	6 mm <sup>2</sup> (10 AWG)	M4 12 kg-cm / (10.4 lb-in.) / (1.2 Nm)
REG075A43A-21		2.5 mm <sup>2</sup> (14 AWG)		2.5 mm <sup>2</sup> (14 AWG)	2.5 mm <sup>2</sup> (14 AWG)	
REG110A43A-21		6 mm <sup>2</sup> (10 AWG)		6 mm <sup>2</sup> (10 AWG)	6 mm <sup>2</sup> (10 AWG)	
REG150A43A-21		6 mm <sup>2</sup> (10 AWG)		6 mm <sup>2</sup> (10 AWG)	6 mm <sup>2</sup> (10 AWG)	

Table 4-5

- If you install at Ta 50°C environment, select copper wire with voltage rating of 600 V and temperature resistance of 75°C or 90°C.
- If you install at Ta 50°C above environment, select copper wire with voltage rating of 600 V and temperature resistance of 90°C or above.
- For UL installation compliance, use copper wires when installing. The wire gauge is based on a temperature resistance of 75°C, in accordance with UL requirements and recommendations.  
Do not reduce the wire gauge when using high-temperature resistant wires.

Unit: mm

AWG	VENDOR	VENDOR P/N	A (MAX.)	B (MAX.)	C (MIN.)	D (MAX.)	d2 (MIN.)	E (MIN.)	F (MIN.)	W (MAX.)	t (MAX.)
14	KST	RNBL2-4	20	5	5.5	9	4.3	8	5.5	10	1.5
10		RNBL5-4									
8		RNBS8-4									

Table 4-6

**NOTE:**

- Use Figure 4-16 to choose terminal wire size.
- As shown in Figure 4-17, use insulated heat shrink tubing that is resistant to at least 600 V<sub>AC</sub> to comply with UL and CSA regulations (600 V<sub>AC</sub>, YDPU2/8).

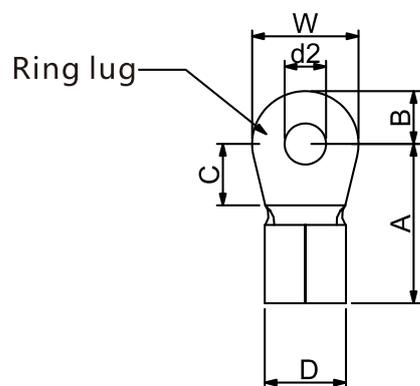


Figure 4-16

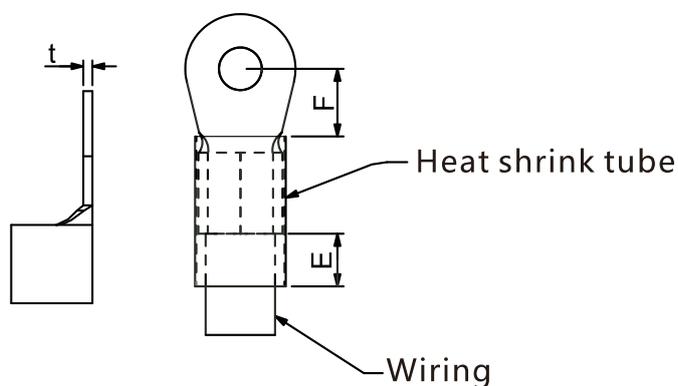


Figure 4-17

**Frame B**

Main Circuit Terminals

-/DC- +/DC+ R/L1 S/L2 T/L3 

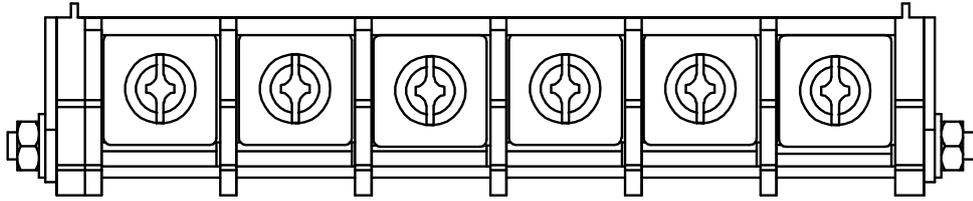


Figure 4-18

REG2000 Frame B							
Model Name	Terminals: R/L1, S/L2, T/L3, -/DC+, +/DC+			Terminals: 			
	Maximum Wire Gauge	Minimum Wire Gauge	Screw Size Tightening Torque (±10%)	Maximum Wire Gauge	Minimum Wire Gauge	Screw Size Tightening Torque (±10%)	
REG150A23A-21	25 mm <sup>2</sup> (4 AWG)	16 mm <sup>2</sup> (6 AWG)	M6 31 kg-cm / (26.9 lb-in.) / (3.0 Nm)	16 mm <sup>2</sup> (6 AWG)	16 mm <sup>2</sup> (6 AWG)	M6 31 kg-cm / (26.9 lb-in.) / (3.0 Nm)	
REG220A43A-21		25 mm <sup>2</sup> (4 AWG)		25 mm <sup>2</sup> (4 AWG)	16 mm <sup>2</sup> (6 AWG)		
REG185A43A-21		10 mm <sup>2</sup> (8 AWG)		10 mm <sup>2</sup> (8 AWG)	10 mm <sup>2</sup> (8 AWG)		10 mm <sup>2</sup> (8 AWG)
REG220A43A-21		10 mm <sup>2</sup> (8 AWG)		10 mm <sup>2</sup> (8 AWG)	10 mm <sup>2</sup> (8 AWG)		10 mm <sup>2</sup> (8 AWG)
REG300A43A-21		16 mm <sup>2</sup> (6 AWG)		16 mm <sup>2</sup> (6 AWG)	16 mm <sup>2</sup> (6 AWG)		16 mm <sup>2</sup> (6 AWG)

Table 4-7

- If you install at Ta 50°C environment, select copper wire with voltage rating of 600 V and temperature resistance of 75°C or 90°C.
- If you install at Ta 50°C above environment, select copper wire with voltage rating of 600 V and temperature resistance of 90°C or above.
- For UL installation compliance, use copper wires when installing. The wire gauge is based on a temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wires.

Unit: mm

AWG	VENDOR	VENDOR P/N	A (MAX.)	B (MAX.)	C (MIN.)	D (MAX.)	d2 (MIN.)	E (MIN.)	F (MIN.)	W (MAX.)	t (MAX.)
8	KST	RNBL8-6	25.5	7.5	8.5	13	6.2	13	10	15	1.5
6		RNBS14-6									
4		RNBS22-6									

Table 4-8

**NOTE:**

- Use Figure 4-19 to choose terminal wire size.
- As shown in Figure 4-20, use insulated heat shrink tubing that is resistant to at least 600 V<sub>AC</sub> to comply with UL and CSA regulations (600 V<sub>AC</sub>, YDPU2/8).

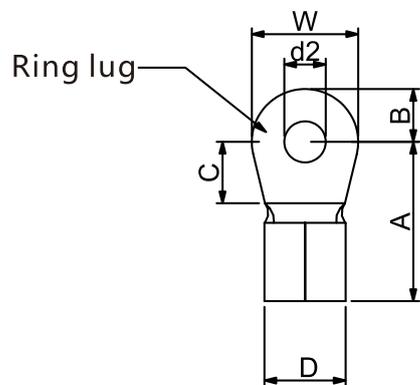


Figure 4-19

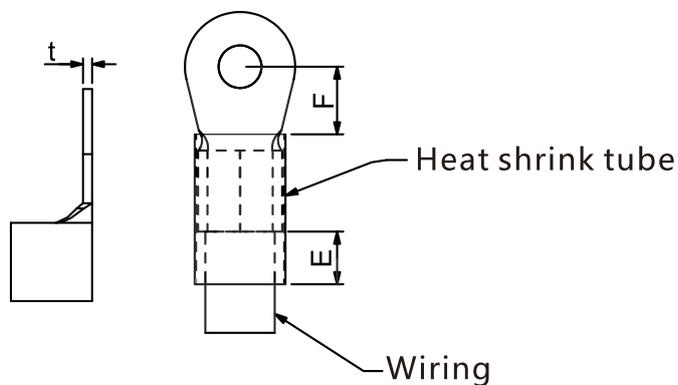


Figure 4-20

**Frame C**

Main Circuit Terminals

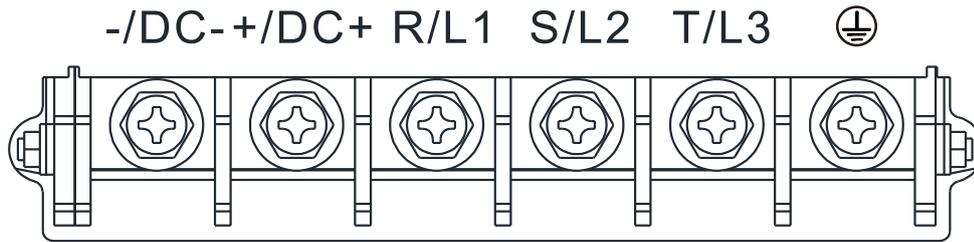


Figure 4-21

REG2000 Frame C						
Model Name	Terminals: R/L1, S/L2, T/L3, -/DC+, +/DC+			Terminals:		
	Maximum Wire Gauge	Minimum Wire Gauge	Screw Size Tightening Torque (±10%)	Maximum Wire Gauge	Minimum Wire Gauge	Screw Size Tightening Torque (±10%)
REG370A23A-21	50 mm <sup>2</sup> (1/0 AWG)	50 mm <sup>2</sup> (1/0 AWG)	M8 81.5 kg-cm / (70.8 lb-in.) / (8 Nm)	50 mm <sup>2</sup> (1/0 AWG)	25 mm <sup>2</sup> (4 AWG)	M8 81.5 kg-cm / (70.8 lb-in.) / (8 Nm)
REG370A43A-21		25 mm <sup>2</sup> (4 AWG)		25 mm <sup>2</sup> (4 AWG)	16 mm <sup>2</sup> (6 AWG)	
REG450A43A-21		25 mm <sup>2</sup> (4 AWG)		25 mm <sup>2</sup> (4 AWG)	16 mm <sup>2</sup> (6 AWG)	
REG550A43A-21		35 mm <sup>2</sup> (2 AWG)		35 mm <sup>2</sup> (2 AWG)	16 mm <sup>2</sup> (6 AWG)	

Table 4-9

- If you install at Ta 50°C environment, select copper wire with voltage rating of 600 V and temperature resistance of 75°C or 90°C.
- If you install at Ta 50°C above environment, select copper wire with voltage rating of 600 V and temperature resistance of 90°C or above.
- For UL installation compliance, use copper wires when installing. The wire gauge is based on a temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wires.

Unit: mm

AWG	VENDOR	VENDOR P/N	A (MAX.)	B (MAX.)	C (MIN.)	D (MAX.)	d2 (MIN.)	E (MIN.)	F (MIN.)	W (MAX.)	t (MAX.)
6	KST	RNB14-8	40.0	11.0	9.5	22.0	8.3	13.0	11.0	24.0	2.5
4		RNB22-8									
2		RNBS38-8									
1/0		RNB60-8									

Table 4-10

**NOTE:**

- Use Figure 4-22 to choose terminal wire size.
- As shown in Figure 4-23, use insulated heat shrink tubing that is resistant to at least 600 V<sub>AC</sub> to comply with UL and CSA regulations (600 V<sub>AC</sub>, YDPU2/8).

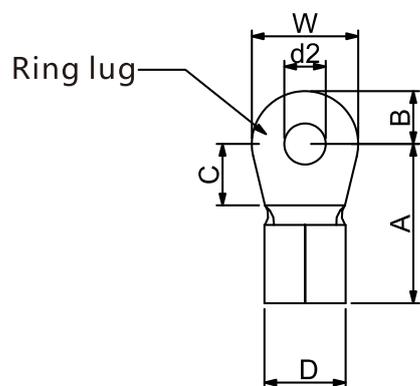


Figure 4-22

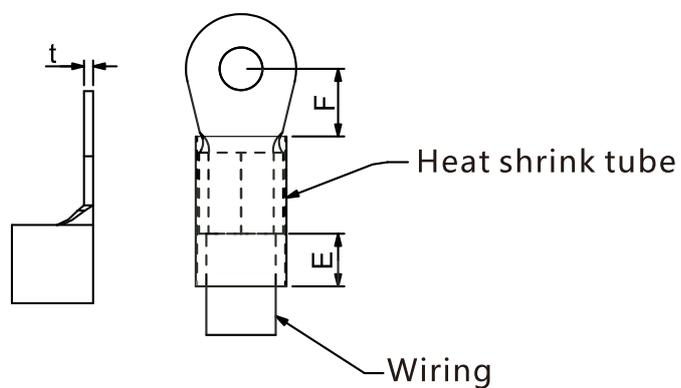


Figure 4-23

### 4-3 Control Circuit Terminals

#### 4-3-1 Removing the Outer Cover for Wiring

Remove the top cover before wiring the multi-function input and output terminals.

**NOTE:** The units shown in the figures are for reference only and your drive may look different.

1. Screw torque: 14–16 kg-cm / (12.15–13.88 lb-in.) / (1.37–1.57 Nm)  
Loosen the screws for the wiring top cover as shown in the figure below.

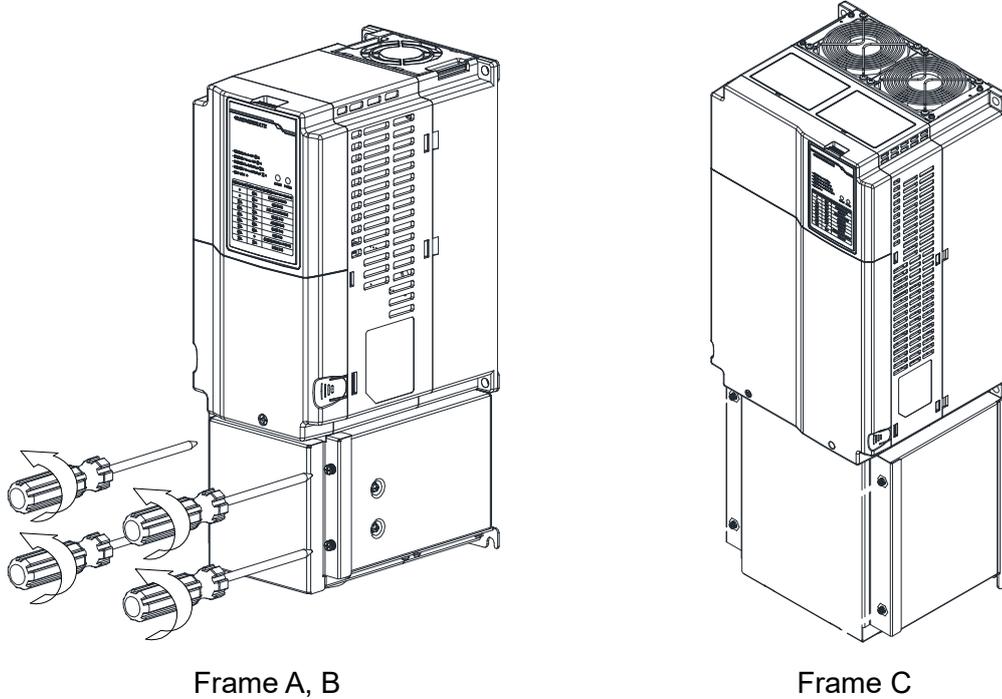


Figure 4-24

2. After loosening the screws, remove the wiring top cover as shown in the figure below.

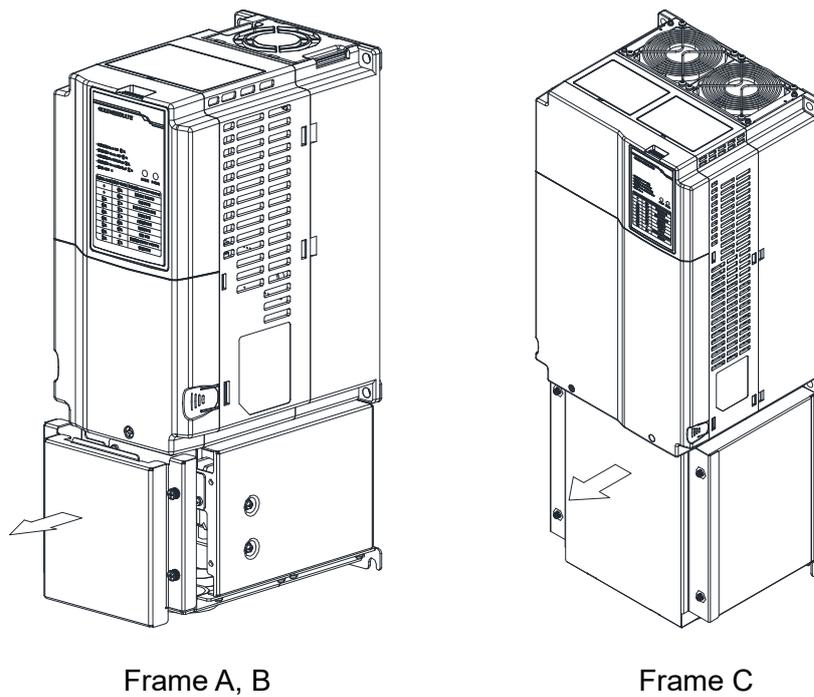


Figure 4-25

3. Loosen the screws.

Frames A, B, C: Screw torque: 10–12 kg-cm / (8.68–10.42 lb-in.) / (0.98–1.18 Nm)

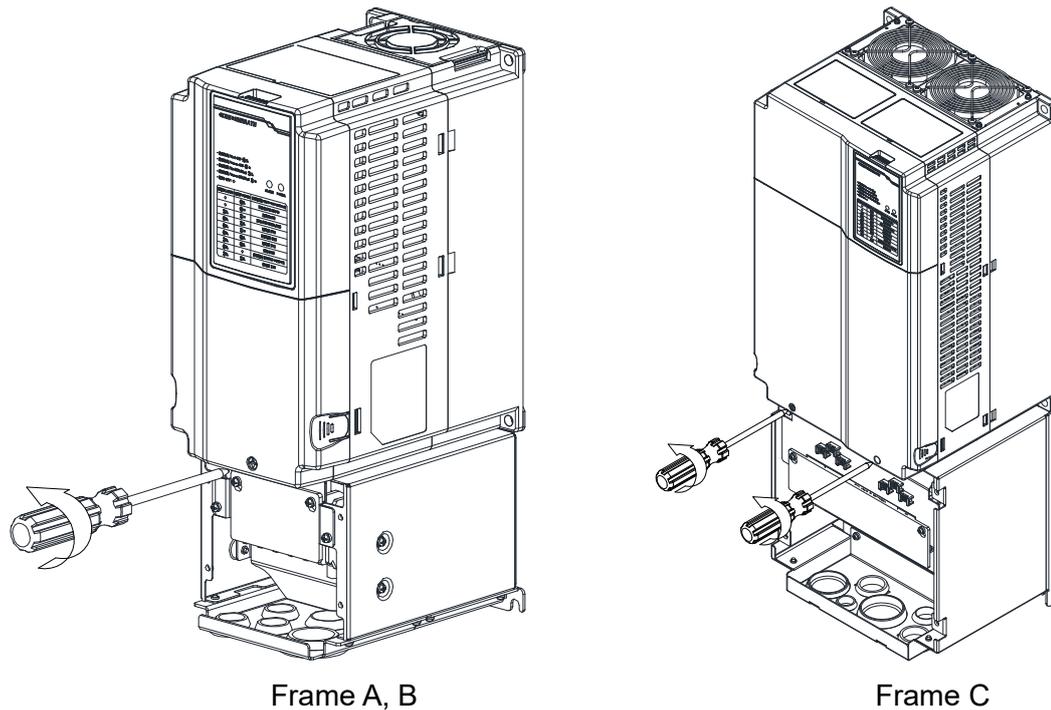


Figure 4-26

4. You can now wire the control terminals.

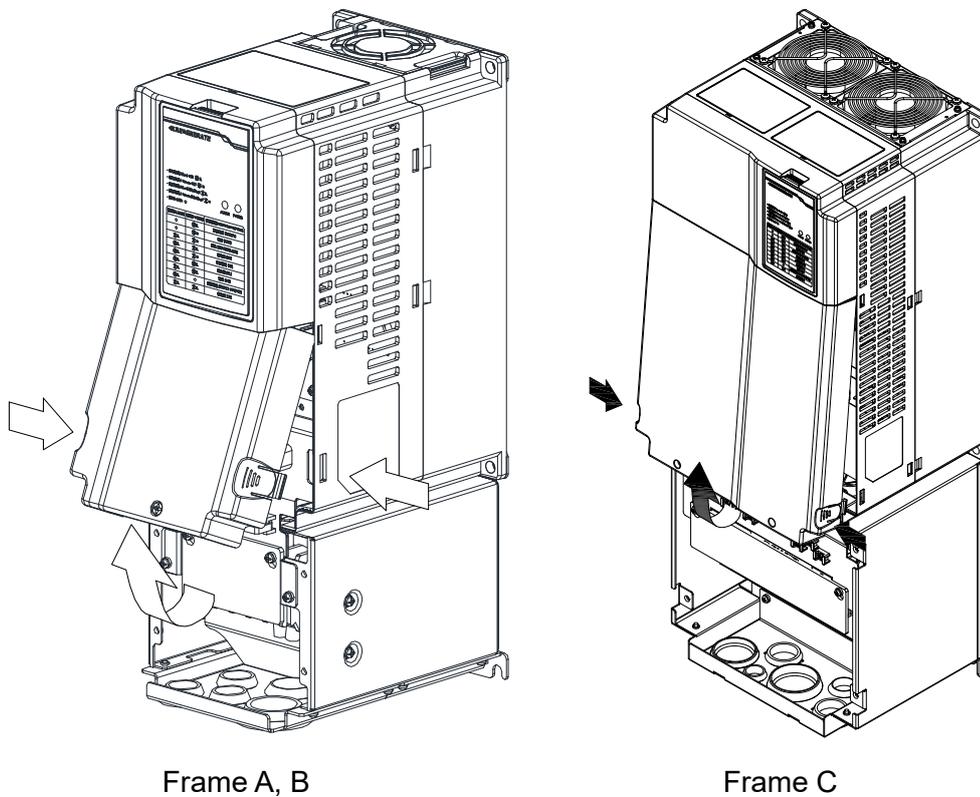


Figure 4-27

4-3-2 Control Terminal Specifications

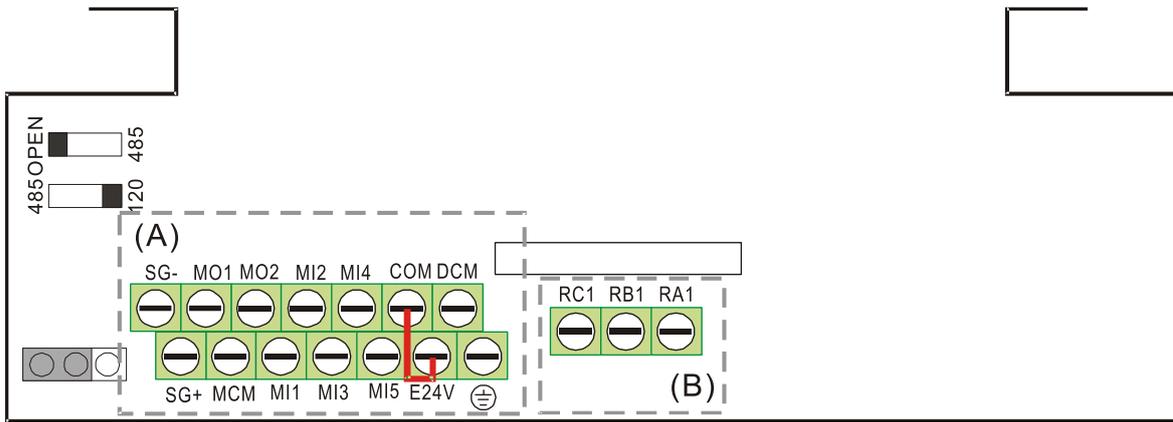


Figure 4-28

Function	Wire Size					Tightening Torque (±10%)
	Group	Conductor	Stripping Length	Minimum Wire Gauge	Maximum Wire Gauge	
Control Terminal	A	Solid / Strand	6 mm	0.2 mm <sup>2</sup> (26 AWG)	1.5 mm <sup>2</sup> (16 AWG)	5.1 kg-cm / (4.42 lb-in.) / (0.5 Nm)
	B					5.6 kg-cm / (4.86 lb-in.) / (0.55 Nm)

Table 4-11

- To set to auto-mode without a keypad, wire the Power Regenerative Unit to go through a multi-function input terminal (MIx, default setting is MI1) to connect to the terminal DCM.

## Wiring notes:

- The default for E24V-COM is short circuit and SINK mode (NPN). Refer to Section 4-1-1-1.

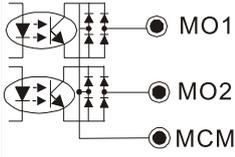
Terminal	Function Description	Default (NPN mode)
E24V	The default for +24 V-COM is short circuit and SINK mode (NPN) (Source).	+24 V $\pm$ 5% 200 mA
COM	Common terminal for digital control signals (Sink)	Common terminal for multi-function inputs
MI1 – MI5	Multi-function input 1–5	Refer to Pr.02-00–Pr.02-04 to program the multi-function inputs MI1–MI5. ON: the activation current is 6.5 mA $\geq$ 11 V <sub>DC</sub> ; OFF: leakage current tolerance is 10 $\mu$ A $\leq$ 5 V <sub>DC</sub>
DCM	Common terminal for digital control signals (Sink)	Common terminal for multi-function inputs
MO1	Multi-function output 1 (photo coupler)	<p>The Power Regeneration Unit releases various monitor signals, using a transistor (open collector).</p> 
MO2	Multi-function output 2 (photo coupler)	
MCM	Common terminal for multi-function outputs	Max 48 V <sub>DC</sub> 50 mA
RA1	Multi-function relay output 1 (N.O.) a	Resistive load 5 A (N.O.) / 3 A (N.C.) 250 V <sub>AC</sub>
RB1	Multi-function relay output 1 (N.C.) b	5 A (N.O.) / 3 A (N.C.) 30 V <sub>DC</sub> N.O. minimum load: 5 V / 0.1 A; 24 V / 3 mA N.C. minimum load: 5 V / 0.1 A; 24 V / 3 mA
RC1	Common terminal for multi-function relays	Inductive load (COS 0.4) 2.0 A (N.O.) / 1.2 A (N.C.) 250 V <sub>AC</sub> 2.0 A (N.O.) / 1.2 A (N.C.) 30 V <sub>DC</sub> Outputs various monitoring signals. N.O. minimum load: 5 V / 0.1 A; 24 V / 3 mA N.C. minimum load: 5 V / 0.1 A; 24 V / 3 mA
SG+	Modbus RS-485	
SG-	PIN 1, 2, 7, 8: Reserved PIN 4: SG-	PIN 3, 6: GND PIN 5: SG+

Table 4-12

**NOTE:** Analog control signals wire size: 18 AWG (0.75 mm<sup>2</sup>) with shielded wire

**Contact Input Terminals (MI1–MI5, COM)**

- When using contacts or switches to control the input terminals, use high quality components to prevent contact bounce.

**Transistor Output Terminals (MO1, MO2, MCM)**

- Make sure to connect the digital outputs to the correct polarity.
- When connecting a relay to the digital outputs, connect a surge absorber across the coil and check the polarity.

