Digitized Automation for a Changing World

Delta Elevator Drive
EB3000 Series User Manual

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DELTA

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(Original instructions)

Before Use

READ PRIOR TO INSTALLATION FOR SAFETY.

DANGER

☑ Disconnect AC input power before connecting any wiring to the AC motor drive.

☑ Turn OFF the AC motor drive 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_{DC}). 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. Take anti-static measure before touching these components or the circuit boards.

☑ Never modify the internal components or wiring.

☑ Ground the AC motor drive by using the ground terminal. The grounding method must comply with the laws of the country where the AC motor drive is to be installed.

☑ Do NOT install the AC motor drive in a location with high temperature, direct sunlight or inflammable materials or gases.

CAUTION

☑ Do NOT connect the drive to a public AC mains distribution network.

☑ Never connect the AC motor drive output terminals U/T1, V/T2 and W/T3 directly to the AC mains circuit power supply.

☑ After finishing the wiring of the AC motor drive, check if R/L1、S/L2、T/L3 are short-circuited to ground with a multimeter. Do NOT power the drive if short circuits occur. Eliminate the short circuits before the drive is powered.

☑ The rated voltage of power system to install motor drives is listed below. Ensure that the installation voltage is in the correct range when installing a motor drive.

1. For 230V models, the range is between 170–264V.
2. For 460V models, the range is between 323–528V.

☑ Refer to the table below for short circuit rating:

Model (Power)	Short circuit rating
230V / 460V	100 kA

☑ Only qualified persons are allowed to install, wire and maintain the AC motor drives.

☑ Even if the three-phase AC motor is stopped, a charge with hazardous voltages may still remain in the main circuit terminals of the AC motor drive.

☑ The performance of electrolytic capacitor will degrade if it is not charged for a long time. It is recommended to charge the drive which is stored in no charge condition every 2 years for 3–4 hours to restore the performance of electrolytic capacitor in the motor drive. **NOTE:** When power up the motor drive, use adjustable AC power source (e.g. AC autotransformer) to charge the drive at 70%–80% of rated voltage for 30 minutes (do not run the motor drive). Then charge the drive at 100% of rated voltage for an hour (do not run the motor drive). By doing these, restore the performance of electrolytic capacitor before starting to run the motor drive. Do NOT run the motor drive at 100% rated voltage right away.

☑ 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 drive. Any damage to the drive 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.

☑ Connect the drive to a three-phase three-wire or three-phase four-wire Wye system to comply with UL standards.

☑ If the motor drive generates leakage current over AC 3.5 mA or over DC 10 mA on a grounding conductor, compliance with local grounding regulations or IEC61800-5-1 standard is the minimum requirement for grounding.

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

Table of Contents

Issued Edition: 00
Firmware Version: V1.01 (Refer to Pr.07-02 on the product for the firmware version.)
Issued Date: 2025/09

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Chapter 1 Introduction

Receiving and Inspection

After you receive the AC motor drive, check the following:

1. Inspect the unit after unpacking to ensure that it was not damaged during shipment. Make sure that the part number printed on the package corresponds with the part number indicated on the nameplate.
2. Make sure that the voltage for the wiring is in the range indicated on the nameplate. Install the AC motor drive according to this manual.
3. Before applying the power, make sure that all the devices, including power, motor, control board and digital keypad are connected correctly.
4. When wiring the AC motor drive, make sure that the wiring for input terminals “R/L1, S/L2, T/L3” and output terminals “U/T1, V/T2, W/T3” is correct to prevent drive damage.
5. When power is applied, set parameter groups with the digital operation panel (KPED-LE02). When executing a trial run, begin with a low speed and then gradually increase the speed until reaching the desired speed.

1-1 Nameplate Information

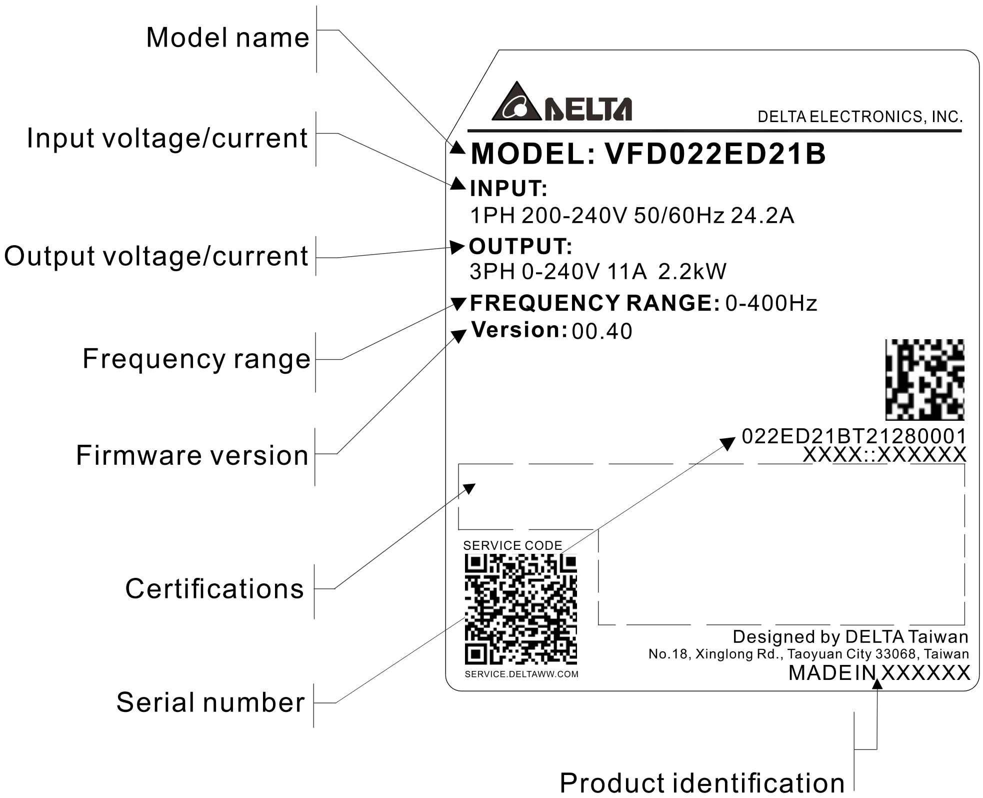
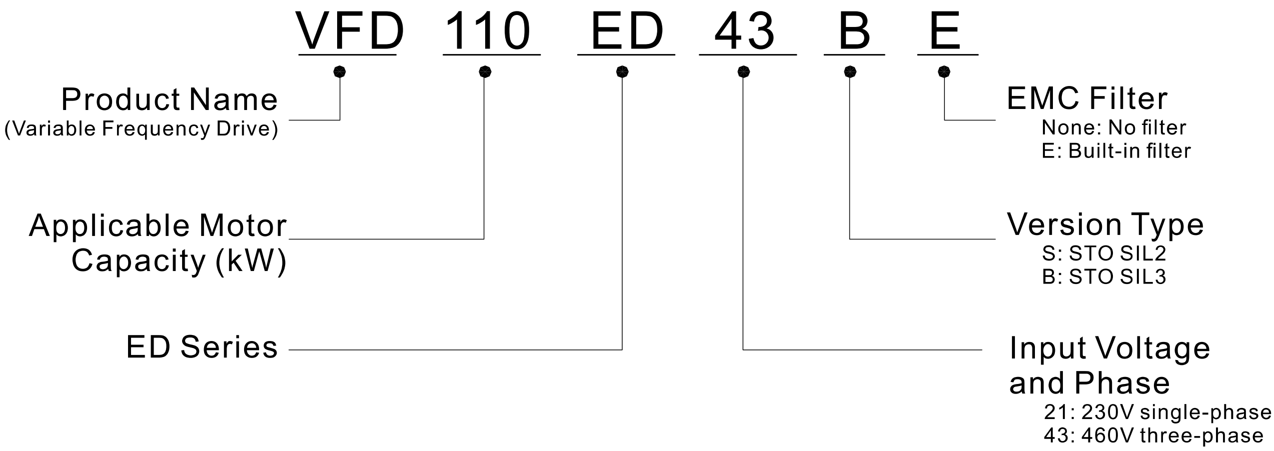
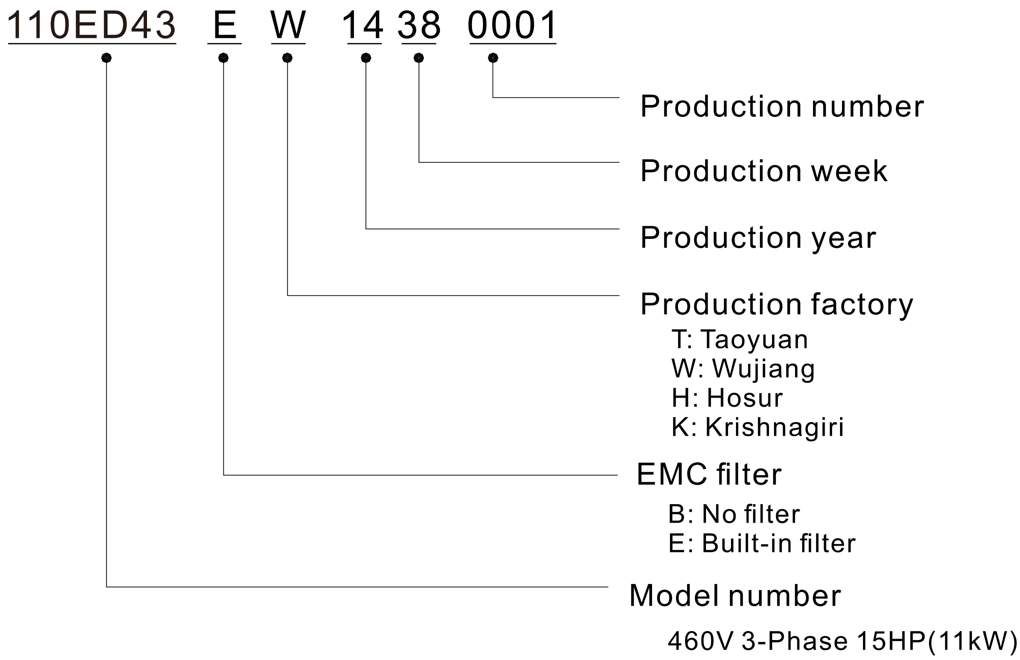


Figure 1-1

1-2 Model Name



1-3 Serial Number



1-4 Apply After-sales Service by Mobile Device

1-4-1 Location of Service Link Label

The images below show the service link label (service label) that is located on the side of the case.

Frame A

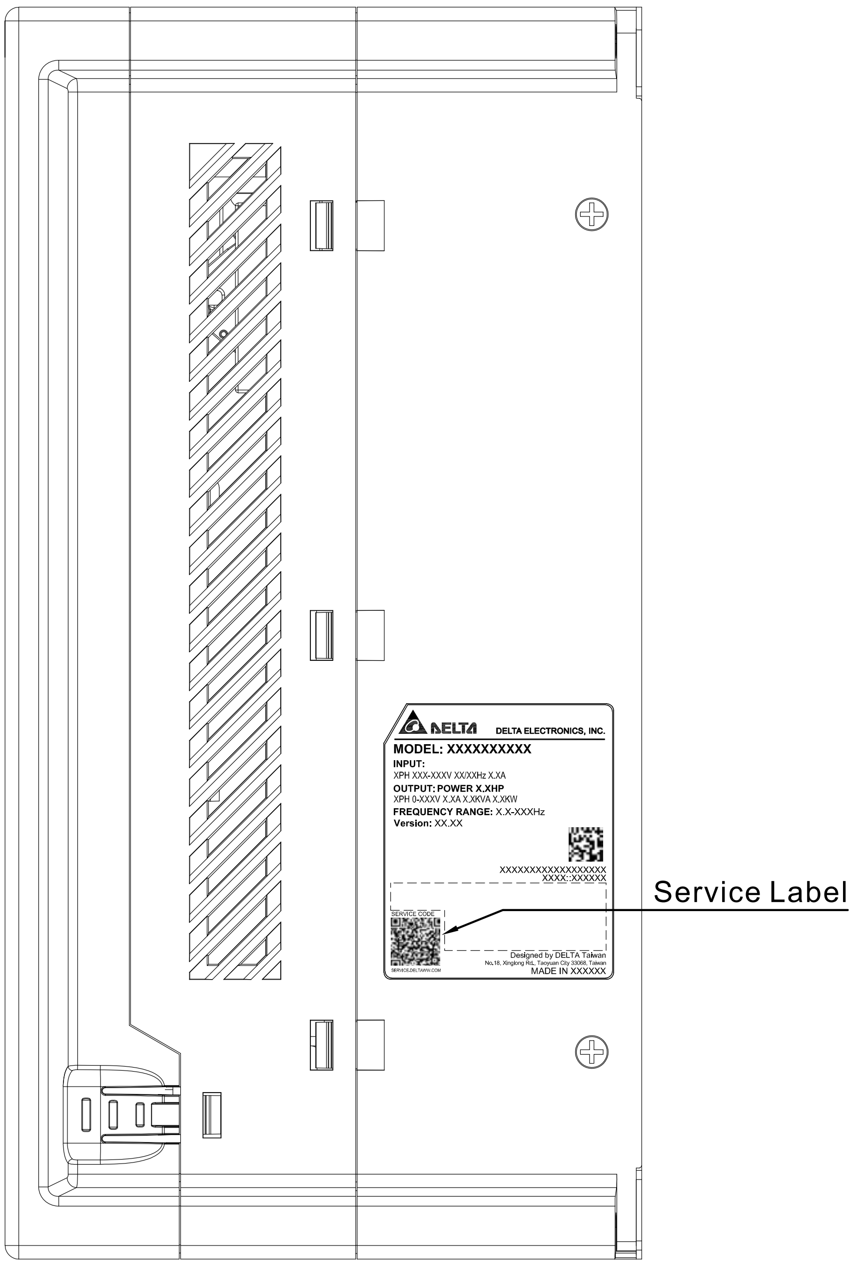


Figure 1-2

Frame B

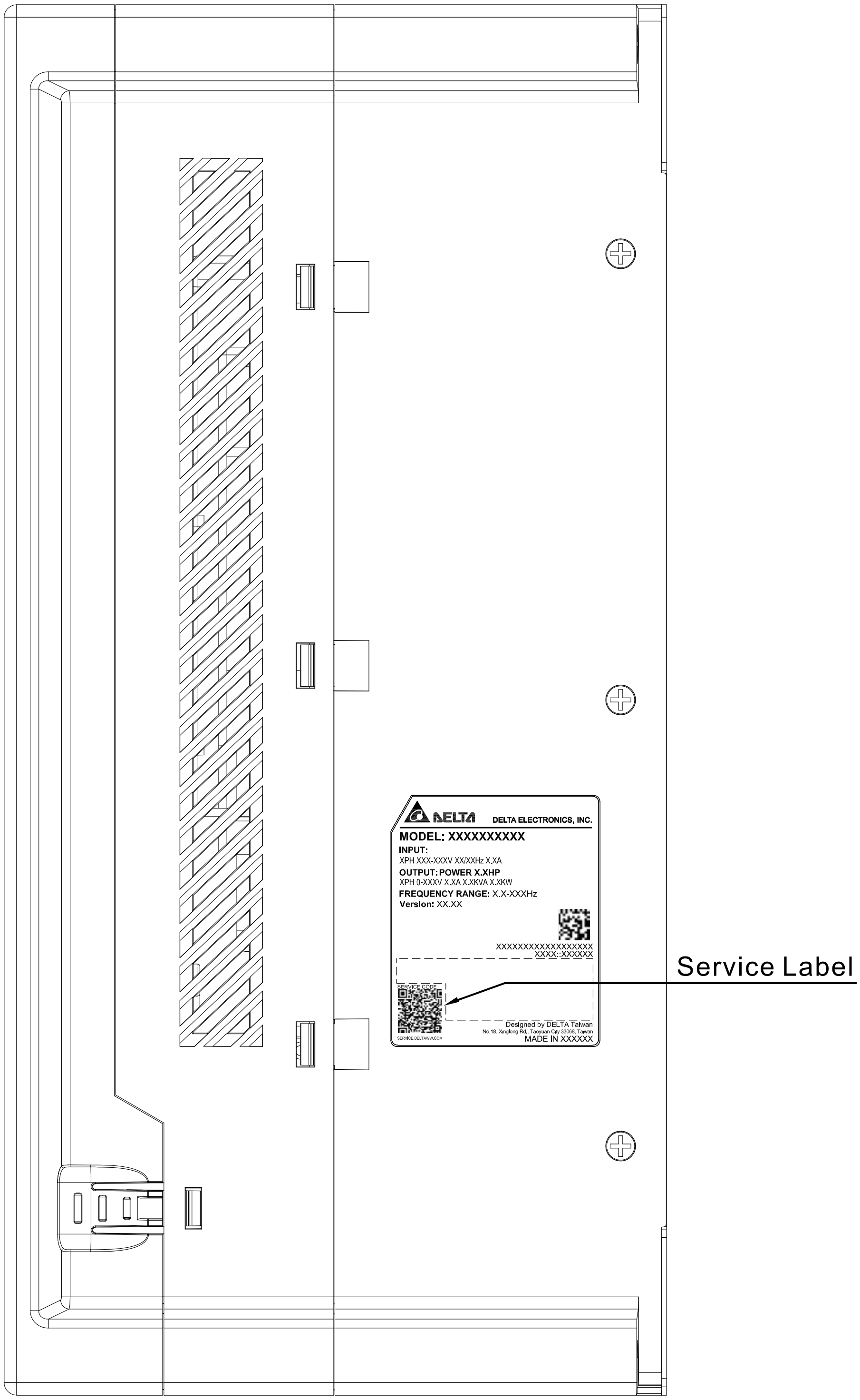


Figure 1-3

1-4-2 Service Link Label

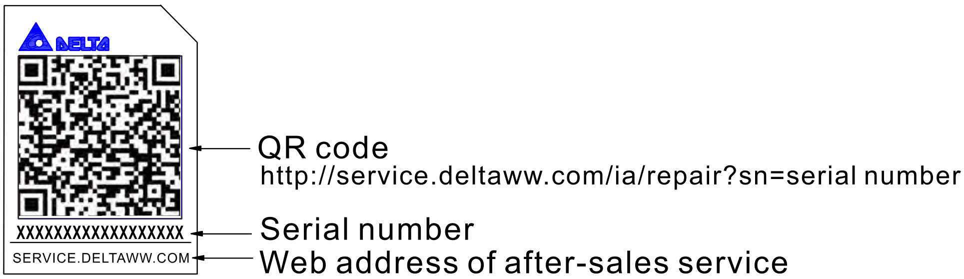


Figure 1-4

Scan QR Code to apply

1. Find the QR code sticker (as shown above).
2. Run the QR code reader App on your smart phone.
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 in the columns marked with an orange star.
6. Enter the CAPTCHA and click **Submit** to complete the request.

Cannot find the QR Code?

1. Open a web browser on your computer or smart phone.
2. Enter https://service.deltaww.com/us/Repair/Request?type=IA in the browser address bar and press the Enter key.
3. Fill in the information in the columns marked with an orange star.
4. Enter the CAPTCHA and click **Submit** to complete the request.

Chapter 2 Installation

2-1 Dimensions

Frame A

VFD022ED21B, VFD022ED21BE, VFD037ED21B, VFD037ED21BE, VFD040ED43B, VFD040ED43BE, VFD055ED43B, VFD055ED43BE, VFD075ED43B, VFD075ED43BE

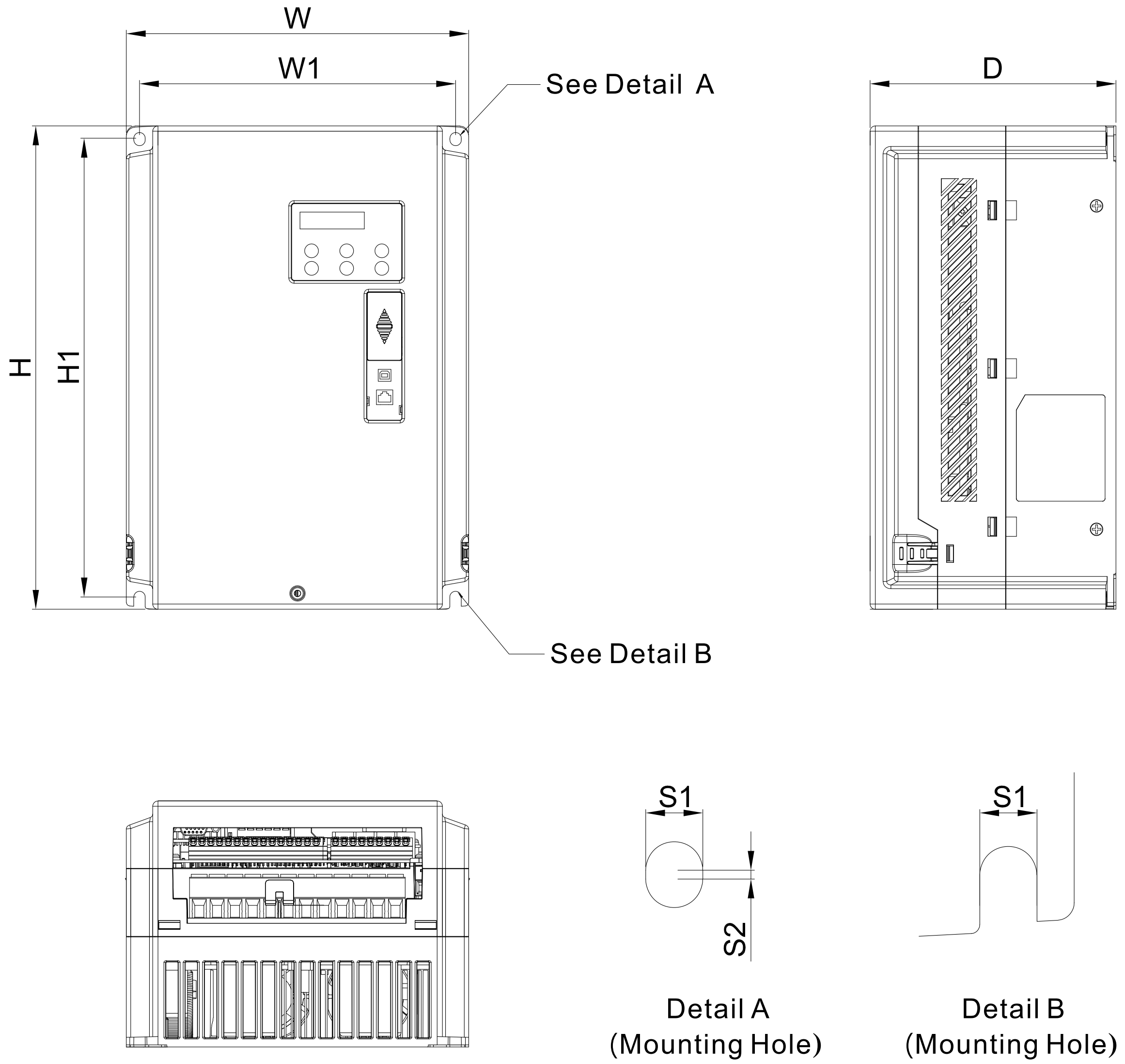


Figure 2-1

Unit: mm (inch)

Frame	W	W1	H	H1	D	S1	S2
A	195.0 (7.68)	180.0 (7.09)	275.0 (10.83)	261.0 (10.28)	140.0 (5.51)	6.5 (0.26)	1.0 (0.04)

Table 2-1

Frame B

VFD110ED43B, VFD110ED43BE, VFD150ED43B, VFD150ED43BE, VFD185ED43B

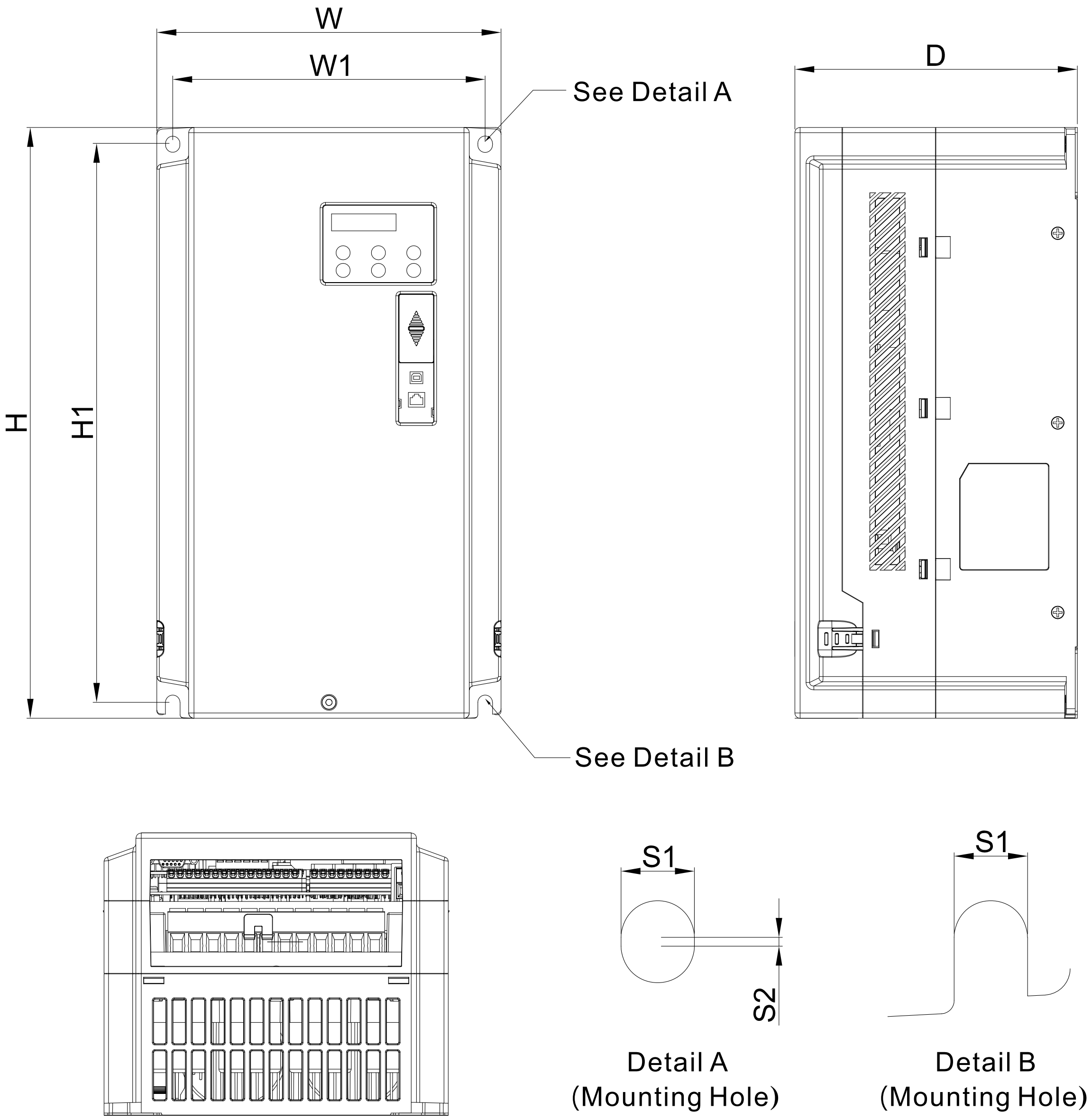


Figure 2-2

Unit: mm (inch)

Frame	W	W1	H	H1	D	S1	S2
B	195.0 (7.68)	177.0 (6.97)	335.0 (13.19)	317.0 (12.48)	160.0 (6.30)	8.3 (0.33)	1.0 (0.04)

Table 2-2

Built-in Keyboard Panel

KPED-LE02

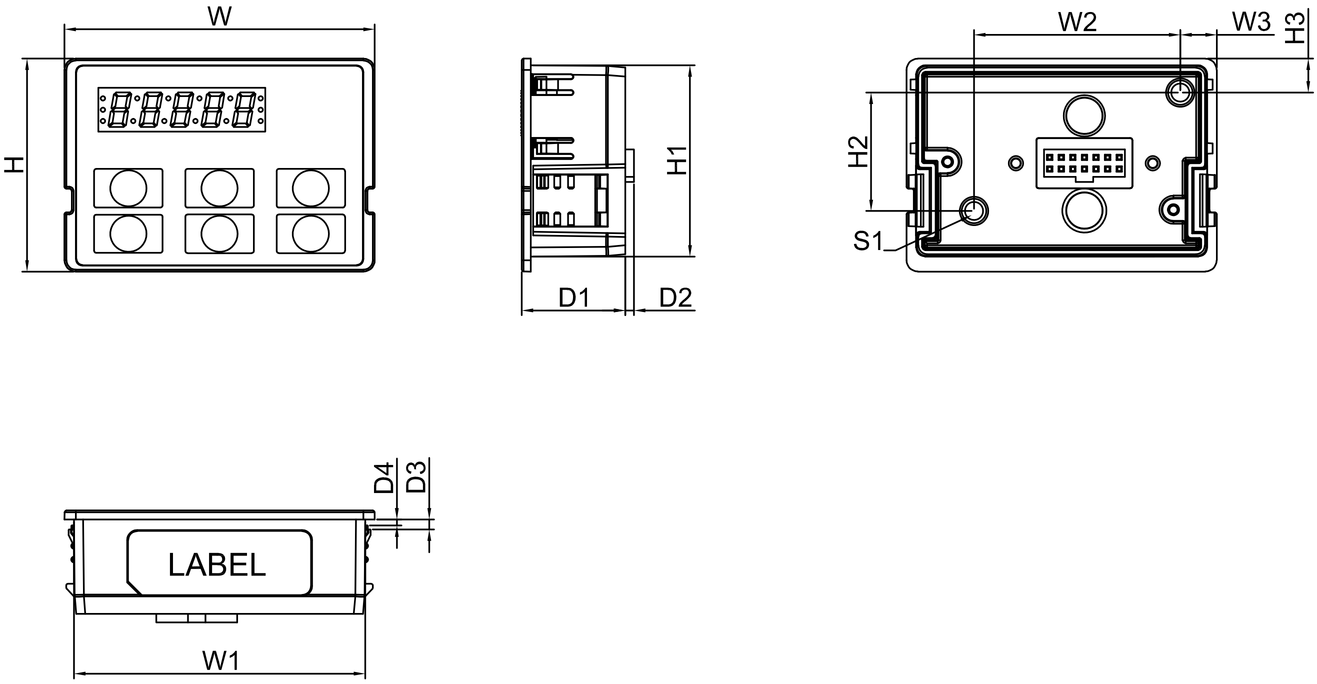


Figure 2-3

Unit: mm (inch)

W	W1	W2	W3	H	H1	H2	H3	D1	D2	D3	D4	S1
68.0 (2.68)	63.8 (2.51)	45.2 (1.78)	8.0 (0.31)	46.8 (1.84)	42.0 (1.65)	26.0 (1.02)	7.5 (0.30)	22.7 (0.89)	2.0 (0.08)	2.2 (0.09)	1.3 (0.05)	M3 x P0.5 (2X)

Table 2-3

2-2 Mechanical Installation

2-2-1 Mounting Considerations

- Before mounting, ensure the mounting location is able to carry the drive, in both strength and rigidity.
- Mount the drive vertically to a sold flat surface.

Frame	Recommended Screw Size	Recommended Screw Torque
A	M6 x P1.0 + Grover (spring-lock) washer + flat washer	30–35 kg-cm (26.04–30.38 Ib-in.) (2.94–3.43 Nm)
B	M8 x P1.25 + Grover (spring-lock) washer + flat washer	95–100 kg-cm (82.46–86.80 Ib-in.) (9.32–9.81 Nm)

Table 2-4

- Do NOT install the drive on an inflammable wall surface.

2-2-2 Mounting Clearance

☑ Prevent fiber particles, scraps of paper, shredded wood, sawdust, metal particles, etc. from adhering to the heat sink.

☑ Install the AC motor drive in a metal cabinet to prevent the risk of fire.

☑ Install the AC motor drive in a Pollution Degree 2 (IEC 60664-1) environment with clean and circulating air. A clean and circulating environment means air without polluting substances and dust.

The motor drives' figures shown below are for reference only. The actual motor drives may look different.

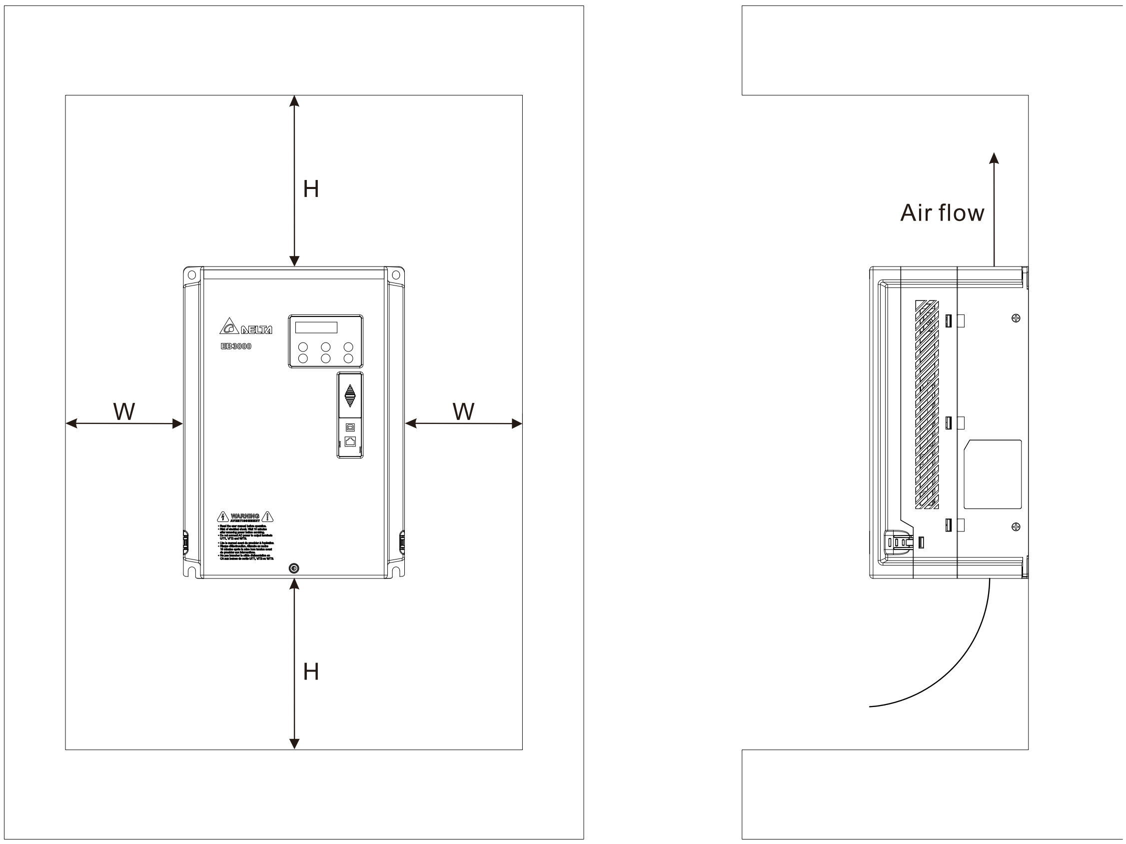


Figure 2-4

Minimum mounting clearance

Frame	Capacity	Model No.	W (Width) mm	H (Height) mm
A	3.0–10.0 HP (2.2–7.5 kW)	VFD022ED21B/BE, VFD037ED21B/BE, VFD040ED43B/BE, VFD055ED43B/BE, VFD075ED43B/BE	10	120
B	15–25 HP (11–18.5 kW)	VFD110ED43B/BE, VFD150ED43B/BE, VFD185ED43B/BE	10	120

Table 2-5

NOTE:

The minimum mounting clearances stated in Table 2-2 apply to AC motor drives frame A and B. Failure to follow the minimum mounting clearances may cause the motor drive fan to malfunction and cause heat dissipation problems.

2-3 Airflow and Power Dissipation

Model No.	Airflow Rate for Cooling						Power Dissipation for AC Motor Drive		
	Flow Rate (cfm)			Flow Rate (m^3/hr)			Power Dissipation (W)		
	External	Internal	Total	External	Internal	Total	Loss External (Heat Sink)	Internal	Total
VFD022ED21B	31.6	-	31.6	53.6	-	53.6	81	111	193
VFD022ED21BE	31.6	-	31.6	53.6	-	53.6	81	112	193
VFD037ED21B	40.6	-	40.6	69.0	-	69.0	138	186	324
VFD037ED21BE	40.6	-	40.6	69.0	-	69.0	146	181	326
VFD040ED43B	36.6	-	36.6	62.2	-	62.2	143	32	175
VFD040ED43BE	36.6	-	36.6	62.2	-	62.2	143	33	176
VFD055ED43B	36.6	-	36.6	62.2	-	62.2	185	56	241
VFD055ED43BE	36.6	-	36.6	62.2	-	62.2	185	58	242
VFD075ED43B	40.6	-	40.6	69.0	-	69.0	204	125	328
VFD075ED43BE	40.6	-	40.6	69.0	-	69.0	217	113	331
VFD110ED43B	61.4	-	61.4	104.4	-	104.4	323	158	481
VFD110ED43BE	61.4	-	61.4	104.4	-	104.4	323	159	482
VFD150ED43B	61.4	-	61.4	104.4	-	104.4	441	215	656
VFD150ED43BE	61.4	-	61.4	104.4	-	104.4	446	219	665
VFD185ED43B	61.4	-	61.4	104.4	-	104.4	519	290	809

Table 2-6

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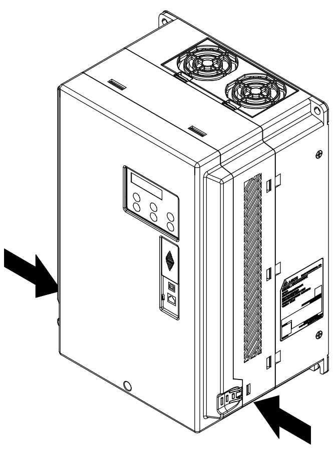
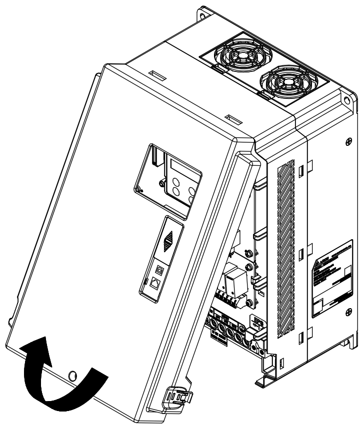
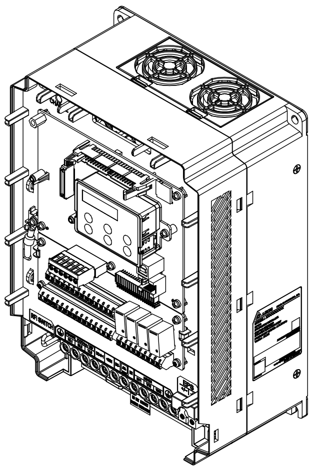
Chapter 3 Option Cards

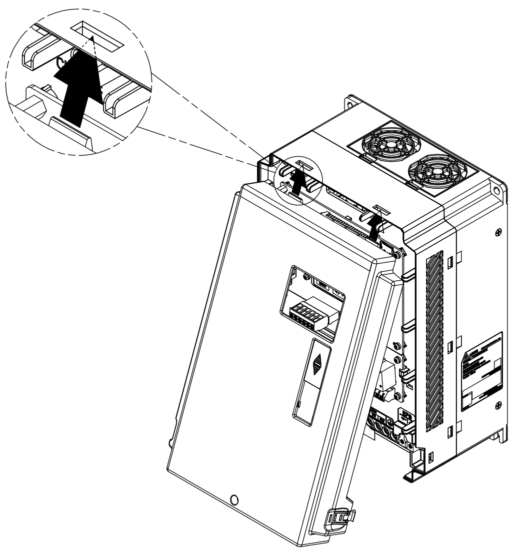
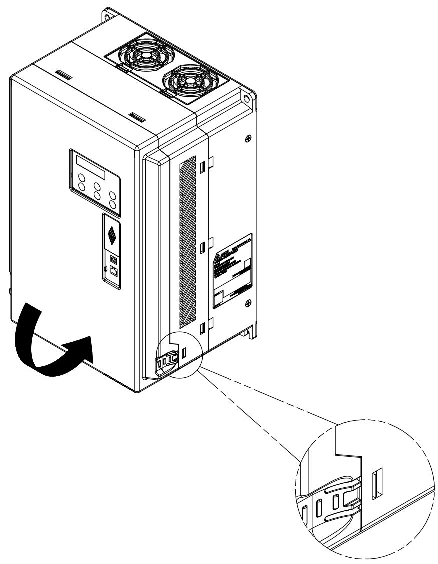
Select the applicable option cards for your drive or contact your local distributor for suggestions. To prevent damage to the motor drive during installation, remove the digital keypad and the cover before wiring. Refer to the following instructions. Note that the option cards do not support hot swapping. Turn off the drive power before installing or removing the option cards.

3-1 Option Card Installation

3-1-1 Detach and Attach the Top Cover

1. Press the snaps on both sides of the top cover.
2. Detach the top cover by rotating it with the direction as the figure in step 2 below shows.
3. Install the option card after detaching the top cover.
4. After installing the option card, attach the top cover and make sure the upper hooks of top cover have already plugged into the upper grooves of middle case.
5. Rotate the top cover in an opposite direction and attach until the snaps engage the grooves of middle case with a click.

Step 1: Press the snaps of top cover	Step 2: Detach the top cover	Step 3: Install the option card
 Figure 3-1	 Figure 3-2	 Figure 3-3

Step 4: Attach the top cover	Step 5: Make the snaps engaged
 Figure 3-4	 Figure 3-5

3-1-2 Option Card Installation Position and Instruction

EMEB-PGAB-1

EMEB-PGABD-1

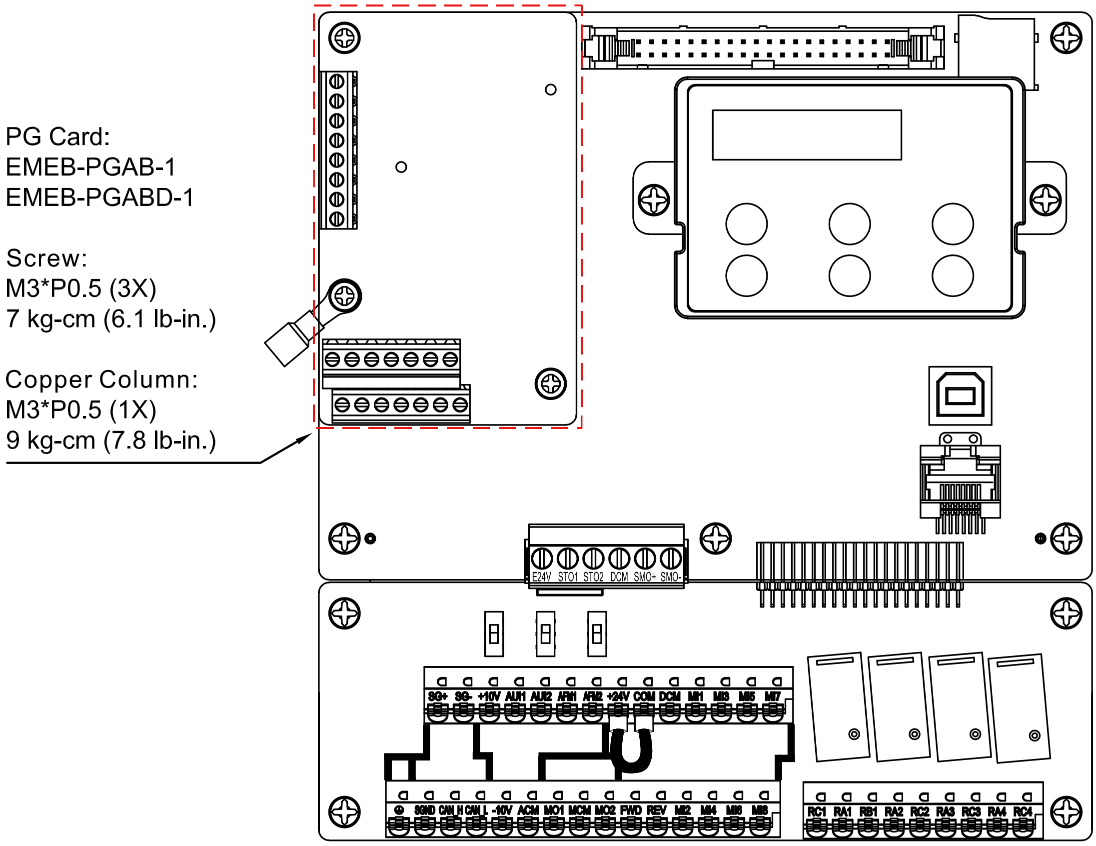


Figure 3-6

Install the PG card according to the following steps.

Step 1: Align positioning holes

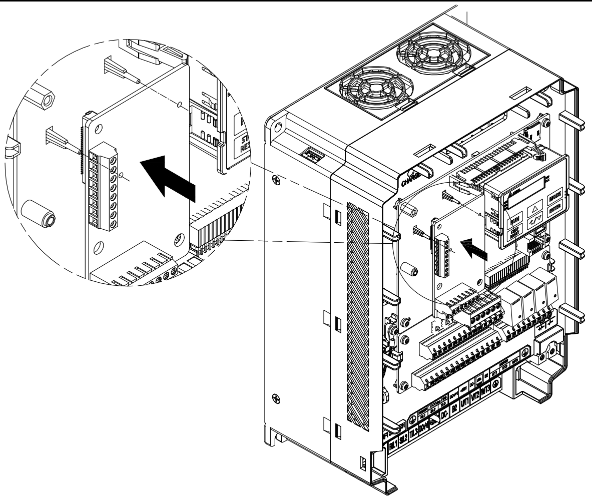


Figure 3-7

Align two positioning holes of the PG card with the positioning columns of middle case, and then vertically press down the PG card to the PCB surface.

Step 2: Tighten the copper column

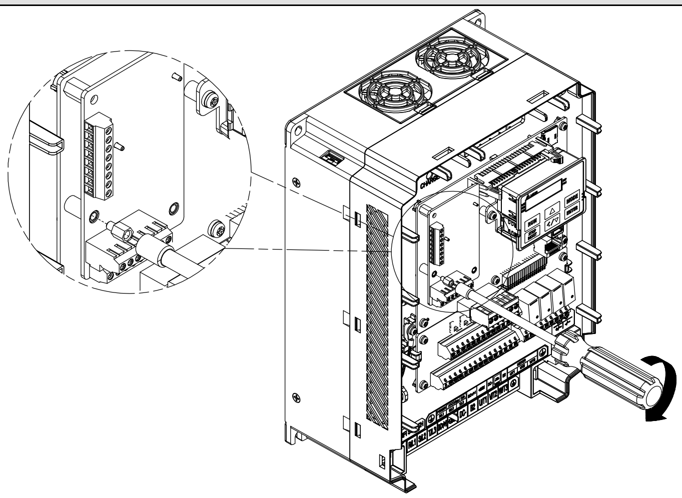


Figure 3-8

Tighten the M3 copper column that are enclosed with accessory packages using a screwdriver with a torque of 8–10 kg-cm to prevent the grounding wire from short-circuiting peripheral components.

Step 3: Tighten the ring lung or tighten the metal braid to the copper column

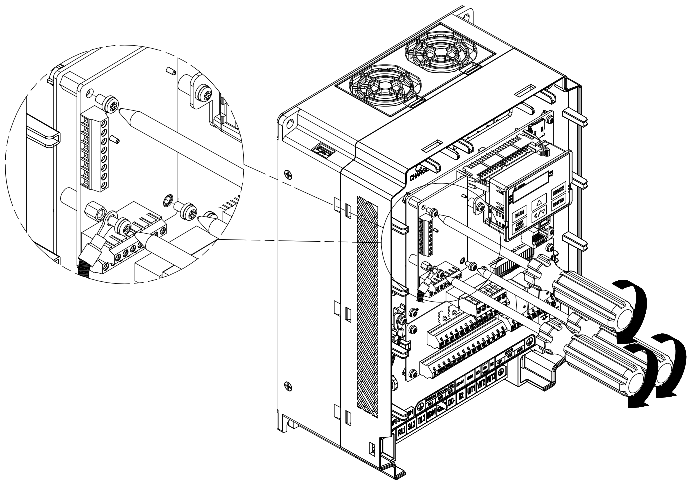


Figure 3-9

Crimp the metal braid of shielding wire to the enclosed ring lung, and then tighten the ring lung with a M3 screw and a torque of 6–8 kg-cm to the copper column as described in step 2. Or simply tighten the metal braid with the screw to the copper columns without crimping. Then, tighten the other two enclosed M3 screws with a torque of 6–8 kg-cm, and the installation is completed.

EMEB-PGSED-x

EMEB-PGHH-1

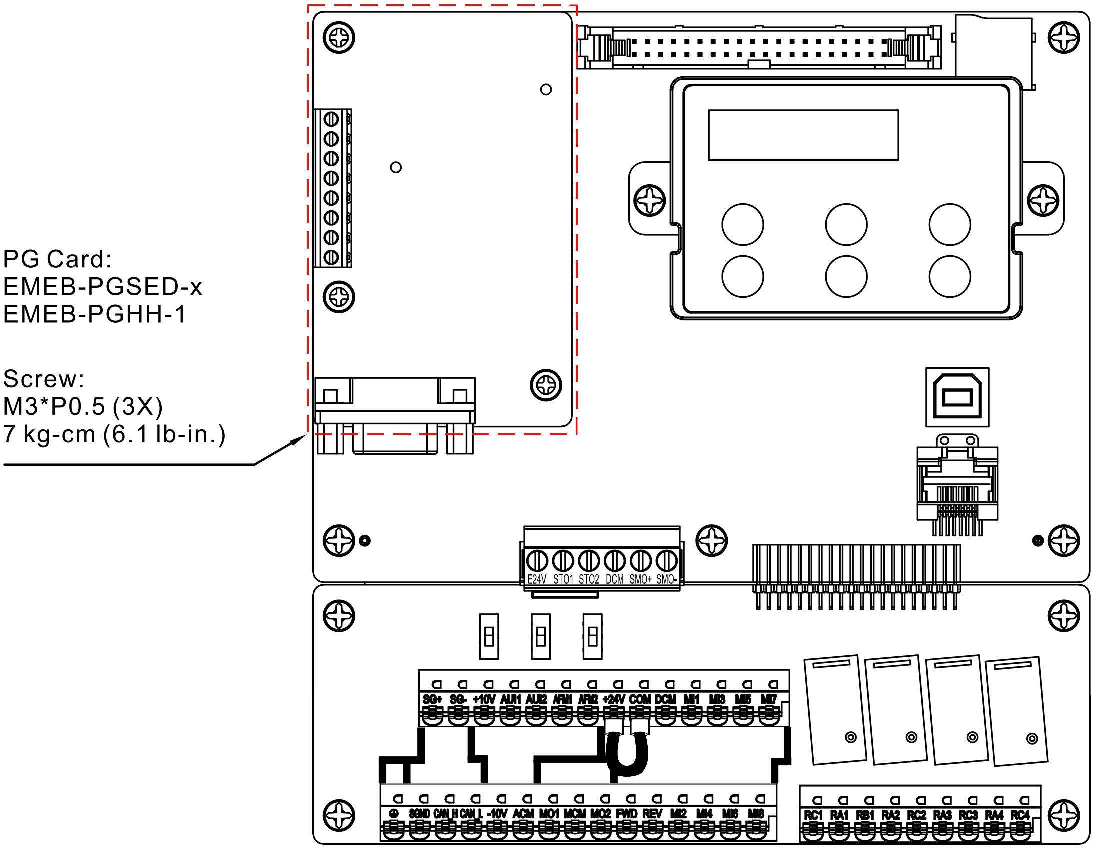
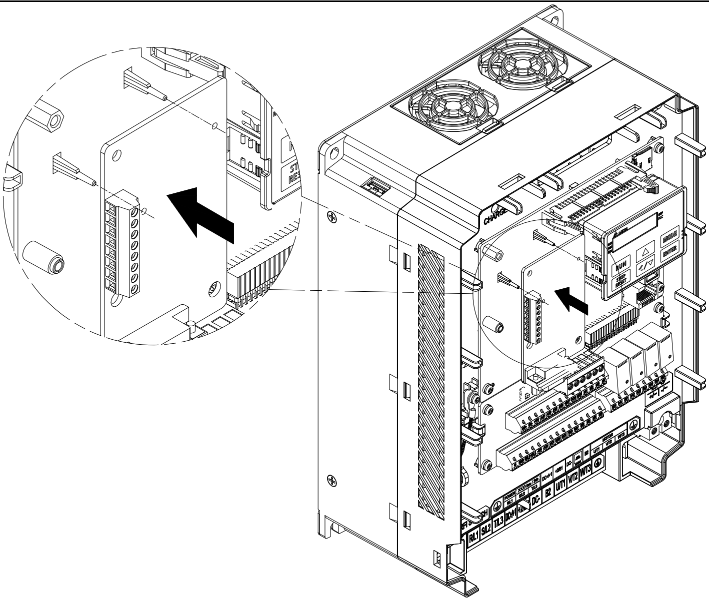
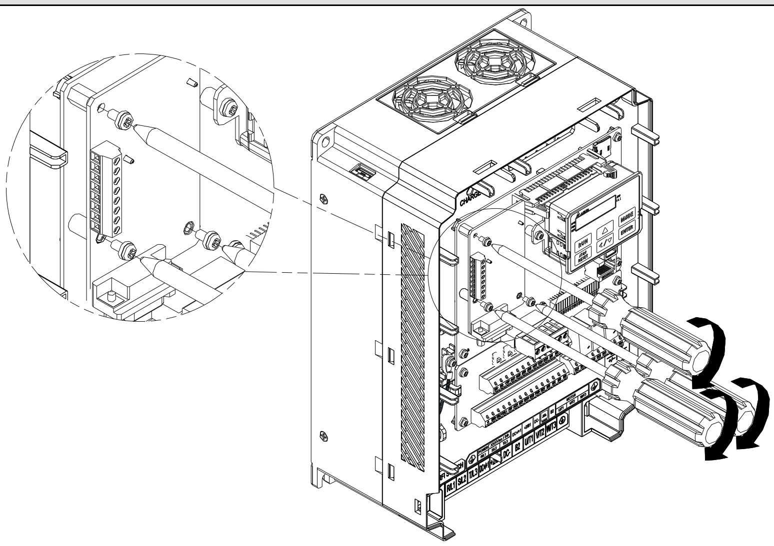


Figure 3-10

Install the PG card according to the following steps.

Step 1: Align positioning holes	
 Figure 3-11	Align two positioning holes of the PG card with the positioning columns of middle case, and then vertically press down the PG card to the PCB surface.
Step 2: Tighten the screws	
 Figure 3-12	Tighten the three M3 screws that are enclosed with accessory packages using a screwdriver with a torque of 6–8 kg-cm. Then, the installation of PG card is completed.

3-2 EMEB-PGHH-1

3-2-1 Product Profile

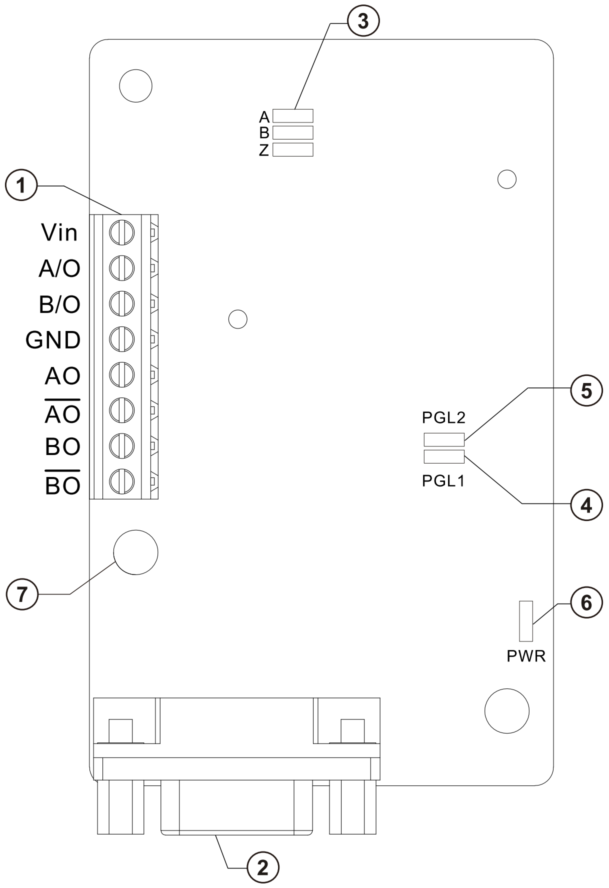


Figure 3-13

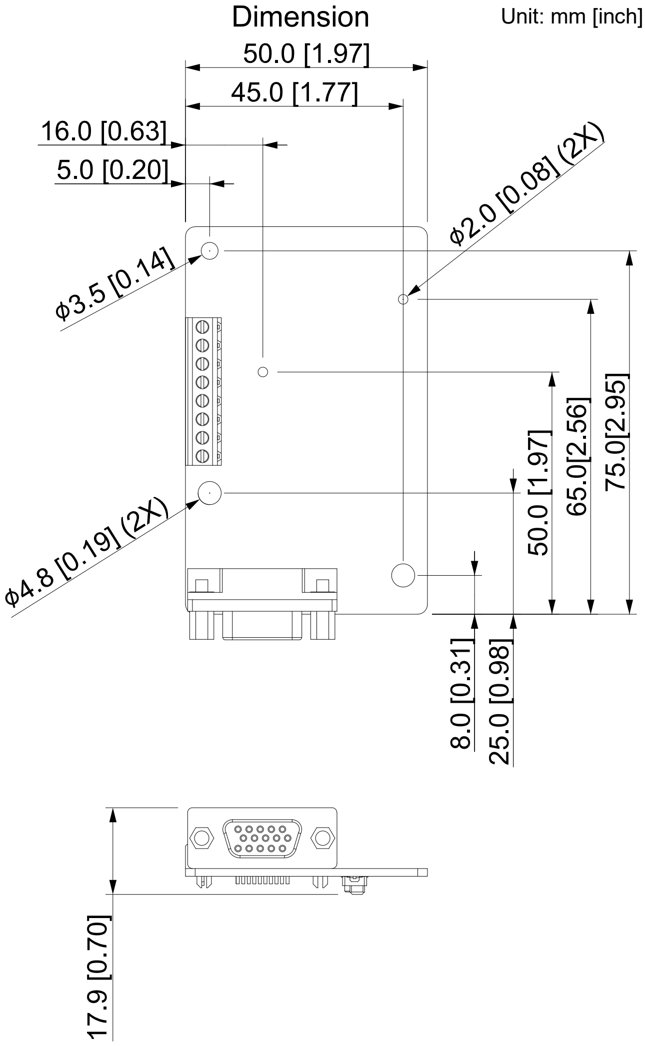


Figure 3-14

NOTE:

1. Applicable encoder: SIN/COS Absolute Encoders
2. Screw specification:

Wire Gauge	0.2–1.5 mm² (30–16 AWG)
Torque	2.0 kg-cm (1.74 Ib-in.)

Table 3-1

	Terminal Name	Description
①	TB1	Terminal block
②	J2	D-SUB connector
	LED Indicator	Function Description
③	A / B / Z	A / B / R signal indicator
④	PGL1	A / B signal abnormality
⑤	PGL2	C / D signal abnormality
⑥	PWR	Encoder power supply
⑦	⏚	Ground Terminal

Table 3-2

3-2-2 Terminal Function

Terminals		Descriptions
TB1	Vin	No function
	A/O, B/O	Open collector pulse output signal Maximum output frequency: 100 kHz
	GND	Common power input/signal output terminal
	AO, $\overline{AO}$, BO, $\overline{BO}$	Output signal for the line driver frequency division. Line Driver RS422 Maximum output frequency:100 kHz
J2	(D-SUB Connector)	Supported encoders: SinCos: Heidenhain ERN1387
⏚	Ground terminal Connect the motor drive power supply to ground. Supports PG shielding.	

Table 3-3

EMEB-PGHH-1 (Terminal J2) Pin Definition Using Encoder Heidenhain ERN1387

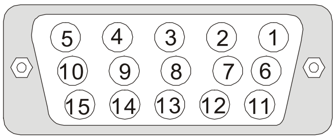
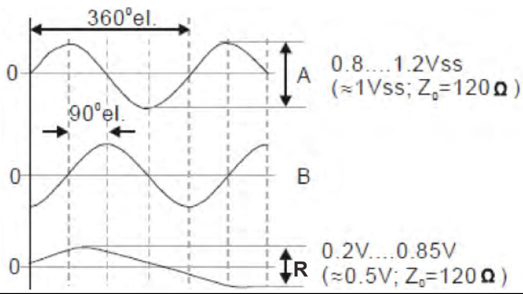
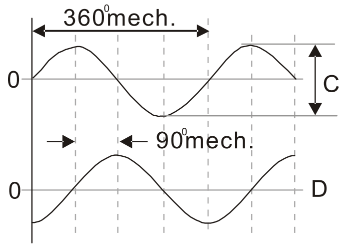
Terminal		Encoder		
J2	No.	Heidenhain ERN1387	No.	Heidenhain ERN1387
 Figure 3-15	①	B-	⑨	Up
	②	-	⑩	C-
	③	R+	⑪	C+
	④	R-	⑫	D+
	⑤	A+	⑬	D-
	⑥	A-	⑭	-
	⑦	0V	⑮	-
	⑧	B+		

Table 3-4

Terminal Function

Terminals		Descriptions	Specifications
J2	Up (VP)	Output is fixed at 5V	Voltage: +5.1 V_{DC} ± 0.3 V Current: 200 mA max.
	0V	Encoder common power terminal	Reference level for the encoder's power.
	A+, A-, B+, B-, R+, R-	Encoder sine wave differential signal input (incremental signal)	Input frequency: 100 kHz max. 

Terminals		Descriptions	Specifications
	C+, C-, D+, D-	Encoder sine wave differential signal input (absolute signal)	 0.8….1.2Vss (≈1Vss; Z_0=1kΩ)

NOTE: Keep the motor drive wiring away from any high voltage lines to avoid interference. Table 3-5

3-2-3 Wiring

☑ To prevent the PG card signal being interfered by electromagnetic interference, refer to the following recommended methods:

1. Use isolated shielded cables to effectively prevent external electromagnetic interference from entering the signal wire.
2. Do not wire in parallel with a circuit voltage above 200 V_{AC}, and keep a distance from circuits with voltage above 200 V_{AC} to reduce electromagnetic interference. If the wiring space is limited, wire in vertical direction to reduce interference.
3. Put the signal wire into an isolation tube and ensure that the isolation tube is placed inside the AC motor drive to provide good shielding effect.
4. Winding a magnetic ring around the signal wire can effectively reduce high-frequency interference and improve the signal stability.

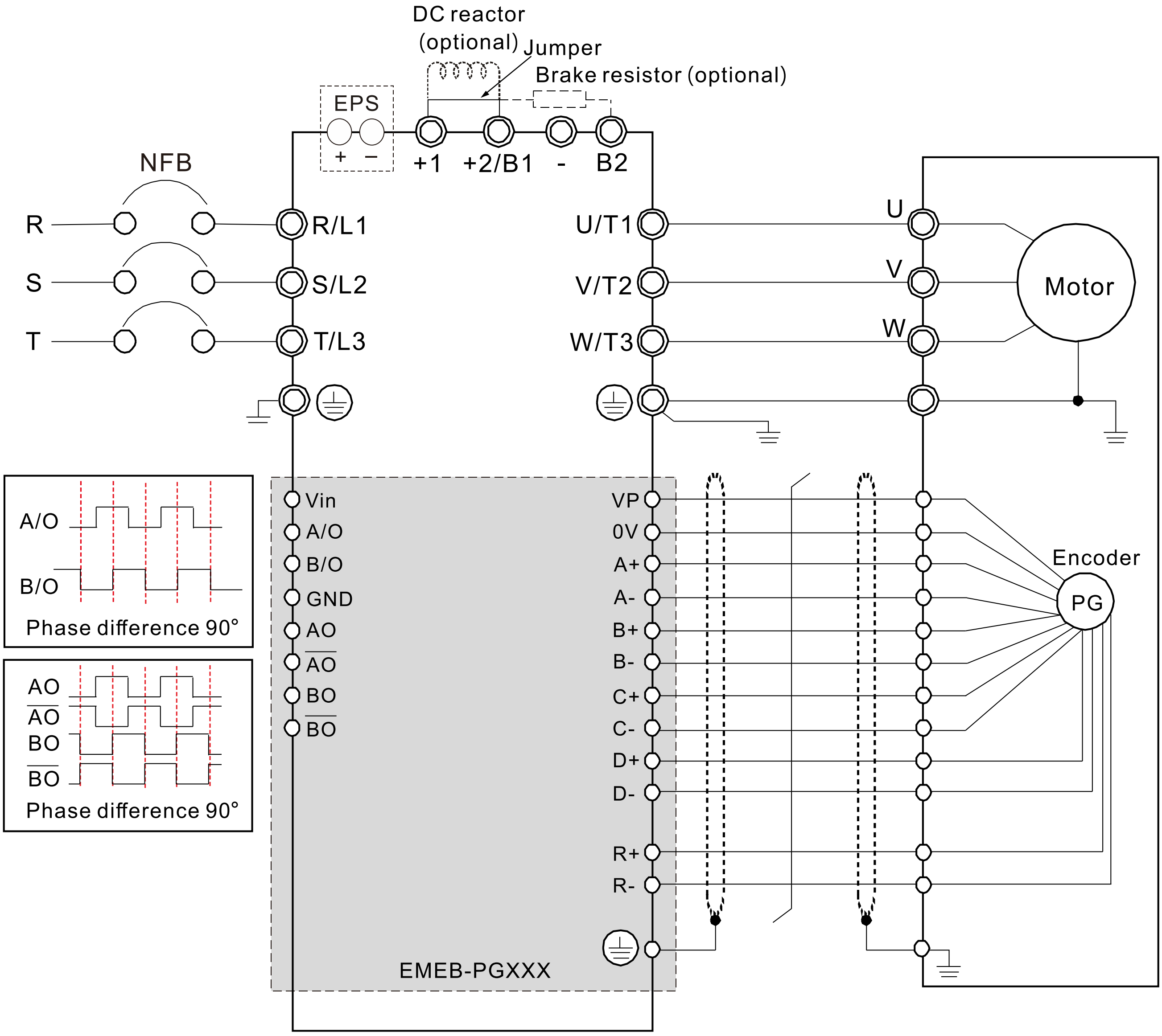


Figure 3-16

3-2-4 Frequency Division Signal Setting

The frequency division ration for EMEB-PGHH-1 is 1:1. Thus the output signal of AO-$\overline{\text{AO}}$ is equal to the signal of the PG card that A- / A inputs, and the output signal of BO-$\overline{\text{BO}}$ is equal to the signal of PG card that B-/B inputs. SIN/COS is only converted into square-wave signal.

3-2-5 Wiring of Frequency Division Output

Open Collector Frequency Division (either external or internal power supply)

5 V	Suggested pull-up resistor: above 150–520 ohm, 1/2 W
12 V	Suggested pull-up resistor: above 600–2K ohm, 1/2 W
24 V	Suggested pull-up resistor: above 2.2K–4.7K ohm, 1/2 W

Table 3-6

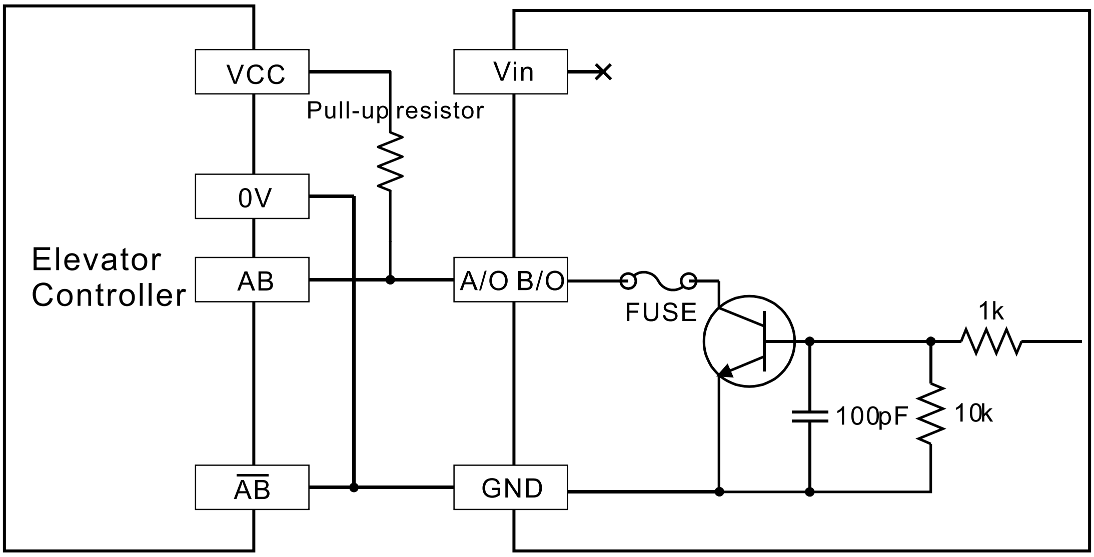


Figure 3-17

Line Driver Frequency Division (internal power supply)

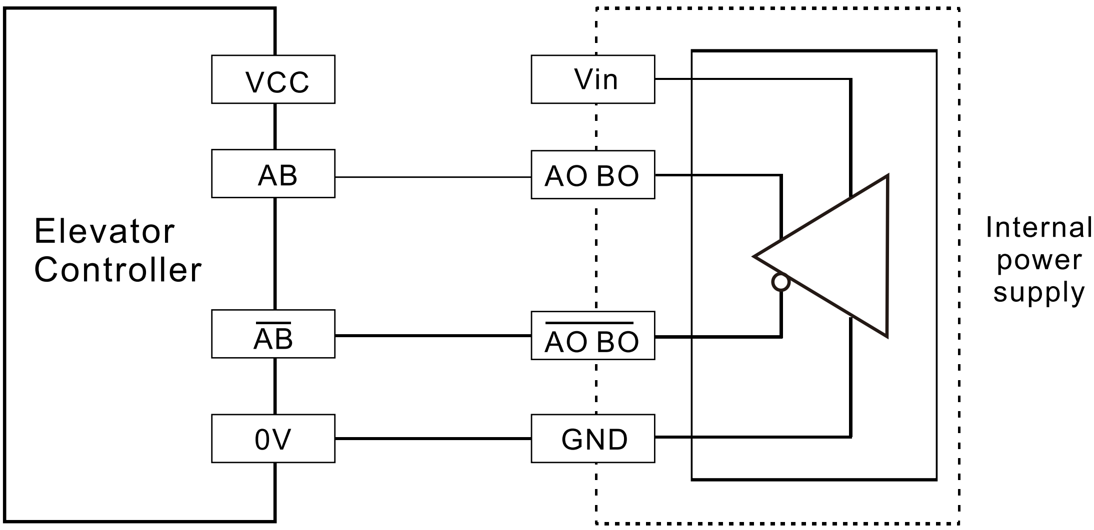


Figure 3-18

3-3 EMEB-PGAB-1

3-3-1 Product Profile

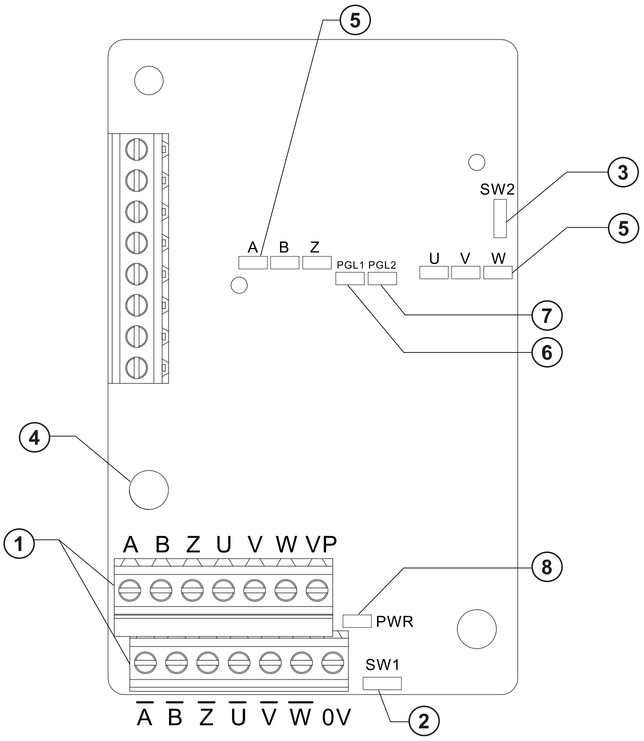


Figure 3-19

Dimension Unit: mm [inch]

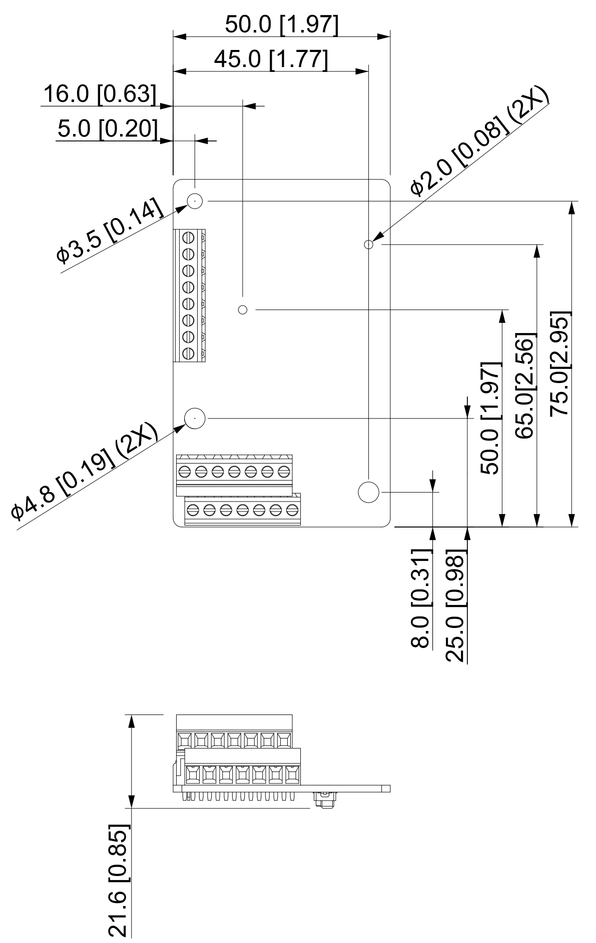


Figure 3-20

NOTE:

1. Applicable encoder: A/B/Z and U/V/W Absolute Encoders
2. Screw specification:

Wire Gauge	0.2–1.5 mm^2 (30–16 AWG)
Torque	2.0 kg-cm (1.74 Ib-in.)

Table 3-7

	Terminal Name	Description
①	TB1	Terminal block
②	SW1	Switch 1
③	SW2	Switch 2
④	⏚	Ground terminal
	LED Indicator	Function Description
⑤	A/B/Z/U/V/W	A/B/Z/U/V/W signal indicator
⑥	PGL1	A/B/Z signal abnormality
⑦	PGL2	U/V/W signal abnormality
⑧	PWR	Encoder power supply

Table 3-8

3-3-2 Terminal Function

Terminals		Descriptions
TB1	VP	Power output for encoder Use SW1 to set output voltage amplitude Voltage: +5 V ± 0.5 V or 12 V ± 1 V Current: 200 mA max.
	0V	Common power terminal for encoder
	A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	Incremental-type encoder signal input terminal Types of input signal: line driver, voltage, push-pull, open collector **NOTE:** Different input signal requires different wiring methods. See following for wiring diagrams. Maximum input frequency: 150 kHz
	U, $\overline{U}$, V, $\overline{V}$, W, $\overline{W}$	Absolute-type encoder signal input terminal Types of input signal: line driver, voltage, push-pull, open collector **NOTE:** Different input signal requires different wiring methods. See following sections for wiring diagrams. Maximum input frequency: 150 kHz
⏚		Ground terminal Connect the motor drive power supply to ground. Supports PG shielding.
SW1		Switch between power for the encoder 5V / 12V
SW2		Offline Detection Switch. Switch to the Line-D side to enable offline detection for the Line-D input signal. Switch to OPEN-C side to disable offline detection function for the OPEN-C input signal.

Table 3-9

3-3-3 Applications for Different Output Encoders

1. Open collector output encoder application: Use one pull-up resistor for each set of input current 5–15 mA. If open collector input voltage uses 12V power, connect the encoder power externally. See the PG wiring Figure 3-22 below.

5 V	Suggested pull-up resistor: above 150–520 ohm, 1/2 W
12 V	Suggested pull-up resistor: above 600–2K ohm, 1/2 W

Table 3-10

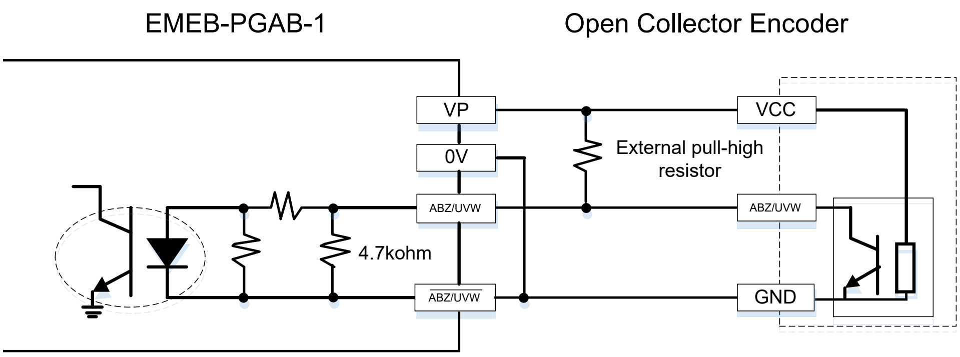


Figure 3-21

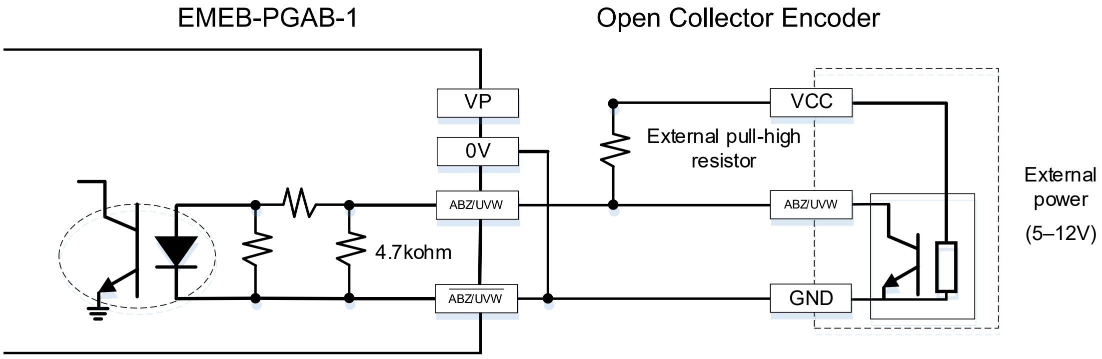


Figure 3-22

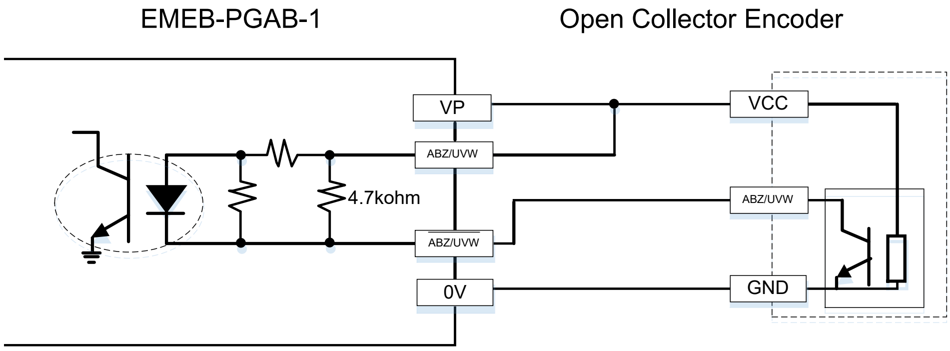


Figure 3-23

2. Voltage output encoder application: Each set of input current is 5–15 mA. If input voltage uses 12V power, connect the encoder power externally. See the PG wiring Figure 3-25 below.

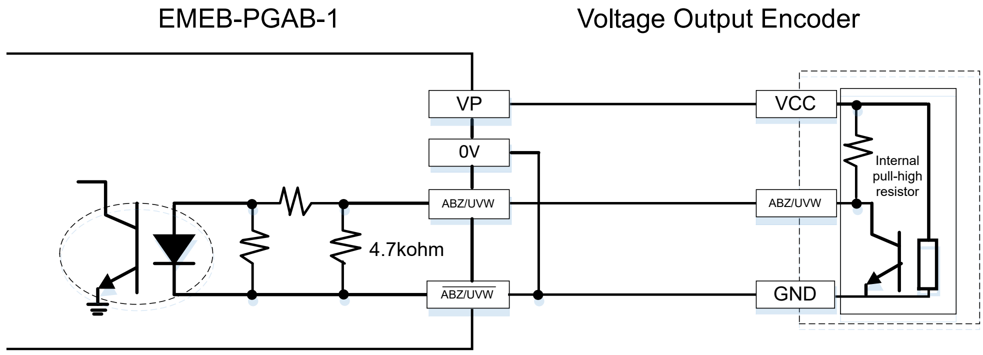


Figure 3-24

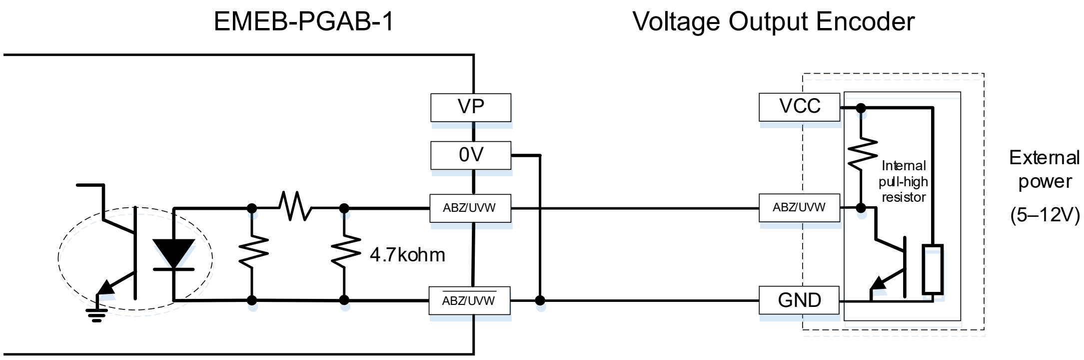


Figure 3-25

EMEB-PGAB-1 Voltage Output Encoder

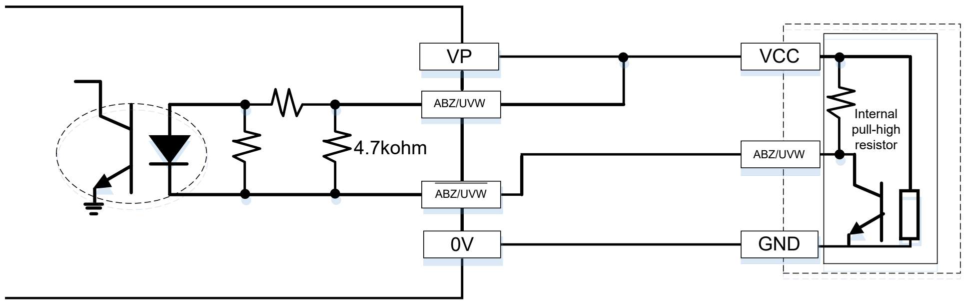


Figure 3-26

3. Push-pull output encoder application: Each set of input current is 5–15 mA. If input voltage uses 12V power, connect the encoder power externally. See the PG wiring Figure 3-28 below.