## 4-4 Display Panel Indicators

### Display Panel



Figure 4-29

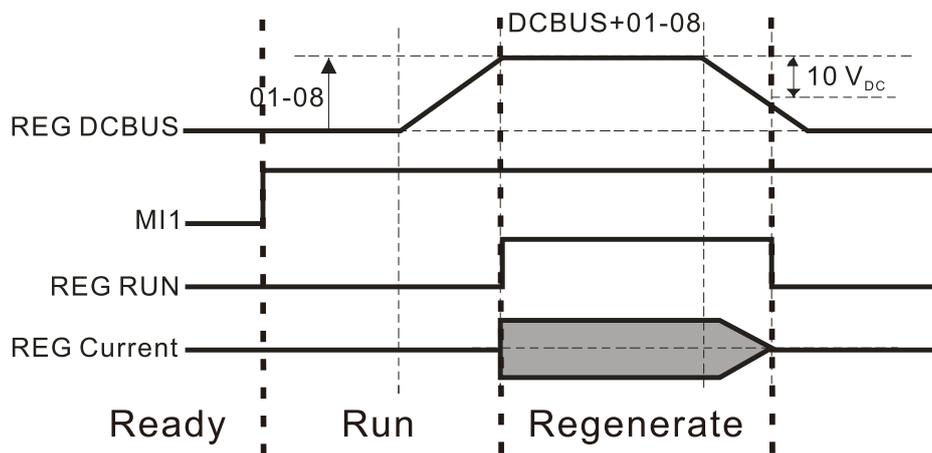
Power & Alarm Indicator Status Descriptions

ALARM	POWER	Description	Note
Blinking red + green lights	Blinking red + green lights	Prepare*1	Once the Power Regenerative Unit is powered on, it performs auto-system checking.
OFF	Constant red light ON	Ready*2	Once the Power Regenerative Unit is powered on, if there are no faults or warnings and phase lock is completed, you can now send the RUN command.
OFF	Constant green light ON	RUN*2	Once you send the RUN command, the Power Regenerative Unit runs smoothly and waits for the conditions to regenerate energy.
OFF	Blinking green light	REGENERATE*2	Power Regenerative Unit regenerates AC current to the mains power.
ALARM	POWER	Description	Fault / Warning Name Corresponds to the Keypad
Constant red light ON	Blinking red light	OV (Over-voltage)	ovn, ovs
Constant red light ON	Blinking green light	EF (External fault)	EF
Constant red light ON	Constant red light ON	OL (Overload)	oL
Blinking red light	Constant red light ON	OH (Overheat)	oH1, oH2, tH1o, tH2o
Constant red light ON	OFF	OC (Over-current)	ocn, ocs
Blinking red light	Blinking red light	Comm. Err. (Communication fault)	Pco, CE1, CE2, CE3, CE4, CE10, SE1, SE2, SE3
Blinking red light	OFF	Mains Err. (Mains power error)	Phase loss (OrP), phase lock (PLE) and low direct voltage (LvS) warning at input.
Blinking green light	Blinking green light	HW Err. (Hardware fault / memory fault)	cd1, cd2, cd3, Hd1, Hd2, 5VF, RYF, cF1, cF2

Table 4-13

**NOTE:**

- \*1 The start-up time is too short, so there is no message on the keypad.
- \*2 Different regeneration statuses are defined in Figure 4-30 below.



The Definition of Different Working Status of Power Regeneration

Figure 4-30

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# Chapter 5 Optional Accessories

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5-1 Digital Keypad

5-2 USB / RS-485 Communication Interface IFD6500, IFD6530

5-3 Fuse Specification Chart

5-4 EMI Filter

5-5 External Power Supply Card (24 V) EMC-BPS01

5-6 Fan Kit

The optional accessories listed in this chapter are available upon request. These accessories can improve your Power Regeneration Unit's performance. Select the accessories you need or contact your local distributor for suggestions.

### 5-1 Digital Keypad

KPC-CC01



KPC-CE01



Communication interface  
RJ45 (socket), RS-485 interface

Installation Method

- The embedded type can be installed flat on the surface of the control box. The front cover is waterproof.
- Buy a MKC-KPPK model for wall mounting or embedded mounting. Its protection level is IP56.

#### Descriptions of Keypad Functions

Keys	Description
	<b>ESC Key</b> Return to the previous page. This also returns you to the last category in the sub-menu.
	<b>Menu Key</b> Return to the main MENU. Menu content: 1. Parameter Detail    3. Keypad Locked    5. PLC copy 2. Copy Parameter    4. PLC function    6. Fault Record REG does not support menu item 4 and 5 (PLC functions).
	<b>ENTER Key</b> Go to the next level. If it is the last level, then press ENTER to execute the command.
	No assigned function
	No assigned function
	No assigned function
	<b>Start Operation Key</b> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> It is only valid when you issue the operation command from the keypad.</li> <li><input checked="" type="checkbox"/> The drive runs according to the function setting and the RUN LED is ON.</li> <li><input checked="" type="checkbox"/> You can press the RUN key many times during the Power Regeneration Unit's stop process.</li> </ul>

Keys	Description
	<b>Stop Key</b> <input checked="" type="checkbox"/> <b>The STOP key has the highest priority in command.</b> <input checked="" type="checkbox"/> When you press the STOP key, the Power Regenerative Unit stops under any condition. <input checked="" type="checkbox"/> Use the RESET key to reset the Power Regenerative Unit when faults occur. <input checked="" type="checkbox"/> If the RESET key is not responding, check MENU → Fault Record for the most recent fault.

Table 5-1

**Digital keypad LED status description**

RUN	STOP	Description	Note
Constant ON	Blinking	Prepare	Once the Power Regenerative Unit is powered on, it performs auto-system checking.
OFF	Constant ON	Ready*	Once the Power Regenerative Unit is powered on, if there are no faults or warnings and phase lock is completed, you can now send the RUN command.
Blinking	Constant ON	RUN*	Once you send the RUN command, the Power Regenerative Unit runs smoothly and waits for the conditions to regenerate energy.
Constant ON	OFF	REGENERATE*	Power Regenerative Unit regenerates AC current to the mains power.

\*See Figure 4-30 in Section 4-4 for the definition of different working status of power regeneration. Table 5-2

**KPC-CC01 & KPC-CE01 Dimensions**

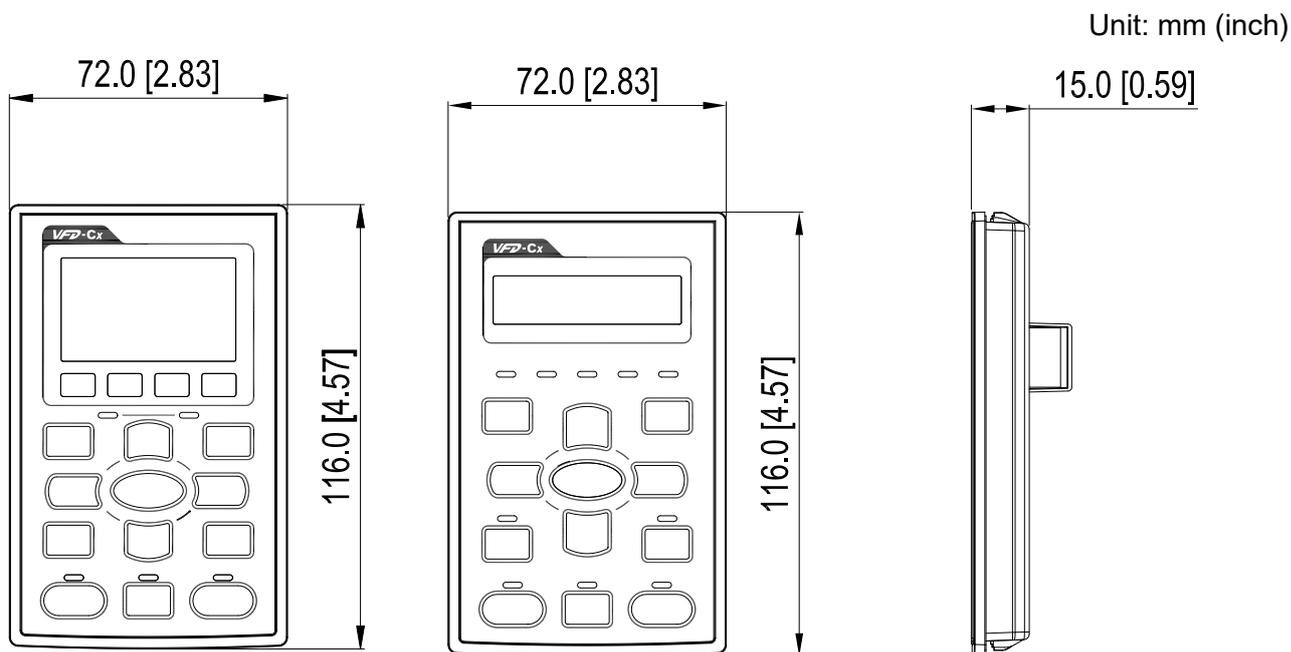


Figure 5-1

### Optional digital keypad RJ45 extension cable

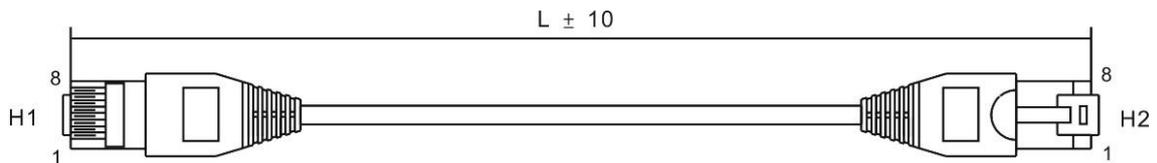


Figure 5-2

No.	Part No.	L	
		mm	inch
1	UC-CMC003-01A	300	11.8
2	UC-CMC005-01A	500	19.6
3	UC-CMC010-01A	1000	39
4	UC-CMC015-01A	1500	59
5	UC-CMC020-01A	2000	78.7
6	UC-CMC030-01A	3000	118.1
7	UC-CMC050-01A	5000	196.8
8	UC-CMC100-01A	10000	393.7
9	UC-CMC200-01A	20000	787.4

Table 5-3

- The Power Regenerative Unit is controlled by an external terminal MIx by default. To use the digital keypad to control the Power Regenerative Unit, the command source can be switched as follows:
  1. Control from the digital keypad:  
Set Pr.01-04 = 2 to change to the digital keypad as the operation command source.
  2. Control by an external terminal (default: MI1):  
Set Pr.01-04 = 1 to change to the external terminals as the operation command source.  
The Power Regenerative Unit activation level is determined by the voltage level. It is not necessary to unplug and reconnect the external terminals.
  
- How to remove the plastic cap
  1. Press the pin on top of the keypad.
  2. Pull forward to remove the keypad.

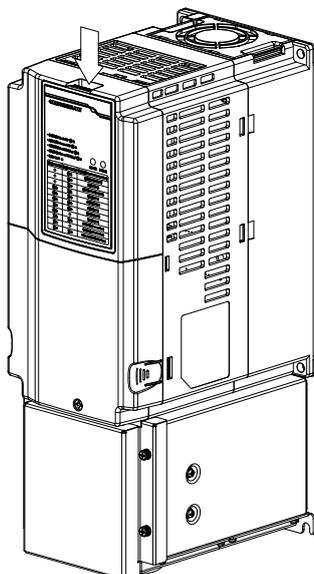


Figure 5-3

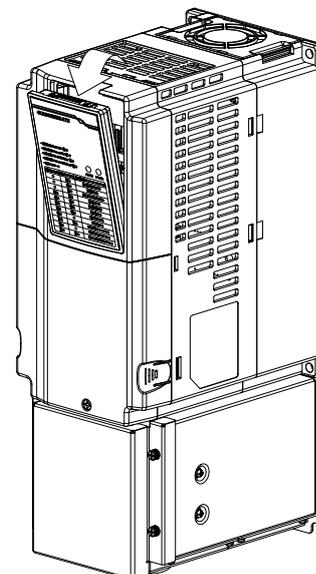


Figure 5-4

## 5-2 USB / RS-485 Communication Interface IFD6500, IFD6530

### Caution

- ✓ Read this instruction sheet thoroughly before installation and operation.
- ✓ The contents of this instruction sheet and the driver file may be revised without prior notice. Consult our distributors or download the most updated instruction / driver version at [http://www.delta.com.tw/product/em/control/cm/control\\_cm\\_main.asp](http://www.delta.com.tw/product/em/control/cm/control_cm_main.asp).

### Introduction

The IFD6530 is a convenient RS-485-to-USB converter, and does not require external power-supply or complex set up. It supports baud rates from 75–115.2 kbps and auto-switching of the direction of data transmission. It uses RJ45 in an RS-485 connectors for convenient wiring. Its tiny dimensions, use of plug-and-play and hot swapping make it easy to connect all DELTA IABU products to your PC.

Applicable Models: All DELTA IABU products.

#### ● Applications and Dimensions

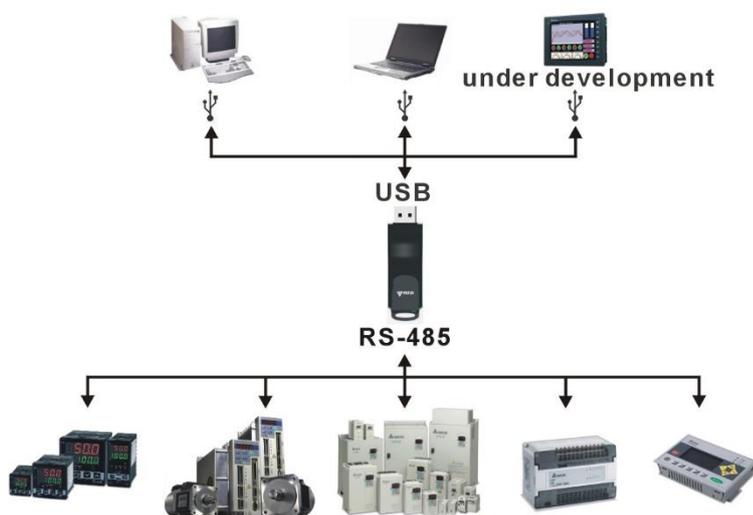


Figure 5-5

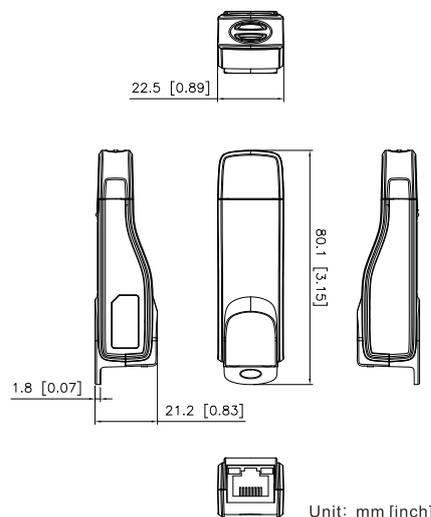


Figure 5-6

Unit: mm [inch]

### Specifications

Power supply	No external power is needed
Power consumption	1.5 W
Isolation voltage	2,500 V <sub>DC</sub>
Baud rate	75; 150; 300; 600; 1,200; 2,400; 4,800; 9,600; 19,200; 38,400; 57,600; 115,200 kbps
RS-485 connector	RJ45
USB connector	A type (plug)
Compatibility	Full compliance with USB V2.0 specification
Maximum cable length	RS-485 Communication Port: 100 m
Supports RS-485 half-duplex transmission	

Table 5-4

RJ45



PIN	Description
1	Reserved
2	Reserved
3	GND
4	SG-

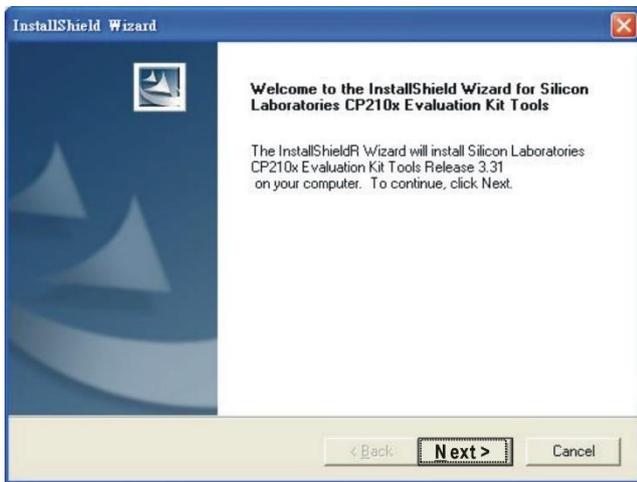
PIN	Description
5	SG+
6	GND
7	Reserved
8	+9V

Preparing for Driver Installation

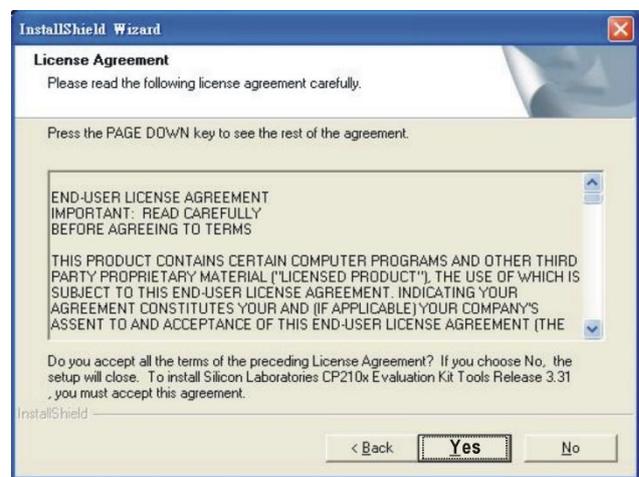
Extract the driver file (IFD6530\_Drivers.exe) with following steps. You can find the driver file (IFD6530\_Drivers.exe) on the CD supplied with the IFD6530.

**NOTE:** DO NOT connect the IFD6530 to your PC before extracting the driver file.

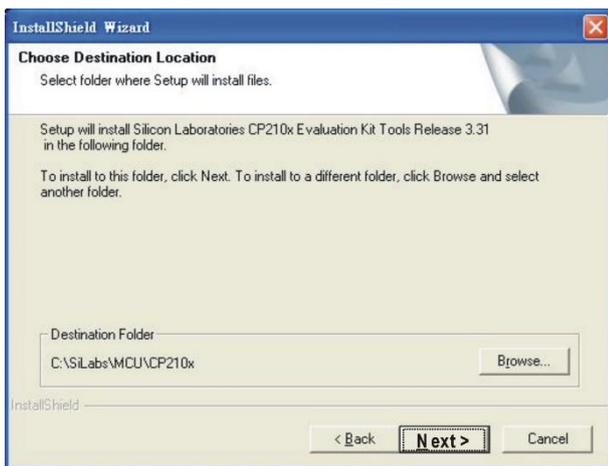
STEP 1



STEP 2



STEP 3



STEP 4



STEP 5

You should now have a folder marked SiLabs under drive C (C:\ SiLabs).

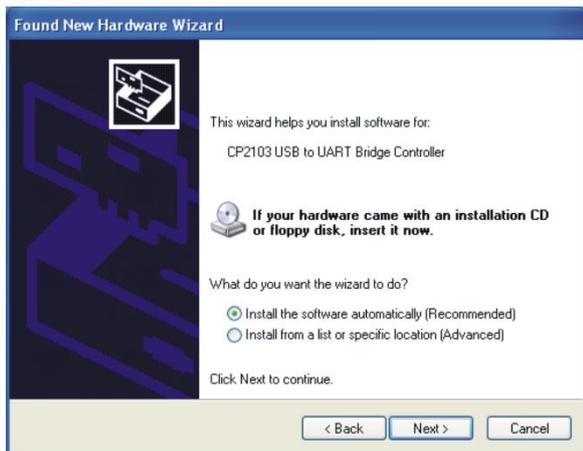
## Driver Installation

After connecting the IFD6530 to your PC, install the driver by following these steps.

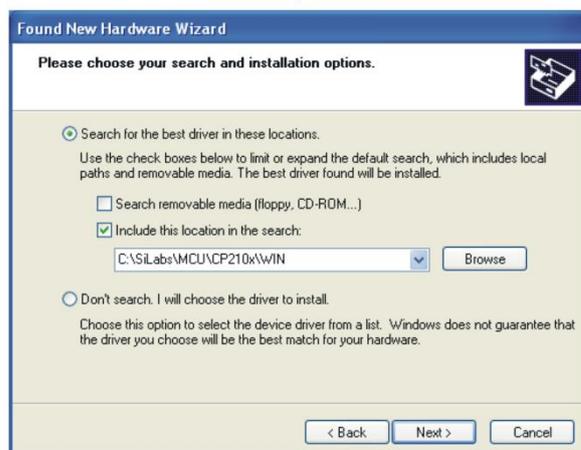
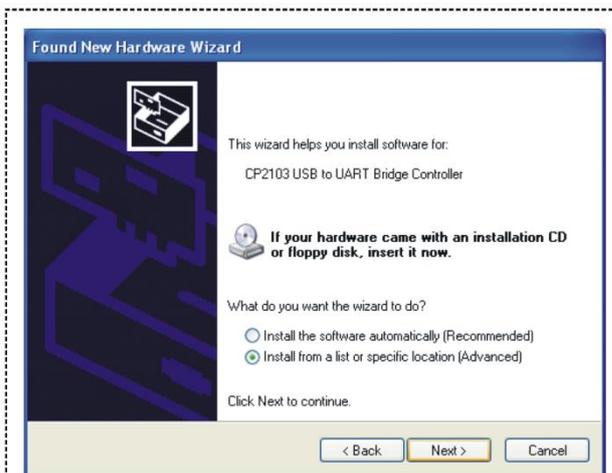
### STEP 1



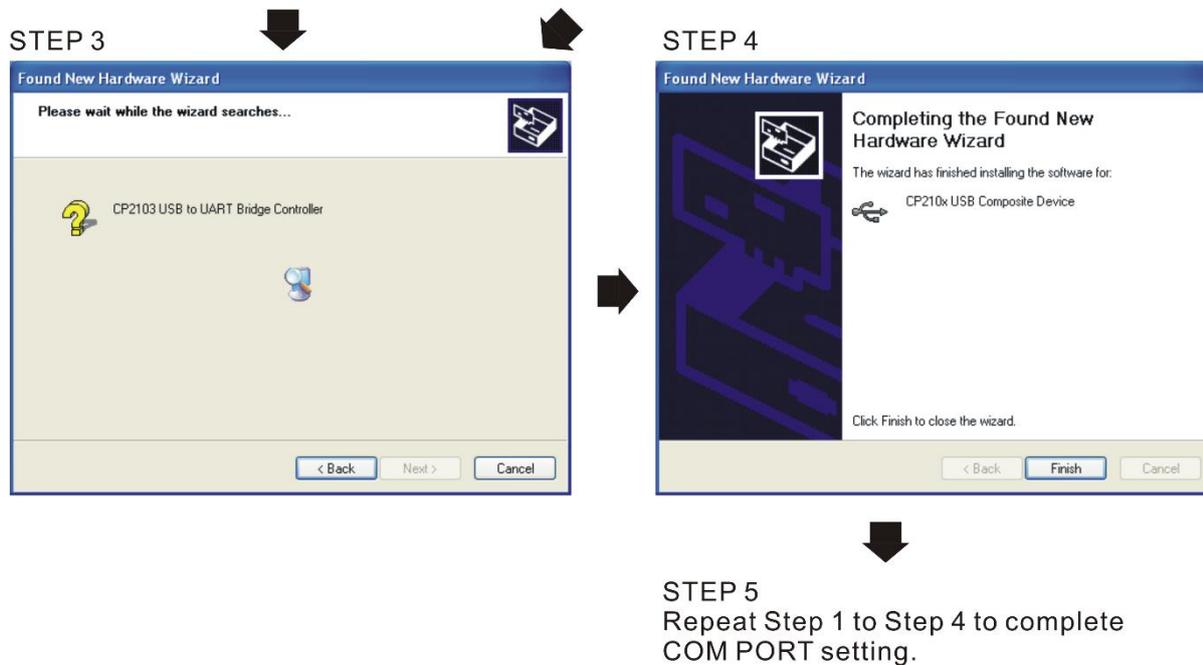
### STEP 2



OR



Browse and select directory, or enter  
C:\SiLabs\MCU\CP210x\WIN



## LED Display

1. Steady green LED ON: power is ON.
2. Blinking orange LED: data is transmitting.

### 5-3 Fuse Specification Chart

- ☑ Use UL certified fuses for short circuit protection. For installation in the United States, branch circuit protection must be provided in accordance with the National Electrical Code (NEC) and any applicable local codes. Use UL classified fuses to fulfill this requirement.
- ☑ For installation in Canada, branch circuit protection must be provided in accordance with Canadian Electrical Code and any applicable provincial codes. Use UL classified fuses to fulfill this requirement.
- ☑ See Section 4-1 Wiring Diagram for fuse installation.

Frame A	
Model No.	Ampere
REG075A23A-21	50
REG075A43A-21	25
REG110A43A-21	45
REG150A43A-21	50

Table 5-5

Frame B	
Model No.	Ampere
REG150A23A-21	100
REG220A23A-21	150
REG185A43A-21	60
REG220A43A-21	80
REG300A43A-21	100

Table 5-6

Frame C	
Model No.	Ampere
REG370A23A-21	250
REG370A43A-21	125
REG450A43A-21	150
REG550A43A-21	200

Table 5-7

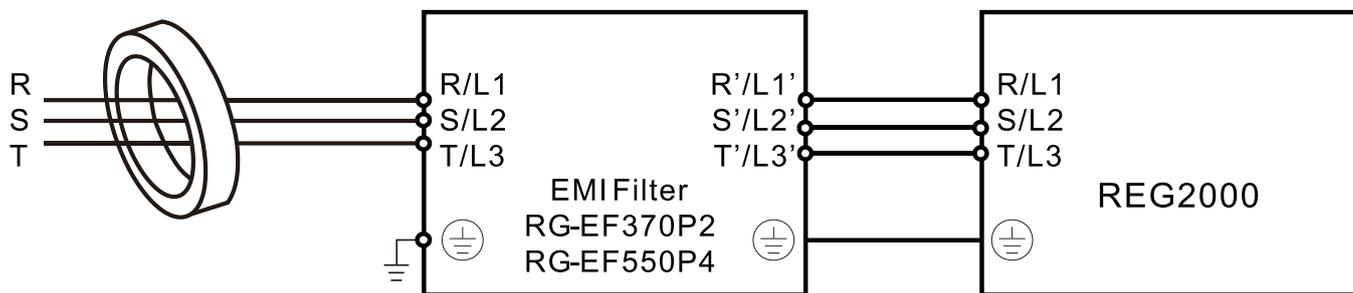
## 5-4 EMI Filter

### Cautions

In order to make sure that the EMI filter can bring out the maximum effect on suppressing the interference of the motor drive, apart from following the installation and wiring instructions in the user manual (Chapter 4 Wiring), pay attention to the following points should be noted:

#### ⚠ Warnings

- ✓ Before you use this product, please follow the **regular inspection and recommended steps** to make sure the normal operation of the product.
- ✓ After you have used this product, you have to do regular inspections according to the **regular inspections and recommendations** every six months.
- ✓ For the EMI filters in Frame C (RG-EF370P2, RG-EF550P4), install the ferrite core provided with the product on the power side, as shown in the figure below.



### Precautions on Function

After you install the Power Regenerative Unit, install an EMI filter on the power system to suppress high frequency interference.

Installing the EMI filter [suppressing electromagnetic interference and radio frequency interference (CLASS A / 3m)] makes the Power Regenerative Unit compliant with EN55011 regulations.

### Specifications

#### Input Voltage

230V series: 170–265 V<sub>AC</sub>, input from main circuit terminals L1, L2, and L3.

460V series: 323–528 V<sub>AC</sub>, input from main circuit terminals L1, L2, and L3.

#### Input Frequency

50 Hz (47–53) / 60 Hz (57–63)

#### Input Current

Model	Rated Current when Running Continuously (Arms)
RG-EF110A2	25.6
RG-EF110P2	
RG-EF220A2	48
RG-EF220P2	
RG-EF370A2	80
RG-EF370P2	
RG-EF150A4	16
RG-EF150P4	
RG-EF300A4	34.4
RG-EF300P4	
RG-EF550A4	60
RG-EF550P4	

Table 5-8

- With variation in ED%, a Power Regenerative Unit can still function normally when overloaded. The rated output current of the EMI filter corresponds to that of the Power Regenerative Unit.
- Follow the table below to select an EMI filter. Delta ensures that all EMI filters are within output current specifications.
- Since there are many conditions and changes at the installation site of a Power Regenerative Unit and temperature rise during continuous operation is the harshest environment for the electronic components, only the rated current during continuous regeneration is listed in the table below.

### EMI Filter Specifications

Frame	REG2000 Model	REG EMI Filter	Weight (kg)
A	REG075A23A-21	RG-EF110A2	3.0 ± 0.5
		RG-EF110P2	4.4 ± 0.5
B	REG150A23A-21	RG-EF220A2	4.7 ± 0.5
	REG220A23A-21	RG-EF220P2	5.7 ± 0.5
C	REG370A23A-21	RG-EF370A2	6.2 ± 0.5
		RG-EF370P2	7.2 ± 0.5
A	REG075A43A-21	RG-EF150A4	3.1 ± 0.5
	REG110A43A-21 REG150A43A-21	RG-EF150P4	4.4 ± 0.5
B	REG185A43A-21	RG-EF300A4	5.0 ± 0.5
	REG220A43A-21 REG300A43A-21	RG-EF300P4	6.2 ± 0.5
C	REG370A43A-21	RG-EF550A4	6.5 ± 0.5
	REG450A43A-21 REG550A43A-21	RG-EF550P4	7.7 ± 0.5

Table 5-9

### Terminal Specifications

- 📖 Refer to Section 4-1 Wiring Diagram for details on EMI filter wiring.
- 📖 To avoid any interference, install the EMI filter on the Power Regenerative Unit for different applications as well as at the installation site.