EMEB-PGAB-1 Push-pull Encoder

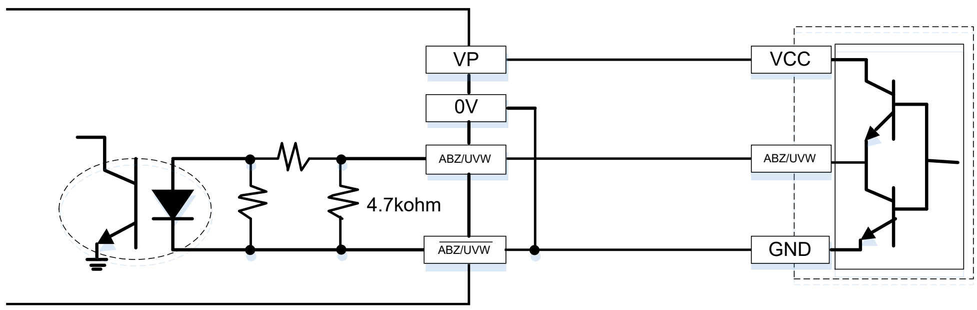


Figure 3-27

EMEB-PGAB-1 Push-pull Encoder

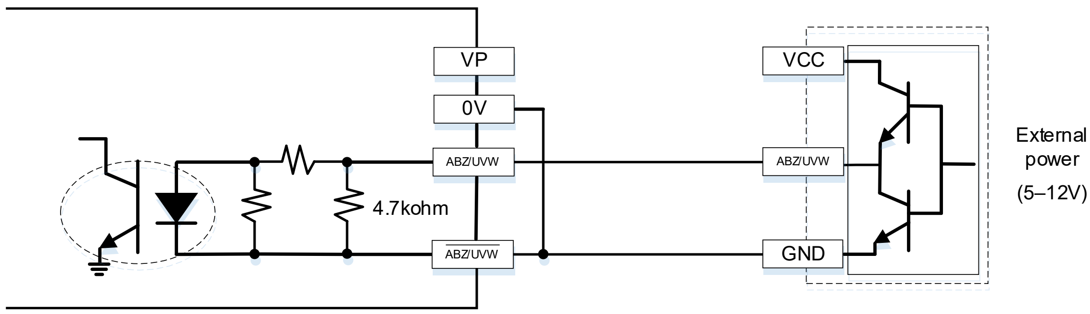


Figure 3-28

EMEB-PGAB-1 Push-pull Encoder

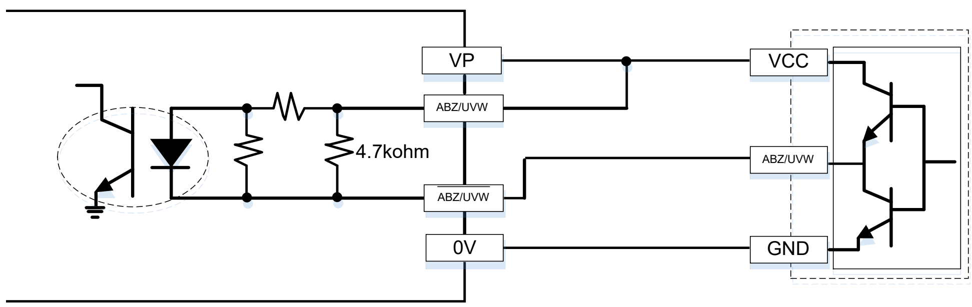


Figure 3-29

4. Line driver output encoder application: Each set of input current is 5–15 mA. If input voltage uses 12V power, connect the encoder power externally. See the PG wiring Figure 3-31 below.

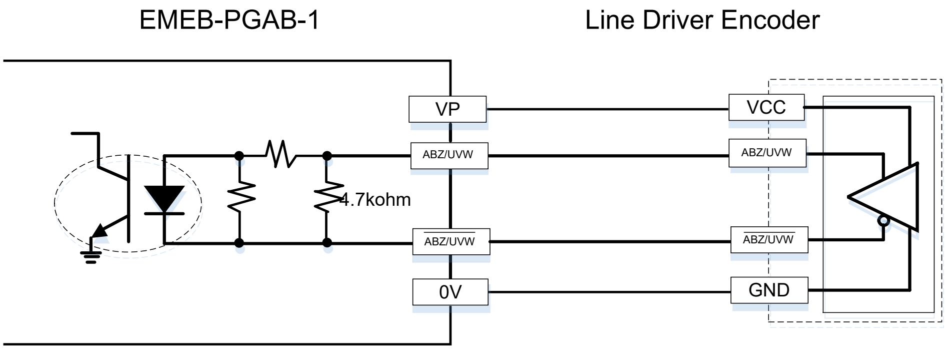


Figure 3-30

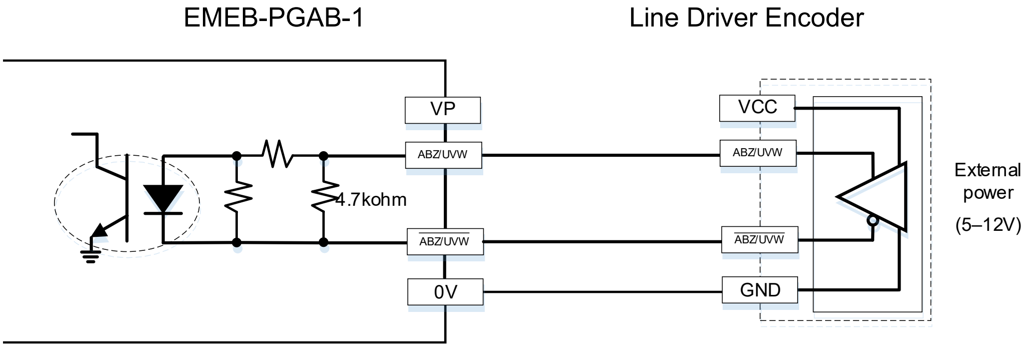


Figure 3-31

NOTE:

1. Verify that the SW1 is set to the correct output voltage before powering ON.
2. Keep the motor drive wiring away from any high voltage lines to avoid interference.

3-3-4 Wiring

☑ To prevent the PG card signal being interfered by electromagnetic interference, refer to the following recommended methods:

1. Use isolated shielded cables to effectively prevent external electromagnetic interference from entering the signal wire.
2. Do not wire in parallel with a circuit voltage above 200 V_{AC}, and keep a distance from circuits with voltage above 200 V_{AC} to reduce electromagnetic interference. If the wiring space is limited, wire in vertical direction to reduce interference.
3. Put the signal wire into an isolation tube and ensure that the isolation tube is placed inside the AC motor drive to provide good shielding effect.
4. Winding a magnetic ring around the signal wire can effectively reduce high-frequency interference and improve the signal stability.

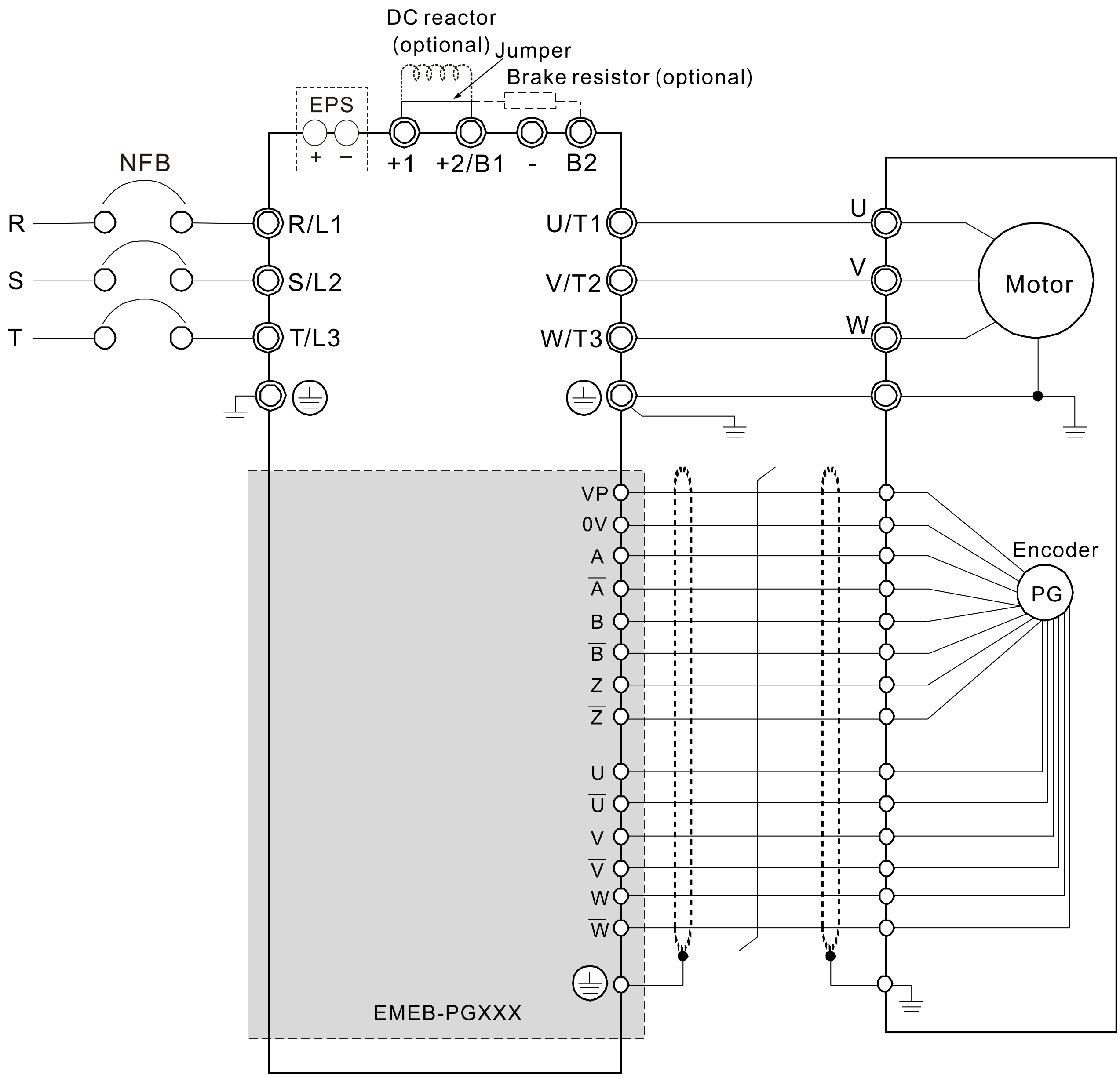


Figure 3-32

3-4 EMEB-PGABD-1

3-4-1 Product Profile

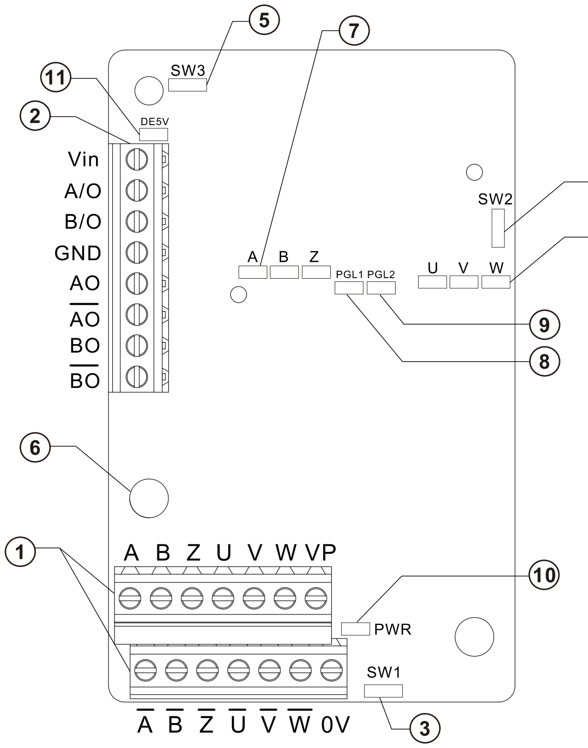


Figure 3-33

Dimension Unit: mm [inch]

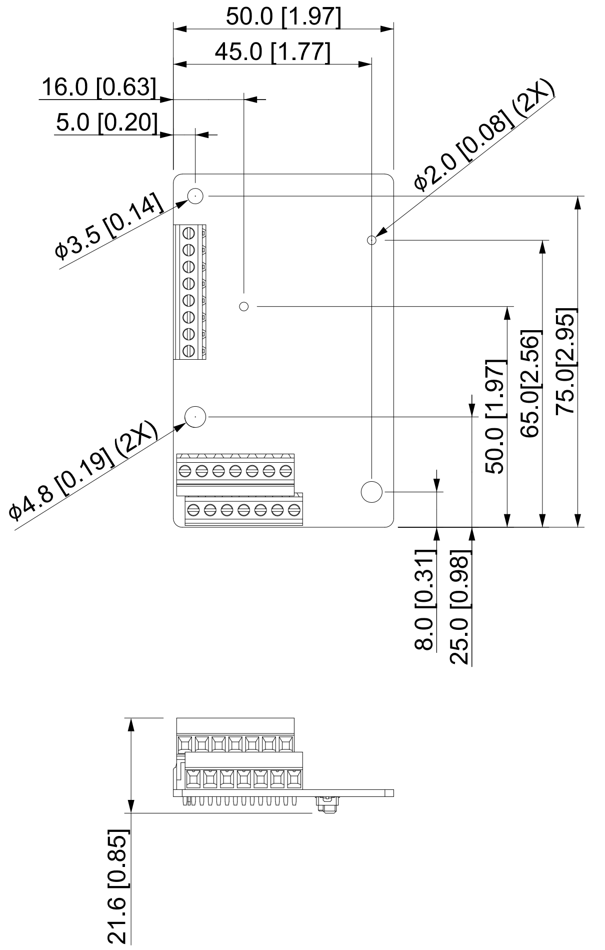


Figure 3-34

NOTE:

1. Applicable encoder: A/B/Z and U/V/W Absolute Encoders
2. Screw specification:

Wire Gauge	0.2–1.5 mm^2 (30–16 AWG)
Torque	2.0 kg-cm (1.74 Ib-in.)

Table 3-11

	Terminal Name	Description
①	TB1	Terminal block
②	TB2	Terminal block
③	SW1	Switch 1
④	SW2	Switch 2
⑤	SW3	Switch 3
⑥	⏚	Ground terminal
	LED Indicator	**Function Description**
⑦	A/B/Z/U/V/W	A/B/Z/U/V/W signal indicator
⑧	PGL1	A/B/Z signal abnormality
⑨	PGL2	U/V/W signal abnormality
⑩	PWR	Encoder power supply
⑪	DE5V	Frequency division supply

Table 3-12

3-4-2 Terminal Function

Terminals		Descriptions
TB2	Vin	Voltage input, to adjust the amplitude of output voltage at terminal A/O and terminal B/O. It also provides a 5 V voltage to support line driver's signal. Vin voltage range: 8–24 V, Maximum: 24 V.
TB2	A/O, B/O	Output signal for the push-pull voltage frequency division. Default: Output amplitude is about +24 V. Use SW3 to disable the internal default power. Required input power through Vin-GND port (i.e. output voltage's amplitude) Vin voltage range: 8–24 V, Maximum: 24 V. Push-Pull Voltage Output Maximum output frequency: 150 kHz Supports frequency division output, the frequency division range: 1–255.
TB2	GND	Common ground terminal connecting to the host controller and the motor drive.
TB2	AO, $\overline{AO}$, BO, $\overline{BO}$	Output signal for the line driver frequency division. Line Driver RS422 Max. output frequency: 150 kHz Supports frequency division output, the frequency division range: 1–255.
TB1	VP	Power output for encoder Use SW1 to set output voltage amplitude Voltage: +5 V ± 0.5 V or 12 V ± 1 V Current: 200 mA max.
TB1	0V	Common power terminal for encoder
TB1	A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	Incremental encoder signal input (line driver, voltage, push-pull, open-collector) Different input signal requires different wiring methods. See following sections for wiring diagrams. Maximum input frequency: 150 kHz
TB1	U, $\overline{U}$, V, $\overline{V}$, W, $\overline{W}$	Absolute encoder signal input (line driver, voltage, push-pull, open collector) Different input signal requires different wiring methods. See following sections for wiring diagrams. Maximum input frequency: 150 kHz
⏚		Ground terminal Connect the motor drive power supply to ground. Supports PG shielding.
SW1		Switch between power for the encoder 5V / 12V
SW2		Offline Detection Switch. Switch to the Line-D side to enable offline detection for the Line-D input signal. Switch to OPEN-C side to disable offline detection function for the OPEN-C input signal.

Terminals	Descriptions
SW3	Power supply switch for frequency division. Switch to INP to provide 24V power for internal use. Switch to EXP to provide 24V power for external use (client).

Table 3-13

3-4-3 Applications for Different Output Encoders

1. Open collector output encoder application: Use one pull-up resistor for each set of input current 5–15 mA. If open collector input voltage uses 12V power, connect the encoder power externally. See the PG wiring Figure 3-36 below.

5 V	Suggested pull-up resistor: above 150–520 ohm, 1/2 W
12 V	Suggested pull-up resistor: above 600–2K ohm, 1/2 W

Table 3-14

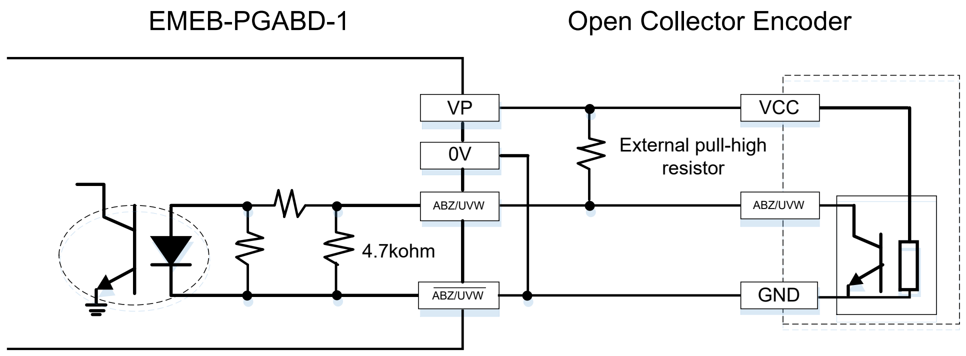


Figure 3-35

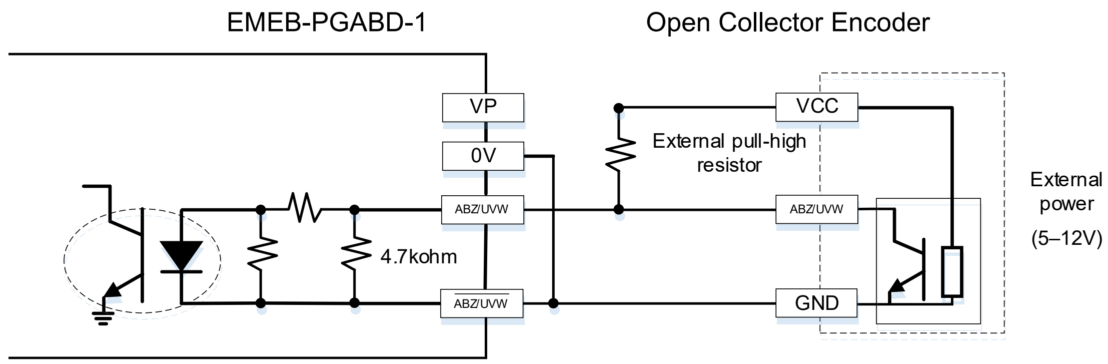


Figure 3-36

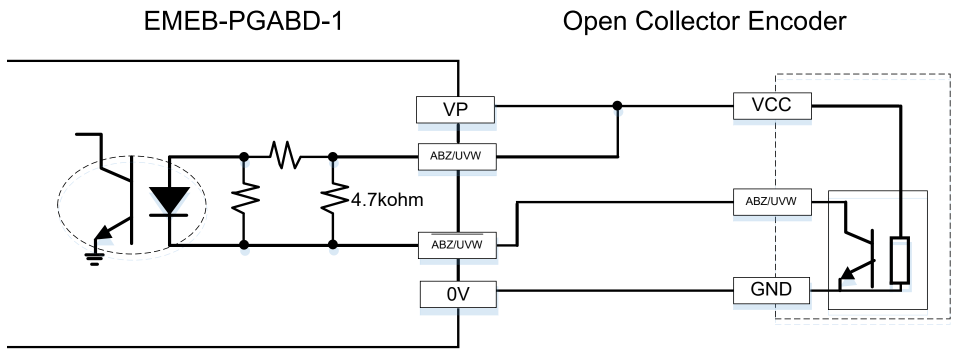


Figure 3-37

2. Voltage output encoder application: Each set of input current is 5–15 mA. If input voltage uses 12V power, connect the encoder power externally. See the PG wiring Figure 3-39 below.

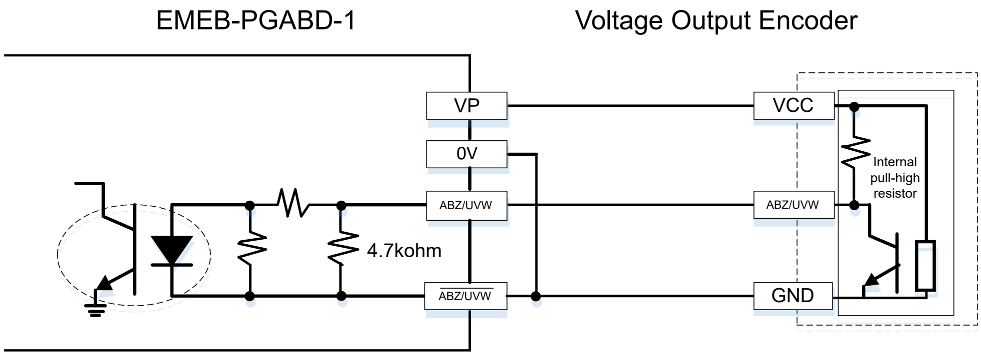


Figure 3-38

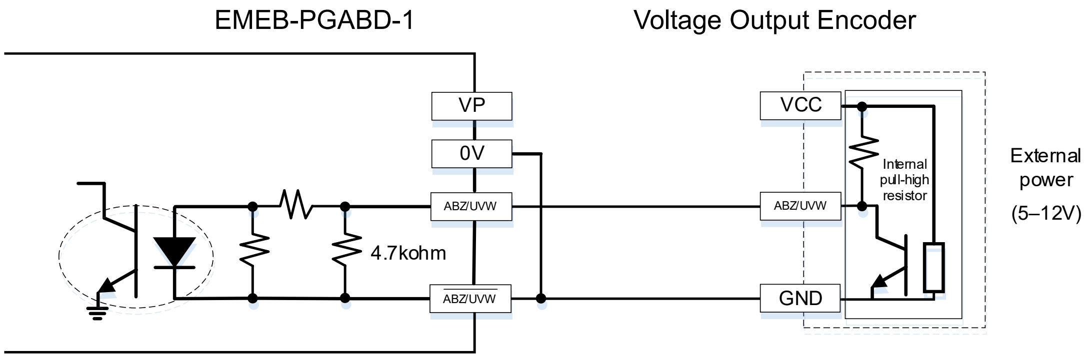


Figure 3-39

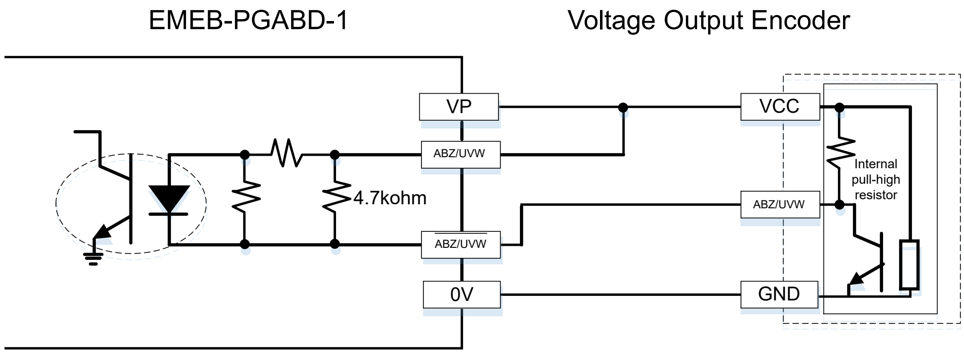


Figure 3-40

3. Push-pull output encoder application: Each set of input current is 5–15 mA. If input voltage uses 12V power, connect the encoder power externally. See the PG wiring Figure 3-42 below.

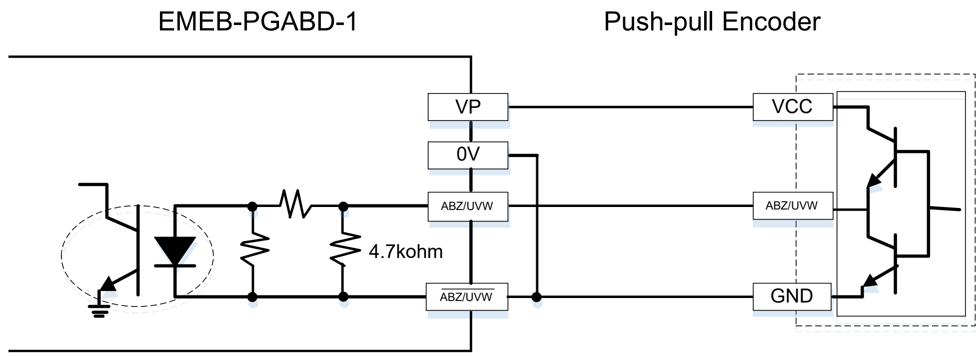


Figure 3-41

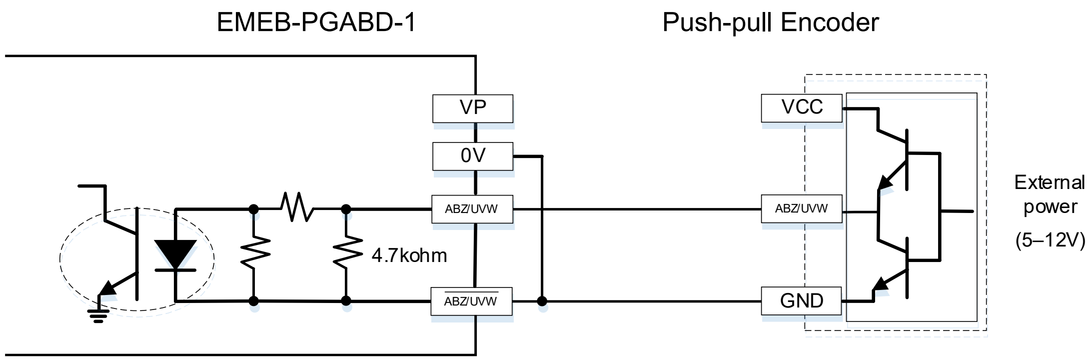


Figure 3-42

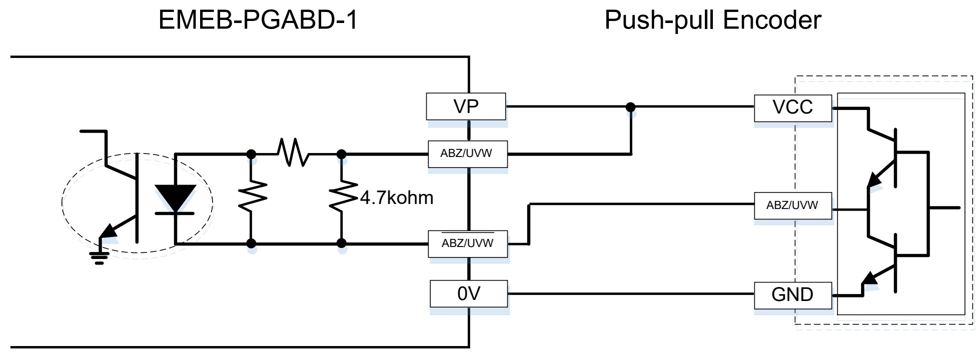


Figure 3-43

4. Line driver output encoder application: Each set of input current is 5–15 mA. If input voltage uses 12V power, connect the encoder power externally. See the PG wiring Figure 3-45 below.

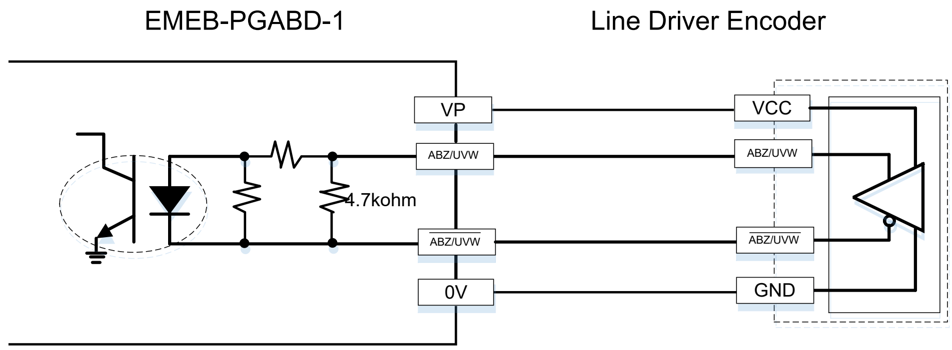


Figure 3-44

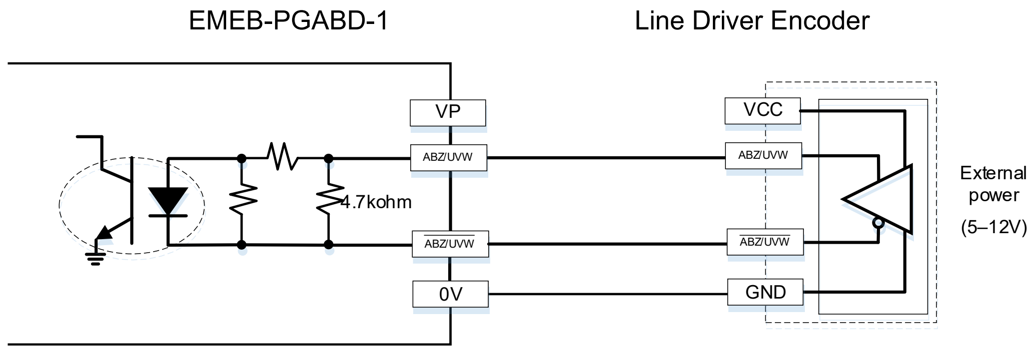


Figure 3-45

NOTE:

1. Verify that the SW1 is set to the correct output voltage before powering ON.
2. Keep the motor drive wiring away from any high voltage lines to avoid interference.

3-4-4 Wiring

☑ To prevent the PG card signal being interfered by electromagnetic interference, refer to the following recommended methods:

1. Use isolated shielded cables to effectively prevent external electromagnetic interference from entering the signal wire.
2. Do not wire in parallel with a circuit voltage above 200 V_{AC}, and keep a distance from circuits with voltage above 200 V_{AC} to reduce electromagnetic interference. If the wiring space is limited, wire in vertical direction to reduce interference.
3. Put the signal wire into an isolation tube and ensure that the isolation tube is placed inside the AC motor drive to provide good shielding effect.
4. Winding a magnetic ring around the signal wire can effectively reduce high-frequency interference and improve the signal stability.

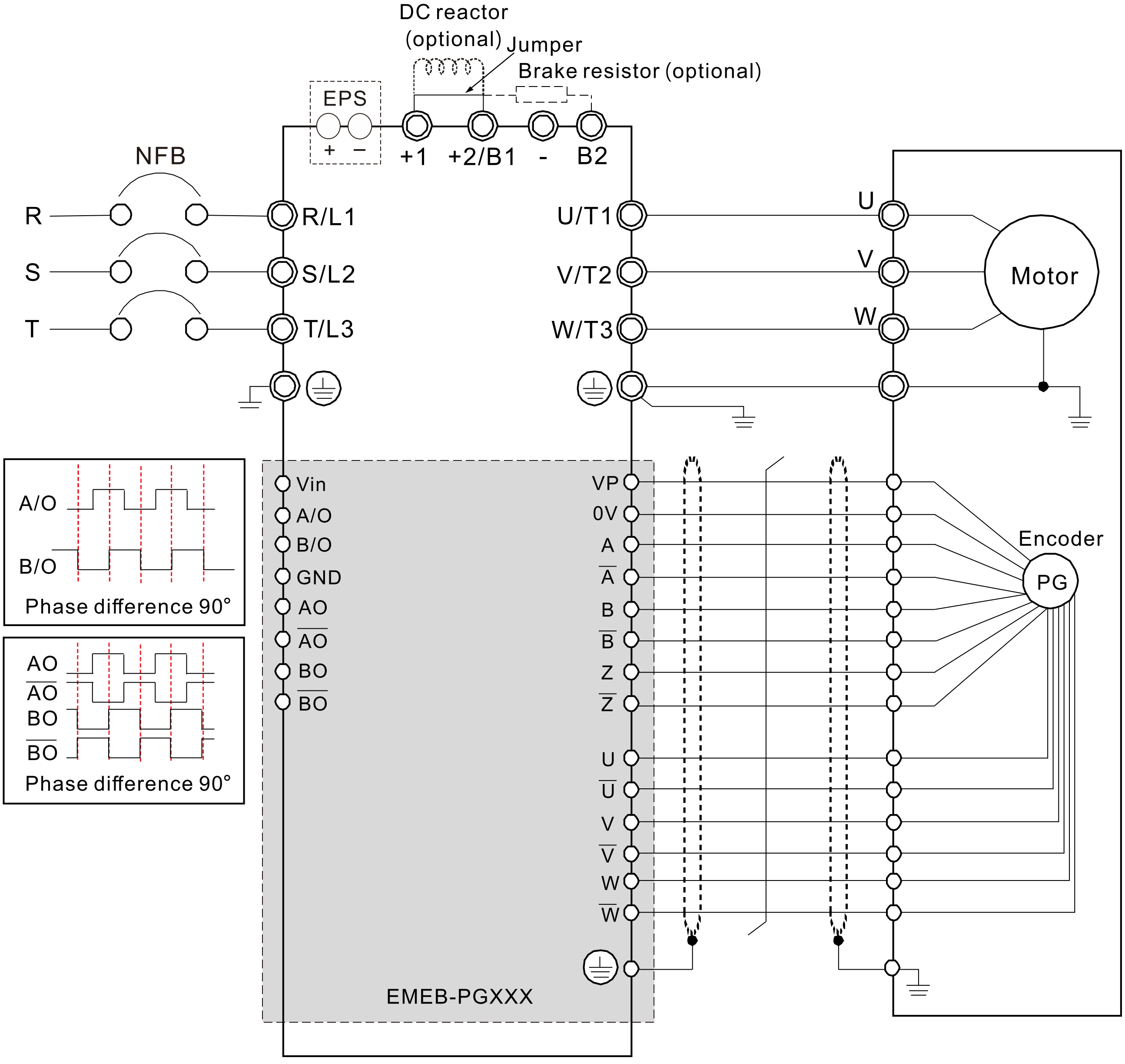


Figure 3-46

3-4-5 Frequency Division Signal Setting

1. After the encoder inputs a PULSE signal, there is an output signal by the division factor “n” Set the value in Pr.00-24 (PG Card Frequency Division Output).
2. Set Pr.00-24 (PG Card Frequency Division Output):
   The decimal frequency division output setting; range of the division factor “n”: 0–255.

3-4-6 Wiring of Frequency Division Output

Push-pull Frequency Division (internal power supply)

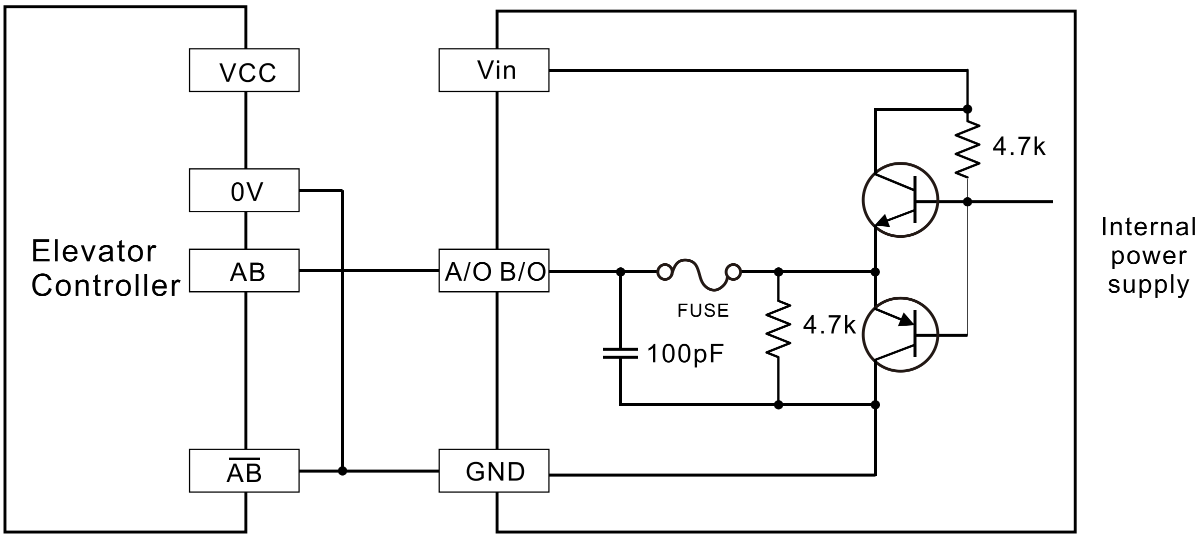


Figure 3-47

Push-pull Frequency Division (external power supply)

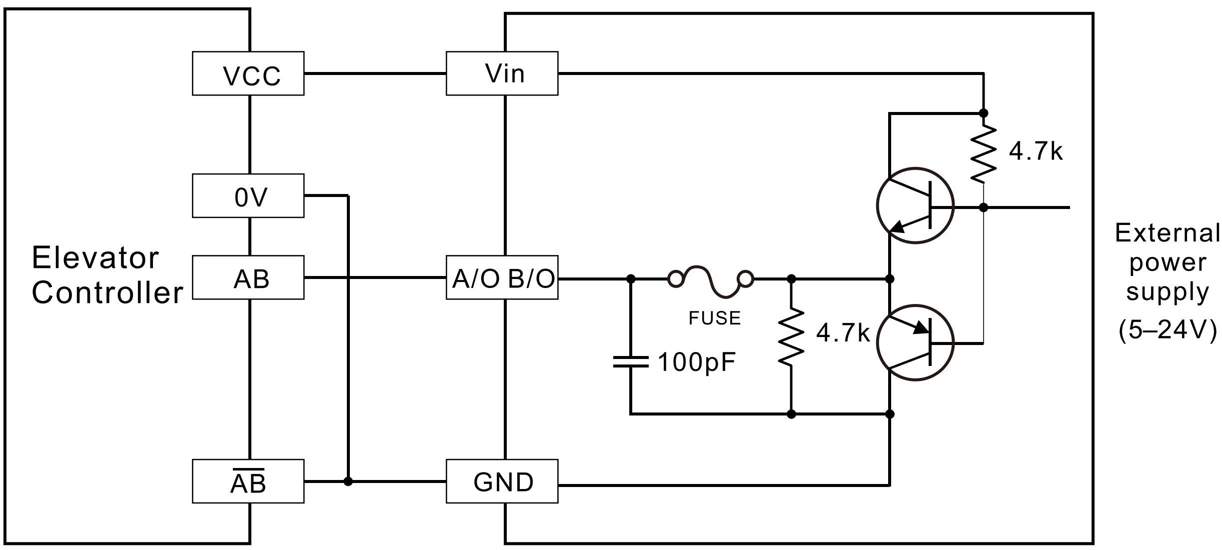


Figure 3-48

Line Driver Frequency Division (internal power supply)

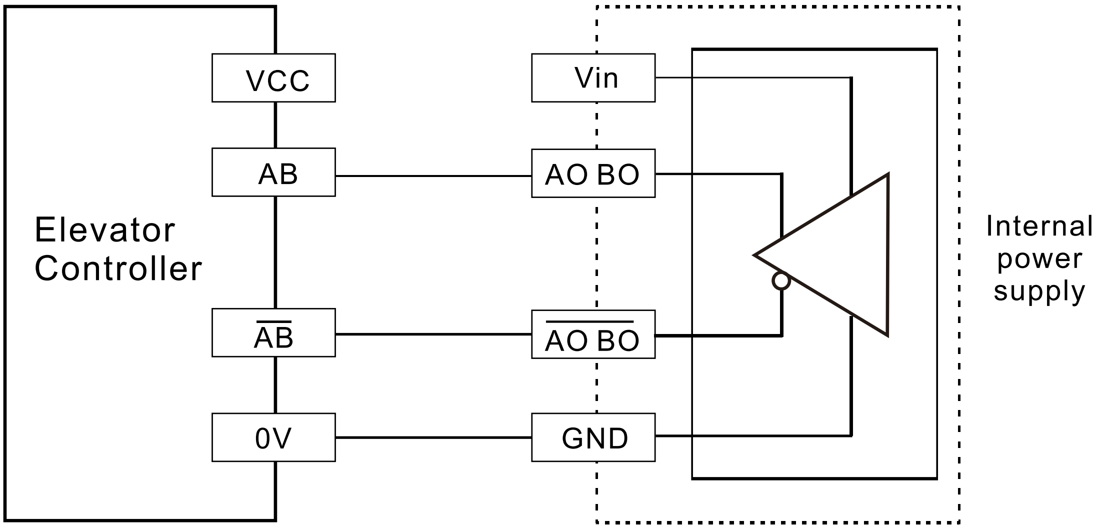


Figure 3-49

Line Driver Frequency Division (external power supply)

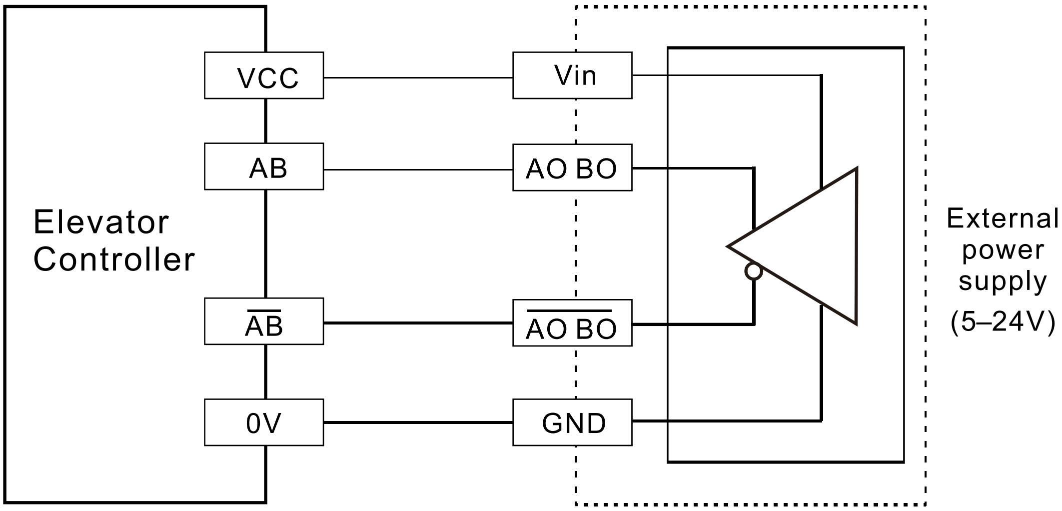


Figure 3-50

3-5 EMEB-PGSED-1

3-5-1 Product Profile

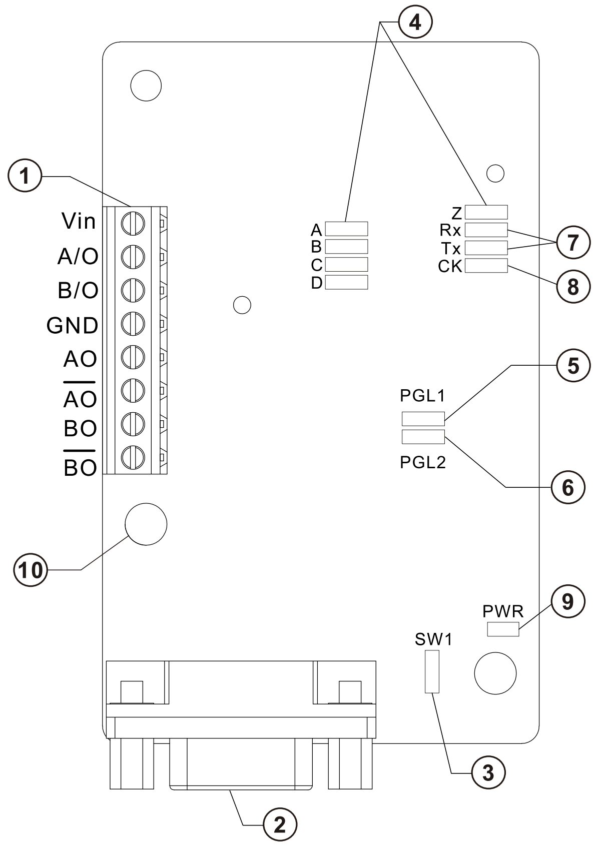


Figure 3-51

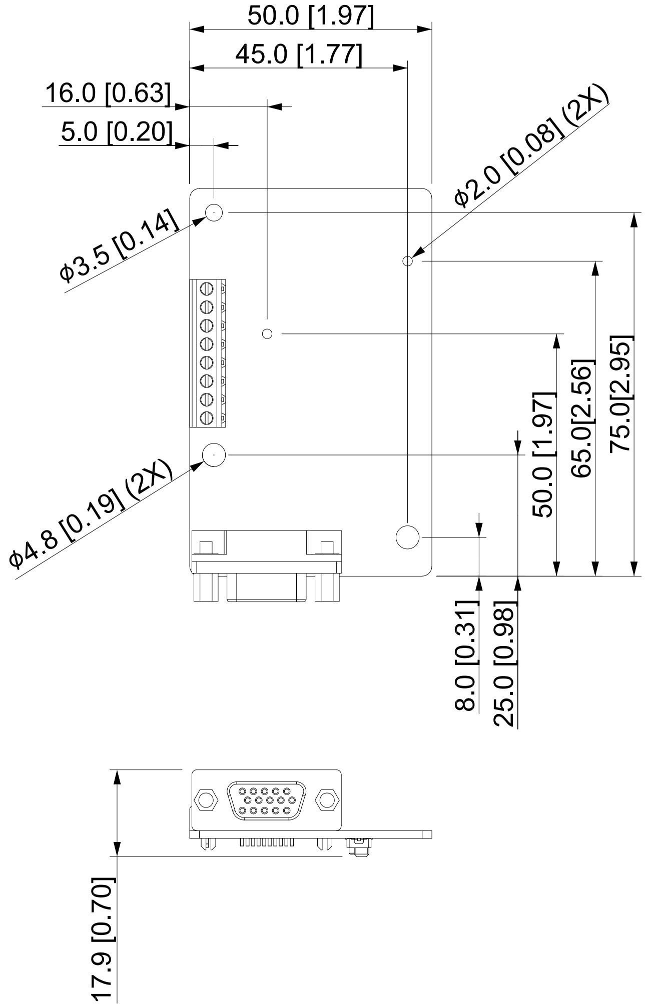


Figure 3-52

NOTE:

1. Applicable encoder:
   SIN/COS: Heidenhain ERN1387
   EnDat2.1/01/21: Heidenhain ECN413, ECN1313
   SICK HIPERFACE: SRS50, SRS60
   EnDat2.2/01/21/02/22: ECN113, ECN1325, ECN425, ECN125
   SSI: SMRS64
   BiSS-C: WDGF 58R
2. Screw specification:

Wire Gauge	0.2–1.5 mm^2 (30–16 AWG)
Torque	2.0 kg-cm (1.74 Ib-in.)

Table 3-15

	Terminal Name	Description
①	TB1	Terminal block
②	J2	D-SUB Connector
③	SW1	Switch 1
	LED Indicator	Function Description
④	A/B/C/D/Z	A/B/C/D/R signal indicator
⑤	PGL1	A/B signal abnormality
⑥	PGL2	C/D signal abnormality
⑦	Rx/Tx	Communication data indicator
⑧	CK	Encoder clock
⑨	PWR	Encoder power supply
⑩	⏚	Ground terminal

Table 3-16

3-5-2 Terminal Function

Terminals		Descriptions
TB1	Vin	No function
	A/O, B/O	Open collector pulse output signal Maximum output frequency: 100 kHz Frequency resolution: 1–2^{11}
	GND	Common power input/signal output terminal
	AO, $\overline{AO}$, BO, $\overline{BO}$	Output signal for the line driver frequency division. Line Driver RS422 Maximum output frequency:100 kHz Frequency resolution: 1–2^{11}
J2	(D-SUB Connector)	Encoder signal input terminal
SW1		Switch between power for the encoder $5V_{DC}$ / $8V_{DC}$ **NOTE:** Modify the terminal output voltage by switching the direction of the SW1 DIP switch on the PG card.
⏚	Ground terminal	Connect the motor drive power supply to ground. Supports PG shielding.

Table 3-17

EMEB-PGSED-1 (Terminal J2) Pin Definition Using Different Encoders

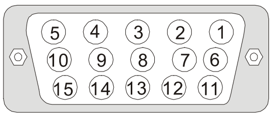
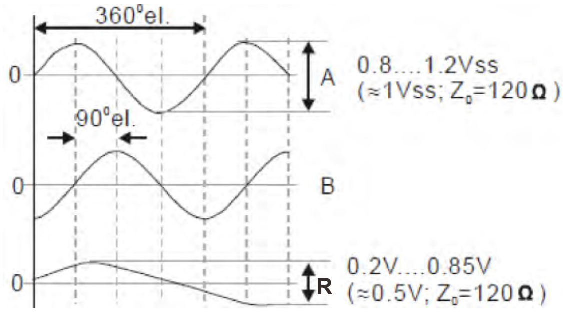
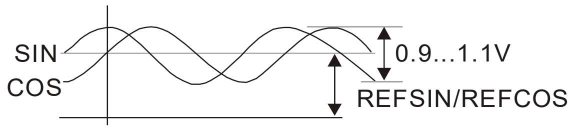
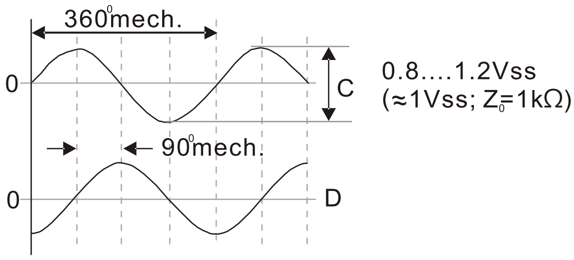
Terminal		Applicable Encoder				
J2	No.	Heidenhain ERN1387	Heidenhain ECN1313	HIPERFACE®	BiSS-C	SSI
 Figure 3-53	①	B-	B-	REFSIN	B-	B-
	②	-	-	-	-	-
	③	R+	DATA	DATA+	DATA+	DATA+
	④	R-	/DATA	DATA-	DATA-	DATA-
	⑤	A+	A+	+COS	+A	A+
	⑥	A-	A-	REFCOS	-A	A-
	⑦	0V	0V	GND	GND	GND
	⑧	B+	B+	+SIN	+B	B+
	⑨	Up	Up	Up	Up	Up
	⑩	C-	-	-	-	-
	⑪	C+	-	-	-	-
	⑫	D+	-	-	-	-
	⑬	D-	-	-	-	-
	⑭	-	/CLOCK	-	CLK+	CLOCK+
	⑮	-	CLOCK	-	CLK-	CLOCK-

Table 3-18

Terminal Function

Terminals		Descriptions	Specifications
J2	Up (VP)	The output voltage for the encoder. Use the SW1 DIP switch to change the output voltage to +5V or +8V.	Voltage: +5 V_{DC} ± 0.3 V; +8 V_{DC} ± 0.7 V Current: 200 mA max.
	0V	Encoder common power terminal	Reference level for the encoder's power.
	A+, A-, B+, B-, R+, R-	Encoder sine wave differential signal input (incremental signal)	Input frequency: 100 kHz max. 
	+SIN, +COS, REFSIN, REFCOS	Encoder sine wave differential signal input (incremental signal)	Input frequency: 20 kHz max. 
	C+, C-, D+, D-	Encoder sine wave differential signal input (absolute signal)	
	DATA+(DATA), DATA-(/DATA)	RS-485 communication interface	Terminal resistance is about 120 Ω
	CLOCK+, CLOCK-	CLOCK differential output for EnDat.	Line Driver RS422 level output

NOTE:

Table 3-19

1. Verify that the SW1 switch is set to the correct output voltage before powering on.
2. Keep the motor drive wiring away from any high voltage lines to avoid interference.

3-5-3 Wiring

☑ To prevent the PG card signal being interfered by electromagnetic interference, refer to the following recommended methods:

1. Use isolated shielded cables to effectively prevent external electromagnetic interference from entering the signal wire.
2. Do not wire in parallel with a circuit voltage above 200 V_{AC}, and keep a distance from circuits with voltage above 200 V_{AC} to reduce electromagnetic interference. If the wiring space is limited, wire in vertical direction to reduce interference.
3. Put the signal wire into an isolation tube and ensure that the isolation tube is placed inside the AC motor drive to provide good shielding effect.
4. Winding a magnetic ring around the signal wire can effectively reduce high-frequency interference and improve the signal stability.

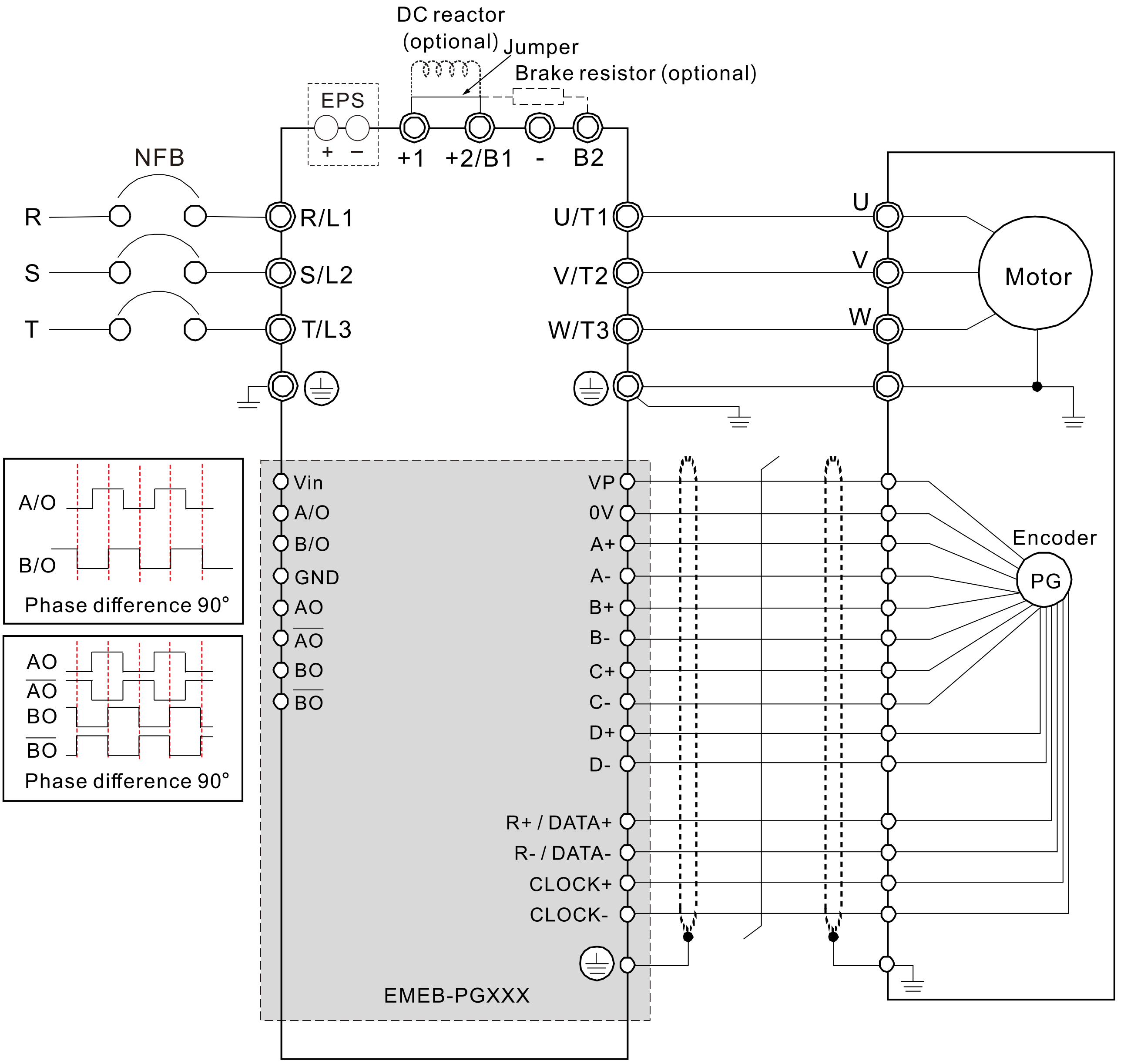


Figure 3-54

3-5-4 Frequency Division Signal Setting

1. After the encoder inputs a PULSE signal, there is an output signal by the division factor “n” Set the value in Pr.00-25 (PGSED Output Resolution).
2. Set Pr.00-25 (PGSED Output Resolution):
   The decimal frequency division output resolution setting; range of the division factor “n”: 0–11.

3-5-5 Wiring of Frequency Division Output

Open Collector Frequency Division (either external or internal power supply)

5 V	Suggested pull-up resistor: above 150–520 ohm, 1/2 W
12 V	Suggested pull-up resistor: above 600–2K ohm, 1/2 W
24 V	Suggested pull-up resistor: above 2.2K–4.7K ohm, 1/2 W

Table 3-20

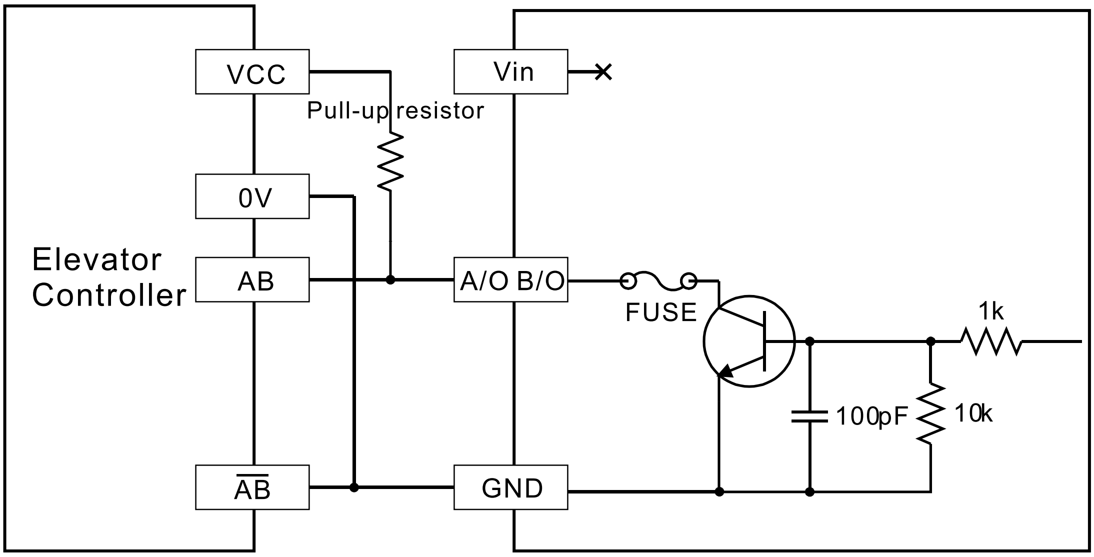


Figure 3-55

Line Driver Frequency Division (internal power supply)

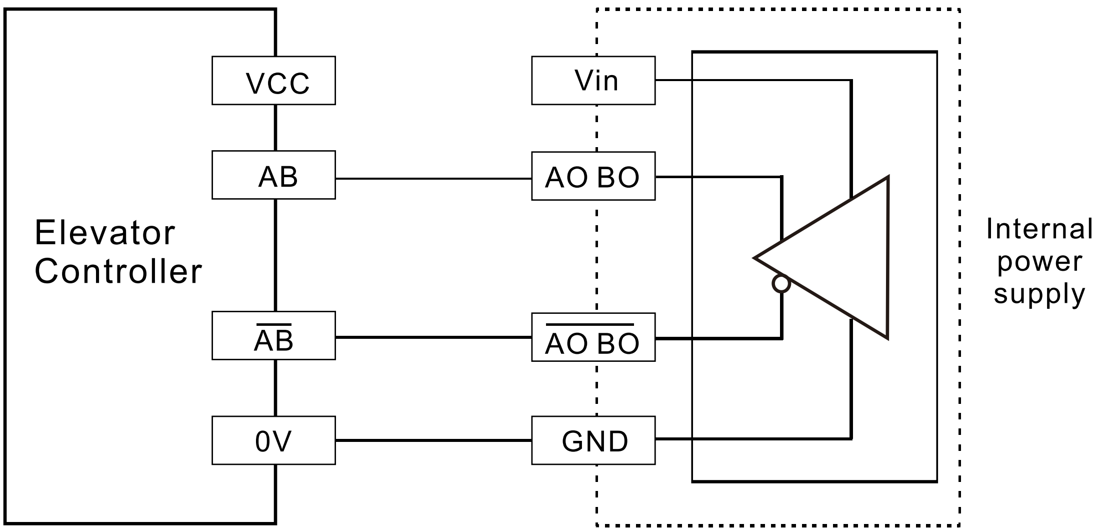


Figure 3-56

3-6 EMEB-PGSED-2

3-6-1 Product Profile

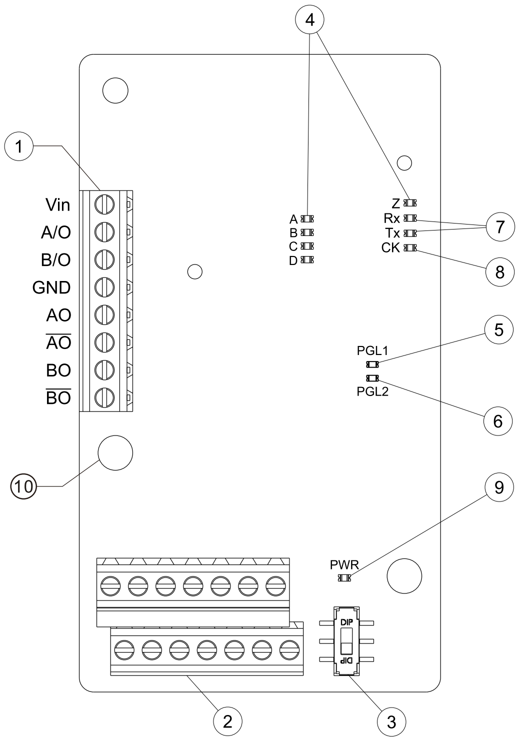


Figure 3-57

Dimension Unit: mm [inch]

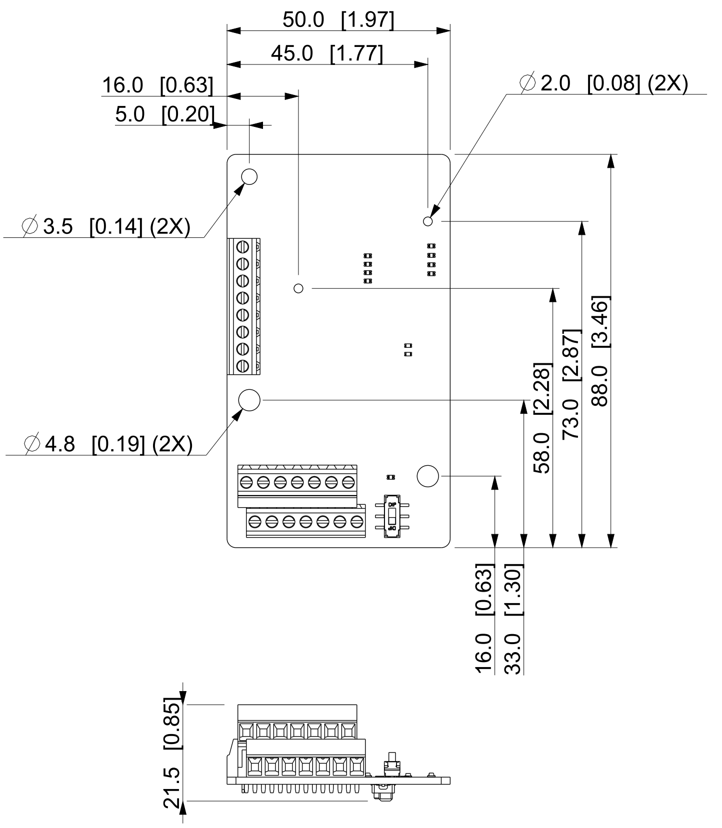


Figure 3-58

NOTE:

1. Applicable encoder:

   SIN/COS: Heidenhain ERN1387

   EnDat2.1/01/21: Heidenhain ECN413, ECN1313

   SICK HIPERFACE: SRS50, SRS60

   EnDat2.2/01/21/02/22: ECN113, ECN1325, ECN425, ECN125

   SSI: SMRS64

   BiSS-C: WDGF 58R

2. Screw specification:

Wire Gauge	0.2–1.5 mm² (30–16 AWG)
Torque	2.0 kg-cm (1.74 Ib-in.)

Table 3-21

	Terminal Name	Description
1	TB1	Terminal block
2	J2	Terminal block
3	SW1	Switch 1
	LED Indicator	Function Description
4	A/B/C/D/Z	A/B/C/D/R signal indicator
5	PGL1	A/B signal abnormality
6	PGL2	C/D signal abnormality
7	Rx/Tx	Communication data indicator
8	CK	Encoder clock
9	PWR	Encoder power supply
10	⏚	Ground terminal

Table 3-22

3-6-2 Terminal Function

Terminals		Descriptions
TB1	Vin	No function
	A/O, B/O	Open collector pulse output signal Maximum output frequency: 100 kHz Frequency resolution: $1–2^{11}$
	GND	Common power input/signal output terminal
	AO, $\overline{AO}$, BO, $\overline{BO}$	Output signal for the line driver frequency division. Line Driver RS422 Maximum output frequency:100 kHz Frequency resolution: $1–2^{11}$
J2	(Terminal Block)	Encoder signal input terminal
SW1		Switch between power for the encoder 5 V_{DC} / 8 V_{DC} **NOTE:** Modify the terminal output voltage by switching the direction of the SW1 DIP switch on the PG card.
⏚	Ground terminal	Connect the motor drive power supply to ground. Supports PG shielding.

Table 3-23

EMEB-PGSED-2 (Terminal J2) Pin Definition Using Different Encoders

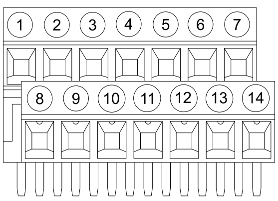
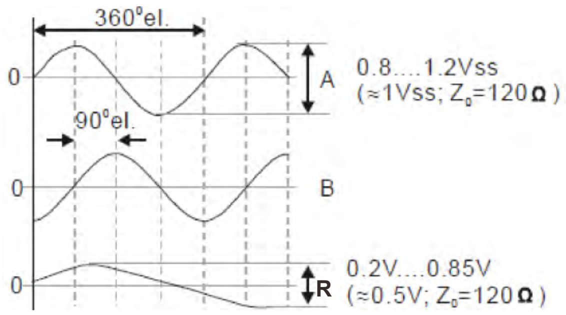
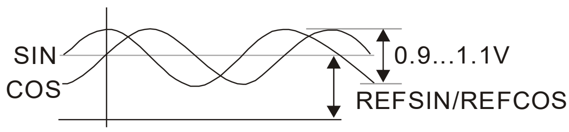
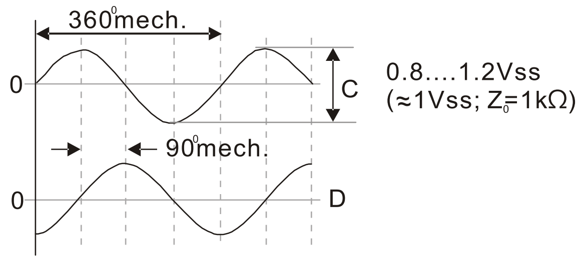
Terminal		Applicable Encoder				
J2	No.	Heidenhain ERN1387	Heidenhain ECN1313	HIPERFACE®	BiSS-C	SSI
 Figure 3-59	①	A+	A+	+COS	+A	A+
	②	A-	A-	REFCOS	-A	A-
	③	C+	-	-	-	-
	④	C-	-	-	-	-
	⑤	R+	DATA	DATA+	DATA+	DATA+
	⑥	R-	/DATA	DATA-	DATA-	DATA-
	⑦	Up	Up	Up	Up	Up
	⑧	B+	B+	+SIN	+B	B+
	⑨	B-	B-	REFSIN	B-	B-
	⑩	D+	-	-	-	-
	⑪	D-	-	-	-	-
	⑫	-	/CLOCK	-	CLK+	CLOCK+
	⑬	-	CLOCK	-	CLK-	CLOCK-
	⑭	0V	0V	GND	GND	GND

Table 3-24

Terminal Function

Terminals		Descriptions	Specifications
J2	Up (VP)	The output voltage for the encoder. Use the SW1 DIP switch to change the output voltage to +5V or +8V.	Voltage: +5 V_{DC} ± 0.3 V; +8 V_{DC} ± 0.7 V Current: 200 mA max.
	0V	Encoder common power terminal	Reference level for the encoder's power.
	A+, A-, B+, B-, R+, R-	Encoder sine wave differential signal input (incremental signal)	Input frequency: 100 kHz max. 
	+SIN, +COS, REFSIN, REFCOS	Encoder sine wave differential signal input (incremental signal)	Input frequency: 20 kHz max. 
	C+, C-, D+, D-	Encoder sine wave differential signal input (absolute signal)	
	DATA+(DATA), DATA-(/DATA)	RS-485 communication interface	Terminal resistance is about 120 Ω
	CLOCK+, CLOCK-	CLOCK differential output for EnDat.	Line Driver RS422 level output

NOTE: Table 3-25

1. Verify that the SW1 switch is set to the correct output voltage before powering on.
2. Keep the motor drive wiring away from any high voltage lines to avoid interference.

3-6-3 Wiring

☑ To prevent the PG card signal being interfered by electromagnetic interference, refer to the following recommended methods:

1. Use isolated shielded cables to effectively prevent external electromagnetic interference from entering the signal wire.
2. Do not wire in parallel with a circuit voltage above 200 V_{AC}, and keep a distance from circuits with voltage above 200 V_{AC} to reduce electromagnetic interference. If the wiring space is limited, wire in vertical direction to reduce interference.
3. Put the signal wire into an isolation tube and ensure that the isolation tube is placed inside the AC motor drive to provide good shielding effect.
4. Winding a magnetic ring around the signal wire can effectively reduce high-frequency interference and improve the signal stability.

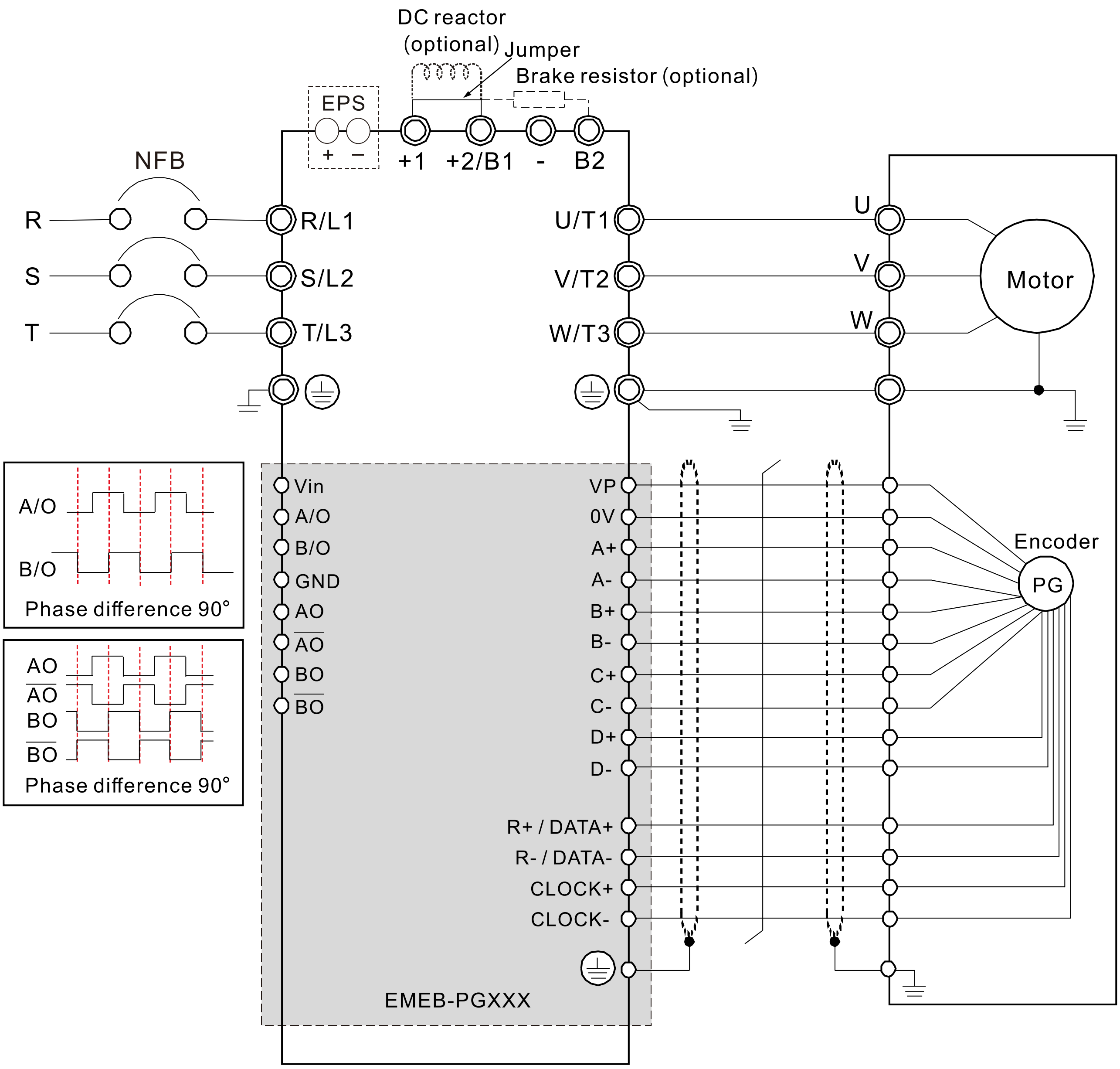


Figure 3-60

3-6-4 Frequency Division Signal Setting

1. After the encoder inputs a PULSE signal, there is an output signal by the division factor “n” Set the value in Pr.00-25 (PGSED Output Resolution).
2. Set Pr.00-25 (PGSED Output Resolution):
   The decimal frequency division output resolution setting; range of the division factor “n”: 0–11.

3-6-5 Wiring of Frequency Division Output

Open Collector Frequency Division (either external or internal power supply)

5 V	Suggested pull-up resistor: above 150–520 ohm, 1/2 W
12 V	Suggested pull-up resistor: above 600–2K ohm, 1/2 W
24 V	Suggested pull-up resistor: above 2.2K–4.7K ohm, 1/2 W

Table 3-26

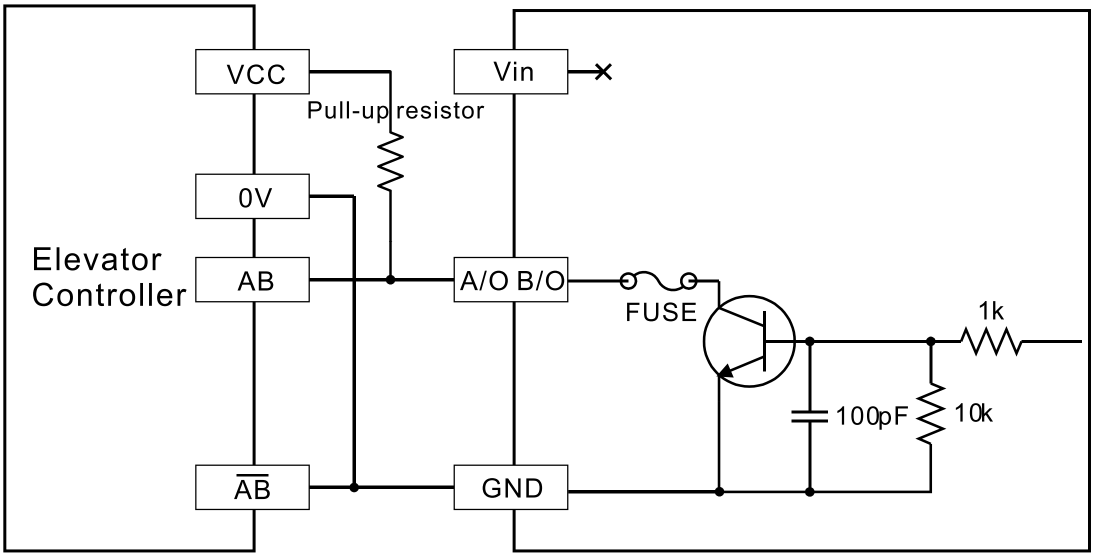


Figure 3-61

Line Driver Frequency Division (internal power supply)

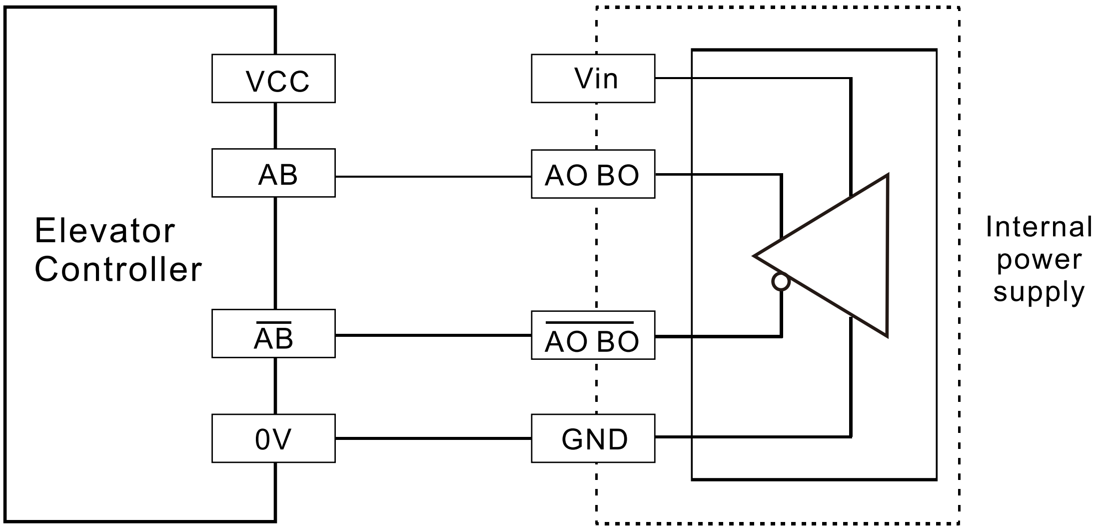


Figure 3-62

Chapter 4 Wiring

After removing the front cover, verify if the power and control terminals are clearly noted. Read following precautions to avoid wiring mistakes.

DANGER

- ☑ **Turn off the AC motor drive 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. Measure the remaining voltage with a DC voltmeter before doing any wiring. For your safety, do not start wiring before the voltage drops to a safe level (less than 25 V_{DC}). Installing wiring with a residual voltage may cause personal injury, sparks and a short circuit.
- ☑ Only qualified personnel familiar with AC motor drives are allowed to perform installation, wiring and commissioning. Make sure the power is turned off before wiring to prevent electric shock.
- ☑ Make sure that power is only applied to the R/L1, S/L2 and T/L3 terminals. Failure to comply may result in damage to the equipment. The voltage and current must be in the range indicated on the nameplate (refer to <Section 1-1 Nameplate Information> for details).
- ☑ All units must be grounded directly to a common ground terminal to prevent damage from a lightning strike or electric shock and reduce noise interference.
- ☑ Tighten the screws of the main circuit terminals to prevent sparks caused by screws loosened due to vibration

CAUTION

- ☑ For your safety, choose wires that comply with local regulation when wiring
- ☑ Check following items after finishing the wiring:
  1. Are all connections correct?
  2. Are there any loose wires?
  3. Are there any short-circuits between the terminals or to ground?

Main input power terminals

- ☑ Do NOT connect three-phase model to single-phase power. R/L1, S/L2 and T/L3 have no phase-sequence requirement, they can be connected in any sequence.
- ☑ You must install a NFB between the three-phase power input terminals and the main circuit terminals (R/L1, S/L2, T/L3). Add a magnetic contactor (MC) to the power input wiring to cut off power quickly and reduce malfunctions when the AC motor drive protection function activates. Both ends of the MC should have an R-C surge absorber.
- ☑ Use voltage and current within the specification in Chapter 12. Refer to <Chapter 12 Specifications> for details.
- ☑ When using a general ELB (Earth Leakage Breaker), select a current sensor with sensitivity of 200 mA or above and not less than 0.1-second operation time to avoid nuisance tripping. When choosing an ELB designed for the AC motor drive, choose a current sensor with sensitivity of 30 mA or above.
- ☑ Use shielded wire or conduit for the power wiring and ground the two ends of the shielded wire or conduit.

- ☑ Do NOT run and stop AC motor drives by turning the power ON and OFF. Run and stop the AC motor drives by sending RUN and STOP commands through the control terminals or the keypad. If you still need to run and stop AC motor drives by turning the power ON and OFF, do so no more often than ONCE per hour.
- ☑ To comply with UL standards, connect the drive to a three-phase three-wire or three-phase four-wire Wye system type of mains power system.