#### Frame A

Model Name	Main Circuit Terminals R/L1、S/L2、T/L3				Grounding Terminal ⊥			
	Stripping Length (mm)	Max. Wire Gauge	Min. Wire Gauge	Screw Spec. and Torque (±10%)	Stripping Length (mm)	Max. Wire Gauge	Min. Wire Gauge	Screw Spec. and Torque (±10%)
RG-EF110A2	10	10 mm <sup>2</sup> (8 AWG)	10 mm <sup>2</sup>	18 kg-cm (15.62 lb-in.) (1.77 Nm)	10	10 mm <sup>2</sup>	10 mm <sup>2</sup>	18 kg-cm (15.62 lb-in.) (1.77 Nm)
RG-EF110P2			8 AWG			8 AWG		
RG-EF150A4			6 mm <sup>2</sup>			6 mm <sup>2</sup>		
RG-EF150P4			(10 AWG)			(10 AWG)		

1. Tighten the wiring with a Philips screwdriver. Specification of this Philips screwdriver: PH1
2. When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.
3. If you install at Ta 40°C environment, use copper wires that have a voltage rating of 600V and are temperature resistance to 75°C or 90°C.
4. If you install at Ta 40°C above environment, use copper wires that have a voltage rating of 600V and are temperature resistance to 90°C or above.
5. To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wire.
6. Shielded cables need to be used for the wiring between the EMI filter and REG2000.

Table 5-10

Frame B

Model Name	Main Circuit Terminals R/L1、S/L2、T/L3				Grounding Terminal ⊥			
	Stripping Length (mm)	Max. Wire Gauge	Min. Wire Gauge	Screw Spec. and Torque (±10%)	Stripping Length (mm)	Max. Wire Gauge	Min. Wire Gauge	Screw Spec. and Torque (±10%)
RG-EF220A2	13~15	25 mm <sup>2</sup> (4 AWG)	25 mm <sup>2</sup> (4 AWG)	30.59 kg-cm (26.55 lb-in.) (3.0 Nm)	13~15	25 mm <sup>2</sup> (4 AWG)	16 mm <sup>2</sup> (6 AWG)	30.59 kg-cm (26.55 lb-in.) (3.0 Nm)
RG-EF220P2								
RG-EF300A4								
RG-EF300P4								

1. Tighten the wiring with a slotted screwdriver: Specification of the slotted screwdriver: the width of the blade should be 5.5 mm and the thickness of the blade should be 1.0 mm.
2. When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.
3. If you install at Ta 40°C environment, use copper wires that have a voltage rating of 600V and are temperature resistance to 75°C or 90°C.
4. If you install at Ta 40°C above environment, use copper wires that have a voltage rating of 600V and are temperature resistance to 90°C or above.
5. To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wire.
6. Shielded cables need to be used for the wiring between the EMI filter and REG2000.

Table 5-11

Frame C

Model Name	Main Circuit Terminals R/L1、S/L2、T/L3				Grounding Terminal ⊥			
	Stripping Length (mm)	Max. Wire Gauge	Min. Wire Gauge	Screw Spec. and Torque (±10%)	Stripping Length(mm)	Max. Wire Gauge	Min. Wire Gauge	Screw Spec. and Torque (±10%)
RG-EF370A2	16~18	50 mm <sup>2</sup> (1/0 AWG)	50 mm <sup>2</sup>	61.18 kg-cm (53.10 lb-in.) (6.0 Nm)	16~18	50 mm <sup>2</sup> (1/0 AWG)	25 mm <sup>2</sup>	61.18 kg-cm (53.10 lb-in.) (6.0 Nm)
RG-EF370P2			(1/0 AWG)				(4 AWG)	
RG-EF550A4			35 mm <sup>2</sup>				16 mm <sup>2</sup>	
RG-EF550P4			(2 AWG)				(6 AWG)	

1. Tighten the wiring with a slotted screwdriver: Specification of the slotted screwdriver: the width of the blade should be 5.5 mm and the thickness of the blade should be 1.0 mm.
2. When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.
3. If you install at Ta 40°C environment, use copper wires that have a voltage rating of 600V and are temperature resistance to 75°C or 90°C.
4. If you install at Ta 40°C above environment, use copper wires that have a voltage rating of 600V and are temperature resistance to 90°C or above.
5. To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wire.
6. Shielded cables need to be used for the wiring between the EMI filter and REG2000.

Table 5-12

● Temperature Signal Terminal

Terminal Name and Function	Cable Specifications				Screw Spec. and Torque (±10%)
	Type of Conductor	Stripping Length	Max. Wire Gauge	Min. Wire Gauge	
Temperature Signal Terminal (TH)	Hard Cable	7~8 mm	2.5 mm <sup>2</sup> (14 AWG)	0.2 mm <sup>2</sup> (24 AWG)	5.10 kg-cm (4.43 lb-in.) (0.5 Nm)
	Soft Cable				
	Soft cable with tube pre-insulating terminal				

1. Tighten the wiring with a slotted screwdriver: Specification of the slotted screwdriver: the width of the blade should be 3.5 mm and the thickness of the blade should be 0.6 mm.
2. When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.

Table 5-13

● Ring Terminals of Temperature Signal Terminal specification:

Recommended Ring Terminals Part# and Size						
AWG	VENDOR	VENDOR P/N	A (MAX)	B (MAX)	D (MAX)	W (MAX)
0.2 mm <sup>2</sup> (24 AWG)	K.S.T	E0308	15 mm	8 mm	4.5 mm	2.5 mm
0.34 mm <sup>2</sup> (22 AWG)		E0508				
0.5 mm <sup>2</sup> (20 AWG)		E7508				
0.75 mm <sup>2</sup> (18 AWG)		E1008				
1.5 mm <sup>2</sup> (16 AWG)		E1508				
2.5 mm <sup>2</sup> (14 AWG)		E2508				

Table 5-14

**NOTE:**

**Definition of Size:**

**Size A:** It depends on the actual wiring space.

**Size B:** It depends on the allowable depth of the terminal block.

**Size D:** It depends on the distance between terminal blocks.

**Size W:** It depends on the allowable width.

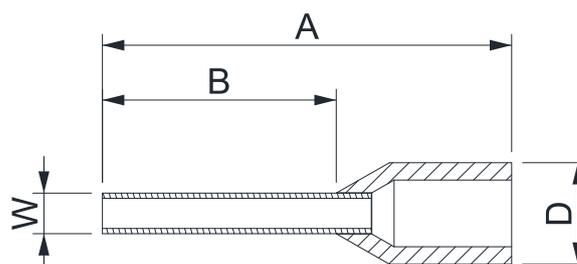


Figure 5-7

## Fuse Specifications

REG EMI Filter	Fuse			
	Power Side I (A)	Power Side P/N	REG Side I (A)	REG Side P/N
RG-EF110P2	5	KLKD005.T, 036.1500C0004	10	KLKD010., 036.2100C0006
RG-EF220P2	10	KLKD010., 036.2100C0006	15	KLKD015., 036.2150C0003
RG-EF370P2	5	KLKD005.T, 036.1500C0004	20	KLKD020., 036.2200C0010
RG-EF150P4	5	KLKD005.T, 036.1500C0004	5	KLKD005.T, 036.1500C0004
RG-EF300P4	5	KLKD005.T, 036.1500C0004	10	KLKD010., 036.2100C0006
RG-EF550P4	5	KLKD005.T, 036.1500C0004	20	KLKD020., 036.2200C0010

Table 5-15

### EMI Filter Dimensions

#### Frame A

RG-EF110A2; RG-EF150A4

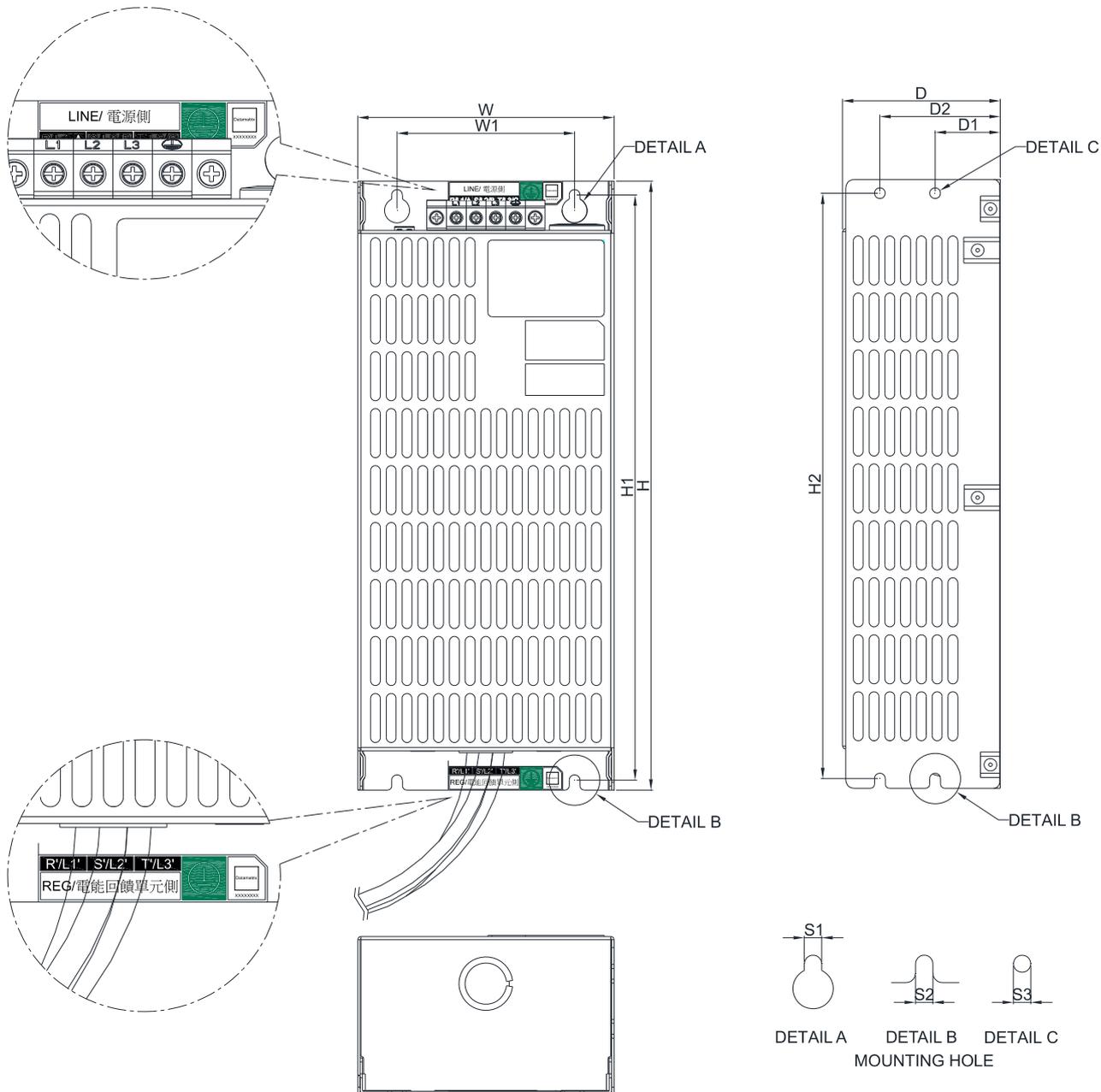


Figure 5-8

Unit: mm (inch)

Frame	W	W1	H	H1	H2	S1	S2	S3	D	D1	D2
A	130.0 (5.12)	90.0 (3.54)	310.0 (12.20)	298.0 (11.73)	298.0 (11.73)	5.5 (0.22)	5.5 (0.22)	5.5 (0.22)	80.0 (3.15)	33.0 (1.30)	61.0 (2.40)

Table 5-16

**Frame A**

RG- EF110P2; RG-EF150P4

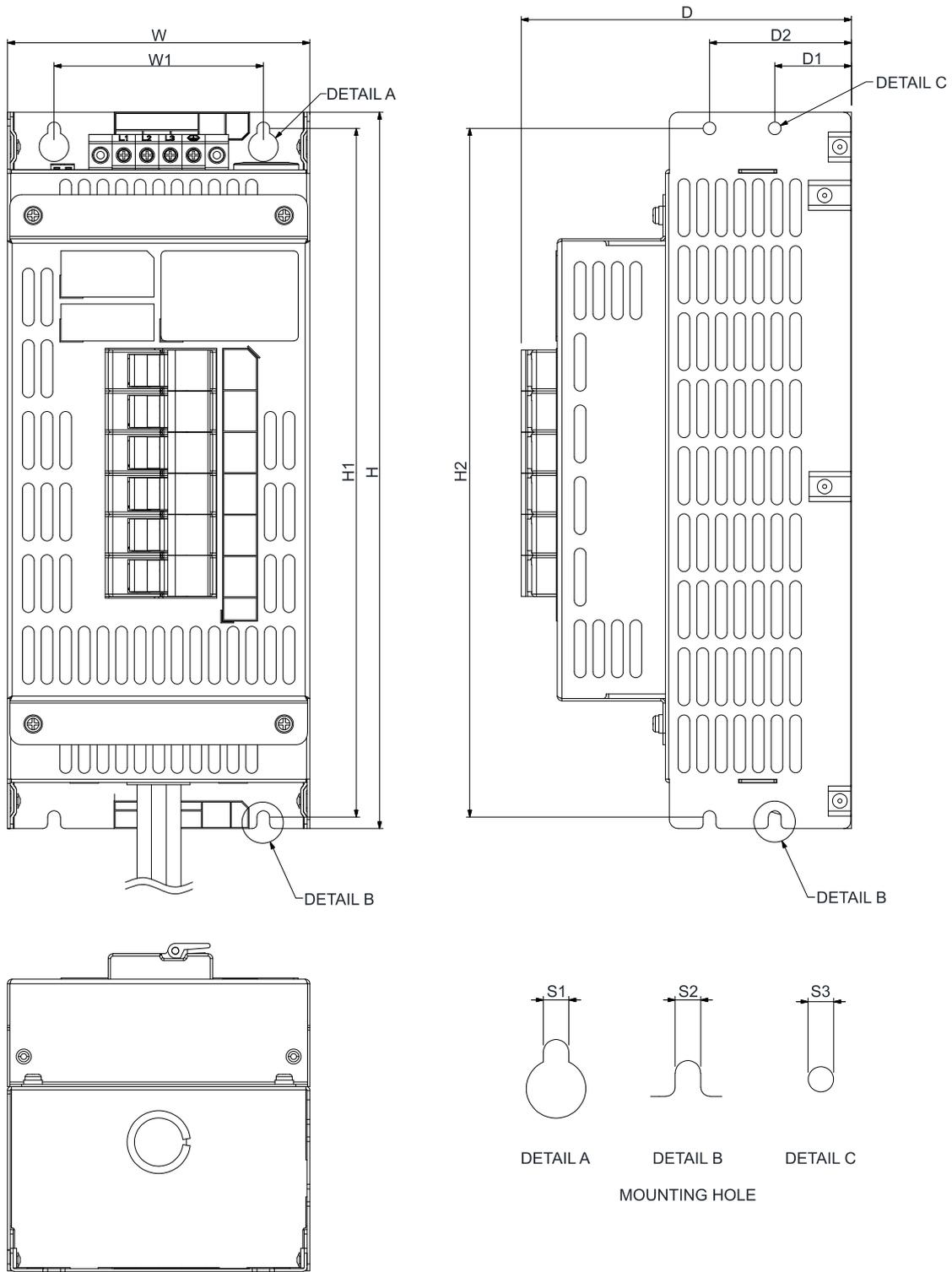


Figure 5-9

Unit: mm (inch)

Frame	W	W1	H	H1	H2	S1	S2	S3	D	D1	D2
A	130.0 (5.12)	90.0 (3.54)	310.0 (12.20)	298.0 (11.73)	298.0 (11.73)	5.5 (0.22)	5.5 (0.22)	5.5 (0.22)	142.0 (5.59)	33.0 (1.30)	61.0 (2.40)

Table 5-17

**Frame B**

RG-EF220A2; RG-EF300A4

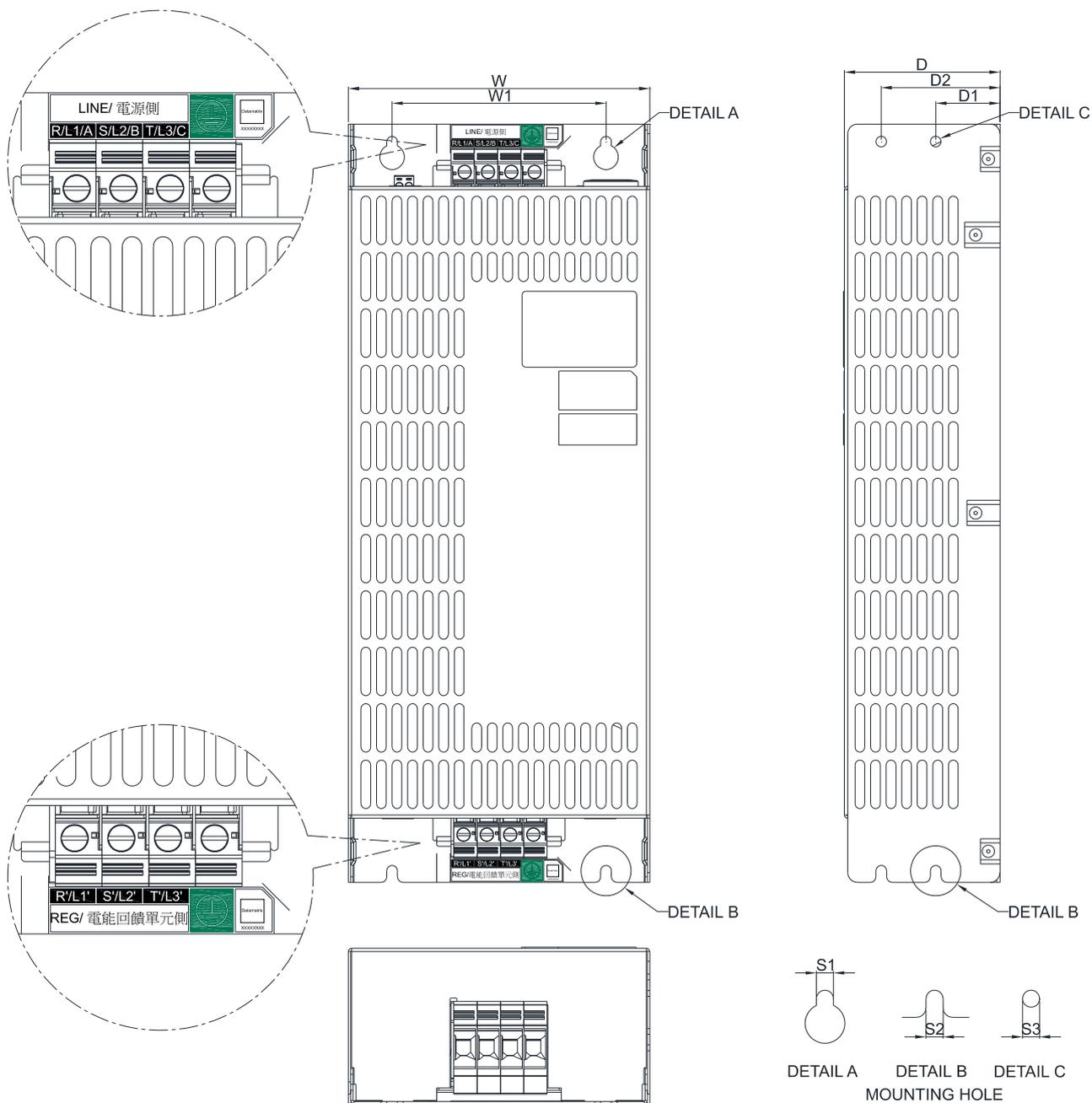


Figure 5-10

Unit: mm (inch)

Frame	W	W1	H	H1	H2	S1	S2	S3	D	D1	D2
B	155.0 (6.10)	110.0 (4.33)	390.0 (15.35)	375.0 (14.76)	375.0 (14.76)	5.5 (0.22)	5.5 (0.22)	5.5 (0.22)	80.0 (3.15)	33.0 (1.30)	61.0 (2.40)

Table 5-18

**Frame B**

RG- EF220P2; RG-EF300P4

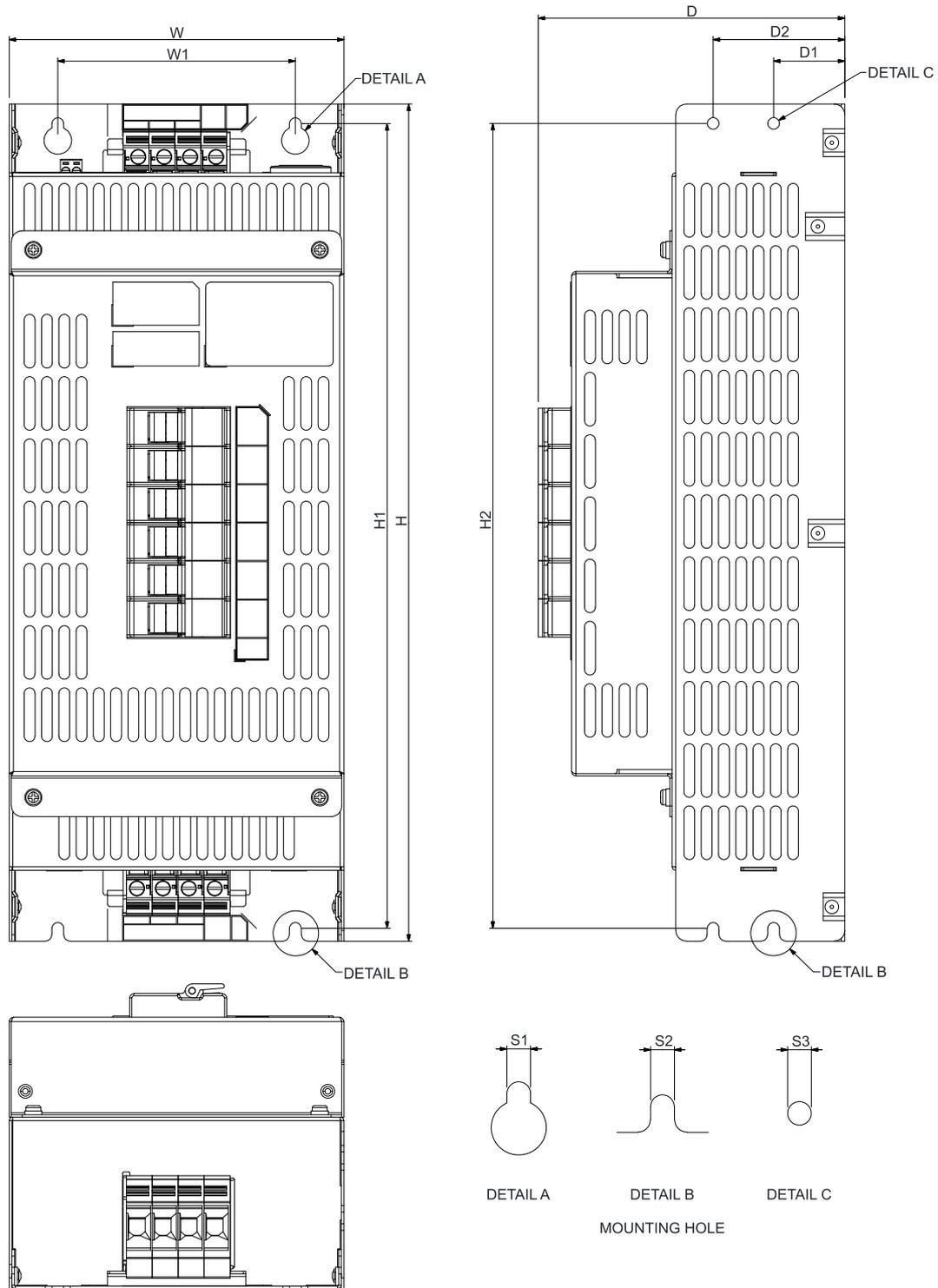


Figure 5-11

Unit: mm (inch)

Frame	W	W1	H	H1	H2	S1	S2	S3	D	D1	D2
B	155.0 (6.10)	110.0 (4.33)	390.0 (15.35)	375.0 (14.76)	375.0 (14.76)	5.5 (0.22)	5.5 (0.22)	5.5 (0.22)	142.0 (5.59)	33.0 (1.30)	61.0 (2.40)

Table 5-19

**Frame C**

RG-EF370A2; RG-EF550A4

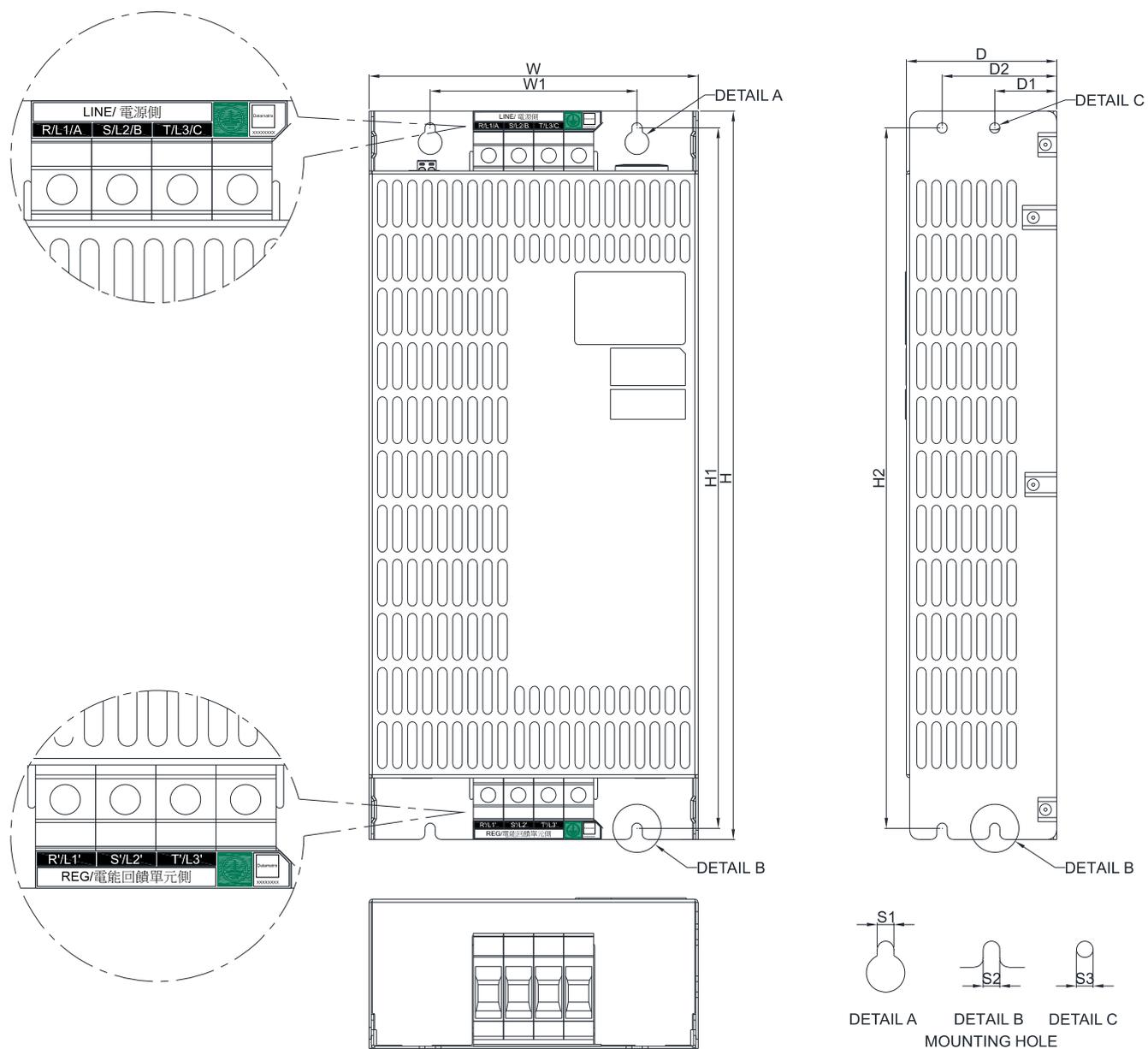


Figure 5-12

Unit: mm (inch)

Frame	W	W1	H	H1	H2	S1	S2	S3	D	D1	D2
C	175.0 (6.89)	110.0 (4.33)	390.0 (15.35)	375.0 (14.76)	375.0 (14.76)	5.5 (0.22)	5.5 (0.22)	5.5 (0.22)	80.0 (3.15)	33.0 (1.30)	61.0 (2.40)

Table 5-20

**Frame C**

RG-EF370P2; RG-EF550P4

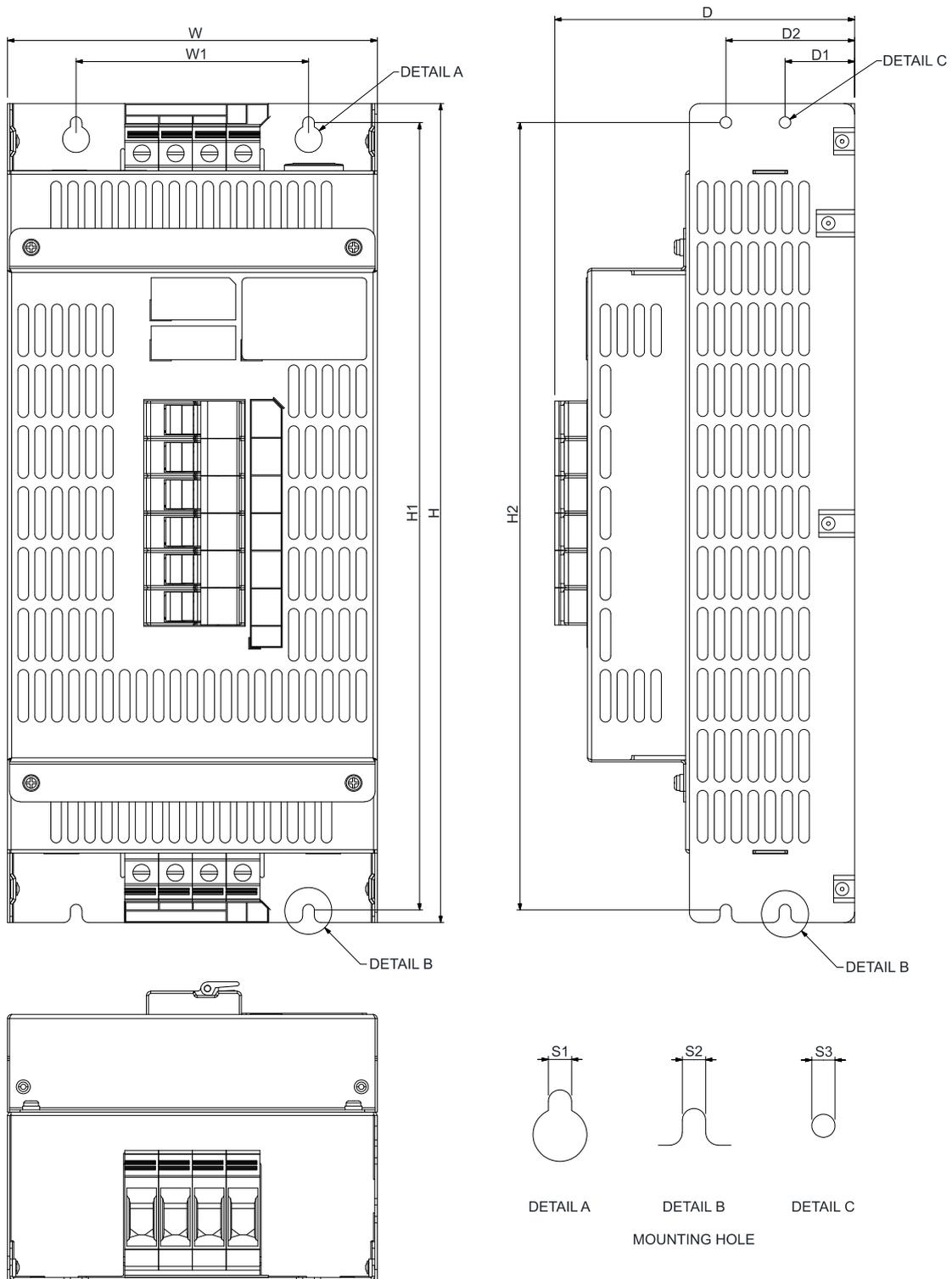


Figure 5-13

Unit: mm (inch)

Frame	W	W1	H	H1	H2	S1	S2	S3	D	D1	D2
C	175.0 (6.89)	110.0 (4.33)	390.0 (15.35)	375.0 (14.76)	375.0 (14.76)	5.5 (0.22)	5.5 (0.22)	5.5 (0.22)	142.0 (5.59)	33.0 (1.30)	61.0 (2.40)

Table 5-21

### Regular inspections and recommendations

Long-term storage or long-term usage of capacitors lead to capacitor decay and cause product defects. For your safety, we recommend that you follow the steps below to verify if the capacitors' condition is within the standard value before you use this product or every six months after the product has been used to make sure that this product can operate normally.

Tools required for inspection: a slotted screwdriver, a Phillips screwdriver, a multimeter (models which support measuring capacitance).

Inspection steps:

1. Disconnect the supply mains first
2. After confirming that all the related machinery / equipment has stopped running, disconnect REG and EMI filter, as shown in Figure 5-14 and Figure 5-15.
3. Ensure that the fuse on the EMI filter (RG-EFxxxPx model) is properly installed and has not blown.

**NOTE:** After the disconnection, do NOT short-circuit the wires.

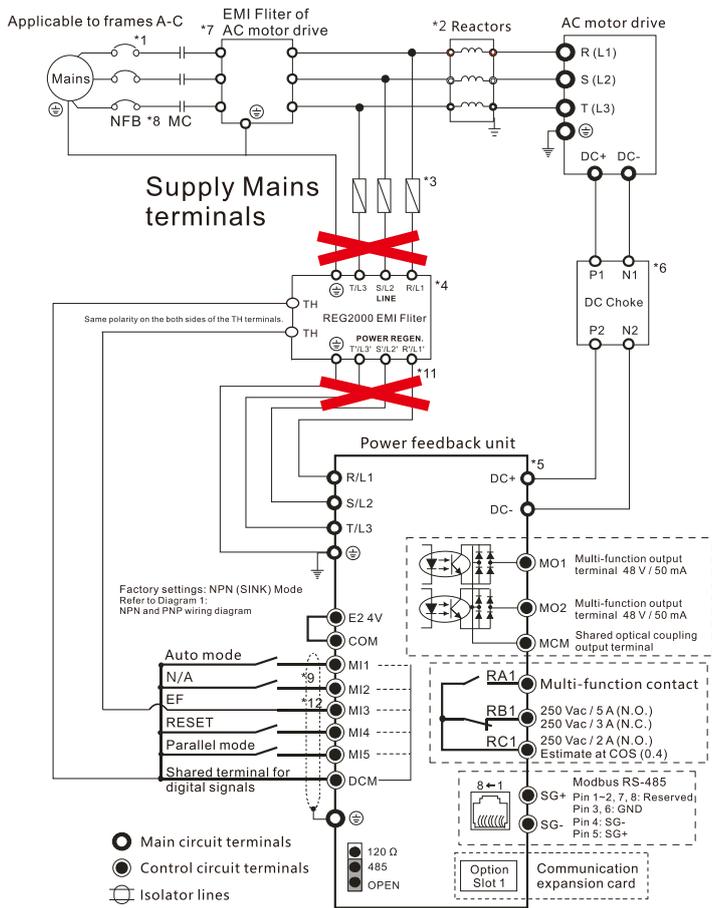


Figure 5-14

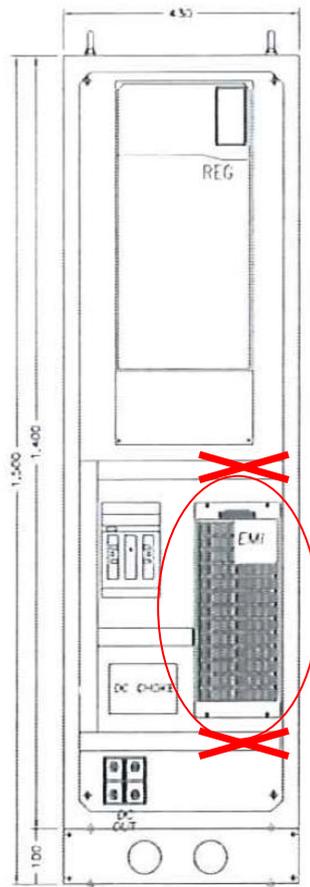


Figure 5-15

## Measuring the capacitance between the phases of EMI filters on REG2000.

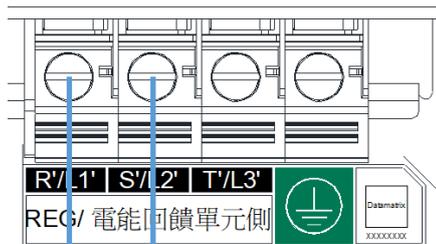
Use a multimeter to measure the capacitance between the phases (R'-S' phase, S'-T' phase, T'-R' phase):

### Capacitance Measurement

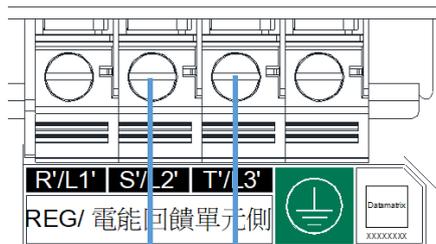
1. Connect the BLACK test lead to the COM terminal and the RED test lead to the V /  $\Omega$  terminal.
2. Set the rotary switch to  position. Select measurement using the function key.
3. Observe polarity when measuring polarized capacitors.
4. Connect the test leads across the capacitor under measurement.



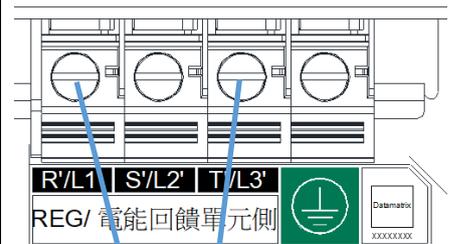
### Measuring R' - S' phase



### Measuring S' - T' phase



### Measuring T' - R' phase



- RG-EF110A2, RG-EF150A4, RG-EF110P2 and RG-EF150P4 don't have terminal blocks, but they have outgoing cords, so you only need to measure R'S'T' cords.

### Standard Rate of Capacitor (failure rate)

If two of three capacitances (R'-S' phase, S'-T' phase and T'-R' phase) are under their failure rate, you need to replace a new EMI filter right away.

The table below lists the **standard rates (in blue color)** and the **failure rates (in red color)** with unit uF.

Product Serial #	Before xxxxxxxxx2109xxxx	After xxxxxxxxx2110xxxx
	21: year of production 2021 09: week of productionw9	21: year of production 2021 10: week of productionw10
RG-EF110A2	11.65 (9.6)	
RG-EF150A4	4.6 (3.9)	
RG-EF220A2	22.35 (18.7)	
RG-EF300A4	9.15 (7.7)	
RG-EF370A2	31.65 (26.1)	
RG-EF550A4	14.85 (12.2)	12.35 (10.2)

Table 5-22

Product Serial #	standard rates (failure rates)
RG-EF110P2	11.65 (9.6)
RG-EF150P4	4.6 (3.9)
RG-EF220P2	22.35 (18.7)
RG-EF300P4	9.15 (7.7)
RG-EF370P2	31.65 (26.1)
RG-EF550P4	13.4 (11)

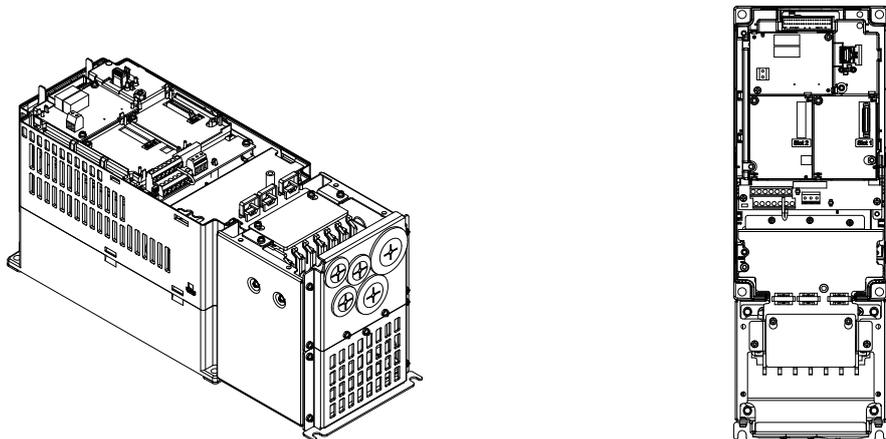
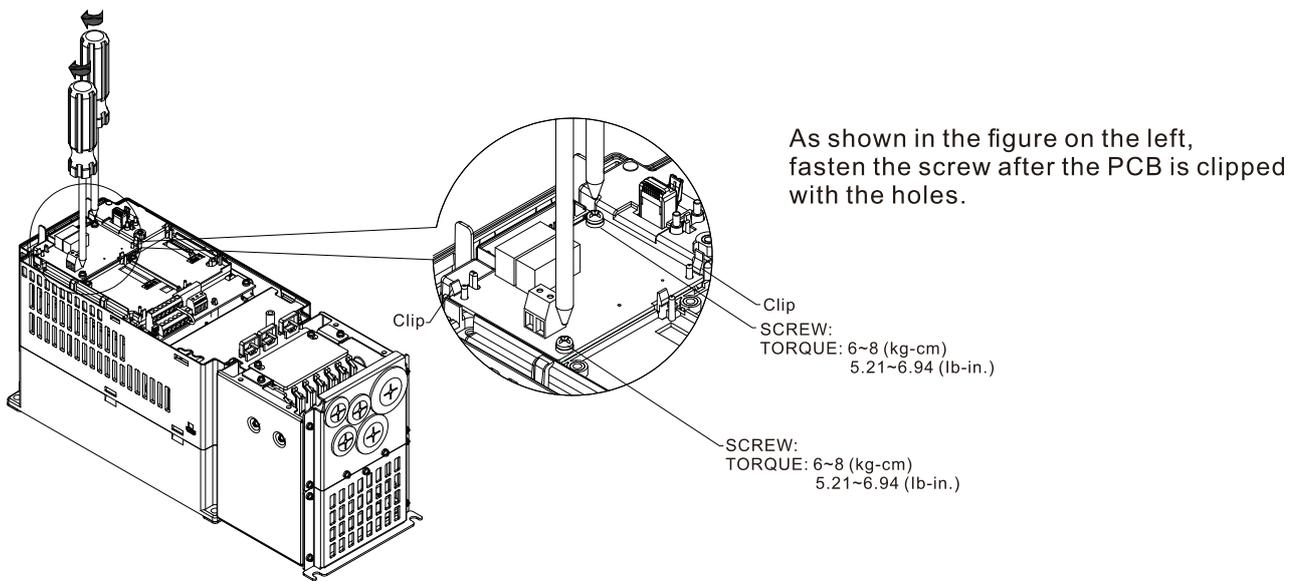
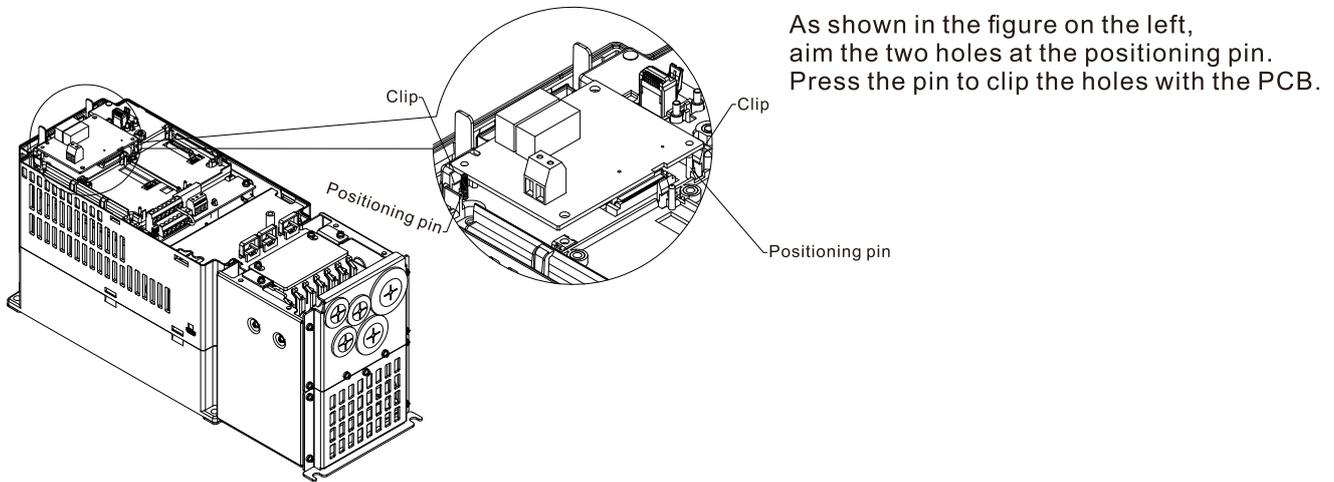
Table 5-23

- Estimation by the failure rate: There are three capacitors in the EMI filter, when one of the capacitor's failure rate is over 15%, that means this capacitor is decaying. A decaying capacitor might cause malfunction of the REG2000 and even cause safety hazards.

## 5-5 External Power Supply Card (24 V) EMC-BPS01

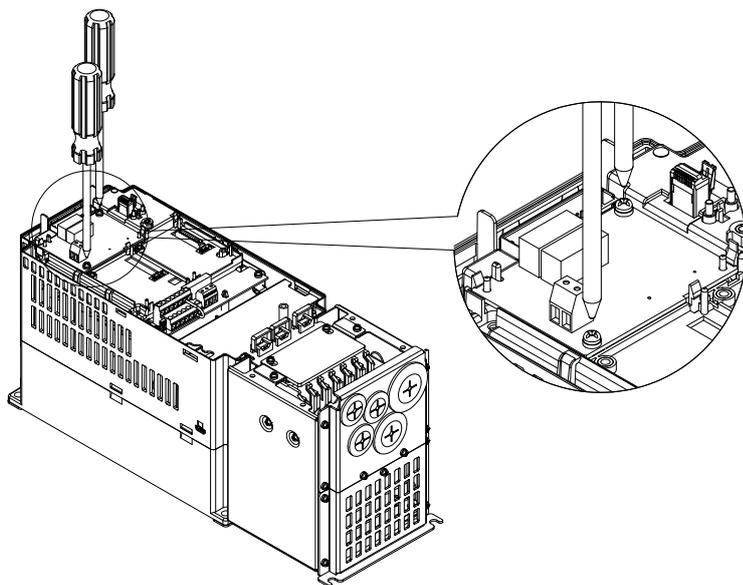
Installing the EMC-BPS01

# Installation

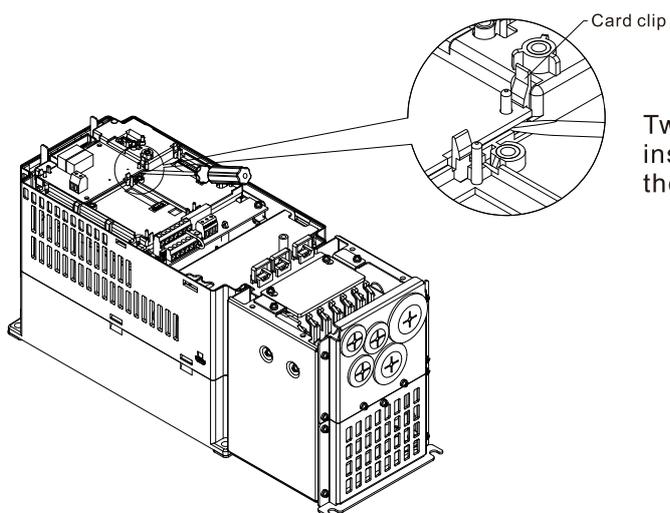


## Removing the EMC-BPS01

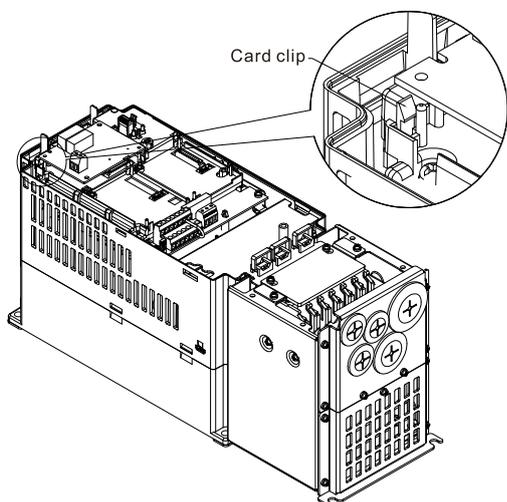
# Removing



As shown in the figure on the left, remove the two screws.



Twist to open the card clip, insert a slot type screwdriver into the hollow to prize the PCB off the card clip.



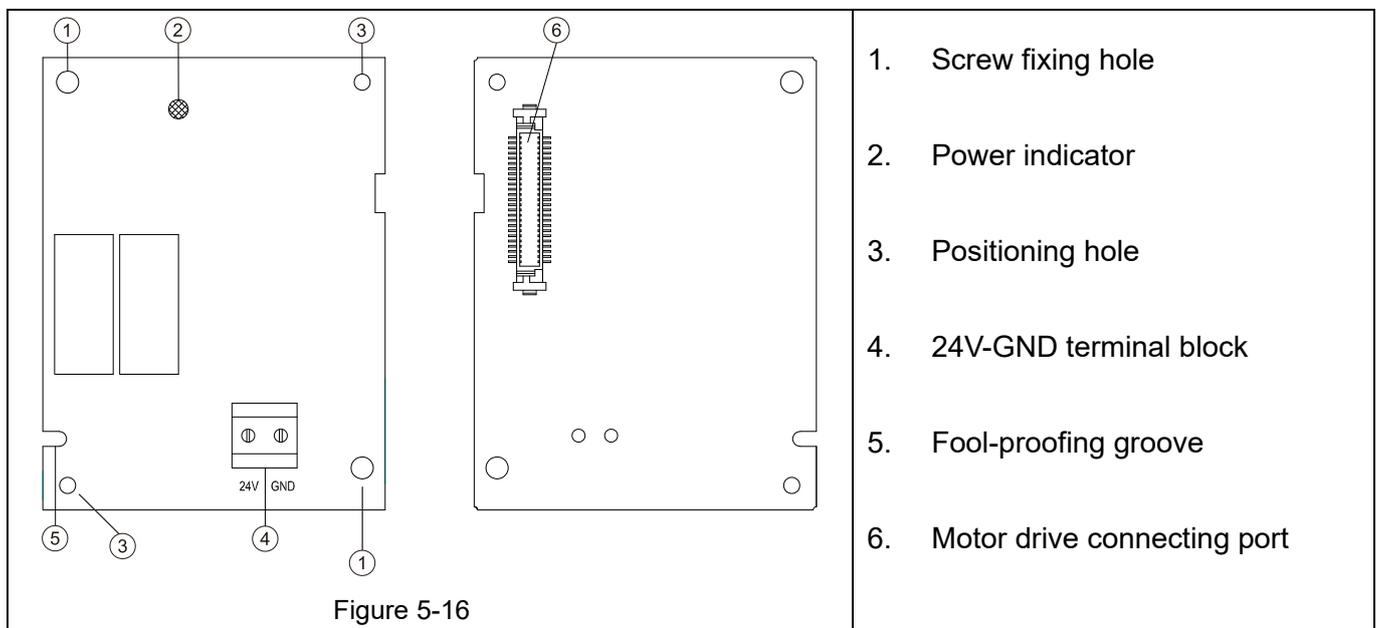
Twist to open the card clip to remove the PCB.

EMC-BPS01

	Terminals	Descriptions
External Power Supply Card	24 V GND	Input power: 24 V ± 5% Maximum input current: 0.5 A Note: 1. Do not connect any control circuit terminal on the Power Regenerative Unit to this +24 V power terminal. 2. Do not connect DCM terminal on the Power Regenerative Unit to the EMC-BPS01 input terminal GND to keep insulation effective.
		Functions: When the EMC-BPS01 is the only Power Regenerative Unit power supply, the communication works normally and the following functions are supported: Read / Write parameters Keypad display All keys except the RUN key can be operated Effective analog input  The following functions are not supported: 1. Relay output (RA1, RB1, RC1); 2. hot swapping

Table 5-24

- Once you install the EMC-BPS01, set Pr.03-05 =1 to enable this external power supply card.
- Multi-Input terminals (MI1– MI5) need an external power supply to function.



Function	Wire Size			Screw Size Tightening Torque (±10%)
	Conductor	Maximum Wire Gauge	Minimum Wire Gauge	
EMC-BPS01	Solid / Strand	0.5 mm <sup>2</sup> (20 AWG)	0.2 mm <sup>2</sup> (24 AWG)	5 kg-cm (4.4 lb-in.) (0.5 Nm)

Table 5-25

## 5-6 Fan Kit

- Appearance of Cooling Fans

### Frame A

Applicable models  
REG075A23A-21,  
REG075A43A-21,  
REG110A43A-21,  
REG150A43A-21

Cooling fan model 『RG-FK00AAN』

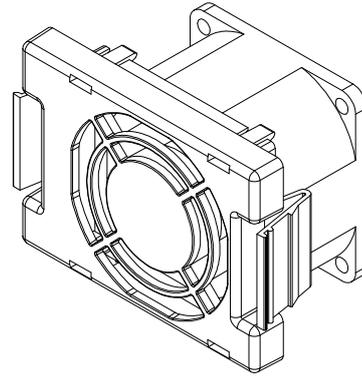


Figure 5-17

### Frame B

Applicable models  
REG150A23A-21,  
REG185A43A-21,  
REG220A23A-21,  
REG220A43A-21,  
REG300A43A-21

Cooling fan model 『RG-FK00BAN』

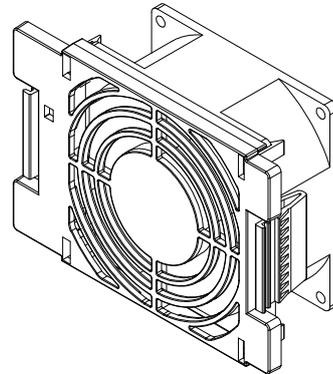


Figure 5-18

### Frame C

Applicable models  
REG370A23A-21,  
REG450A43A-21,  
REG550A43A-21

Capacitance cooling fan model 『MKC-CFKB1』

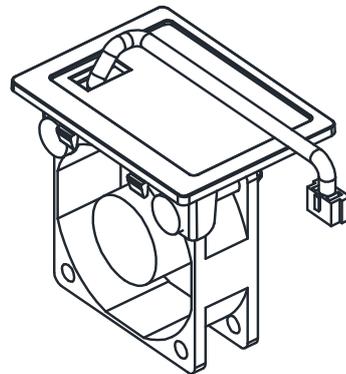


Figure 5-19

### Frame C

Applicable models  
REG370A23A-21,  
REG370A43A-21,  
REG450A43A-21,  
REG550A43A-21

Cooling fan model 『RG-FK00CAN』

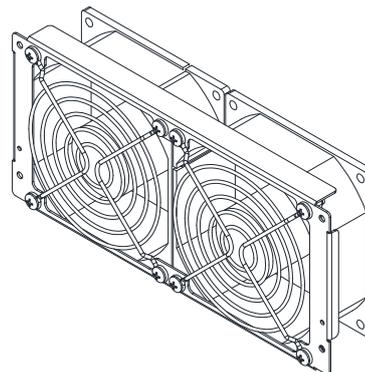


Figure 5-20

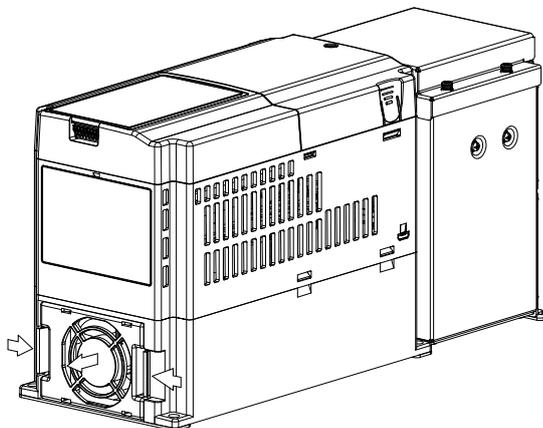
● Removing the Cooling Fan

Frame A

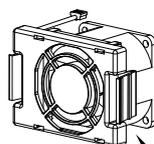
Cooling fan model: 『RG-FK00AAN』

Applicable models

REG075A23A-21, REG075A43A-21, REG110A43A-21, REG150A43A-21



Press the tab on the right and the left to remove the cover.