Output terminals of the main circuit

- ☑ Use well-insulated motors to prevent any electric leakage from the motors.
- ☑ Do NOT connect phase-compensation capacitors or surge absorbers at the output terminals of AC motor drives.
- ☑ When it is necessary to install a filter at the output side of the AC motor drive terminals U/T1, V/T2, W/T3, use an inductance filter. Do NOT use phase-compensation capacitors or L-C (Inductance-Capacitance) or R-C (Resistance-Capacitance) capacitors.

Terminals for connecting DC reactor and DC bus

- ☑ Use terminals [+1, +2] for connecting a DC reactor; use terminals [+1, +2/B1] for connecting a DC bus.
- ☑ When not in use, leave terminals +2/B1, (－) open.
- ☑ Short-circuiting [B2] or [－] to [+2/B1] damages the motor drive. Do NOT short-circuit those terminals.
- ☑ Use these terminals to connect a DC reactor to improve the power factor and reduce harmonics. A jumper is connected to these terminals at the factory. Remove that jumper before connecting to a DC reactor.

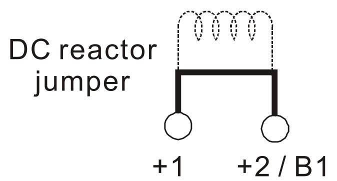


Figure 4-1

4-1 Wiring

Wiring Diagram for Frame A and B

Input: Three-phase power

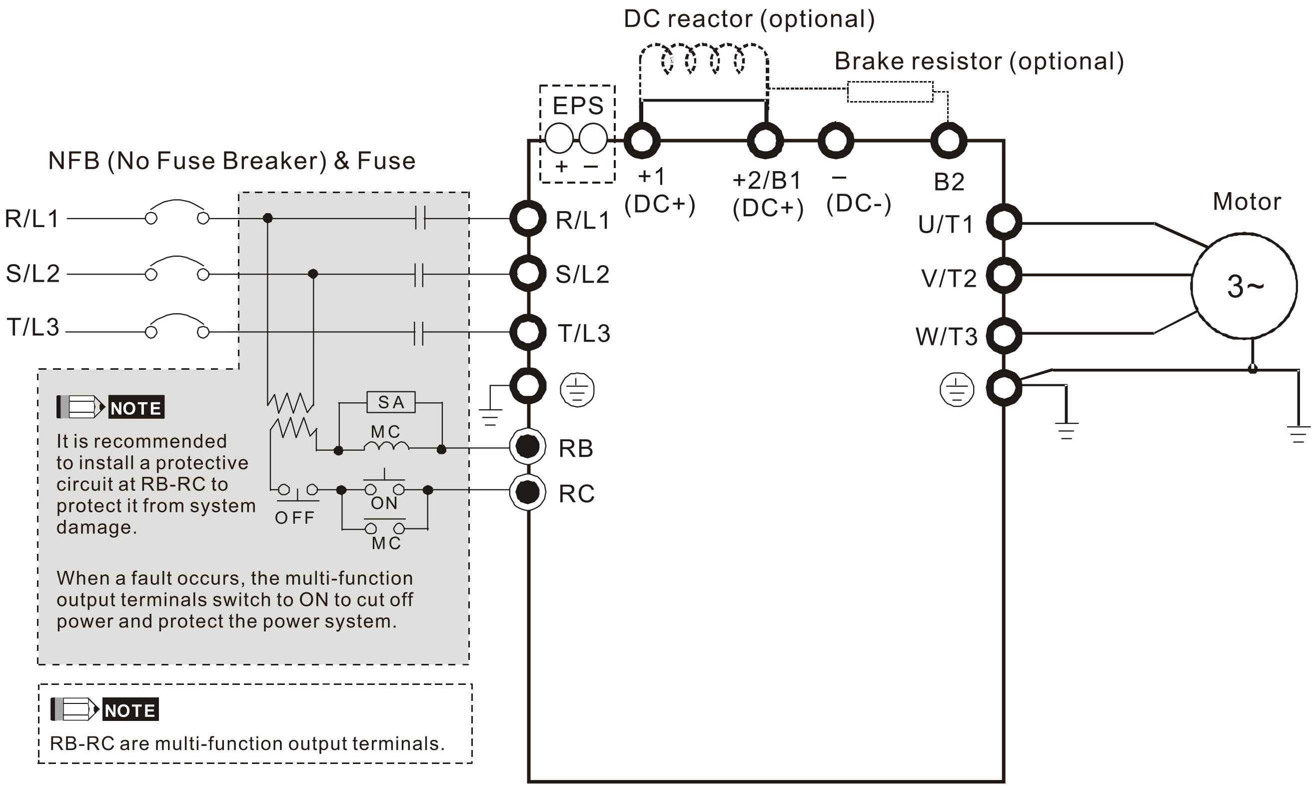


Figure 4-2

NOTE: See Figure 4-5 to Figure 4-7 for Emergency Power Supply (EPS) system wiring diagrams.

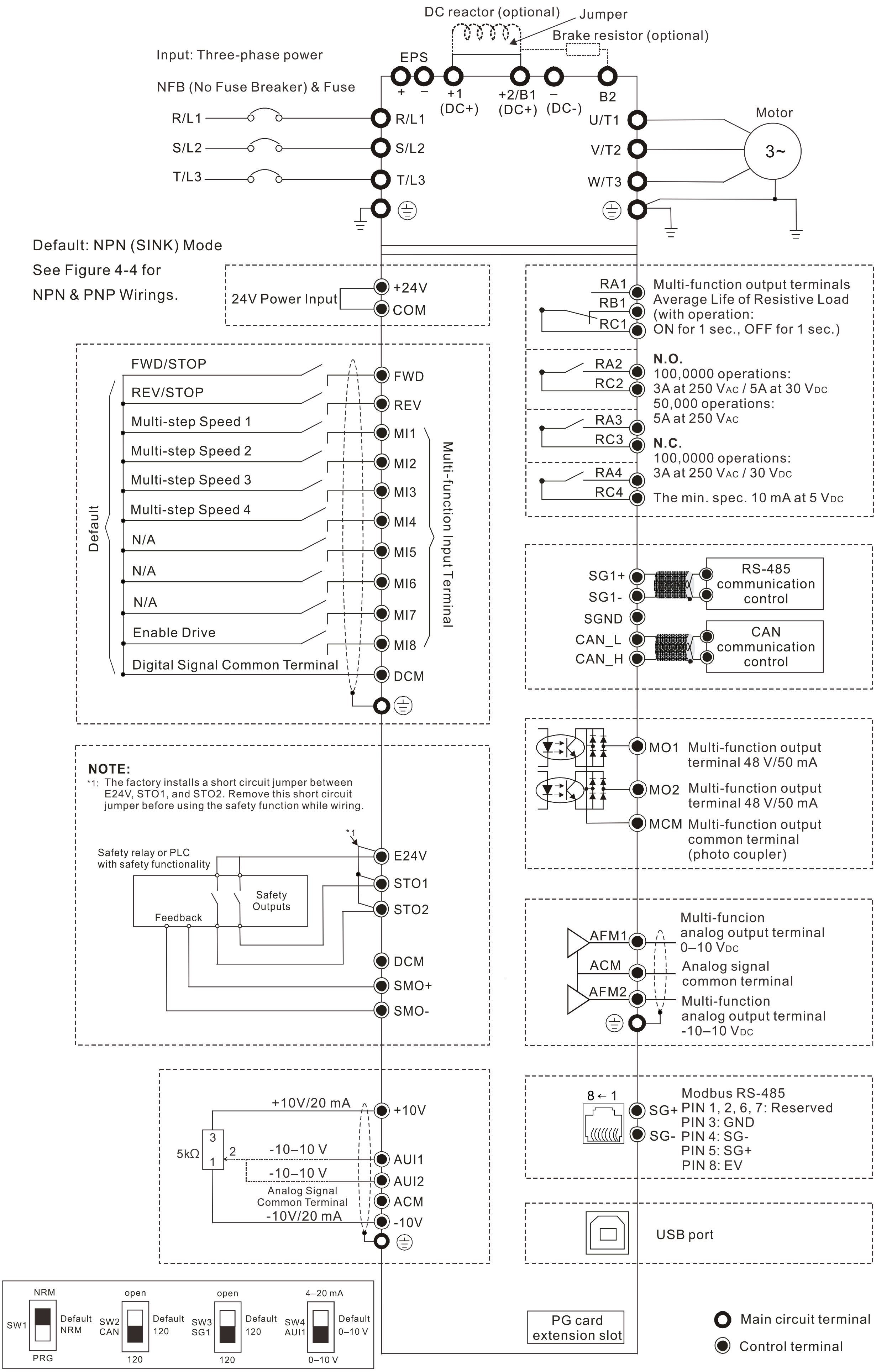

DC reactor (optional)
Jumper
Brake resistor (optional)
Input: Three-phase power
EPS
NFB (No Fuse Breaker) & Fuse
+ −
+1 (DC+)
+2/B1 (DC+)
− (DC-)
B2
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
Motor
3~
Default: NPN (SINK) Mode
See Figure 4-4 for
NPN & PNP Wirings.
24V Power Input
+24V
COM
FWD/STOP
REV/STOP
Multi-step Speed 1
Multi-step Speed 2
Multi-step Speed 3
Multi-step Speed 4
N/A
N/A
N/A
Enable Drive
Digital Signal Common Terminal
Default
FWD
REV
MI1
MI2
MI3
MI4
MI5
MI6
MI7
MI8
DCM
Multi-function Input Terminal
RA1
RB1
RC1
Multi-function output terminals
Average Life of Resistive Load
(with operation:
ON for 1 sec., OFF for 1 sec.)
RA2
RC2
RA3
RC3
RA4
RC4
N.O.
100,0000 operations:
3A at 250 VAC / 5A at 30 VDC
50,000 operations:
5A at 250 VAC
N.C.
100,0000 operations:
3A at 250 VAC / 30 VDC
The min. spec. 10 mA at 5 VDC
SG1+
SG1-
SGND
CAN_L
CAN_H
RS-485 communication control
CAN communication control
NOTE:
*1: The factory installs a short circuit jumper between E24V, STO1, and STO2. Remove this short circuit jumper before using the safety function while wiring.
*1
Safety relay or PLC with safety functionality
Safety Outputs
Feedback
E24V
STO1
STO2
DCM
SMO+
SMO-
MO1 Multi-function output terminal 48 V/50 mA
MO2 Multi-function output terminal 48 V/50 mA
MCM Multi-function output common terminal (photo coupler)
AFM1
ACM
AFM2
Multi-funcion analog output terminal 0–10 VDC
Analog signal common terminal
Multi-function analog output terminal -10–10 VDC
+10V/20 mA
+10V
5kΩ
3
2
1
-10–10 V
AUI1
-10–10 V
AUI2
Analog Signal Common Terminal
ACM
-10V/20 mA
-10V
8←1
SG+
SG-
Modbus RS-485
PIN 1, 2, 6, 7: Reserved
PIN 3: GND
PIN 4: SG-
PIN 5: SG+
PIN 8: EV
USB port
PG card extension slot
NRM
SW1
Default NRM
PRG
open
SW2 CAN
Default 120
120
open
SW3 SG1
Default 120
120
4–20 mA
SW4 AUI1
Default 0–10 V
0–10 V
Main circuit terminal
Control terminal

Figure 4-3

4-1-1 SINK (NPN) / Source (PNP) Mode

Switching between two modes: SINK (NPN) / Source (PNP)

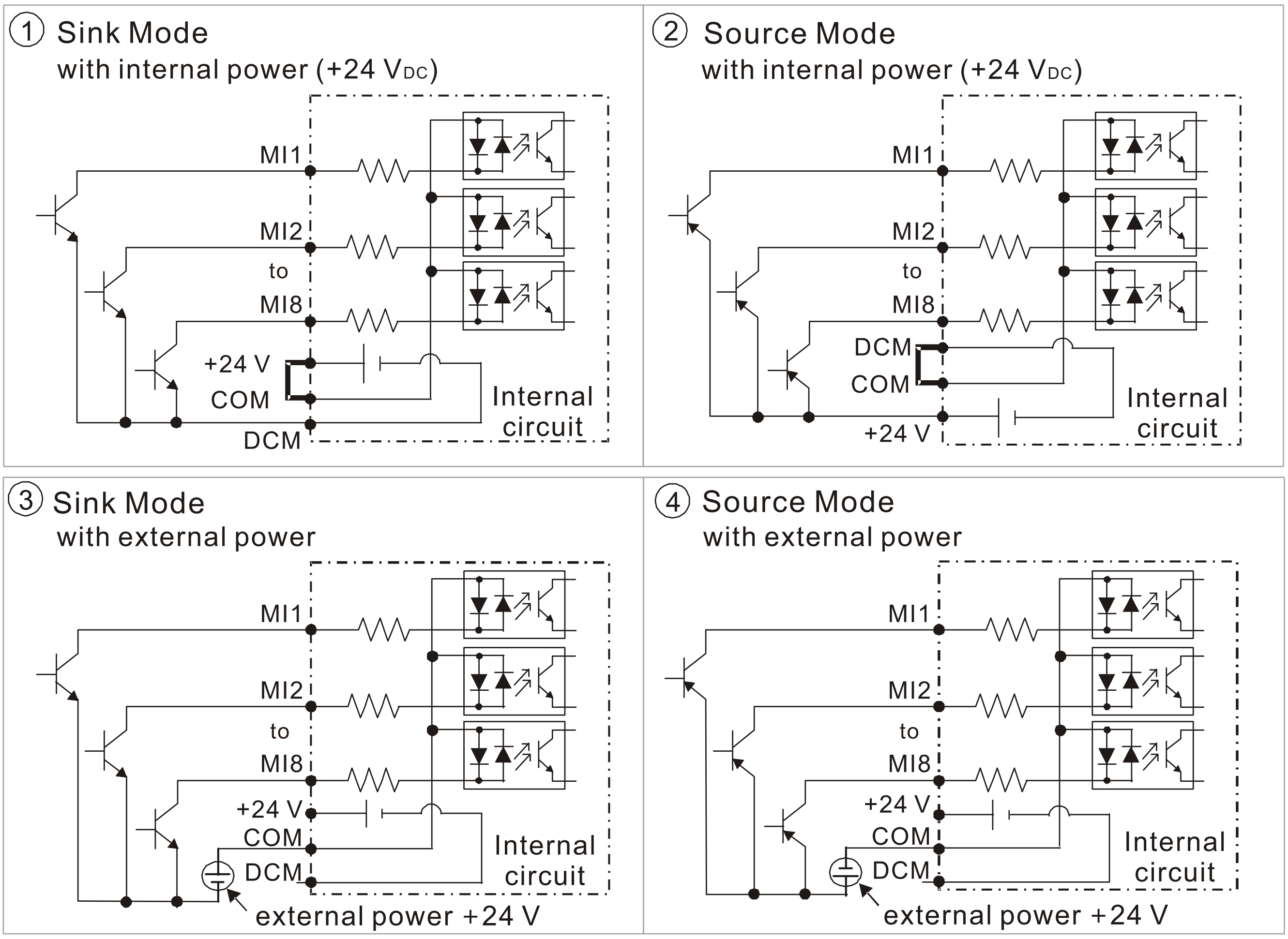
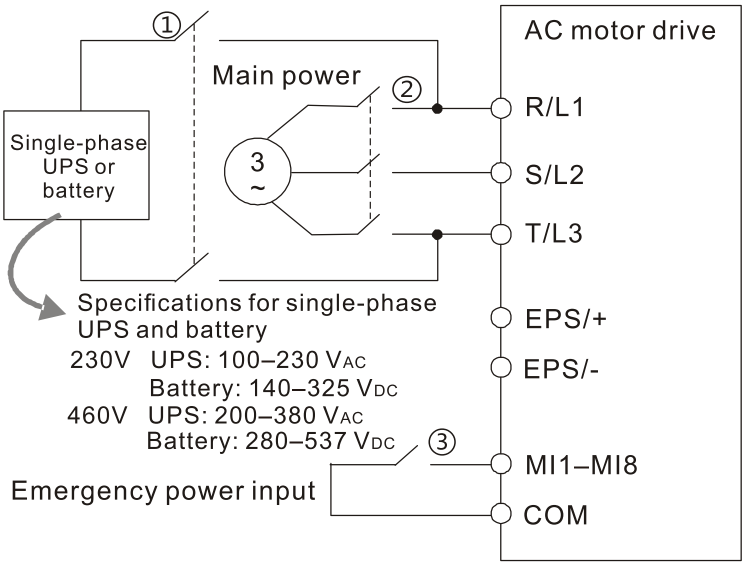


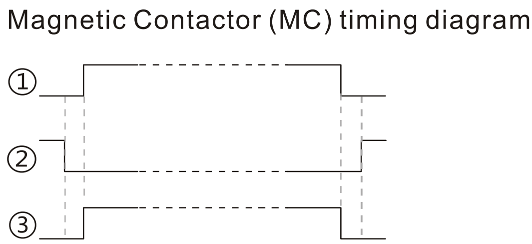
Figure 4-4

4-1-2 Emergency Power Supply (EPS) System Wiring Diagrams

Frame A and B

- Single-phase UPS or battery can only be used on the main power supply side





Before using emergency power, close MC ① and ③, and keep MC ② open. Close MC ① before you close MC ③. Before removing the battery and before closing MC ②, open MC① and ③.

Figure 4-5

Frame A and B

- When the voltage of the main power supply is lower than 140 V_{DC} (230V models) / 280 V_{DC} (460V models), connect the control power to single-phase UPS or battery.

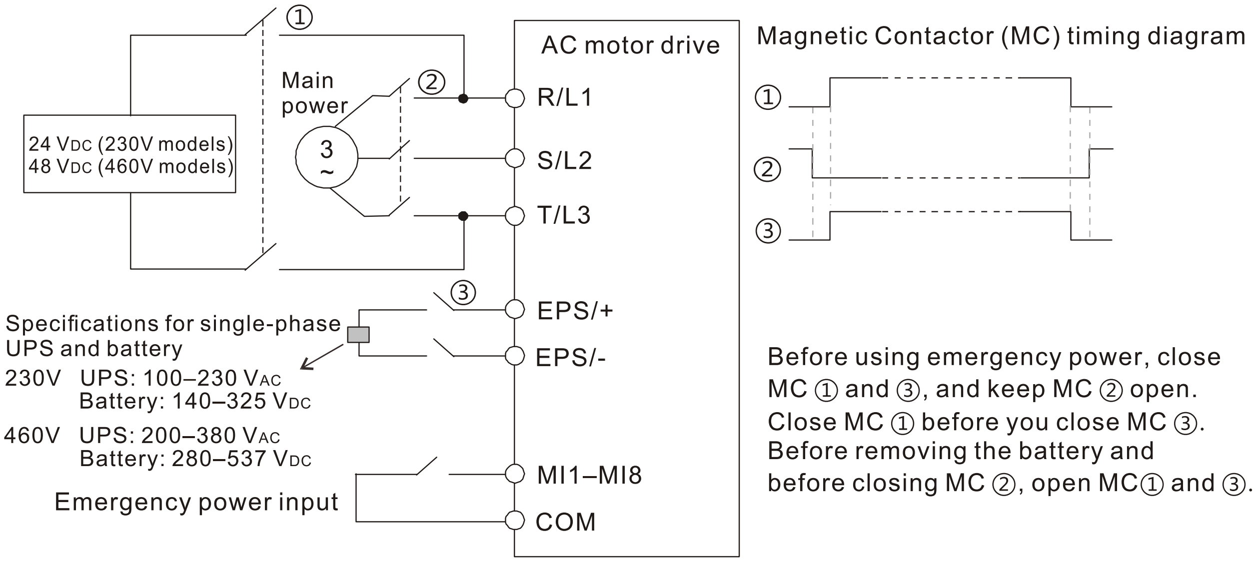


Figure 4-6

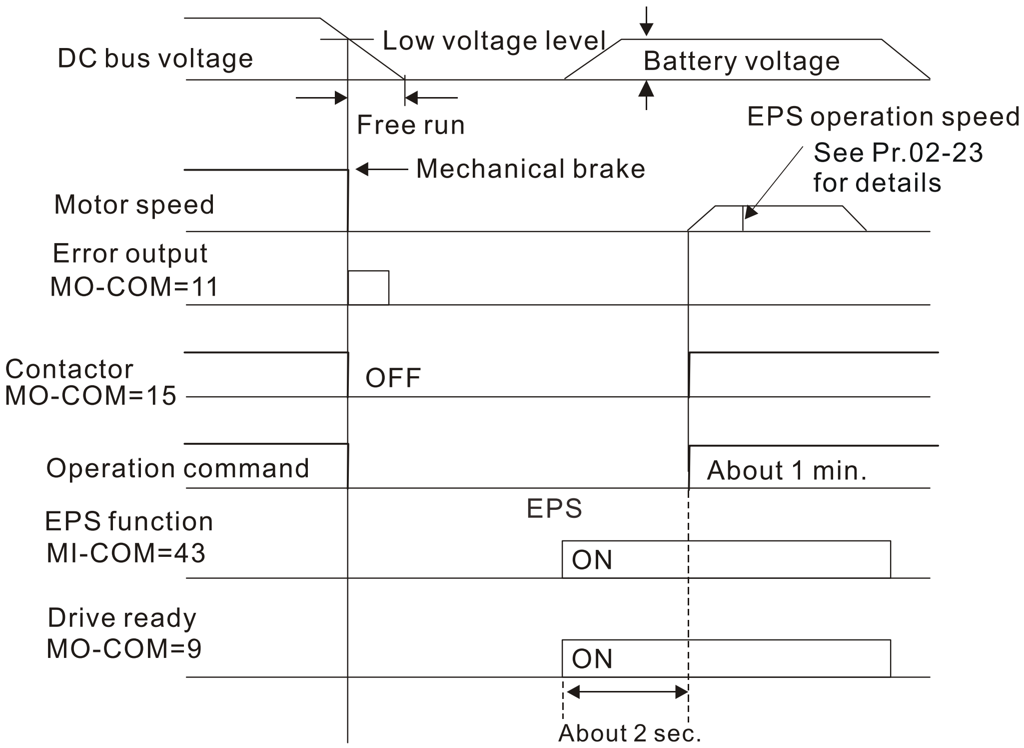


Figure 4-7

NOTE:

When EPS is enabled (MI=43):

- Do NOT make the fan run in case voltage drops during EPS.
- Parameter settings cannot be saved and will be lost after cycling power.
- Set the running speed through Pr.02-23.
- Functions of low voltage and phase loss protection are unavailable.
- Set the DC bus voltage through Pr.02-21.

4-2 System Wiring Diagram

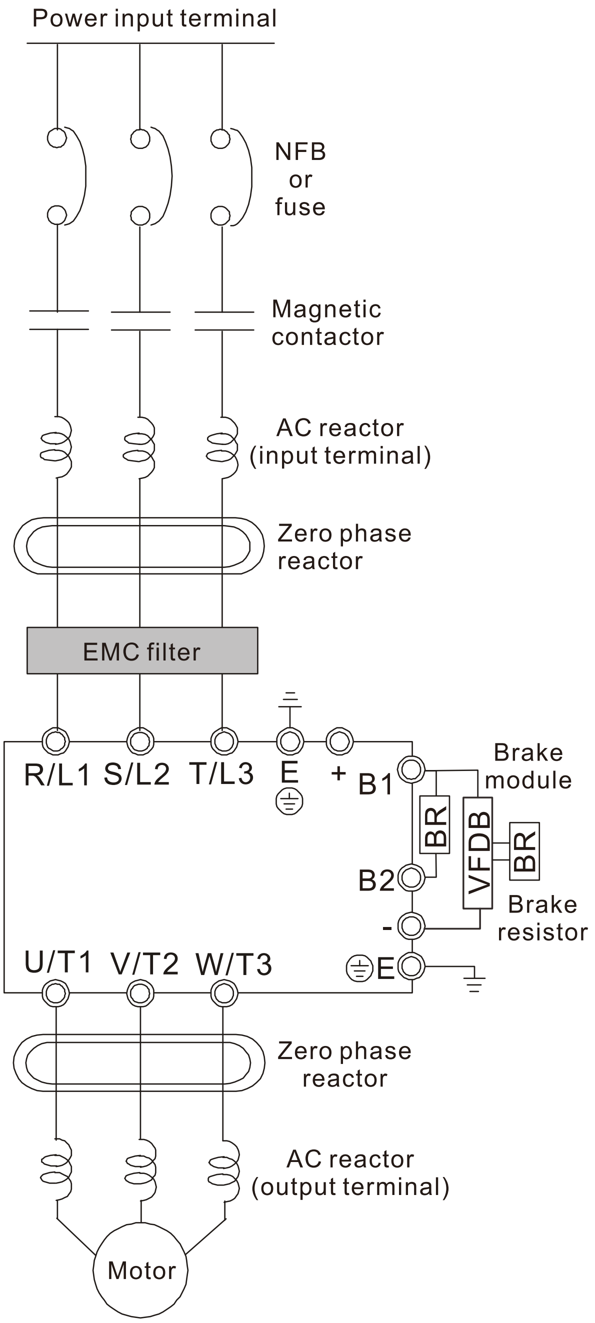


Figure 4-8

Power input terminal	Supply power according to the rated power specifications indicated in the user manual (see <Chapter 12 Specifications>).
NFB or fuse	There may be a large inrush current during power-on. See <Section 11-2 Non-fuse Circuit Breaker> to select a suitable NFB or <Section 11-3 Fuse Specification Chart> for a fuse.
Magnetic contactor	Switching the power ON / OFF on the primary side of the magnetic contactor can turn the drive ON / OFF, but frequent switching can cause machine failure. Do not switch ON / OFF more than once an hour. Do not use the magnetic contactor as the power switch for the drive; doing so shortens the life of the drive.
AC reactor (input terminal)	When the main power capacity is larger than 1000 kVA, or when it switches into the phase capacitor, the instantaneous peak voltage and current generated may destroy the internal circuit of the drive. It is recommended that you install an AC reactor at input side in the drive. This also improves the power factor and reduces power harmonics. The wiring distance should be within 10 m. See <Section 11-4 AC/DC Reactor> for details.
Zero phase reactor	Used to reduce radiated interference, especially in environments with audio devices, and reduce input and output side interference. The effective range is AM band to 10 MHz. See <Section 11-5 Zero Phase Reactor> for details.
EMC filter	Can be used to reduce electromagnetic interference. See <Section 11-6 EMC Filter> for details.
Brake module & Brake resistor (BR)	Used to shorten the deceleration time of the motor. See <Section 11-1 Brake Resistors and Brake Units Used in AC Motor Drives> for details.
AC reactor (output terminal)	The motor cable length affects the size of the reflected wave on the motor end. It is recommended that you install an AC output reactor when the motor wiring length exceeds 20 meters. See <Section 11-4 AC/DC Reactor> for details.

Table 4-1

4-3 Main Circuit Diagram

Frame A and B

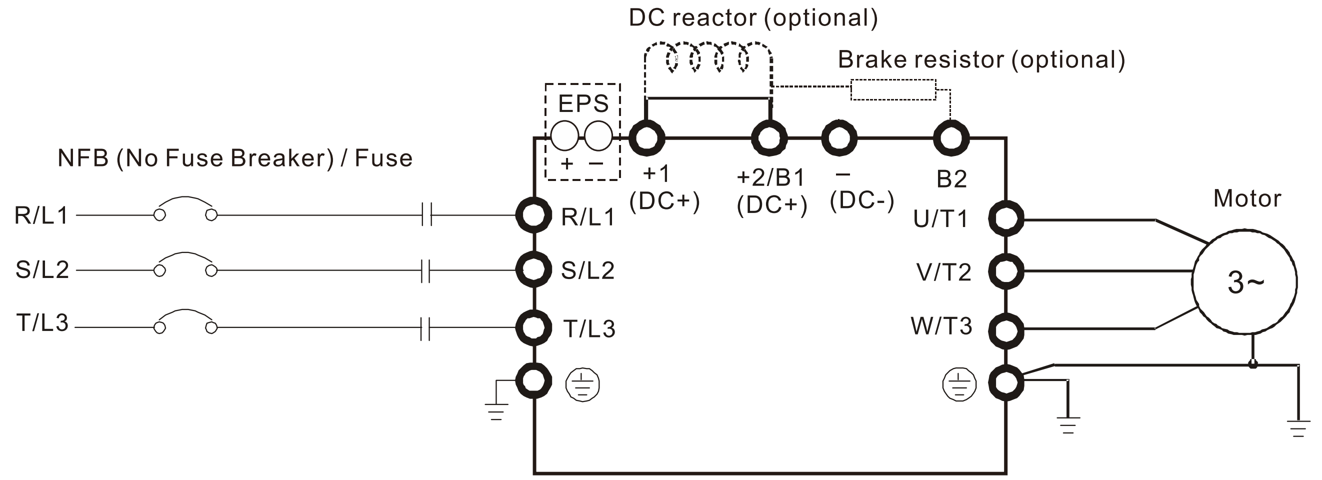


Figure 4-9

Terminals	Descriptions
EPS (+, -)	Backup power/ Emergency power connection terminal.
R/L1, S/L2, T/L3	AC line input terminals three-phase
U/T1, V/T2, W/T3	AC motor drive output terminals for connecting a three-phase induction motor
+1, +2/B1	Connections for DC reactor to improve the power factor. Remove the jumper before installing a DC reactor.
+2/B1, B2	Connections for brake resistor (optional)
⏚	Ground connection; comply with local regulations.

Table 4-2

4-4 Main Circuit Terminal Specifications

Frame A

Applicable models:

VFD022ED21B, VFD022ED21BE, VFD037ED21B, VFD037ED21BE

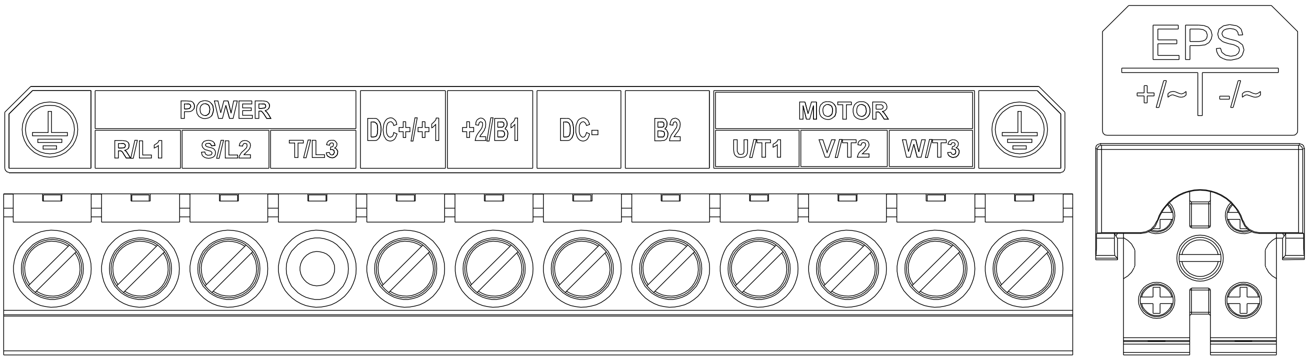


Figure 4-10

<table>
<tr><th rowspan="2">Model</th><th colspan="4">Main Circuit Terminals
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3,
DC-, DC+/+1, +2/B1, B2</th><th colspan="4">Terminals
⏚</th></tr>
<tr><th>Stripping Length (mm)</th><th>Max. Wire Gauge</th><th>Min. Wire Gauge</th><th>Torque (±10%)</th><th>Stripping Length (mm)</th><th>Max. Wire Gauge</th><th>Min. Wire Gauge</th><th>Torque (±10%)</th></tr>
<tr><td>VFD022ED21B</td><td rowspan="4">12–13</td><td rowspan="4">16 mm^2
(6 AWG)</td><td rowspan="2">10 mm^2
(8 AWG)</td><td rowspan="4">20.74 kg-cm
(18.0 lb-in.)
(2.03 Nm)</td><td rowspan="4">12–13</td><td rowspan="2">10 mm^2
(8 AWG)</td><td rowspan="2">10 mm^2
(8 AWG)</td><td rowspan="4">20.74 kg-cm
(18.0 lb-in.)
(2.03 Nm)</td></tr>
<tr><td>VFD022ED21BE</td></tr>
<tr><td>VFD037ED21B</td><td rowspan="2">16 mm^2
(6 AWG)</td><td rowspan="2">16 mm^2
(6 AWG)</td><td rowspan="2">16 mm^2
(6 AWG)</td></tr>
<tr><td>VFD037ED21BE</td></tr>
</table>

NOTE:

- When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.
- If you install at Ta 45°C environment, use copper wires with voltage rating of 600V and temperature resistance of 75°C or 90°C.
- If you install at Ta 45°C above environment, use copper wires with voltage rating of 600V and temperature resistance of 90°C or above.
- 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.
- Use a flathead screwdriver to tighten the wires. The head width and thickness of the flathead screwdriver are 5.5 mm and 1.0 mm.

Table 4-3

Terminal	Conductor	Stripping Length (mm)	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
EPS	Solid	7–8	4 mm^2 (12 AWG)	0.5 mm^2 (20 AWG)	5.61 kg-cm (4.87 lb-in.) (0.55 Nm)
	Strand				
	Stranded with ferrules with plastic sleeve				

NOTE:

- Use a flathead screwdriver to tighten the wires. The head width and thickness of the flathead screwdriver are 3.5 mm and 0.6 mm.
- When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.

Table 4-4

Recommended dimension or models of the crimp terminals

Terminal	Wire Gauge	Models		Recommended Dimension *2			
		VENDOR	VENDOR P/N	A (MAX)	B (MAX)	D (MAX)	W (MAX)
Crimp Terminals	12 AWG	K.S.T.	E4009	15 mm	8 mm	10 mm	3.5 mm
	14 AWG		E2508				
	16 AWG		E1508				
	18 AWG		E1008				
	20 AWG		E0508				

NOTE:

*1: Recommended specifications and models of crimping tools: DNT01-2210B or DNT01-2206B. Manufacturer: DINKLE.

*2: Dimensions of crimp terminals are defined as follows:

Dimension A: the actual wiring space

Dimension B: the allowed depth of the terminal block.

Dimension D: the clearance of the terminal block.

Dimension W: the allowed width of the terminal block.

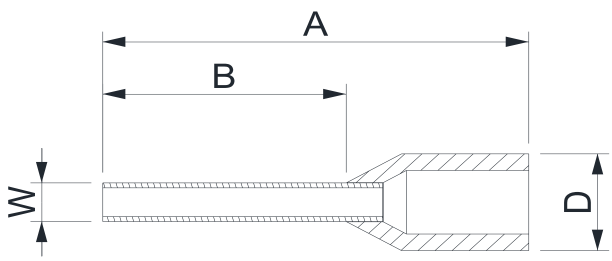


Figure 4-11

Table 4-5

Frame A

Applicable models:

VFD040ED43B, VFD040ED43BE, VFD055ED43B, VFD055ED43BE, VFD075ED43B, VFD075ED43BE

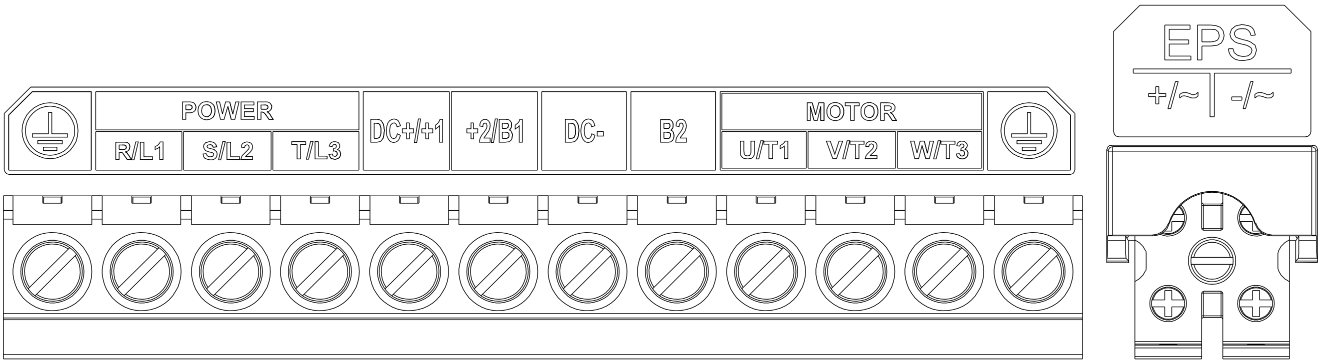


Figure 4-12

<table>
<tr><th rowspan="2">Model</th><th colspan="4">Main Circuit Terminals
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3,
DC-, DC+/+1, +2/B1, B2</th><th colspan="4">Terminals
⏚</th></tr>
<tr><th>Stripping Length (mm)</th><th>Max. Wire Gauge</th><th>Min. Wire Gauge</th><th>Torque (±10%)</th><th>Stripping Length (mm)</th><th>Max. Wire Gauge</th><th>Min. Wire Gauge</th><th>Torque (±10%)</th></tr>
<tr><td>VFD040ED43B</td><td rowspan="6">12–13</td><td rowspan="6">16 mm^2
(6 AWG)</td><td rowspan="2">4 mm^2
(12 AWG)</td><td rowspan="6">20.74 kg-cm
(18.0 lb-in.)
(2.03 Nm)</td><td rowspan="6">12–13</td><td rowspan="2">4 mm^2
(12 AWG)</td><td rowspan="2">4 mm^2
(12 AWG)</td><td rowspan="6">20.74 kg-cm
(18.0 lb-in.)
(2.03 Nm)</td></tr>
<tr><td>VFD040ED43BE</td></tr>
<tr><td>VFD055ED43B</td><td rowspan="2">6 mm^2
(10 AWG)</td><td rowspan="2">6 mm^2
(10 AWG)</td><td rowspan="2">6 mm^2
(10 AWG)</td></tr>
<tr><td>VFD055ED43BE</td></tr>
<tr><td>VFD075ED43B</td><td rowspan="2">10 mm^2
(8 AWG)</td><td rowspan="2">10 mm^2
(8 AWG)</td><td rowspan="2">10 mm^2
(8 AWG)</td></tr>
<tr><td>VFD075ED43BE</td></tr>
</table>

NOTE:

- When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.
- If you install at Ta 45°C environment, use copper wires with voltage rating of 600V and temperature resistance of 75°C or 90°C.
- If you install at Ta 45°C above environment, use copper wires with voltage rating of 600V and temperature resistance of 90°C or above.
- 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.
- Use a flathead screwdriver to tighten the wires. The head width and thickness of the flathead screwdriver are 5.5 mm and 1.0 mm.

Table 4-6

Terminal	Conductor	Stripping Length (mm)	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
EPS	Solid	7–8	$4\ mm^2$ (12 AWG)	$0.5\ mm^2$ (20 AWG)	5.61 kg-cm (4.87 lb-in.) (0.55 Nm)
	Strand				
	Stranded with ferrules with plastic sleeve				

NOTE:

- Use a flathead screwdriver to tighten the wires. The head width and thickness of the flathead screwdriver are 3.5 mm and 0.6 mm.
- When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.

Table 4-7

Recommended dimension or models of the crimp terminals

Terminal	Wire Gauge	Models		Recommended Dimension *2			
		VENDOR	VENDOR P/N	A (MAX)	B (MAX)	D (MAX)	W (MAX)
Crimp Terminals	12 AWG	K.S.T.	E4009	15 mm	8 mm	10 mm	3.5 mm
	14 AWG		E2508				
	16 AWG		E1508				
	18 AWG		E1008				
	20 AWG		E0508				

NOTE:

*1: Recommended specifications and models of crimping tools: DNT01-2210B or DNT01-2206B. Manufacturer: DINKLE.

*2: Dimensions of crimp terminals are defined as follows:

Dimension A: the actual wiring space

Dimension B: the allowed depth of the terminal block.

Dimension D: the clearance of the terminal block.

Dimension W: the allowed width of the terminal block.

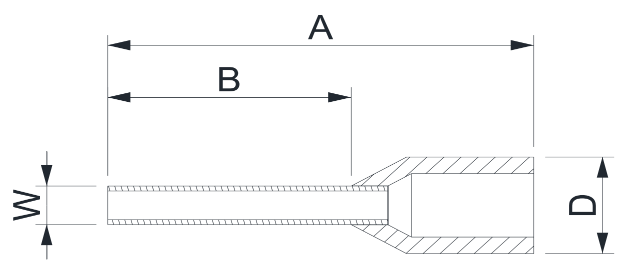


Figure 4-13

Table 4-8

Frame B

Applicable models:

VFD110ED43B, VFD110ED43BE, VFD150ED43B, VFD150ED43BE, VFD185ED43B

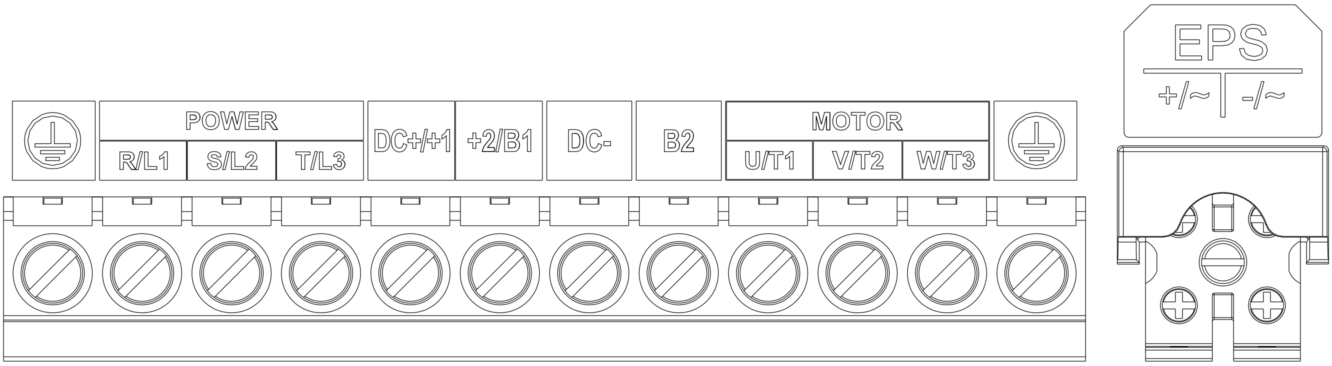


Figure 4-14

<table>
<tr><th rowspan="2">Model</th><th colspan="4">Main Circuit Terminals
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3,
DC-, DC+/+1, +2/B1, B2</th><th colspan="4">Terminals
⏚</th></tr>
<tr><th>Stripping Length (mm)</th><th>Max. Wire Gauge</th><th>Min. Wire Gauge</th><th>Torque (±10%)</th><th>Stripping Length (mm)</th><th>Max. Wire Gauge</th><th>Min. Wire Gauge</th><th>Torque (±10%)</th></tr>
<tr><td>VFD110ED43B</td><td rowspan="5">12–13</td><td rowspan="5">16 mm²
(6 AWG)</td><td rowspan="2">10 mm²
(8 AWG)</td><td rowspan="5">20.74 kg-cm
(18.0 lb-in.)
(2.03 Nm)</td><td rowspan="5">12–13</td><td rowspan="2">10 mm²
(8 AWG</td><td rowspan="2">10 mm²
(8 AWG)</td><td rowspan="5">20.74 kg-cm
(18.0 lb-in.)
(2.03 Nm)</td></tr>
<tr><td>VFD110ED43BE</td></tr>
<tr><td>VFD150ED43B</td><td rowspan="3">16 mm²
(6 AWG)</td><td rowspan="3">16 mm²
(6 AWG)</td><td rowspan="3">16 mm²
(6 AWG)</td></tr>
<tr><td>VFD150ED43BE</td></tr>
<tr><td>VFD185ED43B</td></tr>
</table>

NOTE:

- When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.
- If you install at Ta 45°C environment, use copper wires with voltage rating of 600V and temperature resistance of 75°C or 90°C.
- If you install at Ta 45°C above environment, use copper wires with voltage rating of 600V and temperature resistance of 90°C or above.
- ***For VFD185ED43B***: If you install at Ta 40°C above environment, use copper wires with voltage rating of 600V and temperature resistance of 90°C or above.
- 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.
- Use a flathead screwdriver to tighten the wires. The head width and thickness of the flathead screwdriver are 5.5 mm and 1.0 mm.

Table 4-9

Terminal	Conductor	Stripping Length (mm)	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
EPS	Solid	7–8	4 mm^2 (12 AWG)	0.5 mm^2 (20 AWG)	5.61 kg-cm (4.87 lb-in.) (0.55 Nm)
	Strand				
	Stranded with ferrules with plastic sleeve				

NOTE:

- Use a flathead screwdriver to tighten the wires. The head width and thickness of the flathead screwdriver are 3.5 mm and 0.6 mm.
- When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.

Table 4-10

Recommended dimension or models of the crimp terminals

Terminal	Wire Gauge	Models		Recommended Dimension *2			
		VENDOR	VENDOR P/N	A (MAX)	B (MAX)	D (MAX)	W (MAX)
Crimp Terminals	12 AWG	K.S.T.	E4009	15 mm	8 mm	10 mm	3.5 mm
	14 AWG		E2508				
	16 AWG		E1508				
	18 AWG		E1008				
	20 AWG		E0508				

NOTE:

*1: Recommended specifications and models of crimping tools: DNT01-2210B or DNT01-2206B. Manufacturer: DINKLE.

*2: Dimensions of crimp terminals are defined as follows:

Dimension A: the actual wiring space

Dimension B: the allowed depth of the terminal block.

Dimension D: the clearance of the terminal block.

Dimension W: the allowed width of the terminal block.

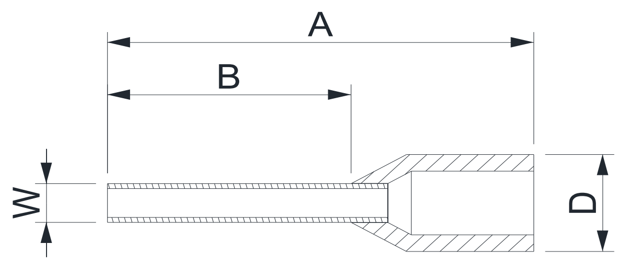


Figure 4-15

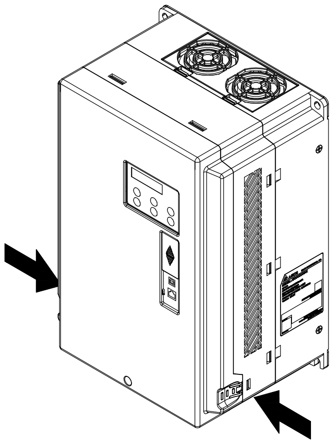
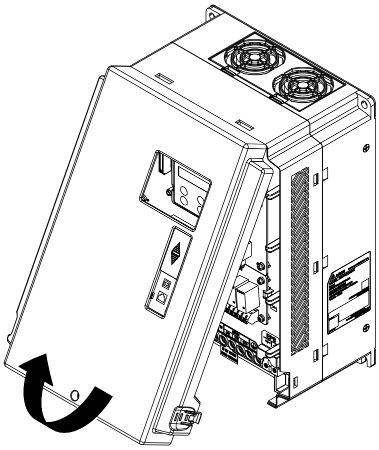
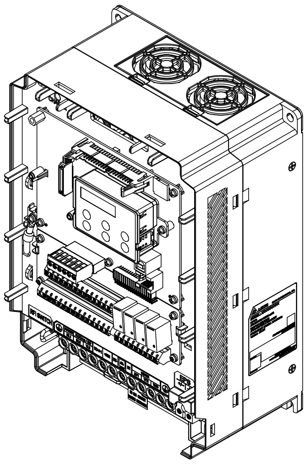
Table 4-11

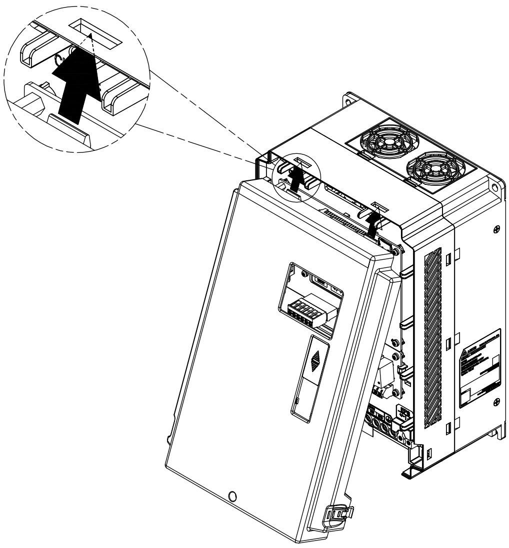
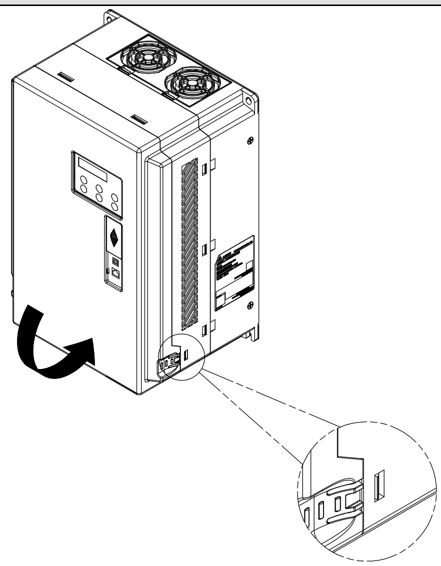
4-5 Remove the Cover before Wiring

Follow the steps below to remove the top cover before wiring the multi-function input and output terminals.

NOTE: The drive figures shown below are for reference only. The actual drive may look different.

1. Press the snaps on both sides of the top cover.
2. Detach the top cover by rotating it with the direction as Figure 4-17 below shows.
3. Making the wiring after detaching the top cover.
4. After finishing the wiring, attach the top cover and make sure the upper hooks of top cover have already plugged into the upper grooves of middle case.
5. Rotate the top cover in an opposite direction and attach until the snaps engage the grooves of middle case with a click.

Step 1: Press the snaps of top cover	Step 2: Detach the top cover	Step 3: Making the wiring
 Figure 4-16	 Figure 4-17	 Figure 4-18

Step 4: Attach the top cover	Step 5: Make the snaps engaged
 Figure 4-19	 Figure 4-20

4-6 Remove the I/O Board

Follow the steps below to detach and attach the I/O board for convenience of wiring.

1. Loosen the four screws surrounding the I/O board using screwdriver, as Figure 4-21 shows.

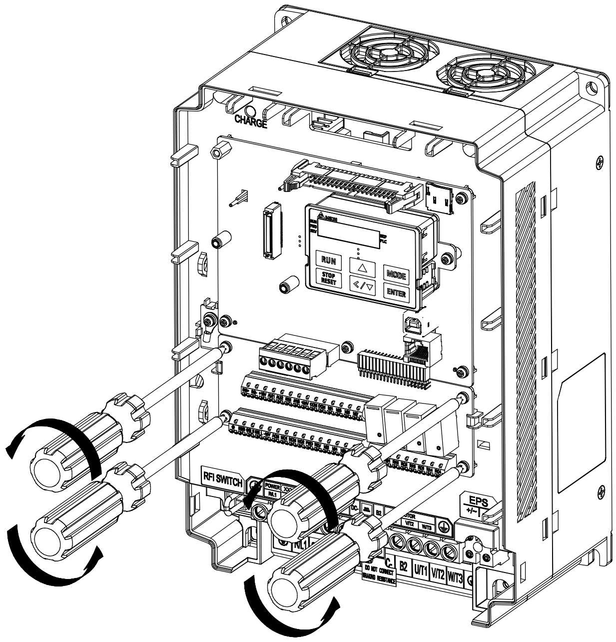


Figure 4-21

2. As shown in Figure 4-22, push the board in a direction as the narrow marking ① shows for about 2.5 cm, and then detach it vertically, as marking ② shows.

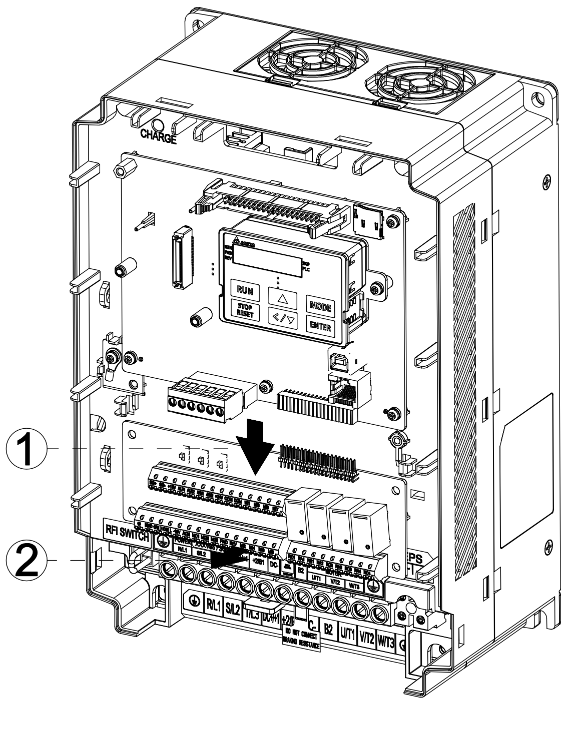


Figure 4-22

4-7 Control Terminal Specifications

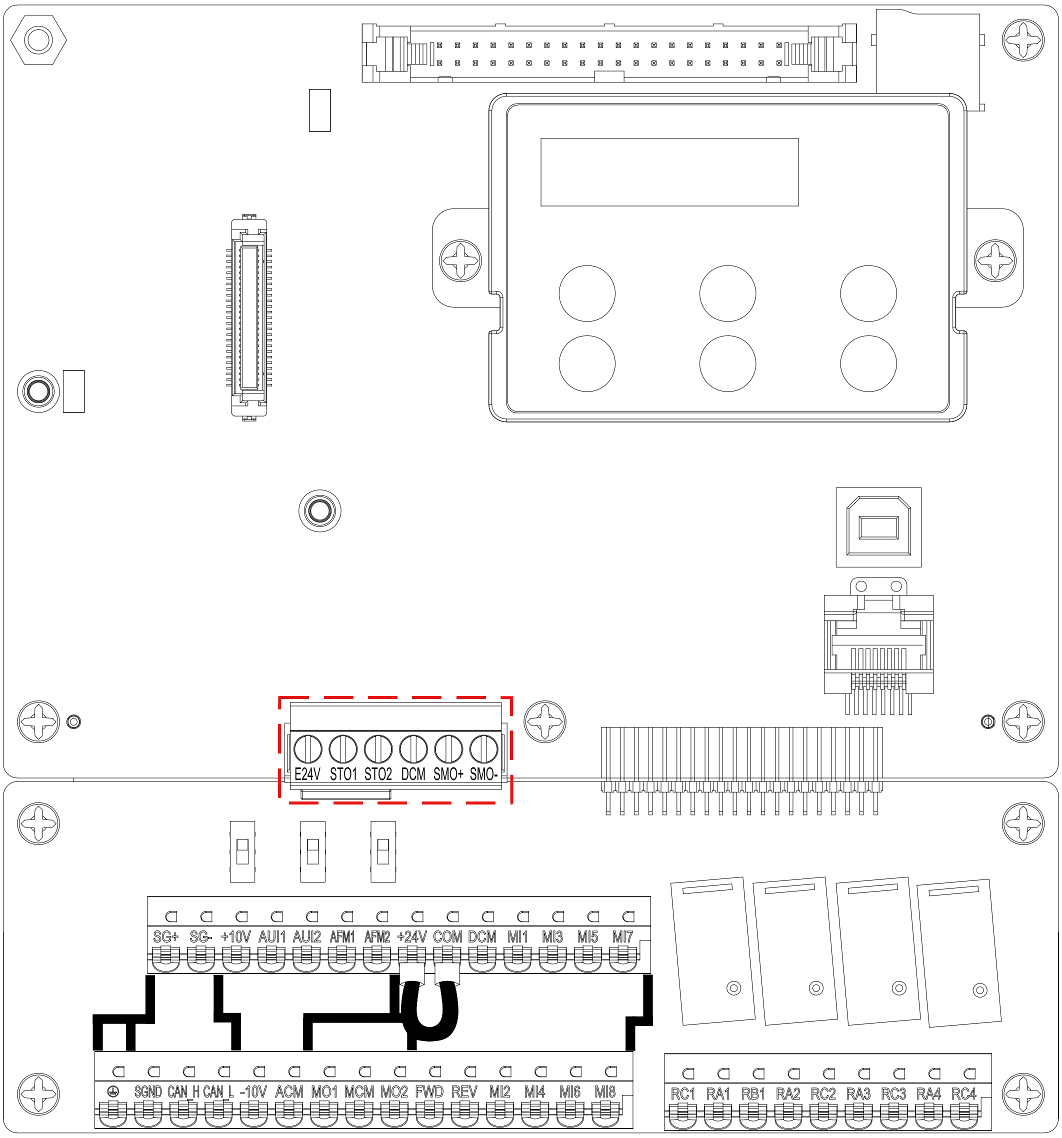


Figure 4-23

<table>
<tr><th>Terminal Function</th><th>Group</th><th>Conductor</th><th>Stripping Length (mm)</th><th>Max. Wire Gauge</th><th>Min. Wire Gauge</th><th>Torque (±10%)</th></tr>
<tr><td rowspan="3">Control Terminals</td><td rowspan="3">Ⓐ</td><td>Solid</td><td rowspan="3">8–9</td><td rowspan="2">1.5 mm²
(16 AWG)</td><td rowspan="2">0.2 mm²
(24 AWG)</td><td rowspan="3">N/A
(Push-in spring Terminals)</td></tr>
<tr><td>Strand</td></tr>
<tr><td>Stranded with ferrules with plastic sleeve</td><td>1.0 mm²
(18 AWG)</td><td>0.25 mm²
(22 AWG)</td></tr>
<tr><td rowspan="3">Relay Terminals</td><td rowspan="3">Ⓑ</td><td>Solid</td><td rowspan="3">8–9</td><td rowspan="2">1.5 mm²
(16 AWG)</td><td rowspan="2">0.2 mm²
(24 AWG)</td><td rowspan="3">N/A
(Push-in spring Terminals)</td></tr>
<tr><td>Strand</td></tr>
<tr><td>Stranded with ferrules with plastic sleeve</td><td>1.0 mm²
(18 AWG)</td><td>0.25 mm²
(22 AWG)</td></tr>
<tr><td rowspan="3">STO Terminals</td><td rowspan="3">Ⓒ</td><td>Solid</td><td rowspan="3">7–8</td><td rowspan="2">4.0 mm²
(12 AWG)</td><td rowspan="2">0.2 mm²
(24 AWG)</td><td rowspan="3">4.59 kg-cm
(3.98 lb-in)
(0.45 Nm)</td></tr>
<tr><td>Strand</td></tr>
<tr><td>Stranded with ferrules with plastic sleeve</td><td>2.5 mm²
(14 AWG)</td><td>0.25 mm²
(22 AWG)</td></tr>
</table>

NOTE:

- The default for E24V, STO1, STO2 are short-circuited, as shown in Figure 4-23. The E24V power supply from group Ⓒ in the figure is for STO only, and cannot be used for other purposes.
- +24V and COM are short-circuited by default at the factory, as shown in Figure 4-23.
- For group Ⓐ and Ⓑ, use a flathead screwdriver to press down the terminal when detaching the wires. The head width and thickness of the flathead screwdriver are 0.6 mm and 3.5 mm and recommended pressing forces is 2.5 kgf.
- For group Ⓒ, use a flathead screwdriver to tighten the wires. The head width and thickness of the flathead screwdriver are 0.6 mm and 3.5 mm.
- When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.
- It’s able to push conductor crimped with insulated ferrule into the terminal block for wiring without using any tools.
- When wiring stranded conductor, ensure that they are perfectly arranged to go through the wiring holes.

Table 4-12

Recommended dimension or models of the crimp terminals

For group Ⓐ and Ⓑ							
Terminal	Wire Gauge	Models		Recommended Dimension *2			
		VENDOR	VENDOR P/N	A (MAX)	B (MAX)	D (MAX)	W (MAX)
Crimp Terminals	18 AWG	K.S.T.	E7510	16 mm	10 mm	3.0 m	1.5 mm
	20 AWG		E0510				
	22 AWG						
For group Ⓒ							
Terminal	Wire Gauge	Models		Recommended Dimension *2			
		VENDOR	VENDOR P/N	A (MAX)	B (MAX)	D (MAX)	W (MAX)
Crimp Terminals	14 AWG	K.S.T.	E2508	15 mm	8 mm	4.2 m	2.5 mm
	16 AWG		E1508				
	18 AWG		E1008				
	20 AWG		E0508				
	22 AWG		E0308				

NOTE:

*1: Recommended specifications and models of crimping tools: DNT01-2210B or DNT01-2206B. Manufacturer: DINKLE.

*2: Dimensions of crimp terminals are defined as follows:

Dimension A: the actual wiring space

Dimension B: the allowed depth of the terminal block.

Dimension D: the clearance of the terminal block.

Dimension W: the allowed width of the terminal block.

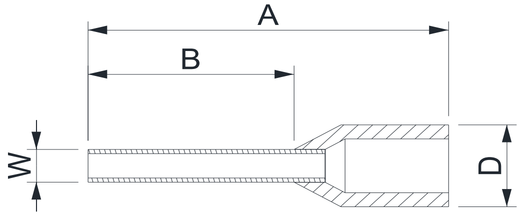


Figure 4-24

Table 4-13

4-8 Control Circuit Terminals

Terminals	Terminal Function	Default (NPN mode)
+24V / E24V	Digital control signal common terminal (Source)	+24 V ± 5% 200 mA
COM	Digital control signal common terminal (Sink)	Common terminal for multi-function input terminals
FWD	Forward-Stop command	FWD-DCM: ON = run in forward OFF = decelerate to stop
REV	Reverse-Stop command	REV-DCM: ON = run in reverse OFF = decelerate to stop
MI1 – MI8	Multi-function input 1–8	Refer to Pr.01-00–Pr.01-07 to program the multi-function inputs MI1–MI8. ● Rated load: 24 V_{DC} / 9.6 mA ● Source Mode (PNP) N.O. (ON, 1): ≥ 17 V_{DC} N.C. (OFF, 0): ≤ 5 V_{DC} ● Sink Mode (NPN) N.O. (ON, 1): ≤ 7 V_{DC} N.C. (OFF, 0): ≥ 19 V_{DC}
DCM	Digital frequency signal common terminal	
STO1	The default is short-circuited (E24V / STO1 / STO2). Power cutoff safety function for IEC/EN61508. When STO1–E24V and STO2–E24V are ON, the activation current is 3.3 mA ≥ 15 V_{DC}.	
STO2		
SMO+		
SMO-		
+10 V	Potentiometer power supply	Power supply for analog frequency setting: +10 V_{DC} 20 mA
-10 V	Potentiometer power supply	Power supply for analog frequency setting: -10 V_{DC} 20 mA

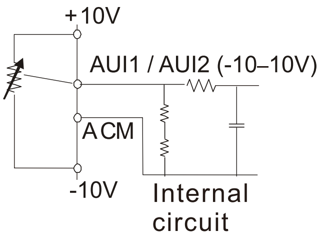
<table>
<tr><th>Terminals</th><th>Terminal Function</th><th>Default (NPN mode)</th></tr>
<tr><td>AUI1 /
ACI1</td><td>Analog voltage frequency command


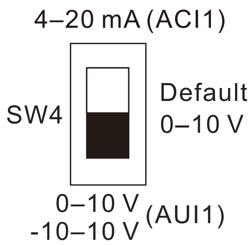
Figure 4-25</td><td rowspan="2">Impedance: 20 kΩ
Impedance in current mode: 250 Ω
Range: -10–10 V_{DC}, corresponding to 0–Maximum Output Frequency (Pr.03-50)
AUI1 Switch (SW4): default setting is 0–10 V


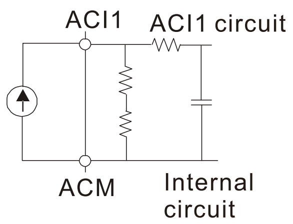
Figure 4-27</td></tr>
<tr><td>AUI2</td><td>Analog current frequency command


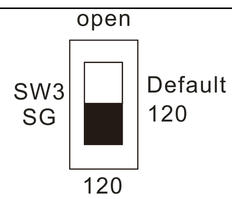
Figure 4-26</td></tr>
<tr><td>ACM</td><td>Analog signal common terminal control</td><td>Analog signal common terminal</td></tr>
<tr><td>RA1</td><td>Multi-function relay output 1 (N.O.) a</td><td rowspan="9">● User-defined function
Average life of resistive load (with operations: ON for 1 sec., OFF for 1 sec.)
<table>
<tr><td>N.O. 100,000 operations:</td><td>3A at 250 V_{AC} / 5A at 30 V_{DC}</td></tr>
<tr><td>N.O. 50,000 operations:</td><td>5A at 250 V_{AC}</td></tr>
<tr><td>N.C. 100,000 operations:</td><td>3A at 250 V_{AC} / 30 V_{DC}</td></tr>
<tr><td colspan="2">The min. spec. 10 mA at 5 V_{DC}</td></tr>
</table>
To output different kinds of monitoring signals such as motor drive in operation, frequency reached, and overload indication.</td></tr>
<tr><td>RB1</td><td>Multi-function relay output 1 (N.C.) b</td></tr>
<tr><td>RC1</td><td>Multi-function relay 1 common</td></tr>
<tr><td>RA2</td><td>Multi-function relay output 2 (N.O.) a</td></tr>
<tr><td>RC2</td><td>Multi-function relay 2 common</td></tr>
<tr><td>RA3</td><td>Multi-function relay output 3 (N.O.) a</td></tr>
<tr><td>RC3</td><td>Multi-function relay 3 common</td></tr>
<tr><td>RA4</td><td>Multi-function relay output 4 (N.O.) a</td></tr>
<tr><td>RC4</td><td>Multi-function relay 4 common</td></tr>
<tr><td>SG+</td><td>Modbus RS-485</td><td rowspan="2">SG Switch (SW3): terminator 120 ohm (default) / open


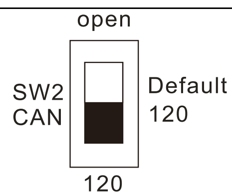
Figure 4-28</td></tr>
<tr><td>SG-</td><td>Modbus RS-485</td></tr>
<tr><td>CAN_L</td><td>CAN Bus</td><td rowspan="2">CAN Switch (SW2): terminator 120 ohm (default) / open


Figure 4-29</td></tr>
<tr><td>CAN_H</td><td>CAN Bus</td></tr>
<tr><td>SGND</td><td colspan="2">RS-485 and CAN Bus</td></tr>
</table>

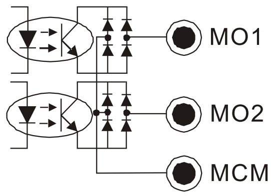
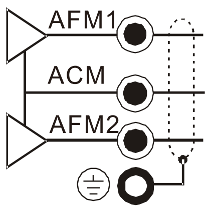
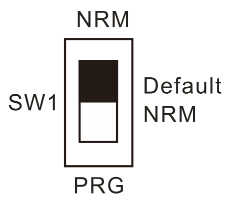
Terminals	Terminal Function	Default (NPN mode)
MO1	Multi-function output terminal 1 (photo coupler)	The AC motor drive outputs various monitoring signals, such as drive in operation, frequency reached, and overload indication through a transistor (open collector).  Figure 4-30
MO2	Multi-function output terminal 2 (photo coupler)	
MCM	Multi-function output common terminal (photo coupler)	Maximum 48 V_{DC} 50 mA
AFM1	Analog output 1 and 2  Figure 4-31	0-10 V_{DC}, max. output current: 2 mA, max. load: 5 kΩ -10–10 V_{DC}, max. output current: 2 mA, max. load: 5 kΩ Maximum output current: 2 mA Resolution: 0–10 V_{DC}, corresponding to the maximum operating frequency. Range: 0–10 V_{DC}, -10–10 V_{DC}
AFM2		
RJ45	PINS 1, 2, 6, 7: Reserved PIN 3: SGND PIN 4: SG- PIN 5: SG+ PIN 8: EV	
SW1	Switching USB port	DIP switch (SW1): NRM (default) / PRG (use this side of the switch to update firmware). Updating firmware should be done by qualified motor drive service personnel only. Do NOT try to update the firmware by yourself.  Figure 4-32

Table 4-14

4-9 Drive's STO Function

This section introduces the STO function and how to use it in elevators. For more information, please contact Delta. Read the following precautions to ensure safety.

DANGER	☑ An improper use of STO (Safe Torque Off) functions would cause serious injuries or death. Make sure the entire system or machinery uses the STO function that complies with safety requirements. When implementing STO functions into a safety system of machines, a thorough risk assessment and validation must be carried out to ensure compliance with safety standards such as ISO/EN 13849, IEC/EN 61508, IEC/EN 62061. ☑ When using a PM (Permanent Magnet) motor, even if drive output is disabled by STO function, a breakdown of two output transistors can cause current to flow through the motor winding, resulting in a rotor movement for a maximum of 180 electrical angle. Make sure that such circumstance does not affect the safety of applications when using STO functions. Failure to comply can result in death or serious injuries. ☑ The STO function disables the drive output, but neither cuts off the drive power supply, nor electrically isolates the drive output from input. When performing maintenance or installation at drive's input and output side, always turn off the drive's power supply. Failure to comply can result in death or series injuries.
CAUTION	☑ If the motor is subjected to an external force, use a mechanical break that meets the safety requirements of the entire system or machinery to stop the machine connected to the load. When an external gravitational force is applied to vertical axis while the STO function is active, the motor may still move. Failure to comply may cause serious personal injury or death. ☑ Connect the safety input into the equipment in compliance with the safety requirements. Failure to comply can result in death or serious injuries. ☑ Make sure to remove the wirings between STO1, STO2 and E24V terminals that were installed prior to shipment. Otherwise, STO circuit will not be able to work normally, and may cause personal injury or even death. ☑ It takes a maximum of 3 ms for the drive to output since input terminals STO1 and STO2 are OFF. The sequence setting to trigger terminals STO1 and STO2 should confirm both terminals remain ON for at least 3 ms in order to properly interrupt the drive output. But this may cause STO input deactivated. ☑ DO NOT use STO (output terminals SMO+ and SMO-) for any other purposes. It can be used only for monitoring STO status or detecting malfunctions in STO inputs. The monitor output is not considered as a safety output.

4-9-1 Failure Rate of the Drive's Safety Function

4-9-1-1 Failure Rate of the Drive's STO Function SIL 3, PL e / Cat. 3

Item	Definition	Standard	Performance
HFT (Type A subsystem)	Hardware Fault Tolerance	IEC 61508	1
SIL	Safety Integrity Level	IEC 61508	SIL3
		EN IEC 62061	SIL CL 3
PFH	Average frequency of dangerous failure [h-1]	IEC 61508	2.45×10^{-9}
PFD_{av}	Probability of Dangerous Failure on Demand	IEC 61508	2.20×10^{-4}
Operation mode	For elevator and machinery	IEC 61508	High demand
PTI	Proof test interval	IEC 61508	20 years
DTI	Diagnostic test interval	IEC 61508	24 hours (STO) 10 msec (SPS)
Category	Category	EN ISO 13849-1	Category 3
PL	Performance level	EN ISO 13849-1	e
$MTTF_d$	Mean time to dangerous failure	EN ISO 13849-1	High
DC	Diagnostic coverage	EN ISO 13849-1	Medium

Table 4-15

NOTE: In order to achieve SIL 3, PL e / Cat. 3, an external safety PLC or the user shall analyse the DSTO feedback signal for the consistency check with STO1 and STO2. As 1oo1 parts (SPS) and 1oo2 parts (STO), once any fault happens during an operation, the drive stops output current and keeps the drive in safe state.

4-9-1-2 Failure Rate of the Drive's STO Function SIL 2, PL d / Cat. 3

Item	Definition	Standard	Performance
HFT (Type A subsystem)	Hardware Fault Tolerance	IEC 61508	1
SIL	Safety Integrity Level	IEC 61508	SIL2
		EN IEC 62061	SIL CL 2
PFH	Average frequency of dangerous failure [h-1]	IEC 61508	2.80×10^{-9}
PFD_{av}	Probability of Dangerous Failure on Demand	IEC 61508	2.50×10^{-4}
Operation mode	For elevator and machinery	IEC 61508	High demand
PTI	Proof test interval	IEC 61508	20 years
DTI	Diagnostic test interval	IEC 61508	24 hours (STO) 10 msec (SPS)
Category	Category	EN ISO 13849-1	Category 3
PL	Performance level	EN ISO 13849-1	d
$MTTF_d$	Mean time to dangerous failure	EN ISO 13849-1	High
DC	Diagnostic coverage	EN ISO 13849-1	Low

Table 4-16

NOTE: In case the external safety PLC or the user does not analyse the DSTO feedback signal for the consistency check with STO1 and STO2, the STO function within EB3000 series drive can achieve only SIL 2, PL d / Cat. 3. As 1oo1 parts (SPS) and 1oo2 parts (STO), once any fault happens during an operation, the drive stops output current and keeps the drive in safe state.

4-9-2 STO Terminal Function

The STO (Safe Torque Off) function is to prevent the motor from producing torque force. It is run by two independent hardware circuits to cut off motor drive's power module output in order to safely stop the motor drive.

The following table describes the terminal functions.

Item	Description
Input / Output	Inputs: 2 STO input: STO1, STO2 Signal ON electric potential: 15–30 V_{DC} Signal OFF electric potential: 0–5 V_{DC}
	Output: 1 STO monitoring output SMO (SMO+, SMO-)
Response time started from inputs are OFF until the drive output stops	Less than 10 ms
Phase deviation time between STO1 and STO2	Less than 110 ms

Table 4-17

4-9-3 Wiring Diagram

4-9-3-1 Internal Safety Circuit

Figure 4-33 shows the drive's internal safety circuit. STO circuit consists of two independent input channels that can block the output transistors (terminals STO1 and STO2). The input uses the drive internal power supply (E24V). A photocoupler output is available to monitor the status of STO terminals SMO+ and SMO-. For details on signal specifications when using this output, see Digital Output Settings in Parameter Group 01 in <Chapter 8 Descriptions of Parameter Settings>. Additionally, a STO monitoring function can be assigned to one of the digital outputs (MO=42 STO Output Status).

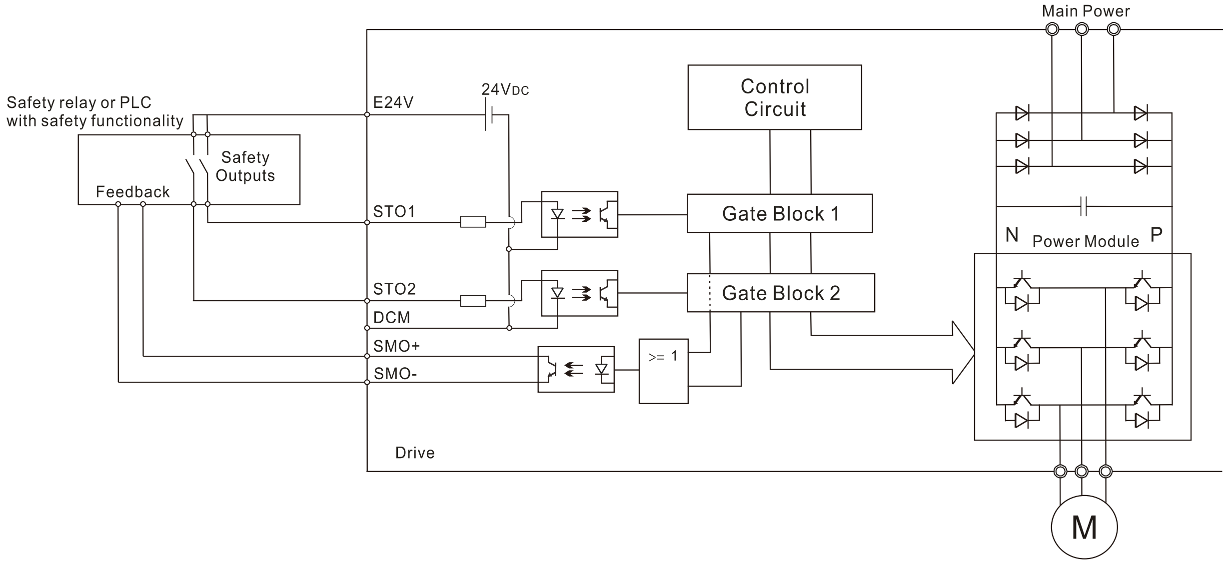


Figure 4-33

NOTE: The STO circuit is designed for pollution degree 3, which ensures the functional safety is maintained even in an environment with pollution degree 3.

4-9-3-2 Internal Safety Circuit Terminals

Group Ⓒ in Figure 4-26 shows the default for terminals E24V-STO1-STO2 and terminals SMO+-SMO--DCM in the drive's internal safety circuit, which are short-circuited when they are delivered from the factory.

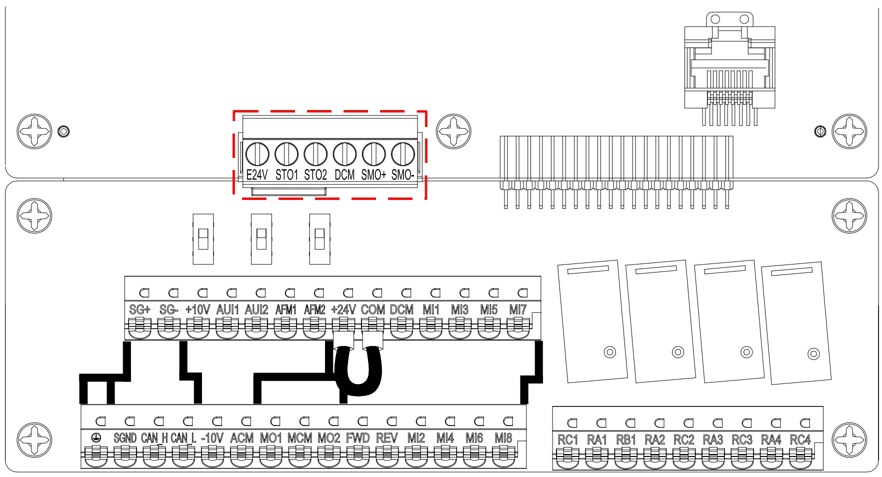


Figure 4-34

NOTE: Well-insulated wiring according to ISO 13849-2:2012, table D.4 for STO1, STO2, and E24V shall be adopted.

4-9-4 Description of STO Function

STO input, in compliance with the STO function defined by IEC/EN 61800-5-2, meets the requirements as shown in Figure 4-33, and provides a STO status monitor used for detecting errors in the safety circuit.

4-9-4-1 STO Active and Non-active

Figure 4-35 illustrates the STO input operation.

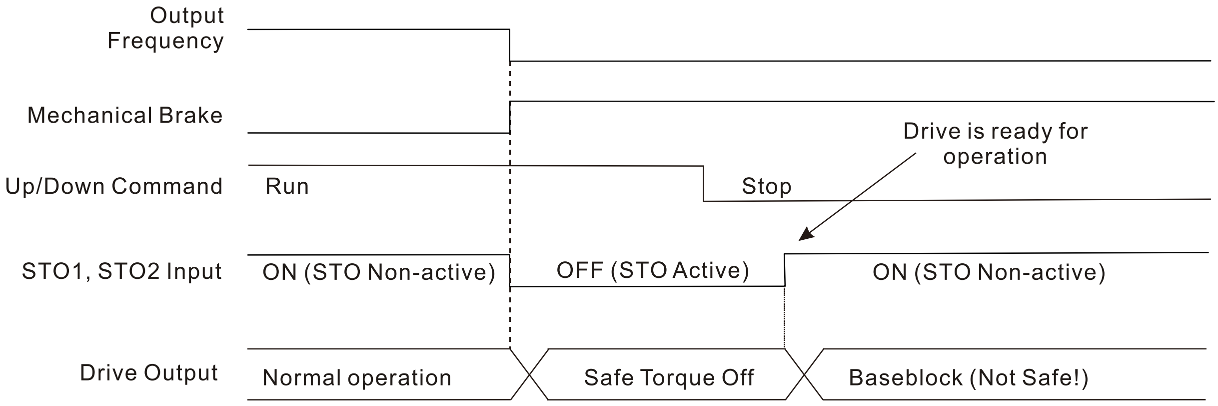


Figure 4-35 STO Operation

STO Active

Whenever either or both STO inputs is/are OFF, motor torque can be stopped by disabling the drive output. But if the motor has been running before STO inputs are OFF, the elevator will coast to stop.

NOTE:

1. STO Active can only be acquired by using STO1/STO2 inputs. When STO1/STO2 inputs are ON and the Up/Down command is deactivated, the drive stops and output disables, and STO Active (Base block) is unable to be entered.
2. After the motor fully stops, ensure that STO inputs are OFF in order to prevent the motor from out of control during normal operation.

STO Non-active

When both STO1 and STO2 are ON and in STO Non-active status and if the Up/Down command is given before STO1/STO2 inputs are ON, the drive immediately starts the motor to generate torque.

4-9-4-2 STO Monitor Output Function and Built-in Keyboard Panel KPED-LE02

The table below describes the drive output and STO monitor status depending on STO inputs:

STO Inputs		STO Monitor SMO (SMO+, SMO-)	STO Monitor		Drive Output	Built-in Keyboard Panel Display (KPED-LE02)
Input 1, STO1-E24V	Input 2, STO2-E24V		Pr.01-14 = 42	Pr.01-14 = 142		
OFF	OFF	ON	ON	OFF	Disabled	No display
ON	OFF	OFF	OFF	ON	Disabled	StL2
OFF	ON	OFF	OFF	ON	Disabled	StL1
ON	ON	OFF	OFF	ON	Ready to output	No display

Table 4-18

STO Status Monitor

With the STO monitor output (terminals SMO+ and SMO-), the drive provides a safety status feedback signal. The safety status feedback signal should be read by the device that controls STO inputs (PLC or a safety relay) in order to prevent the STO Active from exiting in case the safety circuit malfunctions. The external safety PLC or the user shall analyse the DSTO feedback signal for the consistency check with STO1 and STO2.

Display on Built-in Keyboard Panel (KPED-LE02)

- Compared with terminals SMO+ / SMO-, the STO monitoring function of digital output (MO) setting #42 is a software function. It can be used as a single contactor solution that complies with EN81-1, but cannot be used as a SMO signal that complies with IEC/EN 61800-5-2.
- When both STO inputs are OFF, the UD indicator on the built-in keyboard panel will light on.
- If one STO channel is OFF while the other is ON, fault code StL1 or StL2 displays on KPED-LE02. If STO circuits are used properly, in normal condition, these fault codes will not display.
- If both STO channels are not OFF after RUN command has been OFF for more than four seconds, fault code StL4 (STO sticking warning/fault can be set through Pr.04-10) displays on KPED-LE02, indicating there is a problem in the safety circuit or in the drive.
- If faults in the safety circuit are detected, fault code StL3 to StL5 display on KPED-LE02, indicating there is damage to the drive.
- For details on these fault codes, see <Chapter 9 Warning and Fault Codes>.