RG-FK00AAN

The connecting point of cooling fan's power line is on the left.

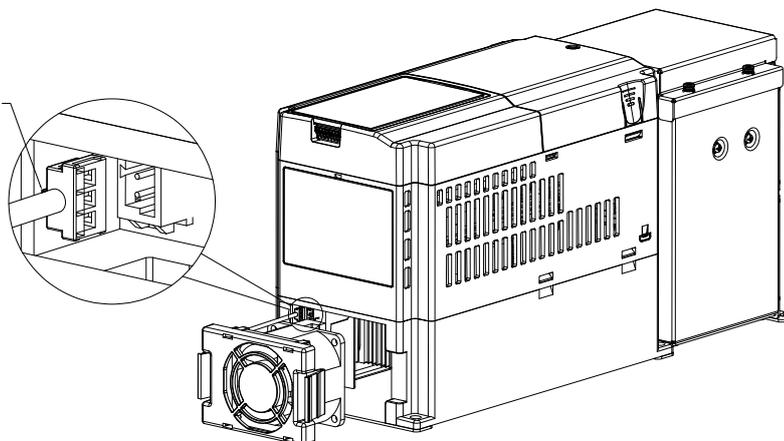


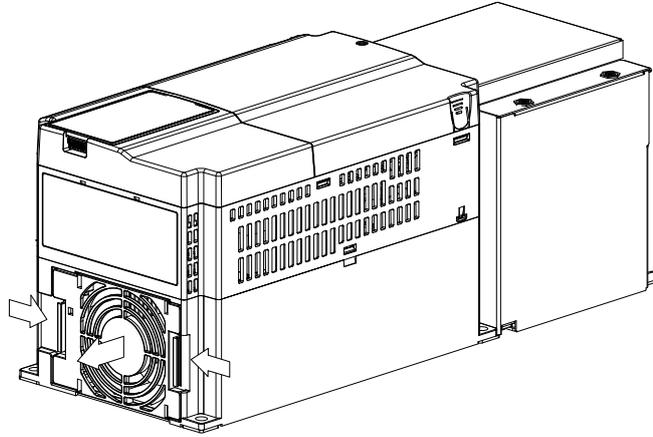
Figure 5-21

Frame B

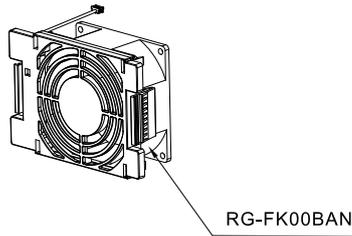
Cooling fan model: 『RG-FK00BAN』

Applicable models

REG150A23A-21, REG185A43A-21, REG220A23A-21, REG220A43A-21, REG300A43A-21



Press the tab on the right and the left to remove the cover.



Place downward the connecting terminal of the cooling fan's power line to connect the cooling fan to the Power Regenerative Unit.

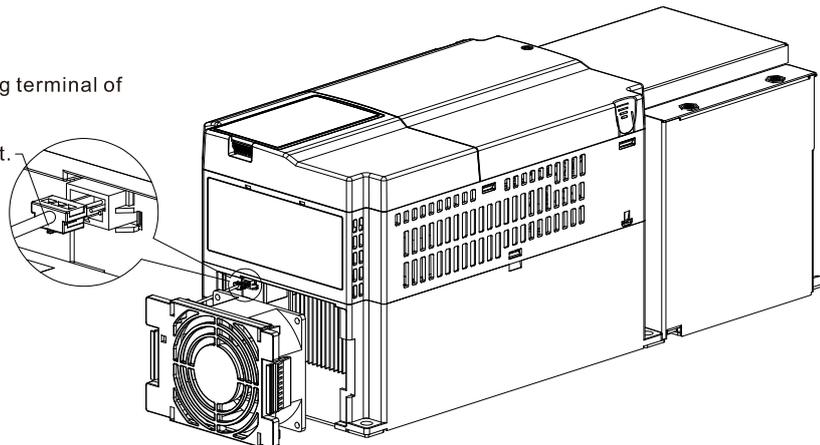


Figure 5-22

## Frame C

Capacitance cooling fan model: 『MKC-CFKB1』

## Applicable models

REG370A23A-21, REG450A43A-21, REG550A43A-21

Disconnect the cooling fan's power and pull out the cooling fan by using a flathead screwdriver.

As shown in the partially enlarged view, pay attention to the connecting point between the cooling fan's power line and the Power Regenerative Unit when installing / removing the cooling fan.

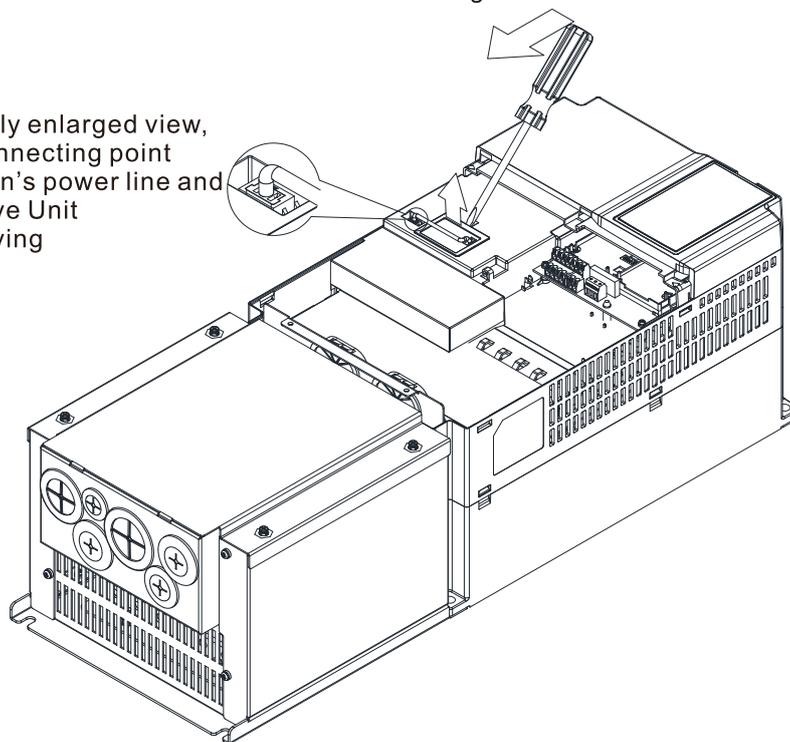


Figure 5-23

Frame C

Cooling fan model: 『RG-FK00CAN』

Applicable models

REG370A23A-21, REG370A43A-21, REG450A43A-21, REG550A43A-21

Disconnect the fan's power and take out the fan by using a slotted screwdriver, as shown in the partially enlarged view below.

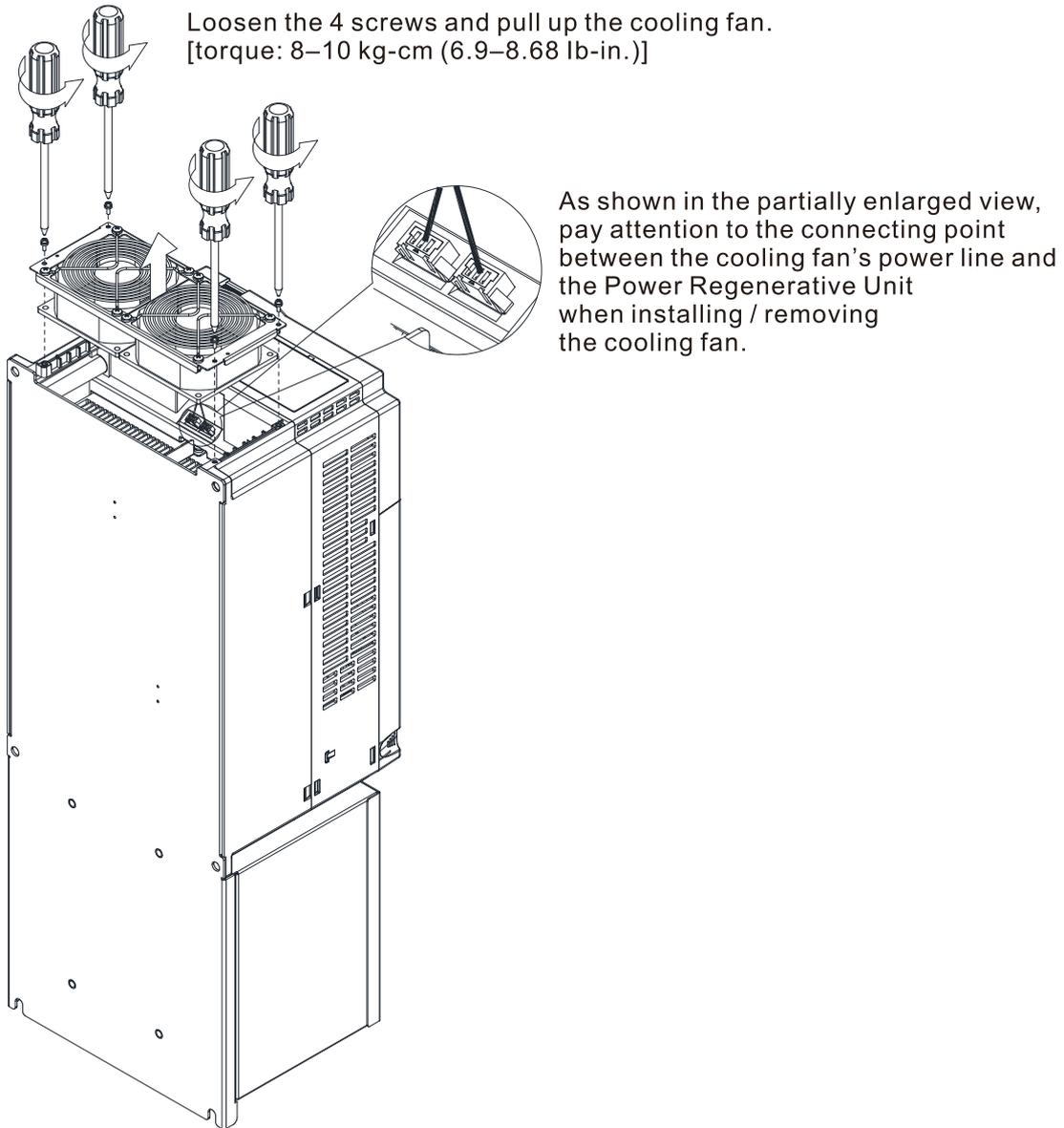


Figure 5-24

# Chapter 6 Summary of Parameter Settings

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- 00 Display Parameters
- 01 Basic Parameters
- 02 Digital Input / Output Parameters
- 03 Special Protection Parameters
- 04 Communication Parameters
- 05 Application Parameters

You can quickly look up the range and default for each parameter when you are setting parameter values. You can set, change, or reset parameter values using the digital keypad (optional) or through the communications.

**NOTE:**

1.  $\swarrow$  Means you can set the parameter during operation.
2. For complete parameter descriptions, refer to Chapter 7 Descriptions of Parameter Settings.
3. When a Power Regenerative Unit is at "STOP", which means it is not performing energy regeneration.

**00 Display Parameters**

Pr.	Parameter Name	Setting range	Default
00-00	Power Regenerative Unit Identity code	0: 230 V, 7.5 kW 1: 460 V, 7.5 kW 3: 460 V, 11 kW 4: 230 V, 15 kW 5: 460 V, 15 kW 7: 460 V, 18.5 kW 8: 230 V, 22 kW 9: 460 V, 22 kW 11: 460 V, 30 kW 12: 230 V, 37 kW 13: 460 V, 37 kW 15: 460 V, 45 kW 17: 460 V, 55 kW	Read-only
00-01	Power Regenerative Unit rated current display	0: 20 A 1: 10.5 A 3: 17 A 4: 38 A 5: 20 A 7: 25 A 8: 60 A 9: 32 A 11: 43 A 12: 100 A 13: 49 A 15: 60 A 17: 75 A	Read-only
00-02	Software version	Read-only (Display according to shipped version)	Read-only
00-03	Display Power Regenerative Unit input current (A <sub>Ac</sub> )	Read-only	Read-only
00-04	Display mains frequency (Hz)	Read-only	Read-only

Pr.	Parameter Name	Setting range	Default
00-05	Display DC BUS voltage (V <sub>DC</sub> )	Read-only	Read-only
00-06	Display power (kW)	-300.0–300.0	Read-only
00-07	Reserved		
00-08	Reserved		
00-09	Display the low word of the kilowatt hours (kWh) regenerated by REG2000	0.0–999.9	Read-only
00-10	Display the high word of the kilowatt hours (kWh) regenerated by REG2000	0–9999	Read-only
00-11	Display the highest internal ambient temperature (°C) (air outlet)	Read-only	Read-only
00-12	Display the highest power module's temperature (°C)	Read-only	Read-only
00-13	Display internal ambient temperature (°C) (air outlet)	Read-only	Read-only
00-14	Display power module's temperature (°C)	Read-only	Read-only
00-15	Display digital input ON / OFF status	Read-only	Read-only
00-16	Display digital output ON / OFF status	Read-only	Read-only
00-17	DC BUS voltage during a malfunction (V <sub>DC</sub> )	Read-only	Read-only
00-18	Mains frequency during a malfunction (Hz)	Read-only	Read-only
00-19	Current during a malfunction (A)	Read-only	Read-only
00-20	Fault record 1	0: no error record	0
00-21	Fault record 2	3: over-current during regeneration (ocn)	0
00-22	Fault record 3	6: over-current at stop (ocs)	0
00-23	Fault record 4	9: over-voltage during regeneration (ovn)	0
00-24	Fault record 5	10: over-voltage at stop (ovs)	0
00-25	Fault record 6	15: phase loss in output (OrP)	0
		16: power module overheated (oH1) 17: internal ambient temperature overheated (air outlet) (oH2)	

Pr.	Parameter Name	Setting range	Default
		18: power module overheated protection circuit error (tHo1) 19: internal ambient temperature overheated protection circuit error (tHo2) 21: overload (oL) 30: memory writing error (cF1) 31: memory read error (cF2) 37: current detection error when powering on (Hd1) 38: voltage detection error when powering on (Hd2) 42: 5 V control board error (firmware v.1.02 (included) and later) (5VF) 43: electric valve switch error (firmware v.1.02 (included) and later) (RYF) 49: external signal input fault (EF) 52: wrong password (Pcod) 54: communication error (cE1) 55: communication error (cE2) 56: communication error (cE3) 57: communication error (cE4) 58: communication time-out (cE10) 66: phase lock error (PLE)	
00-26	Low word in electricity bill	Read-only	Read-only
00-27	High word in electricity bill	Read-only	Read-only
00-28	Display input AC voltage (V <sub>AC</sub> )	Read-only	Read-only

## 01 Basic Parameters

Pr.	Parameter Name	Setting range	Default
01-00	Reset parameters	0: no function 1: parameter cannot be written 10: parameter reset	0
✎ 01-01	Select start-up display	0: mains frequency 1: DC BUS voltage ( $V_{DC}$ ) 2: Output current ( $A_{AC}$ )	0
✎ 01-02	Enter parameter protection password	1–9998, 10000–65535 0–2: number of incorrect passwords entered	0
✎ 01-03	Set parameter protection password	1–9998, 10000–65535 0: password not set or password entered successfully in Pr.01-02 1: parameters locked	0
✎ 01-04	Operation command source	1: controlled by external terminals 2: controlled through the communication interface or the digital keypad (KPC-CE01 / KPC-CC01)	1
01-05	Reserved		
01-06	Reserved		
01-07	Reserved		
01-08	DC BUS voltage activation level (offset value)	230V series: 30–100 V 460V series: 60–200 V	40 80
01-09	Reserved		
✎ 01-10	DC BUS voltage control P gain	0–1000%	100
✎ 01-11	DC BUS voltage control I gain	0–1000%	100
✎ 01-12	DC BUS voltage control bandwidth	1–100 Hz	40
01-13	Reserved		
✎ 01-14	Select multi-function display	0: display DC BUS voltage (v) 1: display mains frequency (H) 2: display output current (A) 3: display output AC voltage (E) 7: display power (P) 8: display current limit (p)	0

## 02 Digital Input / Output Parameters

Pr.	Parameter Name	Setting range	Default
02-00	Multi-function input command 1 (MI1)	0: No function	1
02-01	Multi-function input command 2 (MI2)	1: Automatic mode	0
02-02	Multi-function input command 3 (MI3)	2: Reserved	3
02-03	Multi-function input command 4 (MI4)	3: External Fault (EF)	4
02-04	Multi-function input command 5 (MI5)	4: RESET	5
		5: Parallel mode	
		6: No function	
✓ 02-05	Digital input response time	0.001–30.000 sec.	0.005
✓ 02-06	Digital input direction	0–65535	0
✓ 02-07	Multi-function output 1 (Relay1)	0: No function	4
✓ 02-08	Multi-function output 2 (MO1)	1: Regenerate indicator	3
✓ 02-09	Multi-function output 3 (MO2)	2: RUN indicator	0
		3: Ready indicator	
		4: Error indicator	
		5: No function	
		6: Warn indicator	
		7: No function	
✓ 02-10	Multi-function output direction	0–65535	0

### 03 Special Protection Parameters

Pr.	Parameter Name	Setting range	Default
✎ 03-00	Low voltage level	230V series: 160.0–220.0 V 460V series: 320.0–440.0 V	180.0 360.0
✎ 03-01	Current limit	0–150%	150
✎ 03-02	Reserved		
✎ 03-03	Reserved		
✎ 03-04	Phase lock frequency deviation time	0–1000 ms	150
✎ 03-05	External power supply card 24 V (EMC-BPS01) enabled	0: EMC-BPS01 disabled 1: EMC-BPS01 enabled	0
✎ 03-06	Reserved		
✎ 03-07	Number of times of auto-restart after fault	0–10	0
✎ 03-08	Auto-restart interval of fault	0.1–6000.0 sec.	60.0
✎ 03-09	Cooling fan control mode	0: fan runs always 1: runs for one minute after stop and then stops 2: runs and stops as the Power Regenerative Unit regenerates and stops 3: runs according to the power module's temperature 4: always off	3
03-10	Reserved		
03-11	Reserved		
✎ 03-12	Erase the energy regenerated record	0: parameter reset 1: erase	0
✎ 03-13	Electricity rate	0–6553.5 \$ / kWh	3.0

## 04 Communication Parameters

	Pr.	Parameter Name	Setting range	Default
↗	04-00	Communication address	1–254	1
↗	04-01	COM1 transmission speed	4.8–115.2 Kbps	9.6
↗	04-02	COM1 transmission fault treatment	0: Warn and continue operation 1: Warn and ramp to stop 2: Reserved 3: No action and no display	3
↗	04-03	COM1 time-out detection	0.0–100.0 sec.	0
↗	04-04	COM1 communication protocol	0: 7, N, 1 (ASCII) 1: 7, N, 2 (ASCII) 2: 7, E, 1 (ASCII) 3: 7, O, 1 (ASCII) 4: 7, E, 2 (ASCII) 5: 7, O, 2 (ASCII) 6: 8, N, 1 (ASCII) 7: 8, N, 2 (ASCII) 8: 8, E, 1 (ASCII) 9: 8, O, 1 (ASCII) 10: 8, E, 2 (ASCII) 11: 8, O, 2 (ASCII) 12: 8, N, 1 (RTU) 13: 8, N, 2 (RTU) 14: 8, E, 1 (RTU) 15: 8, O, 1 (RTU) 16: 8, E, 2 (RTU) 17: 8, O, 2 (RTU)	1
↗	04-05	Communication response delay time	0.0–200.0 ms	2.0
	04-06	Reserved		

## 05 Application Parameters

Pr.	Parameter Name	Setting range	Default
↗ 05-00	DC BUS voltage filter time	0.000–65.535 sec.	0.000
↗ 05-01	Mains frequency filter time	0.000–65.535 sec.	0.010
05-02 – 05-20	Reserved		

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# Chapter 7 Descriptions of Parameter Settings

---

00 Display Parameters

01 Basic Parameters

02 Digital Input / Output Parameters

03 Special Protection Parameters

04 Communication Parameters

05 Application Parameters

## 00 Display Parameters

✎ You can set this parameter during operation.

<b>00-00</b>	Power Regenerative Unit identity code
<b>00-01</b>	Power Regenerative Unit rated current display

Default: Read-only

Settings Read-only (Display by model)

📖 Pr.00-00 determines the capacity of the Power Regenerative Unit and is a default setting parameter. Also, the rated current for that model is in the read-only parameter Pr.00-01. Pr.00-00 corresponds to the current displayed in Pr.00-01.

REG2000 Identity Code													
Input voltage	230V				460V								
Model code	0	4	8	12	1	3	5	7	9	11	13	15	17
Power Regenerative Unit corresponding capacity (kW)	7.5	15	22	37	7.5	11	15	18.5	22	30	37	45	55
Rated input current (A)	20	38	60	100	10.5	17	20	25	32	43	49	60	75

<b>00-02</b>	Software version
--------------	------------------

Default: ###

Settings Read-only (Display according to shipped version)

<b>00-03</b>	Display Power Regenerative Unit input current (A <sub>AC</sub> )
<b>00-04</b>	Display mains frequency (Hz) (line frequency)

Default: ###

Settings Read-only

<b>00-05</b>	Display DC BUS voltage (V <sub>DC</sub> )
--------------	---

Default: ##

Settings Read-only

<b>00-06</b>	Display power (kW)
--------------	--------------------

Default: ##

Settings -300.0–300.0

<b>00-07</b>	Reserved
<b>00-08</b>	Reserved

**00-09** Display the low word of the kilowatt hours (kWh) regenerated by REG2000

Default: ###.#

Settings 0.0–999.9

**00-10** Display the high word of the kilowatt hours (kWh) regenerated by REG2000

Default: ####

Settings 0–9999

 When Pr.03-12 = 1, Pr.00-09 and Pr.00-10 are reset to 0 and Pr.03-12 returns to 0.

 After you set Pr.00-09 and Pr.00-10, the REG starts to run and the counting begins.

 It displays by Pr.00-10 \* 1000 + Pr.00-09.

**00-11** Display highest internal ambient temperature (°C) (air outlet)

**00-12** Display highest power module's temperature (°C)

Default: ###.#

Settings Read-only

**00-13** Display internal ambient temperature (°C) (air outlet)

**00-14** Display power module's temperature (°C)

Default: ###.#

Settings Read-only

**00-15** Display digital input ON / OFF status

**00-16** Display digital output ON / OFF status

Default: ###

Settings Read-only

**00-17** DC BUS voltage during a malfunction ( $V_{DC}$ )

Default: ###.#

Settings Read-only

**00-18** Mains frequency during a malfunction (Hz)

**00-19** Current during a malfunction (A)

Default: ###

Settings Read-only

**00-20** Fault record 1

**00-21** Fault record 2

**00-22** Fault record 3

**00-23** Fault record 4

**00-24** Fault record 5

**00-25** Fault record 6

Default: 0

Settings

- 0: no error record
- 3: over-current during regeneration (ocn)
- 6: over-current at stop (ocs)
- 9: over-voltage during regeneration (ovn)
- 10: over-voltage at stop (ovs)
- 15: phase loss in output (OrP)
- 16: power module overheated (oH1)
- 17: internal ambient temperature overheated (air outlet) (oH2)
- 18: power module overheated protection circuit error (tHo1)
- 19: internal ambient temperature overheated protection circuit error (tHo2)
- 21: overload (oL)
- 30: memory writing error (cF1)
- 31: memory read error (cF2)
- 37: current detection error when powering on (Hd1)
- 38: voltage detection error when powering on (Hd2)
- 42: 5 V control board error (firmware v.1.02 (included) and later) (5VF)
- 43: electric valve switch error (firmware v.1.02 (included) and later) (RYF)
- 49: external signal input fault (EF)
- 52: wrong password (Pcod)
- 54: communication error (cE1)
- 55: communication error (cE2)
- 56: communication error (cE3)
- 57: communication error (cE4)
- 58: communication time-out (cE10)
- 66: phase lock error (PLE)

 PLE and OrP errors are recorded as errors only in power regeneration status; otherwise, they are warnings in Ready and Run status.

 OH1 Level

Model	Default
REG075A23A	100
REG150A23A	100
REG220A23A	100
REG370A23A	105

Model	Default
REG075A43A	100
REG110A43A	105
REG150A43A	110
REG185A43A	100
REG220A43A	90
REG300A43A	90
REG370A43A	95
REG450A43A	115
REG550A43A	115

**00-26** Low word in electricity bill**00-27** High word in electricity bill

Default: ###

Settings Read-only

- 
-  When Pr.03-12 = 1, Pr.00-26 and Pr.00-27 are reset to 0 and Pr.03-12 returns to 0.
  -  Display the dollar amount saved on electricity expense. The settings of the related parameters are shown below.

The kW/hr regenerated (Pr.00-09–Pr.00-10) \* electricity expense (Pr.03-13).

It displays by Pr.00-27 \* 1000 + Pr.00-26.

**00-28** Display input AC voltage ( $V_{AC}$ )

Default: ##.#

Settings Read-only

## 01 Basic Parameters

✎ You can set this parameter during operation.

### 01-00 Reset parameters

Default: 0

Settings 0: no function  
1: parameter cannot be written  
10: parameter reset

- 📖 1: You can only adjust Pr.01-00–Pr.01-03, and the other parameters are read-only. In combination with the password parameters, this prevents the parameters from being altered by mistake.
- 📖 10: Restores the parameters to the defaults. If a password is set, you must enter it before restoring the parameter settings, and the password is cleared at the same time.

### 01-01 Select start-up display

Default: 0

Settings 0: mains frequency  
1: DC BUS voltage ( $V_{DC}$ )  
2: Output current ( $A_{AC}$ )

### 01-02 Enter parameter protection password

Default: 0

Settings 1–9998, 10000–65535  
Display value 0–2: number of incorrect passwords entered

- 📖 Enter the password set in Pr.01-03 into Pr.01-02 to unlock all the password protected parameters.
- 📖 After setting this parameter, write down the setting to avoid being locked out in the future.
- 📖 Using parameters Pr.01-02 and Pr.01-03 prevents non-technicians from accidentally altering other parameters.
- 📖 If you lose or forget the password, you can reset it by entering 9999 and pressing the "ENTER" key, enter 9999 and press "ENTER" again (this sequence must be completed within 10 seconds; otherwise, you have to do it again). This also restores all parameters back to the defaults.

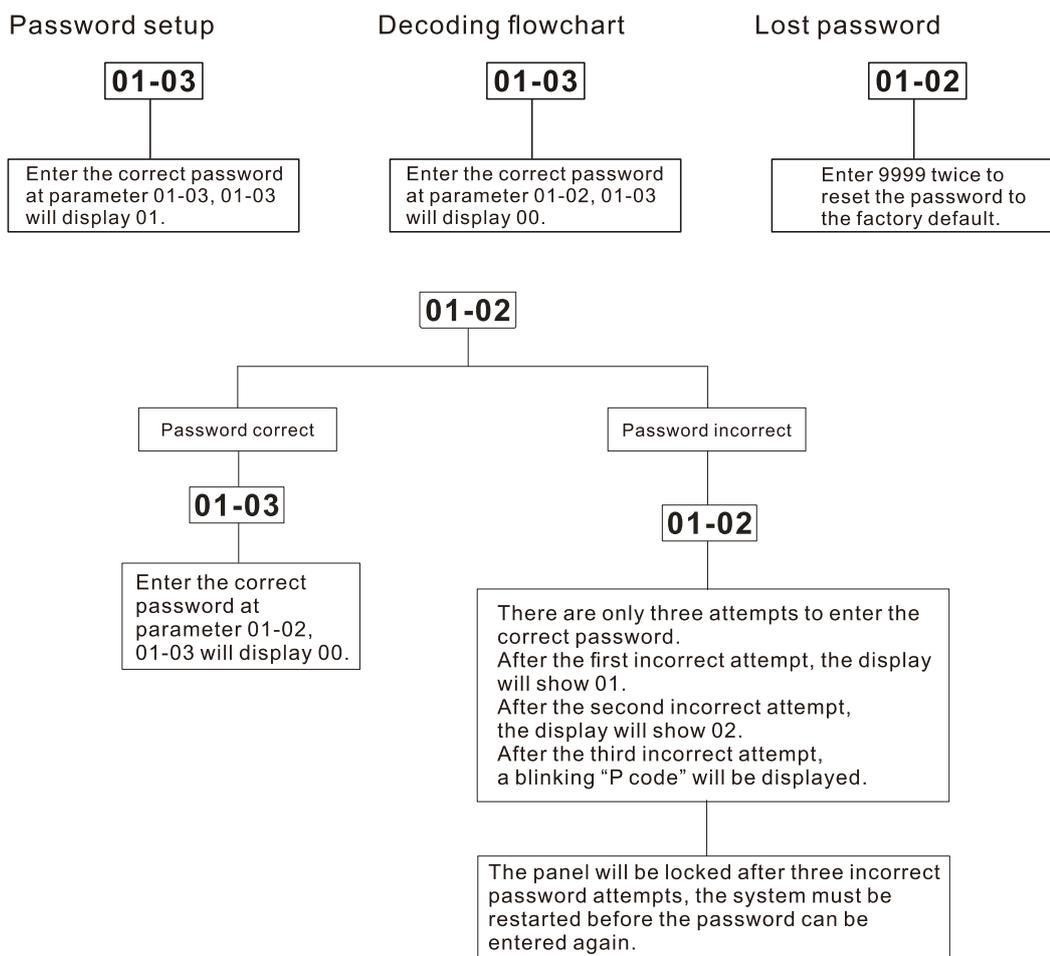
### 01-03 Set parameter protection password

Default: 0

Settings 1–9998, 10000–65535  
Display value 0: password not set or password entered successfully in Pr.01-02  
1: parameters locked

- 📖 This parameter sets the password protection, which you can enter directly the first time. After you set the password, this parameter value becomes 1, meaning that password protection is enabled. To make changes to any parameter, first enter the correct password in Pr.01-02. After you unlock the password protection, the Pr.01-02 is reset to 0, and you can set all parameters.
- 📖 After password protection is enabled, all parameter values except for Pr.01-03 display 0.

- 📖 You can disable password protection by unlocking the password protection in Pr.01-02 and setting this parameter to 0. Password protection remains off after a system reboot.
- 📖 Otherwise, the password remains permanently active. After you turn on the system, you must first unlock the password protection in Pr.01-02 before changing any parameters.
- 📖 To reactivate password protection:
  - Method 1: Reenter the password in Pr.01-03.
  - Method 2: Reboot the system to immediately restore the password protection.
  - Method 3: Enter any value other than the password in Pr.01-02.



**01-04** Operation command source

Default: 1

- Settings
- 1: controlled by external terminals
  - 2: controlled through the communication interface or the digital keypad (KPC-CE01 / KPC-CC01)

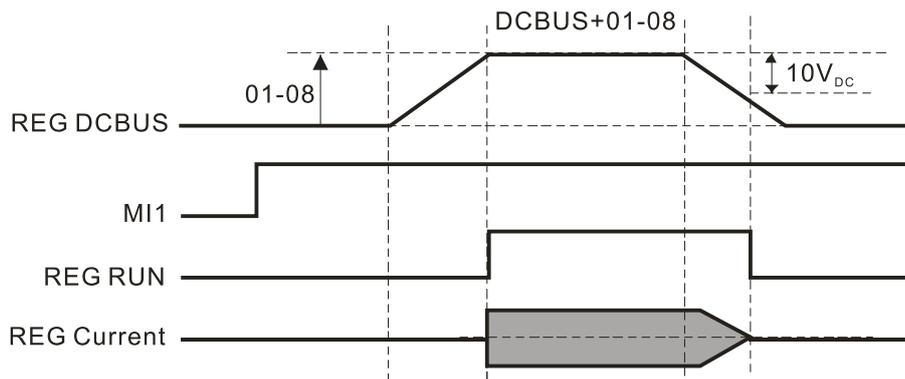
- 📖 The standard REG package does not contain the digital keypad and you must control operation with external terminals. Confirm that the wiring between multi-function input terminals is correct before using.
- 📖 To operate using the communication interface, you must purchase a digital keypad KPC-CC01 or KPC-CE01 before you can set the operation command source to the communication interface.

<b>01-05</b>	Reserved
<b>01-06</b>	Reserved
<b>01-07</b>	Reserved

**01-08** DC BUS voltage activation level (offset value)

Settings	230V series: 30–100 V	Default: 40
	460V series: 60–200 V	Default: 80

- 📖 The regenerative activating voltage is set to the mains AC voltage (Pr.00-28) \*  $\sqrt{2}$  + Pr.01-08.
- 📖 The Power Regenerative Unit stops output when (1) DC BUS voltage < (DC BUS voltage + Pr.01-08 - 10 V) and (2) the Power Regenerative Unit output current ( $A_{AC}$ ) is 10% lower than the rated output for more than one second.
- 📖 There is an absolute upper limit and an absolute lower limit in the DC BUS voltage activation level. For example, the absolute upper limit of the DC BUS voltage activation level for 440V models is 780 V. That means even when the input voltage is 528 V<sub>AC</sub> and the Pr.01-08 = 200 V, the DC BUS voltage activation level should be 528 \* 1.414 + 200 = 947 V<sub>DC</sub>. However, the design of the Power Regenerative Unit forces the trigger upper limit to stay under 780 V<sub>DC</sub>.



**01-09** Reserved

↗	<b>01-10</b>	DC BUS voltage control P gain
↗	<b>01-11</b>	DC BUS voltage control I gain

Default: 100

Settings	0–1000%
----------	---------

- 📖 Pr.01-10 is the parameter that decides the P function response speed on the DC BUS voltage bias. With higher gain, the response is faster while the DC BUS voltage bias becomes smaller. If the gain is too high, there will be an oscillation. With lower gain, the response is slower while the DC BUS voltage bias becomes larger. It is scaled to correspond 100% to the Kp value of auto-calculated DC BUS voltage control bandwidth (Pr.01-12).
- 📖 Pr.01-11 is an integral controller to eliminate the steady-state error caused by the DC BUS voltage bias. The higher the integral gain, the faster the response to the external disturbance, and the oscillation easily occurs. But the lower the integral gain, the slower the response to the external disturbance. It is scaled to correspond 100% to the Ki value of auto-calculated DC BUS voltage control bandwidth (Pr.01-12).

**01-12** DC BUS voltage control bandwidth

Default: 40

Settings 1–100 Hz

 Controls the DC BUS voltage response speed. The higher the value, the faster the response.

**01-13** Reserved**01-14** Select multi-function display

Default: 0

Settings

- 0: display DC BUS voltage (v)
- 1: display mains frequency (H)
- 2: display output current (A)
- 3: display output AC voltage (E)
- 4: reserved
- 5: reserved
- 6: reserved
- 7: display power (P)
- 8: display current limit (p)

---

## 02 Digital Input / Output Parameters

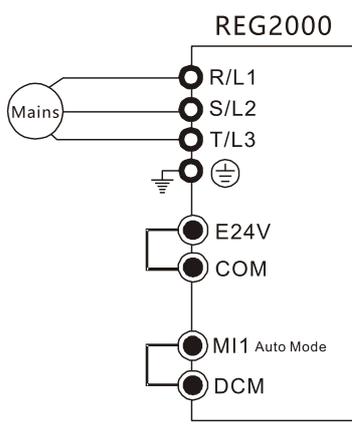
↗ You can set this parameter during operation.

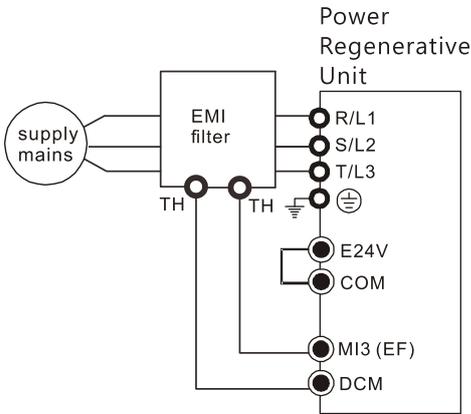
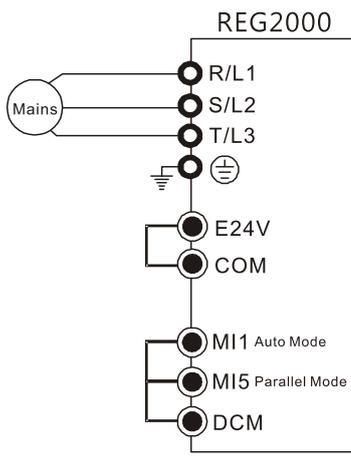
↗	<b>02-00</b>	Multi-function input command 1 (MI1)	Default: 1
↗	<b>02-01</b>	Multi-function input command 2 (MI2)	Default: 0
↗	<b>02-02</b>	Multi-function input command 3 (MI3)	Default: 3
↗	<b>02-03</b>	Multi-function input command 4 (MI4)	Default: 4
↗	<b>02-04</b>	Multi-function input command 5 (MI5)	Default: 5

Settings Refer to the following summary of function settings

📖 Includes the necessary external terminal input functions as required.

The following table lists the multi-function input terminal functions.

Setting	Function	Description
0	No function	The input terminal does not have any function.
1	Automatic mode (the default terminal is MI1)	<p>This terminal setting is effective only when you set Pr.01-04 to 1 "controlled by external terminals".</p> <p>When the automatic mode is ON and the Power Regenerative Unit detects that DC BUS voltage reaches the setting in Pr.01-08, the DC BUS voltage automatically regenerates to the electrical grid.</p> <p>The following diagram shows the default wiring between the multi-function input terminals for each Power Regenerative Unit. Verify that the wiring is correct before using. Refer to Chapter 4 Wiring for more details about automatic mode.</p> 
2	Reserved	The input terminal function is reserved.

Setting	Function	Description
3	External Fault (EF)	<p>While installing an EMI filter, connect one TH terminal to MI3 and another TH terminal (both TH terminals have the same polarity) to DCM to do temperature protection detection. The wiring method is as shown in the image below. See Chapter 4 for more information on wiring.</p> 
4	RESET	<p>You can reset the Power Regenerative Unit after clearing the fault only with this terminal function.</p>
5	Parallel mode (the default terminal is MI5)	<p>This terminal setting is effective only when you set Pr.01-04 to 1 "controlled by external terminals."</p> <p>Before setting to parallel mode, select Automatic as the control mode.</p> <p>When working in parallel mode, each Power Regenerative Unit automatically reduces its current limit to 80%.</p> <p>The following diagram shows the default wiring between the multi-function input terminals for each Power Regenerative Unit. Verify that the wiring is correct before using. Refer to Chapter 4 Wiring for more details about parallel mode.</p> 
6	No function	<p>The input terminal does not have any function.</p>

**02-05 Digital input response time**

Default: 0.005

Settings 0.001–30.000 sec.

📖 Adds a delay and confirms process to digital input terminal signals. The delay time is the confirmation time. This prevents unknown interference from causing the digital input terminals (MI1–5) to malfunction (except counting inputs). This parameter significantly improves these situations, but response time is slightly delayed.

**02-06 Digital Input direction**

Default: 0

Settings 0–65535

📖 Sets the activation level for input signals, and has no relation to the terminal's SINK / SOURCE status.

📖 bits 0–4 correspond to MI1–MI5, respectively.

📖 Enter corresponding values through communications to alter the ON / OFF status of the terminals.

**02-07 Multi-function output 1 (Relay 1)**

Default: 4

**02-08 Multi-function output 2 (MO1)**

Default: 3

**02-09 Multi-function output 3 (MO2)**

Default: 0

Settings Refer to the following summary of function settings

📖 Includes the necessary external terminal output functions as required.

The following table lists the multi-function output terminal functions.

Setting	Function	Description
0	No function	The output terminal does not have any function.
1	Regenerate indicator	When the Power Regenerative Unit is in Regenerate status, the contacts are in ON status.
2	Run indicator	After powering on and sending the RUN command, the Power Regenerative Unit is in normal operation (including standby and regenerate) and the contacts are in ON status.
3	Ready indicator	The contacts are ON when there are no Power Regenerative Unit errors or warnings. (When the phase lock is completed, you can now send the RUN command.)
4	Error indicator	The contacts are ON when the Power Regenerative Unit detects an error.
5	No function	The output terminal does not have any function
6	Warn indicator	The contacts are ON when the Power Regenerative Unit detects a warning.
7	No function	The output terminal does not have any function

📖 See Figure 4-30 in Section 4-4 for more information on the definition of different working status of power regeneration.

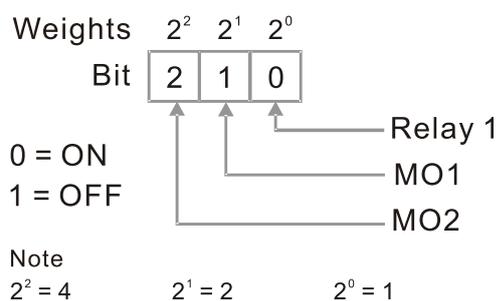
## 02-10 Multi-function output direction

Default: 0

Settings 0–65535

The setting of this function is binary. If you set a bit to 1, the multi-function output direction is reversed. For example, when you set Pr.02-07 to 1 (Regenerate indicator), if the output direction is forward or you set the bit to 0, Relay 1 activates (ON) only when the Power Regenerative Unit regenerates. When the Power Regenerative Unit is stopped, Relay 1 is OFF. In contrast, if the output direction is reverse and you set the bit to 1, Relay 1 is OFF when the Power Regenerative Unit regenerates, and ON when it stops.

Bit2	Bit1	Bit0
MO2	MO1	RY1



### 03 Special Protection Parameters

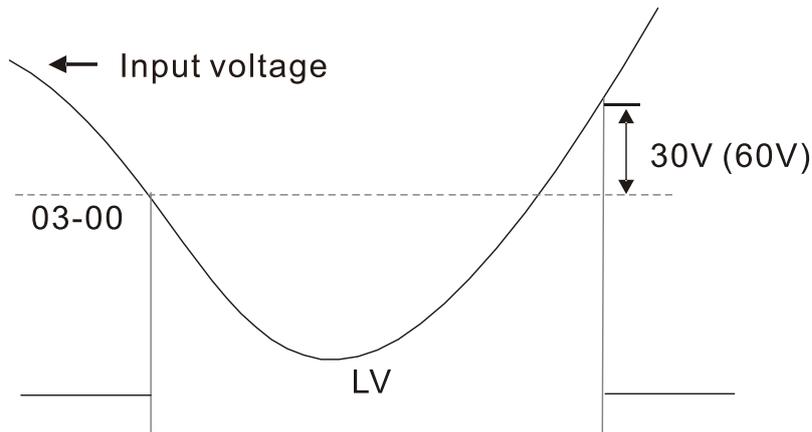
↗ You can set this parameter during operation.

↗ **03-00** Low voltage level

Default: 180.0 / 360.0

Settings 230V series: 160.0–220.0 V  
460V series: 320.0–440.0 V

- 📖 This parameter sets the LV voltage level.
- 📖 When the Power Regenerative Unit voltage drops below the parameter low voltage level, the system sends a warning.



↗ **03-01** Current limit

Default: 150

Settings 0–150%

- 📖 Limits the Power Regenerative Unit maximum current output.

**03-02** Reserved

**03-03** Reserved

↗ **03-04** Phase lock frequency deviation time

Default: 150

Settings 0–1000 ms

- 📖 When a frequency is detected to be outside of 47–63 Hz and the duration is longer than the value set in this parameter, the system generates a PLE phase lock signal.

↗ **03-05** External power supply card 24 V (EMC-BPS01) enabled

Default: 0

Settings 0: EMC-BPS01 disabled  
1: EMC-BPS01 enabled

- 📖 When using EMC-BPS01 as the external power supply for the Power Regenerative Unit, enable EMC-BPS01 through communications or digital keypad to prevent RyF error. (Only REG2000 manufactured after March 2018 supports this function.)

**03-06** Reserved**03-07** Number of times of auto-restart after fault

Default: 0

Settings 0–10

-  Sets the number of times the Power Regenerative Unit can automatically reset / restart after a fault (acceptable errors: only over-current during regeneration and at stop, over-voltage during regeneration and at stop, phase lock) at a maximum of ten times. If you set this parameter to 0, then the system does not automatically reset / restart after a fault.

**03-08** Auto-restart interval of fault

Default: 60.0

Settings 0.1–6000.0 sec.

-  When a restart after fault occurs, the Power Regenerative Unit starts a count-down according to this parameter. Within the Pr.03-08 setting time, the Power Regenerative Unit stops only when the count-down reaches the number of times set in Pr.03-07 (and the faults are recorded). If the count-down does not reach the number of times set in Pr.03-07 within Pr.03-08 setting time, the unit resets Pr.03-07 to the initial value before starting another counting.

**03-09** Cooling fan control mode

Default: 3

Settings 0: fan runs always

1: runs for one minute after stop and then stops

2: runs and stops as the Power Regenerative Unit regenerates and stops

3: runs according to the power module's temperature

4: always off

-  Determines the cooling fan mode setting.
-  0: The cooling fan starts running as soon as the Power Regenerative Unit starts transmitting power.
-  1: The cooling fan runs when the Power Regenerative Unit runs and stops one minute after the Power Regenerative Unit stops.
-  2: The cooling fan runs when the Power Regenerative Unit runs and stops as soon as the Power Regenerative Unit stops.
-  3: The cooling fan adjusts its speed according to the power module's temperature. When the temperature is high, the cooling fan starts running; the higher the temperature the faster the fan runs. When temperature drops into the normal range, as shown in the following table, the cooling fan stops.
-  4: The cooling fan is always off.

Model	Operating temperature range of fans (RUN→STOP)
REG075A23A	50→40
REG150A23A	50→40
REG220A23A	50→40
REG370A23A	65→55

Model	Operating temperature range of fans (RUN→STOP)
REG075A43A	50→40
REG110A43A	55→45
REG150A43A	60→50
REG185A43A	50→40
REG220A43A	40→30
REG300A43A	40→30
REG370A43A	45→35
REG450A43A	65→55
REG550A43A	65→55

- 03-10** Reserved
- 03-11** Reserved

**03-12** Erase the energy regenerated record

Default: 0

Settings 0: parameter reset  
1: erase

 Setting this parameter to 1 clears Pr.00-09 and Pr.00-10 to 0, and the system resets this parameter to 0.

**03-13** Electricity rate

Default: 3.0

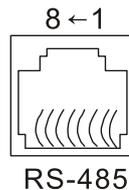
Settings 0–6553.5 \$ / kWh

 Sets the calculation for the local electricity bill. Unit: \$ / kWh.

## 04 Communication Parameters

When using the communication interface, the diagram on the right shows the communication port pin definitions. We recommend that you connect the Power Regenerative Unit to your PC by using Delta IFD6530 or IFD6500 as a communication converter.

⚡ You can set this parameter during operation.



Modbus RS-485  
 Pin 1, 2, 7, 8: Reserved  
 Pin 3, 6: GND  
 Pin 4: SG-  
 Pin 5: SG+

### ⚡ 04-00 Communication address

Default: 1

Settings 1–254

📖 When the system uses the RS-485 serial communication interface for control or monitoring, every Power Regenerative Unit must have its own communication address and every address in the network must be unique.

### ⚡ 04-01 COM1 transmission speed

Default: 9.6

Settings 4.8–115.2 Kbps

📖 Sets the transmission speed between the Power Regenerative Unit and computers.

### ⚡ 04-02 COM1 transmission fault treatment

Default: 3

Settings 0: Warn and continue operation  
 1: Warn and ramp to stop  
 2: Reserved  
 3: No actions and no display

📖 Specifies how the Power Regenerative Unit handles a transmission time-out error (such as a broken line) during communications.

### ⚡ 04-03 COM1 time-out detection

Default: 0.0

Settings 0.0–100.0 sec.  
 0.0: No detection

📖 Sets the duration for a transmission time-out between communication ports and COM1.

### ⚡ 04-04 COM1 communication protocol

Default: 1

Settings 0: 7, N, 1 for ASCII  
 1: 7, N, 2 for ASCII  
 2: 7, E, 1 for ASCII  
 3: 7, O, 1 for ASCII

- 4: 7, E, 2 for ASCII
- 5: 7, O, 2 for ASCII
- 6: 8, N, 1 for ASCII
- 7: 8, N, 2 for ASCII
- 8: 8, E, 1 for ASCII
- 9: 8, O, 1 for ASCII
- 10: 8, E, 2 for ASCII
- 11: 8, O, 2 for ASCII
- 12: 8, N, 1 for RTU
- 13: 8, N, 2 for RTU
- 14: 8, E, 1 for RTU
- 15: 8, O, 1 for RTU
- 16: 8, E, 2 for RTU
- 17: 8, O, 2 for RTU

 Control by PC (Computer Link)

When using the RS-485 serial communication interface, you must first specify a communication address to every Power Regenerative Unit in Pr.04-00. The computer then controls the units based on their individual addresses.

 Modbus ASCII (American Standard Code for Information Interchange): Each byte of data is the combination of two ASCII characters. For example, one byte of data: 64 Hex, shown as '64' in ASCII, consists of '6' (36Hex) and '4' (34Hex).

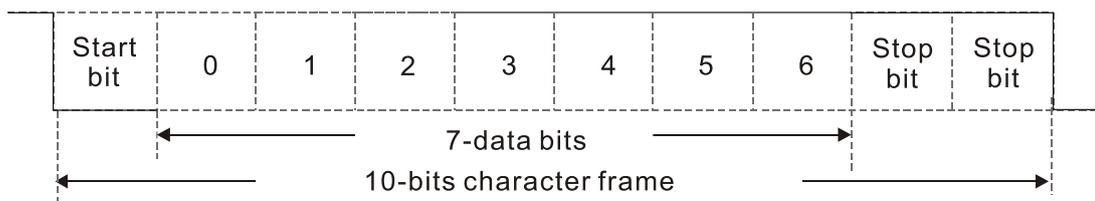
**1. Code Description**

The communication protocol is in hexadecimal, ASCII: "0" ... "9", "A" ... "F", every hexadecimal value represents an ASCII code. The following table shows some examples.

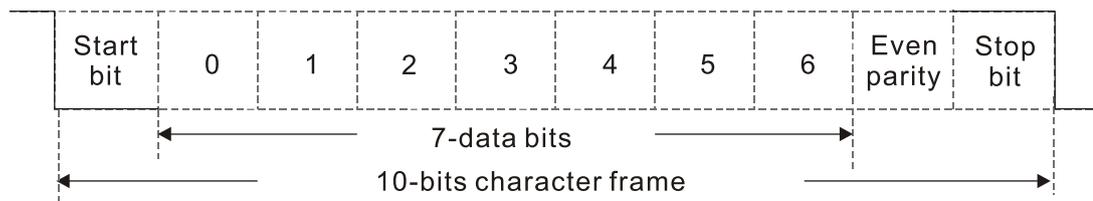
Character	'0'	'1'	'2'	'3'	'4'	'5'	'6'	'7'
ASCII code	30H	31H	32H	33H	34H	35H	36H	37H
Character	'8'	'9'	'A'	'B'	'C'	'D'	'E'	'F'
ASCII code	38H	39H	41H	42H	43H	44H	45H	46H

**2. Character structure**

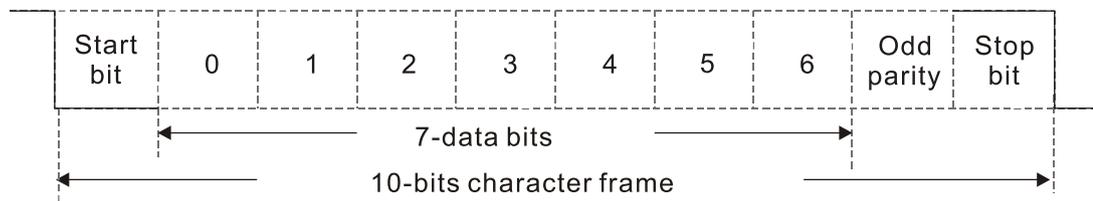
- (1) 10-bit character frame (for ASCII)  
(Data format 7, N, 2)



(Data format 7, E, 1)

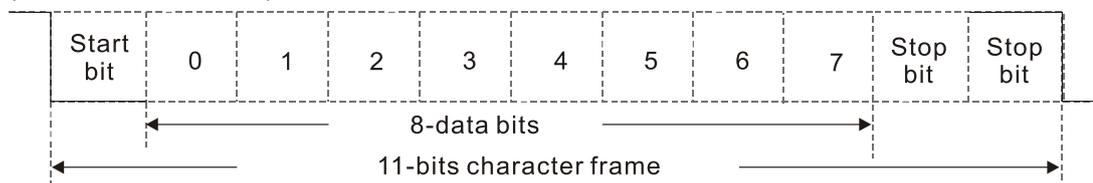


(Data format 7, O, 1)

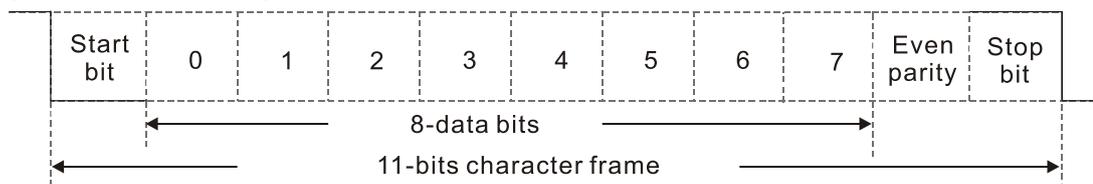


(2) 11-bit character frame (For RTU)

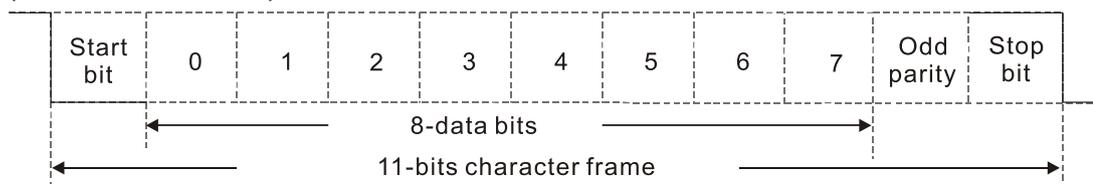
(Data format 8, N, 2)



(Data format 8, E, 1)



(Data format 8, O, 1)



### 3. Communication data structure

(1) Data format frame

ASCII mode:

STX	Start character = ':' (3AH)
Address Hi	Communication address: one 8-bit address consists of 2 ASCII codes
Address Lo	
Function Hi	Function code: one 8-bit function code consists of 2 ASCII codes
Function Lo	
DATA (n-1)	Contents of data: N x 8-bit data consists of 2n ASCII codes N ≤ 16, maximum of 32 ASCII codes (20 sets of data)
.....	
DATA 0	
LRC CHK Hi	LRC checksum: one 8-bit checksum consists of 2 ASCII codes
LRC CHK Lo	
END Hi	End characters: END Hi = CR (0DH), END Lo = LF(0AH)
END Lo	

RTU mode:

START	Maintains no input signal for at least 10 ms
Address	Communication address: 8-bit binary address
Function	Function code: 8-bit binary address
DATA (n-1)	Contents of data: N × 8-bit data, N ≤ 16
..... DATA 0	
CRC CHK Low	CRC checksum: one 16-bit CRC checksum consists of two 8-bit binary codes
CRC CHK High	
END	Maintains no input signal for at least 10 ms

(2) Communication address (Address)

00H: broadcasts to all Power Regenerative Units

01H: targets the Power Regenerative Unit at address 01

0FH: targets the Power Regenerative Unit at address 15

10H: targets the Power Regenerative Unit at address 16... to the maximum of 254 (FEH)

Function code and data characters

03H: reads data from the register

06H: writes one set of data to the register

For example, reading two continuous data from register address 2102H. The Power Regenerative Unit address is 01H.