4-9-4-3 STO Function Validation

When you start-up, replace parts or perform maintenance, always implement the following validation testing into the STO inputs after making the wiring. (The validation results should be kept as records for maintenance.)

- When STO1 and STO2 signals are ON, make sure that the UD indicator on KPED-LE02 has been lighted off, and the motor does not run.
- Monitor the ON / OFF status in SMO (SMO+, SMO-) signals, and verify the SMO signal based on Table 4-18. If the ON / OFF status of the signal is different from displayed, consider the following faults: external device fault, external wiring off, external wiring short circuit, or drive malfunctions. Find the causes and take corrective actions.
- During normal operation, verify the SMO signal based on Table 4-18.

4-9-4-4 24-hour Detection Function

Whenever the drive is powered-on, 24-hour timer starts to count cumulatively. When timer exceeds 24 hours, system enters into safe status and fault code StL5 will be triggered. At this time, activate STO first, and then reset the drive.

- How to disable the 24-hour detection function:
  For details on closing 24-hour detection function, see MI=57 in Parameter Group 01 Input / Output Parameters in <Chapter 8 Descriptions of Parameter Settings>. Even if the 24-hour detection function is disabled through the mentioned parameter setting, the 24-hour timer starts to count cumulatively whenever the AC motor drive is re-powered.

- How to prevent triggering the 24-hour detection function:
  1. You could control the STO through the auxiliary contact of output Magnetic Contactor.
  2. If there is no output Magnetic Contactor, or the output Magnetic Contactor has no auxiliary contact, set one of the output Relays of the drive to 15 (Motor-controlled magnetic contactor output) to control the STO.

4-9-4-5 STO Wiring Examples

Circuit *with* one operation contactor that complies with EN81-1 / EN81-20

The STO circuit can be installed in an elevator system that only uses one instead of two operation contactors. In such a system, the following guidelines must be followed to comply with EN81-1 or EN81-20.

- ***Circuits must be designed*** in order to deactivate input terminals STO1 and STO2 when the safety circuit is OFF, and disable the drive output.
- ***The drive digital output (MO) must be set to 42 (STO Output Status)***. This signal must be connected to the contactor monitoring circuit in the elevator controller in order to prevent the motor from restarting when STO circuit or operation contactor malfunctions.
- All contactors and wirings chosen and installed ***must be conformed to EN81-1 or EN81-20***.
- ***STO inputs (terminals STO1 and STO2) must be used*** to enable / disable the drive.

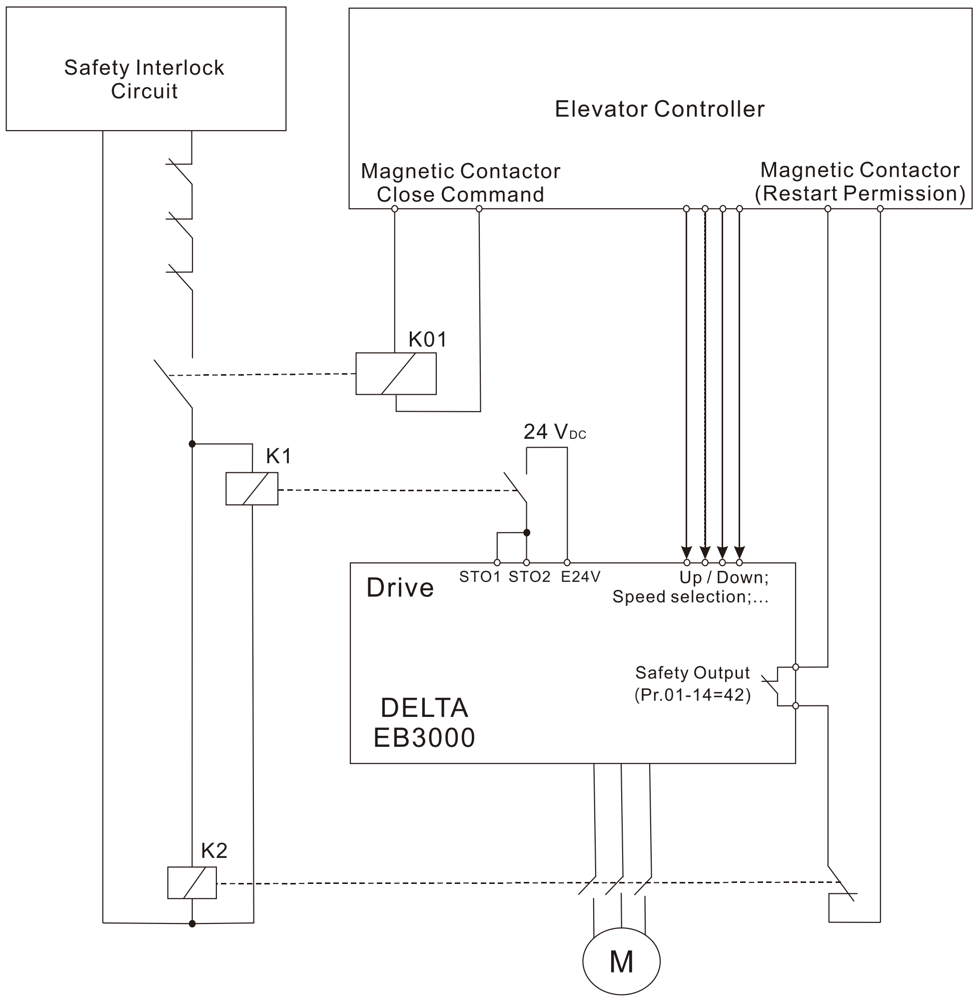


Figure 4-36

NOTE:

1. Once input terminal STO1 or STO2 is OFF, the drive output will immediately stop. In this case, use brake immediately to prevent the elevator from moving.
2. Input terminals STO1 and STO2 must be ON before setting the Up/Down command. The elevator controller can give the Up/Down command only when it receives the signal that the STO Output Status (MO=42) is OFF.
3. After the elevator stops, STO1 and STO2 should be OFF. The elevator controller must receive the signal that the STO Output Status (MO=42) is ON, if not, STO circuit sticking may occur and the elevator cannot be started again.

Circuit *without* operation contactors that complies with EN81-20

The STO circuit is installed in an elevator system that does not use any operation contactors. In such a system, the following guidelines must be followed to comply with EN81-20.

- ***Circuits must be designed*** in order to deactivate input terminals STO1 and STO2 inputs when the safety circuit is OFF, and disable the drive output.
- ***STO inputs (terminals STO1 and STO2) must be used*** to enable / disable the drive.

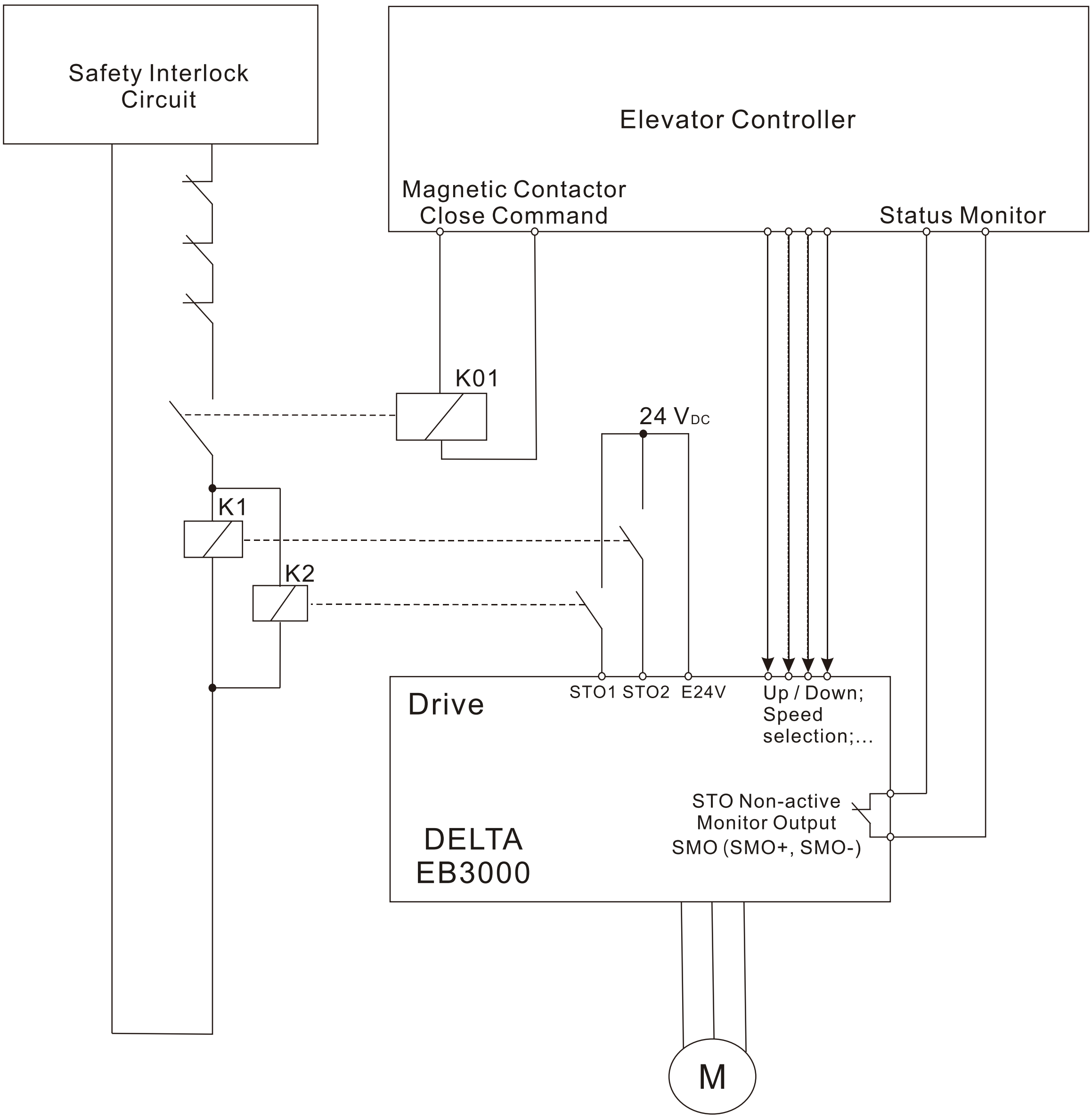


Figure 4-37

NOTE:

1. Once input terminal STO1 or STO2 is OFF, the drive output will immediately stop. In this case, use brake immediately to prevent the elevator from moving.
2. Input terminals STO1 and STO2 must be ON before setting the Up/Down command. The elevator controller can give the Up/Down command only when it receives the signal that the STO monitoring output SMO (SMO+, SMO-) is OFF.
3. After the elevator stops, STO1 and STO2 should be OFF. The elevator controller must receive the signal that the STO monitoring output SMO (SMO+, SMO-) is ON, if not, STO circuit sticking may occur and the elevator cannot be started again.
4. The contactor monitoring circuit in the elevator controller can be changed to monitor STO monitoring output SMO (SMO+, SMO-).

4-10 RFI Switch

The AC motor drive may emit electrical noise. You can use the RFI (Radio Frequency Interference) switch to suppress interference on the power line. The RFI switches on models ***without*** built-in EMC filters for Frame A and Frame B are at similar positions, as shown in Figure 4-30 and Figure 4-32. The RFI switches on models ***with*** built-in EMC filters for Frame A and Frame B are at similar positions, as shown in Figure 4-31 and Figure 4-33. Remove the RFI switches as shown in the following figures if needed.

Frame A: for Models ***without*** Built-in EMC Filters

VFD022ED21B, VFD037ED21B, VFD040ED43B, VFD055ED43B, VFD075ED43B

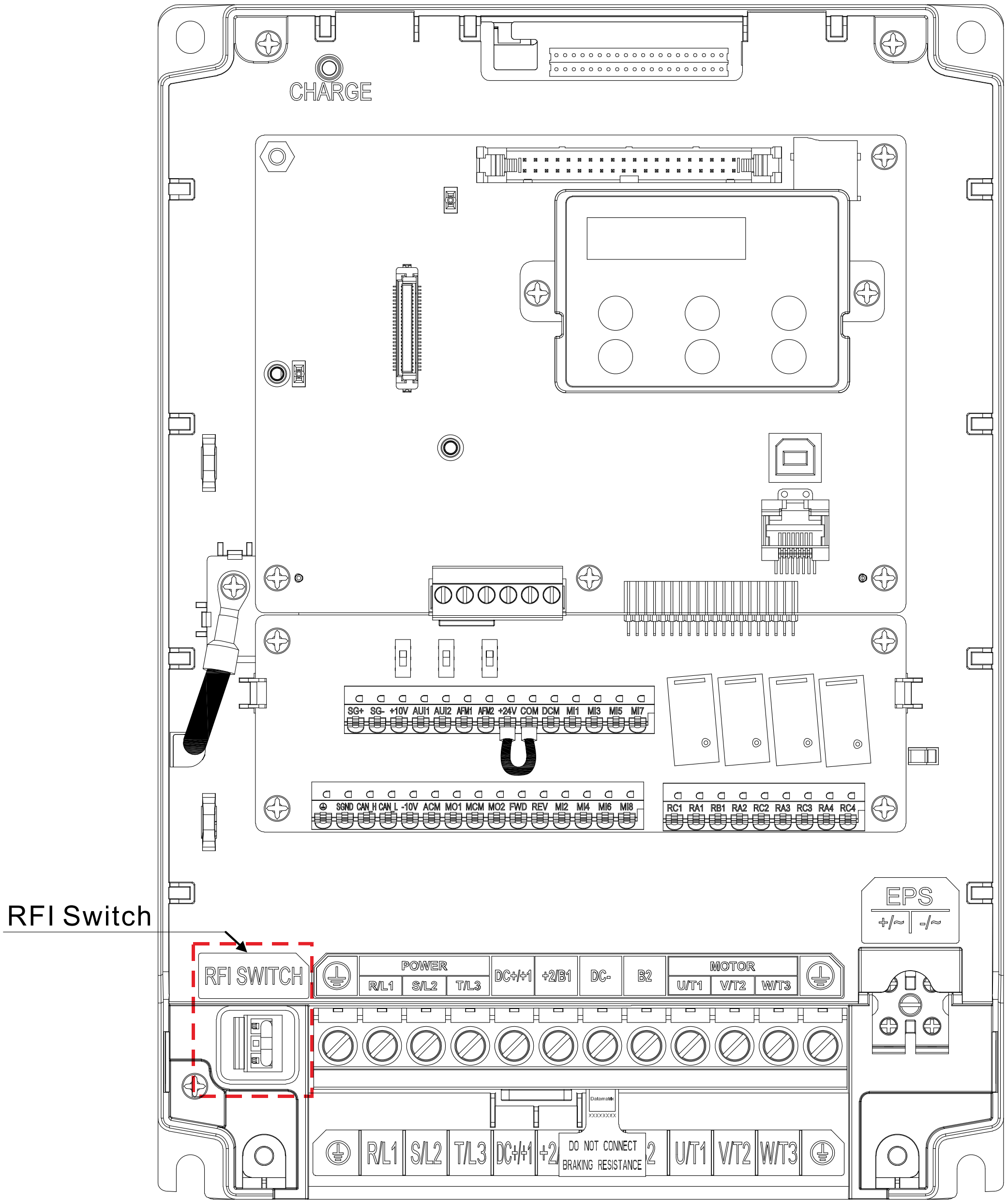


Figure 4-38

Frame A: for Models ***with*** Built-in EMC Filters

VFD022ED21BE, VFD037ED21BE, VFD040ED43BE, VFD055ED43BE, VFD075ED43BE

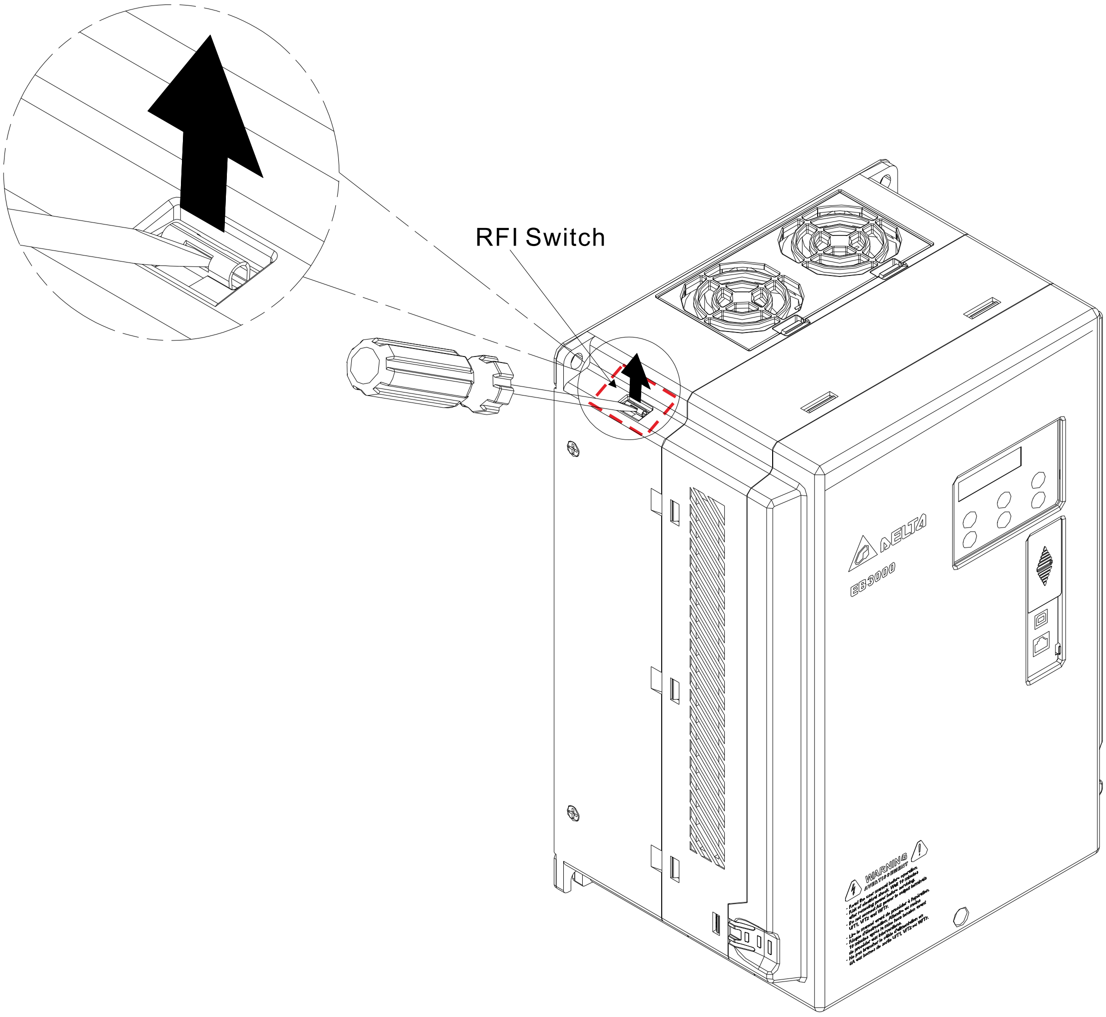


Figure 4-39

Frame B: for Models ***without*** Built-in EMC Filters

VFD110ED43B, VFD150ED43B, VFD185ED43B

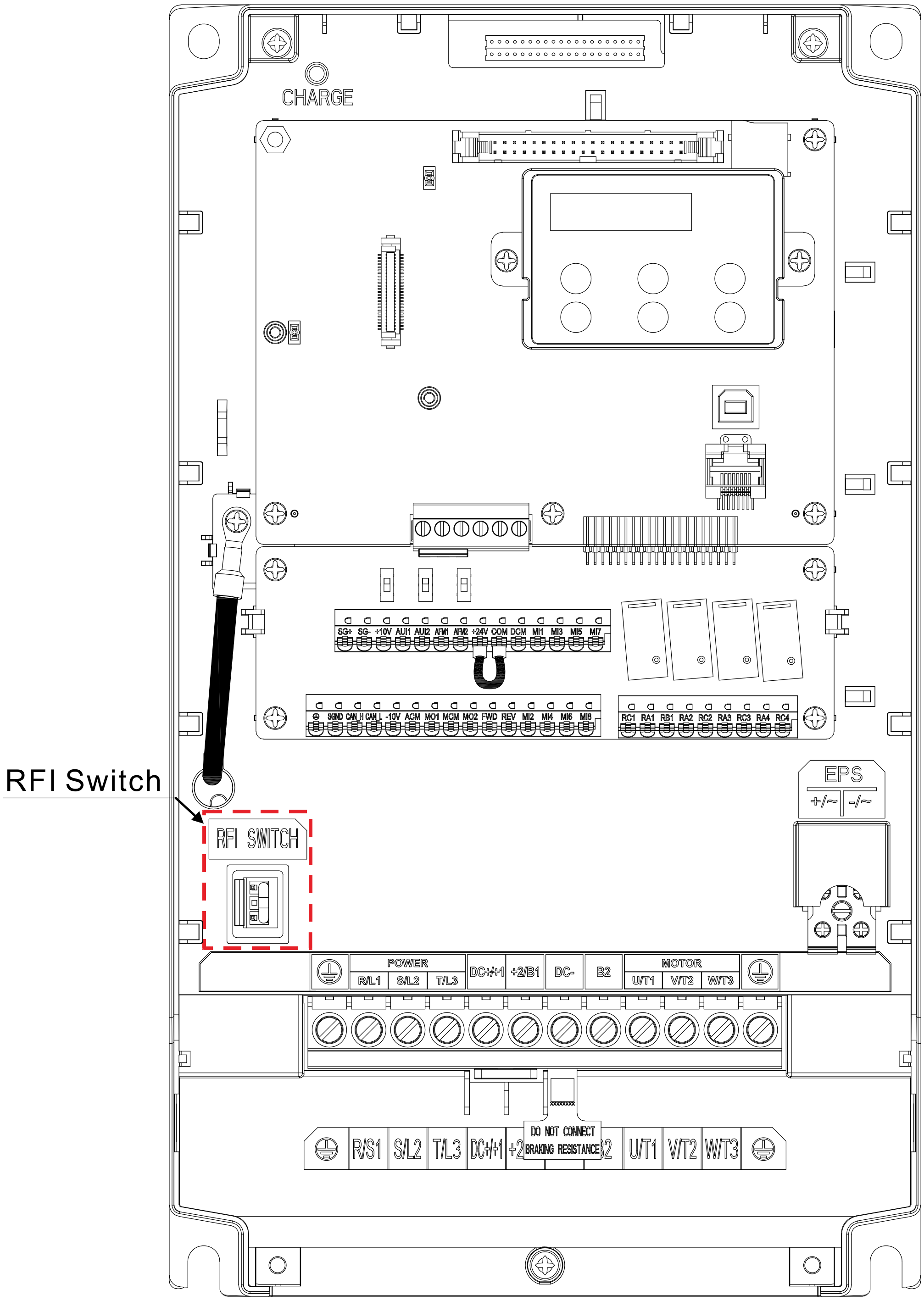


Figure 4-40

Frame B: for Models ***with*** Built-in EMC Filters

VFD110ED43BE, VFD150ED43BE

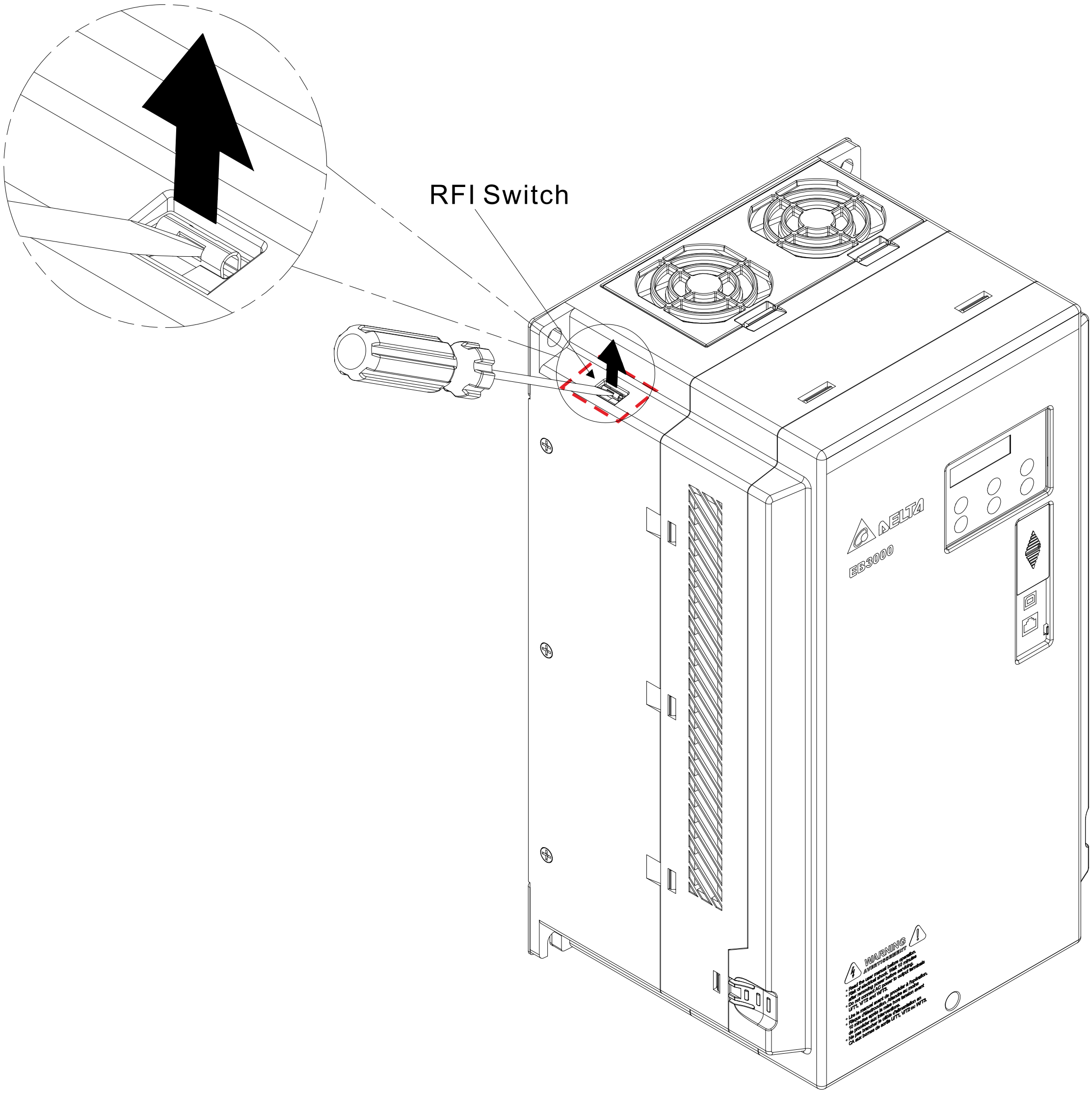


Figure 4-41

Isolating main power from ground

When the power distribution system for the motor drive is a floating ground system (IT) or an asymmetric ground system (TN), you must remove the RFI switch. Voltage of any phase to the ground for either system may be larger than the voltage specifications of the drive's built-in surge absorber and common-mode capacitance. In this case, connecting RFI switch to the ground may cause damage to the drive.

Important points regarding ground connection

☑ To ensure the safety of personnel, ensure proper operation, and reduce electromagnetic radiation, you must properly ground the motor and drive during installation.

☑ The diameter of the grounding cables must meet the size specified by safety regulations.

☑ You must connect the shielded cable to the motor drive's ground to meet safety regulations.

☑ Only use the shielded cable as the ground for equipment when the above points are met.

☑ When installing multiple sets of motor drives, do not connect the motor drives' grounds in series. See the following image.

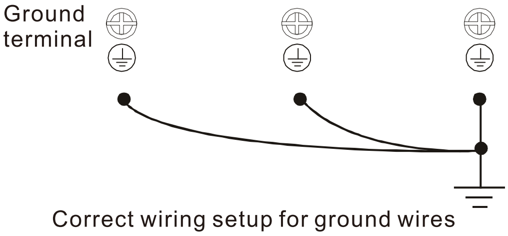


Figure 4-42

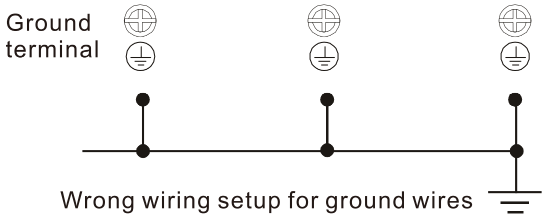


Figure 4-43

Pay particular attention to the following points

☑ Do not remove the RFI switch while the power is ON.

☑ Make sure the main power is OFF before removing the RFI switch.

☑ Removing the RFI switch also cuts the capacitor conductivity. Gap discharge may occur once the transient voltage exceeds 1000 V.

If you remove the RFI switch, you remove the reliable electrical isolation. In other words, all controlled inputs and outputs become low-voltage terminals with basic electrical isolation. Also, when you remove the internal RFI switch, the motor drive is no longer electromagnetic compatible (EMC).

☑ Do not remove the RFI switch if the main power is a grounded power system.

☑ You must remove the RFI switch when conducting high voltage tests. When conducting a high voltage test for 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 an IT system, ungrounded system, or high impedance/resistance (greater than 30 Ω) grounding system.

☑ Disconnect the ground cable from the internal EMC filter.

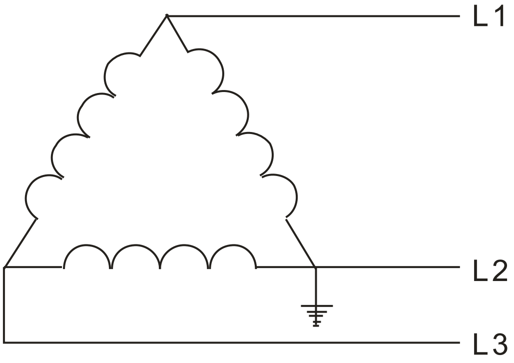
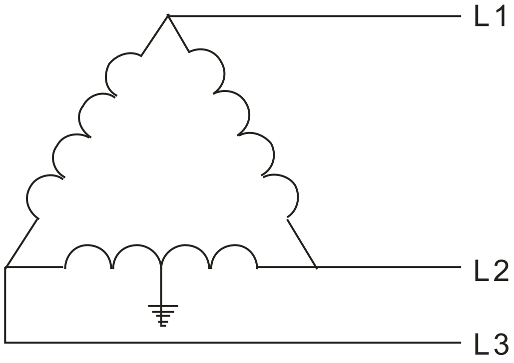
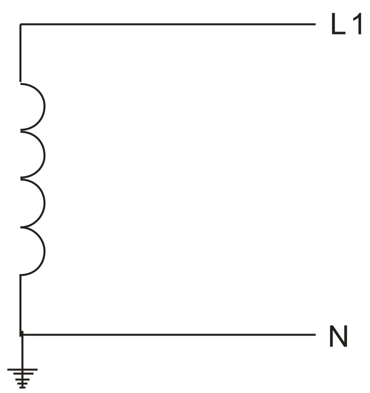
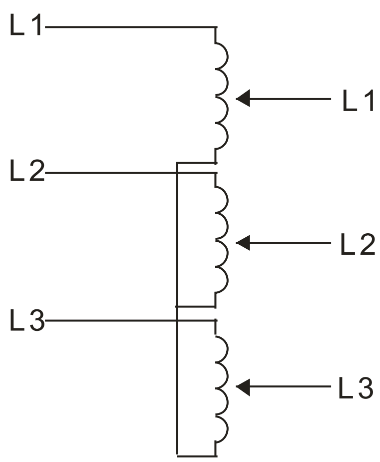
☑ In situations where EMC is required, check for excess electromagnetic radiation affecting nearby low-voltage circuits. In some situations, the adapter and cable naturally provide enough suppression. If in doubt, install an extra electrostatic shielded cable on the power supply side between the main circuit and the control terminals to increase shielding.

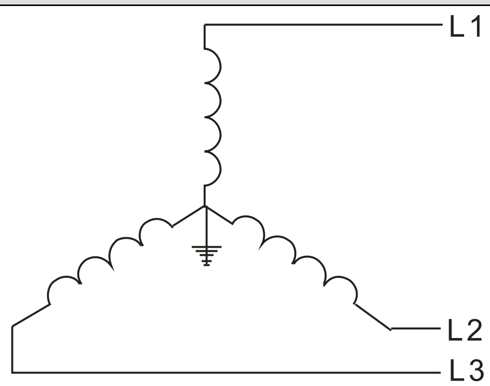
☑ Do not install an external RFI/EMC filter. The external EMC filter passes through a filter capacitor and connects power input to the ground. This is very dangerous and damages the motor drive.

Asymmetric Ground System (Corner Grounded TN Systems)

Caution: Do not remove the RFI switch while power to the motor drive input terminal is ON.

In the following four situations, you must remove the RFI switch. This is to prevent the system from grounding through the RFI capacitor and damaging the motor drive.

Conditions for removing the RFI switch	
1. Grounding at a corner in a triangle configuration  Figure 4-44	2. Grounding at a midpoint in a polygonal configuration  Figure 4-45
3. Grounding at one end in a single-phase configuration  Figure 4-46	4. No stable neutral grounding in a three-phase autotransformer configuration  Figure 4-47

Using the RFI switch	
In the situation as the diagram on the right shows, you can use the RFI switch to pass through RFI capacitor to make an internal grounding and reduce electromagnetic radiation. In a situation with higher requirements for electromagnetic compatibility and a symmetrical grounding power system, you can install an EMC filter. For example, the diagram on the right is a symmetrical grounding power system.	 Figure 4-48

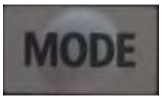
Chapter 5 Operation Interface

5-1 Digital Keypad

5-1-1 Description of Keyboard Panel

Keyboard Panel KPED-LE02

Keypad Functions

Key	Description
	**RUN key** 1. Makes the drive run according to its settings. 2. Pressing the RUN button repeatedly is allowed while the motor drive is stopping.
	**Left Shift key (<)** Press and hold MODE key, and then press this key to move the cursor to the left by each digit to adjust the value more quickly.
	**STOP/RESET key** 1. The STOP key has the highest priority in command. 2. Press the STOP key to stop the drive under any conditions. 3. Press the RESET key to reset the drive when faults occur. If the RESET key does not respond, go to MENU “Fault Records” to check the most recent fault.
	**MODE key** Changes among different display modes.
	**ENTER key** Reads or modifies the current parameter settings.
	**Up (▲) and Down (▼) keys** 1. Press the Up or Down key to increase or decrease the selected value. 2. Press the Up or Down key to select items in a menu and languages.

LED Function Description

LED	Description
	**Status display** **UP**: Car moves upward **DN**: Car moves downward **MC**: Magnetic Contactor **MB**: Mechanical brake **EN**: Multi-function input (MI) 8 enabled **UD**: User-defined
	**Main display area** Displays frequency, current, voltage, running direction, user-defined units, warnings, and faults.

Description of Displayed Functions

Displayed Function	Description
	Displays Frequency command
	Displays output frequency
	Displays DC bus voltage
	Displays output current
	Displays output voltage
	Displays parameter settings
	Displays favorite parameters For how to set favorite parameters, see Parameter Group 12 Access Favorite for more information.
	None
	Displays system parameters*[1]
	Displays comfort parameters*[2]
	Display the user-defined value in Pr.07-41. See Pr.07-41 (Content of Multi-function Display) for details.
	Displays the selected parameter, for example, Pr.00-00.
	Displays the value in a parameter

Displayed Function	Description
	Displays when warning/fault code occurs. For example, “EF” displays when external fault occurs.
	“End” displays for approximately one second if the data has been accepted and automatically stored in the register.
	“Error” displays if the setting data is not accepted or data value exceeds the allowed range.

NOTE:

*1: You can view and set related parameters under System Parameter.

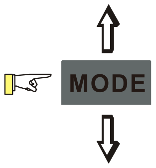
*2: You can view and set related parameters under Comfort Parameter.

Related parameters to System Parameter			Related parameters to Comfort Parameter		
					
Pr. No.	Parameter Description	Unit	Pr. No.	Parameter Description	Unit
00-30	Motor Auto-tuning		03-06	DC Brake Activation Time	sec.
00-10	Motor Rated Power	kW	03-07	DC Brake Stopping Time	sec.
00-11	Motor Rated Voltage	V	03-60	DC Brake Current Level at Start-up	%
00-12	Motor Rated Current	Amps	03-61	DC Brake Current Level at Stop	%
00-13	Motor Rated Frequency	Hz	03-12	Zero Speed Bandwidth	Hz
00-14	Motor Rated Speed	rpm	03-13	Low Speed Bandwidth	Hz
00-15	Number of Motor Poles		03-14	High Speed Bandwidth	Hz
00-20	Selection of Encoder		03-15	Zero Speed Parking Bandwidth	Hz
00-21	Encoder PPR	ppr	03-16	ASR (Auto Speed Regulation) Control (P) of Zero Speed	%
00-23	Encoder Input Type Setting		03-17	ASR (Auto Speed Regulation) Control (I) of Zero Speed	sec.
00-40	Elevator Speed	m/s	03-18	ASR (Auto Speed Regulation) Control (P) 1	%
00-41	Elevator Rated Load	kg	03-19	ASR (Auto Speed Regulation) Control (I) 1	sec.
00-42	Traction Sheave Diameter	mm	03-20	ASR (Auto Speed Regulation) Control (P) 2	%
00-43	Gear Ratio		03-21	ASR (Auto Speed Regulation) Control (I) 2	sec.
00-44	Suspension Ratio		03-22	Elevator Leveling (Zero Speed Gain P)	%
00-45	Motor Current at Acceleration	%	03-23	Elevator Leveling (Zero Speed Integral I)	sec.
00-46	Carriage Acceleration	m/s^2			

5-1-2 Keypad Operation Process

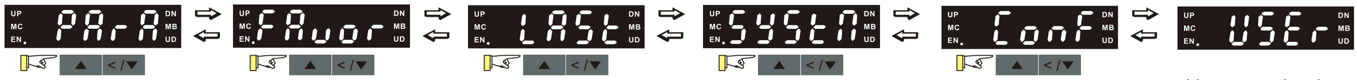
Drive Information Display

F: Frequency command H: Output frequency V: DC bus voltage A: Output current E: Output voltage



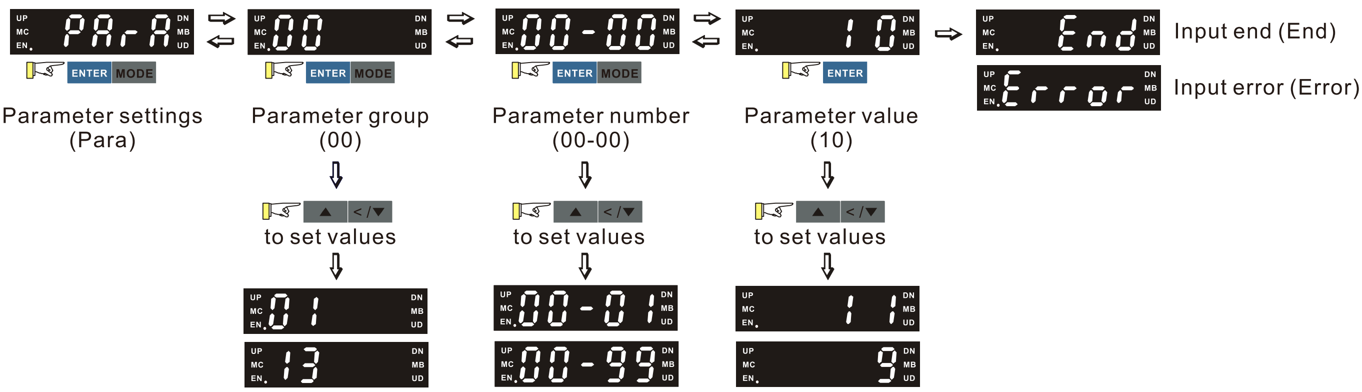
NOTE: Press MODE key to switch between “Drive Information Display” and “Paremeter Mode Selection”.

Parameter Mode Selection



Parameter settings (Para)	Favorite parameters (Favor)	Last changed parameter (Last)	System parameters (System)	Comfort parameters (Comf)	User monitoring (Pr.07-41) (User)

Parameter Setting



NOTE: Press and hold MODE key, and then press < / ▼ key to move the cursor to the left by each digit to set the value more quickly.

5-1-3 Description of Digital Keypad KPC-CC01

KPC-CC01

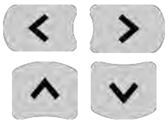
Communication Interface
RJ45 (socket), RS-485 interface

Communication protocol:
RTU19200, 8, N, 2

Installation Method
1. Embedded type and can be put flat on the surface of the control box. The front cover is water proof.
2. Buy a MKC-KPPK model to do wall mounting or embedded mounting. Its protection level is IP66.
3. The maximum RJ45 extension lead is 5 m (16ft)
4. This keypad can only be used on Delta's motor drive C2000, CH2000, CP2000, and EB3000.

Descriptions of Keypad Functions

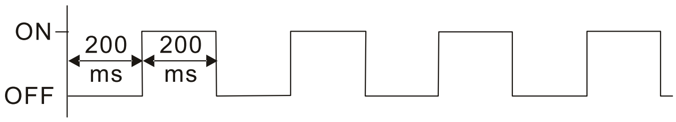
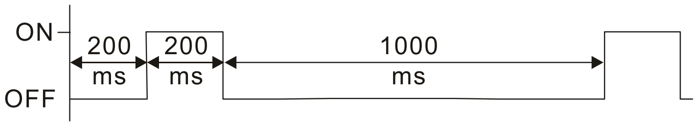
Key	Descriptions
	Start Operation Key 1. Only valid when the source of operation command is the keypad. 2. Operates the AC motor drive by the function setting. The RUN LED will be ON. 3. Can be pressed repeatedly at the stop process.
	Stop Command Key. 1. This key has the highest priority when the command is from the keypad. 2. When it receives the STOP command, regardless of whether the AC motor drive is in operation or stop status, the AC motor drive needs to execute the "STOP" command. 3. Use the RESET key to reset the drive after a fault occurs. 4. If you cannot reset after the fault: (1) The condition which triggers the fault is not cleared. After you clear the condition, you can then reset the fault. (2) The drive is in the fault status when powered on. After you clear the condition, restart and then you can reset the fault.
	Operation Direction Key 1. Only controls the operation direction, NOT the drive activation. FWD: forward, REV: reverse. 2. Refer to the LED descriptions for more details.
	ENTER Key Goes to the next menu level. If at the last level, press ENTER to execute the command.
	ESC Key Leaves the current menu and returns to the previous menu; also functions as a return key or cancel key in a sub-menu.

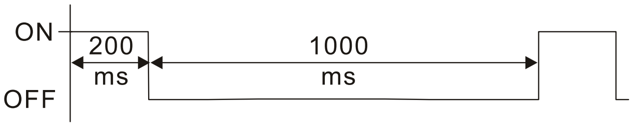
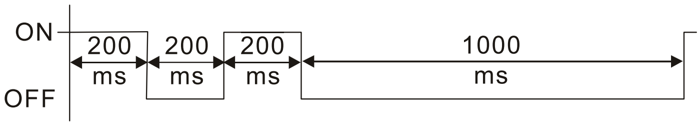
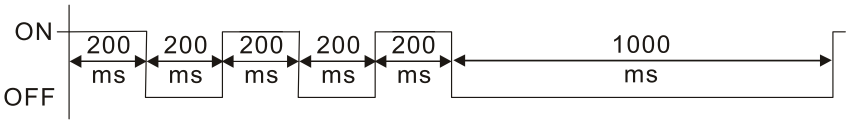
Key	Descriptions
	MENU key. Returns to the main menu. Menu items: 1. Parameter Setup 8. Time Setup 14. Main Page 5. Copy Parameter 9. Keypad Locked 15. PC Link 6. Fault Record 12. Display Setup 7. Language Setup 13. Start-up **NOTE:** Menu items that are not listed above are not supported in EB3000.
	Direction: Left / Right / Up / Down 1. In the numeric value setting mode, moves the cursor and changes the numeric value. 2. In the menu / text selection mode, selects an item.
	Function Key The functions keys have defaults and can also be user-defined. The defaults for F1 and F4 work with the function list below. For example, F1 is the JOG function, and F4 is a quick setting key for adding / deleting user-defined parameters.

Descriptions of LED Functions

LED	Descriptions
	Steady ON: STOP indicator for the AC motor drive. Blinking: the drive is in standby. Steady OFF: the drive does not execute the "STOP" command.
	Operation Direction LED 1. Green light: the drive is running forward. 2. Red light: the drive is running backward. 3. Flashing light: the drive is changing direction.
CANopen– "RUN"	RUN LED: (see table below)

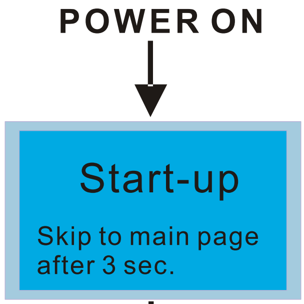
RUN LED:

LED Status	Condition / State
OFF	CANopen at initial No LED
Blinking	CANopen at pre-operation 
Single flash	CANopen at stop 
ON	CANopen at operation status 

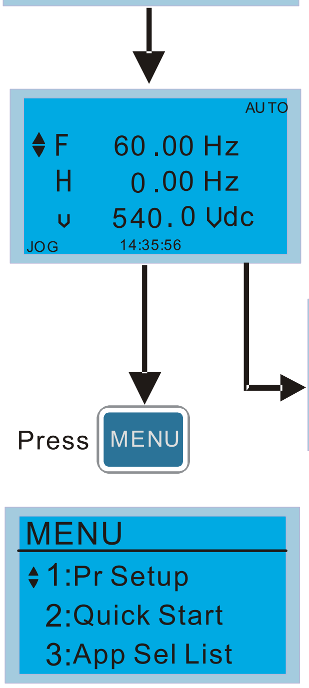
<table>
<tr><th>LED</th><th>Descriptions</th></tr>
<tr><td>CANopen–
“ERR”</td><td>ERR LED:
<table>
<tr><th>LED Status</th><th>Condition / State</th></tr>
<tr><td>OFF</td><td>No Error</td></tr>
<tr><td>Single flash</td><td>One message fail

</td></tr>
<tr><td>Double flash</td><td>Node guarding failure or heartbeat message failure

</td></tr>
<tr><td>Triple flash</td><td>Synchronization failure

</td></tr>
<tr><td>ON</td><td>Bus off

</td></tr>
</table>
</td></tr>
</table>

5-1-4 Digital Keypad KPC-CC01 Functions

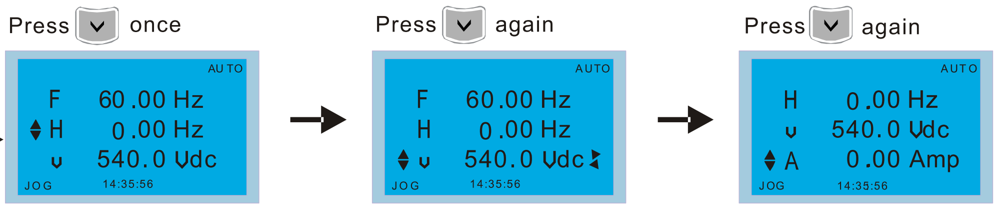


1) The default Start-up page is Delta Logo. (Default 1 and 2)
2) User can customize their start-up page through the edited function. (Need to purchase the optional accessories.)



The top line of LCD displays the status of drive.
After you select the main menu, the start-up screen displays in the user-defined format. The page on the left shows the Delta default setting.

The bottom line of LCD displays time and JOG.



MENU

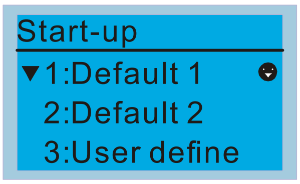
1: Parameter Setup
2: Quick Start
3: Application Selection List
4: Changed List
5: Copy Parameter
6: Fault Record
7: Language Setup
8: Time Setup
9: Keypad Locked
10: PLC Function
11: Copy PLC
12: Display Setup
13: Start-up Menu
14: Main Page
15: PC Link
16: Start Wizard

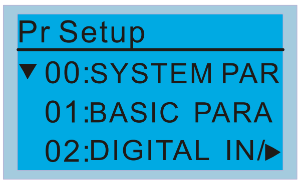
NOTE:

1. Start-up screen can only display pictures, not animation.
2. When powered ON, it displays the start-up screen then the main screen. The main screen displays Delta's default setting F/H/A/U. You can set the display order with Pr.07-40 (Start-up display). When you selected the U screen, use the left / right keys to switch between the items, and set the display order for the U screen with Pr.07-41 (User display).
3. **NOTE:** EB3000 only supports the following menu items:

1. Parameter Setup	6. Fault Record	8. Time Setup	12. Display Setup	14. Main Page
5. Copy Parameter	7. Language Setup	9. Keypad Locked	13. Start-up	15. PC Link

Display Icon





● : present setting

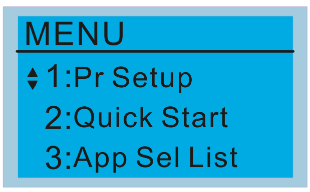
▼ : Scroll down the page for more options

Press ∧ ∨ for more options

▶ : show complete sentence

Press < > for complete information

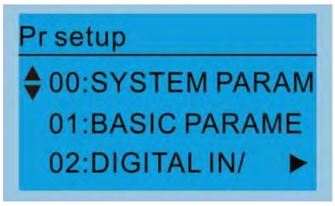
Display item



MENU

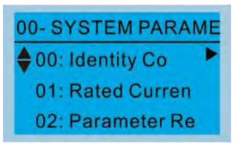
1: Parameter Setup
2: Quick Start
3: Application Selection List
4: Changed List
5: Copy Parameter
6: Fault Record
7: Language Setup
8: Time Setup
9: Keypad Locked
10: PLC Function
11: Copy PLC
12: Display Setup
13: Start-up Menu
14: Main Page
15: PC Link
16: Start Wizard

1. Parameter Setup

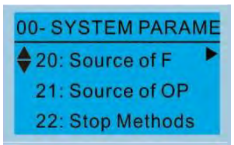


Press ETNER to select.
Press Up/Down keys to select the parameter group.
Once you select a parameter group, press ENTER to go into that group.

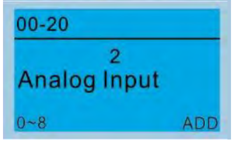
For example: Setup source for the master frequency command.



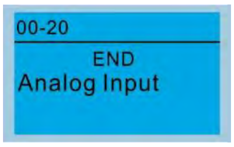
In Parameter Group 00 Basic Parameters, use Up/Down keys to select parameter 20: Auto Frequency Command.



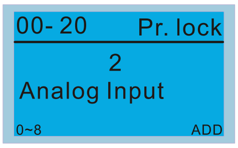
Press ENTER to go to this parameter's setting menu.



Use Up/Down keys to choose a setting.
For example: choose “2 Analog Input”, and then press ENTER.

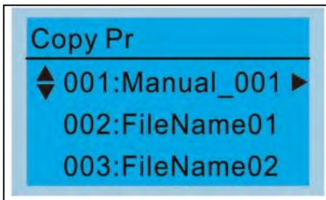


After you press ENTER, END is displayed which means the parameter setting is done.



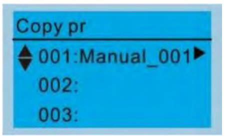
NOTE: When parameter lock / password protection function is enabled, it displays “Pr. lock” on the upper right corner of the keypad. The parameter cannot be written or is protected by the password under this circumstance.

5. Copy Parameter

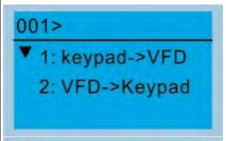


Press ENTER to go to 001–004: content storage

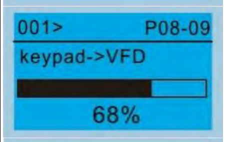
Four groups of parameters are available to copy.
The steps are shown in the example below.
Example: parameter saved in the motor drive.



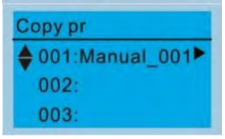
1. Go to “Copy Parameter”
2. Select the parameter group to copy and press ENTER key.



1. Select 1: keypad → VFD
2. Press ENTER key to go to “keypad → VFD” screen.

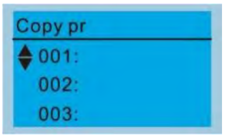


Begin copying parameters until it is done.

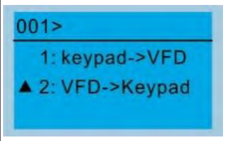


After copying parameters is done, the keypad automatically returns to this screen.

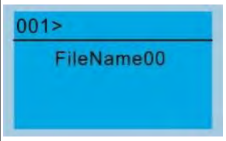
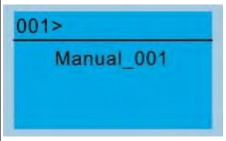
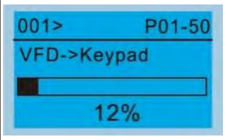
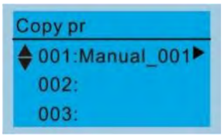
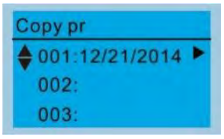
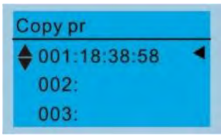
Example: parameter saved in the keypad.



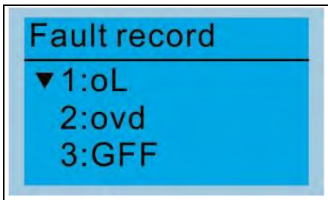
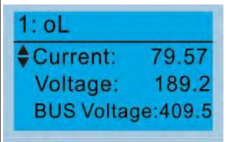
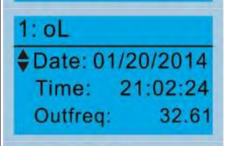
1. Go to Copy parameter
2. Select the parameter group to copy and press ENTER.

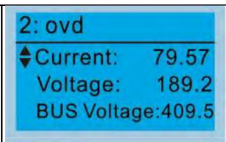


Press ENTER to go to “VFD → keypad” screen.

		Press Up / Down keys to select a symbol. Press Left / Right keys to move the cursor to select a file name.
	String & Symbol Table: ! " # $ % & ′ ( ) * + · - · / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\ ] ^ _ ′ a b c d f g h i j k l m n o p q r s t u v w x y z { | } ~	
		After you confirm the file name, press ENTER key.
		To begin copying parameters until it is done.
		After copying parameters is done, the keypad automatically returns to this screen.
		Press Right key to see the date of the parameters copied.
		Press Right key to see the time of the parameters copied.

6. Fault Record

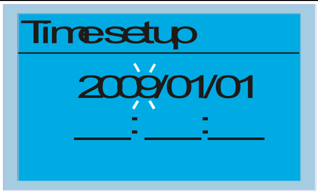
 Press ENTER to see a fault record's details.	Able to store 6 fault codes (Keypad V1.02 and previous versions) Able to store 30 fault codes (Keypad V1.20 and later version) The most recent fault record shows as the first record. Choose a fault record to see its details such as date, time, frequency, current, voltage, and DC bus voltage)	
		Press Up / Down keys to select a fault record. After selecting a fault code, press ENTER to see that fault record's details.
	 	Press Up / Down keys to scroll through a fault record's details such as date, time, frequency, current, voltage, and DC bus voltage.
		Press Up / Down keys to select the next fault code. After selecting a fault code, press ENTER to see that fault record's details.

	  Press Up / Down keys to see a fault record's detail such as date, time, frequency, current, voltage, and DC bus voltage. **NOTE:** The AC motor drive actions are recorded and saved to the KPC-CC01. When you remove the KPC-CC01 and connect it to another AC motor drive, the previous fault records are not deleted. The new fault records of the new AC motor drive continue to be added to the KPC-CC01.

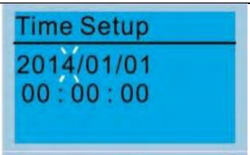
7. Language Setup

 Use Up / Down keys to select the language, and then press ENTER.	The language setting option is displayed in the language of your choice. Language setting options: 1. English 2. 繁體中文 3. 简体中文 4. Türkçe 5. Русский 6. Español 7. Português 8. Français 9. Polski 10. Deutsch 11. Italiano 12. Svenska

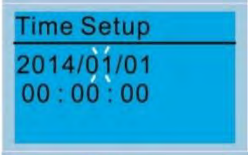
8. Time Setup



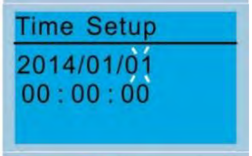
Use Left / Right keys to select Year, Month, Day, Hour, Minute or Second to change.



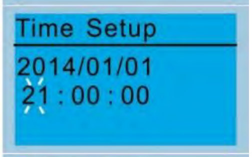
Press Up / Down keys to set the Year



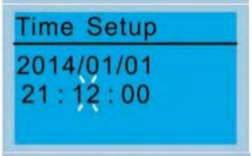
Press Up / Down keys to set the Month



Press Up / Down keys to set the Day

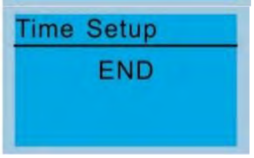


Press Up / Down keys to set the Hour



Press Up / Down keys to set the Minute

Press Up / Down keys to set the Second

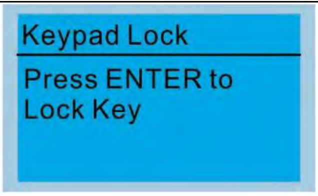


Press ENTER to confirm the Time Setup.

NOTE:

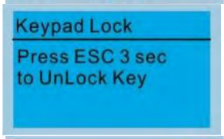
Limitation: The charging process for the keypad super capacitor finishes in about 6 minutes. When the digital keypad is removed, the time setting is saved for 7 days. After 7 days, you must reset the time.

9. Keypad Locked

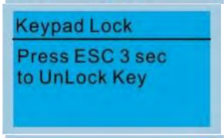
<table>
<tr>
<td>


Press ENTER to lock
</td>
<td>
Lock the keypad

Use this function to lock the keypad. The main screen does not display “keypad locked” when the keypad is locked; however, it displays the message ”Press ESC 3 sec to UnLock Key” when you press any key.


When the keypad is locked, the main screen does not indicate the lock status.


Press any key on the keypad; a message displays as shown on the left.

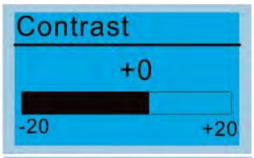

If you do not press ESC, the keypad automatically returns to this screen.


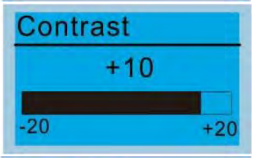
Press any key on the keypad, a message displays as shown on the left.

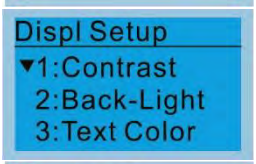

Press ESC for 3 seconds to unlock the keypad; the keypad returns to this screen. All keys on the keypad is functional.
All keys on the keypad is functional. Turning the power off and on does not lock the keypad.
</td>
</tr>
</table>

12. Display setup

<table>
<tr>
<td>


Press ENTER to go to the setting screen.
</td>
<td>
1. Contrast


Press Up / Down keys to adjust the setting value.


For example, increase Contrast to +10.


After you set the value, press ENTER to see the screen display after contrast is adjusted to +10.

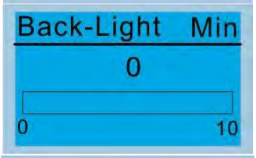

Then press ENTER and decrease the Contrast to -10.


Press ENTER to see screen display after contrast is adjusted to -10.
</td>
</tr>
</table>

2. Back-light

Press ENTER to go to the Back-Light Time Setting screen.

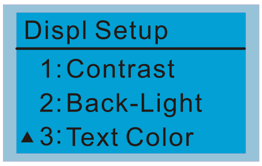
Press Up / Down keys to adjust the setting value.



When the setting value is 0 Min, the backlight remains on.

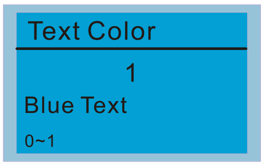
When the setting value is 10 Min, the backlight turns off in 10 minutes.

3. Text Color

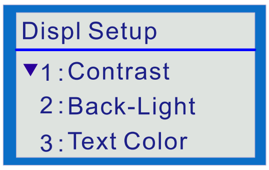


Press ENTER to go to Text Color Setting screen.

The default value is White Text.

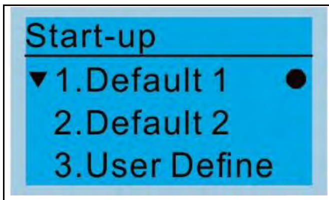


Press Up / Down keys to adjust the setting value, and then press ENTER.



The setting value changes to Blue Text.

13. Start-up

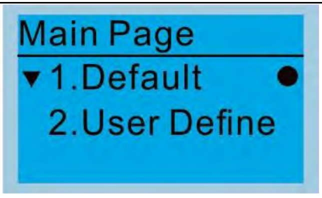
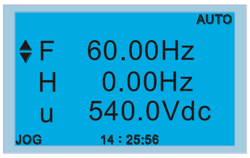
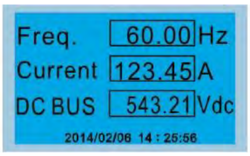
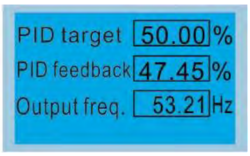


1. Default 1 DELTA LOGO

2. Default 2 DELTA Text

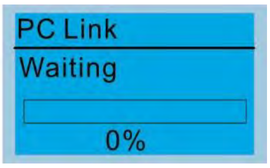
	3. User Defined: an optional accessory is required (TPEditor & USB / RS-485 Communication Interface-IFD6530) to design your own start-up screen. If the editor accessory is not installed, the User Define option displays a blank screen.  USB/RS-485 Communication Interface-IFD6530 Refer to <Chapter 11 Optional Accessories> for more details. TPEditor Download TPEditor software at Delta website. Select TPEditor version 1.60 or above. Refer to the instructions for TPEditor in <15. PC Link> below.

14. Main page

 Default screen and editable screen are available upon selection. Press ENTER to select.	1. Default page  F 60.00Hz >>> H >>> A >>> U (options rotate) 2. User Define: an optional accessory is required (TPEditor & USB / RS-485 Communication Interface-IFD6530) to design your own main screen. If the editor accessory is not installed, the User Define option displays a blank screen.   USB/RS-485 Communication Interface-IFD6530 Refer to <Chapter 11 Optional Accessories> for more detail.

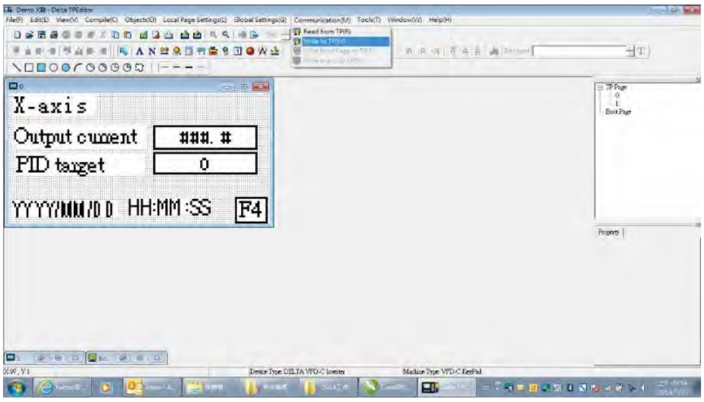
15. PC Link

1. TPEditor: This function enables you to connect the keypad to a computer then to download and edit user-defined screens.

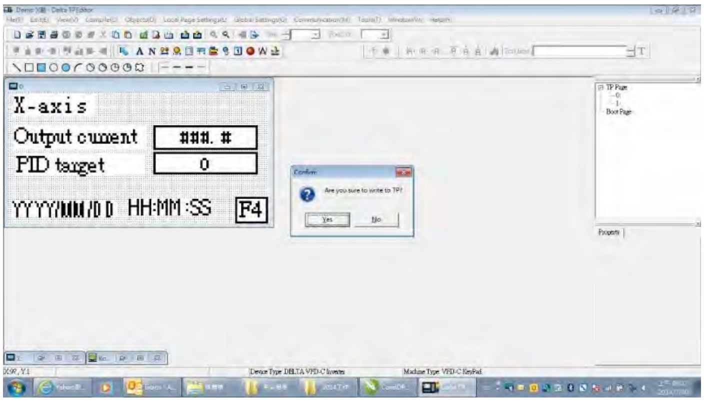


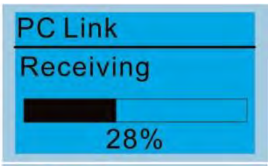
Click ENTER to go to <Waiting to connect to PC>

In TPEditor, from the Communication menu, then choose "Write to HMI"

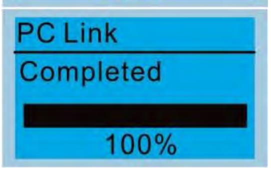


In the **Confirm** message box, click **YES**.





The software starts downloading screens to edit to the KPC-CC01.

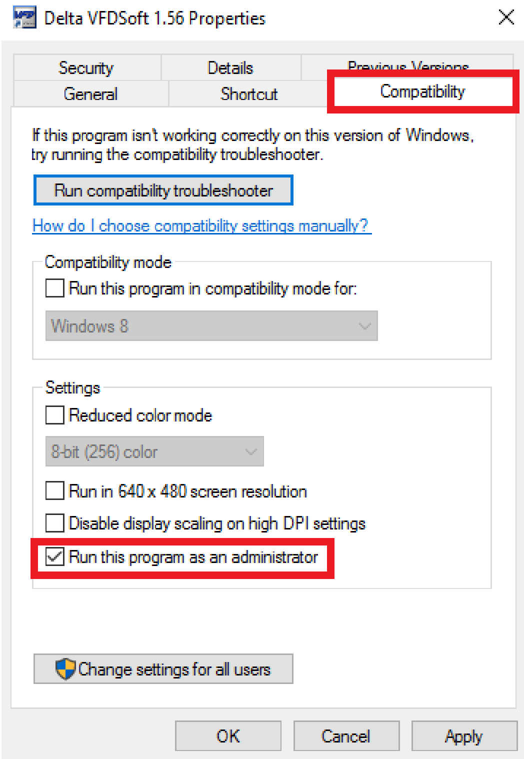


Download completed

2. VFDSoft: this function enables you to link to the VFDSoft then upload the parameters 1–4 you have saved in KPC-CC01.

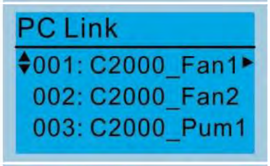
NOTE:

If the Operation System (OS) of your computer is Windows 10, right-click on the VFDSoft icon to enter the **Property**. Then, click the **Compatibility** tab and select the **Run this program as an administrator** checkbox. (as shown in the red frames in the figure below)

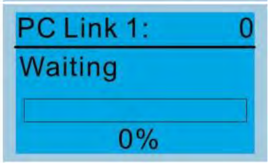


Connecting KPC-CCO1 to a computer

Select 2: VFDSoft, and then press ENTER.

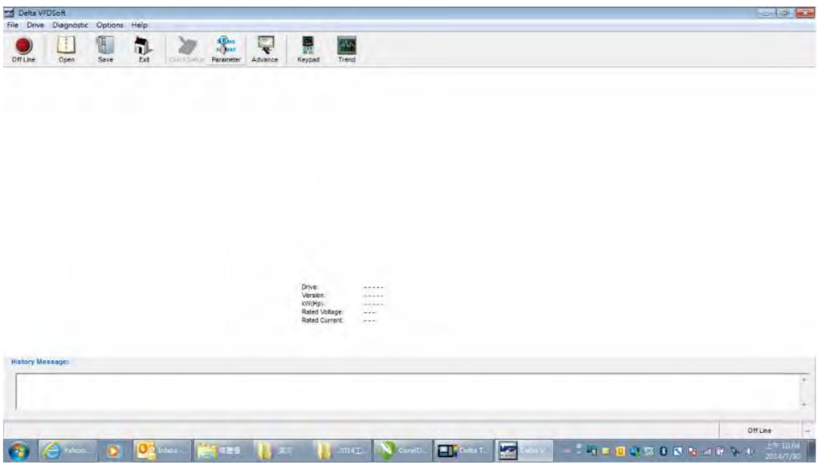


Press the Up / Down keys to select a parameter group to upload to VFDSoft.



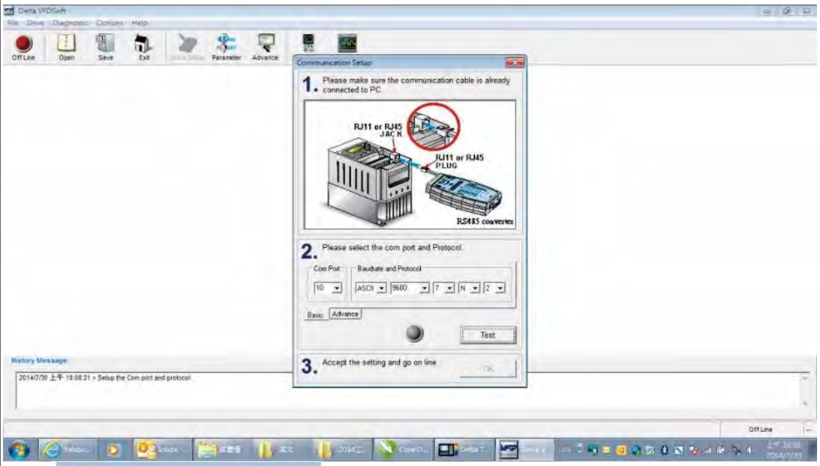
Press ENTER to go to Waiting to connect to PC screen.

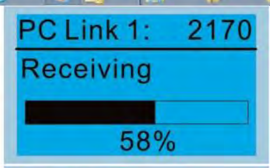
Open VFDSoft and click **Parameter** on the toolbar.



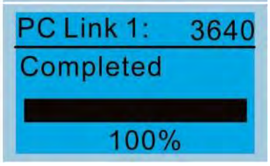
In Parameter Manager, from the **Table** menu, choose **Read from KPC-CC01**.

Choose the correct communication port and click OK





Start to upload parameters to VFDSoft

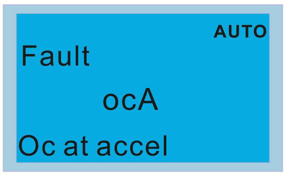


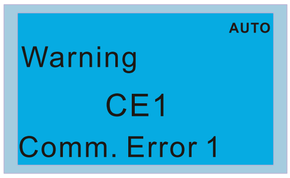
Uploading parameter is completed

Before using the user-defined start-up screen and user-defined main screen, you must preset the start-up screen and the main screen as user- defined. If you do not download the user-defined screen to the KPC-CC01, the start-up screen and the main screen are blank.

Other displays

When a fault occurs, the screen displays shows the fault or warning:





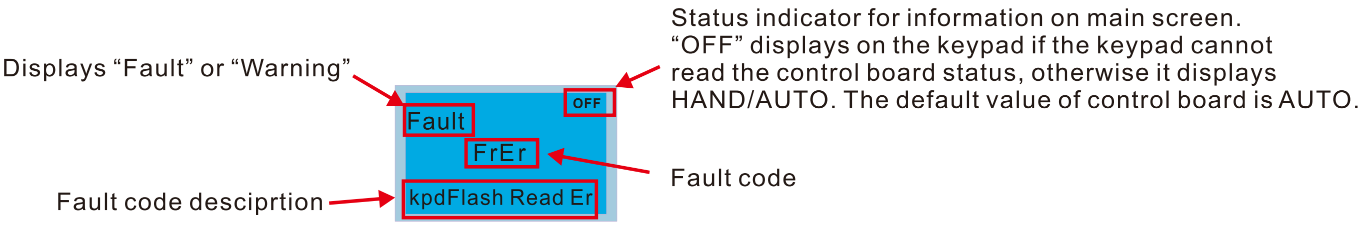
1. Press STOP / RESET key to reset the fault code. If there is no response, contact your local distributor or return the unit to the factory. To view the fault DC bus voltage, output current and output voltage, press MENU and then choose 6: Fault Record.
2. After resetting, if the screen returns to the main screen and shows no fault after you press ESC, the fault is cleared.
3. When the fault or warning message appears, the LED backlight blinks until you clear the fault or the warning.

Optional accessory: RJ45 Extension Lead for Digital Keypad

Part No.	Description
CBC-K3FT	RJ45 extension lead, 3 feet (approximately 0.9 m)
CBC-K5FT	RJ45 extension lead, 5 feet (approximately 1.5 m)
CBC-K7FT	RJ45 extension lead, 7 feet (approximately 2.1 m)
CBC-K10FT	RJ45 extension lead, 10 feet (approximately 3 m)
CBC-K16FT	RJ45 extension lead, 16 feet (approximately 4.9 m)

NOTE: When you need to buy communication cables, buy non-shielded, 24 AWG, four-wire twisted pair, 100 ohms communication cables.

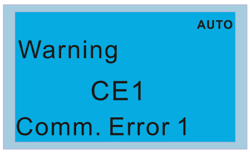
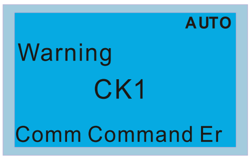
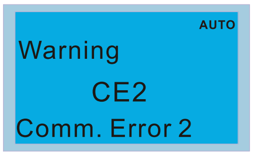
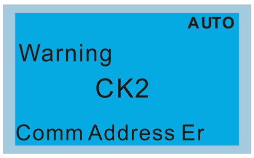
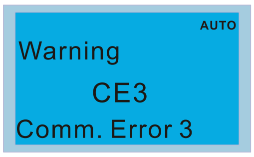
5-1-5 Fault Code Description of Digital Keypad KPC-CC01

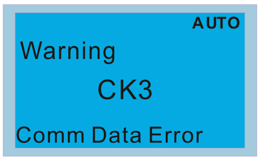
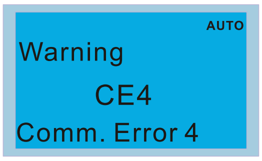
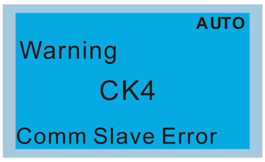
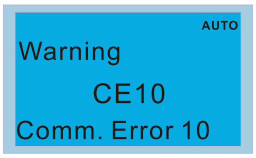
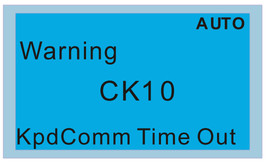


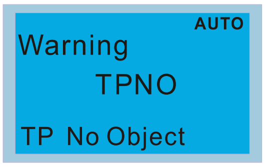
Fault Codes

LCD Display	Fault Name	Description	Corrective Actions
AUTO Fault FrEr kpd Flash Read Er	Flash memory read error (FrEr)	Keypad flash memory read error	Error in the keypad's flash memory. 1. Press RESET to clear the errors. 2. Check for any problem on Flash IC. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized local dealer for assistance.
AUTO Fault FsEr kpd Flash Save Er	Flash memory save error (FsEr)	Keypad flash memory save error	Error in the keypad's flash memory. 1. Press RESET to clear the errors. 2. Check for any problem on Flash IC. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized local dealer for assistance.
AUTO Fault FPEr kpd Flash Pr Er	Flash memory parameter error (FPEr)	Keypad flash memory parameter error	Error in the default parameters. It might be caused by a firmware update. 1. Press RESET to clear the errors. 2. Check for any problem on Flash IC. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized local dealer for assistance.
AUTO Fault VFDr Read VFD Info Er	Reading AC motor drive data error (VFDr)	Keypad error when reading AC motor drive data	Keypad cannot read any data sent from the VFD. 1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. 2. Press RESET to clear the errors. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized local dealer for assistance.
AUTO Fault CPUEr CPU Error	CPU error (CPUEr)	Keypad CPU error	A serious error in the keypad's CPU. 1. Check for any problem on CPU clock. 2. Check for any problem on Flash IC. 3. Check for any problem on RTC IC. 4. Verify that the communication quality of the RS-485 cable is good. 5. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized local dealer for assistance.

Warning Codes

LCD Display	Warning Name	Description	Corrective Actions
	Communication error 1 (CE1)	RS-485 Modbus illegal function code	Motor drive does not accept the communication command sent from the keypad. 1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. 2. Press RESET on the keypad to clear errors. If none of the above solutions works, contact your local authorized dealer for assistance.
	Communication command error 1 (CK1)	Keypad communication data, illegal function code (Keypad auto-detect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 3. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ45. If none of the above solutions works, contact your local authorized dealer.
	Communication error 2 (CE2)	RS-485 Modbus illegal data address	Motor drive does not accept the keypad's communication address. 1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. 2. Press RESET to clear the errors. If none of the above solutions works, contact your local authorized dealer for assistance.
	Communication address error (CK2)	Keypad communication data, illegal data address (Keypad auto-detect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 3. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ45. If none of the above solutions works, contact your local authorized dealer.
	Communication error 3 (CE3)	RS-485 Modbus illegal data value	Motor drive does not accept the communication data sent from the keypad. 1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. 2. Press RESET to clear the errors. If none of the above solutions works, contact your local authorized dealer for assistance.

LCD Display	Warning Name	Description	Corrective Actions
	Communication data error (CK3)	Keypad communication data, illegal data value (Keypad auto-detect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 3. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ45. If none of the above solutions works, contact your local authorized dealer.
	Communication error 4 (CE4)	RS-485 Modbus data is written to read-only address	Motor drive cannot process the communication command sent from the keypad. 1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. 2. Press RESET to clear the errors. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.
	Communication slave error (CK4)	Keypad communication data is written to read-only address (Keypad auto-detect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 3. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ45. If none of the above solutions works, contact your local authorized dealer.
	Communication error 10 (CE10)	Modbus transmission time-Out	Motor drive does not respond to the communication command sent from the keypad. 1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. 2. Press RESET to clear the errors. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.
	Keypad communication time out (CK10)	Digital keypad transmission time-out (The keypad automatically detects and shown this warning)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 3. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ45. If none of the above solutions works, contact your local authorized dealer.

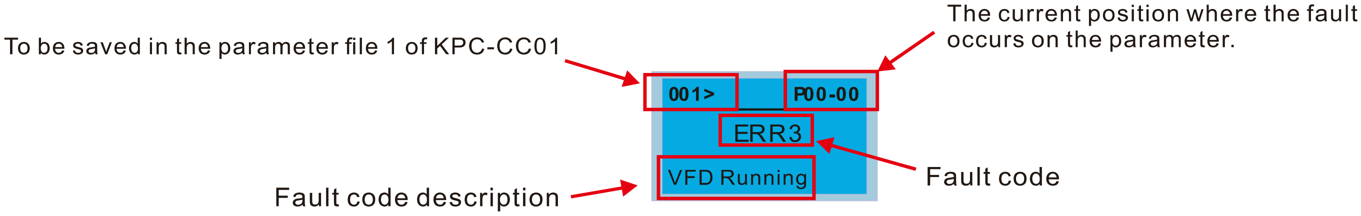
LCD Display	Warning Name	Description	Corrective Actions
	TP object is not defined (TPNO)	Object not supported by TPEditor	Keypad's TPEditor uses an unsupported object. 1. Verify that the TPEditor is not using an unsupported object or setting. Delete unsupported objects and unsupported settings. 2. Re-edit the object in the TPEditor, and then download it to the keypad. 3. Verify that the motor drive supports the TP functions. If the drive does not support TP function, the main page displays Default. If none of the above solutions works, contact your local authorized dealer for assistance.

NOTE:

The warning code CExx only occurs when the communication problem is between the drive and the keypad. It has nothing to do with the drive and other devices. Note the warning code description to find the cause of the error if CExx appears.

File Copy Setting Fault Description

These faults occur when KPC-CC01 cannot perform the command after pressing the ENTER key in the copy function.



LCD Display	Fault Name	Description	Corrective Actions
001> P00-00 ERR1 Read Only	Read only (ERR1)	Parameter and file are read-only	The parameter / file is read-only and cannot be written to. 1. Verify the specification in the user manual. If this solution does not work, contact your local authorized dealer for assistance.
001> P00-00 ERR2 Write Fail	Write in error (ERR2)	Fail to write parameter and file	An error occurred while writing to a parameter / file. 1. Check for any problem on the Flash IC. 2. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.
001> P00-00 ERR3 VFD Running	Drive operating (ERR3)	AC motor drive is in operating status	A setting cannot be changed while the motor drive is in operation. 1. Verify that the drive is not in operation. If this solution does not work, contact your local authorized dealer for assistance.
001> P00-00 ERR4 Pr Lock	Parameter locked (ERR4)	AC motor drive parameter is locked	A setting cannot be changed because a parameter is locked. 1. Check if the parameter is locked. If it is locked, unlock it and try to set the parameter again. If this solution does not work, contact your local authorized dealer for assistance.
001> P00-00 ERR5 Pr Changing	Parameter changing (ERR5)	AC motor drive parameter is changing	A setting cannot be changed because a parameter is being modified. 1. Check if the parameter is being modified. If it is not being modified, try to change that parameter again. If this solution does not work, contact your local authorized dealer for assistance.
001> P00-00 ERR6 Fault Code	Fault code (ERR6)	Fault code is not cleared	A setting cannot be changed because an error has occurred in the motor drive. 1. Check if any error occurred in the motor drive. If there is no error, try to change the setting again. If this solution does not work, contact your local authorized dealer for assistance.
001> P00-00 ERR7 Warning Code	Warning code (ERR7)	Warning code is not cleared	A setting cannot be changed because of a warning message given to the motor drive. 1. Check if there is a warning message given to the motor drive. If this solution does not work, contact your local authorized dealer for assistance.

LCD Display	Fault Name	Description	Corrective Actions
001> P00-00 ERR8 Type Mismatch	File type mismatch (ERR8)	File type mismatch	Data to be copied are not the correct type, so the setting cannot be changed. 1. Check if the products' serial numbers to be copied are in the same category. If they are in the same category, try to copy the setting again. If this solution does not work, contact your local authorized dealer for assistance.
001> P00-00 ERR9 Password Lock	Password locked (ERR9)	File is locked with password	A setting cannot be changed because some data are locked. 1. Check if the data are unlocked or able to be unlocked. If the data are unlocked, try to change the setting again. 2. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.
001> P00-00 ERR10 Password Fail	Password fail (ERR10)	File password mismatch	A setting cannot be changed because the password is incorrect. 1. Check if the password is correct. If the password is correct, try to change the setting again. 2. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.
001> P00-00 ERR11 Version Fail	Version fail (ERR11)	File version mismatch	A setting cannot be changed because the version of the data is incorrect. 1. Check if the version of the data matches the motor drive. If it matches, try to change the setting again. If none of the above solutions works, contact your local authorized dealer for assistance.
001> P00-00 ERR12 VFD Time Out	VFD Time out (ERR12)	AC motor drive copy function time-out	A setting cannot be changed because the data copying time-out expired. 1. Try copying the data again. 2. Check if copying data is authorized. If it is authorized, try to copy the data again. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.

NOTE: The content in this section only applies to KPC-CC01 keypad V1.01 and later versions.

5-2 Tuning Software

VFD Explorer Lite is a Delta drive tool that helps monitor drives online. Considering user operations and scenarios, this software enables you to check and set parameter settings of the drives, monitor drives online, and tune the drives during process. You can also analyze, operate and exchange data among drives, as well as search, change, save and plan data. VFD Explorer Lite significantly enhances convenience of usage and tuning efficiency, bringing users a convenient and highly efficient development environment.

Features

Connectivity

- Monitor status online
- Analyze status offline
- Online monitoring functions
- Multi-drives monitoring

Waveform Management

- Eight monitoring signals
- Save and export monitoring data
- Adjust ratio/offset
- Change colors of waveforms/backgrounds

Parameter Editing

- Edit parameters online
- Edit parameter documents offline
- Parameter backups and uploading/downloading

Software Download

Download VFD Explorer Lite at:
https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=41206&DocPath=1&hl=zh-TW

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Chapter 6 Tuning Process

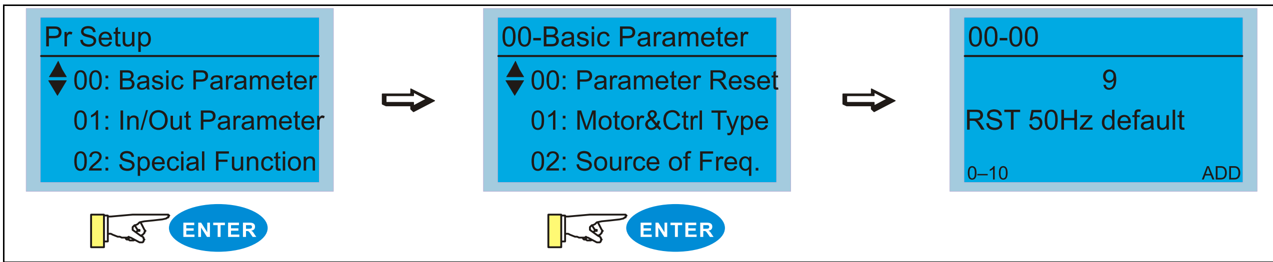
6-1 Tuning in Easy Steps

1. **Basic Parameter Settings**
   Pr.00-00 Parameter Reset
   Pr.00-01 Control Mode
   Pr.00-02 Master Frequency Command Source
   Pr.00-03 Operation Command Source
2. **Motor Auto-tuning**
   (1) Motor Settings
      Pr.00-10 Motor Rated Power
      Pr.00-11 Motor Rated Voltage
      Pr.00-12 Motor Rated Current
      Pr.00-13 Motor Rated Frequency
      Pr.00-14 Motor Rated Speed
      Pr.00-15 Number of Motor Poles
   (2) Encoder Settings
      Pr.00-20 Selection of Encoder
      Pr.00-21 Encoder PPR
      Pr.00-22 High Resolution SIN/COS and Communication Encoder
      Pr.00-23 Encoder Input Type Setting
   Pr.01-00–Pr.01-07 Multi-function Input Settings
   Pr.01-10–Pr.01-15 Multi-function Output Settings
   Pr.03-90 System Control (PM)
   Pr.00-30 Motor Auto-tuning
3. **Elevator Related Parameters**
   Pr.00-40 Elevator Speed
   Pr.00-45 Motor Current at Acceleration
   Pr.03-11 Mechanical Inertial Ratio
4. **Multi-step Speed Settings**
   Pr.00-50–Pr.00-65 Multi-step Speed Settings
   Pr.00-71–Pr.00-78 Acceleration / Deceleration Time Settings
   Pr.00-82 Deceleration Time when Operating without RUN Command
   Pr.00-90–Pr.00-95 S-curve for Acceleration and Deceleration Time Settings
5. **Trial Run**
6. **Elevator Performance Fine-tuning**

6-2 Descriptions of Tuning Steps

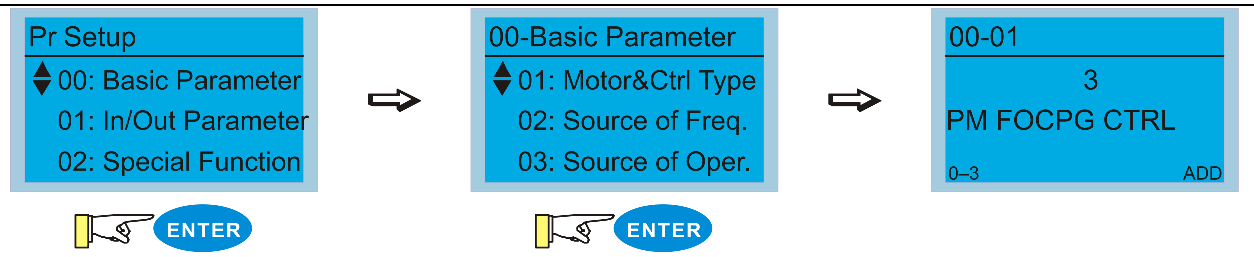
6-2-1 Basic Parameter Settings

Pr.00-00 Parameter Reset



📖 Set Pr.00-00=9 or 10: Reset all parameters to the default. If the keypad is locked by a password, enter the password to reset to the default. The password is also erased.

Pr.00-01 Contol Mode



📖 Mode selection

Settings	Control Mode	Applicable Motor Type	Speed Feedback	Energy-savings	Tuning Difficulty	Ride Comfort	Speed Control Range	Motor Parameter Tuning	Basic Control	Speed Control
0	V/F	IM		Low	Low	Normal	1:50		V/F control	Voltage control
1	SVC	IM		Medium	Medium	Normal	1:50	✓	Voltage control	Voltage control
2	FOCPG	IM	✓	High	High	Good	1:1000	✓	Vector control	Frequency control
3	FOCPM	PM	✓	High	High	Good	1:1000	✓	Vector control	Frequency control

📖 Determines the AC motor drive control method.

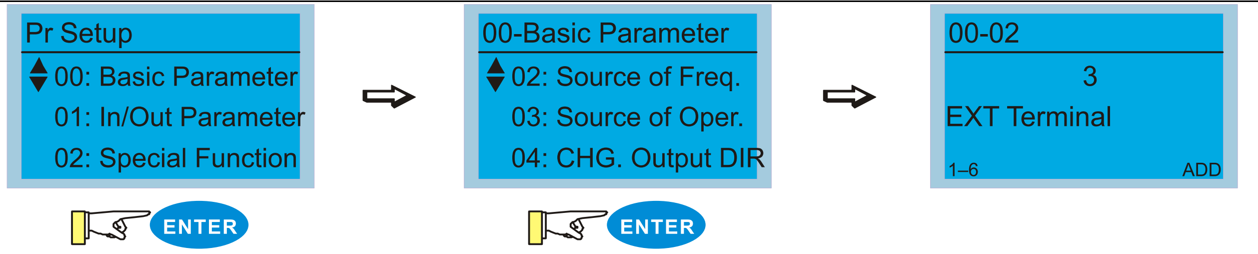
0: You can set the V/F ratio as required and control multiple motors simultaneously.

1: Use auto-tuning for optimal settings of the control parameters.

2: To increase torque and the accuracy of the speed control (1:1000).

3: To increase torque and the accuracy of the speed control (1:1000). This setting is for use only with permanent magnet motors. The other settings are for use with induction motors.

Pr.00-02 Master Frequency Command Source



📖 Setting values:

1: RS-485 serial communication or keyboard panel (KPED-LE02)

2: External analog input (Pr.01-20)

3: External digital input

4: Direct docking mode (Delta CAN). Contact Delta for more information.

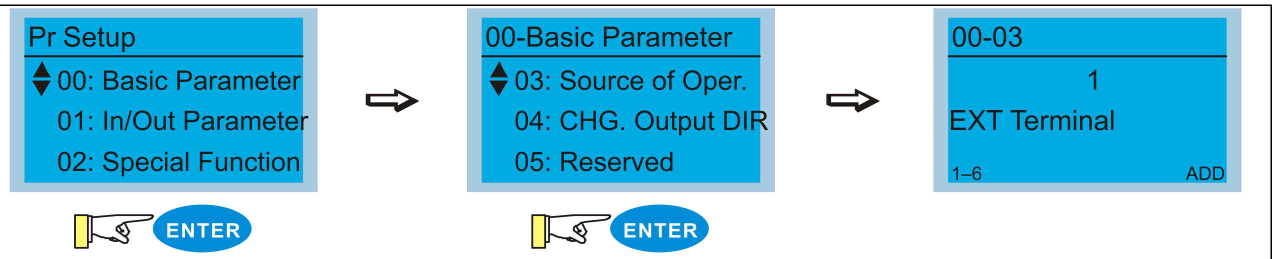
5: Direct docking mode (Delta CAN + Terminal (FWD/REV)). Contact Delta for more information.

6: CAN Lift. Contact Delta for more information.

7: DCP serial communication (SG±)

📖 Determines the drive's master frequency source.

Pr.00-03 Operation Command Source



📖 Setting values:

1: External terminals

2: RS-485 serial communication or digital keypad (KPC-CC01)

3: Keyboard panel (KPED-LE02)

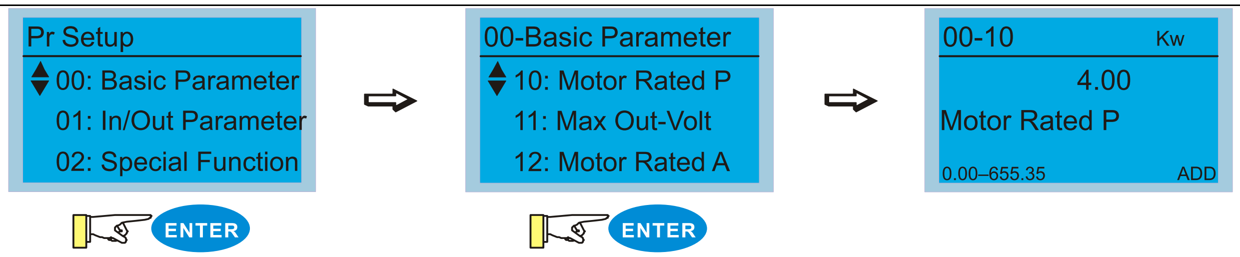
6: CAN Lift. Contact Delta for more information.

7: DCP serial communication (SG±)

6-2-2 Motor Auto-tuning

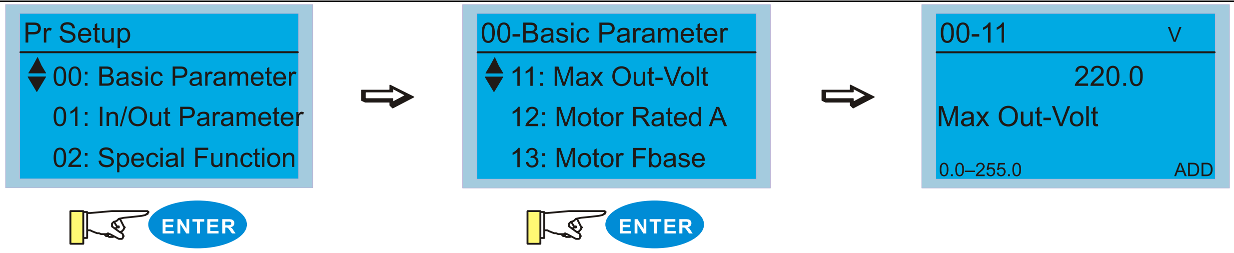
6-2-2-1 Motor Settings

Pr.00-10 Motor Rated Power



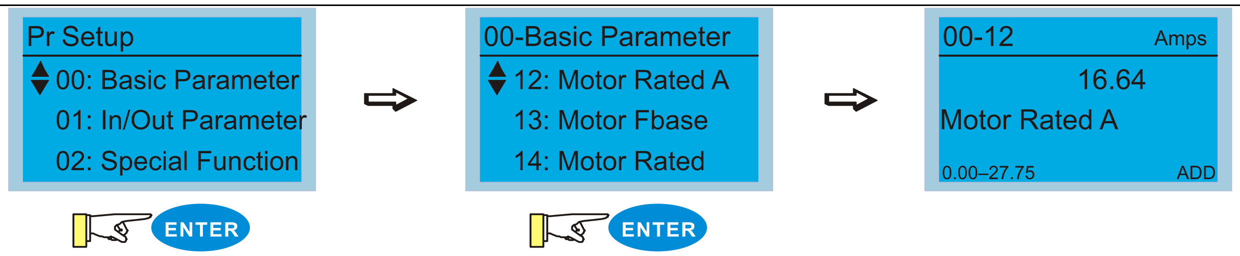
📖 Sets the rated power of the motor. The default is the power of the drive.

Pr.00-11 Motor Rated Voltage



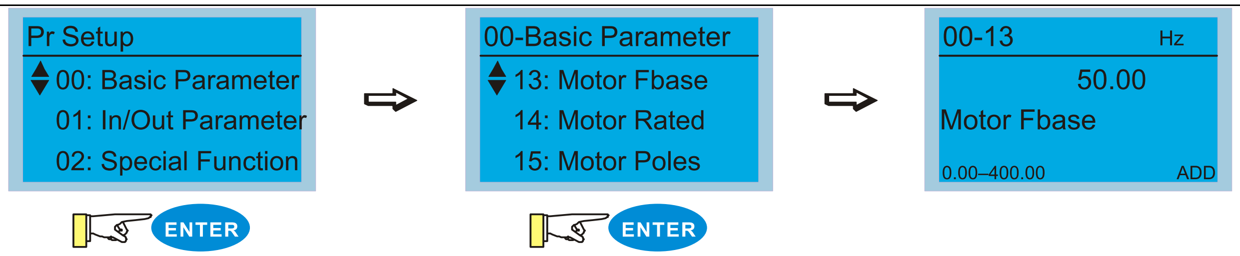
📖 Set this parameter according to the rated voltage on the motor nameplate. If the motor is 220V, set this parameter to 220.0. If the motor is 200V, set this parameter to 200.0.

Pr.00-12 Motor Rated Current



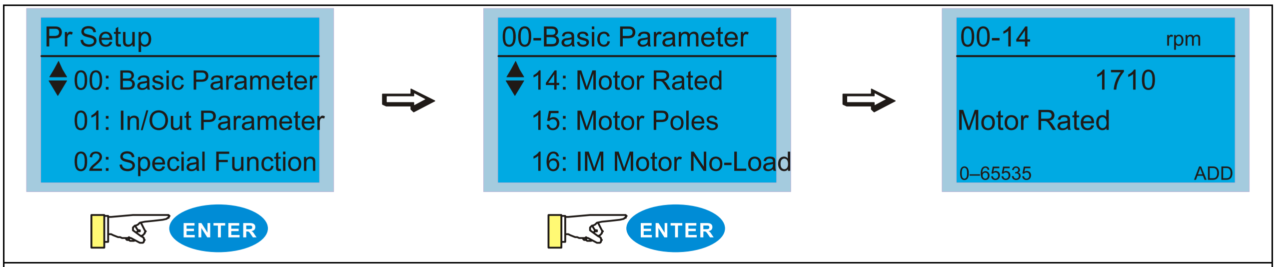
📖 Set this value according to the rated motor current from the motor nameplate.

Pr.00-13 Motor Rated Frequency



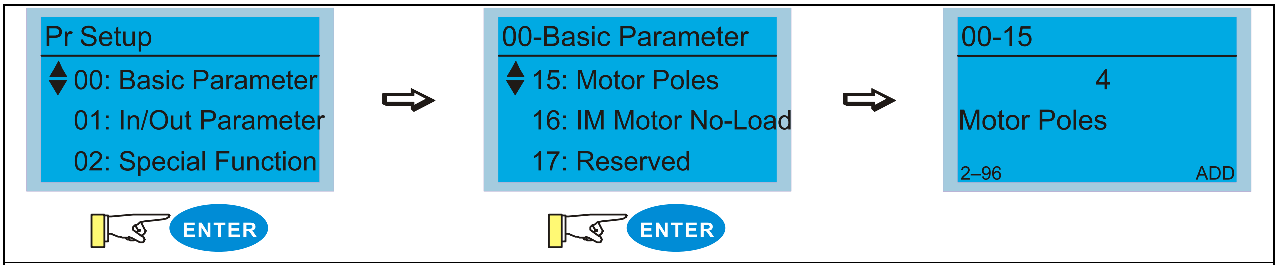
📖 Set this parameter according to the rated frequency on the motor nameplate. If the motor is 60 Hz, set this parameter to 60. If the motor is 50 Hz, set it to 50.

Pr.00-14 Motor Rated Speed



- Sets the motor rated speed from the value on the motor nameplate.
- Speed (RPM) = (120 × Frequency) ÷ Number of Motor Poles
- For induction motors (IM), the drive must be run with slip. Default value of slip is 5% [(1800 - 1710) ÷ 1800].

Pr.00-15 Number of Motor Poles

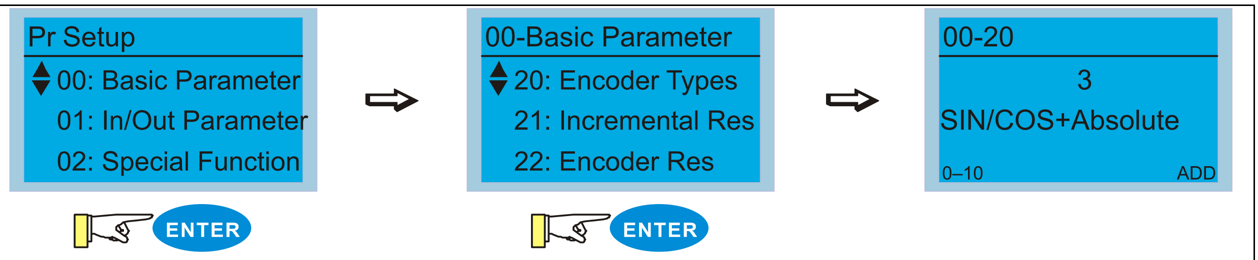


- Sets the number of motor poles (must be an even number).

6-2-2-2 Encoder Settings

Speed feedback card selections: See <Chapter 3 Option Cards>. Delta provides five types of PG cards, including EMEB-PGHH-1, EMEB-PGAB-1, EMEB-PGABD-1, EMEB-PGSED-1, and EMEB-PGSED-2.

Pr.00-20 Selection of Encoder



- When you set Pr.00-20 to 3, the encoder has one sine and one cosine signal for each revolution. The signal must be: 0.75–1.2 Vpp for the amplitude with phase angle 90°±5 elec. (E.g. ERN 1185 ERN 1387)
- When you set Pr.00-20 to 4 or 6, wait for two seconds after applying the power before executing the RUN command.
- When you set Pr.00-20 to 5, you must set Pr.00-36 to 360.
- Detection of the magnetic pole:
  (1) 1 or 5: The drive outputs a short circuit to detect the position of the magnetic pole. At this moment, the motor generates a little noise.
  (2) 2: The drive detects the position of the magnetic pole with the UVW encoder signal.
  (3) 3: The drive detects the position of the magnetic pole with the sine encoder signal.
  (4) 4 or 6: The drive detects the position of the magnetic pole with the communication encoder signal.
- The table below shows the correspondence among encoder, PG card and auto-tuning.

PG Signal Type Setting	PG Signal Type	Applicable PG Card	Pr.00-30=6	Pr.00-30=8
Pr.00-20=1	A, B, Z	EMEB-PGAB-1 EMEB-PGABD-1	N/A	N/A
Pr.00-20=2	A, B, Z+U, V, W	EMEB-PGAB-1 EMEB-PGABD-1	Rolling test *1	Rolling test *1
Pr.00-20=3	SIN/COS + Sinusoidal (e.g. ERN1185, ERN1387)	EMEB-PGHH-1 EMEB-PGSED-x	Rolling test *1	Pr.03-90 Bit9=0: Rolling test *1 Pr.03-90 Bit9=1: Static test *2
Pr.00-20=4	SIN/COS + EnDat 2.1/01/21 (e.g. ECN1313, ECN413)	EMEB-PGSED-x	Dynamic test *3	Static test *2
Pr.00-20=5	SIN/COS	EMEB-PGHH-1 EMEB-PGSED-x	N/A	N/A
Pr.00-20=6	SIN/COS + Hiperface (e.g. SRS50/60)	EMEB-PGSED-x	Dynamic test *3	Static test *2
Pr.00-20=7	SIN/COS + EnDat 2.2/01/21/02/22 (e.g. ECN113, ECN1325, ECN425, ECN125)	EMEB-PGSED-x	Rolling test *1	Static test *2

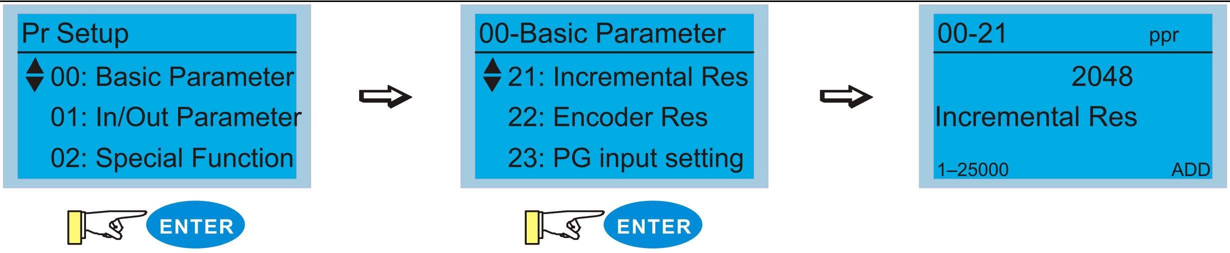
Pr.00-20=8	SIN/COS + SSI (e.g. SMRS64)	EMEB-PGSED-x	Rolling test *1	Static test *2
Pr.00-20=9	SIN/COS + BiSS-C (e.g. WDGF 58R)	EMEB-PGSED-x	Rolling test *1	Static test *2

*1: Rolling test: Brake released, and motor rotates more than one revolution.

*2: Static test: Brake engaged, and no motor runs.

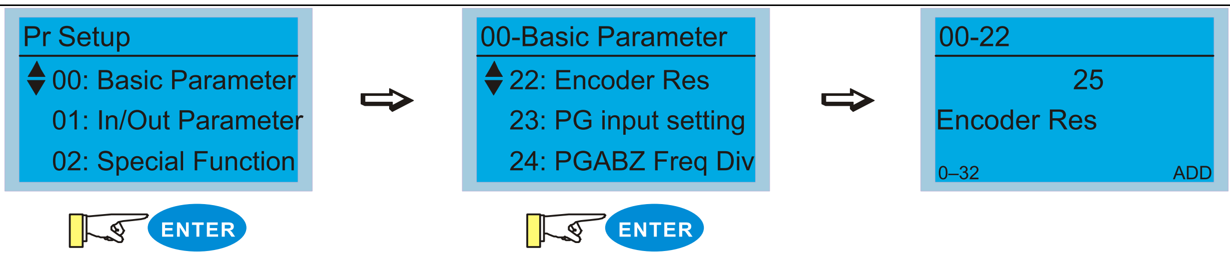
*3: Dynamic test: Brake released, and motor rotates less than one revolution.

Pr.00-21 Encoder PPR



📖 Sets the encoder Pulses per Revolution (PPR).

Pr.00-22 High Resolution SIN/COS and Communication Encoder

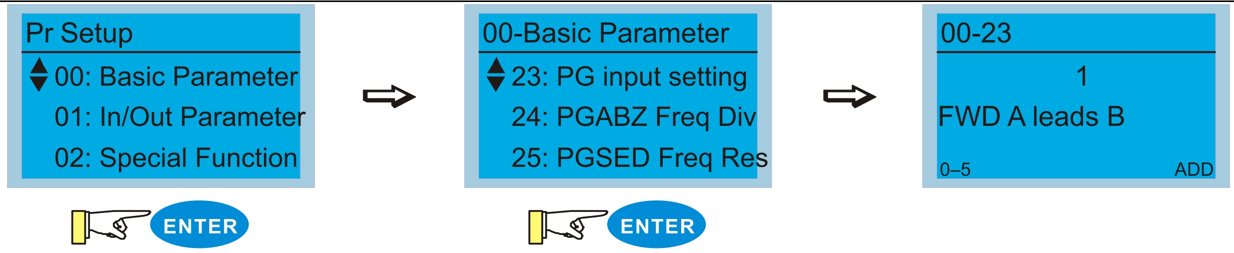


📖 Sets the resolution of communication encoder (Bit).

📖 The table below shows the commonly used encoders.

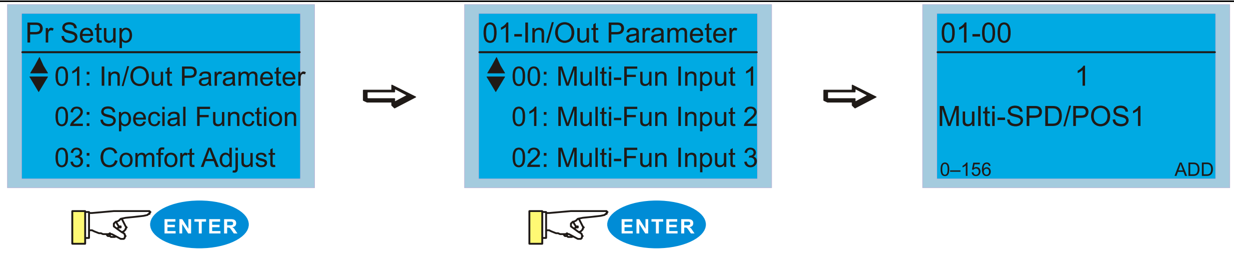
Encoder Model (Recommended)	Encoder Comm. Interface	Encoder PPR (Pr.00-21)	Absolute Resolution (Pr.02-22)
ERN 1387	N/A	2048	N/A
ECN 1313, 413	EnDat01	2048	13
ECN 1325	EnDat22	N/A	25
SICK-SRS50	Hiperface®	1024	15
HOHNER-SMRS64	SSI Gray code	2048	13
WDGF-58R	Biss-C	2048	17

Pr.00-23 Encoder Input Type Setting



- 🕮 You must enter the correct pulse type for stable control.
- 🕮 It is suggested that you set Pr.00-23 to 1 first. When fault code PGF1 occurs or the motor does not run, set it to 2.

Pr.01-00–Pr.01-07 Multi-function Input Settings

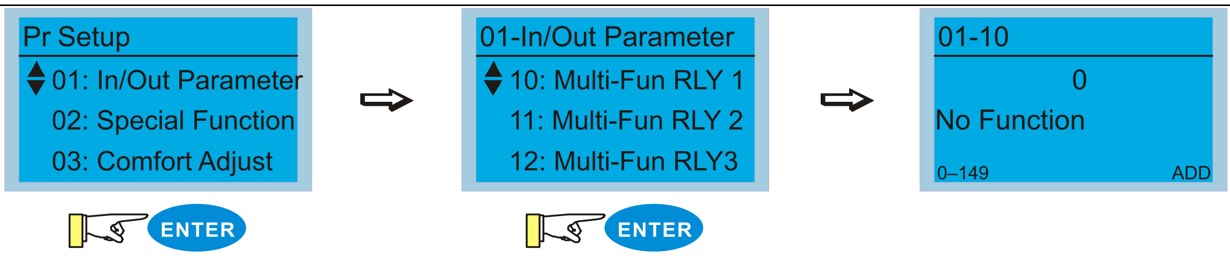


- 🕮 The default value of Pr.01-07 is 40 (Enable Drive). If you do not need this function (does not work with controller), set the setting value to 0.
- 🕮 Setting values:

  0: No function
  1: Multi-step speed command 1
  2: Multi-step speed command 2
  3: Multi-step speed command 3
  4: Multi-step speed command 4
  5: Reset
  6: JOG command
  7: Acceleration/deceleration speed inhibit
  8: First, second set of acceleration/deceleration time
  9: Third, fourth set of acceleration/deceleration time
  10: EF input (Pr.02-16)
  11: Reserved
  12: Stop output
  13–14: Reserved
  15: AUI1 operation speed command
  16: Reserved
  17: AUI2 operation speed command
  18: Emergency Stop (Pr.02-16)
  19–23: Reserved
  24: FWD JOG Command
  25: REV JOG Command
  26: Reserved

27: ASR1/ASR2 selection
28: Emergency stop (EF1) (motor coasts to stop)
29–30: Reserved
31: High torque bias (according to Pr.02-43)
32: Middle torque bias (according to Pr.02-44)
33: Low torque bias (according to Pr.02-45)
34: Rescue by mechanical brake control
35–37: Reserved
38: Disable writing to EEPROM
39: Reserved
40: Enable drive function
41: Magnetic contactor detection
42: Mechanical brake 1
43: EPS function (Emergency Power System)
44: Mechanical brake 2
45–51: Direct docking mode only
53: Terminal leveling signal for direct docking
54: Power failure signal
55: Manual emergency deceleration
56: Automatic emergency deceleration
57: STO signal check

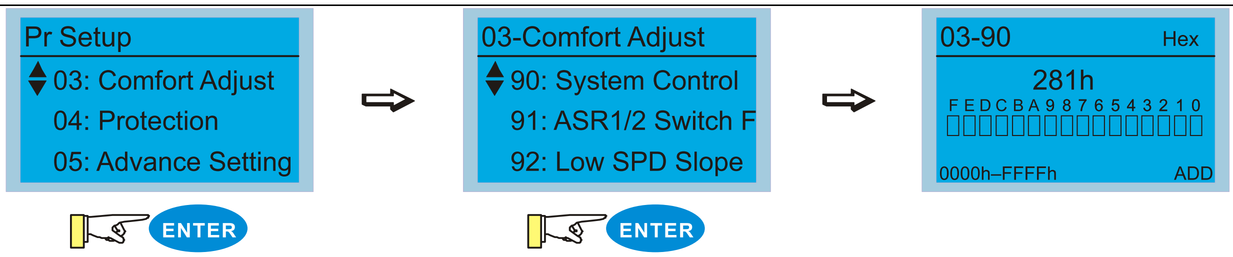
Pr.01-10–Pr.01-15 Multi-function Output Settings



Setting values:
0: No function
1: Indication during operation
2: Operation speed reached
3: Desired frequency 1 reached (Pr.02-10, Pr.02-11)
4: Desired frequency 2 reached (Pr.02-12, Pr.02-13)
5: Zero Speed (Frequency command)
6: Zero speed with stop (Frequency command)
7: Over-torque (OT1) (Pr.04-40–04-42)
8: Reserved
9: Drive is ready
10: User-defined low-voltage detection (LV)
11: Fault indication

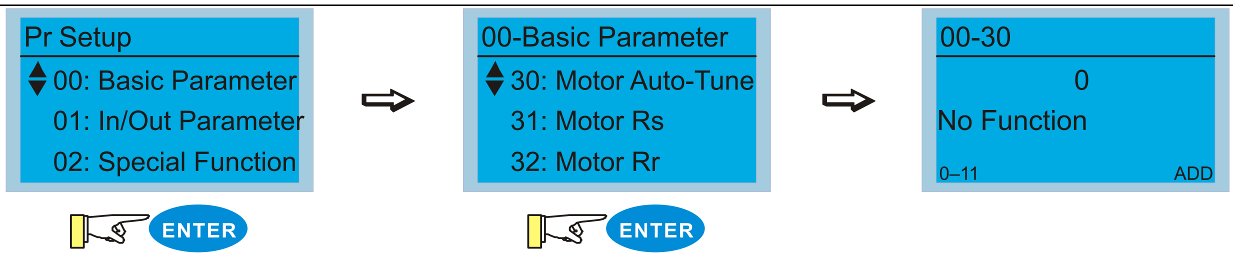
12: Mechanical brake release (Pr.03-00, Pr.03-01, Pr.02-02)
13: IGBT overheat warning (oH1)
14: Brake transistor signal
15: Motor-controlled magnetic contactor output
16: Slip error (oSL)
17: Fault indication 1
18: Reserved
19: Brake transistor output error
20: Warning output
21: Over-voltage
22: Over-current stall prevention warning
23: Over-voltage stall prevention warning
24: Operation mode indication (Pr.00-03=1)
25: Forward command
26: Reverse command
27: Output when current ≥ Pr.02-03
28: Output when current < Pr.02-03
29: Reserved
30: Reserved
31: Power generation direction and status verification
32: Power generation direction
33: Zero speed (actual output frequency)
34: Zero speed with Stop (actual output frequency)
35: Fault output option 1 (Pr.02-71)
36: Fault output option 2 (Pr.02-72)
37: Fault output option 3 (Pr.02-73)
38: Fault output option 4 (Pr.02-74)
39: Reserved
40: Speed reached (including zero speed)
41: Reserved
42: STO output status
43–44: Direct Docking Mode only
45: Reserved
46: Retrying after a fault has occurred indication
47: Direct Docking Mode only
48: Control output of MPSCC (Motor Phase Short Circuit Contactor)
49: Emergency power mode action

Pr.03-90 System Control



When Bit 9=1, PGHH-1 and PGSED-x with load static PG origin auto-tuning function is enabled. This function is valid only when the mechanical brake is in engaged status.

Pr.00-30 Motor Auto-tuning



Position the elevator near the middle floors before auto-tuning.

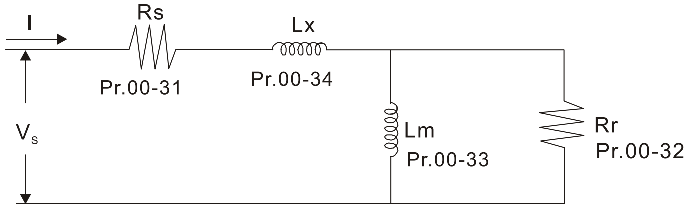
IM Motor when Pr.00-01 is set to 0 (VF), 1 (SVC), 2 (IMFOCPG):

Motor auto-tuning:

Set Pr.00-30 to 3–4, and then press the RUN key on the built-in keyboard panel KPED-LE02 (Pr.00-03=3) to start auto-tuning. Or when the drive is in manual mode (inspection), run the upward operation or downward operation (Pr.00-03=1) to start auto-tuning immediately. In the process of auto-tuning, an “Auto tuning” warning will be continuously displayed on the keyboard panel until it is finished.

Pay attention to the following notes when Pr.00-30=3 (dynamic test):

1. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
2. Make sure the motor is not loaded before auto-tuning, and that the shaft is not connected to any belt or gear motor. Set this parameter to 4 if you cannot separate the motor from the load.
3. Enter the correct values for Pr.00-10–Pr.00-15. Refer to motor capacity to set the acceleration/deceleration time.
4. After auto-tuning is finished, check that Pr.00-16 no-load current (A), Pr.00-31 Rs (ohm/L-L), Pr.00-32 Rr (ohm/L-L), Pr.00-33 Lm (mH/L-L) and Pr.00-34 Lx (mH/L-L) all have values.
5. Line to line equivalent circuit diagram:



Line to line equivalent circuit for VFD-ED Series

PM Motor when Pr.00-01 is set to 3 (FOCPM):

- Auto-tuning process: 7, 9 or 10 and then 6 or 8.
- Motor auto-tuning:
  Set Pr.00-30 to 6–10, and then press the RUN key on the built-in keyboard panel KPED-LE02 (Pr.00-03=3) to start auto-tuning. Or when the drive is in manual mode (inspection), run the upward operation or downward operation (Pr.00-03=1) to start auto-tuning immediately. In the process of auto-tuning, an “Auto tuning” warning will be continuously displayed on the keyboard panel until it is finished.
- Pr.00-30=7: SPM static test:
  1. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
  2. Enter the correct values for Pr.00-10–Pr.00-15. Refer to motor capacity to set the acceleration/deceleration time.
  3. Note that it is suggested the brake should be locked.
  4. After auto-tuning is finished, check that Pr.00-31 Rs (ohm/phase), Pr.00-33 Ld (mH/phase), Pr.00-34 Lq (mH/phase) and Pr.00-35 Back-EMF (Vrms/L-L @rated speed) all have values.
- Pr.00-30=9: IPM / SPM dynamic test:
  1. Unload before auto-tuning. Note that the motor will run!
  2. If the drive controls the brake, the drive can auto-tune according to the normal sequence after you complete the wiring and set the brake control parameters.
  3. If the host controller controls the brake, make sure that the brake is in release status before auto-tuning.
  4. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
  5. Enter the correct values for Pr.00-10–Pr.00-15. Refer to motor capacity to set the acceleration/deceleration time.
  6. After auto-tuning is finished, check that Pr.00-31 Rs (ohm/phase), Pr.00-33 Ld (mH/phase), Pr.00-34 Lq (mH/phase) and Pr.00-35 Back-EMF (Vrms/L-L @rated speed) all have values.
- Pr.00-30=10: IPM / SPM static test:
  1. Note that it is suggested the brake should be locked.
  2. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
  3. Enter the correct values for Pr.00-10–Pr.00-15. Refer to motor capacity to set the acceleration/deceleration time.
  4. After auto-tuning is finished, check that Pr.00-31 Rs (ohm/phase), Pr.00-33 Ld (mH/phase), Pr.00-34 Lq (mH/phase) and Pr.00-35 Back-EMF (Vrms/L-L @rated speed) all have values.
- Pr.00-30=6: Auto-measures the angle between the magnetic pole and the PG origin. Pay attention to the following notes when measuring: (dynamic test)

1. Unload before auto-tuning.
2. If the drive controls the brake, the drive can auto-tune according to the normal sequence after you complete the wiring and set the brake control parameters.
3. If the host controller controls the brake, make sure that the brake is in release status before auto-tuning.

🕮 Pr.00-30=8: Auto-measures the angle between the magnetic pole and the PG origin. Pay attention to the following notes when measuring: (static test)

1. The motor can be loaded or unloaded before auto-tuning.
2. See the reference table for auto-tuning for Pr.00-20 (PG Signal Type). When Pr.00-20=3, set Pr.03-90 bit9=1.
3. If the drive controls the brake, the drive can auto-tune according to the normal sequence after you complete the wiring and set the brake control parameters.
4. If the host controller controls the brake, make sure that the brake is in release status before auto-tuning.
5. Make sure the setting for Pr.00-23 is correct. Incorrectly setting Pr.00-23 causes incorrect positioning of the magnetic pole and results in the wrong angle between the magnetic pole and PG origin.

NOTE:

☑ In vector control mode, do not run motors in parallel.

☑ Do not use vector control mode if the motor rated power exceeds the rated power for the AC motor drive.

☑ The no-load current is usually 20–50% of the rated current.

☑ The rated speed cannot be larger or equal to 120 f/p (f: output frequency Pr.00-13, p: Number of Motor Poles Pr.00-15).

☑ After auto-tuning is finished, start the drive again to make it operate when the auto-tuning command source is the external terminal.

☑ Note that if the contactor and brake are not controlled by the AC motor drive, release it manually.

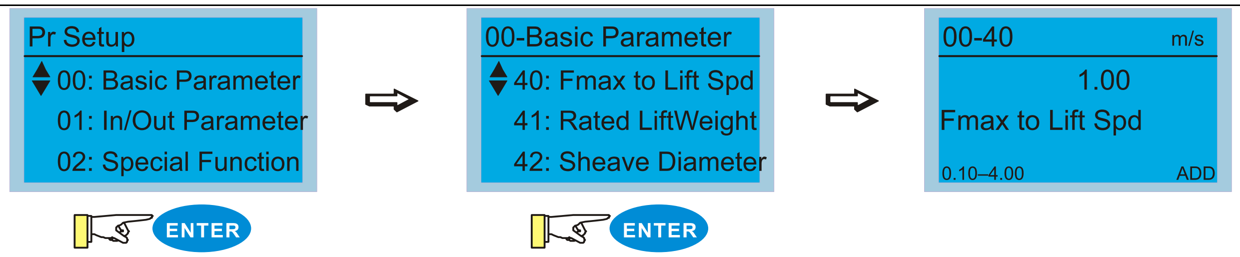
☑ Set Pr.00-30=6 (unloaded motor) for accurate calculation. If you need to execute this function with a loaded motor, balance the carriage before execution.

☑ If you do not balance the carriage in a measured environment, you can execute this function with a loaded motor by setting Pr.00-30=8. It will have a difference of 15–30^{o} for different encoder types.

☑ “Auto Tuning Err” displays on the keyboard panel when stopping due to an AC motor drive fault or human error, which means the detection fails. Check the wiring connections of the AC motor drive. If “PG Fbk Error” displays on the keyboard panel, change the setting of Pr.00-23 (if set to 1, change it to 2). If “PG Fbk Loss” displays on the keyboard panel, check the feedback of Z-phase pulse.

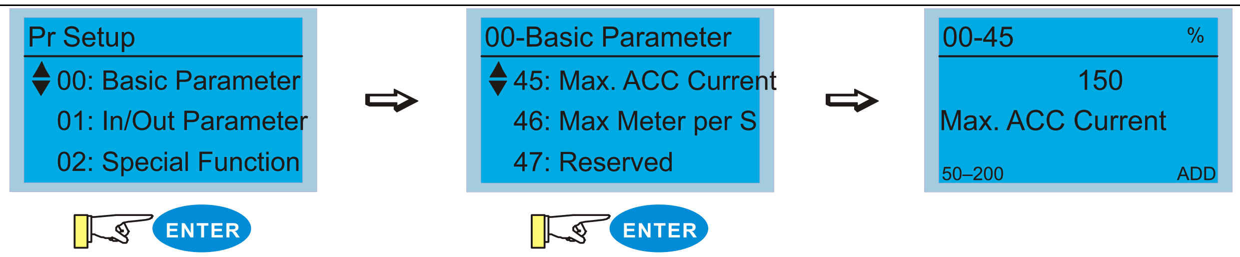
6-2-2-3 Elevator Related Parameters

Pr.00-40 Elevator Speed



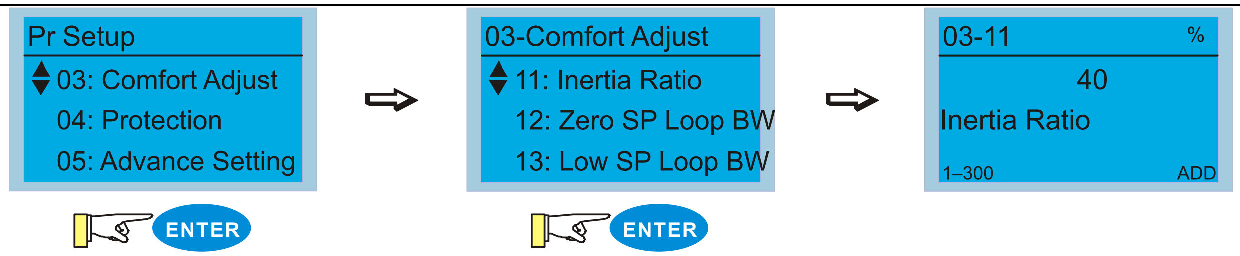
- Elevator speed (m/sec. = m/min. ÷ 60)

Pr.00-45 Motor Current at Acceleration



- The maximum motor current measured when the elevator is tuning in automatic mode.

Pr.03-11 Mechanical Inertial Ratio

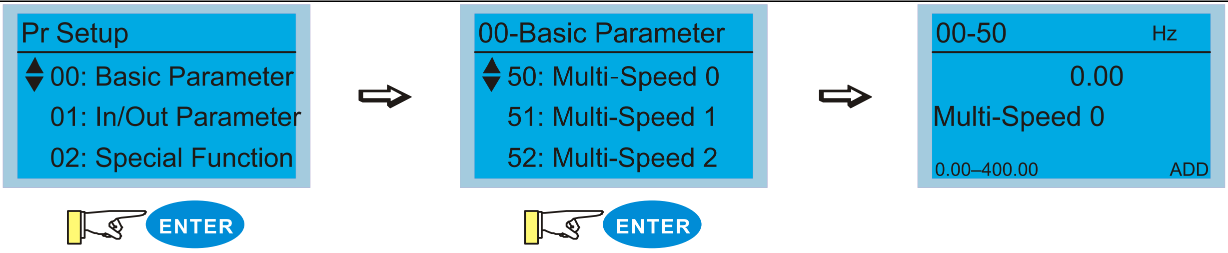


- You can calculate the load inertia according to the settings of motor parameters, Pr.00-45 Motor Current at Acceleration and Pr.00-46 Carriage Acceleration. You can use this parameter to adjust the mechanical inertia ratio.
- Mechanical inertia reference value (%):

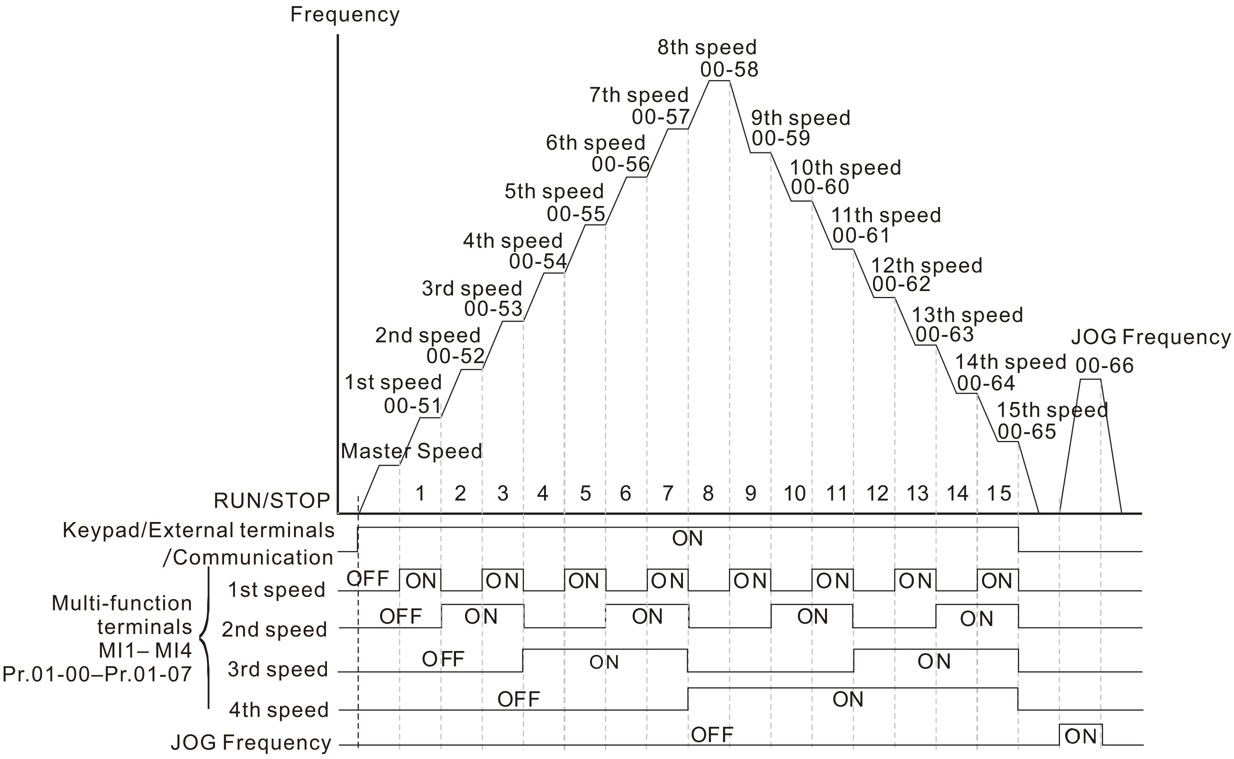
Load / Motor	IM	PM
Without load	40	10
With load	80–120	40 (Suspension Ration 1:1) 20 (Suspension Ration 2:1)

6-2-2-4 Multi-step Speed Settings

Pr.00-50–Pr.00-65 Multi-step Speed Setting

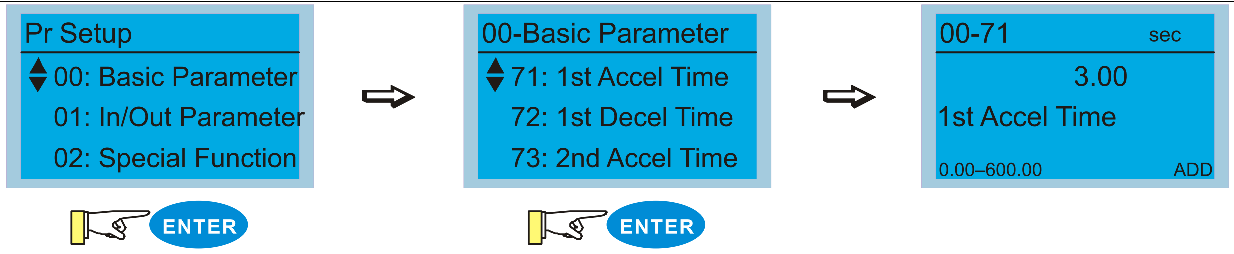


- The multi-function input terminals (refer to Pr.01-00–Pr.01-07) select one of the AC motor drive multi-step speeds (including the master frequency, in total 16 speeds). Pr.00-50–Pr.00-65 determine the speeds (frequencies) as shown above.
- When Pr.00-02 = 1, the master frequency is Pr.03-50.
- When Pr.00-02 = 3, the master frequency is Pr.00-50.

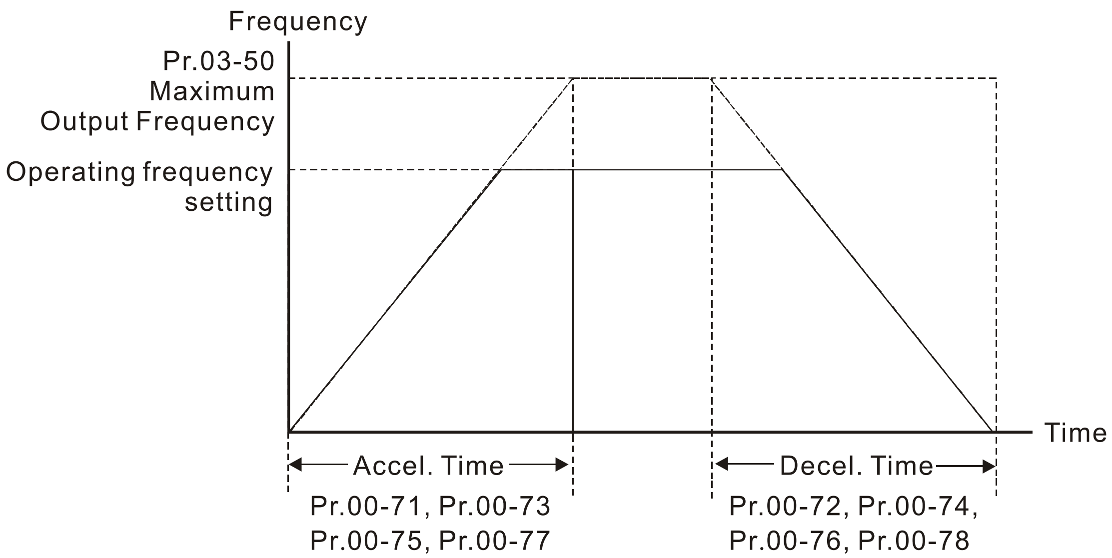


Multi-step speed via External Terminals

Pr.00-71–Pr.00-78 Acceleration / Deceleration Time Setting

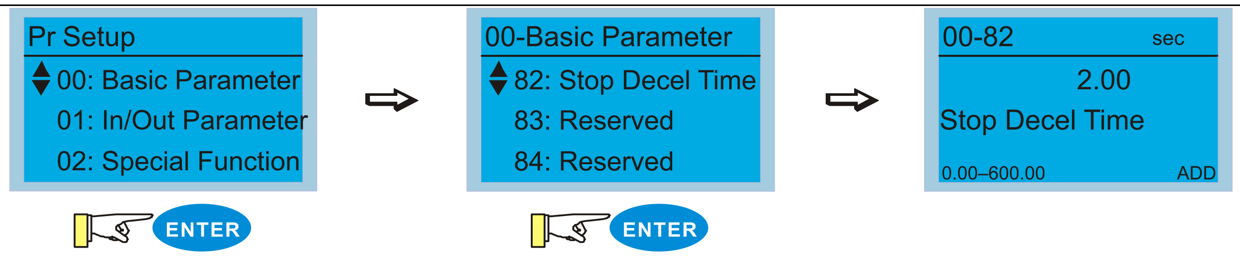


- The Acceleration Time determines the time required for the AC motor drive to ramp from 0.00 Hz to the Maximum Output Frequency (Pr.03-50). The Deceleration Time determines the time required for the AC motor drive to decelerate from the Maximum Output Frequency (Pr.03-50) down to 0.00 Hz.
- Select the Acceleration/Deceleration Time of Set 1, 2, 3, 4 with the multi-function input terminal settings. The defaults are Acceleration Time of Set 1 and Deceleration Time of Set 1.
- When there is a large opposing torque and inertial torque for the load, and the acceleration and deceleration time settings are less than the necessary value, then they enable the torque limit and stall prevention functions. When this happens, the actual acceleration and deceleration time are longer than the settings.



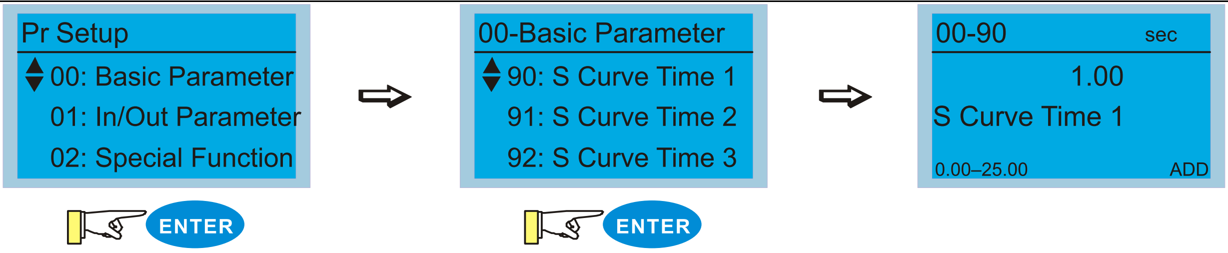
Acceleration & Decelertion Time Setting

Pr.00-82 Deceleration Time when Operating without RUN command



- The AC motor drive stops according to this parameter when cancelling the RUN command. Refer to the figure in the description for Pr.00-94 for details.

Pr.00-90–Pr.00-95 S-curve for Acceleration and Deceleration Time Setting

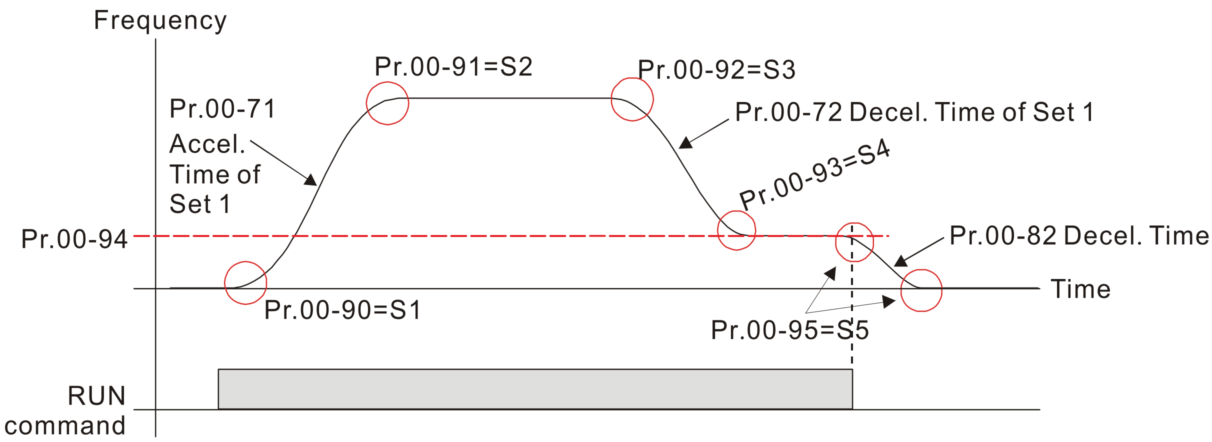


📖 Using an S-curve gives the smoothest transition between speed changes. The acceleration and deceleration curve adjusts the acceleration and deceleration S-curve. When enabled, the motor drive produces a different acceleration and deceleration curve according to the acceleration and deceleration time.

📖 The Actual Acceleration Time = selected acceleration Time + (Pr.00-90 + Pr.00-91) ÷ 2.
The Actual Deceleration Time = selected deceleration Time + (Pr.00-92 + Pr.00-93 + Pr.00-95 × 2) ÷ 2.

📖 Use Pr.00-94 to set the switch frequency between S4 and S5 for smooth stopping.

📖 Set Pr.00-94 to the leveling speed of the elevator.



6-2-2-5 Trial Run

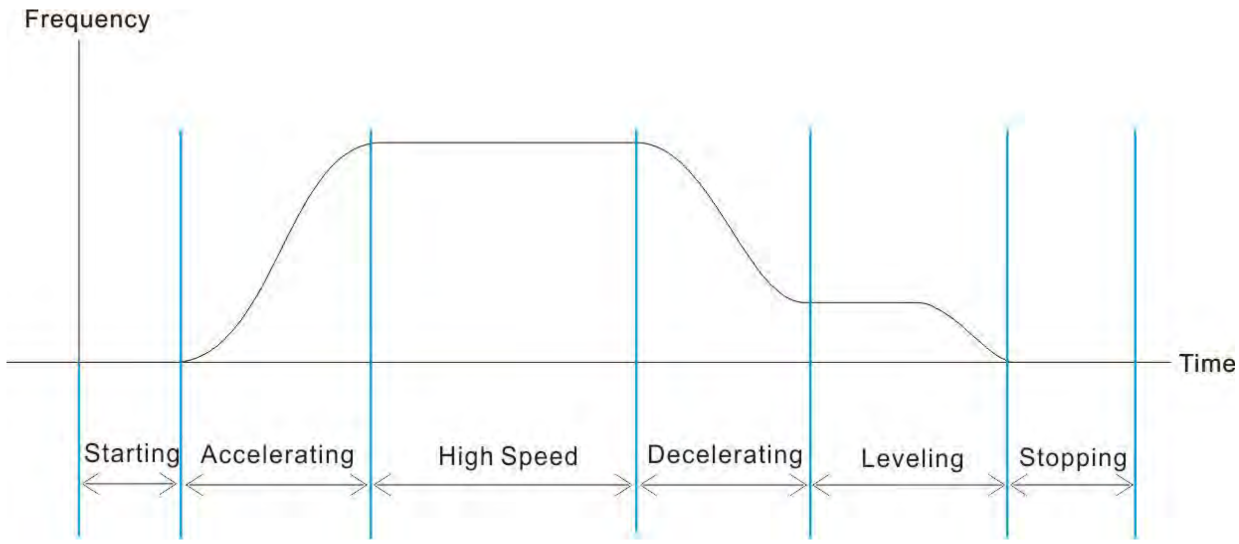
Testing method:

1. Position the elevator near the middle floors.
2. Enter the correct values into Pr.00-02 and Pr.00-03.
3. Run the test using the upward / downward operation of the inspection mode.
4. If jerk occurs while elevator is running, see the table below (Pr.03-11) to set mechanical inertial ratio:

   Mechanical inertia reference value (%):

Load / Motor	IM	PM
Without load	40	10
With load	80–120	40 (Suspension Ration 1:1) 20 (Suspension Ration 2:1)

6-3 Elevator Performance Fine-tuning



Stage	Function	Pr.	Control Mode	Description	Settings	Default
All	Slip Compensation	03-75	VF, SVC	Slip Compensation Gain	0.00–10.00	0
		03-70	VF	Regenerative Slip Compensation Ratio %	0.0–100.0%	1.0
		03-71	VF	Slip Compensation Switch Gap %	0.0–100.0%	5.0
		03-95	SVC	Core Loss Compensation	0–250%	10
	System Control	03-90	FOCPG, FOCPM	System Control	· bit 0=1: ASR auto-tuning; PDFF enabled (Pr.03-12–Pr.03-15) · bit 7=1: Zero speed position control is enabled (Pr.00-30, Pr.00-31, Pr.00-33)	281h
Starting	Delay Time	03-00	VF, SVC, FOCPG, FOCPM	Brake Release Delay Time when Elevator Starts	0.000–65.000 sec.	0.250
		03-02	VF, SVC, FOCPG, FOCPM	Magnetic Contactor Contracting Delay Time between Drive and Motor	0.010–65.000 sec.	0.200
	Start-up Adjustment	03-56	VF, SVC	Fourth Output Voltage Setting	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	5.0 10.0
	Comfort	03-11	FOCPG, FOCPM	Mechanical Inertial Ratio	1–300%	40
		03-12	FOCPG, FOCPM	Zero Speed Bandwidth	1–40 Hz	10

Stage	Function	Pr.	Control Mode	Description	Settings	Default
	Torque Check	02-03	VF, SVC, FOCPG, FOCPM	External Terminal Output Current Level	0–100% (drive's rated current)	0
		02-02	VF, SVC, FOCPG, FOCPM	Torque Check	0: Disable 1: Enable	0
	Rollback	03-60	VF, SVC	DC Brake Current Level at Start-up	0–100% (drive's rated current)	0
		03-06	VF, SVC, FOCPG, FOCPM	DC Brake Activation Time	0.0–60.0 sec.	0.7
		03-30	FOCPM	Zero Speed Position Control (PPI) Gain (P)	0.00–655.00%	80.00
		03-31	FOCPM	Zero Speed Position Control (PPI) Holding Time	0.000–65.535 sec.	0.250
		03-33	FOCPM	Zero Speed Position Control (PPI) Activation Mode Selection	0: After the brake release set in Pr.03-00 1: After the brake signal input (Pr.01-00–Pr.01-07 is set to 42)	0
Accelerating	Multi-step Speed	00-71	VF, SVC, FOCPG, FOCPM	Accel. Time of Set 1	0.00–600.00 sec.	3.00
		00-90	VF, SVC, FOCPG, FOCPM	S-curve for Acceleration Begin Time S1	0.00–25.00 sec.	1.00
		00-91	VF, SVC, FOCPG, FOCPM	S-curve for Acceleration Arrival Time S2	0.00–25.00 sec.	1.00
	Comfort	03-52	VF, SVC	Second Output Voltage Setting	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	5.0 10.0
		03-54	VF, SVC	Third Output Voltage Setting	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	5.0 10.0
		03-11	FOCPG, FOCPM	Mechanical Inertial Ratio	1–300%	40
		03-13	FOCPG, FOCPM	Low Speed Bandwidth	1–40 Hz	10
		03-14	FOCPG, FOCPM	High Speed Bandwidth	1–40 Hz	10

Stage	Function	Pr.	Control Mode	Description	Settings	Default
High Speed	Comfort	03-11	FOCPG, FOCPM	Mechanical Inertial Ratio	1–300%	40
		03-14	FOCPG, FOCPM	High Speed Bandwidth	1–40 Hz	10
		03-83	FOCPG, FOCPM	PDFF Gain Value	0–200%	30
Decelerating	Multi-step Speed	00-72	VF, SVC, FOCPG, FOCPM	Decel. Time of Set 1	0.00–600.00 sec.	2.00
		00-92	VF, SVC, FOCPG, FOCPM	S-curve for Deceleration Begin Time S3	0.00–25.00 sec.	1.00
		00-93	VF, SVC, FOCPG, FOCPM	S-curve for Deceleration Arrival Time S4	0.00–25.00 sec.	1.00
	Comfort	03-52	VF, SVC	Second Output Voltage Setting	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	5.0 10.0
		03-54	VF, SVC	Third Output Voltage Setting	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	5.0 10.0
		03-11	FOCPG, FOCPM	Mechanical Inertial Ratio	1–300%	40
		03-13	FOCPG, FOCPM	Low Speed Bandwidth	1–40 Hz	10
		03-14	FOCPG, FOCPM	High Speed Bandwidth	1–40 Hz	10
Leveling	Comfort	03-11	FOCPG, FOCPM	Mechanical Inertial Ratio	1–300%	40
		03-13	FOCPG, FOCPM	Low Speed Bandwidth	1–40 Hz	10
Stopping	Delay Time	03-01	VF, SVC, FOCPG, FOCPM	Brake Engage Delay Time when Elevator Stops	0.000–65.000 sec.	0.250
		03-03	VF, SVC, FOCPG, FOCPM	Magnetic Contactor Release Delay Time between Drive and Motor	0.010–65.000 sec.	0.200
	Elevator Parking	00-94	VF, SVC, FOCPG, FOCPM	Switch Frequency for S4/S5 Changes to S5	0.00–400.00 Hz	0.00
		00-95	VF, SVC, FOCPG,	S-curve for Deceleration Arrival Time S5	0.00–25.00 sec.	1.00

Stage	Function	Pr.	Control Mode	Description	Settings	Default
			FOCPM			
		00-82	VF, SVC, FOCPG, FOCPM	Deceleration Time when Operating without RUN Command	0.00–600.00 sec.	2.00
	Comfort	03-11	FOCPG, FOCPM	Mechanical Inertial Ratio	1–300%	40
	Comfort	03-15	FOCPG, FOCPM	Zero Speed Parking Bandwidth	1–40 Hz	10
	Torque Check	02-03	VF, SVC, FOCPG, FOCPM	External Terminal Output Current Level	0–100% (drive's rated current)	0
	Torque Check	02-02	VF, SVC, FOCPG, FOCPM	Torque Check	0: Disable 1: Enable	0
	DC Brake	03-61	VF, SVC	DC Brake Current Level at Stop	0–100% (drive's rated current)	0
	DC Brake	03-07	VF, SVC, FOCPG, FOCPM	DC Brake Stopping Time	0.0–60.0 sec.	0.7

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Chapter 7 Summary of Parameter Settings

This chapter provides a summary of parameter (Pr.) setting ranges and defaults. You can set, change and reset parameters through the digital keypad.

NOTE:

1. ⚡: You can set this parameter during operation
2. For details on parameters, refer to <Chapter 8 Descriptions of Parameter Settings>.
3. The following are abbreviations for different types of motors:
   - IM: Induction motor
   - PM: Permanent magnet synchronous AC motor
   - IPM: Interior permanent magnet synchronous AC motor
   - SPM: Surface permanent magnet synchronous AC motor
   - SynRM: Synchronous reluctance motor

00 Basic Parameters

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOC	FOCPM
	00-00	Parameter Reset	0: No Function 1: Read Only 5: Direct docking mode only, contact Delta for more information. 8: Keypad Locked 9: Reset all parameters to defaults (50 Hz) 10: Reset all parameters to defaults (60 Hz)	0	○	○	○	○
	00-01	Control Mode	0: V/F control (V/F) 1: Sensorless Vector Control (SVC) 2: FOC vector control + Encoder (FOCPG) 3: FOC Permanent Motor control (FOCPM)	0	○	○	○	○
⚡	00-02	Master Frequency Command Source	1: RS-485 serial communication or keyboard panel (KPED-LE02) 2: External analog input (Pr.01-20) 3: External digital input 4: Direct docking mode (Delta CAN). Contact Delta for more information. 5: Direct docking mode (Delta CAN + Terminal (FWD/REV)). Contact Delta for more information. 6: CAN Lift. Contact Delta for more	1	○	○	○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOC	FOCPM
		information. 7: DCP serial communication (SG±)					
00-03	Operation Command Source	1: External terminals 2: RS-485 serial communication or digital keypad (KPC-CC01) 3: Keyboard panel (KPED-LE02) 6: CAN Lift. Contact Delta for more information. 7: DCP serial communication (SG±)	1	○	○	○	○
00-04	Output Direction Selection	0: FWD: counterclockwise, REV: clockwise 1: FWD: clockwise, REV: counterclockwise	0	○	○	○	○
00-05	Speed Unit	0: Hz 1: m/s 2: ft/s 3: Direct docking mode only, contact Delta for more information.	0	○	○	○	○
00-10	Motor Rated Power	0.00–655.35 kW	#.##	○	○	○	○
00-11	Motor Rated Voltage	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	220.0 / 440.0	○	○	○	○
00-12	Motor Rated Current	[(40–120%) × Pr.07-01] Amps	#.##	○	○	○	○
00-13	Motor Rated Frequency	0.00–400.00 Hz	60.00 / 50.00	○	○	○	○
00-14	Motor Rated Speed	0–65535 rpm	1710	○	○	○	○
00-15	Number of Motor Poles	2–96	4	○	○	○	○
00-16	IM Motor No-load Current	0–Pr.00-12 Amps	#.##		○	○	
00-20	Selection of Encoder	0: No function 1: ABZ 2: ABZ+Hall 3: SIN/COS + Sinusoidal 4: SIN/COS + EnDat2.1/01/21 5: SIN/COS 6: SIN/COS + Hiperface 7: SIN/COS + EnDat2.2/01/21/02/22 8: SIN/COS + SSI 9: SIN/COS + BiSS-C	0			○	○
00-21	Encoder PPR	1–25000	2048			○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOC	FOCPM
00-22	High Resolution SIN/COS and Communication Encoder	0–32 bit	25				○
00-23	Encoder Input Type Setting	0: Disable 1: Phase A leads in a forward run command and phase B leads in a reverse run command 2: Phase B leads in a forward run command and phase A leads in a reverse run command	0			○	○
00-24	PG Card Frequency Division Output	0–255 (0 equals to 1)	0			○	
00-25	Output Resolution for PGSED	0–11	8			○	○
00-26	PG Card C+ / C-	0000h–0001h	0000h			○	○
00-27	Mode Selection for UVW Input	0: Z signal is at the falling edge of U-phase 1: Z signal is at the rising edge of U-phase	0			○	○
00-28	Magnetic Pole Re-orientation	0: Disable 1: Six-pulse positioning	0				○
00-30	Motor Auto-tuning	0: No function 3: IM dynamic test (Rs, Rr, Lm, Lx, no-load current) [motor runs] 4: IM static test (Rs, Rr, Lm, Lx) [motor does not run] 6: PM Only for an unloaded motor; auto-measures the angle between magnetic pole and PG origin (Pr.00-36) 7: SPM static test (Rs, Ld, Lq, BEMF) (suggested to lock the brake) 8: PM auto-measures the angle between magnetic pole and PG origin (Pr.00-36) 9: IPM / SPM dynamic test (Rs, Ld, Lq, BEMF)	0		○	○	○

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOC	FOCPM
			10: IPM / SPM static test (Rs, Ld, Lq, BEMF) (suggested to lock the brake)					
	00-31	IM/PM Rs	0.000–65.535 Ω	0.000		○	○	○
	00-32	IM Rr	0.000–65.535 Ω	0.000		○	○	
	00-33	IM Lm / PM Ld	0.0–6553.5 mH	0.0		○	○	○
	00-34	IM Lx / PM Lq	0.0–6553.5 mH	0.0		○	○	○
	00-35	Back Electromotive Force	0.0–6553.5 Vrms	0.0				○
	00-36	Offset Angle between Magnetic Pole and PG Origin	0.0–360.0°	360.0				○
⚡	00-40	Elevator Speed	0.10–4.00 m/s	1.00			○	○
	00-41	Elevator Rated Load	400–4000 kg	800			○	○
⚡	00-42	Traction Sheave Diameter	100–2000 mm	400			○	○
⚡	00-43	Gear Ratio	1.00–100.00	1.00			○	○
⚡	00-44	Suspension Ratio	0 = 1: 1 1 = 2: 1 2 = 4: 1 3 = 8: 1	1			○	○
⚡	00-45	Motor Current at Acceleration	50–200%	150				○
⚡	00-46	Carriage Acceleration	0.20–2.00 m/s^2	0.75				○
⚡	00-50	Zero Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-51	1st Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-52	2nd Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-53	3rd Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-54	4th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-55	5th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-56	6th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-57	7th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-58	8th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-59	9th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-60	10th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-61	11th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-62	12th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-63	13th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-64	14th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○
⚡	00-65	15th Step Speed Frequency	0.00–400.00 Hz	0.00	○	○	○	○

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOC	FOCPM
ϟ	00-66	JOG Frequency	0.00–400.00 Hz	6.00	○	○	○	○
	00-70	Starting Frequency	0.00–400.00 Hz	0.50	○	○	○	
ϟ	00-71	Accel. Time of Set 1	0.00–600.00 sec.	3.00	○	○	○	○
ϟ	00-72	Decel. Time of Set 1	0.00–600.00 sec.	2.00	○	○	○	○
ϟ	00-73	Accel. Time of Set 2	0.00–600.00 sec.	3.00	○	○	○	○
ϟ	00-74	Decel. Time of Set 2	0.00–600.00 sec.	2.00	○	○	○	○
ϟ	00-75	Accel. Time of Set 3	0.00–600.00 sec.	3.00	○	○	○	○
ϟ	00-76	Decel. Time of Set 3	0.00–600.00 sec.	2.00	○	○	○	○
ϟ	00-77	Accel. Time of Set 4	0.00–600.00 sec.	3.00	○	○	○	○
ϟ	00-78	Decel. Time of Set 4	0.00–600.00 sec.	2.00	○	○	○	○
ϟ	00-79	JOG Acceleration Time	0.00–600.00 sec.	1.00	○	○	○	○
ϟ	00-80	JOG Deceleration Time	0.00–600.00 sec.	1.00	○	○	○	○
ϟ	00-81	Switch Frequency between First and Fourth Set of Accel./Decel.	0.00–400.00 Hz	0.00	○	○	○	○
ϟ	00-82	Deceleration Time when Operating without RUN Command	0.00–600.00 sec.	2.00	○	○	○	○
ϟ	00-90	S-curve for Acceleration Begin Time S1	0.00–25.00 sec.	1.00	○	○	○	○
ϟ	00-91	S-curve for Acceleration Arrival Time S2	0.00–25.00 sec.	1.00	○	○	○	○
ϟ	00-92	S-curve for Deceleration Begin Time S3	0.00–25.00 sec.	1.00	○	○	○	○
ϟ	00-93	S-curve for Deceleration Arrival Time S4	0.00–25.00 sec.	1.00	○	○	○	○
ϟ	00-94	Switch Frequency for S4 Changes to S5	0.00–400.00 Hz	0.00	○	○	○	○
ϟ	00-95	S-curve for Deceleration Arrival Time S5	0.00–25.00 sec.	1.00	○	○	○	○

01 Input / Output Parameters

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
✎	01-00	Multi-function Input Command 1 (MI1)	0: No function	1	○	○	○	○
			1: Multi-step speed command 1		○	○	○	○
			2: Multi-step speed command 2		○	○	○	○
			3: Multi-step speed command 3		○	○	○	○
			4: Multi-step speed command 4		○	○	○	○
			5: Reset		○	○	○	○
✎	01-01	Multi-function Input Command 2 (MI2)	6: JOG command	2	○	○	○	○
			7: Acceleration/deceleration speed inhibit		○	○	○	○
			8: Reserved					
✎	01-02	Multi-function Input Command 3 (MI3)	9: Reserved	3				
			10: EF input (Pr.02-16)		○	○	○	○
			11: Reserved					
✎	01-03	Multi-function Input Command 4 (MI4)	12: Stop output	4	○	○	○	○
			13–14: Reserved					
			15: AUI1 operation speed command		○	○	○	○
✎	01-04	Multi-function Input Command 5 (MI5)	16: Reserved	0				
			17: AUI2 operation speed command		○	○	○	○
			18: Emergency Stop (Pr.02-16)		○	○	○	○
✎	01-05	Multi-function Input Command 6 (MI6)	19–23: Reserved	0				
			24: FWD JOG Command		○	○	○	○
			25: REV JOG Command		○	○	○	○
✎	01-06	Multi-function Input Command 7 (MI7)	26: Reserved	0				
			27: ASR1/ASR2 selection		○	○	○	○
			28: Emergency stop (EF1) (motor coasts to stop)		○	○	○	○
✎	01-07	Multi-function Input Command 8 (MI8)	29–30: Reserved	40				
			31: High torque bias (according to Pr.02-43)		○	○	○	○
			32: Middle torque bias (according to Pr.02-44)		○	○	○	○
			33: Low torque bias (according to Pr.02-45)		○	○	○	○
			34: Rescue by mechanical brake control		○	○	○	○
			35–37: Reserved					
			38: Disable writing to EEPROM		○	○	○	○
			39: Reserved					
			40: Enable drive function		○	○	○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
		41: Magnetic contactor detection			○	○	○
		42: Mechanical brake 1		○	○	○	○
		43: EPS function (Emergency Power System)		○	○	○	○
		44: Mechanical brake 2		○	○	○	○
		45–51: Direct docking mode only				○	○
		53: Terminal leveling signal for direct docking				○	○
		54: Power failure signal		○	○	○	○
		55: Manual emergency deceleration				○	○
		56: Automatic emergency deceleration				○	○
		57: STO signal check		○	○	○	○
01-08	Digital Input Response Time	0.001–30.000 sec.	0.005	○	○	○	○
01-09	FWD/REV Terminal Contact Action	0: Disable 1: FWD inversed 2: REV inversed 3: FWD and REV inversed	0	○	○	○	○
01-10	Multi-function Output 1: RA1, RB1, RC1 (Relay 1)	0: No function	0	○	○	○	○
		1: Indication during operation		○	○	○	○
		2: Operation speed reached		○	○	○	○
01-11	Multi-function Output 2: RA2, RC2 (Relay 2)	3: Desired frequency 1 reached (Pr.02-10, Pr.02-11)	0	○	○	○	○
		4: Desired frequency 2 reached (Pr.02-12, Pr.02-13)		○	○	○	○
01-12	Multi-function Output 3: RA3, RC3 (Relay 3)	5: Zero Speed (Frequency command)	0	○	○	○	○
		6: Zero speed with stop (Frequency command)		○	○	○	○
01-13	Multi-function Output 4: RA4, RC4 (Relay 4)	7: Over-torque (OT1) (Pr.04-40–04-42)	0	○	○	○	○
		8: Reserved					
		9: Drive is ready		○	○	○	○
01-14	Multi-function Output 5: MO1	10: User-defined low-voltage detection (LV)	0	○	○	○	○
01-15	Multi-function Output 6: MO2	11: Fault indication	0	○	○	○	○
		12: Mechanical brake release (Pr.03-00, Pr.03-01, Pr.02-02)		○	○	○	○
		13: IGBT overheat warning (oH1)		○	○	○	○
		14: Brake transistor signal		○	○	○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
		15: Motor-controlled magnetic contactor output		○	○	○	○
		16: Slip error (oSL)		○	○	○	○
		17: Fault indication 1		○	○	○	○
		18: Reserved					
		19: Brake transistor output error		○	○	○	○
		20: Warning output		○	○	○	○
		21: Over-voltage		○	○	○	○
		22: Over-current stall prevention warning		○	○	○	○
		23: Over-voltage stall prevention warning		○	○	○	○
		24: Operation mode indication (Pr.00-03=1)		○	○	○	○
		25: Forward command		○	○	○	○
		26: Reverse command		○	○	○	○
		27: Output when current ≥ Pr.02-03		○	○	○	○
		28: Output when current < Pr.02-03		○	○	○	○
		29: Reserved					
		30: Reserved					
		31: Power generation direction and status verification		○	○	○	○
		32: Power generation direction		○	○	○	○
		33: Zero speed (actual output frequency)		○	○	○	○
		34: Zero speed with Stop (actual output frequency)		○	○	○	○
		35: Fault output option 1 (Pr.02-71)		○	○	○	○
		36: Fault output option 2 (Pr.02-72)		○	○	○	○
		37: Fault output option 3 (Pr.02-73)		○	○	○	○
		38: Fault output option 4 (Pr.02-74)		○	○	○	○
		39: Reserved					
		40: Speed reached (including zero speed)		○	○	○	○
		41: Reserved					
		42: STO output status		○	○	○	○
		43–44: Direct Docking Mode only					
		45: Reserved					
		46: Retrying after a fault has occurred indication		○	○	○	○
		47: Direct Docking Mode only					

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
			48: Control output of MPSCC (Motor Phase Short Circuit Contactor)		○	○	○	○
			49: Emergency power mode action		○	○	○	○
			53: Power off detect		○	○	○	○
〆	01-20	AUI1 Selection	0: No function	1	○	○	○	○
〆	01-26	AUI2 Selection	1: Frequency command	0	○	○	○	○
〆	01-32	ACI Selection	3: Load compensation	0	○	○	○	○
			4: Reserved					
			5: P.T.C. thermistor 1 input value		○	○	○	○
			6: P.T.C. thermistor 2 input value		○	○	○	○
			7: Positive torque limit				○	○
			8: Negative torque limit				○	○
			9: Regenerative torque limit				○	○
			10: Positive/negative torque limit				○	○
〆	01-21	AUI1 Input Bias	-100.0–100.0%	0.0	○	○	○	○
〆	01-27	AUI2 Input Bias	-100.0–100.0%	0.0	○	○	○	○
〆	01-33	ACI Input Bias	-100.0–100.0%	0.0	○	○	○	○
〆	01-22	AUI1 Positive / negative Bias Mode	0: Zero bias 1: Lower than or equal to bias 2: Higher than or equal to bias	0	○	○	○	○
〆	01-28	AUI2 Positive / negative Bias Mode	3: Use bias as the base to get the absolute value of bias voltage 4: Using bias as the base	0	○	○	○	○
〆	01-34	ACI Positive/negative Bias Mode	0: Zero bias 1: Lower than or equal to bias	0	○	○	○	○
〆	01-23	AUI1 Input Gain	-500.0–500.0%	100.00	○	○	○	○
〆	01-29	AUI2 Input Gain	-500.0–500.0%	100.00	○	○	○	○
〆	01-35	ACI Input Gain	0.0–500.0%	100.00	○	○	○	○
〆	01-24	AUI1 Input Filter Time	0.00–2.00 sec.	0.01	○	○	○	○
〆	01-30	AUI2 Input Filter Time	0.00–2.00 sec.	0.01	○	○	○	○
〆	01-36	ACI Input Filter Time	0.00–2.00 sec.	0.01	○	○	○	○
	01-25	AUI1 Input Type	0: Bipolar (±10 V)	0	○	○	○	○
	01-31	AUI2 Input Type	1: Unipolar (0–10 V)	0	○	○	○	○

<table>
<tr><th></th><th>Pr.</th><th>Parameter Name</th><th>Setting Range</th><th>Default</th><th>VF</th><th>SVC</th><th>FOCPG</th><th>FOCPM</th></tr>
<tr><td>ϟ</td><td>01-40</td><td>Analog Output Selection 1</td><td rowspan="2">0: Output frequency (Hz)
1: Frequency command (Hz)
2: Motor speed (RPM)
3: Output current (rms)
4: Output voltage
5: DC bus voltage
6: Power factor angle
7: Power factor
8: Output torque
9: AUI1
10: Reserved
11: AUI2
12: q-axis current
13: q-axis feedback value
14: d-axis current
15: d-axis feedback value
16: q-axis voltage
17: d-axis voltage
18: Torque command
19–20: Reserved
21: Power output</td><td>0</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>ϟ</td><td>01-43</td><td>Analog Output Selection 2</td><td>0</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>ϟ</td><td>01-41</td><td>Analog Output Gain 1</td><td>0–200%</td><td>100.0</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>ϟ</td><td>01-44</td><td>Analog Output Gain 2</td><td>0–200%</td><td>100.0</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>ϟ</td><td>01-42</td><td>Analog Output Value in REV Direction 1</td><td rowspan="2">0: Absolute value in output voltage
1: Output 0 V in REV direction
2: Enable output voltage in REV direction</td><td>0</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>ϟ</td><td>01-45</td><td>Analog Output Value in REV Direction 2</td><td>0</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
</table>