ASCII mode:

Inquiry message string format		Response message string format	
STX	':'	STX	':'
Address	'0'	Address	'0'
	'1'		'1'
Function	'0'	Function	'0'
	'3'		'3'
Starting address	'2'	Number of data (count by byte)	'0'
	'1'		'4'
	'0'	Content of starting address 2102H	'1'
	'2'		'7'
Number of data (count by word)	'0'	Content of address 2103H	'7'
	'0'		'0'
	'0'		'0'
	'2'		'0'
LRC Check	'D'	LRC Check	'0'
	'7'		'0'
END	CR	END	'7'
	LF		'1'
			CR
			LF

RTU mode:

Inquiry message string format		Response message string format	
Address	01H	Address	01H
Function	03H	Function	03H
Starting data address	21H	Number of data (count by byte)	04H
	02H		Content of data address 2102H
Number of data (count by word)	00H	17H	
	02H	70H	
CRC CHK Low	6FH	Content of data address 2103H	00H
CRC CHK High	F7H	00H	
		CRC CHK Low	FEH
		CRC CHK High	5CH

- (3) 06H: single write, write single data to a register.

(The system can write up to 20 sets of data simultaneously.)

For example, writing data 6000 (1770H) to register 0100H. The Power Regenerative Unit address is 01H.

ASCII mode:

Inquiry message string format		Response message string format	
STX	‘:’	STX	‘:’
Address	‘0’	Address	‘0’
	‘1’		‘1’
Function	‘0’	Function	‘0’
	‘6’		‘6’
Data address	‘0’	Data address	‘0’
	‘1’		‘1’
	‘0’		‘0’
	‘0’		‘0’
Data content	‘1’	Data content	‘1’
	‘7’		‘7’
	‘7’		‘7’
	‘0’		‘0’
LRC Check	‘7’	LRC Check	‘7’
	‘1’		‘1’
END	CR	END	CR
	LF		LF

RTU mode:

Inquiry message string format		Response message string format	
Address	01H	Address	01H
Function	06H	Function	06H
Data address	01H	Data address	01H
	00H		00H
Data content	17H	Data content	17H
	70H		70H
CRC CHK Low	86H	CRC CHK Low	86H
CRC CHK High	22H	CRC CHK High	22H

- (4) 10H: write multiple registers (write multiple data to registers). Checksum in ASCII mode (LRC Check)
- (5) Checksum (LRC Check) is the sum from Address to Data Content. For example, the checksum of the inquiry message above: 01H + 03H + 21H + 02H + 00H + 02H = 29H, and then take the 2's complement = D7H.

Checksum in RTU mode (CRC Check)

Checksum starts from Address and ends at Data content. The calculation is shown below.

Step 1: Set the 16-bit register (CRC register) = FFFFH.

Step 2: Exclusive OR the first 8-bit byte message and the low bit 16-bit CRC register, create Exclusive OR, and store the results in CRC register.

Step 3: Shift one CRC register to the right, and fill in 0 high bit position.

Step 4: Check the shifted value. If it is 0, store the new value from Step 3 in the CRC register; otherwise, Exclusive OR A001H and the CRC register store the results in the CRC register.

Step 5: Repeat Steps 3–4, until all eight bits are complete.

Step 6: Repeat Step 2–5, and take the message command from the next 8-bit byte until all message commands are computed. Finally, the acquired value in the CRC register is the CRC checksum. Note that the CRC checksum must alternate places within the message command checksum.

(6) The following is an example of computing the CRC checksum using C language.

```

unsigned char* data    ← // message command index
unsigned char length  ← // length of message command
unsigned int crc_chk(unsigned char* data, unsigned char length)
{
    int j;
    unsigned int reg_crc=0Xffff;
    while(length--){
        reg_crc ^= *data++;
        for(j=0;j<8;j++){
            if(reg_crc & 0x01){ /* LSB(b0)=1 */
                reg_crc=(reg_crc>>1) ^ 0Xa001;
            }else{
                reg_crc=reg_crc >>1;
            }
        }
    }
}
return reg_crc; // final value returned to CRC register
    
```

**4. Definition of parameter addresses in the communication protocol**

Definition of REG2000 parameters	Parameter address (GGnnH)	Function Description (GG stands for the parameter group and nn stands for the parameter number. For example: Pr.04-01 is shown as 0401H.)		Read / Write
Command / Write only	2000H	bit1–0	00: No function (operation command remains unchanged)	W
			01: Stop	W
			10: Start	W
	bit15–3	No function	N/A	
	2001H	No function		N/A

Definition of REG2000 parameters	Parameter address (GGnnH)	Function Description (GG stands for the parameter group and nn stands for the parameter number. For example: Pr.04-01 is shown as 0401H.)		Read / Write
	2002H	bit0	1: Enable the external fault (E.F.)	W
		bit1	2: Reset Command	W
		bit5–2	No function	N/A
Status monitor / Read-only	2100H	bit7–0	High Byte: Error Code	R
		bit15–8	Low Byte: Warning Code	R
	2110H	bit7–0	Identity code of the Power Regenerative Unit (same as Pr.00-00)	R
		bit15–8	Product model ID (REG2000 code: 14)	R
	2112H	bit15–0	Firmware version (high word, SX.XX) S: 0–9, Defined by Delta X.XX: 0.00–9.99, REG firmware version #	R
	2119H	bit1–0	00: Ready	R
			01: Run	
			10: Prepare	
			11: Regenerate	
	2119H	bit9–2	Reserved	N/A
		bit10	REG operation command source 1: Operation commands come from the external terminals 2: Control commands come from the communication interface or the digital keypad (KPC-CC01).	R
bit11		Unlock or lock the parameters 0: Unlock the parameters 1: Lock the parameters	R	
Status monitor / Read-only	2102H	bit15–0	Mains electricity frequency (Hz)	R
	2116H	bit15–0	Select multi-function display (Pr.01-14)	R
	2200H	bit15–0	Output current (A <sub>AC</sub> )	R
	2203H	bit15–0	DC BUS voltage (V <sub>DC</sub> )	R
	2204H	bit15–0	Output voltage (V <sub>AC</sub> )	R
	2206H	bit15–0	Output power (kW)	R
	220EH	bit15–0	Internal temperature (air outlet) (°C)	R
	220FH	bit15–0	Power module's temperature (°C)	R
	2210H	bit15–0	Digital input ON / OFF status, see Pr.02-06	R
	2211H	bit15–0	Digital output ON / OFF status, see Pr.02-10	R
	2222H	bit15–0	Cooling fan rotation speed (%)	R
	2229H	bit15–0	Display REG2000 regenerated kWh in low word.	R
	222AH	bit15–0	Display REG2000 regenerated kWh in high word.	R
	2237H	bit15–0	Display current upper limit (p)	R

### 5. Additional response in communication errors

If an error occurs when the Power Regenerative Unit is making communication connections, the Power Regenerative Unit sends an error code to the main control system and sets the highest bit (bit7) to 1 (that is, Function code AND 80H) to make the main control system aware of the error. The Power Regenerative Unit keypad displays a warning message CE-XX, where XX is the error code. Refer to the error code definitions in communication errors in the table below.

For example:

ASCII mode		RTU mode	
STX	‘.’	Address	01H
Address	‘0’	Function	86H
	‘1’	Exception code	02H
Function	‘8’	CRC CHK Low	C3H
	‘6’	CRC CHK High	A1H
Exception code	‘0’		
	‘2’		
LRC CHK	‘7’		
	‘7’		
END	CR		
	LF		

#### Error code definitions

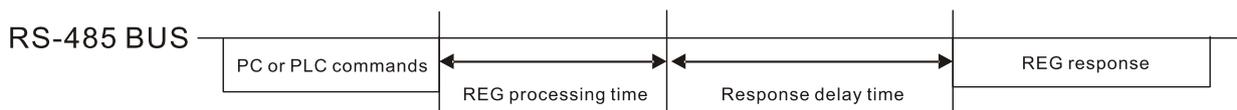
Error code	Description
1	Data character value error: the value is too large and is not recognized by the Power Regenerative Unit.
2	Parameter address error: parameter address is not recognized by the Power Regenerative Unit.
3	Password locked: cannot edit the parameters
4	Parameters cannot be edited in operation
10	Transmission time-out

### ⚡ 04-05 Communication response delay time

Default: 2.0

Settings 0.0–200.0 ms

📖 Sets the delay for the Power Regenerative Unit response time in situations where the host machine has not completed the transition (transmission–reception).



### 04-06 Reserved

## 05 Application Parameters

⚡ You can set this parameter during operation.

### ⚡ **05-00** DC BUS voltage filter time

Default: 0.000

Settings 0.000–65.535 sec.

📖 Sets the filter time to adjust DC BUS voltage. The higher the value, the better the filter result. This may affect control performance, so it normally does not need adjustment.

### ⚡ **05-01** Mains frequency filter time

Default: 0.010

Settings 0.000–65.535 sec.

📖 Sets the mains frequency filter time which normally does not need adjustment.

**05-02**

~

**05-20**

Reserved

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# Chapter 8 Warnings and Fault Codes

## Summary of Warning Codes

ID No.	Warning Name	ID No.	Warning Name
1	<a href="#">Illegal communication command (CE1)</a>	8	<a href="#">Keypad copy parameter warning (SE2)</a>
2	<a href="#">Illegal communication data address (CE2)</a>	11	<a href="#">Keypad copy parameter warning (SE3)</a>
3	<a href="#">Illegal communication data value (CE3)</a>	12	<a href="#">Low DC voltage warning (LvS)</a>
4	<a href="#">Data written to read-only addresses (CE4)</a>	13	<a href="#">Phase lock warning (PLE)</a>
5	<a href="#">Modbus transmission time-out (CE10)</a>	14	<a href="#">Phase loss warning (OrP)</a>
7	<a href="#">Keypad copy parameter warning (SE1)</a>		

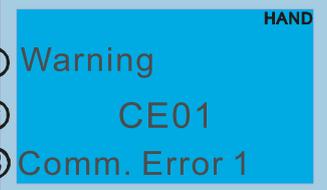
## Summary of Fault Codes

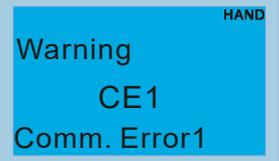
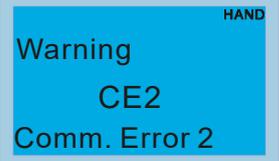
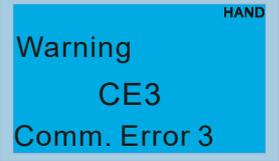
ID No.	Fault Name	ID No.	Fault Name
3	<a href="#">Over-current during regeneration (ocn)</a>	37	<a href="#">Current detection error when powering on (Hd1)</a>
6	<a href="#">Over-current at stop (ocS)</a>	38	<a href="#">Voltage detection error when powering on (Hd2)</a>
9	<a href="#">Over-voltage during regeneration (ovn)</a>	42	<a href="#">5V control board error (5VF)</a>
10	<a href="#">Over-voltage at stop (ovS)</a>	43	<a href="#">Electric valve switch error (RYF)</a>
15	<a href="#">Phase loss in output (OrP)</a>	49	<a href="#">External signal input fault (EF)</a>
16	<a href="#">Power module overheated (oH1)</a>	52	<a href="#">Wrong password (Pco)</a>
17	<a href="#">Internal ambient temperature overheated (oH2)</a>	54	<a href="#">Communication error (CE1)</a>
18	<a href="#">Power module overheated protection circuit error (tH1o)</a>	55	<a href="#">Communication error (CE2)</a>
19	<a href="#">Internal ambient temperature overheated protection circuit error (tH2o)</a>	56	<a href="#">Communication error (CE3)</a>
21	<a href="#">Overload (oL)</a>	57	<a href="#">Communication error (CE4)</a>
30	<a href="#">Memory writing error (cF1)</a>	58	<a href="#">Communication time-out (CE10)</a>
31	<a href="#">Memory read error (cF2)</a>	66	<a href="#">Phase lock error (PLE)</a>

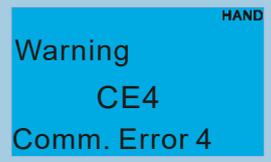
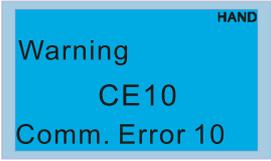
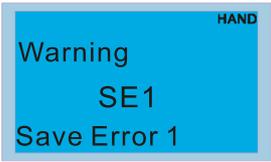
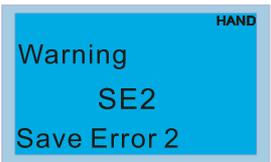
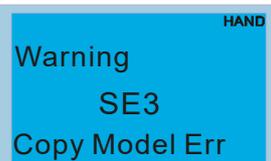
This chapter contains information on the optional digital keypad display (KPC-CC01 / KPC-CE01). If you did not purchase the optional digital keypad, you can find out about error signals through the RS-485 communication interface.

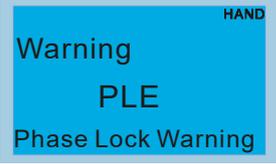
- When a Power Regenerative Unit is at STOP, it is between the Ready status and the Run status (see Section 4-4 Display Panel Indicators for the definition of different working status of power regeneration).
- This chapter helps on-site technicians with troubleshooting. If the warning / fault remains after following the corrective actions, contact a local dealer near you or Delta to return this product.

Warnings Codes

	<p>① Display error type</p> <p>② Display error code (abbreviation) This error code is the same as displayed on the digital controller (KPC-CE01)</p> <p>③ Display error description</p>
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ID #	LCM panel display	Description
1		<p>Communication Warning 1: Illegal communication command</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct (see Section 4-3).</li> <li><input checked="" type="checkbox"/> Verify that the related parameter settings are in the correct setting ranges (see Chapter 7 Descriptions of Parameter Settings).</li> </ul> <p>Press the RESET button after verifying the above items. If the warning message still appears, contact a local dealer near you or Delta to return this product.</p>
2		<p>Communication Warning 2: Illegal communication data address</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct.</li> <li><input checked="" type="checkbox"/> Verify that the communication command is correct.</li> </ul> <p>Press the RESET button after verifying the above items. If the warning message still appears, contact a local dealer near you or Delta to return this product.</p>
3		<p>Communication Warning 3: Illegal communication data value</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct.</li> <li><input checked="" type="checkbox"/> Verify that the communication command is correct.</li> </ul> <p>Press the RESET button after verifying the above items. If the warning message still appears, contact a local dealer near you or Delta to return this product.</p>

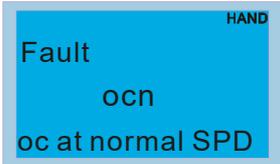
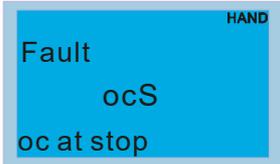
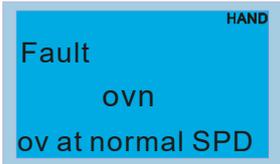
4	 <p>Warning CE4 Comm. Error 4</p>	<p>Communication Warning 4: Data written to read-only addresses</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct.</li> <li><input checked="" type="checkbox"/> Verify that the communication command is correct</li> </ul> <p>Press the RESET button after verifying the above items. If the warning message still appears, contact a local dealer near you or Delta to return this product.</p>
5	 <p>Warning CE10 Comm. Error 10</p>	<p>Communication Warning 10: Modbus transmission time-out</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct.</li> <li><input checked="" type="checkbox"/> Verify that there is any noise interference.</li> </ul> <p>Press the RESET button after verifying the above items. If the warning message still appears, contact a local dealer near you or Delta to return this product.</p>
7	 <p>Warning SE1 Save Error 1</p>	<p>Keypad copy parameter warning 1: Errors during copying which include communication delay, communication error and parameter value error.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct.</li> </ul> <p>Press the RESET button after verifying the above item. If the warning message still appears, contact a local dealer near you or Delta to return this product.</p>
8	 <p>Warning SE2 Save Error 2</p>	<p>Keypad copy parameter warning 2: Keypad copy completes but there is still a parameter writing error.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct.</li> </ul> <p>Press the RESET button after verifying the above item. If the warning message still appears, contact a local dealer near you or Delta to return this product.</p>
11	 <p>Warning SE3 Copy Model Err</p>	<p>Keypad copy parameter warning 3: The copied parameters do not match the Power Regenerative Unit model.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the model number and model name saved in the keypad match the model number and model name in the copied parameters.</li> </ul> <p>Press the RESET button after verifying the above item. If the warning message still appears, contact a local dealer near you or Delta to return this product.</p>

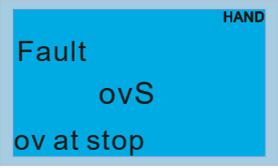
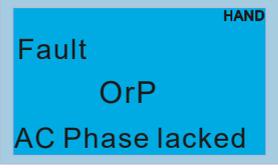
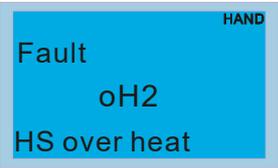
<p>12</p>		<p>Low DC voltage warning: In either the Ready status or the Run status, the Power Regenerative Unit DC BUS voltage (<math>V_{DC}</math>) is lower than the setting value in Pr.03-00.</p> <p>For 440V series when <math>V_{DC} \leq 360</math> V and for 220 series when <math>V_{DC} \leq 180</math> V, this warning message appears.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the mains voltage is normal</li> <li><input checked="" type="checkbox"/> Verify that the mains three-phase wiring is correct.</li> </ul> <p>When the <math>V_{DC}</math> is greater than the setting in Pr.03-00 (+30 / 60 V), this warning message appears and the system automatically resets.</p> <p>If the warning message still appears after verifying the above items, contact a local dealer near you or Delta to return this product.</p>
<p>13</p>		<p>Phase lock warning: In either the Ready status or the Run status, the mains electricity frequency is not between 47–63 Hz (see Mains Frequency Range in Chapter 3 Specification) and the deviation time is longer than the setting in Pr.03-04.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the mains frequency is normal.</li> <li><input checked="" type="checkbox"/> Verify that the mains three-phase wiring is correct.</li> </ul> <p>When the Power Regenerative Unit executes the phase-lock again, the system automatically resets. If the warning message still appears after verifying the above items, contact a local dealer near you or Delta to return this product.</p>
<p>14</p>		<p>Phase loss warning: In the Ready status or the Run status, the three-phase mains power loses one or two phases.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the mains three-phase voltages are similar.</li> <li><input checked="" type="checkbox"/> Verify that the mains three-phase wiring is correct.</li> </ul> <p>When the voltage of the mains is back to normal, the system automatically resets. If the warning message still appears after verifying the above items, contact a local dealer near you or Delta to return this product.</p>

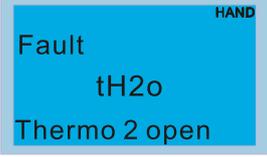
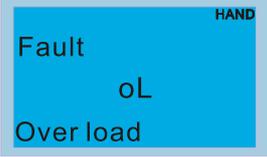
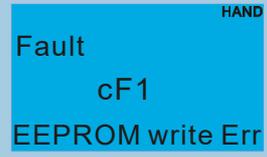
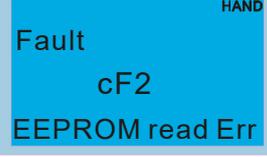
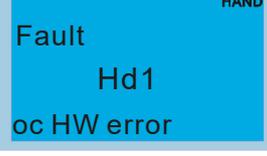
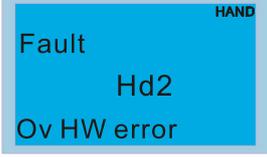
## Fault Codes

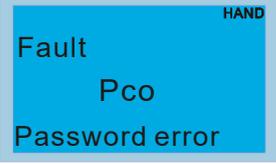
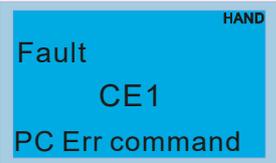
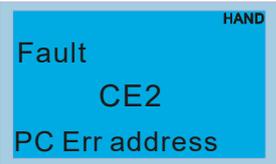
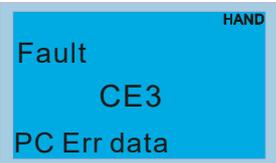
① Fault	① Display error type
② ocA	② Display error code (abbreviation) This error code is the same as displayed on the digital controller (KPC-CE01)
③ Oc at accel	③ Display error description

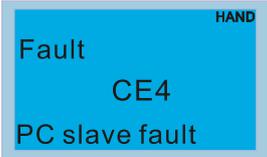
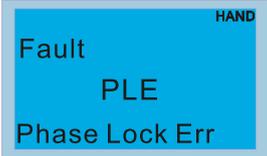
**NOTE:** In accordance with the setting value in Pr.00-20–Pr.00-25

ID #	LCM panel display	Description
3		<p>Over-current during regeneration; input current exceeds 2.4 times the Power Regenerative Unit rated current.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Check for any poor wiring insulation.</li> <li><input checked="" type="checkbox"/> Increase the DC BUS voltage operating level (see Pr.01-08).</li> <li><input checked="" type="checkbox"/> Verify that you chose the right Power Regenerative Unit. See Chapter 10 Power Regenerative Unit Selection for more information.</li> <li><input checked="" type="checkbox"/> Check for any unusual voltage surge or phase loss at the mains side.</li> </ul> <p>Press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
6		<p>Over-current occurs in the Ready status or the Run status, or hardware circuit error occurs in output current detection.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Check for any poor wiring insulation.</li> <li><input checked="" type="checkbox"/> Check for any unusual voltage surge or phase loss at the mains side.</li> </ul> <p>Press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
9		<p>While regenerating, the Power Regenerating Unit detects over-voltage on the high-voltage end of the internal DC voltage.</p> <p>For 440V series when <math>V_{DC} \geq 820</math> V and for 220 series when <math>V_{DC} \geq 410</math> V, this warning message appears.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Check the power supply wiring between terminals R, S, T for poor insulation or phase loss.</li> <li><input checked="" type="checkbox"/> Check that the input voltage is in the Power Regenerative Unit voltage rated range, and monitor for voltage surges.</li> <li><input checked="" type="checkbox"/> Lower the DC BUS voltage activation level (Pr.01-08) or increase the current limit (Pr.03-01).</li> <li><input checked="" type="checkbox"/> If there is a voltage surge, there may be a phase lead capacitor switch in the same power supply system that causes an abnormal rise in input voltage.</li> </ul> <p>Press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>

<p>10</p>		<p>Over-voltage occurs in the Ready status or the Run status, or hardware circuit error occurs in voltage detection.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Check that the input voltage is in the Power Regenerative Unit voltage rated range, and monitor for voltage surges.</li> <li><input checked="" type="checkbox"/> If there is a voltage surge, there may be a phase lead capacitor switch in the same power supply system that causes an abnormal rise in input voltage.</li> </ul> <p>Press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
<p>15</p>		<p>While regenerating, the three-phase main power loses one or two phases.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the mains three-phase voltages are similar.</li> <li><input checked="" type="checkbox"/> Verify that the mains three-phase wiring is correct.</li> </ul> <p>Press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
<p>16</p>		<p>The Power Regenerative Unit detects a temperature higher than the protection level in the power module (see Pr.00-25 in Chapter 7).</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Check if the ambient temperature is too high.</li> <li><input checked="" type="checkbox"/> Check for foreign objects in the heat sink, and if the fan is operating.</li> <li><input checked="" type="checkbox"/> Check that there is enough ventilation space near the Power Regenerative Unit.</li> </ul> <p>After verifying the above items, stop running the unit, wait for ten minutes, and then press the RESET button. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
<p>17</p>		<p>The Power Regenerative Unit detects an internal (air outlet) overheat higher than the protection level. (This error message appears only when the air outlet temperature for the REG370A23A / REG450A43A / REG550A43A models is higher than 80°C.)</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Check if the ambient temperature is too high.</li> <li><input checked="" type="checkbox"/> Check for foreign objects in the heat sink, and if the fan is operating.</li> <li><input checked="" type="checkbox"/> Check that there is enough ventilation space near the Power Regenerative Unit.</li> </ul> <p>After verifying the above items, stop running the unit, wait for ten minutes, and then press the RESET button. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>

18		The Power Regenerative Unit detects a temperature lower than normal (lower than -30°C) at the power module or a circuit error in temperature.
		<p><b>Corrective Action</b></p> <p>Increase the temperature and press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
19		The Power Regenerative Unit detects a temperature lower than normal (lower than -30°C) at the power module or a circuit error in temperature.
		<p><b>Corrective Action</b></p> <p>Increase the temperature and press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
21		Output current (AC) exceeds the Power Regenerative Unit allowed rated current. (See REG2000 Performance Curve in Chapter 3 for the duration (seconds) of output current in the allowable range.)
		<p><b>Corrective Action</b></p> <p><input checked="" type="checkbox"/> Verify that you chose the right Power Regenerative Unit. See Chapter 10 Power Regenerative Unit Selection for more information.</p> <p>Press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
30		Memory write error
		<p><b>Corrective Action</b></p> <p>Press the RESET button to restore the system to the default setting. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
31		Memory read error
		<p><b>Corrective Action</b></p> <p>Press the RESET button to restore the system to the default setting. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
37		OC protection hardware circuit error
		<p><b>Corrective Action</b></p> <p>Current detection error at first power-on. This error cannot be reset. Shut down the system and then turn the power back on. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
38		OV protection hardware circuit error
		<p><b>Corrective Action</b></p> <p>Voltage detection error at first power-on. This error cannot be reset. Shut down the system and then turn the power back on. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>

<p>42</p>		<p>Power supply (5V) on control board error</p> <p><b>Corrective Action</b></p> <p>Shut down the system and then turn the power back on. Wait for at least five seconds, make sure the supply power is normal, and then reset this error. If the error message still appears, contact a local dealer near you or Delta to return this product.</p>
<p>43</p>		<p>Electric valve switch error</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Check if the three-phase input power is normal.</li> <li><input checked="" type="checkbox"/> Verify the wiring / grounding of the main circuit to prevent interference.</li> <li><input checked="" type="checkbox"/> Shut down the system and then turn the power back on. If the error message still appears, contact a local dealer near you or Delta to return this product.</li> </ul>
<p>49</p>		<p>External command causes external fault (EF) and closes terminal (MOx). The Power Regenerative Unit stops output.</p> <p><b>Corrective Action</b></p> <p>Press the RESET button after clearing the faults. If the error message still appears, contact a local dealer near you or Delta to return the product.</p>
<p>52</p>		<p>Password entered incorrectly for three consecutive times</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> See Pr.01-02 and Pr.01-03.</li> <li><input checked="" type="checkbox"/> Shut down the system and then turn the power back on to enter the correct password.</li> </ul>
<p>54</p>		<p>Illegal communication command</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct.</li> <li><input checked="" type="checkbox"/> Check if communication commands are correct (communication commands must be 03, 06, 10, 63).</li> </ul> <p>Press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return the product.</p>
<p>55</p>		<p>Illegal communication address (00H–254H)</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct.</li> <li><input checked="" type="checkbox"/> Check if the address of communication data is correct.</li> </ul> <p>Press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return the product.</p>
<p>56</p>		<p>Illegal communication data value</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct.</li> <li><input checked="" type="checkbox"/> Check if the communication data value exceeds the maximum / minimum values (see Chapter 7).</li> </ul>

		Press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return the product.
57	 <p>Fault CE4 PC slave fault</p>	<p>Data written to read-only addresses</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct.</li> <li><input checked="" type="checkbox"/> Check that the communication address is correct.</li> </ul> <p>Press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return the product.</p>
58	 <p>Fault CE10 PC time out</p>	<p>Modbus transmission time-out</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the communication wiring is correct.</li> </ul> <p>Press the RESET button after verifying the above item. If the error message still appears, contact a local dealer near you or Delta to return the product.</p>
66	 <p>Fault PLE Phase Lock Err</p>	<p>While regenerating, the mains electricity frequency is not between 47–63 Hz (see Mains Frequency Range in Chapter 3 Specification) and the deviation time is longer than the setting in Pr.03-04.</p> <p><b>Corrective Action</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Verify that the mains frequency is normal.</li> <li><input checked="" type="checkbox"/> Verify that the mains three-phase wiring is correct.</li> </ul> <p>Press the RESET button after verifying the above items. If the error message still appears, contact a local dealer near you or Delta to return the product.</p>

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# Chapter 9 Usage Recommendations and Troubleshooting

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9-1 Regular Maintenance

9-2 Greasy Dirt Problems

9-3 Fiber Dust Problems

9-4 Corrosion Problems

9-5 Industrial Dust Problems

9-6 Installation and Wiring Problems

9-7 Multi-function Input / Output Terminal Application Problems

The Power Regenerative Unit has various warnings and protections against errors such as over-voltage, low voltage, or over-current. Once an error occurs, the protections activate, the Power Regenerative Unit stops output and activates the error contacts. Please refer to the error display from the Power Regenerative Unit and look up the corresponding causes and solutions.