02 Special Function Parameters

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
	02-00	Serial Start Signal Selection	0: According to FWD/REV signal 1: According to Enable drive function signal	0	○	○	○	○
	02-01	Two-wire Operation Control	0: FWD/STOP, REV/STOP 1: FWD/STOP, REV/STOP (Line Start Lockout)	0	○	○	○	○
	02-02	Torque Check	0: Disable 1: Enable	0	○	○	○	○
↯	02-03	External Terminal Output Current Level	0–100%	0	○	○	○	○
↯	02-10	Desired Frequency Reached 1	0.00–400.00 Hz	60.00 / 50.00	○	○	○	○
↯	02-11	Desired Frequency Reached Width 1	0.00–400.00 Hz	2.00	○	○	○	○
↯	02-12	Desired Frequency Reached 2	0.00–400.00 Hz	60.00 / 50.00	○	○	○	○
↯	02-13	Desired Frequency Reached Width 2	0.00–400.00 Hz	2.00	○	○	○	○
	02-14	Automatic Emergency Deceleration Level	5.00–400.00 Hz	60.00			○	○
↯	02-15	Deceleration Time for Emergency Deceleration	0.00–600.00 sec.	2.00			○	○
↯	02-16	Emergency Stop (EF) & Forced Stop	0: Coast to stop 1: According to deceleration Time 1 2: According to deceleration Time 2 3: According to deceleration Time 3 4: According to deceleration Time 4 5: According to Pr.00-82	0	○	○	○	○
↯	02-20	Emergency Power (EPS) ON Operation Direction	0: Run according to current command 1: Run according to the operation direction of power generation mode, and execute the power generation direction detection when in power generation mode. 2: After determining the power generation direction, the host controller sends a running direction	0	○	○	○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
		command. (When at STOP, the direction of power generation mode (MO = 32) confirms and the direction of power generation mode does not remain.) Execute the power generation direction detection every time. 3: After determining the power generation direction, the host controller sends a running direction command. (When at STOP, the direction of power generation mode (MO =32) confirms and the direction of power generation mode remains.) Execute the power generation direction detection one time. 4: Run according to the operation direction of power generation mode, and execute the power generation direction detection when in normal mode.					
02-21	Voltage of Emergency Power (V_{DC})	24.0–375.0 V_{DC} 48.0–750.0 V_{DC}	24.0 / 48.0	○	○	○	○
02-22	Power Capacity of Emergency Power (EPS)	0.0–100.0 kVA	0.0	○	○	○	○
02-23	Emergency Power (EPS) Mode Maximum Speed	0.00–400.00 Hz	0.00				
✎ 02-24	Power Generation Direction Search Time	0.0–5.0 sec.	1.0	○	○	○	○
✎ 02-25	Power Factor Angle Level for Power Generation Direction	0.0–150.0°	70.0	○	○	○	○
02-26	Reference Level for Power Factor Angle during Operation	Read only	Read only	○	○	○	○
02-27	Power Generation Direction	0: FWD 1: REV	Read only	○	○	○	○
✎ 02-28	Battery Output Delay Time	0.0–10.0 sec.	1.0	○	○	○	○

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
	02-29	Battery Stops Output Delay Time	0.0–60.0 sec.	3.0	○	○	○	○
✎	02-40	Load Compensation Auto-tuning	0: No function 1: Auto-tunes with running without load 2: Auto-tunes with running with load	0	○	○	○	○
✎	02-41	Torque Offset Source	0: Disable 1: Use the analog input (Pr.01-20) 2: Use the torque offset setting (Pr.02-46) 3: Use the external terminals (by Pr.02-43–Pr.02-45)	0		○	○	○
✎	02-42	Torque Command Source	0: KPC-CC01 1: RS-485 communication 2: Analog signal (Pr.01-20)	2		○	○	○
✎	02-43	High Torque Offset	-100.0–100.0% (motor drive rated torque)	30.0		○	○	○
✎	02-44	Middle Torque Offset	-100.0–100.0% (motor drive rated torque)	20.0		○	○	○
✎	02-45	Low Torque Offset	-100.0–100.0% (motor drive rated torque)	10.0		○	○	○
✎	02-46	Torque Offset Setting	-100.0–100.0% (motor drive rated torque)	0.0		○	○	○
	02-52	Limit for Direct Docking Terminal Function	0.00–10.00	2.00	○	○	○	○
	02-53	Deceleration Distance for Direct Docking Terminal Function	0.00–100.00 cm	30.00	○	○	○	○
	02-55	Direct Docking Terminal Function Enabled	0000h: Disabled 0002h: Direct docking terminal function enabled	0000h	○	○	○	○
	02-60	Permanent Operation Direction Count (H)	Read only	Read only	○	○	○	○
	02-61	Permanent Operation Direction Count (L)	Read only	Read only	○	○	○	○
	02-62	Single Operation Direction Count (H)	Read only	Read only	○	○	○	○
	02-63	Single Operation Direction Count (L)	Read only	Read only	○	○	○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
02-64	Number of Times for Single Operation Reset	Read only	Read only	○	○	○	○
02-65	Number of Times for Operation Direction	0.00–200.00 k	2.00	○	○	○	○
02-66	Function Selection for Operation Times	0–2	0	○	○	○	○
02-70	Fault Output Setting Method	0: According to settings in Pr.02-71–Pr.02-74 1: According to the binary setting	0	○	○	○	○
02-71	Fault Output Option 1	0–65535 sec. (See the bit table in Chapter 8 for details)	0	○	○	○	○
02-72	Fault Output Option 2	0–65535 sec. (See the bit table in Chapter 8 for details)	0	○	○	○	○
02-73	Fault Output Option 3	0–65535 sec. (See the bit table in Chapter 8 for details)	0	○	○	○	○
02-74	Fault Output Option 4	0–65535 sec. (See the bit table in Chapter 8 for details)	0	○	○	○	○
02-80	Dwell Time at Acceleration	0.00–600.00 sec.	0.00	○	○	○	○
02-81	Dwell Frequency at Acceleration	0.00–400.00 Hz	0.00	○	○	○	○
02-82	Dwell Time at Deceleration	0.00–600.00 sec.	0.00	○	○	○	○
02-83	Dwell Frequency at Deceleration	0.00–400.00 Hz	0.00	○	○	○	○

03 Comfort Adjustment Parameters

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
	03-00	Brake Release Delay Time when Elevator Starts	0.000–65.000 sec.	0.250	○	○	○	○
	03-01	Brake Engage Delay Time when Elevator Stops	0.000–65.000 sec.	0.250	○	○	○	○
✓	03-02	Magnetic Contactor Contracting Delay Time between Drive and Motor	0.010–65.000 sec.	0.200	○	○	○	○
✓	03-03	Magnetic Contactor Release Delay Time between Drive and Motor	0.010–65.000 sec.	0.200	○	○	○	○
✓	03-04	MPSCC (Motor Phase Short Circuit Contactor) Release Delay Time between Drive and Motor	0.010–65.000 sec.	0.200	○	○	○	○
✓	03-05	MPSCC (Motor Phase Short Circuit Contactor) Contracting Delay Time between Drive and Motor	0.010–65.000 sec.	0.200	○	○	○	○
✓	03-06	DC Brake Activation Time	0.0–60.0 sec.	0.7	○	○	○	○
✓	03-07	DC Brake Stopping Time	0.0–60.0 sec.	0.7	○	○	○	○
	03-10	Mechanical Inertia Estimation Reference Value	Read only	Read only			○	○
✓	03-11	Mechanical Inertial Ratio	1–300%	40 / 20			○	○
✓	03-12	Zero Speed Bandwidth	1–40 Hz	10			○	○
✓	03-13	Low Speed Bandwidth	1–40 Hz	10			○	○
✓	03-14	High Speed Bandwidth	1–40 Hz	10			○	○
✓	03-15	Zero Speed Parking Bandwidth	1–40 Hz	10			○	○
✓	03-16	ASR (Auto Speed Regulation) Control (P) of Zero Speed	0.0–1000.0%	100.0	○	○	○	○
✓	03-17	ASR (Auto Speed Regulation) Control (I) of Zero Speed	0.000–10.000 sec.	0.100	○	○	○	○
✓	03-18	ASR (Auto Speed Regulation) Control (P) 1	0.0–1000.0%	100.0	○	○	○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
03-19	ASR (Auto Speed Regulation) Control (I) 1	0.000–10.000 sec.	0.100	○	○	○	○
03-20	ASR (Auto Speed Regulation) Control (P) 2	0.0–1000.0%	100.0	○	○	○	○
03-21	ASR (Auto Speed Regulation) Control (I) 2	0.000–10.000 sec.	0.100	○	○	○	○
03-22	Elevator Leveling (Zero Speed Gain P)	0.0–1000.0%	100.0	○	○	○	○
03-23	Elevator Leveling (Zero Speed Integral I)	0.000–10.000 sec.	0.100	○	○	○	○
03-24	ASR Primary Low Pass Filter Gain	0.001–0.350 sec.	0.008			○	○
03-30	Zero Speed Position Control (PPI) Gain (P)	0.00–655.00%	10.00				○
03-31	Zero Speed Position Control (PPI) Holding Time	0.000–65.535 sec.	0.250				○
03-32	Zero Speed Position Control (PPI) Low Pass Filter Time	0.000–65.535 sec.	0.004				○
03-33	Zero Speed Position Control (PPI) Activation Mode Selection	0: After the brake release set in Pr.03-00 1: After the brake signal input (Pr.01-00–Pr.01-07 is set to 42)	0				○
03-34	Elevator Starting (Zero Speed Gain P)	0.0–1000.0%	100.0	○	○	○	○
03-35	Elevator Starting (Zero Speed Integral I)	0.000–10.000 sec.	0.100	○	○	○	○
03-50	Maximum Output Frequency	5.00–400.00 Hz	60.00 / 50.00	○	○	○	○
03-51	Second Output Frequency Setting	0.00–400.00 Hz	0.50	○	○		
03-52	Second Output Voltage Setting	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	5.0 / 10.0	○	○		
03-53	Third Output Frequency Setting	0.00–400.00 Hz	0.50	○	○		
03-54	Third Output Voltage Setting	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	5.0 / 10.0	○	○		
03-55	Fourth Output Frequency Setting	0.00–400.00 Hz	0.00	○	○	○	

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
✔	03-56	Fourth Output Voltage Setting	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	5.0 / 10.0	○	○		
	03-57	Mode Selection when Frequency < Fmin	0: Output Waiting 1: Zero-speed operation 2: Fmin (Fourth output frequency setting)	1	○	○	○	○
✔	03-60	DC Brake Current Level at Start-up	0–100% of the rated current of the motor drive	0	○	○		
✔	03-61	DC Brake Current Level at Stop	0–100% of the rated current of the motor drive	0	○	○		
✔	03-62	Start-point for DC Brake	0.00–400.00 Hz	0.00	○	○	○	
✔	03-63	DC Brake Proportional Gain	1–500	50	○	○		
✔	03-70	Regenerative Slip Compensation Ratio %	0.0–100.0%	1.0	○			
✔	03-71	Slip Compensation Switch Gap %	0.0–100.0%	5.0	○			
✔	03-73	Torque Compensation Gain	0.00–100.00	0.00	○	○		
✔	03-74	Torque Compensation Low Pass Filter Time	0.001–10.000 sec.	0.020	○	○		
✔	03-75	Slip Compensation Gain	0.00–10.00	0	○	○		
✔	03-76	Slip Compensation Low Pass Filter Time	0.001–10.000 sec.	0.500	○	○		
✔	03-80	Hunting Gain	0.00–10.00 0: Disable	2.50	○	○		
✔	03-83	PDFF Gain Value	0–200%	30			○	○
✔	03-84	Speed Feed Forward Gain	0–500	0			○	
	03-90	System Control	bit 0 = 0: No function bit 0 = 1: ASR auto-tuning; PDFF enabled bit 7 = 0: No function bit 7 = 1: Zero speed position control is enabled bit 9 = 0: Dynamic PG origin auto-tuning with load (supported by PGHH-1, PGSED-x) bit 9 = 1: Static PG origin auto-tuning with load by enabling	281h			○	○

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
			PGHH-1, PGSED-x bit 15 = 0: When power is applied, detect the position of the magnetic pole again bit 15 = 1: When power is applied, start from the magnetic pole position of the previous power failure					
⌿	03-91	ASR 1/ASR2 Switch Frequency	0.00–400.00 Hz 0: Disable	7.00			○	○
⌿	03-92	Low Speed ASR Width Adjustment	0.00–400.00 Hz	5.00			○	○
⌿	03-93	High Speed ASR Width Adjustment	0.00–400.00 Hz	5.00			○	○
⌿	03-94	ASR Feed Forward	10–150	65			○	○
⌿	03-95	Core Loss Compensation	0–250%	10		○		

04 Protection Parameters

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
〆	04-01	Fault and Warning Action	bit 0 = 0: Display Lv fault and coast to stop bit 0 = 1: Display Lv warn and coast to stop bit 2 = 0: Software GFF protection enabled bit 2 = 1: Software GFF protection disabled	0000h	○	○	○	○
〆	04-02	Number of Times to Retry after Fault	0–10 times	0	○	○	○	○
〆	04-03	Time Interval between Retries	0.5–600.0 sec.	10.0	○	○	○	○
〆	04-04	Output of MO Terminal when Retrying after Fault	0: Output 1: No output	0	○	○	○	○
〆	04-10	STO Function Selection	0: STO fault latched, resending RUN command is required 1: STO warning latched, resending RUN command is required 2: STO fault latched 3: STO warning unlatched 4: Elevator Stop timing, does not detect STO sticking 5: Elevator Stop timing, Stoc warning occurs when STO sticks 6: Elevator Stop timing, StoS fault occurs when STO sticks (fault can be cleared manually) 7: Elevator Stop timing, StL4 fault occurs when STO sticks (fault cannot be cleared and must be powered-on again)	4	○	○	○	○
〆	04-11	Mechanical Brake Detection Time	0.00–10.00 sec.	1.00	○	○	○	○
〆	04-12	Magnetic Contactor Detection Time	0.00–10.00 sec.	0.00	○	○	○	○
	04-13	STO Timing Activation	0: Triggers fault if an error occurs on timing activation	0	○	○	○	○

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
			1: Triggers warning if an error occurs on timing activation (valid only when using two-wire operation control)					
✎	04-14	STO Sticking Detection Time	0.0–10.0 sec.	2.0	○	○	○	○
✎	04-15	MBF Reset	0: MbF can be reset 1: MbF cannot be reset 2: MbF can be reset, and automatically set to 1 after reset	0	○	○	○	○
✎	04-20	Over-slip Action	0: Warn and keep operation 1: Warn and ramp to stop 2: Warn and coast to stop	0		○	○	
✎	04-21	Slip Deviation Level	0.0–100.0% 0: Disable	0.0		○	○	
✎	04-22	Slip Deviation Detection Time	0.0–10.0 sec.	1.0		○	○	
✎	04-30	Low Voltage Level	230V models: 160.0–220.0 V 460V models: 320.0–440.0 V	180.0 / 360.0	○	○	○	○
✎	04-31	Input Phase-loss Protection during Operation	0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and coast to stop	2	○	○	○	○
	04-32	Phase Loss Detection of Drive Output at Start-up (MPHL)	0: Disable 1: Enable	0	○	○	○	○
	04-33	MPHL Speed Level	0.00–15.00 Hz	10.00	○	○	○	○
	04-34	MPHL Current Level	0.00–10.00% (of rated current)	5.50	○	○	○	○
	04-35	MPHL Count Time	10.0–1000.0	30.0	○	○	○	○
	04-37	Over Ripple Protection	0: Disable 1: Enable	1	○	○	○	○
✎	04-40	Over-torque Detection (OT1)	0: Over-torque detection disabled 1: Over-torque detection during constant speed operation, continue to operate after detection 2: Over-torque detection during constant speed operation, stop operating after detection 3: Over-torque detection during operation, continue to operate after detection	0	○	○	○	○

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
			4: Over-torque detection during operation, stop operating after detection					
✎	04-41	Over-torque Detection Level (OT1)	10–250% (rated current of the motor drive)	150	○	○	○	○
✎	04-42	Over-torque Detection Time (OT1)	0.1–60.0 sec.	0.1	○	○	○	○
✎	04-47	PTC 1 (Positive Temperature Coefficient) Detection Action	0: Warn and keep operation 1: Fault and ramp to stop	0	○	○	○	○
✎	04-48	PTC 1 Level	0.0–100.0%	50.0	○	○	○	○
✎	04-49	PTC 1 Detection Filter Time	0.00–10.00 sec.	0.20	○	○	○	○
✎	04-50	PTC 2 (Positive Temperature Coefficient) Detection Action	0: Warn and keep operation 1: Fault and ramp to stop	0	○	○	○	○
✎	04-51	PTC 2 Level	0.0–100.0%	50.0	○	○	○	○
✎	04-52	PTC 2 Detection Filter Time	0.00–10.00 sec.	0.20	○	○	○	○
	04-53	Electronic Thermal Relay	0: Standard motor (motor with fan on the shaft) 1: Inverter motor (with external forced cooling) 2: Disabled	2	○	○	○	○
✎	04-54	Electronic Thermal Characteristic	30.0–600.0 sec.	60.0	○	○	○	○
✎	04-55	IGBT Overheat Warning (oH1)	0.0–110.0°C	varies with drive identity code	○	○	○	○
✎	04-60	COM Transmission Fault Treatment	0: Warn and keep operation 1: Fault and ramp to stop 2: Reserved 3: No action and no display	3	○	○	○	○
✎	04-61	Time-out Detection	0.0–100.0 sec. 0.0: Disable	0.0	○	○	○	○
✎	04-62	Communication (RJ45) Fault Treatment	0: Warn and keep operation 1: Fault and ramp to stop	3	○	○	○	○

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
			2: Reserved 3: No action and no display					
✓	04-63	Communication (RJ45) Time-out	0.0–100.0	0.0	○	○	○	○
✓	04-64	Communication (RJ45) Delay Time	0.0–200.0	2.0	○	○	○	○
✓	04-70	Encoder Feedback Signal Fault Action (PGF1, PGF2)	0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and stop operation	2			○	○
✓	04-71	Encoder Feedback Signal Fault Detection Time	0.0–10.0 sec.	1.0			○	○
✓	04-72	Encoder Stall and Slip Error Action (PGF3, PGF4) (maximum output frequency Pr.03-50 = 100%)	0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and stop operation	2		○	○	○
✓	04-73	Encoder Stall Level (PGF3)	0–120% 0: Disable	115		○	○	○
✓	04-74	Encoder Stall Detection Time (maximum output frequency Pr.03-50 = 100%)	0.0–2.0 sec.	0.1		○	○	○
✓	04-75	Encoder Slip Range (PGF4) (maximum output frequency Pr.03-50 = 100%)	0–50% 0: Disable	50		○	○	○
✓	04-76	Encoder Slip Detection Time (maximum output frequency Pr.03-50=100%)	0.0–10.0 sec.	0.5		○	○	○
✓	04-80	Brake Resistor Detection during Operation	0: Does not detect brake resistor 1: Detects brake resistor	0	○	○	○	○
✓	04-81	Brake Over-current Percentage	100–155%	140	○	○	○	○
✓	04-82	Pulse Time	300–600	300	○	○	○	○
✓	04-83	Brake Resistor	0.0–6553.5 ohm	0.0	○	○	○	○
	04-90	Over-acceleration Detection Selection	0: Always detect 1: Detect during operation	0	○	○	○	○

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
〆	04-91	Over-acceleration Level	0.0–20.0 m/s^2	0.0	○	○	○	○
	04-92	Over-acceleration Detection Time	0.01–5.00 sec.	0.05	○	○	○	○

05 Advanced Setting Parameters

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
05-00	CANopen Protocol	0: Disable CANopen 1: Enable CANopen and use CIA417(CANLift) protocol 2: Reserved 3: DCP3 4: DCP4	0	○	○	○	○
05-01	CANopen Slave Address	0–65535	0	○	○	○	○
05-02	CANopen Communication Status	0: Not ready for use state 1: Inhibit start state 2: Ready to switch on state 3: Switched on state 4: Enable operation state 7: Quick stop active state 13: Error reaction activation state 14: Error state	Read only	○	○	○	○
05-03	CANopen Drive Status	0: Node reset state 1: Com reset state 2: Boot up state 3: Pre-operation state 4: Operation state 5: Stop state	Read only	○	○	○	○
05-04	CAN Warning Record	bit0: CANopen guarding time out bit1: CANopen heartbeat time out bit2: CANopen SYNC time out bit3: CANopen SDO time out bit4: CANopen SDO buffer overflow bit5: CAN bus off bit6: Error protocol of CANopen bit8: The setting values of CANopen indexes are failed bit9: The setting value of CANopen address is failed bit10: The checksum value of CANopen indexes is failed	Read only	○	○	○	○
05-05	CAN PDO Disconnection Time	0–10000 ms	0	○	○	○	○
05-15	Maximum Target Position	0.00–655.35 m	300.00	○	○	○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
05-16	Minimum Target Position	0.00–655.35 m	0.00	○	○	○	○
05-17	Position Unit (Pulse)	0–65535	10000	○	○	○	○
05-18	Position Unit (mm)	0–65535	4473	○	○	○	○
05-19	Velocity Window Range	0–1000 mm/s	10	○	○	○	○
05-20	Velocity Window Time	0–1000 m/s	100	○	○	○	○
05-21	Velocity Threshold Range	0–1000 mm/s	10	○	○	○	○
05-22	Velocity Threshold Time	0–1000 m/s	100	○	○	○	○
05-29	Safety Gear Speed Level	0–100% (drive's rated frequency)	50	○	○	○	○
05-30	Safety Gear Release Enabled	0: Disabled 1: Enabled	0	○	○	○	○
05-31	Safety Gear Time	0.0–10.0 sec.	5.0	○	○	○	○
05-32	Safety Gear Pulse Low Time	0.0–2.0 sec.	0.2	○	○	○	○
05-33	Safety Gear Pulse High Time	0.0–2.0 sec.	0.5	○	○	○	○
05-34	Safety Gear Pulse Current Level	0–250% (drive's rated current)	180	○	○	○	○
05-35	Speed Upper Limit of Rescue by Mechanical Brake Control	0–500 mm/s	100			○	○
05-36	Speed Lower Limit of Rescue by Mechanical Brake Control	0–20 mm/s	10			○	○
05-37	Minimum Speed Detection Time of Rescue by Mechanical Brake Control	0.0–10.0 sec.	0.5			○	○
05-38	Re-release Waiting Time of Rescue by Mechanical Brake Control	0.0–10.0 sec.	0.0			○	○
05-39	Maximum Release Time of Rescue by Mechanical Brake Control	0.0–20.0 sec.	5.0			○	○

06 Customized Parameters

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
06-01 – 06-99	Customized Parameters	Contact Delta for more information	0	○	○	○	○

07 System Parameters

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
07-00	AC Motor Drive Identity Code	306: 220V, 2.2 kW, 3 HP (Single-phase) 307: 220V, 3.7 kW, 5 HP (Single-phase) 407: 460V, 4.0 kW, 5 HP 408: 460V, 5.5 kW, 7.5 HP 409: 460V, 7.5 kW, 10 HP 410: 460V, 11 kW, 15 HP 411: 460V, 15 kW, 20 HP 412: 460V, 18.5 kW, 25 HP	Read only	○	○	○	○
07-01	AC Motor Drive Rated Current Display	Read only	Read only	○	○	○	○
07-02	Software Version	Read only	Read only	○	○	○	○
07-03	Date Code Y.WKD	Read only	Read only	○	○	○	○
07-04	Extension Card Firmware Version	Read only	Read only	○	○	○	○
07-05	Power Board Firmware Version	Read only	Read only	○	○	○	○
07-06	Power Board Default ID High Byte	Read only	Read only	○	○	○	○
07-07	Power Board Default ID Medium Byte	Read only	Read only	○	○	○	○
07-08	Power Board Default ID Low Byte	Read only	Read only	○	○	○	○
07-09	Power Board Current ID High Byte	Read only	Read only	○	○	○	○
07-10	Power Board Current ID Medium Byte	Read only	Read only	○	○	○	○
07-11	Power Board Current ID Low Byte	Read only	Read only	○	○	○	○
07-12	SD Card Formatting	0–1	0	○	○	○	○
07-13	Formatting Progress	Read only	Read only	○	○	○	○
07-20	Password Input	1–9998, 10000–65535 0–2 (number of wrong password attempts)	0	○	○	○	○

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
	07-21	Password Set	1–9998, 10000–65535 0: No password set or successful input in Pr.07-20 1: Password has been set	0	○	○	○	○
	07-22	Times of Drive Service	Read only	Read only	○	○	○	○
	07-23	Drive Service Setting	0: Disable 1: Enable	Read only	○	○	○	○
✓	07-30	Carrier Frequency	2–15 kHz	12	○	○	○	○
✓	07-31	PWM Mode (Pulse-Width Modulation Mode)	0: DPWM (Discontinuous Pulse Width Modulation) mode 1: SVPWM (Space-Vector Pulse Width Modulation) mode	0	○	○	○	○
✓	07-32	Time for Decreasing Torque at Stop	0.000–5.000 sec.	0.000			○	○
✓	07-33	Cooling Fan Control	0: Cooling fan is always ON. 1: One minute after AC motor drive stops, cooling fan is OFF. 2: AC motor drive runs and cooling fan is ON; AC motor drive stops and cooling fan is OFF. 3: Cooling fan is ON to run when preliminary IGBT temperature (°C) reached. 4: Cooling fan is always OFF.	2	○	○	○	○
✓	07-36	Notch Filter Depth	0–20 dB	0			○	○
✓	07-37	Notch Filter Frequency	0.00–200.00 Hz	0.00			○	○
✓	07-40	Start-up Display	0: Display the Frequency command value (LED F) 1: Display the actual output frequency (LED H) 2: DC bus voltage (V) 3: Display the output current (A) 4: Output voltage (E) 5: User-defined (see Pr.07-41)	0	○	○	○	○
✓	07-41	Content of Multi-function Display	0: Display the output current supplied to the motor from the drive (A) (Unit: Amp) 1: Reserved	0	○	○	○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
		2: Display the drive's actual output frequency (H) (Unit: Hz) 3: Display the drive's DC bus voltage (v) (Unit: VDC) 4: Display the terminals U, V, and W output voltage of the drive (E) (Unit: VAC) 5: Display the terminals U, V, and W output power factor angle to the motor (n) (Unit: deg) 6: Display the terminals U, V, and W output power to the motor (P) (Unit: kW) 7: Display the actual motor speed in rpm (r) (Unit: rpm) 8: Display the drive's estimated output torque in %; the motor's rated torque is 100% (t) (Unit: %) 9: Display the PG feedback (G) (See Pr.00-20 and Pr.00-21) 10: Display the electrical angle of drive output (d) (Unit: deg) 11: Display the AUI1 analog input terminal signal (1.) (Unit: %) 12: Display ACI1 (Unit: %) 13: Display the AUI2 analog input terminal signal (Unit: %) 14: Reserved 15: Display the IGBT temperature (T) (Unit: °C) 16: Display digital input status ON/OFF (i) 17: Display digital output status ON/OFF (o) 18: Display the step speed of multi-step speed that is executing (S) 19: The corresponding CPU digital input pin status (i.) 20: The corresponding CPU digital					

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
			output pin status (o.) 21–23: Reserved 24: Output AC voltage when malfunction occurred (E) (Unit: V_{AC}) 25: Output DC voltage when malfunction occurred (v) (Unit: V_{DC}) 26: Motor frequency when malfunction occurred (H) (Unit: Hz) 27: Output current when malfunction occurred (A) (Unit: Amp) 28: Output frequency when malfunction occurred (F) (Unit: Hz) 29: Frequency command when malfunction occurred (F) (Unit: Hz) 30: Output power when malfunction occurred (P) (Unit: kW) 31: Output torque when malfunction occurred (t) (Unit: %) 32: Input terminal status when malfunction occurred (i) 33: Output terminal status when malfunction occurred (o) 34: Reserved 35: 24-hour detection for STO status 36: Reserved 37: Reserved 38: Reserved					
⚡	07-50	Automatic Voltage Regulation (AVR) Function	0: Enable AVR 1: Disable AVR 2: Disable AVR when decelerating to stop	0	○	○	○	○
⚡	07-51	Brake Transistor Level	230V models: 350.0–450.0 V_{DC} 460V models: 700.0–900.0 V_{DC}	380.0 / 760.0	○	○	○	○
⚡	07-52	Brake Transistor Hysteresis Voltage	0.0–100.0	0.0	○	○	○	○
⚡	07-53	Current Limit	0–250% (rated current of the motor drive)	200			○	○
⚡	07-54	Forward Motor Torque Limit	0–300% (rated torque of the motor drive)	200			○	○

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
✎	07-55	Forward Regenerative Torque Limit	0–300% (rated torque of the motor drive)	200			○	○
✎	07-56	Reverse Motor Torque Limit	0–300% (rated torque of the motor drive)	200			○	○
✎	07-57	Reverse Regenerative Torque Limit	0–300% (rated torque of the motor drive)	200			○	○

09 Communication Parameters

	Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
⌿	09-00	Communication Address	1–254	1	○	○	○	○
⌿	09-01	Transmission Speed	4.8–115.2 Kbps	19.2	○	○	○	○
⌿	09-02	Communication Protocol	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	13	○	○	○	○
⌿	09-03	Response Delay Time	0.0–200.0 ms	2.0	○	○	○	○
	09-11	CAN Baud Rate	0: 1M 1: 500k 2: 250k 3: 125k	1	○	○	○	○
	09-04 – 09-99	Direct Docking Mode Only	Contact Delta for more information	-	○	○	○	○

10 DLC Parameters

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
10-00 – 10-99	Direct Docking Mode Only	Contact Delta for more information	Read only	○	○	○	○

11 Monitoring Function Parameters

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
11-20	Accumulated Motor Operation Time (Min.)	Read only	Read only	○	○	○	○
11-21	Accumulated Motor Operation Time (Day)	Read only	Read only	○	○	○	○
11-22	Accumulated Motor Power-on Time (Min.)	Read only	Read only	○	○	○	○
11-23	Accumulated Motor Power-on Time (Day)	Read only	Read only	○	○	○	○
11-24	Present Fault Record	0: No fault record 1: Over-current during acceleration (ocA) 2: Over-current during deceleration (ocd) 3: Over-current during constant speed (ocn) 4: Ground fault (GFF) 5: IGBT short-circuit (occ) 6: Over-current at stop (ocS) 7: Over-voltage during acceleration (ovA) 8: Over-voltage during deceleration (ovd) 9: Over-voltage during constant speed (ovn) 10: Over-voltage at stop (ovS) 11: Low voltage during acceleration (LvA) 12: Low voltage during deceleration (Lvd) 13: Low voltage during constant speed (Lvn) 14: Low voltage at stop (LvS) 15: Phase loss (PHL) 16: IGBT overheating fault (oH1) 18: IGBT temperature detection failure (tH1o) 21: Overload (oL) 22: Electronic thermal relay 1 protection (EoL1) 24: Motor over-heating PTC 2 (oH3_2) 26: Over-torque 1 (ot1) 30: FRAM writing error (cF1) 31: FRAM read error (cF2) 32: Current detection error (cd0) 33: U-phase error (cd1)	Read only	○	○	○	○
11-25	Second Most Recent Fault Record		Read only	○	○	○	○
11-26	Third Most Recent Fault Record		Read only	○	○	○	○
11-27	Fourth Most Recent Fault Record		Read only	○	○	○	○
11-28	Fifth Most Recent Fault Record		Read only	○	○	○	○
11-29	Sixth Most Recent Fault Record		Read only	○	○	○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
		34: V-phase error (cd2) 35: W-phase error (cd3) 36: cc hardware failure (Hd0) 37: oc hardware failure (Hd1) 38: ov hardware failure (Hd2) 39: GFF hardware failure (Hd3) 40: Auto-tuning error (AUE) 42: Opposite PG feedback direction (PGF1) 43: PG feedback loss (PGF2) 44: PG feedback stall (PGF3) 45: PG slip error (PGF4) 49: External fault (EF) 50: Emergency stop (EF1) 52: Password is locked (Pcod) 54: Communication error 1 (CE01) 55: Communication error 2 (CE02) 56: Communication error 3 (CE03) 57: Communication error 4 (CE04) 58: Communication error 10 (CE10) 59: Digital keypad transmission time-out (CP10) 60: Brake transistor error (bF) 64: Mechanical brake feedback error (MbF) 65: PGSED communication error (PGF5) 66: Magnetic contactor error (MCF) 67: Motor phase loss (MPHL) 68: CAN Bus off (CAnF) 69: Rescue by mechanical brake control error (rbrE) 70: Safety gear release error (SFGE) 72: STO loss 1 (StL1) 73: PG cd wiring error (PGcd) 74: PG absolute signal error (PGHL) 75: PG Z-phase signal loss (PGAF) 76: Safe Torque Off function is enabled (Stoo) 77: STO loss 2 (StL2) 78: STO loss 3 (StL3) 81: Contact service (SERV)					

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
		85: Hardware brake over-current (Hocb) 86: Software brake over-current (Socb) 87: Brake resistor configuration error (brF) 88: Brake resistor is not connected (bro) 89: IGBT overload (oL3) 90: STO loss 4 (StL4) 91: STO loss 5 (StL5) 93: CANLift disconnection (CndL) 95: CANLift error (CnLF) 96: STO disconnection (Stod) 97: STO at running (Stor) 98: STO circuit sticking fault (StoS) 99: Ignore STO is ON (iSto) 100: Over Ripple Protection (orP) 105: Motor over-heating PTC 1 (oH3_1)					
11-30	Accumulated Drive Power-on Time at the First Fault (Min.)	Read only	Read only	○	○	○	
11-32	Accumulated Drive Power-on Time at the Second Fault (Min.)	Read only	Read only	○	○	○	
11-34	Accumulated Drive Power-on Time at the Third Fault (Min.)	Read only	Read only	○	○	○	
11-36	Accumulated Drive Power-on Time at the Fourth Fault (Min.)	Read only	Read only	○	○	○	
11-38	Accumulated Drive Power-on Time at the Fifth Fault (Min.)	Read only	Read only	○	○	○	
11-40	Accumulated Drive Power-on Time at the Sixth Fault (Min.)	Read only	Read only	○	○	○	
11-31	Accumulated Drive Power-on Time at the First Fault (Day)	Read only	Read only	○	○	○	
11-33	Accumulated Drive Power-on Time at the Second Fault (Day)	Read only	Read only	○	○	○	

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
11-35	Accumulated Drive Power-on Time at the Third Fault (Day)	Read only	Read only	○	○	○	
11-37	Accumulated Drive Power-on Time at the Fourth Fault (Day)	Read only	Read only	○	○	○	
11-39	Accumulated Drive Power-on Time at the Fifth Fault (Day)	Read only	Read only	○	○	○	
11-41	Accumulated Drive Power-on Time at the Sixth Fault (Day)	Read only	Read only	○	○	○	
11-42	Frequency Command when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○
11-43	Output Frequency when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○
11-44	Output Current when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○
11-45	Motor Frequency when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○
11-46	Output Voltage when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○
11-47	DC Bus Voltage when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○
11-48	Output Power when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○
11-49	Output Torque when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
11-50	IGBT Temperature when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○
11-51	Multi-input Terminals Status when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○
11-52	Multi-output Terminals Status when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○
11-53	Motor Drive Status when the Most Recent Fault Occurred	Read only	Read only	○	○	○	○
11-54	Output Frequency when Fault 2 Occurred	Read only	Read only	○	○	○	○
11-55	DC Bus Voltage when Fault 2 Occurred	Read only	Read only	○	○	○	○
11-56	Output Current when Fault 2 Occurred	Read only	Read only	○	○	○	○
11-57	IGBT Temperature when Fault 2 Occurred	Read only	Read only	○	○	○	○
11-58	Output Frequency when Fault 3 Occurred	Read only	Read only	○	○	○	○
11-59	DC Bus Voltage when Fault 3 Occurred	Read only	Read only	○	○	○	○
11-60	Output Current when Fault 3 Occurred	Read only	Read only	○	○	○	○
11-61	IGBT Temperature when Fault 3 Occurred	Read only	Read only	○	○	○	○
11-62	Output Frequency when Fault 4 Occurred	Read only	Read only	○	○	○	○

Pr.	Parameter Name	Setting Range	Default	VF	SVC	FOCPG	FOCPM
11-63	DC Bus Voltage when Fault 4 Occurred	Read only	Read only	○	○	○	○
11-64	Output Current when Fault 4 Occurred	Read only	Read only	○	○	○	○
11-65	IGBT Temperature when Fault 4 Occurred	Read only	Read only	○	○	○	○
11-66	Output Frequency when Fault 5 Occurred	Read only	Read only	○	○	○	○
11-67	DC Bus Voltage when Fault 5 Occurred	Read only	Read only	○	○	○	○
11-68	Output Current when Fault 5 Occurred	Read only	Read only	○	○	○	○
11-69	IGBT Temperature when Fault 5 Occurred	Read only	Read only	○	○	○	○
11-70	Output Frequency when Fault 6 Occurred	Read only	Read only	○	○	○	○
11-71	DC Bus Voltage when Fault 6 Occurred	Read only	Read only	○	○	○	○
11-72	Output Current when Fault 6 Occurred	Read only	Read only	○	○	○	○
11-73	IGBT Temperature when Fault 6 Occurred	Read only	Read only	○	○	○	○
11-74	MBF Recorder	Read only	Read only	○	○	○	○
11-75	EoL Cnt Recorder H	Read only	Read only	○	○	○	○
11-76	EoL Cnt Recorder L	Read only	Read only	○	○	○	○
11-79	STO 24-hour Counter	Read only	Read only	○	○	○	○

12 Access Favorite

Pr.	Parameter Name	Setting Range	Default
12-00	User-defined Parameter 1	0–1599	700
12-01	User-defined Parameter 2	0–1599	702
12-02	User-defined Parameter 3	0–1599	703
12-03	User-defined Parameter 4	0–1599	1124
12-04	User-defined Parameter 5	0–1599	1125
12-05	User-defined Parameter 6	0–1599	1126
12-06	User-defined Parameter 7	0–1599	1127
12-07	User-defined Parameter 8	0–1599	1128
12-08	User-defined Parameter 9	0–1599	1129
12-09	User-defined Parameter 10	0–1599	1
12-10	User-defined Parameter 11	0–1599	2
12-11	User-defined Parameter 12	0–1599	3
12-12	User-defined Parameter 13	0–1599	10
12-13	User-defined Parameter 14	0–1599	11
12-14	User-defined Parameter 15	0–1599	12
12-15	User-defined Parameter 16	0–1599	13
12-16	User-defined Parameter 17	0–1599	14
12-17	User-defined Parameter 18	0–1599	15
12-18	User-defined Parameter 19	0–1599	20
12-19	User-defined Parameter 20	0–1599	21
12-20	User-defined Parameter 21	0–1599	22
12-21	User-defined Parameter 22	0–1599	23
12-22	User-defined Parameter 23	0–1599	40
12-23	User-defined Parameter 24	0–1599	42
12-24	User-defined Parameter 25	0–1599	50
12-25	User-defined Parameter 26	0–1599	51
12-26	User-defined Parameter 27	0–1599	52
12-27	User-defined Parameter 28	0–1599	53
12-28	User-defined Parameter 29	0–1599	71
12-29	User-defined Parameter 30	0–1599	72
12-30	User-defined Parameter 31	0–1599	82
12-31	User-defined Parameter 32	0–1599	90
12-32	User-defined Parameter 33	0–1599	91
12-33	User-defined Parameter 34	0–1599	92
12-34	User-defined Parameter 35	0–1599	93
12-35	User-defined Parameter 36	0–1599	95
12-36	User-defined Parameter 37	0–1599	100
12-37	User-defined Parameter 38	0–1599	101

	Pr.	Parameter Name	Setting Range	Default
✓	12-38	User-defined Parameter 39	0–1599	102
✓	12-39	User-defined Parameter 40	0–1599	103
✓	12-40	User-defined Parameter 41	0–1599	104
✓	12-41	User-defined Parameter 42	0–1599	105
✓	12-42	User-defined Parameter 43	0–1599	106
✓	12-43	User-defined Parameter 44	0–1599	107
✓	12-44	User-defined Parameter 45	0–1599	110
✓	12-45	User-defined Parameter 46	0–1599	111
✓	12-46	User-defined Parameter 47	0–1599	112
✓	12-47	User-defined Parameter 48	0–1599	113
✓	12-48	User-defined Parameter 49	0–1599	114
✓	12-49	User-defined Parameter 50	0–1599	115

13 Display Favorite

Pr.	Parameter Name	Setting Range	Default
13-00 – 13-49	View User-defined Parameters	-	-
13-00	AC Motor Drive Identity Code	0700 (Same as Pr.07-00)	-
13-01	Software Version	0702 (Same as Pr.07-02)	-
13-02	Date Code Y.WKD	0703 (Same as Pr.07-03)	-
13-03	Present Fault Record	1124 (Same as Pr.11-24)	-
13-04	Second Most Recent Fault Record	1125 (Same as Pr.11-25)	-
13-05	Third Most Recent Fault Record	1126 (Same as Pr.11-26)	-
13-06	Fourth Most Recent Fault Record	1127 (Same as Pr.11-27)	-
13-07	Fifth Most Recent Fault Record	1128 (Same as Pr.11-28)	-
13-08	Sixth Most Recent Fault Record	1129 (Same as Pr.11-29)	-
13-09	Control Mode	0001 (Same as Pr.00-01)	-
13-10	Master Frequency Command Source	0002 (Same as Pr.00-02)	-
13-11	Operation Command Source	0003 (Same as Pr.00-03)	-
13-12	Motor Rated Power	0010 (Same as Pr.00-10)	-
13-13	Motor Rated Voltage	0011 (Same as Pr.00-11)	-
13-14	Motor Rated Current	0012 (Same as Pr.00-12)	-
13-15	Motor Rated Frequency	0013 (Same as Pr.00-13)	-
13-16	Motor Rated Speed	0014 (Same as Pr.00-14)	-
13-17	Number of Motor Poles	0015 (Same as Pr.00-15)	-
13-18	Selection of Encoder	0020 (Same as Pr.00-20)	-
13-19	Encoder PPR	0021 (Same as Pr.00-21)	-
13-20	High Resolution SIN/COS and Communication Encoder	0022 (Same as Pr.00-22)	-
13-21	Encoder Input Type Setting	0023 (Same as Pr.00-23)	-
13-22	Elevator Speed	0040 (Same as Pr.00-40)	-
13-23	Traction Sheave Diameter	0042 (Same as Pr.00-42)	-
13-24	Zero Step Speed Frequency	0050 (Same as Pr.00-50)	-
13-25	1st Step Speed Frequency	0051 (Same as Pr.00-51)	-
13-26	2nd Step Speed Frequency	0052 (Same as Pr.00-52)	-
13-27	3rd Step Speed Frequency	0053 (Same as Pr.00-53)	-
13-28	Accel. Time of Set 1	0071 (Same as Pr.00-71)	-
13-29	Decel. Time of Set 1	0072 (Same as Pr.00-72)	-
13-30	Deceleration Time when Operating without RUN Command	0082 (Same as Pr.00-82)	-
13-31	S-curve for Acceleration Begin Time S1	0090 (Same as Pr.00-90)	-
13-32	S-curve for Acceleration Arrival Time S2	0091 (Same as Pr.00-91)	-

Pr.	Parameter Name	Setting Range	Default
13-33	S-curve for Deceleration Begin Time S3	0092 (Same as Pr.00-92)	-
13-34	S-curve for Deceleration Arrival Time S4	0093 (Same as Pr.00-93)	-
13-35	S-curve for Deceleration Arrival Time S5	0095 (Same as Pr.00-95)	-
13-36	Multi-function Input Command 1 (MI1)	0100 (Same as Pr.01-00)	-
13-37	Multi-function Input Command 2 (MI2)	0101 (Same as Pr.01-01)	-
13-38	Multi-function Input Command 3 (MI3)	0102 (Same as Pr.01-02)	-
13-39	Multi-function Input Command 4 (MI4)	0103 (Same as Pr.01-03)	-
13-40	Multi-function Input Command 5 (MI5)	0104 (Same as Pr.01-04)	-
13-41	Multi-function Input Command 6 (MI6)	0105 (Same as Pr.01-05)	-
13-42	Multi-function Input Command 7 (MI7)	0106 (Same as Pr.01-06)	-
13-43	Multi-function Input Command 8 (MI8) (Enable Drive terminal)	0107 (Same as Pr.01-07)	-
13-44	Multi-function Output 1: RA, RB, RC (Relay 1)	0110 (Same as Pr.01-10)	-
13-45	Multi-function Output 2: MRA, MRB, MRC (Relay 2)	0111 (Same as Pr.01-11)	-
13-46	Multi-function Output 3: R1A, R12C (Relay 3)	0112 (Same as Pr.01-12)	-
13-47	Multi-function Output 4: R2A, R12C (Relay 4)	0113 (Same as Pr.01-13)	-
13-48	Multi-function Output 5: MO1	0114 (Same as Pr.01-14)	-
13-49	Multi-function Output 6: MO2	0115 (Same as Pr.01-15)	-

Chapter 8 Descriptions of Parameter Settings

00 Basic Parameters

00 Basic Parameters

✓: You can set this parameter during operation.

Initialized Settings (Pr.00-00–00-05)

00-00 Parameter Reset

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: No Function
1: Read Only
5: Direct docking mode only, contact Delta for more information.
8: Keypad Locked
9: Reset all parameters to defaults (50 Hz)
10: Reset all parameters to defaults (60 Hz)

- 1: Set all parameters to read-only except Pr.07-00–Pr.07-20, and you can use this setting with the password setting for password protection.
- 9 or 10: Reset all parameters to the default. If the keypad is locked by a password, enter the password to reset to the default. The password is also erased.
- 8: Lock the keypad and only Pr.00-00 and Pr.07-20 can be changed.

00-01 Control Mode

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

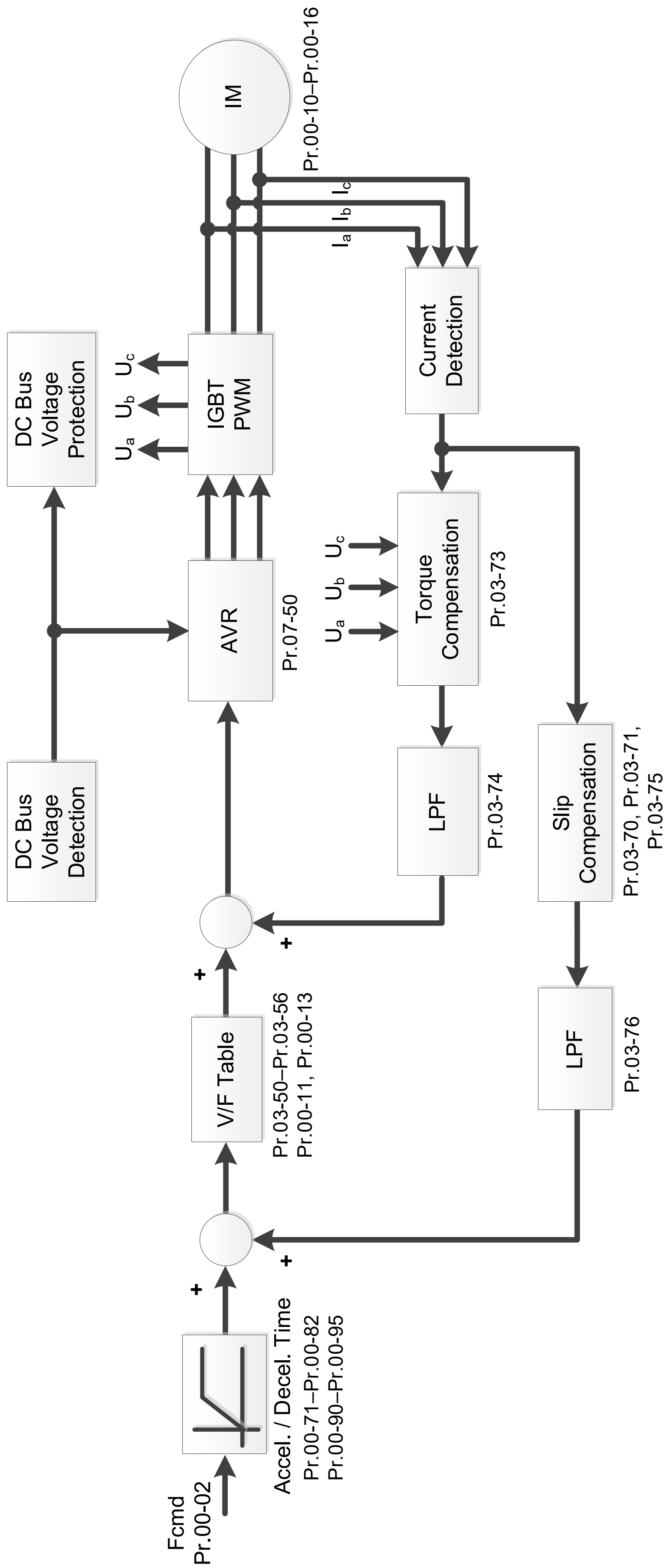
Settings 0: V/F control (V/F)
1: Sensorless Vector Control (SVC)
2: FOC vector control + Encoder (FOCPG)
3: FOC Permanent Motor control (FOCPM)

- Mode selection

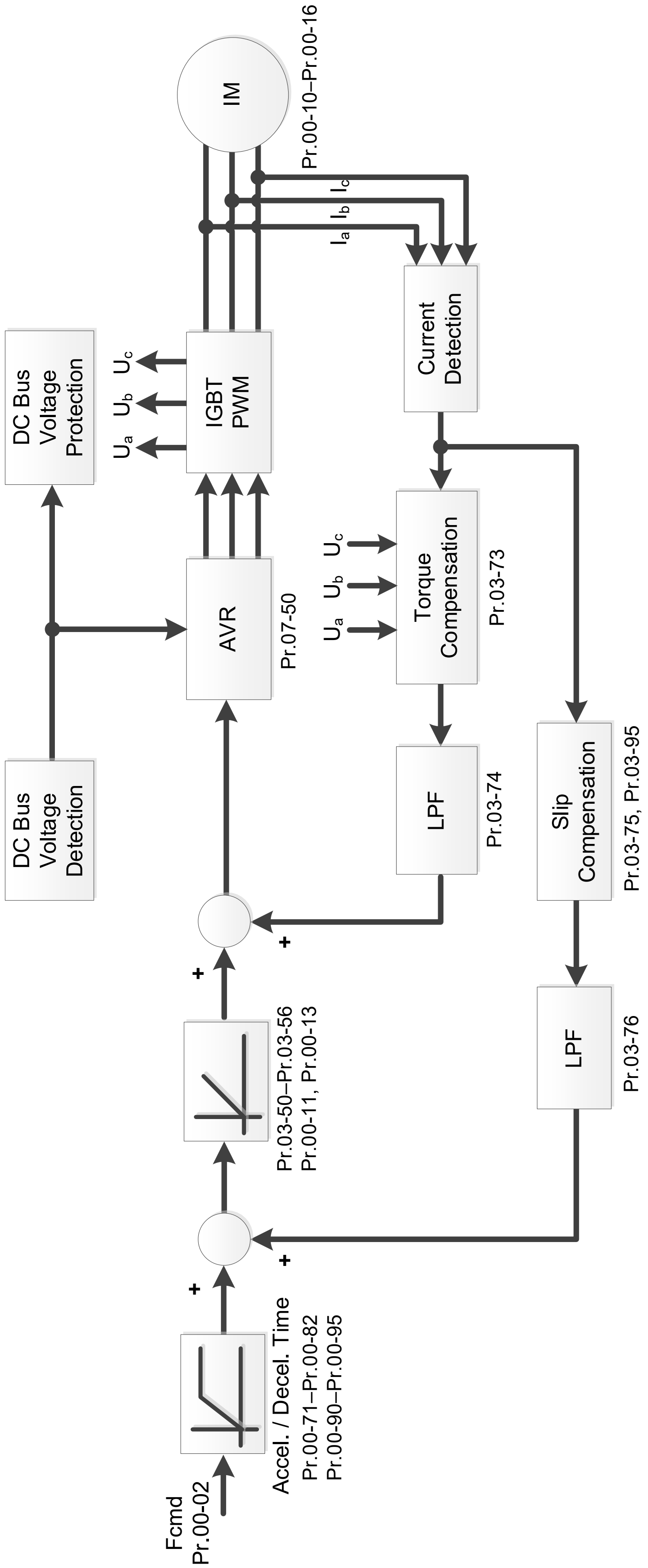
Settings	Control Mode	Applicable Motor Type	Speed Feedback	Energy-savings	Tuning Difficulty	Ride Comfort	Speed Control Range	Motor Parameter Tuning	Basic Control	Speed Control
0	V/F	IM		Low	Low	Normal	1:50		V/F control	Voltage control
1	SVC	IM		Medium	Medium	Normal	1:50	√	Voltage control	Voltage control
2	FOCPG	IM	√	High	High	Good	1:1000	√	Vector control	Frequency control
3	FOCPM	PM	√	High	High	Good	1:1000	√	Vector control	Frequency control

- Determines the AC motor drive control method.
  0: You can set the V/F ratio as required and control multiple motors simultaneously.
  1: Use auto-tuning for optimal settings of the control parameters.
  2: To increase torque and the accuracy of the speed control (1:1000).
  3: To increase torque and the accuracy of the speed control (1:1000). This setting is for use only with permanent magnet motors. The other settings are for use with induction motors.

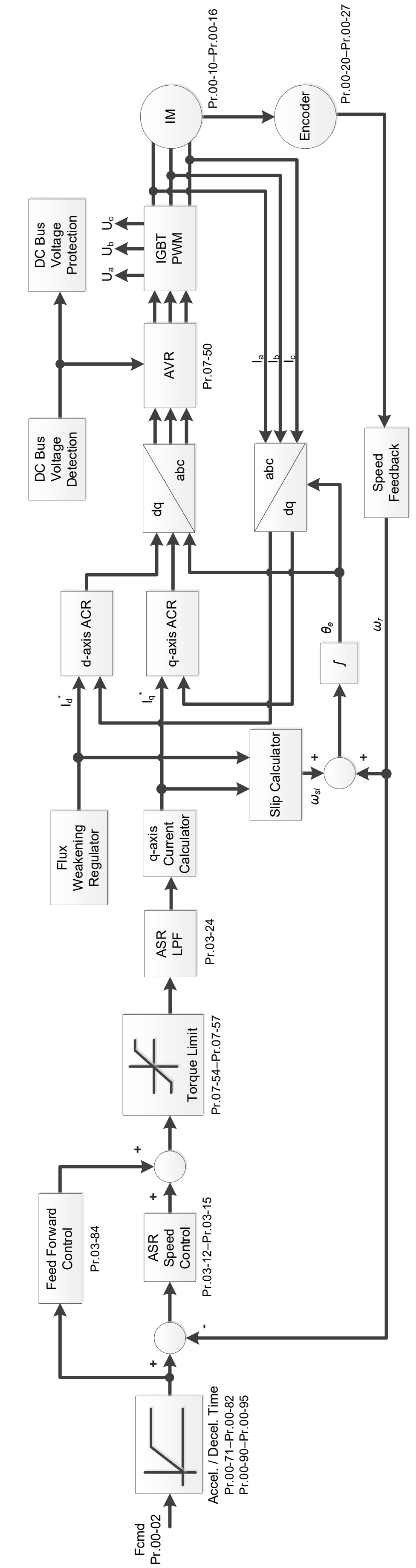
📖 When Pr.00-01=0, V/F control diagram is as follows:



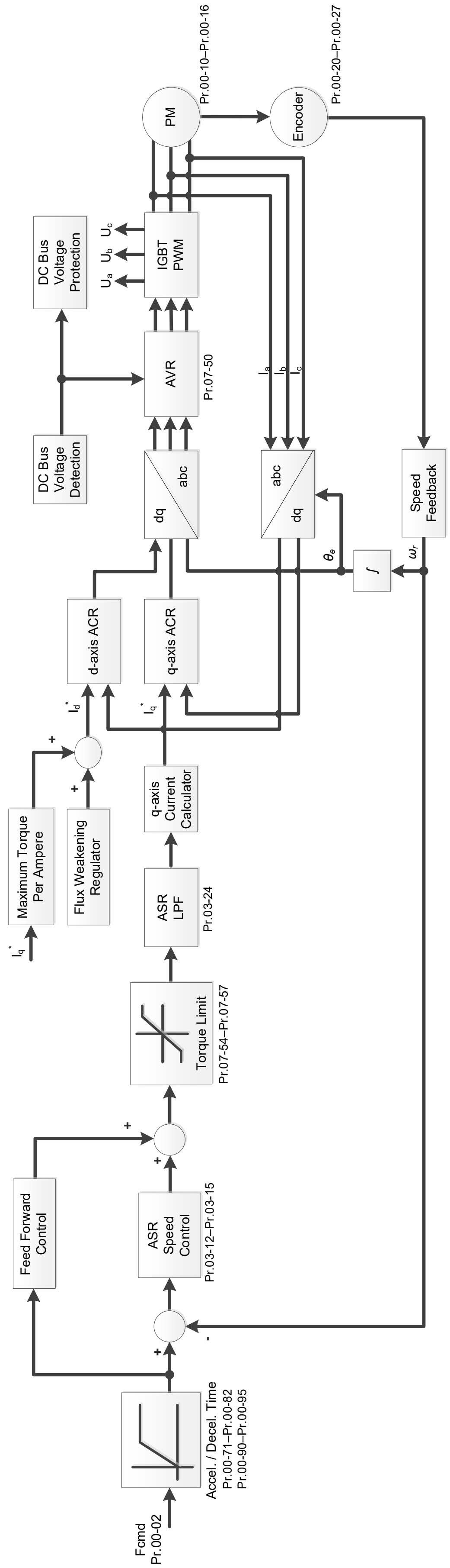
📖 When Pr.00-01=1, SVC control diagram is as follows:



📖 When Pr.00-01=2, FOCPG control diagram is as follows:



📖 When Pr.00-01=3, FOCPM control diagram is as follows:



✗ 00-02 Master Frequency Command Source

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1

Settings
1: RS-485 serial communication or keyboard panel (KPED-LE02)
2: External analog input (Pr.01-20)
3: External digital input
4: Direct docking mode (Delta CAN). Contact Delta for more information.
5: Direct docking mode (Delta CAN + Terminal (FWD/REV)). Contact Delta for more information.
6: CAN Lift. Contact Delta for more information.
7: DCP serial communication (SG±)

📖 Determines the drive's master frequency source.

✗ 00-03 Operation Command Source

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1

Settings
1: External terminals
2: RS-485 serial communication or digital keypad (KPC-CC01)
3: Keyboard panel (KPED-LE02)
6: CAN Lift. Contact Delta for more information.
7: DCP serial communication (SG±)

📖 The EB3000 series motor drives are shipped without a digital keypad, but you can use the external terminals or RS-485 to control the operation command.

00-04 Output Direction Selection

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings
0: FWD: counterclockwise, REV: clockwise
1: FWD: clockwise, REV: counterclockwise

📖 Use this parameter when elevator running direction is opposite to the command direction.

✗ 00-05 Speed Unit

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings
0: Hz
1: m/s
2: ft/s
3: Direct docking mode only, contact Delta for more information.

📖 Setting value 1 and 2: To display the correct speed on the display panel, values entered into Pr.00-42, Pr.00-43 and Pr.00-44 must be correct.

Motor Parameters (Pr.00-10–00-16)

00-10 Motor Rated Power

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: #.##

Settings 0.00–655.35 kW

- Sets the rated power of the motor. The default is the power of the drive.

00-11 Motor Rated Voltage

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 220.0 / 440.0

Settings 230V models: 0.0–255.0 V
460V models: 0.0–510.0 V

- Set this parameter according to the rated voltage on the motor nameplate. If the motor is 220V, set this parameter to 220.0. If the motor is 200V, set this parameter to 200.0.
- There are many motor types in the market and the power system for each country is also different. The economical and convenient solution is to install an AC motor drive. Then there is no problem using the motor with different voltage and frequency inputs, and the motor drive can improve the original motor characteristics and useful life.

00-12 Motor Rated Current

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: #.##

Settings [(40–120%) × Pr.07-01] Amps

- Set this value according to the rated motor current from the motor nameplate.
- Example: Suppose the rated current for 7.5 HP (5.5 kW) models is 25 A and the default is 22.5 A. In this way, the current range is from 10 A (25 × 40%) to 30 A (25 × 120%).
- As shown in the table below, the defaults vary according to the different motor drive outputs in HP and in kW.

	Motor Drive's Output (HP)	3*	5*	5	7.5	10	15	20	25
	Motor Drive's Output (kW)	2.2	3.7	4	5.5	7.5	11	15	18.5
230V Models	Motor Rated Current (A) Default	9.82	13.91	16.36	19.64	24.54	36.82	47.46	63
460V Models	Motor Rated Current (A) Default			9.41	10.64	13.91	18.82	24.54	31.1

*: Single-phase models.

00-13 Motor Rated Frequency

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 60.00 / 50.00

Settings 0.00–400.00 Hz

- Sets this value according to the motor nameplate. In general, set this value equal to motor's rated frequency.
- Sets the drive's maximum operating frequency range. The formula is: Pr.00-13 = (Pr.00-15 Number of Motor Poles × RPM when elevator runs with rated speed) ÷ 120

00-14 Motor Rated Speed

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1710

Settings 0–65535 rpm

- Sets this value according to the motor nameplate.

- Speed (RPM) = (120 × Frequency) ÷ Number of Motor Poles
- For induction motors (IM), the drive must be run with slip. Default value of slip is 5% [(1800 - 1710) ÷ 1800].

00-15 Number of Motor Poles

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 4

Settings 2–96

- Sets this value according to the motor nameplate.
- Sets the number of motor poles (must be an even number).

00-16 IM Motor No-load Current

Control Mode **SVC** **FOCPG** Default: #.##

Settings 0–Pr.00-12 Amps

- After changing this parameter setting, you must execute the auto-tuning of motor parameters again to ensure the stability and accuracy of the system.
- As shown in the table below, the defaults vary according to the different motor drive output in HP and in kW.

	Motor Drive's Output (HP)	3*	5*	5	7.5	10	15	20	25
	Motor Drive's Output (kW)	2.2	3.7	4	5.5	7.5	11	15	18.5
230V Models	Motor Current w/o Load (A) Default	3.44	4.87	5.73	6.85	8.5	12.56	15.97	20.78
460V Models	Motor Current w/o Load (A) Default			3.29	3.71	4.81	6.43	8.26	10.28

*: Single-phase models.

Encoder Parameters (Pr.00-20–00-28)

00-20 Selection of Encoder

Control Mode **FOCPG** **FOCPM** Default: 0

Settings
0: No function
1: ABZ
2: ABZ+Hall
3: SIN/COS + Sinusoidal
4: SIN/COS + EnDat2.1/01/21
5: SIN/COS
6: SIN/COS + Hiperface
7: SIN/COS + EnDat2.2/01/21/02/22
8: SIN/COS + SSI
9: SIN/COS + BiSS-C

- When you set Pr.00-20 to 3, the encoder has one sine and one cosine signal for each revolution. The signal must be: 0.75–1.2 Vpp for the amplitude with phase angle 90°±5 elec. (E.g. ERN 1185 ERN 1387)
- When you set Pr.00-20 to 4 or 6, wait for two seconds after applying the power before executing the RUN command.
- When you set Pr.00-20 to 5, you must set Pr.00-36 to 360.
- When using communication encoders, be sure to set Pr.00-23 correctly.
- Detection of the magnetic pole:
  (1) 1 or 5: The drive outputs a short circuit to detect the position of the magnetic pole. At this moment, the motor generates a little noise.
  (2) 2: The drive detects the position of the magnetic pole with the UVW encoder signal.
  (3) 3: The drive detects the position of the magnetic pole with the sine encoder signal.
  (4) 4 or 6: The drive detects the position of the magnetic pole with the communication encoder signal.
- The table below shows the correspondence among encoder, PG card and auto-tuning.

PG Signal Type Setting	PG Signal Type	Applicable PG Card	Pr.00-30=6	Pr.00-30=8	e.g. Encoder	Description
Pr.00-20=1	A, B, Z	EMEB-PGAB-1 EMEB-PGABD-1	N/A	N/A		No need to execute Pr.00-30 = 6/8. The first operation after power-on will generate six pulse, and being calibrated through the Z-pulse during operation.
Pr.00-20=2	A, B, Z+U, V, W	EMEB-PGAB-1 EMEB-PGABD-1	Dynamic + Rolling test	Static + Rolling test		
Pr.00-20=3	SIN/COS + Sinusoidal	EMEB-PGHH-1 EMEB-PGSED-x	Dynamic test	Pr.03-90 bit9=0: Static + Rolling test Pr.03-90 bit9=1: Static test	ERN1185, ERN1387	
Pr.00-20=4	SIN/COS + EnDat 2.1/01/21	EMEB-PGSED-x	Dynamic test	Static test	ECN1313, ECN413	

PG Signal Type Setting	PG Signal Type	Applicable PG Card	Pr.00-30=6	Pr.00-30=8	e.g. Encoder	Description
Pr.00-20=5	SIN/COS	EMEB-PGHH-1 EMEB-PGSED-x	N/A	N/A		No need to execute Pr.00-30 = 6/8. The first operation after power-on will generate six pulse, set Pr.00-36 as 360.0 to avoid calibrating through Z-pulse during operation.
Pr.00-20=6	SIN/COS + Hiperface	EMEB-PGSED-x	Dynamic test	Static test	SRS50/60	
Pr.00-20=7	SIN/COS + EnDat 2.2/01/21/02/22	EMEB-PGSED-x	Dynamic test	Static test	ECN113, ECN1325, ECN425, ECN125	
Pr.00-20=8	SIN/COS + SSI	EMEB-PGSED-x	Dynamic test	Static test	SMRS64	
Pr.00-20=9	SIN/COS + BiSS-C	EMEB-PGSED-x	Dynamic test	Static test	WDGF 58R	

NOTE:

1. Rolling test: Detects Z-pulse for origin calibration. Brake released, and motor rotates more than one revolution.
2. Static test: Use Pulse injection to detect the magnetic pole angle. If there is an absolute position, the offset angle (Pr.00-36) could be calculated through the magnetic pole angle according to the absolute position. Brake engaged, and no motor runs.
3. Dynamic test: Force attracting the rotor to zero degrees and calculate the offset angle (Pr.00-36) according to the absolute position. Brake released, and motor rotates less than one revolution.

00-21 Encoder PPR

Control Mode **FOCPG** **FOCPM** Default: 2048

Settings 1–25000

📖 Sets the encoder Pulses per Revolution (PPR).

00-22 High Resolution SIN/COS and Communication Encoder

Control Mode **FOCPM** Default: 25

Settings 0–32 Bit

📖 Sets the resolution of communication encoder (Bit).

📖 The table below shows the commonly used encoders.

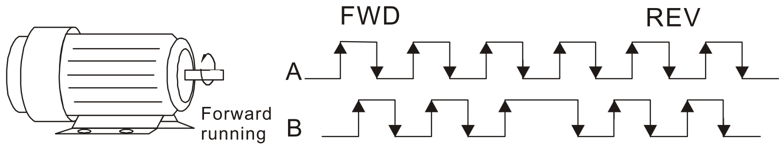
Encoder Model (Recommended)	Encoder Comm. Interface	Encoder PPR (Pr.00-21)	Absolute Resolution (Pr.02-22)
ERN 1387	N/A	2048	N/A
ECN 1313, 413	EnDat01	2048	13
ECN 1325	EnDat22	NA	25
SICK-SRS50	Hiperface®	1024	15
HOHNER-SMRS64	SSI Gray code	2048	13
WDGF-58R	Biss-C	2048	17

00-23 Encoder Input Type Setting

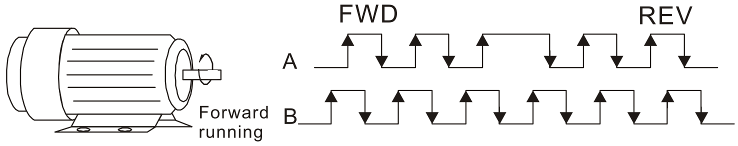
Control Mode **FOCPG** **FOCPM** Default: 0

Settings 0: Disable

1: Phase A leads in a forward run command and phase B leads in a reverse run command



2: Phase B leads in a forward run command and phase A leads in a reverse run command



📖 You must enter the correct pulse type for stable control.

00-24 PG Card Frequency Division Output

Control Mode **FOCPG** Default: 0

Settings 0–255

0 equals to 1

📖 Setting to 0 is the same as setting to 1:

0: No frequency division

1: Frequency division by 1 (remains the same as the original frequency)

00-25 Output Resolution for PGSED

Control Mode **FOCPG** **FOCPM** Default: 8

Settings 0–11

📖 Sets the output resolution of encoder.

📖 The resolution for encoder is 17-bit. When resolution for frequency division output is set to 10, the absolute position per revolution is 1024.

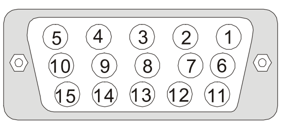
00-26 PG Card C+ / C-

Control Mode **FOCPG** **FOCPM** Default: 0000h

Settings 0000h–0001h

📖 When using a Heidenhain ERN1387 encoder, use Pr.00-26 to adjust the definition of the Delta PG card EMEB-PGHH-1 and EMEB-PGSED-x's terminal No. 10 and terminal 11 (see the table below). Refer to <Chapter 3 Option Cards> page 3-8 and page 3-28 for detailed terminal descriptions.

📖 Delta PG card: EMEB-PGHH-1 and EMEB-PGSED-1 (D-sub Terminal No.)



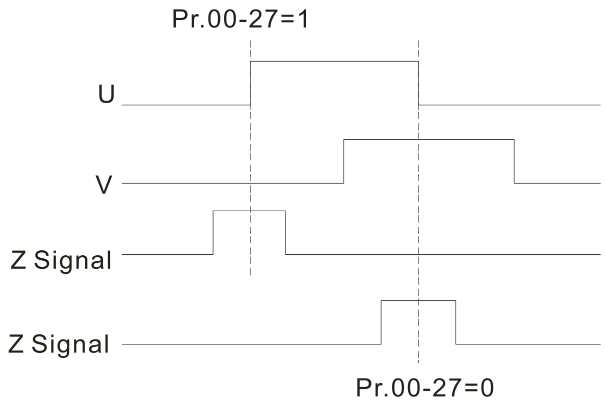
	Heidenhain ERN1387	
Terminal No.	Pr.00-26=0000h	Pr.00-26=0001h
10	C-	C+
11	C+	C-

00-27 Mode Selection for UVW Input

Control Mode FOCPG FOCPM Default: 0

Settings 0: Z signal is at the falling edge of U-phase
1: Z signal is at the rising edge of U-phase

- 0: The operation is U->V->W, Z signal is at the falling edge of U-phase.
- 1: The operation is U->V->W, Z signal is at the rising edge of U-phase.



00-28 Magnetic Pole Re-orientation

Control Mode FOCPM Default: 0

Settings 0: Disable
1: Six-pulse positioning

- Use with Pr.03-90 bit15 = 1.
- Use this function to search for the magnetic pole position only for permanent magnet motors.
- When there is no origin-adjustment for the encoder (Pr.00-36 is 360.0), it only ensures that the motor operation efficiency can be up to 86% of the best efficiency. In this situation, if you need to improve the operation efficiency, cycle the power or set Pr.00-28 to 1 to measure the magnetic pole orientation again.

Motor Auto-tuning (Pr.00-30–00-36)

00-30 Motor Auto-tuning

Control Mode SVC FOCPG FOCPM Default: 0

Settings 0: No function

3: IM dynamic test (Rs, Rr, Lm, Lx, no-load current) [motor runs]

4: IM static test (Rs, Rr, Lm, Lx) [motor does not run]

6: PM Only for an unloaded motor; auto-measures the angle between magnetic pole and PG origin (Pr.00-36)

7: SPM static test (Rs, Ld, Lq, BEMF) (suggested to lock the brake)

8: PM auto-measures the angle between magnetic pole and PG origin (Pr.00-36)

9: IPM / SPM dynamic test (Rs, Ld, Lq, BEMF)

10: IPM / SPM static test (Rs, Ld, Lq, BEMF) (suggested to lock the brake)

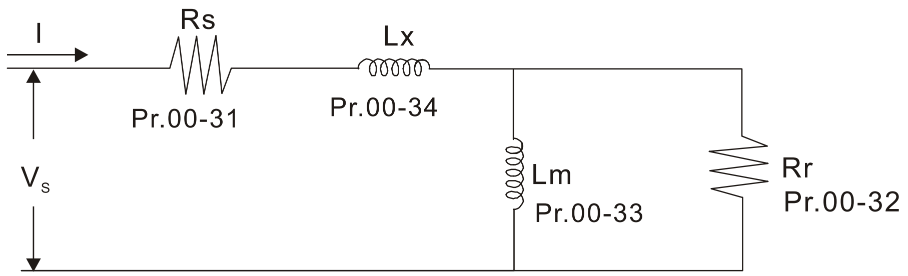
📖 Position the elevator near the middle floors before auto-tuning.

IM Motor when Pr.00-01 is set to 0 (VF), 1 (SVC), 2 (IMFOCPG):

📖 Motor auto-tuning:
Set Pr.00-30 to 3–4, and then press the RUN key on the built-in keyboard panel KPED-LE02 (Pr.00-03=3) to start auto-tuning. Or when the drive is in manual mode (inspection), run the upward operation or downward operation (Pr.00-03=1) to start auto-tuning immediately. In the process of auto-tuning, an “Auto tuning” warning will be continuously displayed on the keyboard panel until it is finished.

📖 Pay attention to the following notes when Pr.00-30=3 (dynamic test):

1. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
2. Make sure the motor is not loaded before auto-tuning, and that the shaft is not connected to any belt or gear motor. Set this parameter to 4 if you cannot separate the motor from the load.
3. Enter the correct values for Pr.00-10–Pr.00-15. Refer to motor capacity to set the acceleration/deceleration time.
4. After auto-tuning is finished, check that Pr.00-16 no-load current (A), Pr.00-31 Rs (ohm/L-L), Pr.00-32 Rr (ohm/L-L), Pr.00-33 Lm (mH/L-L) and Pr.00-34 Lx (mH/L-L) all have values.
5. Line to line equivalent circuit diagram:



Line to line equivalent circuit for VFD-ED Series

PM Motor when Pr.00-01 is set to 3 (FOCPM):

📖 Auto-tuning process: 7, 9 or 10 and then 6 or 8.

📖 Motor auto-tuning:
Set Pr.00-30 to 6–10, and then press the RUN key on the built-in keyboard panel KPED-LE02 (Pr.00-03=3) to start auto-tuning. Or when the drive is in manual mode (inspection), run the upward operation or downward operation (Pr.00-03=1) to start auto-tuning immediately. In the process of auto-tuning, an “Auto tuning” warning will be continuously displayed on the keyboard panel until it is finished.

📖 Pr.00-30=7: SPM static test:
1. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
2. Enter the correct values for Pr.00-10–Pr.00-15. Refer to motor capacity to set the acceleration/deceleration time.
3. Note that it is suggested the brake should be locked.
4. After auto-tuning is finished, check that Pr.00-31 Rs (ohm/phase), Pr.00-33 Ld (mH/phase), Pr.00-34 Lq (mH/phase) and Pr.00-35 Back-EMF (Vrms/L-L @rated speed) all have values.

📖 Pr.00-30=9: IPM / SPM dynamic test:
1. Unload before auto-tuning. Note that the motor will run!
2. If the drive controls the brake, the drive can auto-tune according to the normal sequence after you complete the wiring and set the brake control parameters.
3. If the host controller controls the brake, make sure that the brake is in release status before auto-tuning.
4. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
5. Enter the correct values for Pr.00-10–Pr.00-15. Refer to motor capacity to set the acceleration/deceleration time.
6. After auto-tuning is finished, check that Pr.00-31 Rs (ohm/phase), Pr.00-33 Ld (mH/phase), Pr.00-34 Lq (mH/phase) and Pr.00-35 Back-EMF (Vrms/L-L @rated speed) all have values.

📖 Pr.00-30=10: IPM / SPM static test:
1. Note that it is suggested the brake should be locked.
2. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
3. Enter the correct values for Pr.00-10–Pr.00-15. Refer to motor capacity to set the acceleration/deceleration time.
4. After auto-tuning is finished, check that Pr.00-31 Rs (ohm/phase), Pr.00-33 Ld (mH/phase), Pr.00-34 Lq (mH/phase) and Pr.00-35 Back-EMF (Vrms/L-L @rated speed) all have values.

📖 Pr.00-30=6: Auto-measures the angle between the magnetic pole and the PG origin. Pay attention to the following notes when measuring: (dynamic test)
1. Unload before auto-tuning.
2. If the drive controls the brake, the drive can auto-tune according to the normal sequence after you complete the wiring and set the brake control parameters.
3. If the host controller controls the brake, make sure that the brake is in release status before auto-tuning.

📖 Pr.00-30=8: Auto-measures the angle between the magnetic pole and the PG origin. Pay attention to the following notes when measuring: (static test)

1. The motor can be loaded or unloaded before auto-tuning.
2. See the reference table for auto-tuning for Pr.00-20 (PG Signal Type). When Pr.00-20=3, set Pr.03-90 bit9=1.
3. If the drive controls the brake, the drive can auto-tune according to the normal sequence after you complete the wiring and set the brake control parameters.
4. If the host controller controls the brake, make sure that the brake is in release status before auto-tuning.
5. Make sure the setting for Pr.00-23 is correct. Incorrectly setting Pr.00-23 causes incorrect positioning of the magnetic pole and results in the wrong angle between the magnetic pole and PG origin.

NOTE:

☑ In vector control mode, do not run motors in parallel.

☑ Do not use vector control mode if the motor rated power exceeds the rated power for the AC motor drive.

☑ The no-load current is usually 20–50% of the rated current.

☑ The rated speed cannot be larger or equal to 120 f/p (f: output frequency Pr.00-13, p: Number of Motor Poles Pr.00-15).

☑ After auto-tuning is finished, start the drive again to make it operate when the auto-tuning command source is the external terminal.

☑ Note that if the contactor and brake are not controlled by the AC motor drive, release it manually.

☑ Set Pr.00-30=6 (unloaded motor) for accurate calculation. If you need to execute this function with a loaded motor, balance the carriage before execution.

☑ If you do not balance the carriage in a measured environment, you can execute this function with a loaded motor by setting Pr.00-30=8. It will have a difference of 15–30° for different encoder types.

☑ "Auto Tuning Err" displays on the keyboard panel when stopping due to an AC motor drive fault or human error, which means the detection fails. Check the wiring connections of the AC motor drive. If "PG Fbk Error" displays on the keyboard panel, change the setting of Pr.00-23 (if set to 1, change it to 2). If "PG Fbk Loss" displays on the keyboard panel, check the feedback of Z-phase pulse.

00-31 IM/PM Rs

Control Mode **SVC** **FOCPG** **FOCPM** Default: 0.000

Settings 0.000–65.535 Ω

📖 The values are automatically measured after motor auto-tuning.

00-32 IM Rr

Control Mode **SVC** **FOCPG** Default: 0.000

Settings 0.000–65.535 Ω

📖 The values are automatically measured after motor auto-tuning.

00-33 IM Lm / PM Ld
00-34 IM Lx / PM Lq

Control Mode **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings 0.0–6553.5 mH

📖 The values are automatically measured after motor auto-tuning.

00-35 Back Electromotive Force

Control Mode **FOCPM** Default: 0.0

Settings 0.0–6553.5 Vrms

📖 Sets the back electromotive force (Line-to-line RMS value) when the motor is operated at the rated speed.

📖 You can get the RMS value by setting Pr.00-30 = 7, 9 or 10 (Motor Auto-tuning).

00-36 Offset Angle between Magnetic Pole and PG Origin

Control Mode **FOCPM** Default: 360.0

Settings 0.0–360.0°

📖 The offset angle between the magnetic pole and PG origin (measured by auto-tuning).

Elevator Parameters (Pr.00-40–00-46)

00-40 Elevator Speed

Control Mode	FOCPG	FOCPM	Default: 1.00
Settings	0.10–4.00 m/s		

Elevator speed (m/sec. = m/min. ÷ 60)

00-41 Elevator Rated Load

Control Mode	FOCPG	FOCPM	Default: 800
Settings	400–4000 kg		

00-42 Traction Sheave Diameter

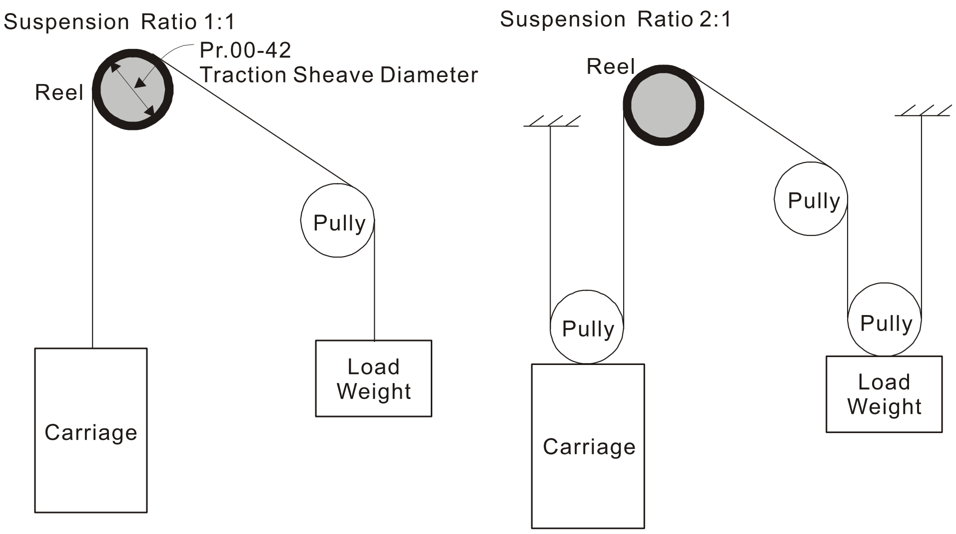
Control Mode	FOCPG	FOCPM	Default: 400
Settings	100–2000 mm		

00-43 Gear Ratio

Control Mode	FOCPG	FOCPM	Default: 1.00
Settings	1.00–100.00		

00-44 Suspension Ratio

Control Mode	FOCPG	FOCPM	Default: 1
Settings	0 = 1: 1 1 = 2: 1 2 = 4: 1 3 = 8: 1		



00-45 Motor Current at Acceleration

Control Mode	FOCPM	Default: 150
Settings	50–200%	

Measures motor's maximum current when the elevator is under test in automatic mode.

00-46 Carriage Acceleration

Control Mode	FOCPM	Default: 0.75
Settings	0.20–2.00 m/s^2	

Multi-step Speed Parameters (Pr.00-50–00-66)

⌿ **00-50**	Zero Step Speed Frequency
⌿ **00-51**	1st Step Speed Frequency
⌿ **00-52**	2nd Step Speed Frequency
⌿ **00-53**	3rd Step Speed Frequency
⌿ **00-54**	4th Step Speed Frequency
⌿ **00-55**	5th Step Speed Frequency
⌿ **00-56**	6th Step Speed Frequency
⌿ **00-57**	7th Step Speed Frequency
⌿ **00-58**	8th Step Speed Frequency
⌿ **00-59**	9th Step Speed Frequency
⌿ **00-60**	10th Step Speed Frequency
⌿ **00-61**	11th Step Speed Frequency
⌿ **00-62**	12th Step Speed Frequency
⌿ **00-63**	13th Step Speed Frequency
⌿ **00-64**	14th Step Speed Frequency
⌿ **00-65**	15th Step Speed Frequency

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

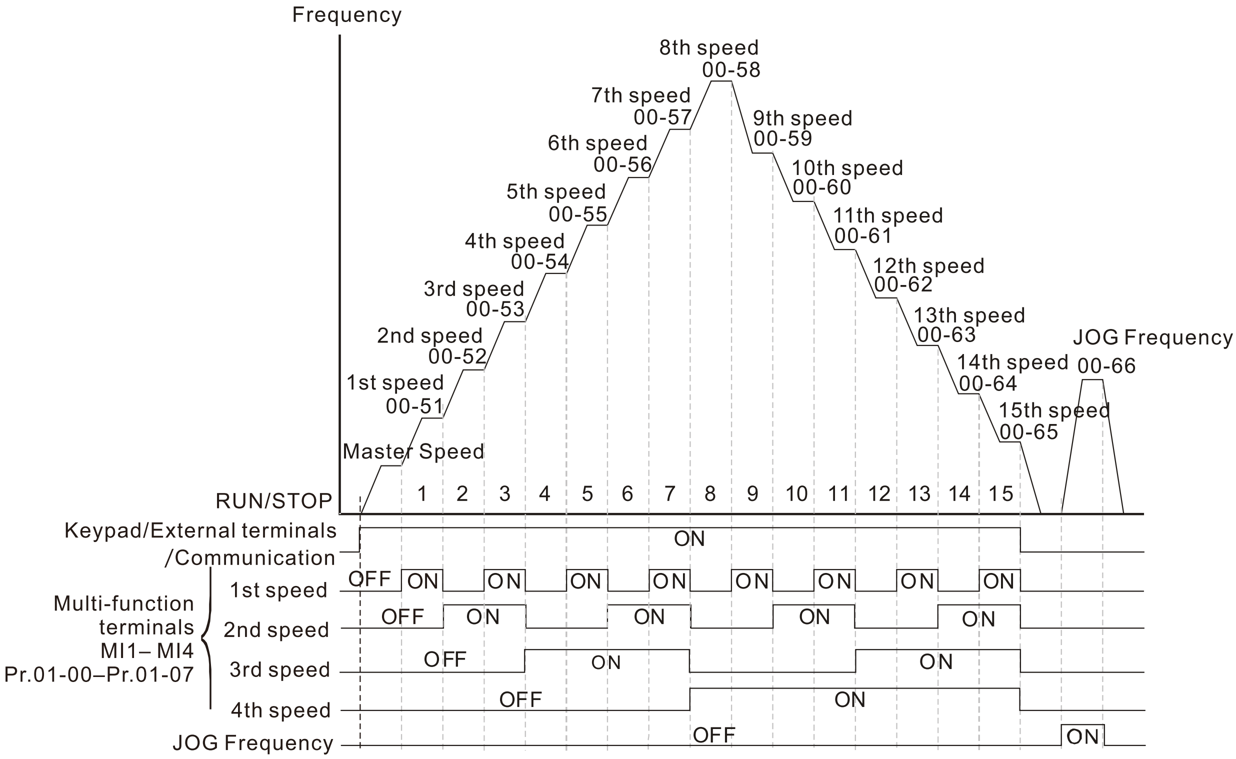
- The multi-function input terminals (refer to Pr.01-00–Pr.01-07) select one of the AC motor drive multi-step speeds (including the master frequency, in total 16 speeds). Pr.00-50–Pr.00-65 determine the speeds (frequencies) as shown above.
- When Pr.00-02 = 1, the master frequency is Pr.03-50.
- When Pr.00-02 = 3, the master frequency is Pr.00-50.

⌿ 00-66 JOG Frequency

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 6.00

Settings 0.00–400.00 Hz

- You can use both the external terminal JOG and the JOG key on PU. When the JOG terminal is disabled, the AC motor drive accelerates from 0 Hz to the JOG frequency (Pr.00-66). When the JOG terminal is enabled, the AC motor drive decelerates from the JOG frequency to zero. The Acceleration and Deceleration time are set by these parameters (Pr.00-79, Pr.00-80). You cannot execute the JOG command when the AC motor drive is running. When the JOG command is running, other operation commands are invalid except the Forward and Reverse commands and the STOP key on the digital keypad.



Multi-step speed via External Terminals

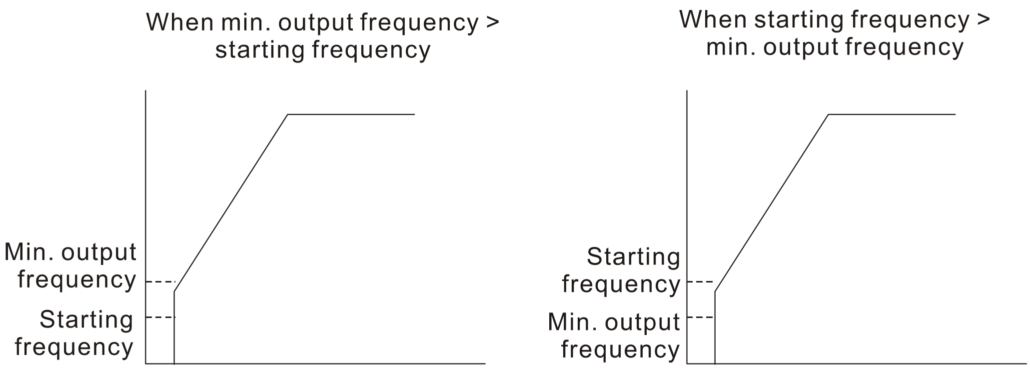
Acceleration and Deceleration Parameters (Pr.00-70–00-82)

00-70 Starting Frequency

Control Mode **VF** **SVC** **FOCPG** Default: 0.50

Settings 0.00–400.00 Hz

- Determines the starting frequency. When the starting frequency (Pr.00-70) is larger than the output frequency (Pr.03-55), the frequency output starts when the starting frequency (Pr.00-70) reaches the F command.



- The drive runs as the speed curve shows above only when it is in VF (Pr.00-01=0) and SVC (Pr.00-01=1) control mode and used with Pr.03-60 (cannot be se to 0).

00-71 Accel. Time of Set 1

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 3.00

Settings 0.00–600.00 sec.

- Defined as acceleration speed (m/s^2) in CANLift PP mode.
- Defined as acceleration time (sec.) in CANLift PV mode.

00-72 Decel. Time of Set 1

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–600.00 sec.

- Defined as deceleration speed (m/s^2) in CANLift PP mode.
- Defined as deceleration time (sec.) in CANLift PV mode.

00-73 Accel. Time of Set 2

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 3.00

Settings 0.00–600.00 sec.

00-74 Decel. Time of Set 2

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–600.00 sec.

00-75 Accel. Time of Set 3

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 3.00

Settings 0.00–600.00 sec.

00-76 Decel. Time of Set 3

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–600.00 sec.

00-77 Accel. Time of Set 4

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 3.00

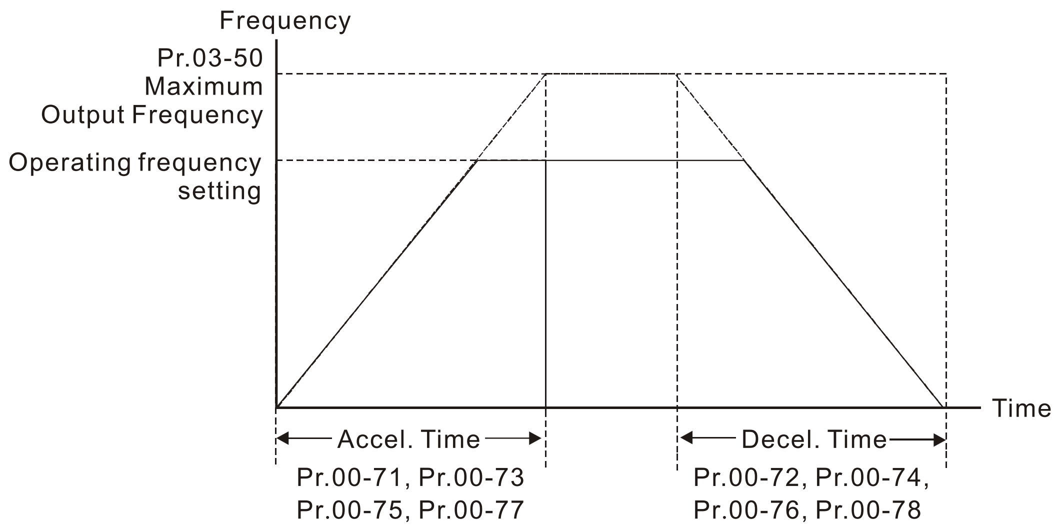
Settings 0.00–600.00 sec.

00-78 Decel. Time of Set 4

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–600.00 sec.

- The Acceleration Time determines the time required for the AC motor drive to ramp from 0.00 Hz to the Maximum Output Frequency (Pr.03-50). The Deceleration Time determines the time required for the AC motor drive to decelerate from the Maximum Output Frequency (Pr.03-50) down to 0.00 Hz.
- Select the Acceleration/Deceleration Time of Set 1, 2, 3, 4 with the multi-function input terminal settings. The defaults are Acceleration Time of Set 1 and Deceleration Time of Set 1.
- When there is a large opposing torque and inertial torque for the load, and the acceleration and deceleration time settings are less than the necessary value, then they enable the torque limit and stall prevention functions. When this happens, the actual acceleration and deceleration time are longer than the settings.



Acceleration & Decelertion Time Setting

00-79 JOG Acceleration Time

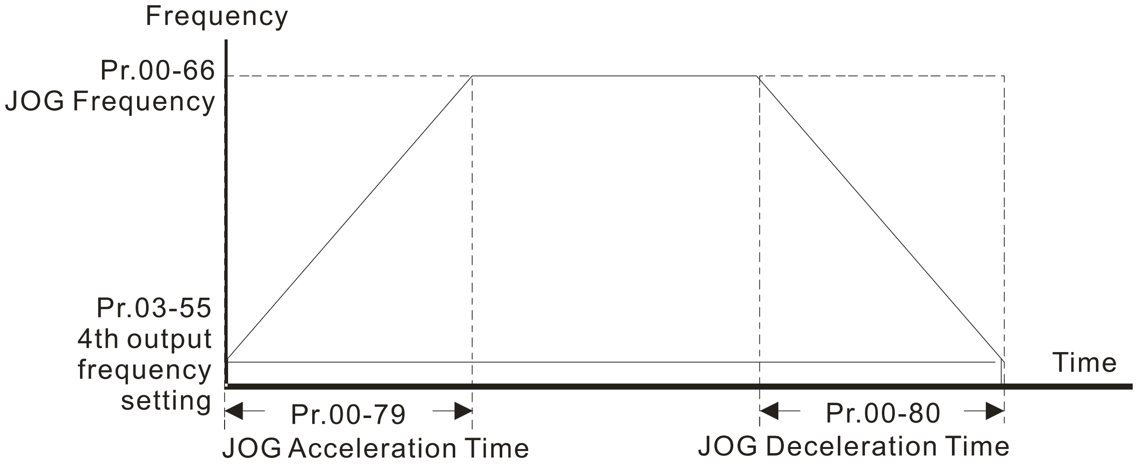
00-80 JOG Deceleration Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1.00

Settings 0.00–600.00 sec.

- You can use the external terminal JOG. When the JOG command is ON, the AC motor drive accelerates from the fourth output voltage setting (Pr.03-55) to the JOG frequency (Pr.00-66). When the JOG command is OFF, the AC motor drive decelerates from the JOG frequency to zero. The Acceleration and Deceleration time are set by these parameters (Pr.00-79, Pr.00-80).
- You cannot execute the JOG command when the AC motor drive is running. When the JOG

command is running, other operation commands are invalid except the Forward and Reverse commands.



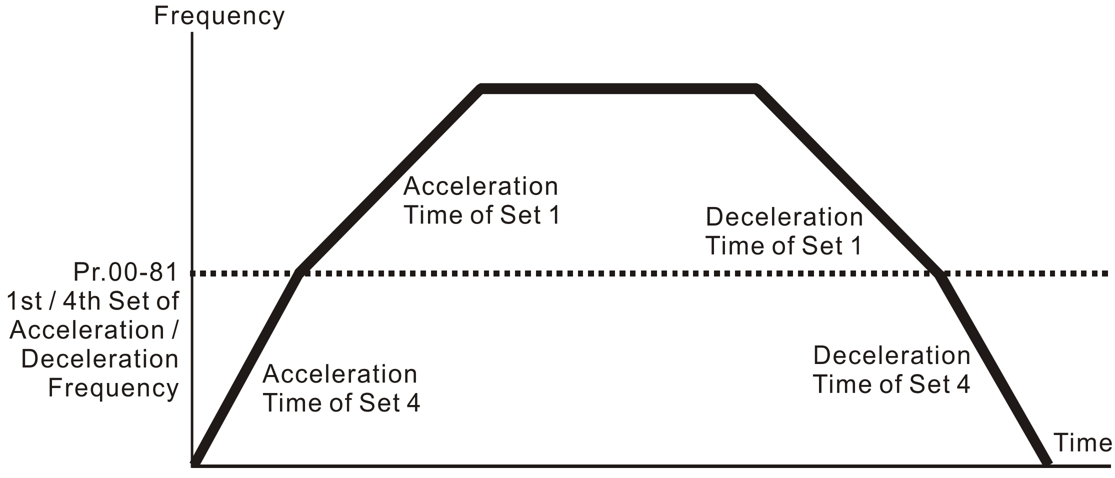
JOG Accel. / Decel. Time

00-81 Switch Frequency between First and Fourth Set of Accel./Decel.

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

📖 Determines the frequency for the transition from acceleration and deceleration time of set 1 to acceleration and deceleration time of set 4. You can also enable the transition from acceleration or deceleration time of set 1 to acceleration and deceleration time of set 4 with the external terminals (Pr.01-00–Pr.01-07). The external terminal has priority over Pr.00-81.



1st/4th Set of Acceleration/Deceleration Switching

00-82 Deceleration Time when Operating without RUN Command

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–600.00 sec.

📖 The AC motor drive stops according to this parameter when cancelling the RUN command. Refer to the figure in the description for Pr.00-94 for details.

S-curve Parameters (Pr.00-90–00-94)

〆	**00-90**	S-curve for Acceleration Begin Time S1
〆	**00-91**	S-curve for Acceleration Arrival Time S2
〆	**00-92**	S-curve for Deceleration Begin Time S3
〆	**00-93**	S-curve for Deceleration Arrival Time S4
〆	**00-95**	S-curve for Deceleration Arrival Time S5

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1.00

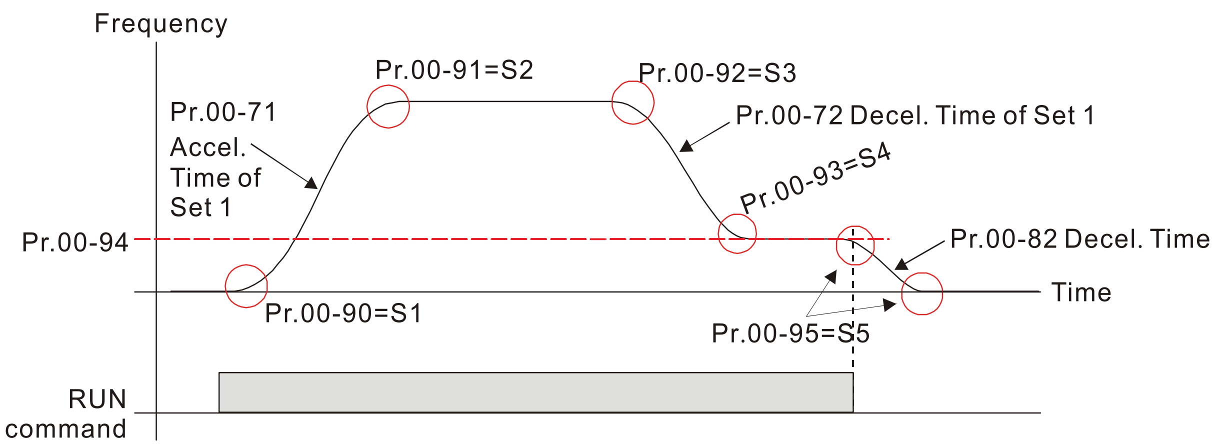
Settings 0.00–25.00 sec.

〆	**00-94**	Switch Frequency for S4 Changes to S5

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

- Using an S-curve gives the smoothest transition between speed changes. The acceleration and deceleration curve adjusts the acceleration and deceleration S-curve. When enabled, the motor drive produces a different acceleration and deceleration curve according to the acceleration and deceleration time.
- The Actual Acceleration Time = selected acceleration Time + (Pr.00-90 + Pr.00-91) ÷ 2.
  The Actual Deceleration Time = selected deceleration Time + (Pr.00-92 + Pr.00-93 + Pr.00-95 × 2) ÷ 2.
- Use Pr.00-94 to set the switch frequency between S4 and S5 for smooth stopping.
- Set Pr.00-94 to the leveling speed of the elevator.



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01 Input / Output Parameters

01 Input / Output Parameters

〆: You can set this parameter during operation.

Digital Input Settings (Pr.01-00–01-09)

〆 **01-00** Multi-function Input Command 1 (MI1)

Default: 1

〆 **01-01** Multi-function Input Command 2 (MI2)

Default: 2

〆 **01-02** Multi-function Input Command 3 (MI3)

Default: 3

〆 **01-03** Multi-function Input Command 4 (MI4)

Default: 4

〆 **01-04** Multi-function Input Command 5 (MI5)

Default: 0

〆 **01-05** Multi-function Input Command 6 (MI6)

Default: 0

〆 **01-06** Multi-function Input Command 7 (MI7)

Default: 0

〆 **01-07** Multi-function Input Command 8 (MI8) (Enable Drive terminal)

Default: 40

Settings	Control Mode	VF	SVC	FOCPG	FOCPM
0: No function		○	○	○	○
1: Multi-step speed command 1		○	○	○	○
2: Multi-step speed command 2		○	○	○	○
3: Multi-step speed command 3		○	○	○	○
4: Multi-step speed command 4		○	○	○	○
5: Reset		○	○	○	○
6: JOG command		○	○	○	○
7: Acceleration/deceleration speed inhibit		○	○	○	○
8: First, second set of acceleration/deceleration time		○	○	○	○
9: Third, fourth set of acceleration/deceleration time		○	○	○	○
10: EF input (Pr.02-16)		○	○	○	○
11: Reserved					
12: Stop output		○	○	○	○
13–14: Reserved					
15: AUI1 operation speed command		○	○	○	○
16: Reserved					
17: AUI2 operation speed command		○	○	○	○
18: Emergency Stop (Pr.02-16)		○	○	○	○
19–23: Reserved					
24: FWD JOG Command		○	○	○	○
25: REV JOG Command		○	○	○	○

26: Reserved				
27: ASR1/ASR2 selection	○	○	○	○
28: Emergency stop (EF1) (motor coasts to stop)	○	○	○	○
29–30: Reserved				
31: High torque bias (according to Pr.02-43)	○	○	○	○
32: Middle torque bias (according to Pr.02-44)	○	○	○	○
33: Low torque bias (according to Pr.02-45)	○	○	○	○
34: Rescue by mechanical brake control	○	○	○	○
35–37: Reserved				
38: Disable writing to EEPROM	○	○	○	○
39: Reserved				
40: Enable drive function	○	○	○	○
41: Magnetic contactor detection		○	○	○
42: Mechanical brake 1	○	○	○	○
43: EPS function (Emergency Power System)	○	○	○	○
44: Mechanical brake 2	○	○	○	○
45–51: Direct docking mode only			○	○
53: Terminal leveling signal for direct docking			○	○
54: Power failure signal	○	○	○	○
55: Manual emergency deceleration			○	○
56: Automatic emergency deceleration			○	○
57: STO signal check	○	○	○	○

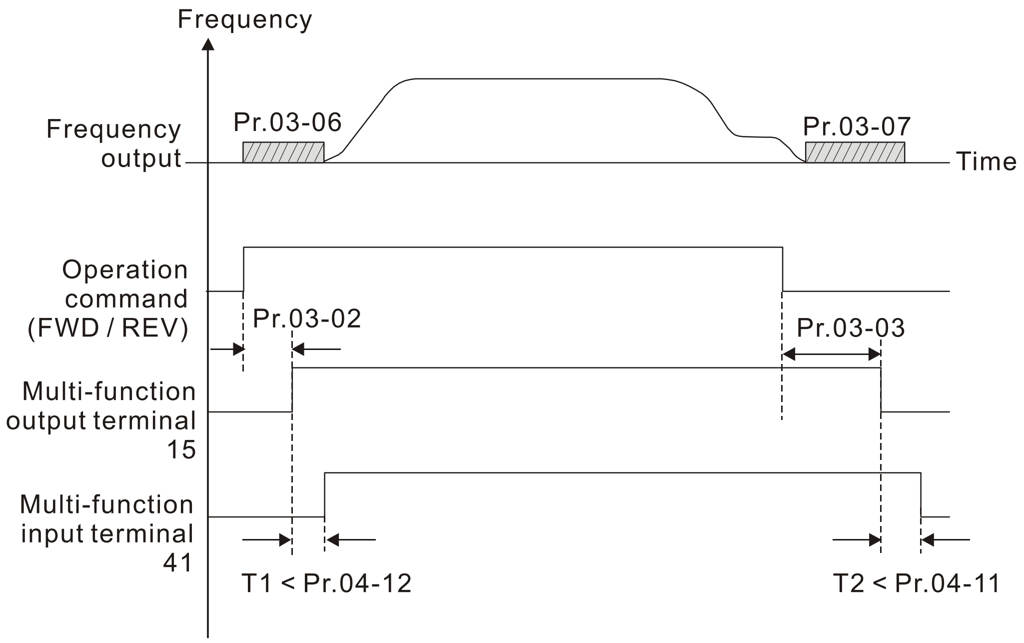
- Selects the functions for each multi-function input terminal.
- Setting the setting value to hundreds digit changes the contact from N.O. to N.C. or vice versa. For example, if you set MI1 to 1, the contact is N.O. (Normally Open); if you set MI1 to 101, the contact becomes N.C. (Normally Closed).

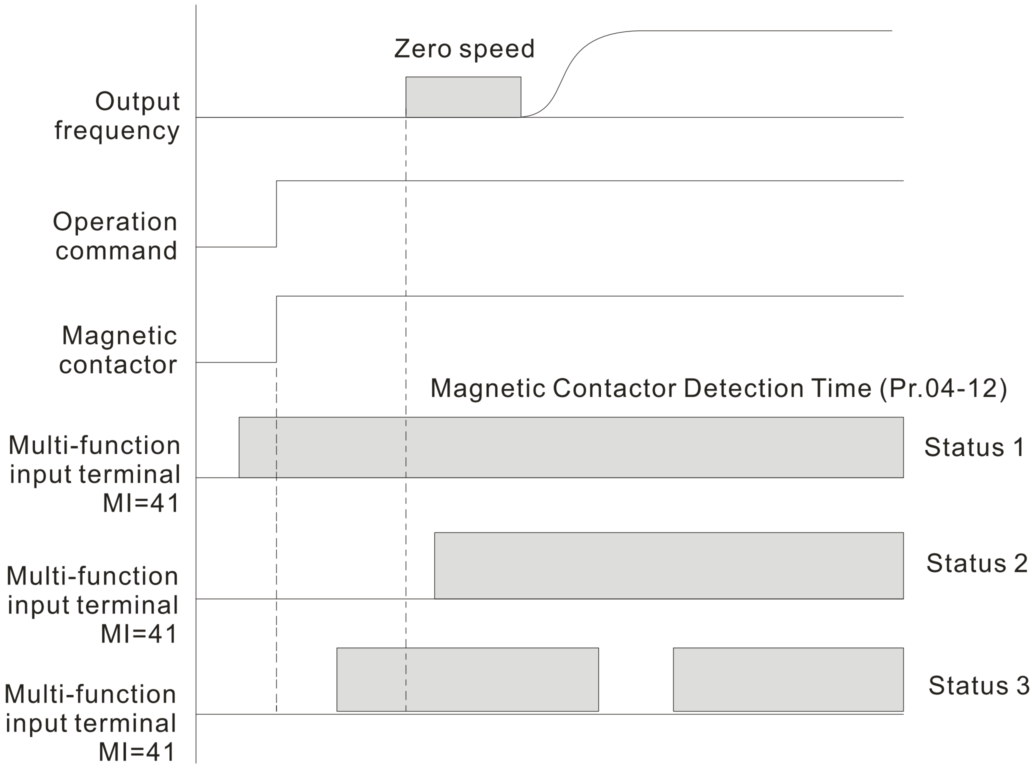
Settings	Functions	Descriptions
0	No Function	
1	Multi-step speed command 1	15-step speeds controlled through the four terminals, and 17 in total including the master speed and JOG (refer to Pr.00-50–Pr.00-65). When using communication to control the multi-step speed, settings 1–4 are invalid.
2	Multi-step speed command 2	
3	Multi-step speed command 3	
4	Multi-step speed command 4	
5	Reset	After you eliminate the drive error, use this terminal to reset the drive.
6	JOG Command	JOG operation
7	Acceleration / deceleration Speed Inhibit	When enabled, acceleration and deceleration are stopped and the AC motor drive starts to accelerate and decelerate from the inhibit point.

<table>
<tr><th>Settings</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>8</td><td>The first, second set of acceleration or deceleration time</td><td rowspan="2">You can select the motor drive’s acceleration and deceleration time through the terminals; there are four sets of acceleration and deceleration speeds in total.
<table>
<tr><th>bit 0
MI = 9</th><th>bit 1
MI = 8</th><th>Descriptions</th></tr>
<tr><td>0</td><td>0</td><td>First set of accel. /decel. time
When output frequency is less than Pr.00-81 (Switch Frequency between First/Fourth Set of Accel./Decel.), it outputs the fourth set of accel./decel. time.</td></tr>
<tr><td>0</td><td>1</td><td>Second set of accel./decel. time</td></tr>
<tr><td>1</td><td>0</td><td>Third set of accel./decel. time</td></tr>
<tr><td>1</td><td>1</td><td>Fourth set of accel./decel. time</td></tr>
</table>
If the drive receives STOP command, it decelerates to stop with Pr.00-82.</td></tr>
<tr><td>9</td><td>The third, fourth set of acceleration or deceleration time</td></tr>
<tr><td>10</td><td>EF Input</td><td>External fault input terminal, and decelerates according to Pr.02-16 (records EF fault).</td></tr>
<tr><td colspan="3">11: Reserved</td></tr>
<tr><td>12</td><td>Stop output</td><td>When enabled, the motor drive output stops immediately and the motor coasts. When disabled, the motor drive accelerates to the frequency setting.</td></tr>
<tr><td colspan="3">13–14: Reserved</td></tr>
<tr><td>15</td><td>AUI1 operation speed command</td><td>When the operation speed command source is AUI1 and AUI2, and two or more terminals are ON, the priority is AUI1 > AUI2.
When enabled, the frequency source is AUI1.</td></tr>
<tr><td colspan="3">16: Reserved</td></tr>
<tr><td>17</td><td>AUI2 operation speed command</td><td>When enabled, it forces the frequency source to AUI2.</td></tr>
<tr><td>18</td><td>Emergency Stop</td><td>When enabled, the motor drive ramps to stop according to Pr.02-16.</td></tr>
<tr><td colspan="3">19–23: Reserved</td></tr>
<tr><td>24</td><td>FWD JOG command</td><td>When enabled, the motor drive executes the forward Jog command.</td></tr>
<tr><td>25</td><td>REV JOG command</td><td>When enabled, the motor drive executes the reverse Jog command.</td></tr>
<tr><td colspan="3">26: Reserved</td></tr>
<tr><td>27</td><td>ASR1/ASR2 selection</td><td>ON: Speed is adjusted according to ASR 2.
OFF: Speed is adjusted according to ASR 1.</td></tr>
<tr><td>28</td><td>Emergency stop (EF1) (Motor coasts to stop)</td><td>ON: The motor drive executes emergency stop and records the fault code.</td></tr>
<tr><td colspan="3">29–30: Reserved</td></tr>
<tr><td>31</td><td>High torque bias</td><td>When Pr.02-41 is set to 3:
Set the high torque bias in Pr.02-43.
Set the middle torque bias in Pr.02-44.
Set the low torque bias in Pr.02-45.</td></tr>
</table>

<table>
<tr><th>Settings</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>32</td><td>Middle torque bias</td><td rowspan="2">
<table>
<tr><th>31</th><th>32</th><th>33</th><th>Torque Bias</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>N/A</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>Pr.02-45</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>Pr.02-44</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>Pr.02-44+ Pr.02-45</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>Pr.02-43</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>Pr.02-43 + Pr.02-45</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>Pr.02-43 + Pr.02-44</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>Pr.02-43 + Pr.02-44 + Pr.02-45</td></tr>
</table>
</td></tr>
<tr><td>33</td><td>Low torque bias</td></tr>
<tr><td>34</td><td>Rescue by mechanical brake control</td><td>When enabled, the drive releases the brake to perform emergency rescue (Pr.05-35 to Pr.05-39).</td></tr>
<tr><td colspan="3">35–37: Reserved</td></tr>
<tr><td>38</td><td>Disable writing to EEPROM</td><td>When enabled, you cannot write to EEPROM.</td></tr>
<tr><td>39</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>40</td><td>Enable drive function</td><td>When enabled, it executes the motor drive function. This function can be used with multi-function output (setting Pr.01-10–Pr.01-13 to 15) and (Pr.03-02 and Pr.03-03).</td></tr>
<tr><td>41</td><td>Magnetic contactor detection</td><td>This terminal is for the magnetic contactor feedback signal ON/OFF. When the motor drive receives a RUN command, it enables the corresponding output terminal (setting 15) after Pr.03-02 time. It checks if this function is enabled in the detection time (Pr.04-12). If NOT, the magnetic contactor error occurs and fault code “MCF” displays.</td></tr>
<tr><td>42</td><td>Mechanical brake 1</td><td>When the motor drive receives a RUN command, it enables the corresponding output terminal (setting 12) after Pr.03-00 time. It checks if this function is enabled in the detection time (Pr.04-11). If NOT, the mechanical brake error occurs and fault code “MbF” displays.</td></tr>
<tr><td>43</td><td>EPS function (Emergency Power System)</td><td>If power is cut during running, the drive stops when the DC bus voltage is less than the low voltage level. After power is cut, the drive runs according to the EPS frequency when EPS is applied and this function is ON.</td></tr>
<tr><td>44</td><td>Mechanical brake 2</td><td>When the motor drive receives a RUN command, it enables the corresponding output terminal (setting 12) after Pr.03-00 time. It checks if this function is enabled in the detection time (Pr.04-11). If NOT, the mechanical brake error occurs and fault code “MbF” displays.</td></tr>
<tr><td>45–51</td><td>Direct docking mode only</td><td>Contact Delta for more information.</td></tr>
<tr><td>53</td><td>Terminal leveling signal for direct docking</td><td>When the elevator runs to the leveling area, controller sends a signal to the drive to make the drive stop within effective distance (Pr.02-53).</td></tr>
</table>

Settings	Functions	Descriptions
54	Power failure signal	When power failure occurs, the host controller inputs this signal to inform the drive. When the motor drive receives this signal, MO = 49 is disabled after Pr.02-28 time
55	Manual emergency deceleration	When the motor drive receives this signal, it decelerates to Pr.00-94 speed according to Pr.02-15 deceleration time.
56	Automatic emergency deceleration	After setting this MI function, the system monitors the current speed. If the speed is higher than Pr.02-14, the drive decelerates to Pr.00-94 speed according to Pr.02-15 deceleration time.
57	STO signal check	Used to disable the 24-hour detections for STO (Safe Torque Off). The steps to make STO non-active are as follows: 1. Set multi-function input (MI) terminal to 57 2. Setting MI=57 triggers a fault code iSto (MI should be continuously active) 3. Three methods to check if the 24-hour STO detection function is disabled: (1) Press ENTER key on the keyboard panel KPED-LE02 (2) The host controller uses Modbus protocol to send 0xABCD packet to address 9100Hex (3) The host controller uses CANopen protocol to send 0xABCD packet to communication object 2091-FF. **NOTE**: 1. Whenever the power is cycled, make sure that the 24-hour detection for STO is disabled. 2. 24-hour detection timer can be ignored only when the purpose of usage or applications are not related to safety or being under maintenance for safety applications.





01-08 Digital Input Response Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.005

Settings 0.001–30.000 sec.

📖 Defines the digital input terminal signal delay and confirmation. The delay time prevents interference that can cause errors (except for the counter input) in the digital terminal input (FWD, REV and MI1–8). Increasing the setting for this parameter can reduce the errors, but it delays the response time.

01-09 FWD/REV Terminal Contact Action

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Disable

1: FWD terminal inversed

2: REV terminal inversed

3: FWD and REV terminals inversed

📖 0: FWD/REV terminal is, by default, a N.O. contact (Normally Open).

📖 1: FWD terminal is set to N.C. (Normally Closed) contact.

📖 2: REV terminal is set to N.C. contact.

📖 3: FWD/REV terminal is set to N.C. contact.

Digital Output Settings (Pr.01-10–01-15)

✓	**01-10**	Multi-function Output 1: RA1, RB1, RC1 (Relay 1)
✓	**01-11**	Multi-function Output 2: RA2, RC2 (Relay 2)
✓	**01-12**	Multi-function Output 3: RA3, RC3 (Relay 3)
✓	**01-13**	Multi-function Output 4: RA4, RC4 (Relay 4)
✓	**01-14**	Multi-function Output 5: MO1
✓	**01-15**	Multi-function Output 6: MO2

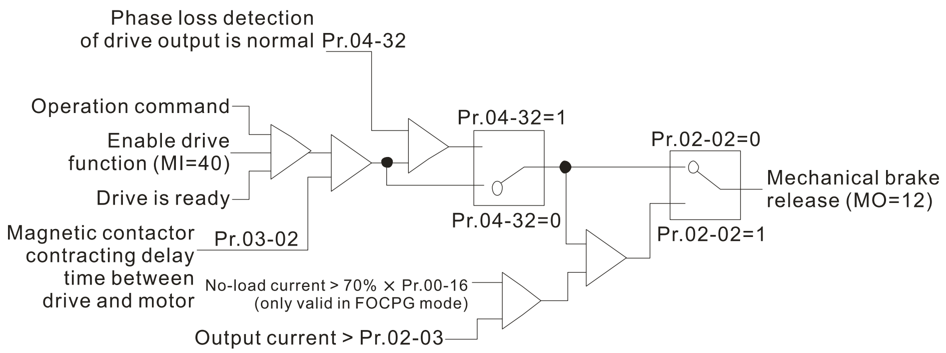
Default: 0

Settings	Control Mode	VF	SVC	FOCPG	FOCPM
0: No function		○	○	○	○
1: Indication during operation		○	○	○	○
2: Operation speed reached		○	○	○	○
3: Desired frequency 1 reached (Pr.02-10, Pr.02-11)		○	○	○	○
4: Desired frequency 2 reached (Pr.02-12, Pr.02-13)		○	○	○	○
5: Zero Speed (Frequency command)		○	○	○	○
6: Zero speed with stop (Frequency command)		○	○	○	○
7: Over-torque (OT1) (Pr.04-40–04-42)		○	○	○	○
8: Reserved					
9: Drive is ready		○	○	○	○
10: User-defined low-voltage detection (LV)		○	○	○	○
11: Fault indication		○	○	○	○
12: Mechanical brake release (Pr.03-00, Pr.03-01, Pr.02-02)		○	○	○	○
13: IGBT overheat warning (oH1)		○	○	○	○
14: Brake transistor signal		○	○	○	○
15: Motor-controlled magnetic contactor output		○	○	○	○
16: Slip error (oSL)		○	○	○	○
17: Fault indication 1		○	○	○	○
18: Reserved					
19: Brake transistor output error		○	○	○	○
20: Warning output		○	○	○	○
21: Over-voltage		○	○	○	○
22: Over-current stall prevention warning		○	○	○	○
23: Over-voltage stall prevention warning		○	○	○	○
24: Operation mode indication (Pr.00-03=1)		○	○	○	○
25: Forward command		○	○	○	○
26: Reverse command		○	○	○	○
27: Output when current ≥ Pr.02-03		○	○	○	○
28: Output when current < Pr.02-03		○	○	○	○
29: Reserved					
30: Reserved					

31: Power generation direction and status verification	○	○	○	○
32: Power generation direction	○	○	○	○
33: Zero speed (actual output frequency)	○	○	○	○
34: Zero speed with Stop (actual output frequency)	○	○	○	○
35: Fault output option 1 (Pr.02-71)	○	○	○	○
36: Fault output option 2 (Pr.02-72)	○	○	○	○
37: Fault output option 3 (Pr.02-73)	○	○	○	○
38: Fault output option 4 (Pr.02-74)	○	○	○	○
39: Reserved				
40: Speed reached (including zero speed)	○	○	○	○
41: Reserved				
42: STO output status	○	○	○	○
43–44: Direct Docking Mode only				
45: Reserved				
46: Retrying after a fault has occurred indication	○	○	○	○
47: Direct Docking Mode only				
48: Control output of MPSCC (Motor Phase Short Circuit Contactor)	○	○	○	○
49: Emergency power mode action	○	○	○	○
53: Power off detect	○	○	○	○

📖 Setting the setting value to hundreds digit changes the contact from N.O. to N.C. or vice versa. For example, if you set MI1 to 1, the contact is N.O. (Normally Open); if you set MI1 to 101, the contact becomes N.C. (Normally Closed).

Settings	Functions	Descriptions
0	No function	MO has no function
1	Indication during operation	Active when there is an output from the drive or RUN command is ON.
2	Operation speed reached	Active when the AC motor drive reaches the output frequency setting.
3	Desired frequency 1 reached (Pr.02-10)	Active when the desired frequency (Pr.02-10) reached.
4	Desired frequency 2 reached (Pr.02-12)	Active when the desired frequency (Pr.02-12) reached.
5	Zero Speed (Frequency command)	Active when the Frequency command = 0. (the drive should be at RUN mode)
6	Zero Speed with stop (Frequency command)	Active when Frequency command = 0 or Stop.
7	Over-torque (OT1) (Pr.04-40–Pr.04-42)	Active when detecting over-torque. Refer to Pr.04-40 (over-torque detection-OT1), Pr.04-41 (over-torque detection level-OT1) and Pr.04-42 (over-torque detection time-OT1).
8	Reserved	Reserved

Settings	Functions	Descriptions
9	Drive is ready	Active when the drive is ON and no error detected.
10	User-defined low-voltage detection	Active when the DC bus voltage is too low (see Pr.04-30 Low voltage level).
11	Fault indication	Active when a fault occurs (except Lv stop).
12	Mechanical brake release (Pr.03-00, Pr.03-01, Pr.02-02)	When the drive runs according to Pr.03-00, it is ON. Use this function with the DC brake. It is recommended to use contact “b” (N.C).
		
13	IGBT overheat warning (oH1)	Active when IGBT overheats. To prevent oH, turn off the drive (refer to Pr.04-55).
14	Brake transistor signal	Activated when the drive needs help braking the load. This function helps achieve a smooth deceleration (refer to Pr.07-51).
15	Motor-controlled magnetic contactor output	Active when you set MI function to #40 (Enable drive function).
16	Slip error (oSL)	Active when the slip error is detected (according to Pr.04-21).
17	Fault indication 1	Activate after 10 ms when a fault occurs (except Lv stop).
18	Reserved	
19	Brake transistor output error	Active when a brake transistor error is detected
20	Warning output	Active when a warning is detected.
21	Over-voltage	Active when an over-voltage is detected. DC bus over-voltage during acceleration (ovA), DC bus over-voltage during deceleration (ovd), DC bus over-voltage during constant speed (ovn), or DC bus over-voltage at stop (ovS).
22	Over-current stall prevention warning	Active when an over-current stall prevention is detected.
23	Over-voltage stall prevention warning	Active when an over-voltage stall prevention is detected.
24	Operation mode indication	Active when the operation command is controlled by an external terminal (Pr.00-03=1).
25	Forward command	Active when the operation direction is forward.
26	Reverse command	Active when the operation direction is reverse.
27	Output when current ≥ Pr.02-03	Active when current is ≥ Pr.02-03.
28	Output when current < Pr.02-03	Active when current is < Pr.02-03.

<table>
<tr><th>Settings</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>29</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>30</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>31</td><td>Power generation direction and status verification</td><td>Activate when the power generation direction is verified.</td></tr>
<tr><td>32</td><td>Power generation direction</td><td>Activate when the power generation direction runs forward.</td></tr>
<tr><td>33</td><td>Zero speed (actual output frequency)</td><td>Active when the actual output frequency is 0. The drive should be in RUN mode.</td></tr>
<tr><td>34</td><td>Zero speed with stop (actual output frequency)</td><td>Active when the actual output frequency is 0 or Stop. The drive should be in RUN mode.</td></tr>
<tr><td>35</td><td>Fault output option 1 (Pr.02-71)</td><td>Active when Pr.02-71 is ON.</td></tr>
<tr><td>36</td><td>Fault output option 2 (Pr.02-72)</td><td>Active when Pr.02-72 is ON.</td></tr>
<tr><td>37</td><td>Fault output option 3 (Pr.02-73)</td><td>Active when Pr.02-73 is ON.</td></tr>
<tr><td>38</td><td>Fault output option 4 (Pr.02-74)</td><td>Active when Pr.02-74 is ON.</td></tr>
<tr><td>39</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>40</td><td>Speed reached (including zero speed)</td><td>Active when the output frequency reaches the frequency setting.</td></tr>
<tr><td>41</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>42</td><td>STO output status</td><td><table>
<tr><th rowspan="2">Drive Status</th><th colspan="2">STO Output Status</th></tr>
<tr><th>Logic Output A (MO=42)</th><th>Logic Output B (MO=142)</th></tr>
<tr><td>Either STO1 or STO2 circuit is ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>STO active</td><td>ON</td><td>OFF</td></tr>
</table></td></tr>
<tr><td>43–44</td><td>Direct Docking Mode only</td><td>Contact Delta for more information</td></tr>
<tr><td>45</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>46</td><td>Retrying after a fault has occurred indication</td><td>Retry multiple outputs after an error has occurred. When the retry period has finished, MO stops.</td></tr>
<tr><td>47</td><td>Direct Docking Mode only</td><td>Contact Delta for more information</td></tr>
<tr><td>48</td><td>Control output of MPSCC (Motor Phase Short Circuit Contactor)</td><td>Active when the drive receives a RUN command.
Deactivated when the drive stops for more than Pr.03-05 time (MPSCC Contracting Delay Time between Drive and Motor).</td></tr>
<tr><td>49</td><td>Emergency power mode action</td><td>Active when the drive receives a power failure signal (Pr.01-00–Pr.01-07 = 54) after Pr.02-28 (Battery Output Delay Time).
Deactivated when the drive receives a signal of disabling EPS function (Pr.01-00–Pr.01-07 = 43) after Pr.02-29 (Battery Stops Output Delay Time). For detailed information, see the EPS Flow Chart in Pr.02-29.</td></tr>
<tr><td>53</td><td>Power off detect</td><td>Active when the drive input power is OFF or the power supply is switched to low-voltage batteries.</td></tr>
</table>

Analog Input / Output Settings (Pr.01-20–01-45)

✓ 01-20 AUI1 Selection

Default: 1

✓ 01-26 AUI2 Selection

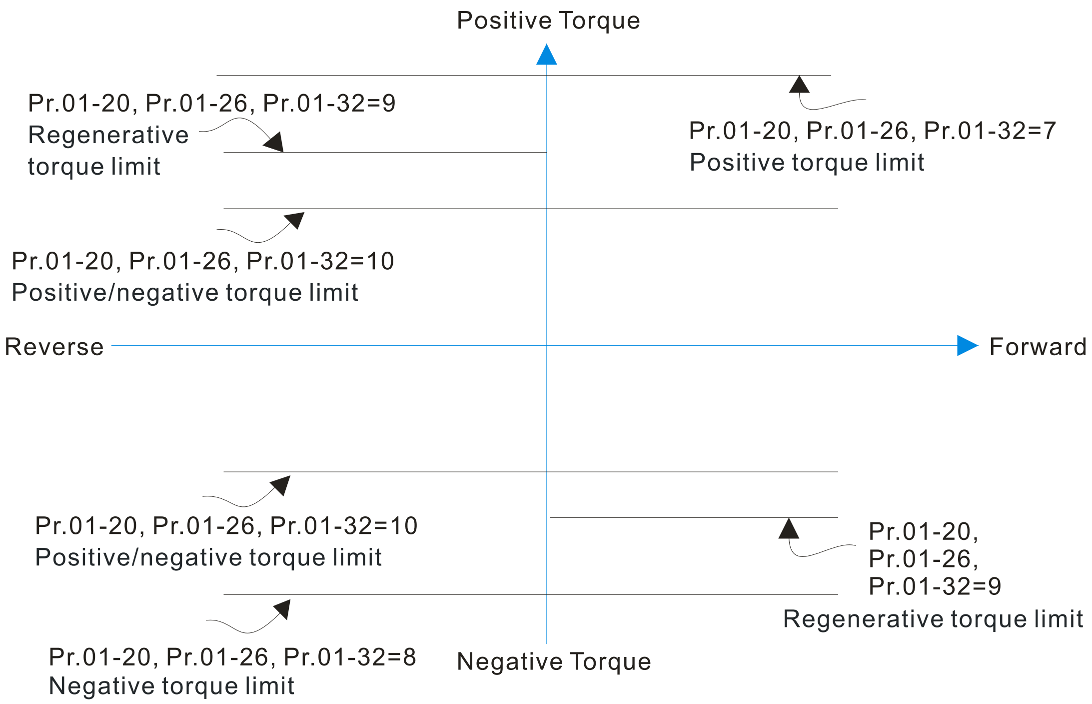
Default: 0

✓ 01-32 ACI Selection

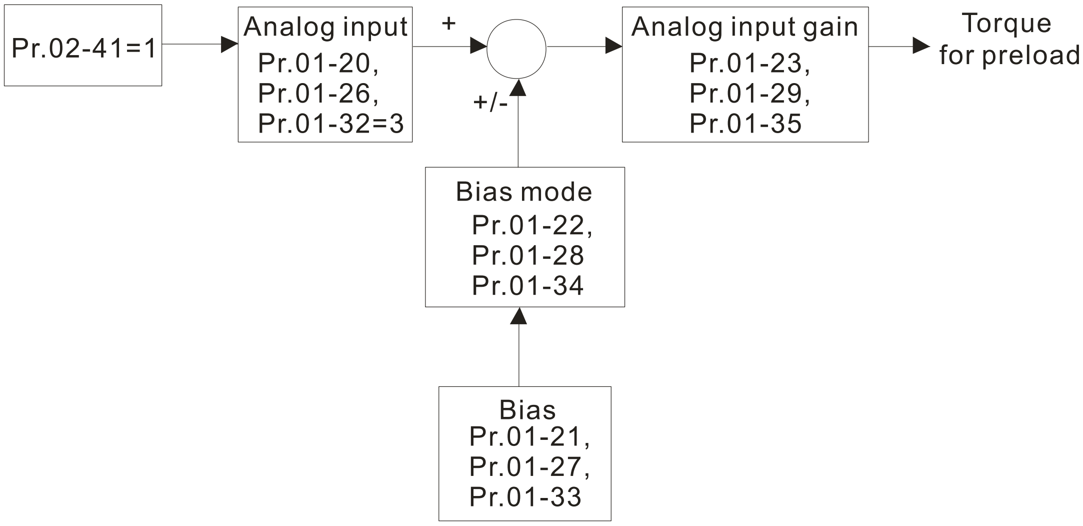
Default: 0

Settings	Control Mode	VF	SVC	FOCPG	FOCPM
0: No function		○	○	○	○
1: Frequency command		○	○	○	○
3: Load compensation		○	○	○	○
4: Reserved					
5: P.T.C. thermistor 1 input value		○	○	○	○
6: P.T.C. thermistor 2 input value		○	○	○	○
7: Positive torque limit				○	○
8: Negative torque limit				○	○
9: Regenerative torque limit				○	○
10: Positive/negative torque limit				○	○

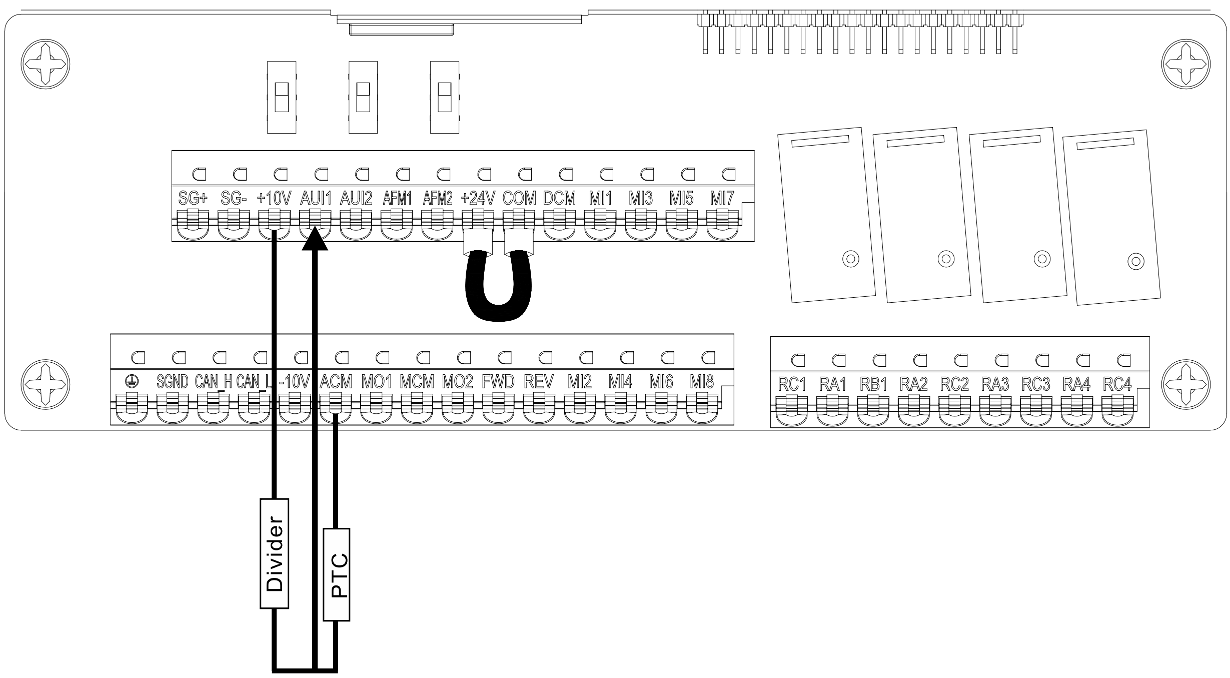
- When using the Frequency command, the corresponding value for 0 to ±10 V or 4–20 mA is 0–maximum output frequency (Pr.03-50). When the Frequency command of analog input is transferred from positive voltage to negative voltage or negative voltage to positive voltage, a RUN command should be given again to ensure an opposite direction is run.
- When using load compensation, the corresponding value for 0 to ±10 V or 4–20 mA is 0–moto's rated torque.



Pr.02-41: Torque Offset Source
Pr.01-20, Pr.01-26, Pr.01-32: Analog input selections (AUI1 / AUI2 / ACI)
Pr.01-21, Pr.01-27, Pr.01-33: Analog input bias (AUI1 / AUI2 / ACI)
Pr.01-22, Pr.01-28, Pr.01-34: AUI1 / AUI2 / ACI bias mode
Pr.01-23, Pr.01-29, Pr.01-35: AUI1 / AUI2 / ACI input gain



📖 The wring of PTC shows as below



01-21 AUI1 Input Bias

Control Mode	VF	SVC	FOCPG	FOCPM	Default: 0.0

Settings -100.0–100.0%

📖 Sets the corresponding AUI1 voltage for the external analog input 0.

01-27 AUI2 Input Bias

Control Mode	VF	SVC	FOCPG	FOCPM	Default: 0.0

Settings -100.0–100.0%

📖 Sets the corresponding AUI2 voltage for the external analog input 0.

✎ 01-33 ACI Input Bias

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings -100.0–100.0%

- Sets the corresponding ACI voltage for the external analog input 0.
- The relation between external input voltage/current and setting frequency is equal to -10–10 V (4–20 mA) corresponding to 0–60 Hz.

✎ 01-22 AUI1 Positive/negative Bias Mode

✎ 01-28 AUI2 Positive/negative Bias Mode

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Zero bias

1: Lower than or equal to bias

2: Higher than or equal to bias

3: Use bias as the base to get the absolute value of bias voltage

4: Using bias as the base

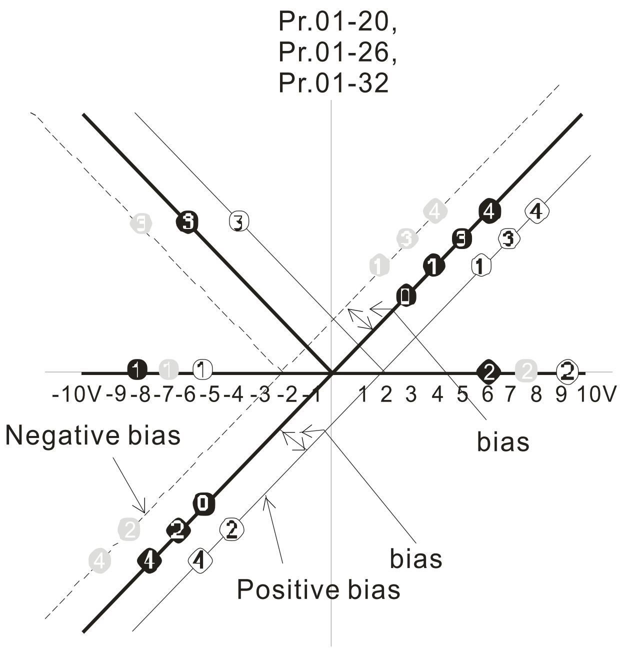
✎ 01-34 ACI Positive/negative Bias Mode

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Zero bias

1: Lower than or equal to bias

- In a noisy environment, you can use a negative bias to provide a noise margin. It is recommended that you NOT use less than 1 V to set the operating frequency.



When Pr.01-25 and Pr.01-31 are set to 0: Bipolar (±10 V), Pr.01-22, Pr.01-28, and Pr.01-34 input gain is positive.

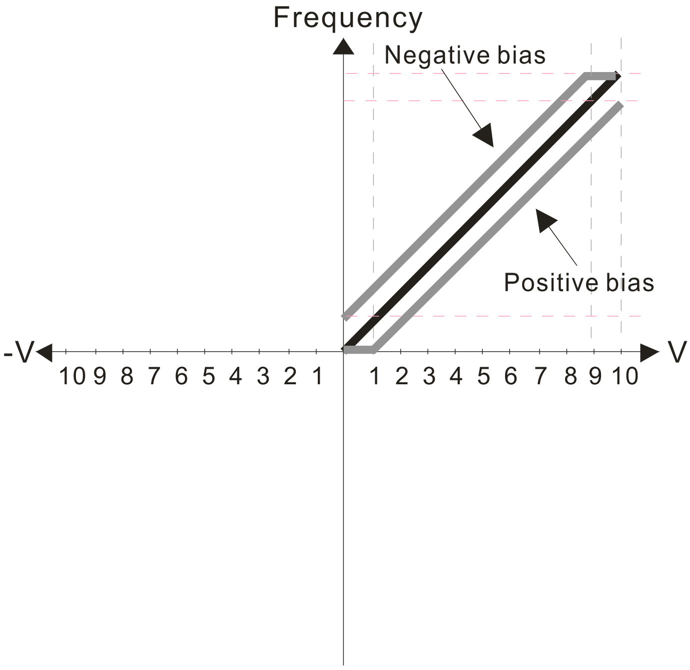
0: No bias

1: Bias serves as center, lower than or equal to bias

2: Bias serves as center, higher than or equal to bias

3: The absolute value of the bias voltage while serving as the center

4: Bias serves as the center



When Pr.01-25 and Pr.01-31 are set to 1: Unipolar (0–10 V), Pr.01-22, Pr.01-28, and Pr.01-34 input gain is positive.

1: Bias serves as center, lower than or equal to bias

- When Pr.01-25=1, Pr.01-22 and Pr.01-34 can only be set to 0 and 1.
- When Pr.01-31=1, Pr.01-28 can only be set to 0 and 1.

01-23 AUI1 Input Gain

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 100.0

Settings -500.0–500.0%

- Pr.01-21–Pr.01-23 are used when the Frequency command source is the analog voltage/current signal.
- When Pr.01-25=1, only positive gain can be inputted.

01-29 AUI2 Input Gain

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 100.0

Settings -500.0–500.0%

- Pr.01-27–Pr.01-29 are used when the Frequency command source is the analog voltage/current signal.
- When Pr.01-31=1, only positive gain can be inputted.

01-35 ACI Input Gain

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 100.0

Settings 0.0–500.0%

- Pr.01-33–Pr.01-35 are used when the Frequency command source is the analog voltage/current signal.
- When Pr.01-25=1, only positive gain can be inputted.

01-24 AUI1 Input Filter Time
01-30 AUI2 Input Filter Time
01-36 ACI Input Filter Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.01

Settings 0.00–2.00 sec.

- Analog signals, such as those entering AUI1, AUI2 and ACI, are commonly affected by interference that affects the stability of the analog control. Use the Input Noise Filter to create a more stable system.
- If Pr.01-24 is large, the control is more stable, but the response to the input is slower. If Pr.01-24 is small, the control may be unstable, but the response to the input is faster.

01-25 AUI1 Input Type
01-31 AUI2 Input Type

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Bipolar (±10 V)
1: Unipolar (0–10 V)

- When this parameter is set to 0 (bipolar), the input function direction is determined by the input signal.
- 0: And Pr.01-20=1, AUI decides the operation direction.
- 1: And Pr.01-20=1, the FWD/REV terminal decides the operation direction.
- AUI1: Use Switch (SW4) set as ACI or AVI.
- AUI2: only AVI is available.

✓ 01-40 Analog Output Selection 1
✓ 01-43 Analog Output Selection 2

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Output frequency (Hz)
1: Frequency command (Hz)
2: Motor speed (RPM)
3: Output current (rms)
4: Output voltage
5: DC bus voltage
6: Power factor angle
7: Power factor
8: Output torque
9: AUI1
10: Reserved
11: AUI2
12: q-axis current
13: q-axis feedback value
14: d-axis current
15: d-axis feedback value
16: q-axis voltage
17: d-axis voltage
18: Torque command
19–20: Reserved
21: Power output

- When setting to 0, it is output frequency, not ASR output frequency.

01-41 Analog Output Gain 1
01-44 Analog Output Gain 2

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 100.0

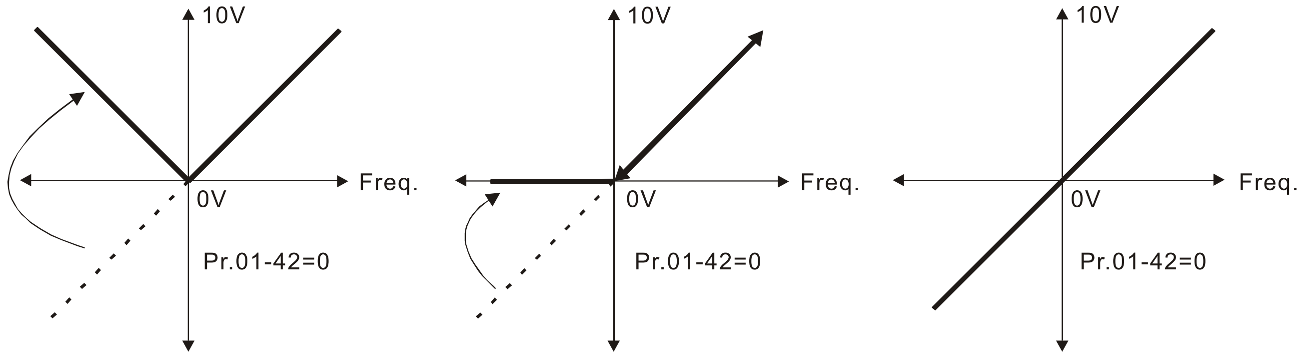
Settings 0–200%

Sets the corresponding voltage for the analog output 0.

01-42 Analog Output Value in REV Direction 1
01-45 Analog Output Value in REV Direction 2

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Absolute value in output voltage
1: Output 0 V in REV direction
2: Enable output voltage in REV direction



Analog output direction selection

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02 Special Function Parameters

02 Special Function Parameters

✓: You can set this parameter during operation.

Starting Method (Pr.02-00–02-04)

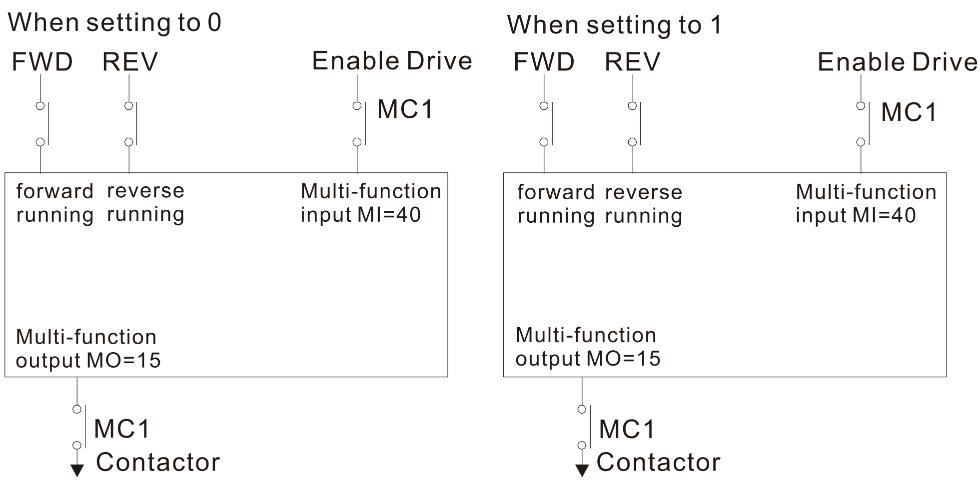
02-00 Serial Start Signal Selection

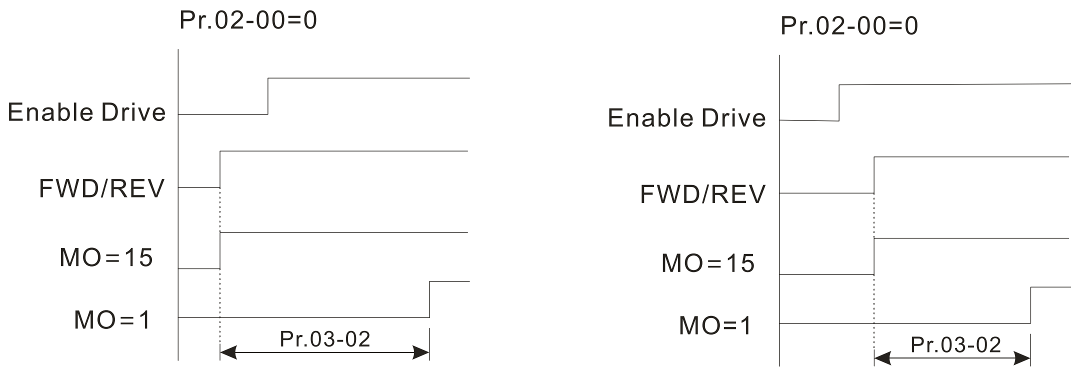
Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: According to FWD/REV signal

1: According to Enable drive function signal

- Selects the contactor serial start method.
- 0: According to FWD/REV signal, the motor starts to run after the Enable signal MI = 40 is ON.
- 1: According to Enable signal, the contactor, mechanical brake and DC brake all follow parameters' setting to run after FWD/REV and Enable are ON.

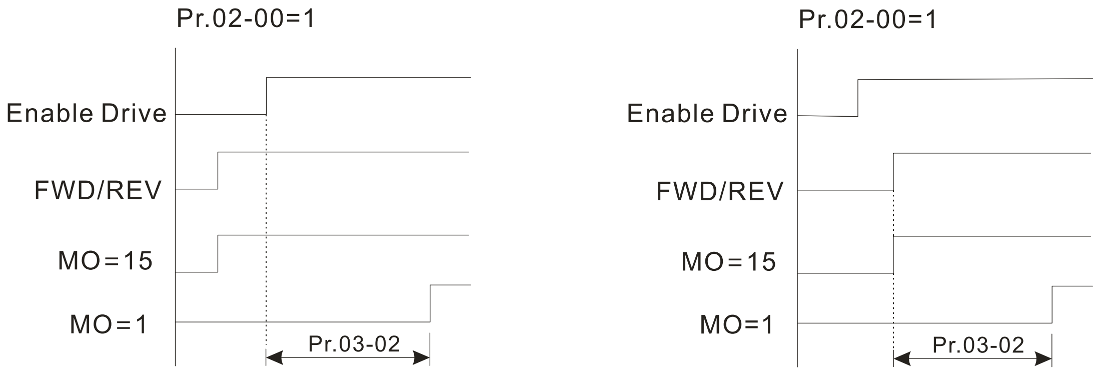




Pr.02-00=0		Enable Drive	
		0	1
Multi-function output MO= 15	0	False	False
	1	True	True

<u>**No matter** if the Enable Drive function signal outputs or not,</u>

<u>the drive starts to count Pr.03-02 after MO15 outputs.</u>



Pr.02-00=1		Enable Drive	
		0	1
Multi-function output MO= 15	0	False	False
	1	False	True

After both Enable Drive function signal and MO15 output, the drive starts to count Pr.03-02.

02-01 Two-wire Operation Control

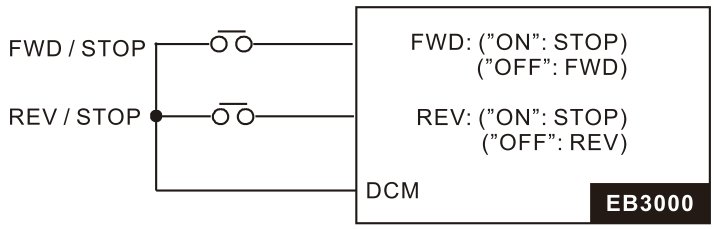
Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: FWD/STOP, REV/STOP

1: FWD/STOP, REV/STOP (Line Start Lockout)

📖 One of the two modes includes a "Line Start Lockout" feature. When line start lockout is enabled, the motor drive does not run when you apply power. The Line Start Lockout feature does not guarantee that the motor never starts under this condition. It is possible the motor may be set in motion by a mechanical vibration or malfunctioning switch.

📖 This parameter controls operation from external terminals.

Pr.02-01	External Terminal Control Circuits
0, 1 Two-wire operation control (1) FWD / STOP REV / STOP	

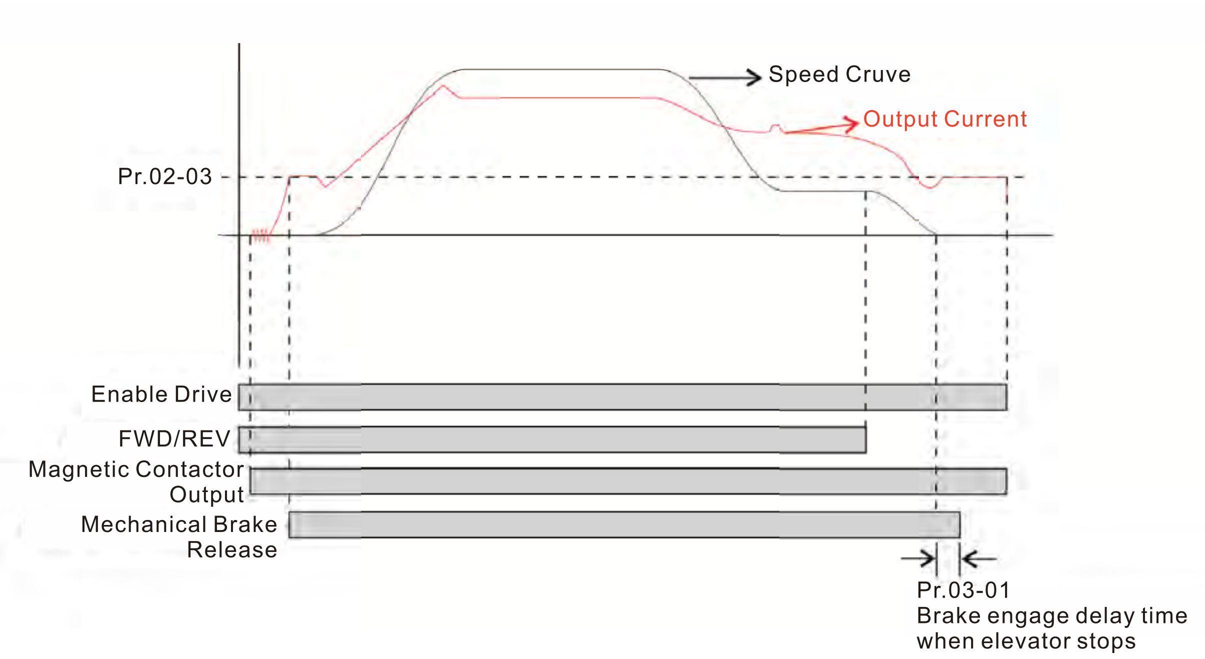
02-02 Torque Check

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Disable

1: Enable

📖 When the drive receives the operation signal, the drive checks if there is a torque output. When enabled, the drive releases the mechanical brake after confirming that there is a torque output.



02-03 External Terminal Output Current Level

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–100%

- When output current is ≥ Pr.02-03, it activates the multi-function output terminal (Pr.01-10–Pr.01-15 are set to 27).
- When output current is < Pr.02-03, it activates the multi-function output terminal (Pr.01-10–Pr.01-15 are set to 28).

Emergency Deceleration Protection (Pr.02-10–02-16)

02-10 Desired Frequency Reached 1

Control Mode	VF	SVC	FOCPG	FOCPM	Default: 60.00 / 50.00

Settings 0.00–400.00 Hz

02-11 Desired Frequency Reached Width 1

Control Mode	VF	SVC	FOCPG	FOCPM	Default: 2.00

Settings 0.00–400.00 Hz

02-12 Desired Frequency Reached 2

Control Mode	VF	SVC	FOCPG	FOCPM	Default: 60.00 / 50.00

Settings 0.00–400.00 Hz

02-13 Desired Frequency Reached Width 2

Control Mode	VF	SVC	FOCPG	FOCPM	Default: 2.00

Settings 0.00–400.00 Hz

- Once the output frequency reaches the desired frequency and the corresponding multi-function output terminal is set to 3 or 4 (Pr.01-10–Pr.01-15), this multi-function output terminal is ON.

02-14 Automatic Emergency Deceleration Level

Control Mode	FOCPG	FOCPM	Default: 60.00

Settings 5.00–400.00 Hz

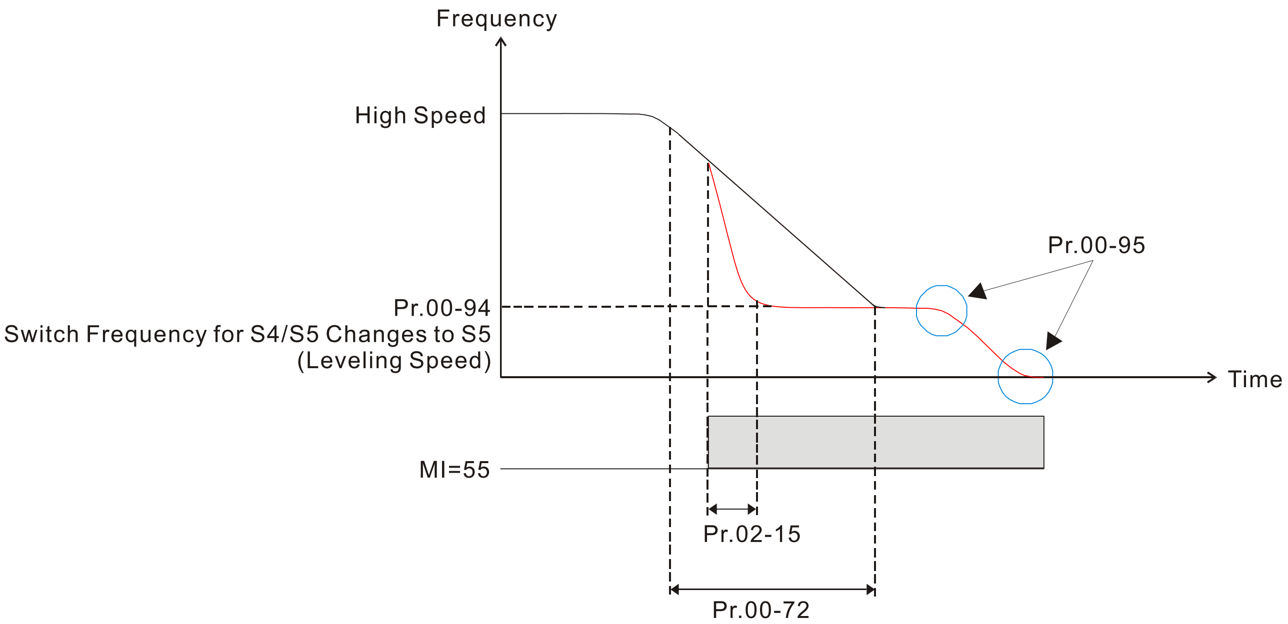
- When MI is set to 56, the system monitors the current speed. If the speed is higher than Pr.02-14, the drive decelerates to Pr.00-94 speed according to Pr.02-15 deceleration time.

02-15 Deceleration Time for Emergency Deceleration

Control Mode	FOCPG	FOCPM	Default: 2.00

Settings 0.00–600.00 sec.

- When MI=55 function is triggered, the drive decelerates to Pr.00-94 speed according to Pr.02-15 deceleration time, as shown in the figure below.



02-16 Emergency Stop (EF) & Forced Stop

Control Mode	VF	SVC	FOCPG	FOCPM	Default: 0

Settings
0: Coast to stop
1: According to deceleration Time 1
2: According to deceleration Time 2
3: According to deceleration Time 3
4: According to deceleration Time 4
5: According to Pr.00-82

- When the multi-function input terminal is set to 10 or 18 and is ON, the drive operates according to this parameter setting.

Emergency Power Supply (EPS) (Pr.02-20–02-29)

⌁ 02-20 Emergency Power (EPS) ON Operation Direction

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Run according to current command

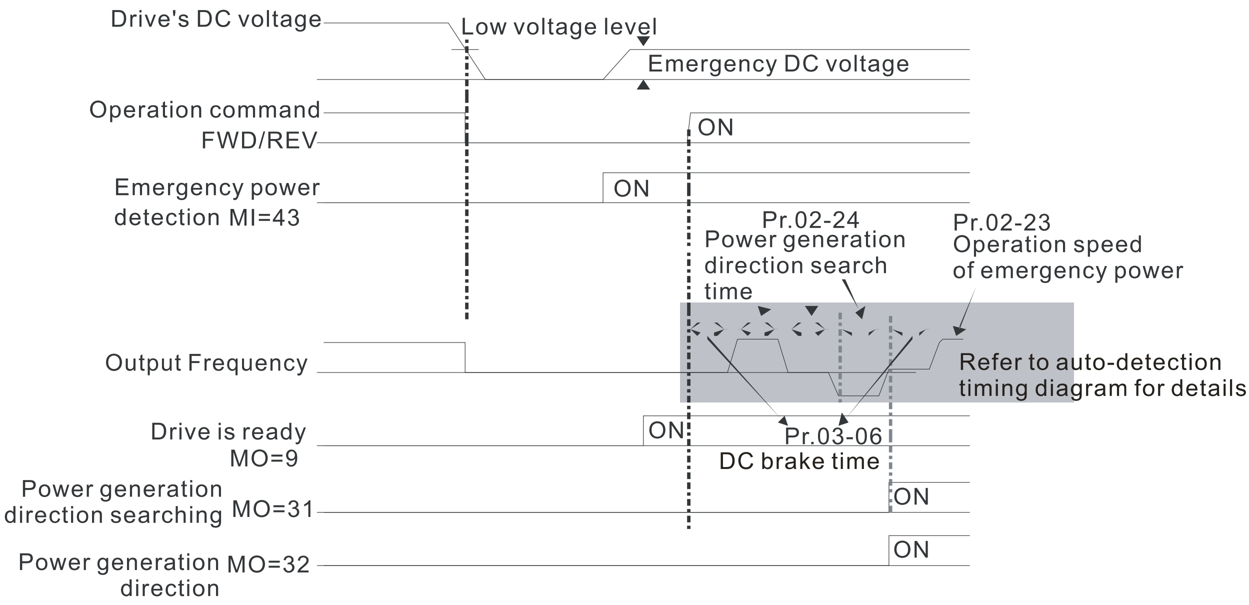
1: Run according to the operation direction of power generation mode, and execute the power generation direction detection when in power generation mode.

2: After determining the power generation direction, the host controller sends a running direction command. (When at STOP, the direction of power generation mode (MO = 32) confirms and the direction of power generation mode does not remain.) Execute the power generation direction detection every time.

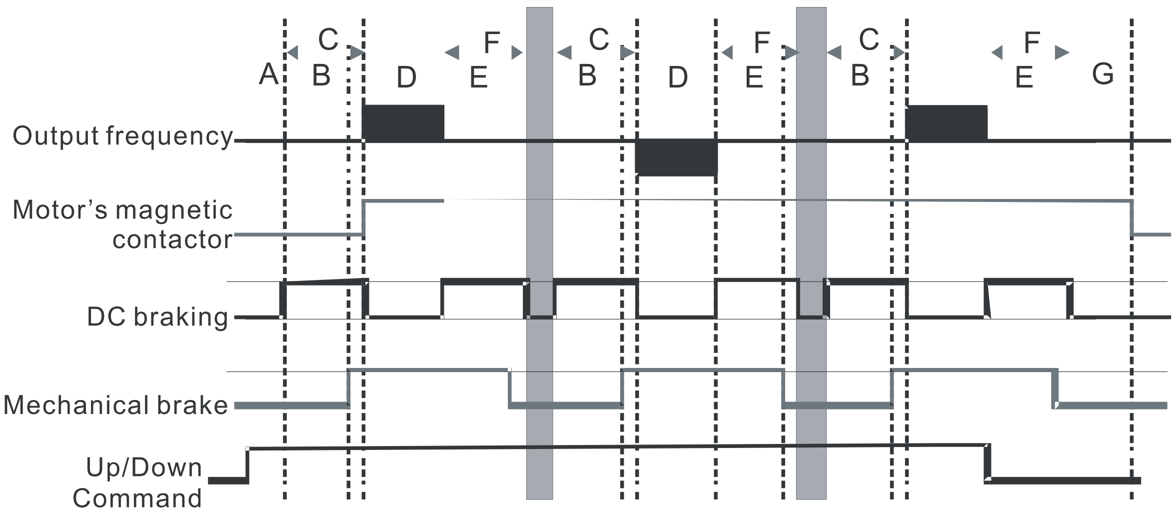
3: After determining the power generation direction, the host controller sends a running direction command. (When at STOP, the direction of power generation mode (MO =32) confirms and the direction of power generation mode remains.) Execute the power generation direction detection one time.

4: Run according to the operation direction of power generation mode, and execute the power generation direction detection when in normal mode.

- Pr.02-20 is enabled when the external terminal detects the emergency power signal EPS (MI=43).
- When you set Pr.02-20 to 1 and a forward/reverse run command is given, the drive checks for the elevator loading and operates in the power regeneration direction (the motor is in power generating status). The drive uses and operates in the direction that was detected as its power regeneration direction. For safety, the drive does not operate in user command direction to prevent emergency power voltage drop (EPS).
- When you set Pr.02-20 to 4 (motor with gear box):
  1. When the normal mode runs to the largest power factor angel, the results are saved in Pr.02-26.
  2. Compare the power factor angle detected by the power generation direction with Pr.02-25 setting value, if the value is larger than Pr.02-25, the current direction is saved in Pr.02-27.
  3. When in emergency power mode, the drive runs according to the Pr.02-27 operation direction.
- VF and SVC control modes: In the time setting in Pr.02-24, the drive detects the elevator loading status by performing forward/reverse run. Then the elevator operates in the power regeneration direction (the motor is in power generating status). Refer to the Auto-detection Timing Diagram 1 and 2 below for details.