The fault record is stored in the Power Regenerative Unit internal memory and can store the six most recent error messages. You can read it from the digital keypad or through the communications by accessing the parameters.

The Power Regenerative Unit includes a large number of electronic components, including ICs, resistors, capacitors, transistors, cooling fans and relays. These components do not last forever. Even under normal circumstances, they will eventually become error-prone if used past their lifespans. Therefore, you must perform periodic preventive maintenance to identify defective and worn out parts, and eliminate the causes of malfunctions in the Power Regenerative Unit at an early stage. At the same time, parts that have exceeded their product life should be replaced whenever possible to ensure safe operation.

Visual checks should be done regularly to monitor the unit's operation, and to make sure nothing unusual happens. Check the situations listed in the following table.

 <p><b>CAUTION</b></p>	<ul style="list-style-type: none"> <li>☑ After an error occurs, the error must be cleared for at least five seconds before the RESET key is enabled.</li> <li>☑ The Power Regenerative Unit must first be switched off for at least five minutes for <math>\leq 22</math> kW models, and 10 minutes for <math>\geq 30</math> kW models until the charging indicator turns off, and the DC voltage between terminals <math>\oplus-\ominus</math> must be lower than 25 V before it is safe to open the cover to begin maintenance operations.</li> <li>☑ Only qualified personnel can work on maintenance or replace parts. (Remove metal items such as watch, rings, and other metal items before operation, and use only insulated tools.)</li> <li>☑ Never modify the Power Regenerative Unit in any way.</li> <li>☑ The performance and the surrounding environment should meet the standard specifications. There should be no abnormal noise, vibration, or odor.</li> </ul>
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## 9-1 Regular Maintenance

For regular maintenance, first stop operation, then turn off the power, and then take off the outer cover. Even after turning off the power supply, charging voltages remaining in the filter capacitor require some time to discharge. To avoid danger, operation must not start until the charging indicator goes off, and you confirm the voltage with a voltmeter to be below the safety value ( $\leq 25 V_{DC}$ ).

### Ambient environment

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check the ambient temperature, humidity, vibration, and check for any dust, gas, oil, water drops, and so on.	Visual inspection and measuring instruments	○		
Are dangerous or abnormal objects such as tools in the surrounding area?	Visual inspection	○		

### Voltage

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Are the main circuit and control circuit voltages normal?	Measure with a multimeter	○		

### Keypad display panel

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Are the displays clear for reading?	Visual inspection	○		
Are there any missing characters?	Visual inspection	○		

### Mechanical parts

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Are there abnormal sounds or vibrations?	Visual and auditory inspection	○	○	
Are any bolts (or other fastening pieces) loose?	Securely tighten	○	○	
Are any parts deformed or damaged?	Visual inspection	○	○	
Is there any discoloration due to overheating?	Visual inspection	○	○	
Is there any dust or dirt?	Visual inspection	○	○	

**Main circuit**

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Are any bolts loose or missing?	Securely tighten	o		
Is the machine or insulator deformed, cracked, damaged, or discolored due to overheating and aging?	Visual inspection		o	
Is there any dust or dirt?	Visual inspection		o	

**Main circuit terminal and wiring**

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Are the terminals and copper plates deformed or discolored due to overheating?	Visual inspection		o	
Is any wire insulation damaged or discolored?	Visual inspection		o	

**Main circuit terminal block**

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Is there any damage?	Visual inspection	o		

**Main circuit filter capacitor**

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Are there any liquid leaks, discoloration, cracks, or shell expansions?	Visual inspection	o		
Are the safety valves released? Are the valve bodies significantly expanded?	Visual inspection	o		
Measure electrostatic capacity as required		o		

**Main circuit resistor**

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Are there abnormal odors or cracks in the insulator due to overheating?	Visual inspection, smell	o		
Are there broken wires?	Visual inspection	o		
Are the connection joints damaged?	Measure the resistance with a multimeter	o		

**Main circuit transformer and reactor**

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Are there abnormal vibrating noises or odors?	Visual inspection, auditory, smell	o		

**Main circuit electromagnetic contactor and relay**

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Is there a vibrating noise during operation?	Auditory inspection	o		
Are the contacts well connected?	Visual inspection	o		

**Control circuit control printed circuit board and connector**

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Are there any loose screws or connectors?	Securely tighten		o	
Are there any abnormal odors or discoloration?	Smell, visual inspection		o	
Are there cracks, damages, deformations, or obvious corrosions?	Visual inspection		o	
Are there signs of leakage or deformation in the capacitors?	Visual inspection		o	

**Cooling system cooling fan**

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Are there abnormal sounds or vibrations?	Auditory, visible inspection, and turn the fan by hand (turn off the power before operation) to see if it rotates smoothly.		o	
Are any bolts loose?	Securely tighten		o	
Is there any discoloration due to overheating?	Visual inspection		o	

**Cooling system ventilation channel**

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Are heat sinks or vents blocked or obstructed with abnormal objects?	Visual inspection		o	

**NOTE:** Use a chemically neutral cloth for cleaning and use dust cleaner to remove dust when necessary.

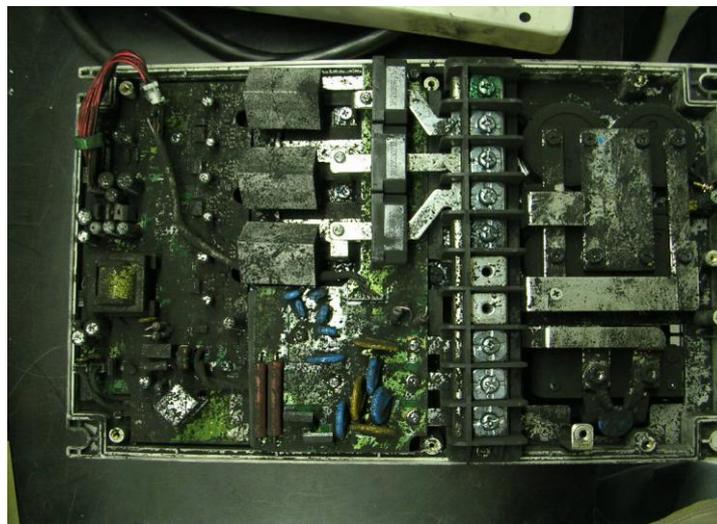
## 9-2 Greasy Dirt Problems

Serious greasy dirt problems generally occur in processing industries such as machine tools, punching machines and so on. Please be aware of the possible damages that greasy oil may cause to your Power Regenerative Unit.

1. Electronic components that silt up with greasy oil may cause the Power Regenerative Unit to burn out or even explode.
2. Most greasy dirt contains corrosive substances that may damage the Power Regenerative Unit.

### Solution

Install the Power Regenerative Unit in a dedicated cabinet to keep it away from greasy dirt. Clean and remove greasy dirt regularly to prevent damage to the unit.



### 9-3 Fiber Dust Problems

Serious fiber dust problems generally occur in the textile industry. Please be aware of the possible damages that fiber may cause to your Power Regenerative Unit.

1. Fiber that accumulates or adheres to the fans leads to poor ventilation and causes overheating problems.
2. Plant environments in the textile industry have higher degrees of humidity that may cause the Power Regenerative Unit to burn out, become damaged or explode due to wet fiber dust adhering to the devices.

#### Solution

Install the Power Regenerative Unit in a dedicated cabinet to keep it away from fiber dust. Clean and remove fiber dust regularly to prevent damage to the unit.



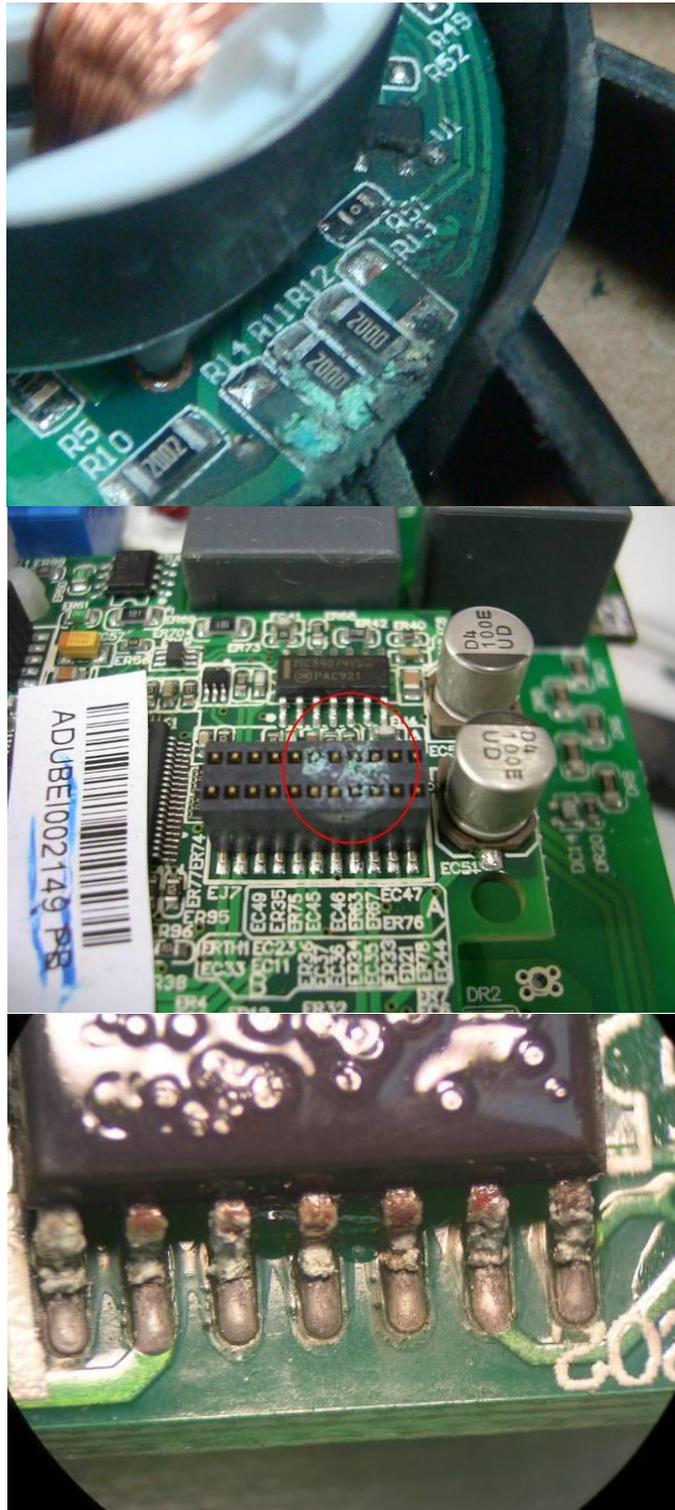
## 9-4 Corrosion Problems

Corrosion problems may occur if any fluids flow into the Power Regenerative Units. Please be aware of the possible damages that corrosion may cause to your Power Regenerative Unit.

1. Corrosion of internal components may cause the unit to malfunction and possibility to explode.

### Solution

Install the Power Regenerative Unit in a dedicated cabinet to keep it away from fluids. Clean the unit regularly to prevent corrosion.



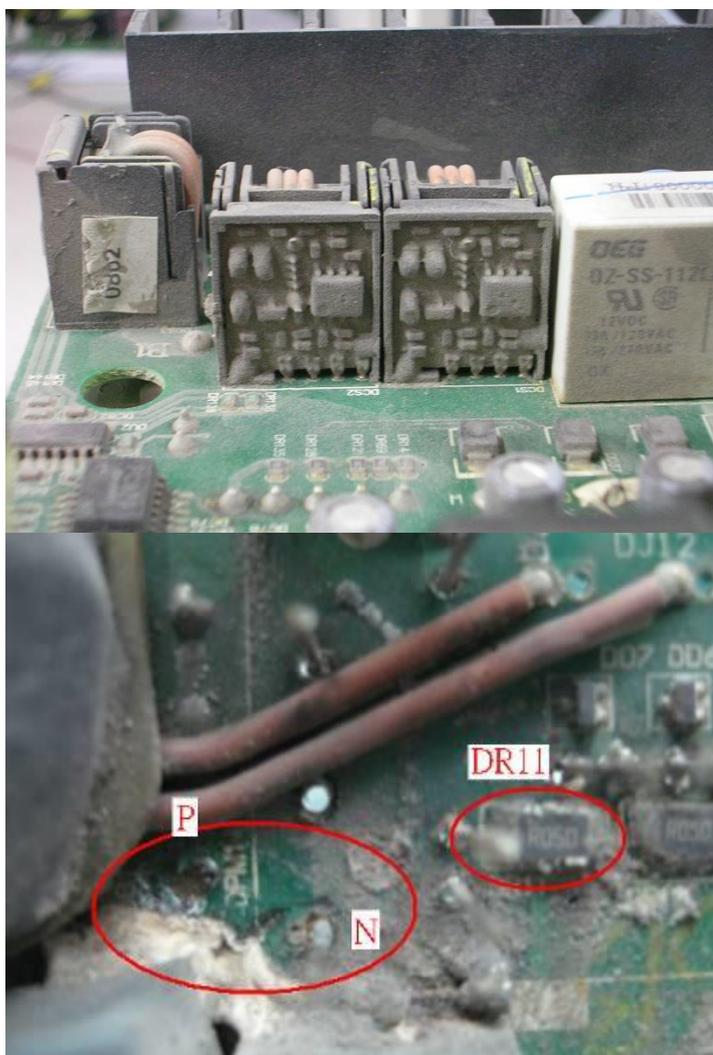
## 9-5 Industrial Dust Problems

Serious industrial dust pollution frequently occurs in environments such as stone processing plants, flour mills, cement plants, and so on. Please be aware of the possible damages that industrial dust may cause to your Power Regenerative Unit.

1. Dust accumulating on electronic components may cause overheating problem and shorten the service life of the Power Regenerative Unit.
2. Conductive dust may damage the circuit board and may even cause the unit to explode.

### Solution

Install the Power Regenerative Unit in a dedicated cabinet and cover the unit with a dust cover. Clean the cabinet and ventilation holes regularly for good ventilation.



## 9-6 Installation and Wiring Problems

When wiring the Power Regenerative Unit, the most common problem is incorrect wire installation or poor wiring. Please be aware of the possible damages that poor wiring may cause to your units.

1. If screws are not fully tightened, then sparking may occur as impedance increases.
2. If you have opened the unit and modified the internal circuit board, the internal components may have been damaged.

### Solution

Ensure that all screws are tightened when installing the Power Regenerative Unit. If the unit functions abnormally, send it back to Delta for repair. DO NOT try to modify or repair the internal components or wiring.



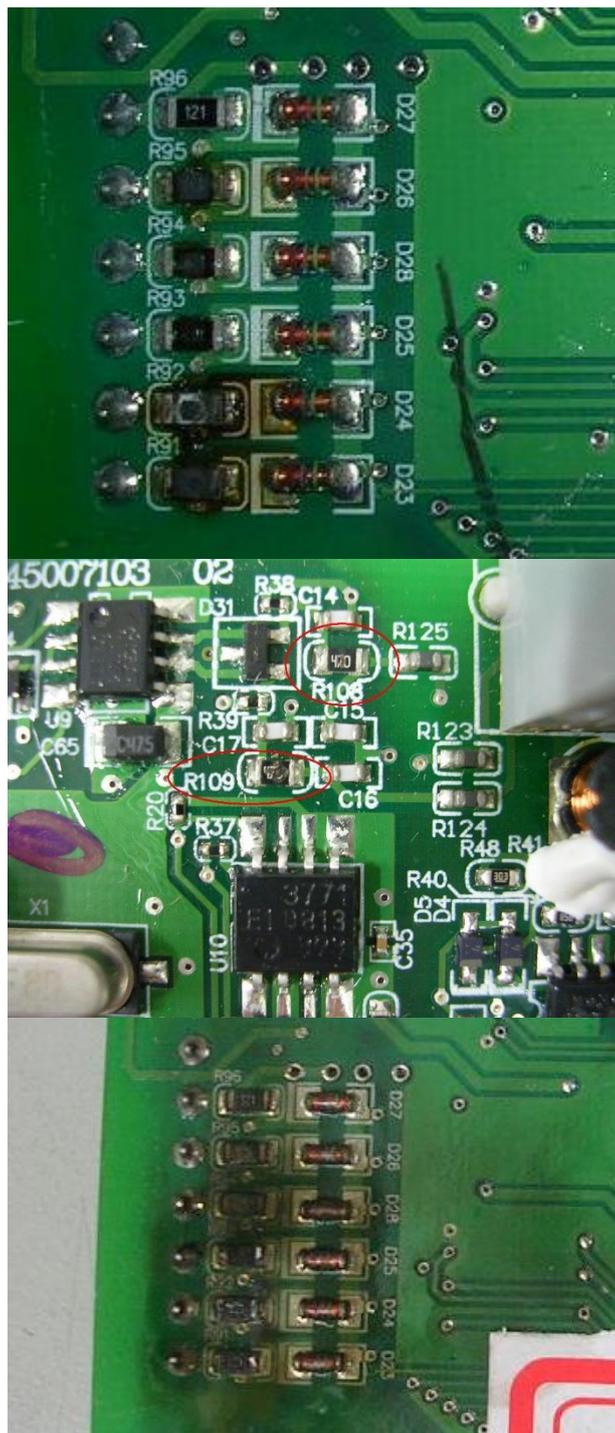
## 9-7 Multi-function Input / Output Terminal Application Problems

Multi-function input / output terminal errors are generally caused by over-usage of the terminals and not following the specifications. Please be aware of the possible damages that multi-function input / output terminal errors may cause to your Power Regenerative Unit.

1. Input / output circuit may burn out when the terminal usage exceeds the specified limit.

### Solution

Refer to the user manual for multi-function input output terminals usage and follow the specified voltage and current. DO NOT exceed the specification limits.



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# Chapter 10 Power Regenerative Unit Selection

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10-1 Model selection method 1 (based on the brake resistor specifications)

10-2 Model selection method 2 (based on the drive's overload ability)

10-3 Model selection method 3 (based on the application load characteristics)

Delta offers four ways to select a REG2000 model.

1. Select the model based on the brake resistor specifications. Select the model according to the applications that require rapid acceleration and deceleration, such as tapping, drilling machines, and lathes.
2. Select the model based on the drive's overload ability. A servo drive has a higher overload ability than an AC motor drive. So select the model that has a larger capacity if you use the servo drive.
3. Select the model based on the application load characteristics. Calculate the regenerated power for the applications using the application's system characteristics and specifications, especially for elevator and hoist application.
4. Use the Delta REG2000 Sizing Wizard:  
 中文: <http://deltavfdsizingtool.deltaww.com/REG2000/TC/index.html>  
 ENGLISH: <http://deltavfdsizingtool.deltaww.com/REG2000/EN/index.html>

This chapter describes the first three model selection methods in more detail.

### 10-1 Model selection method 1 (based on the brake resistor specifications)

Take 220 V as an example; if you select a 1500 W 13 Ω brake resistor with brake level set to 380 V, then the total braking current would be  $380\text{ V} / 13\ \Omega = 29\text{ A}$ .

DC power equals to AC power, that is,  $V_{DC} * I_{DC} = \sqrt{3} * V_{AC} * I_{AC}$ .

$V_{AC}$  is AC voltage

$I_{AC}$  is AC current

$V_{DC}$  is DC voltage

$I_{DC}$  is DC current

For example,  $I_{AC} = (V_{DC} * I_{DC}) / (\sqrt{3} * V_{AC}) = (380 * 29) / (\sqrt{3} * 220) = 28.9\text{ A}$ .

The brake resistor's braking torque is 125% at 10% ED, and REG2000 is 150% at 10% ED; therefore, you can make your selection using the REG2000's current at 150% in the following tables. In this example, you can select REG075A23A-21, as the current at 150% of 30 A > total braking current of 28.9 A.

#### 230V Series

Frames		A	B		C
Model REG__A23A-21		0.75	150	220	370
Rated Power (kW)		7.5	15	22	37
Mains	Input current (A)	20	38	60	100
	Input current at 150%	30	57	90	150

#### 460V Series

Frames		A			B			C		
Model REG__A43A-21		0.75	110	150	185	220	300	370	450	550
Rated Power (kW)		7.5	11	15	18.5	22	30	37	45	55
Mains	Input current (A)	10.5	17	20	25	32	43	49	60	75
	Input current at 150%	15.8	25.5	30	37.5	48	64.5	73.5	90	112.5

**NOTE:** Please contact Delta if the required current exceeds the units listed above.

### 10-2 Model selection method 2 (based on the drive's overload ability)

Select the model based on the drive's overload ability. The table below is an example for the C2000 using with REG2000 when the condition is 10% ED and the maximum regenerated working time during one cycle is 10 seconds. The overload ability of C2000 is 160% / 3 seconds and 120% / 60 seconds based on the rated output current.

Voltage	10% ED / 10 seconds		
	Drive	REG selection	
220 V	kW	Model	Quantity
	0.7	REG075A23A	1
	1.5	REG075A23A	1
	2.2	REG075A23A	1
	3.7	REG075A23A	1
	5.5	REG075A23A	1
	7.5	REG075A23A	1
	18	REG150A23A	1
	30	REG220A23A	1
	45	REG370A23A	1
	55	Please contact Delta Electronics	-
	75		
	90		

Voltage	10% ED / 10 seconds		
	Drive	REG selection	
440 V	kW	Model	Quantity
	0.7	REG075A43A	1
	1.5	REG075A43A	1
	2.2	REG075A43A	1
	3.7	REG075A43A	1
	4	REG075A43A	1
	5.5	REG075A43A	1
	7.5	REG075A43A	1
	11	REG075A43A	1
	15	REG110A43A	1
	18	REG150A43A	1
	22	REG185A43A	1
	30	REG220A43A	1
	37	REG300A43A	1
	45	REG370A43A	1
	55	REG450A43A	1
	75	REG550A43A	1
	90	Please contact Delta Electronics	-
	110		
	132		
	160		
185			
220			
280			
315			
355			

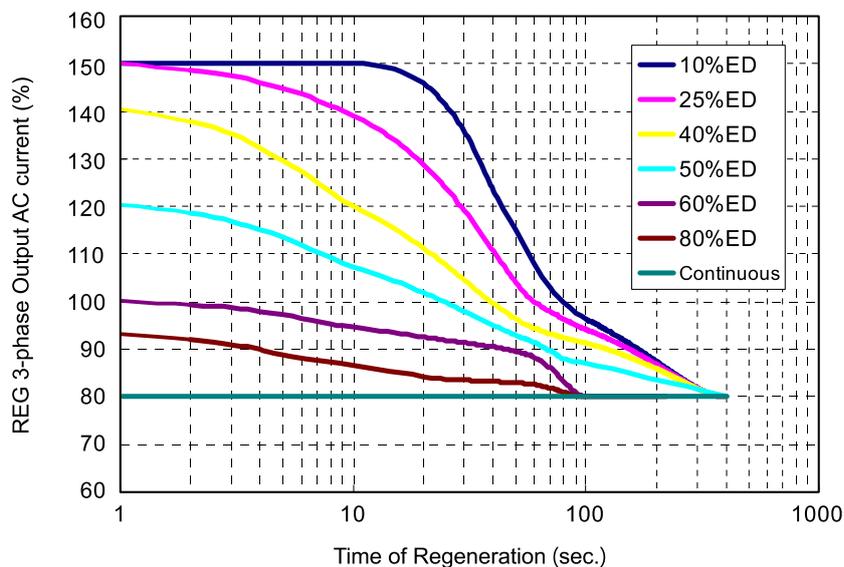
### 10-3 Model selection method 3 (based on the application load characteristics)

#### 1. Crane / Hoist Application

The equipment weighs 10 tons, drive model: VFD075CH43A, with a 5.5 kW motor.  
 From the crane's specification we know

Model No.	V10C4B036I-W18I	Serial No.	
Capacity	10 TON	Duty Cycle	40%ED, ISO M5
Lifting Height	9 m	Hoisting Speed	3.6/0.36 m/min
Trolley Type	W	Traveling Speed	24/2.4 m/min
Main Voltage	380/60 V/Hz	Date	2010/9/15

- (1) In high-speed operation, the time it takes from top to bottom is  $9 \text{ (m)} / 3.6 \text{ (m/min)} = 2.5 \text{ (min)} = 150 \text{ (sec)}$ .
- (2) Assuming the motor efficiency is 85%, the mechanical efficiency is 85%, and the drive and the REG2000's efficiencies are both 95%, the useful power output would be  $5.5 \text{ kW} * 0.85^2 * 0.95^2 = 3.57 \text{ kW}$ .
- (3) When using the REG2000, and the mains voltage is 380 V, the current would be  $3.57 \text{ kW} / (\text{sqrt}(3) * 380 \text{ V}) = 5.4 \text{ A}$ .
- (4) From the table below, at 40% ED, and a working duration of 150 seconds, the output current must be lower than 90% of the rated current to avoid overload.



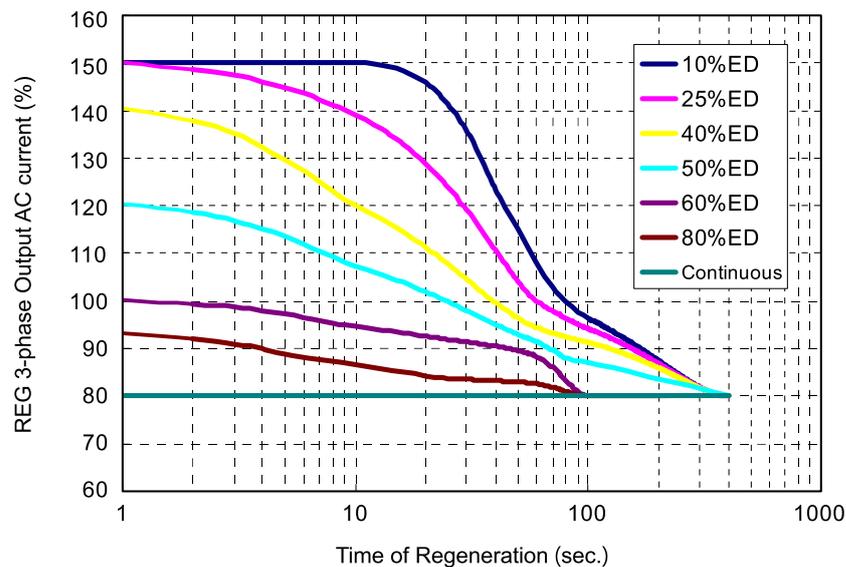
- The diagram above shows the testing result by combining REG and a DC choke. (Definition of ED%: See Chapter 3 Specifications.)

- (5) From the specification sheet, the REG075A43A-21 rated current is 10.5 A, and  $10.5 \text{ A} * 90\% = 9.45 \text{ A} > 5.4 \text{ A}$ ; therefore, in this case, you can select the REG075A43A-21.

## 2. Elevator Application

For this example, take an elevator with two tons of working load, a speed of 60 m/min, floors from B1–4F, using 22 kW motor, and a counterweight of 48%.

- (1) The elevator takes 30 seconds to reach floor 4F from B1, and the whole trip takes 100 seconds, then  $ED = 30/100 = 30\%$ .
- (2) Assuming the motor efficiency is 85%, mechanical efficiency is 85%, and the drive and the REG2000's efficiencies are both 95%, the useful power output would be  $22 \text{ kW} * 85\% * 85\% * 95\% * 95\% = 14.3 \text{ kW}$ .
- (3) When using the REG2000, and the mains voltage is 380 V, the current would be  $14.3 \text{ kW} / (\sqrt{3} * 380 \text{ V}) = 21.8 \text{ A}$ .
- (4) From the table below, at 30% ED, and a working duration of 30 seconds, the output current must be lower than 115% of the rated current to avoid overload.



- The diagram above shows the testing result by combining REG and a DC choke. (Definition of ED%: See Chapter 3 Specifications.)

- (5) From the specification sheet, the REG110A43A-21 rated current is 17 A,  $17 \text{ A} * 115\% = 19.55 \text{ A} < 21.8 \text{ A}$ , and the REG150A43A-21 rated current is 20 A,  $20 \text{ A} * 115\% = 23 \text{ A} > 21.8 \text{ A}$ ; therefore, in this case, you can select the REG150A43A-21.



Smarter. Greener. Together.

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