Auto-detection Timing Diagram 1



Auto-detection Timing Diagram 2

A Pr.03-02: Magnetic Contactor Contracting Delay Time between Drive and Motor

B Pr.03-00: Brake Release Delay Time when Elevator Starts

C Pr.03-06: DC Brake Activation Time

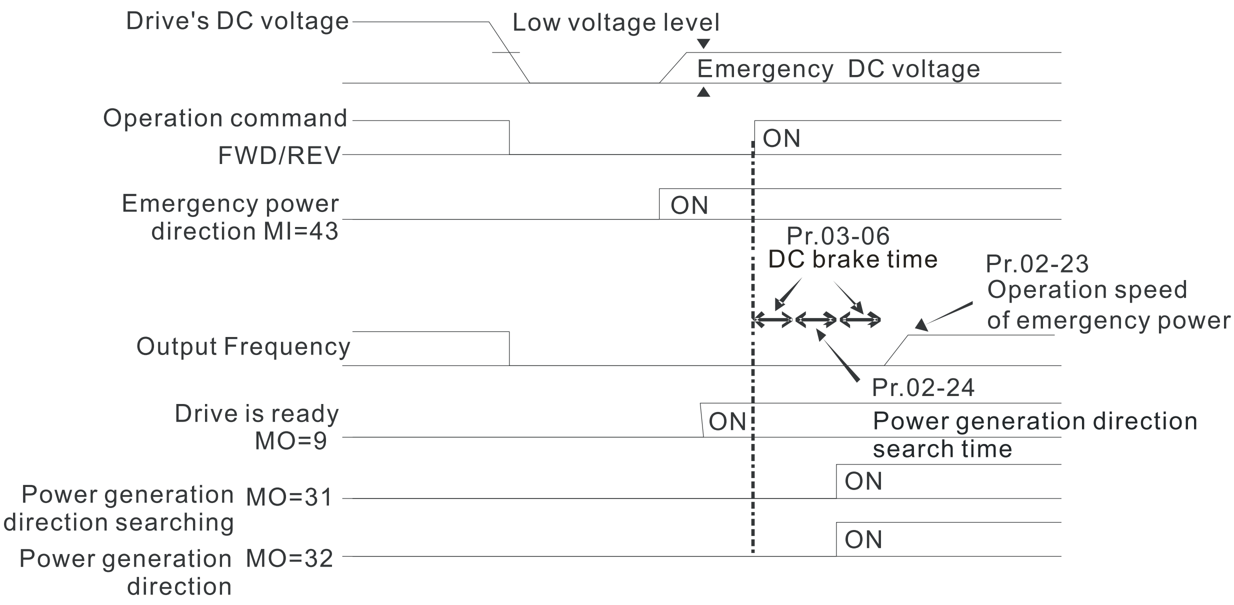
D Pr.02-24: Power Generation Direction Search Time

E Pr.03-01: Brake Engage Delay Time when Elevator Stops

F Pr.03-07: DC Brake Stopping Time

G Pr.03-03: Magnetic Contactor Release Delay Time between Drive and Motor

📖 FOCPG/PM Control Mode: In the time setting in Pr.02-24, the drive remains at zero-speed and it is able to determine the elevator loading without performing forward/reverse run. Then the elevator operates in the power regeneration direction (the motor is in power generating status). Refer to the Auto-detection Timing Diagram 3 below for details.



Auto-detection Timing Diagram 3

02-21 Voltage of Emergency Power (V_{DC})

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 24.0 / 48.0

Settings 24.0–375.0 V_{DC}

48.0–750.0 V_{DC}

📖 Inputs voltage into emergency power. If power is AC, change to DC input according to the following formula:

The formula is: $V_{DC} = \sqrt{2} \times V_{AC}$

02-22 Power Capacity of Emergency Power (EPS)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings 0.0–100.0 kVA

📖 When using emergency power (EPS), you must set the parameter to the required power capacity for the emergency power, and then the AC motor drive calculates the acceptable elevator speed (Pr.02-23) with the following equation.

I_{motor_rated} = Pr.00-12 (Motor Rated Current)

$$V_{eps\_max} = \frac{\text{Pr.02-22} \times 0.5}{\sqrt{3} \times I_{motor\_rated}}$$

$$f_{eps\_limit} = \frac{V_{eps\_max}}{\text{Pr.00-11}} \times \text{Pr.00-13}$$

02-23 Emergency Power (EPS) Mode Maximum Speed

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

- Displays the maximum speed under EPS mode.
- After setting Pr.02-22, the EPS speed will be calculated according to the formula in Pr.02-22 and automatically filled in Pr.02-23.

NOTE:

1. When the Frequency command > fEPS (Pr.02-23), the operation speed of emergency power (EPS) is fEPS.
2. When the Frequency command ≤ fEPS (Pr.02-23), the operation speed of emergency power (EPS) is set according to the current Frequency command.

02-24 Power Generation Direction Search Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1.0

Settings 0.0–5.0 sec.

02-25 Power Factor Angle Level for Power Generation Direction

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 70.0

Settings 0.0–150.0°

- During operation, if the largest power factor angle is larger than Pr.02-25 setting value, the power generation direction is the current operation direction.

02-26 Reference Level for Power Factor Angle during Operation

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

- The largest power factor angle during operation.

02-27 Power Generation Direction

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0: FWD

1: REV

02-28 Battery Output Delay Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1.0

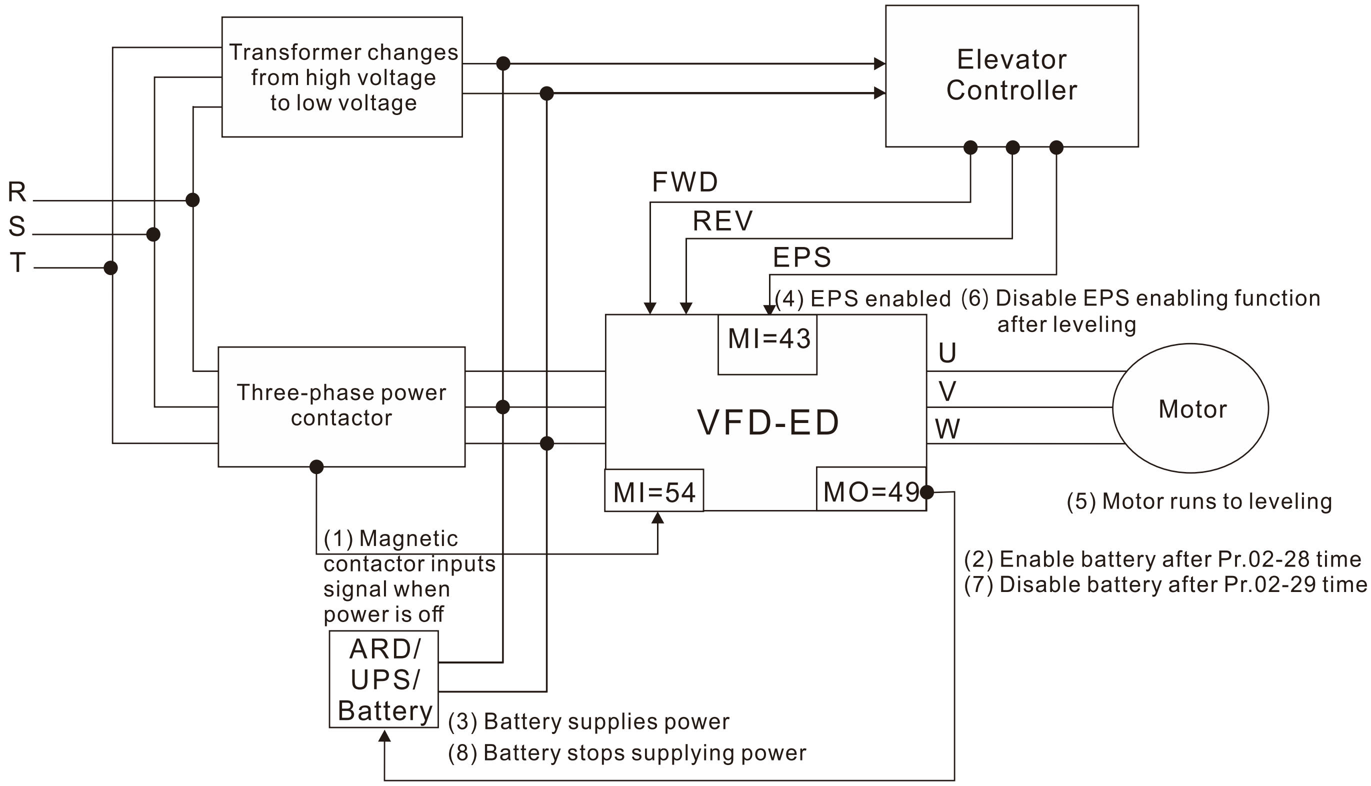
Settings 0.0–10.0 sec.

02-29 Battery Stops Output Delay Time

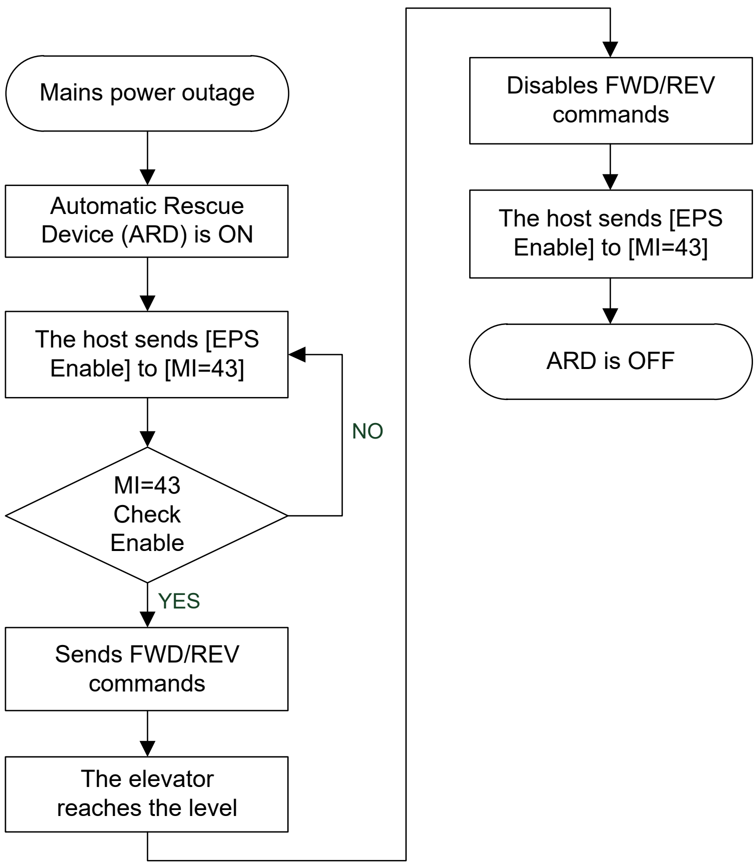
Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 3.0

Settings 0.0–60.0 sec.

- Pr.02-28: At power failure, the contactor sends a MI signal to inform the drive to activate battery. Then, the drive sends a MO signal to activate the battery output after Pr.02-28 delay time.
- Pr.02-29: After the controller deactivates the emergency power mode, it stops sending a MO signal to deactivate the battery output after Pr.02-29 delay time.
- Related parameters: multi-function input commands Pr.01-00–Pr.01-07 function setting 54 (Power failure signal) and multi-function output terminals Pr.01-10–Pr.01-15 function setting 49 (Emergency power mode action).



EPS Flow Chart

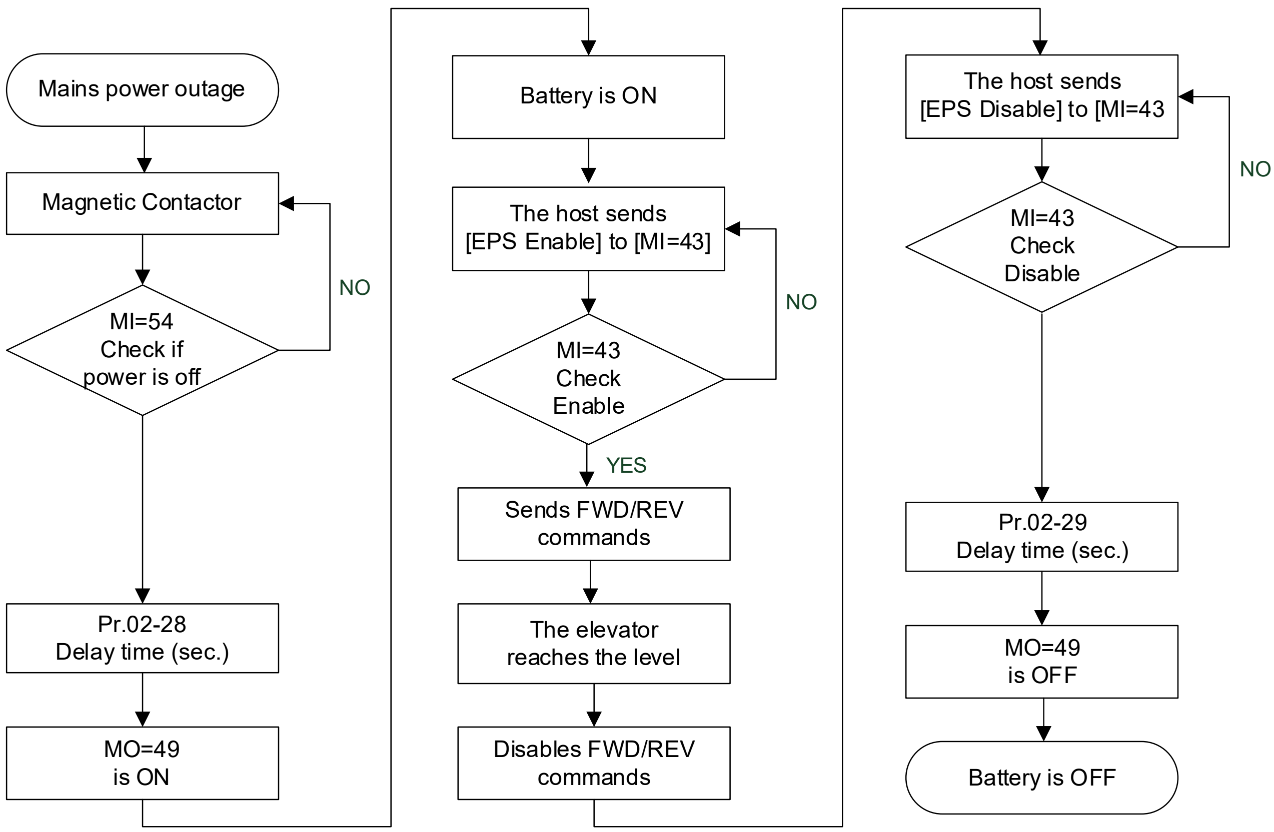


The steps to set ARD/UPS as EPS are as follows:

1. Set MI = 43 (EPS function)
2. Set Pr.02-20 = EPS mode selection
3. Set Pr.02-21 = Emergency power voltage running
4. Set Pr.02-22 = Emergency power capacity running
5. Set Pr.02-24 = Power generation direction search time
6. Set Pr.02-25 = Detecting level of power factor at the direction of power generation

NOTE: ARD or UPS can automatically judge whether to cut off the power or not.

EPS Flow Chart (ARD or UPS)



EPS Flow Chart (Battery)

The steps to set battery as EPS are as follows:

1. Set MI = 54 (Power failure signal)
2. Set MI = 43 (EPS function)
3. Set MO = 49 (Emergency power mode action)
4. Set Pr.02-20 = EPS mode selection
5. Set Pr.02-21 = Emergency power voltage running
6. Set Pr.02-22 = Emergency power capacity running
7. Set Pr.02-24 = Power generation direction search time
8. Set Pr.02-25 = Detecting level of power factor at the direction of power generation
9. Set Pr.02-28 = MO enables battery delay time
10. Set Pr.02-29 = MO disables battery delay time

NOTE: When using battery as EPS in an elevator system, auxiliary contact of the contactor should be used to judge whether to cut off the power and notify the drive.

Load Compensation (Pr.02-40–02-46)

02-40 Load Compensation Auto-tuning

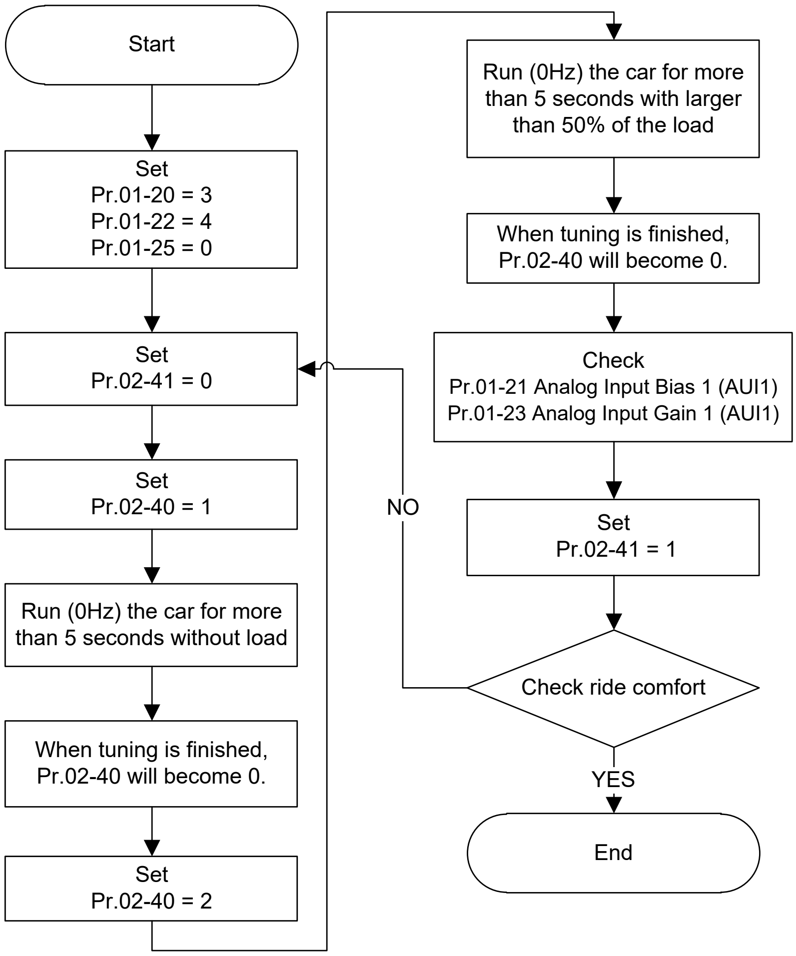
Control Mode VF SVC FOCPG FOCPM Default: 0

Settings 0: No function

1: Auto-tunes with running without load

2: Auto-tunes with running with load

- Use torque compensation function to avoid the roll-back generated by using IM to work with spiral gear.
- This function is only valid for AUI1.
- Auto-tuning process:



02-41 Torque Offset Source

Control Mode SVC FOCPG FOCPM Default: 0

Settings 0: Disable

1: Use the analog input (Pr.01-20)

2: Use the torque offset setting (Pr.02-46)

3: Use the external terminals (by Pr.02-43–Pr.02-45)

- Specifies the torque offset source.
- When set to 3, the torque offset sources are Pr.02-43, Pr.02-44 and Pr.02-45 according to the multi-function input terminal settings (31, 32 or 33).

Pr.01-00–Pr.01-07 is set to 31	Pr.01-00–Pr.01-07 is set to 32	Pr.01-00–Pr.01-07 is set to 33	Torque Offset
OFF	OFF	OFF	N/A
OFF	OFF	ON	Pr.02-45
OFF	ON	OFF	Pr.02-44
OFF	ON	ON	Pr.02-44 + Pr.02-45
ON	OFF	OFF	Pr.02-43
ON	OFF	ON	Pr.02-43 + Pr.02-45
ON	ON	OFF	Pr.02-43 + Pr.02-44
ON	ON	ON	Pr.02-43 + Pr.02-44 + Pr.02-45

✎ 02-42 Torque Command Source

Control Mode **SVC** **FOCPG** **FOCPM** Default: 2

Settings 0: KPC-CC1

1: RS-485 communication

2: Analog signal (Pr.01-20)

✎ 02-43 High Torque Offset

Control Mode **SVC** **FOCPG** **FOCPM** Default: 30.0

Settings -100.0–100.0% (motor drive rated torque)

✎ 02-44 Middle Torque Offset

Control Mode **SVC** **FOCPG** **FOCPM** Default: 20.0

Settings -100.0–100.0% (motor drive rated torque)

✎ 02-45 Low Torque Offset

Control Mode **SVC** **FOCPG** **FOCPM** Default: 10.0

Settings -100.0–100.0% (motor drive rated torque)

- When set to 3, the torque offset sources are Pr.02-43, Pr.02-44 and Pr.02-45 according to the multi-function input terminal settings (31, 32 or 33). The motor rated torque is 100%.

✎ 02-46 Torque Offset Setting

Control Mode **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings -100.0–100.0% (motor drive rated torque)

- Sets the torque offset. The motor rated torque is 100%.
- To remove the sound made at the moment of brake releasing due to brake clearance, set Pr.02-41=2 and Pr.02-46.

Direct Docking Terminal Function (Pr.02-52–02-55)

02-52 Limit for Direct Docking Terminal Function

Control Mode **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–10.00

📖 Sets the limit for changing from leveling speed to acceleration when using direct docking terminal function.

02-53 Deceleration Distance for Direct Docking Terminal Function

Control Mode **FOCPG** **FOCPM** Default: 30.00

Settings 0.00–100.00 cm

📖 Sets the distance between deceleration points.

02-55 Direct Docking Terminal Function Enabled

Control Mode **FOCPG** **FOCPM** Default: 0000h

Settings 0000h: Disabled
0002h: Direct docking terminal function enabled

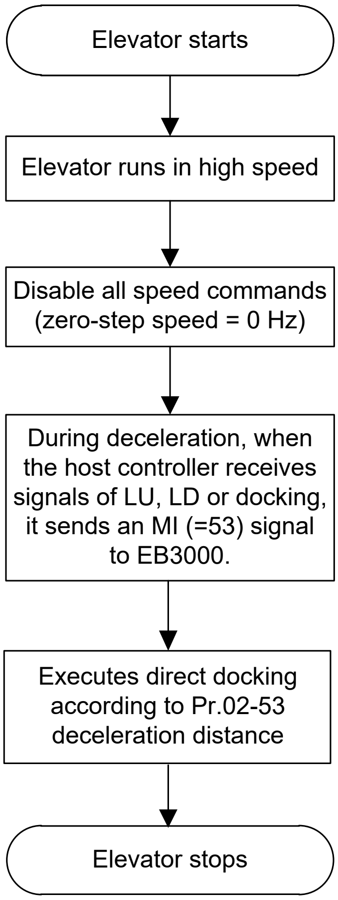
📖 Related parameters: Pr.01-00–Pr.01-07 multi-function input terminal (53: terminal leveling signal for direct docking).

📖 Direct docking terminal function:
When the elevator runs to the leveling area, controller sends a leveling signal to the drive to make the drive stop within effective distance (Pr.02-53). If deceleration distance is too short, the drive adjusts the speed according to the limit for acceleration change (Pr.02-52). Deceleration of direct docking terminal function is calculated through Pr.00-40.

There are two methods for sending leveling signals:

1. Using multi-function input terminals (MI = 53)
2. Deactivate MI1 and MI2 (Multi-step speed command 1 and 2).

Method 1: Direct docking terminal function (using MI terminal to input leveling signals)

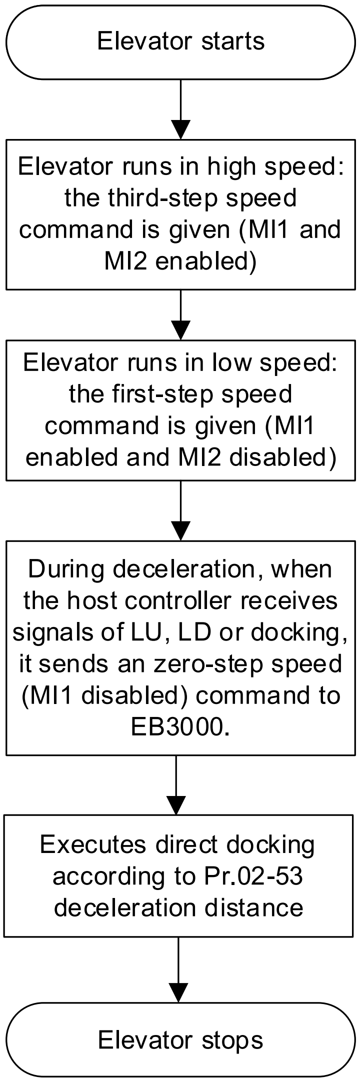


The steps to execute direct docking terminal function using multi-function input terminal (MI=53) are as follows:

1. The control mode should be in closed-loop. Set Pr.00-01 = 2 (FOCPG) or 3 (FOCPM).
2. Set Pr.00-02 = 3 (External digital input).
3. Set Pr.00-03 = 1 (External terminals).
4. Set Pr.00-50 = 0 (Zero-step speed frequency must be set to 0 Hz).
5. Increase Pr.00-72 appropriately in case the elevator stops while having not reached the leveling plate.
6. Set Pr.02-52 (Limit for Direct Docking Terminal Function). In normal condition, there is no need to adjust this parameter.
7. Set Pr.02-53 (Deceleration Distance for Direct Docking Terminal Function). Enter the length of leveling plate.
8. Set Pr.02-55 = 2 (Direct docking terminal function enabled).
9. Set multi-function input (MI) terminal to 53.
10. Set Pr.00-40 (Elevator speed). Deceleration speed for terminal function direct docking is calculated according to this parameter

NOTE: Before the terminal function direct docking is activated, all speed commands must be disabled (zero-step speed = 0 Hz).

Method 2: Direct docking terminal function (using multi-step speed change)



The steps to execute direct docking terminal function using deactivating multi-step speed command 1 and 2 (MI1 and MI2) are as follows:

1. The control mode should be in closed-loop. Set Pr.00-01 = 2 (FOCPG) or 3 (FOCPM).
2. Set Pr.00-02 = 3 (External digital input).
3. Set Pr.00-03 = 1 (External terminals).
4. Set Pr.00-50 = 0 (Zero-step speed frequency must be set to 0 Hz).
5. Set Pr.00-51 (First-step Speed Frequency).
6. Set Pr.00-53 (Third-step Speed Frequency).
7. Increase Pr.00-72 appropriately in case the elevator stops while having not reached the leveling plate.
8. Set Pr.02-52 (Limit for Direct Docking Terminal Function). In normal condition, there is no need to adjust this parameter.
9. Set Pr.02-53 (Deceleration Distance for Direct Docking Terminal Function). Enter the length of leveling plate.
10. Set Pr.02-55 = 2 (Direct docking terminal function enabled).
11. Set Pr.00-40 (Elevator speed). Deceleration speed for terminal function direct docking is calculated according to this parameter.

NOTE: Do NOT set multi-function (MI) terminal to 53.

Steel Rope Life Inspection (Pr.02-60–02-66)

02-60 Permanent Operation Direction Count (H)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

02-61 Permanent Operation Direction Count (L)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

02-62 Single Operation Direction Count (H)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

02-63 Single Operation Direction Count (L)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

02-64 Number of Times for Single Operation Reset

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

02-65 Number of Times for Operation Direction

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–200.00 k

02-66 Function Selection for Operation Times

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–2

- When you set Pr.02-66 to 0:
  Disable the operation direction count function and clear parameters (Pr.02-62, Pr.02-63, and Pr.02-65), and add one time to the number of times for single operation reset (Pr.02-64).
- When you set Pr.02-66 to 1:
  Enable the operation direction count function and add one time to the permanent operation direction count and single operation direction count whenever the operation direction changes. If the single operation direction count is larger than Pr.02-65, it displays a SERV warning and continues operation.
- When you set Pr.02-66 to 2:
  Enable the operation direction count function and add one time to the permanent operation direction count and single operation direction count whenever the operation direction changes. If the single operation direction count is larger than Pr.02-65, it displays a SERV fault and decelerates to stop.

Fault Output (Pr.02-70–02-74)

02-70 Fault Output Setting Method

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: According to settings in Pr.02-71–Pr.02-74

1: According to the binary setting

- This parameter is used with the settings 35–38 in Pr.01-10–Pr.01-15 (multi-function output). The fault output selections 1–4 correspond to bit 0–3.
- This parameter provides two setting methods for the fault output.

  0: Set according to the settings in Pr.02-71–Pr.02-74.

  1: Set according to the binary setting. Refer to the following example for details.

  Example:

  Assume that:

  Pr.01-10 (Multi-function output Relay 1) is set to 35 Fault output option 1 (Pr.02-71).

  Pr.01-11 (Multi-function output Relay 2) is set to 36 Fault output option 2 (Pr.02-72).

  Pr.01-12 (Multi-function output Relay 3) is set to 37 Fault output option 3 (Pr.02-73).

  Pr.01-13 (Multi-function output Relay 4) is set to 38 Fault output option 4 (Pr.02-74).

  Also assume that external fault outputs with the following signal: RLY1 = 1, RLY2 = 1, RLY3 = 0 and RLY4 = 1. The corresponding bit 3–0 is 1011.

bit 3	bit 2	bit 1	bit 0	Fault Code
-	-	-	-	0: No fault record
0	0	0	1	1: Over-current during acceleration (ocA)
				2: Over-current during deceleration (ocd)
				3: Over-current during constant speed (ocn)
				4: Ground fault (GFF)
				5: IGBT short-circuit (occ)
				6: Over-current at stop (ocS)
0	0	1	0	7: Over-voltage during acceleration (ovA)
				8: Over-voltage during deceleration (ovd)
				9: Over-voltage during constant speed (ovn)
				10: Over-voltage at stop (ovS)
0	0	1	1	11: Low voltage during acceleration (LvA)
				12: Low voltage during deceleration (Lvd)
				13: Low voltage during constant speed (Lvn)
				14: Low voltage at stop (LvS)
				15: Phase loss (PHL)
0	1	0	0	16: IGBT overheating fault (oH1)
				18: IGBT temperature detection failure (tH1o)
0	1	0	1	21: Overload (oL)
0	1	1	0	22: Electronic thermal relay 1 protection (EoL1)
				24: Motor over-heating PTC 2 (oH3_2)

bit 3	bit 2	bit 1	bit 0	Fault Code
0	1	1	1	26: Over-torque 1 (ot1)
1	0	0	0	30: FRAM writing error (cF1)
				31: FRAM read error (cF2)
				32: Current detection error (cd0)
				33: U-phase error (cd1)
				34: V-phase error (cd2)
				35: W-phase error (cd3)
				36: cc hardware failure (Hd0)
				37: oc hardware failure (Hd1)
				38: ov hardware failure (Hd2)
				39: GFF hardware failure (Hd3)
1	0	0	1	40: Auto-tuning error (AUE)
1	0	1	0	42: Opposite PG feedback direction (PGF1)
				43: PG feedback loss (PGF2)
0	1	1	1	44: PG feedback stall (PGF3)
1	0	1	0	45: PG slip error (PGF4)
1	0	1	1	49: External fault (EF)
				50: Emergency stop (EF1)
1	0	0	1	52: Password is locked (Pcod)
1	1	0	0	54: Communication error 1 (CE01)
				55: Communication error 2 (CE02)
				56: Communication error 3 (CE03)
				57: Communication error 4 (CE04)
				58: Communication error 10 (CE10)
				59: Digital keypad transmission time-out (CP10)
1	0	0	0	60: Brake transistor error (bF)
1	0	1	1	64: Mechanical brake feedback error (MbF)
1	0	0	0	65: PGSED communication error (PGF5)
1	0	1	1	66: Magnetic contactor error (MCF)
1	0	1	1	67: Motor phase loss (MPHL)
1	1	0	1	68: CAN Bus off (CAnF)
1	0	1	1	69: Rescue by mechanical brake control error (rbrE)
1	0	1	1	70: Safety gear release error (SFGE)
1	1	1	0	72: STO loss 1 (StL1)
1	0	0	0	73: PG cd wiring error (PGcd)
1	0	0	0	74: PG absolute signal error (PGHL)
1	0	0	0	75: PG Z-phase signal loss (PGAF)
1	1	1	0	76: Safe Torque Off function is enabled
1	1	1	0	77: STO loss 2 (StL2)

bit 3	bit 2	bit 1	bit 0	Fault Code
1	1	1	0	78: STO loss 3 (StL3)
0	0	0	1	85: Hardware brake over-current (Hocb)
0	0	0	1	86: Software brake over-current (Socb)
1	0	1	1	87: Brake resistor configuration error (brF)
1	0	1	1	88: Brake resistor is not connected (bro)
-	-	-	-	89: IGBT overload (oL3)
1	1	1	0	90: STO loss 4 (StL4)
1	1	1	0	91: STO loss 5 (StL5)
1	1	0	1	93: CANLift disconnection (CndL)
1	1	0	1	95: CANLift error (CnLF)
-	-	-	-	96: STO disconnection (Stod)
1	1	1	0	97: STO at running (Stor)
1	1	1	0	98: STO circuit sticking fault (StoS)
1	1	1	0	99: Ignore STO is ON (iSto)
-	-	-	-	100: Over ripple protection (orP)
0	1	1	0	105: Motor over-heating PTC 1 (oH3_1)

✓ 02-71 Fault Output Option 1
✓ 02-72 Fault Output Option 2
✓ 02-73 Fault Output Option 3
✓ 02-74 Fault Output Option 4

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–65535 sec. (refer to bit table for fault code)

📖 You can use these parameters with multi-function output (set Pr.01-10–Pr.01-15 to 35–38) for the specific requirement. When a fault occurs, the corresponding terminals are activated. You must convert binary value to decimal value when setting Pr.02-71–Pr.02-74.

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
0: No fault record							
1: Over-current during acceleration (ocA)	●						
2: Over-current during deceleration (ocd)	●						
3: Over-current during constant speed (ocn)	●						
4: Ground fault (GFF)						●	
5: IGBT short-circuit (occ)	●						
6: Over-current at stop (ocS)	●						
7: Over-voltage during acceleration (ovA)		●					
8: Over-voltage during deceleration (ovd)		●					
9: Over-voltage during constant speed (ovn)		●					
10: Over-voltage at stop (ovS)		●					
11: Low voltage during acceleration (LvA)		●					

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
12: Low voltage during deceleration (Lvd)		●					
13: Low voltage during constant speed (Lvn)		●					
14: Low voltage at stop (LvS)		●					
15: Phase loss (PHL)						●	
16: IGBT overheating fault (oH1)			●				
18: IGBT temperature detection failure (tH1o)			●				
21: Overload (oL)			●				
22: Electronic thermal relay 1 protection (EoL1)			●				
24: Motor over-heating PTC 2 (oH3_2)			●				
26: Over-torque 1 (ot1)			●				
30: FRAM writing error (cF1)				●			
31: FRAM read error (cF2)				●			
32: Current detection error (cd0)				●			
33: U-phase error (cd1)				●			
34: V-phase error (cd2)				●			
35: W-phase error (cd3)				●			
36: cc hardware failure (Hd0)				●			
37: oc hardware failure (Hd1)				●			
38: ov hardware failure (Hd2)				●			
39: GFF hardware failure (Hd3)				●			
40: Auto-tuning error (AUE)	●			●			
42: Opposite PG feedback direction (PGF1)					●		
43: PG feedback loss (PGF2)					●		
44: PG feedback stall (PGF3)					●		
45: PG slip error (PGF4)					●		
49: External fault (EF)						●	
50: Emergency stop (EF1)						●	
52: Password is locked (Pcod)				●			
54: Communication error 1 (CE01)							●
55: Communication error 2 (CE02)							●
56: Communication error 3 (CE03)							●
57: Communication error 4 (CE04)							●
58: Communication error 10 (CE10)							●
59: Digital keypad transmission time-out (CP10)							●
60: Brake transistor error (bF)						●	
64: Mechanical brake feedback error (MbF)						●	
65: PGSED communication error (PGF5)				●			
66: Magnetic contactor error (MCF)						●	

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
67: Motor phase loss (MPHL)						●	
68: CAN Bus off (CAnF)							●
69: Rescue by mechanical brake control error (rbrE)				●			
70: Safety gear release error (SFGE)				●			
72: STO loss 1 (StL1)				●			
73: PG cd wiring error (PGcd)					●		
74: PG absolute signal error (PGHL)					●		
75: PG Z-phase signal loss (PGAF)					●		
76: Safe Torque Off function is enabled (Stoo)							
77: STO loss 2 (StL2)				●			
78: STO loss 3 (StL3)				●			
85: Hardware brake over-current (Hocb)				●			
86: Software brake over-current (Socb)				●			
87: Brake resistor configuration error (brF)						●	
88: Brake resistor is not connected (bro)						●	
89: IGBT overload (oL3)							
90: STO loss 4 (StL4)					●		
91: STO loss 5 (StL5)					●		
93: CANLift disconnection (CndL)							●
95: CANLift error (CnLF)							●
96: STO disconnection (Stod)							
97: STO at running (Stor)						●	
98: STO circuit sticking fault (StoS)						●	
99: Ignore STO is ON (iSto)						●	
100: Over ripple protection (orP)							
105: Motor over-heating PTC 1 (oH3_1)			●				

Dwell (Pr.02-80–02-83)

✓ 02-80 Dwell Time at Acceleration

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–600.00 sec.

✓ 02-81 Dwell Frequency at Acceleration

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

✓ 02-82 Dwell Time at Deceleration

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.00

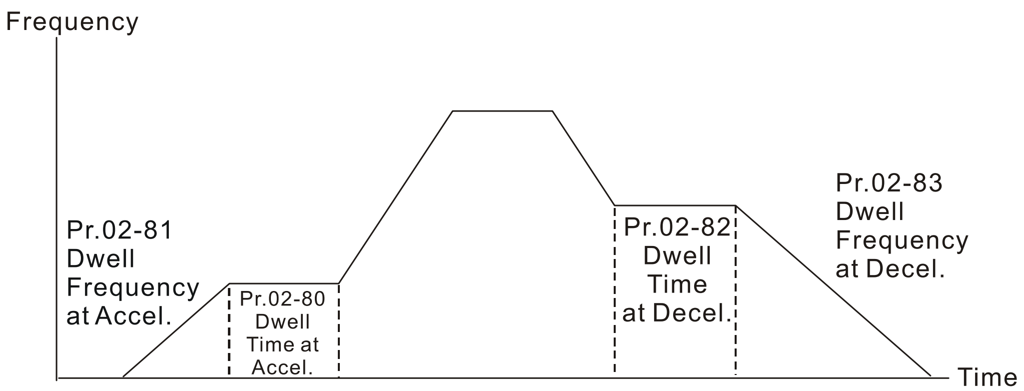
Settings 0.00–600.00 sec.

✓ 02-83 Dwell Frequency at Deceleration

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

- In a heavy load situation, dwelling can temporarily stabilize the output frequency.
- Use Pr.02-80–Pr.02-83 with heavy load to prevent over-voltage or over-current.



Dwell at acceleration / deceleration

03 Comfort Adjustment Parameters

03 Comfort Adjustment Parameters

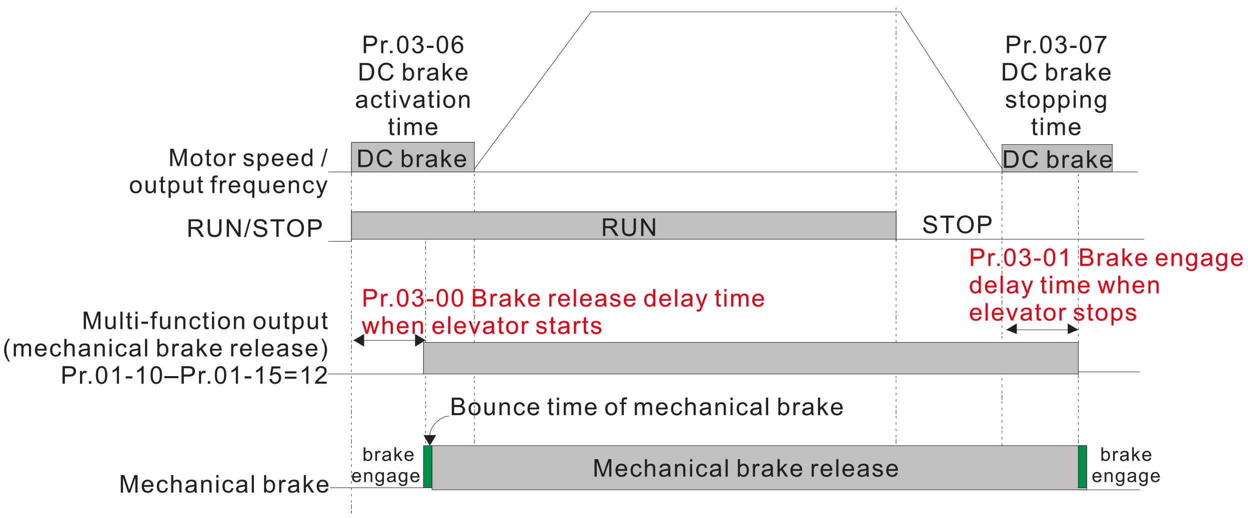
✔: You can set this parameter during operation.

Delay Time (Pr.03-00–03-07)

03-00	Brake Release Delay Time when Elevator Starts				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 0.250
	Settings	0.000–65.000 sec.			

03-01	Brake Engage Delay Time when Elevator Stops				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 0.250
	Settings	0.000–65.000 sec.			

- When the AC motor drive runs and after the delay time in Pr.03-00, the corresponding multi-function output terminal (12: mechanical brake release) is ON.
- When the AC motor drive stops and after the delay time in Pr.03-01, the corresponding multi-function output terminal (12: mechanical brake release) is OFF.
- Use this function with the DC brake function.



✔ **03-02**	Magnetic Contactor Contracting Delay Time between Drive and Motor				
✔ **03-03**	Magnetic Contactor Release Delay Time between Drive and Motor				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 0.200
	Settings	0.010–65.000 sec.			

- After running, use these parameters with multifunction input terminal setting 40 (Enable drive function), and multifunction output terminal setting 15 (motor-controlled magnetic contactor output). When the multifunction output terminals are ON, the drive starts outputting after the delay time in Pr.03-02. When the drive stops outputting, multifunction output terminals release after the delay time in Pr.03-03.

✔ **03-04**	MPSCC (Motor Phase Short Circuit Contactor) Release Delay Time between Drive and Motor				
✔ **03-05**	MPSCC (Motor Phase Short Circuit Contactor) Contracting Delay Time between Drive and Motor				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 0.200
	Settings	0.010–65.000 sec.			

03-06 DC Brake Activation Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.7

Settings 0.0–60.0 sec.

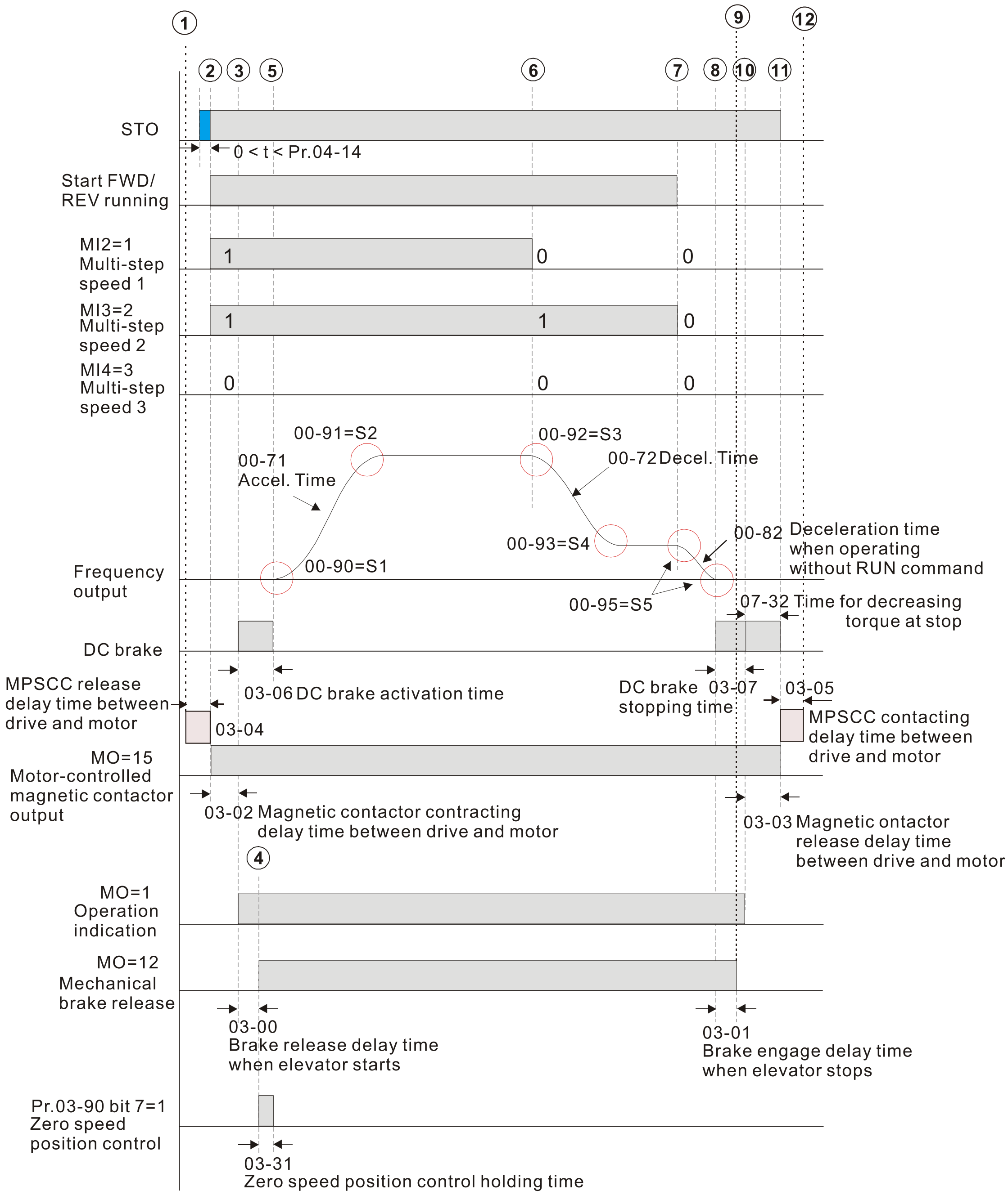
Sets the length of time that the DC brake current is supplied to motor when activating the drive.

03-07 DC Brake Stopping Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.7

Settings 0.0–60.0 sec.

Sets the length of time that the DC brake current is supplied to motor when stopping the drive.



1. Elevator starts running
2. MPSCC release
3. Magnetic contactor is ON
4. Mechanical brake release
5. End of <DC brake at start-up>
6. Start of deceleration
7. End of creeping
8. Start of <DC brake at stop>
9. Brake release engage
10. End of <DC brake at stop>
11. Magnetic contactor release
12. MPSCC contacting (motor release)

<u>Elevator Timing Diagram</u>

Ride Adjustment (Pr.03-10–03-24)

03-10 Mechanical Inertia Estimation Reference Value

Control Mode FOCPG FOCPM Default: Read only

📖 Shows the reference value (%) of inertial ratio (Pr.03-11) after inertial tuning.

03-11 Mechanical Inertial Ratio

Control Mode FOCPG FOCPM Default: 40

Settings 1–300%

📖 You can calculate the load inertia according to the settings of motor parameters, Pr.00-45 Motor Current at Acceleration and Pr.00-46 Carriage Acceleration. You can use this parameter to adjust the mechanical inertia ratio.

📖 Mechanical inertia reference value (%):

Load / Motor	IM	PM
Without load	40	10
With load	80–120	40 (Suspension Ration 1:1), 20 (Suspension Ration 2:1)

03-12 Zero Speed Bandwidth

Control Mode FOCPG FOCPM Default: 10

Settings 1–40 Hz

03-13 Low Speed Bandwidth

Control Mode FOCPG FOCPM Default: 10

Settings 1–40 Hz

03-14 High Speed Bandwidth

Control Mode FOCPG FOCPM Default: 10

Settings 1–40 Hz

📖 After estimating the inertia and setting Pr.03-90 =1 (auto-tuning), you can adjust parameters Pr.03-12, Pr.03-13 and Pr.03-14 separately by speed response. The larger the value, the faster the response. Pr.03-91 is the switch frequency between the low speed and high speed bandwidth.

03-15 Zero Speed Parking Bandwidth

Control Mode FOCPG FOCPM Default: 10

Settings 1–40 Hz

03-16 ASR (Auto Speed Regulation) Control (P) of Zero Speed

Control Mode VF SVC FOCPG FOCPM Default: 100.0

Settings 0.0–1000.0%

03-17 ASR (Auto Speed Regulation) Control (I) of Zero Speed

Control Mode VF SVC FOCPG FOCPM Default: 0.100

Settings 0.000–10.000 sec.

✓ 03-18 ASR (Auto Speed Regulation) Control (P) 1

Control Mode **VF SVC FOCPG FOCPM** Default: 100.0

Settings 0.0–1000.0%

✓ 03-19 ASR (Auto Speed Regulation) Control (I) 1

Control Mode **VF SVC FOCPG FOCPM** Default: 0.100

Settings 0.000–10.000 sec.

✓ 03-20 ASR (Auto Speed Regulation) Control (P) 2

Control Mode **VF SVC FOCPG FOCPM** Default: 100.0

Settings 0.0–1000.0%

- ASR P determines the proportional control and associated gain (P). ASR I determines the integral control and associated gain (I).
- See Pr.03-91 for details.

✓ 03-21 ASR (Auto Speed Regulation) Control (I) 2

Control Mode **VF SVC FOCPG FOCPM** Default: 0.100

Settings 0.000–10.000 sec.

✓ 03-22 Elevator Leveling (Zero Speed Gain P)

Control Mode **VF SVC FOCPG FOCPM** Default: 100.0

Settings 0.0–1000.0%

✓ 03-23 Elevator Leveling (Zero Speed Integral I)

Control Mode **VF SVC FOCPG FOCPM** Default: 0.100

Settings 0.000–10.000 sec.

✓ 03-24 ASR Primary Low Pass Filter Gain

Control Mode **FOCPG FOCPM** Default: 0.008

Settings 0.001–0.350 sec.

- Defines the ASR command filter time.
- When Pr.03-90 is set to 1 ASR auto-tuning, Pr.03-24 is invalid.

Zero-speed Position Control (PPI) Adjustment (Pr.03-30–03-35)

✓ 03-30 Zero Speed Position Control (PPI) Gain (P)

Control Mode **FOCPM** Default: 10.00

Settings 0.00–655.00%

📖 When Pr.03-90 is set to bit 7=1, Pr.03-30 is valid.

✓ 03-31 Zero Speed Position Control (PPI) Holding Time

Control Mode **FOCPM** Default: 0.250

Settings 0.000–65.535 sec.

📖 When Pr.03-90 is set to bit 7=1, Pr.03-31 is valid.

📖 Sets this parameter when elevator jerk at start-up or carriage inversion occurs. In principle, the holding time cannot exceed the time when frequency starts output.

✓ 03-32 Zero Speed Position Control (PPI) Low Pass Filter Time

Control Mode **FOCPM** Default: 0.004

Settings 0.000–65.535 sec.

✓ 03-33 Zero Speed Position Control (PPI) Activation Mode Selection

Control Mode **FOCPM** Default: 0

Settings 0: After the brake release set in Pr.03-00

1: After the brake signal input (Pr.01-00–Pr.01-07 is set to 42)

📖 When Pr.03-33 = 0, use the zero speed position control (PPI) with Pr.03-00 (see Pr.03-03 for detailed descriptions).

✓ 03-34 Elevator Starting (Zero Speed Gain P)

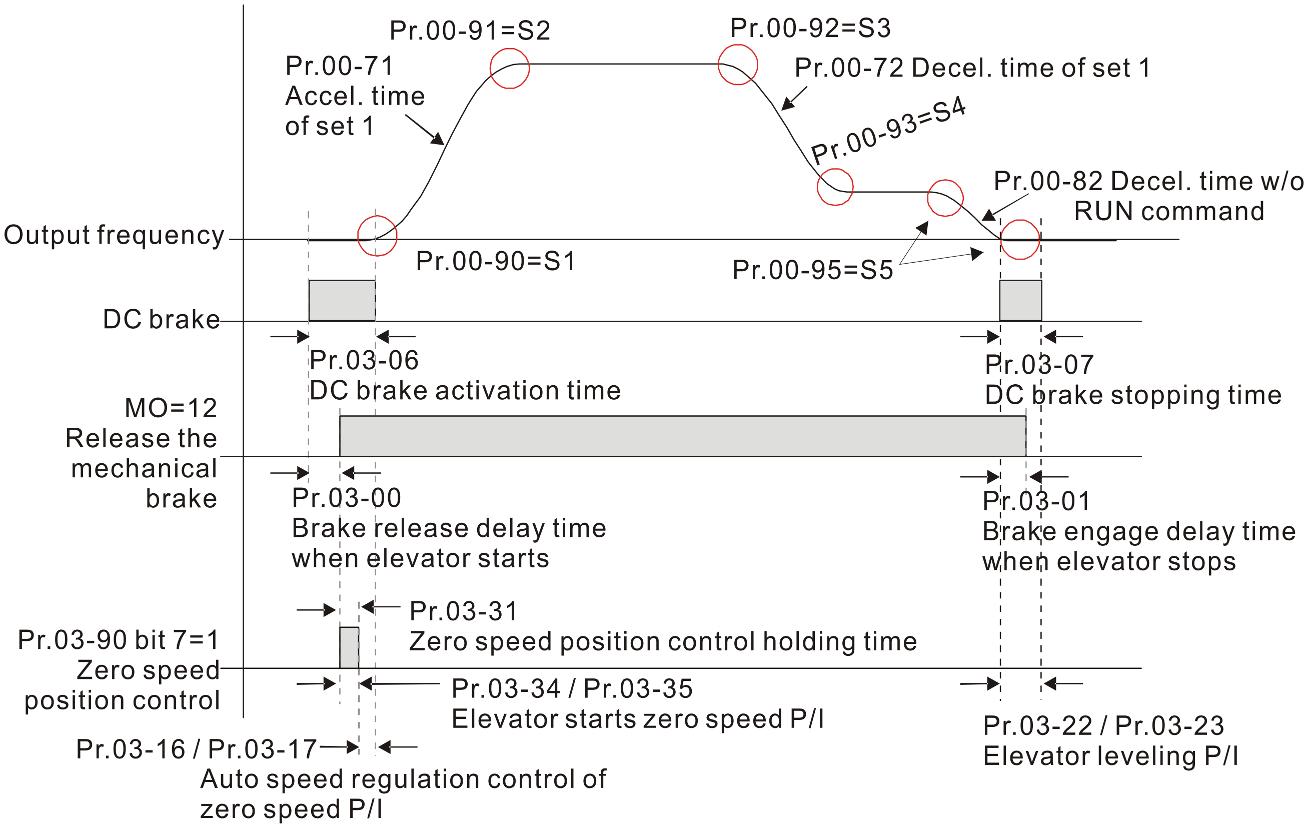
Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 100.0

Settings 0.0–1000.0%

✓ 03-35 Elevator Starting (Zero Speed Integral I)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.100

Settings 0.000–10.000 sec.


Pr.00-91=S2
Pr.00-92=S3
Pr.00-71
Accel. time
of set 1
Pr.00-72 Decel. time of set 1
Pr.00-93=S4
Pr.00-82 Decel. time w/o
RUN command
Output frequency
Pr.00-90=S1
Pr.00-95=S5
DC brake
Pr.03-06
DC brake activation time
Pr.03-07
DC brake stopping time
MO=12
Release the
mechanical
brake
Pr.03-00
Brake release delay time
when elevator starts
Pr.03-01
Brake engage delay time
when elevator stops
Pr.03-31
Zero speed position control holding time
Pr.03-90 bit 7=1
Zero speed
position control
Pr.03-34 / Pr.03-35
Elevator starts zero speed P/I
Pr.03-22 / Pr.03-23
Elevator leveling P/I
Pr.03-16 / Pr.03-17
Auto speed regulation control of
zero speed P/I

V/F Curve (Pr.03-50–03-57)

03-50 Maximum Output Frequency

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 60.00 / 50.00

Settings 5.00–400.00 Hz

📖 Determines the AC motor drive's Maximum Output Frequency. All the AC motor drive frequency command sources (analog inputs -10–10 V) are scaled to correspond to the output frequency range.

03-51 Second Output Frequency Setting

Control Mode **VF** **SVC** Default: 0.50

Settings 0.00–400.00 Hz

✎ 03-52 Second Output Voltage Setting

Control Mode **VF** **SVC** Default: 5.0 / 10.0

Settings 230V models: 0.0–255.0 V

460V models: 0.0–510.0 V

03-53 Third Output Frequency Setting

Control Mode **VF** **SVC** Default: 0.50

Settings 0.00–400.00 Hz

✎ 03-54 Third Output Voltage Setting

Control Mode **VF** **SVC** Default: 5.0 / 10.0

Settings 230V models: 0.0–255.0 V

460V models: 0.0–510.0 V

03-55 Fourth Output Frequency Setting

Control Mode **VF** **SVC** **FOCPG** Default: 0.00

Settings 0.00–400.00 Hz

✎ 03-56 Fourth Output Voltage Setting

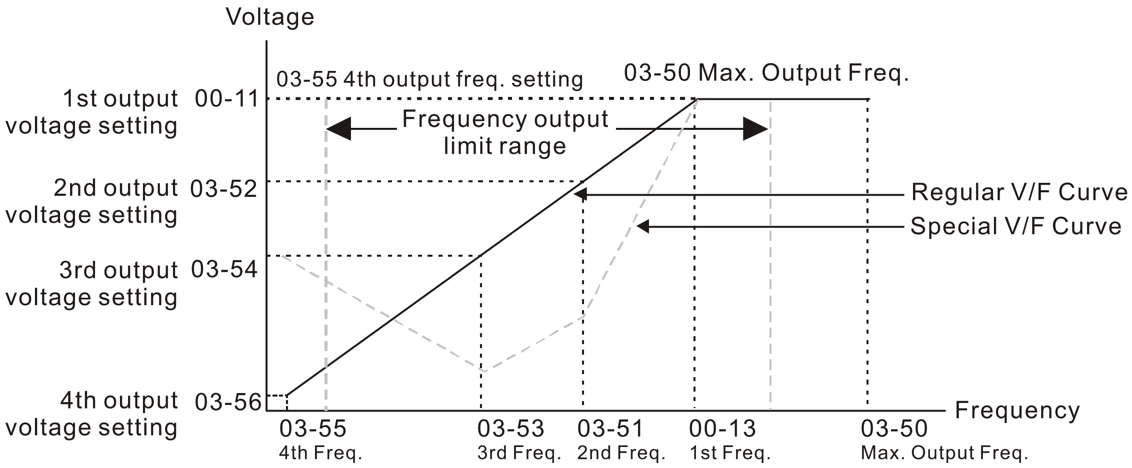
Control Mode **VF** **SVC** Default: 5.0 / 10.0

Settings 230V models: 0.0–255.0 V

460V models: 0.0–510.0 V

📖 You usually set the V/F curve according to the motor's allowable loading characteristics. Pay special attention to the motor's heat dissipation, dynamic balance, and bearing lubrication when the loading characteristics exceed the loading limit of the motor.

📖 The frequency setting of V/F curve must be set according to this rule: Pr.00-13 ≥ Pr.03-51 ≥ Pr.03-53 ≥ Pr.03-55. There is no limit for the voltage setting, but a high voltage at low frequency may cause motor burnout, overheating, and trigger stall prevention or over-current protection. Use low voltages at low frequencies to prevent motor damage or drive malfunction.



V/F Curve

03-57 Mode Selection when Frequency < Fmin

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1

Settings 0: Output Waiting

1: Zero-speed operation

2: Fmin (Fourth output frequency setting)

- The AC motor drive uses this parameter when it is at 0 Hz.
- 1 or 2: The voltage outputs according to the output voltage command corresponding to Fmin (Pr.03-56).

DC Brake Level (Pr.03-60–03-63)

03-60 DC Brake Current Level at Start-up

Control Mode **VF** **SVC** Default: 0

Settings 0–100% of the rated current of the motor drive

- Sets the level of the DC brake current output to the motor at start-up. When setting the DC brake current, the rated current (Pr.07-01) is 100%. It is recommended that you start with a low DC brake current level and then increase until you reach the proper holding torque. However, the DC brake current cannot exceed the motor’s rated current to prevent the motor from burnout. Therefore, DO NOT use the DC brake for mechanical retention, otherwise injury or accident may occur.
- When in FOCPG/FOCPM mode, you can enable the DC brake function without setting up this parameter.

03-61 DC Brake Current Level at Stop

Control Mode **VF** **SVC** Default: 0

Settings 0–100% of the rated current of the motor drive

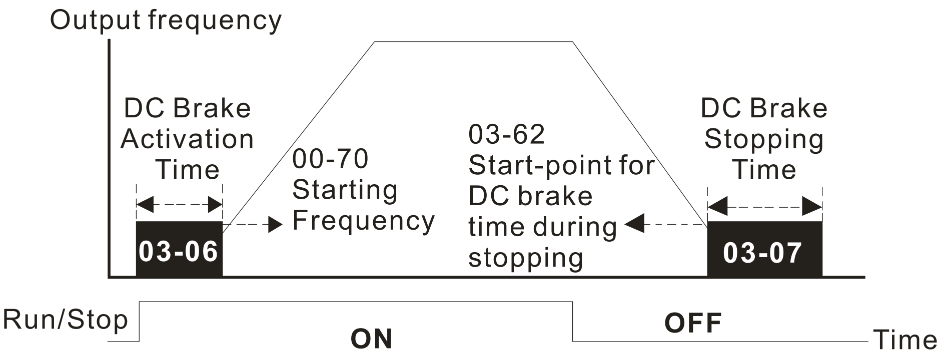
- Sets the level of the DC brake current output to the motor at stop. When setting the DC brake current, the rated current (Pr.07-01) is 100%. It is recommended that you start with a low DC brake current level and then increase until you reach the proper holding torque. However, the DC brake current cannot exceed the motor’s rated current to prevent the motor from burnout. Therefore, DO NOT use the DC brake for mechanical retention, otherwise injury or accident may occur.
- When in FOCPG/FOCPM control mode, you can enable the DC brake without setting up Pr.03-61.

03-62 Start-point for DC Brake

Control Mode **VF** **SVC** **FOCPG** Default: 0.00

Settings 0.00–400.00 Hz

- Determines the frequency at which the DC brake begins during deceleration. When the setting is less than the start frequency (Pr.00-70), the start-point for the DC brake begins at the minimum frequency.



DC Brake Time

✎ 03-63 DC Brake Proportional Gain

Control Mode	**VF**	**SVC**	Default: 50
	Settings	1–500	

📖 Sets the output voltage gain when DC braking.

Slip Compensation (Pr.03-70–03-76)

03-70 Regenerative Slip Compensation Ratio %

Control Mode VF Default: 1.0

Settings 0.0–100.0%

- Determines the largest gain in power generation mode and electricity mode.

03-71 Slip Compensation Switch Gap %

Control Mode VF Default: 5.0

Settings 0.0–100.0%

- Adjusts the gap of air power switched from power generation mode and electricity mode. Mainly used to make slip compensation smoother while switching between electricity mode and power generation mode.

03-73 Torque Compensation Gain

Control Mode VF SVC Default: 0.00

Settings 0.00–100.00

- You can set this parameter so that the AC motor drive increases its voltage output for a higher torque.

03-74 Torque Compensation Low Pass Filter Time

Control Mode VF SVC Default: 0.020

Settings 0.001–10.000 sec.

03-75 Slip Compensation Gain

Control Mode VF SVC Default: 0

Settings 0.00–10.00

- When the motor drive controls an asynchronous motor, the load and slip increase. Use this parameter to correct the frequency and lower the slip to make the motor run near the synchronous speed under the rated current. When the output current is larger than the motor no-load current, the drive compensates the frequency according to the Pr.03-75 setting. If the actual speed is slower than the expected speed, increase the setting and vice versa.
- This is only valid in SVC mode.

03-76 Slip Compensation Low Pass Filter Time

Control Mode VF SVC Default: 0.500

Settings 0.001–10.000 sec.

- Setting Pr.03-74 and Pr.03-76 changes the response time for the compensation.
- When you set Pr.03-74 and Pr.03-76 to 10 seconds, it maximizes the response time for the compensation. If the settings are too low, the system may become unstable.

Speed Gain (Pr.03-80–03-84)

✎ 03-80 Hunting Gain

Control Mode **VF** **SVC** Default: 2.50

Settings 0.00–10.00

0: Disable

📖 The motor has current wave motion under some specific conditions. You can improve this situation by setting this parameter. You can set it to 0 for current wave motion in the high frequency range or when running with PG. When the current wave motion happens in the low frequency range, increase Pr.03-80.

✎ 03-83 PDFF Gain Value

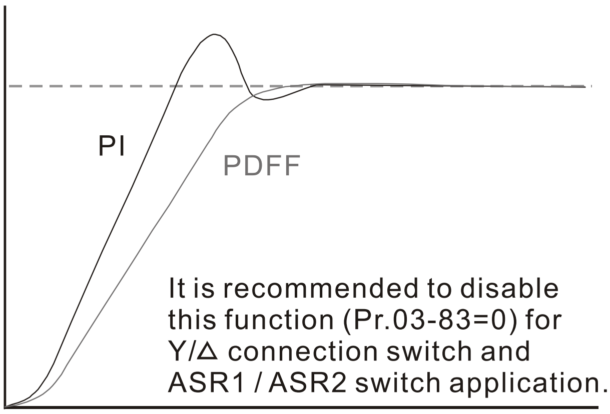
Control Mode **FOCPG** **FOCPM** Default: 30

Settings 0–200%

📖 After you estimate and set Pr.03-90=1 (auto-tuning), use Pr.03-83 / Pr.03-84 to reduce overshoot. Adjust the PDFF gain value according to the actual situation.

📖 In addition to traditional PI control, it also provides the PDFF function to reduce overshoot for speed control.

1. Get system inertia
2. Set Pr.03-90 to 1
3. Adjust Pr.03-83 and Pr.03-84 (a larger value suppresses overshoot better). Adjust according to the actual condition.



✎ 03-84 Speed Feed Forward Gain

Control Mode **FOCPG** Default: 0

Settings 0–500

📖 Pr.03-83 and Pr.03-84 are enabled when Pr.03-90 is set to bit 0 = 1.

System Control (Pr.03-90–03-95)

03-90 System Control

Control Mode FOCPG FOCPM Default: 281h

Settings bit 0 = 0: No function

bit 0 = 1: ASR auto-tuning; PDFF enabled

bit 7 = 0: No function

bit 7 = 1: Zero speed position control is enabled

bit 9 = 0: Dynamic PG origin auto-tuning with load (supported by PGHH-1, PGSED-x)

bit 9 = 1: Static PG origin auto-tuning with load by enabling PGHH-1, PGSED-x

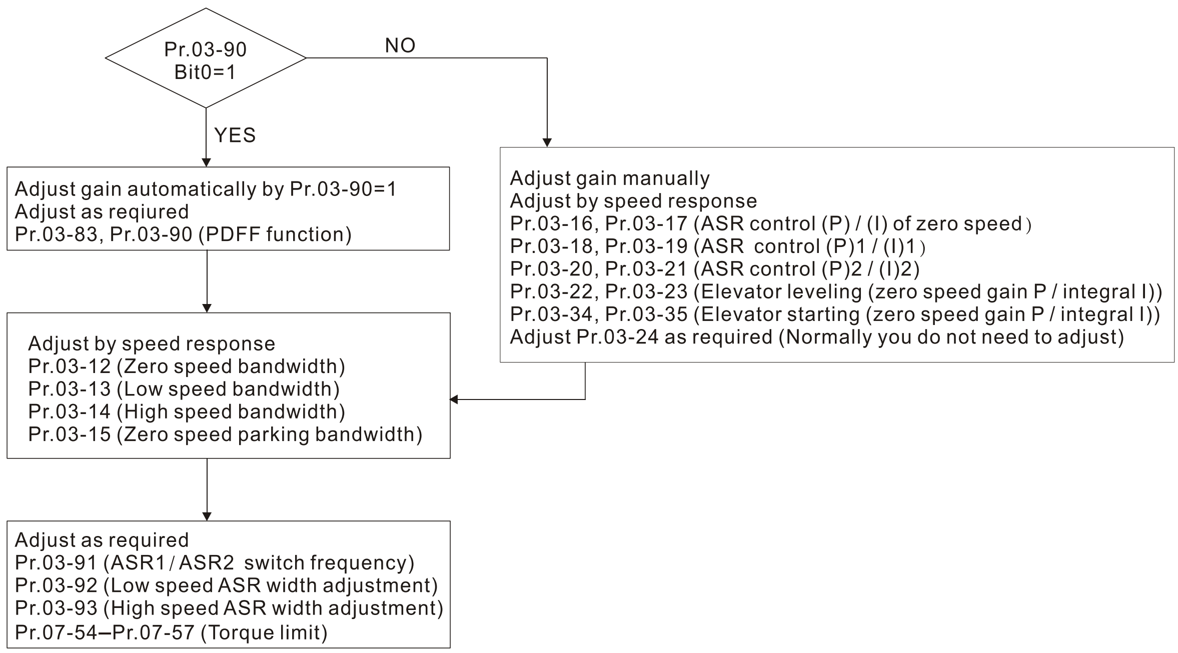
bit 15 = 0: When power is applied, detect the position of the magnetic pole again

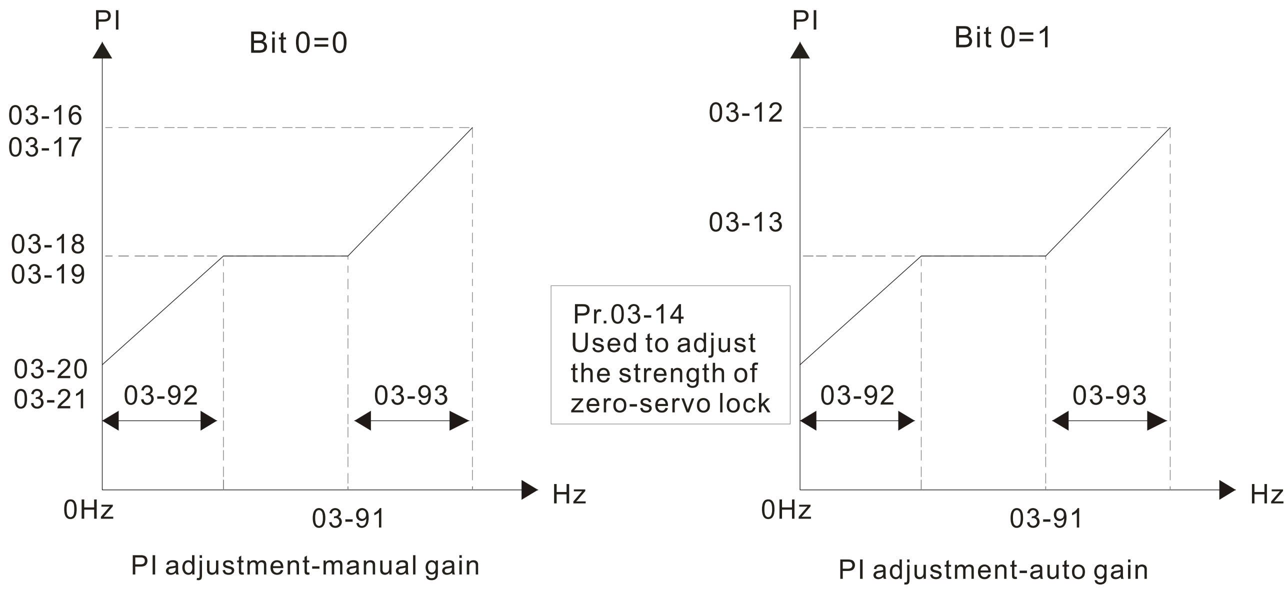
bit 15 = 1: When power is applied, start from the magnetic pole position of the previous power failure

📖 The table below shows the function of different settings.

bit	bit15		bit9		bit7		bit0	
Setting	1	0	1	0	1	0	1	0
Function	When power is applied, start from magnetic pole position of the previous power failure.	When power is applied, detect the position of magnetic pole again.	Static PG origin auto-tuning with load by enabling PGHH-1, PGSED-x	Dynamic PG origin auto-tuning with load (supported by PGHH-1, PGSED-x)	Zero speed position control enabled	No function	ASR auto-tuning; PDFF enabled	No function

📖 bit 0 = 1: Enable the PDFF function and the system generates an ASR setting. At this time, Pr.03-16–Pr.03-21 are invalid and Pr.03-83–Pr.03-84 are valid.





- When Bit 7 = 1, zero speed position control is enabled (refer to Parameter Group 03 Elevator Timing Diagram in Chapter 8). Pr.03-31 is valid only when bit 7 is set to 1, and this function only supports PM motors.
- When Bit 9 = 1, valid only when Pr.03-90 is set to 3, and the mechanical brake must be in engaged status.

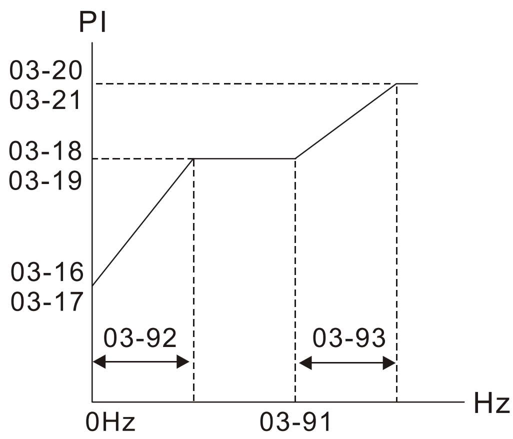
03-91 ASR 1/ASR2 Switch Frequency

Control Mode FOCPG FOCPM Default: 7.00

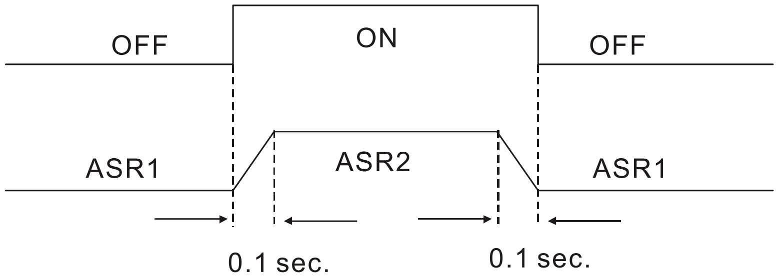
Settings 0.00–400.00 Hz

0: Disable

- ASR P determines the proportional control and associated gain (P). ASR I determines the integral control and associated gain (I).
- When you set the integral time to 0, it is disabled. Pr.03-91 defines the switch frequency for the ASR1 (Pr.03-18, Pr.03-19) and ASR2 (Pr.03-20, Pr.03-21).



- When using multi-function input terminals to switch ASR1/ASR2, the following diagram shows the operation.



Setting MI=17 ASR1 / ASR2 switch

03-92 Low Speed ASR Width Adjustment

Control Mode **FOCPG** **FOCPM** Default: 5.00

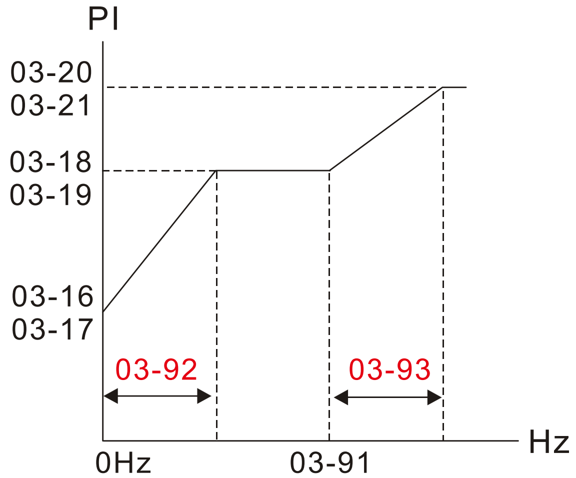
Settings 0.00–400.00 Hz

03-93 High Speed ASR Width Adjustment

Control Mode **FOCPG** **FOCPM** Default: 5.00

Settings 0.00–400.00 Hz

📖 These two parameters set the width of the slope of the ASR command during zero speed to low speed or Pr.03-91 to high speed.



03-94 ASR Feed Forward

Control Mode **FOCPG** **FOCPM** Default: 65

Settings 10–150

📖 Controls the speed in the flux weakening area. The larger the value in Pr.03-94, the faster the acceleration/deceleration. In general, you do not need to adjust this parameter.

03-95 Core Loss Compensation

Control Mode **SVC** Default: 10

Settings 0–250%

04 Protection Parameters

04 Protection Parameters

✎: You can set this parameter during operation.

Fault Retry (Pr.04-00–04-04)

✎ 04-01 Fault and Warning Action

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0000h

Settings bit 0 = 0: Display Lv fault and coast to stop
bit 0 = 1: Display Lv warn and coast to stop
bit 2 = 0: Software GFF protection enabled
bit 2 = 1: Software GFF protection disabled

📖 The table below shows the function of different settings.

bit	bit2		bit0	
Setting	1	0	1	0
Function	Software GFF protection disabled	Software GFF protection enabled	Display Lv warn and coast to stop	Display Lv fault and coast to stop

✎ 04-02 Number of Times to Retry after Fault

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–10 times

📖 To determine the number of times to retry when the following faults occur:
7: Over-voltage during acceleration (ovA)
8: Over-voltage during deceleration (ovd)
9: Over-voltage during constant speed (ovn)
10: Over-voltage at stop (ovS)
11: Low voltage during acceleration (LvA)
12: Low voltage during deceleration (Lvd)
13: Low voltage during constant speed (Lvn)
14: Low voltage at stop (LvS)
15: Phase loss (PHL)

📖 After every retry attempt, the number of times to retry is automatically reduced by one as displayed on the keypad.

📖 The principles for the number of times to reset:
1. Reset the fault manually.
2. After running normally for 10 minutes, the motor drive returns to previous settings.
3. The motor drive is powered on and powered off again.

📖 When the fault is attempted to be automatically cleared by system and if multi-function output (MO) is set to 46, then, at this time, MO will be activated. This is used to inform the host controller that the drive is currently clearing the fault automatically.

04-03 Time Interval between Retries

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 10.0

Settings 0.5–600.0 sec.

Determines the time interval between retries when the following faults occur:

7: Over-voltage during acceleration (ovA)

8: Over-voltage during deceleration (ovd)

9: Over-voltage during constant speed (ovn)

10: Over-voltage at stop (ovS)

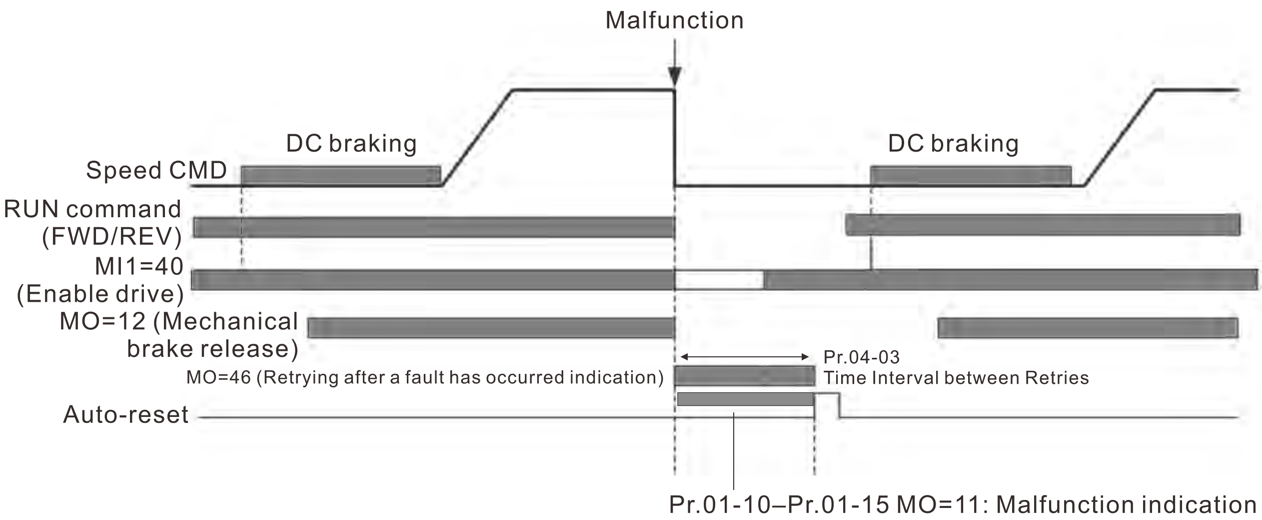
11: Low voltage during acceleration (LvA)

12: Low voltage during deceleration (Lvd)

13: Low voltage during constant speed (Lvn)

14: Low voltage at stop (LvS)

15: Phase loss (PHL)



04-04 Output of MO Terminal when Retrying after Fault

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Output

1: No output

Determines whether to display the fault indication when the following faults occur:

7: Over-voltage during acceleration (ovA)

8: Over-voltage during deceleration (ovd)

9: Over-voltage during constant speed (ovn)

10: Over-voltage at stop (ovS)

11: Low voltage during acceleration (LvA)

12: Low voltage during deceleration (Lvd)

13: Low voltage during constant speed (Lvn)

14: Low voltage at stop (LvS)

15: Phase loss (PHL)

Two MO terminals are affected by this parameter and should be set up as:

MO = 10: Low voltage waning (LV)

MO = 11: Fault Indication

Safe Torque Off (STO) (Pr.04-10–04-15)

04-10 STO Function Selection

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 4

Settings
0: STO fault latched, resending RUN command is required
1: STO warning latched, resending RUN command is required
2: STO fault latched
3: STO warning unlatched
4: Elevator Stop timing, does not detect STO sticking
5: Elevator Stop timing, Stoc warning occurs when STO sticks
6: Elevator Stop timing, StoS fault occurs when STO sticks (fault can be cleared manually)
7: Elevator Stop timing, StL4 fault occurs when STO sticks (fault cannot be cleared and must be powered-on again)

- Pr.04-10=0: STO fault latched, resending RUN command is required. If STO is ON in any condition and a fault occurs, it does not reset until STO is back to normal and use a RESET command or power-on again after resending the RUN command.
- Pr.04-10=1: STO warning latched, resending RUN command is required. If STO is ON in any condition and a warning occurs, it does not reset until STO is back to normal and resend the RUN command.
- Pr.04-10=2: STO fault latched. If STO is ON in any condition and a fault occurs, it does not reset until STO is back to normal and use a RESET command or power-on again.
- Pr.04-10=3: STO warning unlatched. If STO is ON in any condition and a warning occurs, it automatically resets when STO is back to normal.
- Pr.04-10=4 / 5 / 6 / 7: When FWD/REV command is ON and STO circuit is OFF for more than 10 ms, and when Pr.00-03=1 and Pr.04-13=1, STO will be OFF and then Stob warning occurs. When FWD/REV command is OFF and STO circuit is ON, Stob warning will be automatically cleared. Once Stob warning is cleared, the drive starts to run when FWD/REV command and STO circuit are both ON. When Pr.00-03=2 / 3 / 6 and Pr.04-13=1, Stod fault occurs. Stod fault can be reset only when RUN command is removed. If there is no warning or fault that specifically requires to give RUN command again, the drive normally will start to run when FWD/REV command and STO circuit are both ON after warning/fault is cleared.
- Pr.04-10=4 / 5 / 6 / 7: If STO circuit is OFF while drive outputs, STO circuit will be OFF in advance and then Stor fault occurs. This fault will be automatically cleared after 5 seconds.
- STO function selection comparison table:

04-10 (STO Function Selection)	STL1 Fault	STL2 Fault	STL3 Fault	STL5 Fault	Stoo Fault	StoA Warning	Stoc Warning	StoS Fault	STL4 Fault	Stor Fault	Stod Fault (Pr.04-13=0)	Stob Warning (Pr.04-13=1)
	Hardware failure			24-hour sticking	STO circuit OFF		STO circuit sticks. Must cycle the power to clear the fault (STL4).			STO circuit is OFF during drive output	STO circuit should be ON but is not ON	
0	✓	✓	✓	✓[*1]	✓							
1	✓	✓	✓	✓[*1]		✓						
2	✓	✓	✓	✓[*1]	✓							

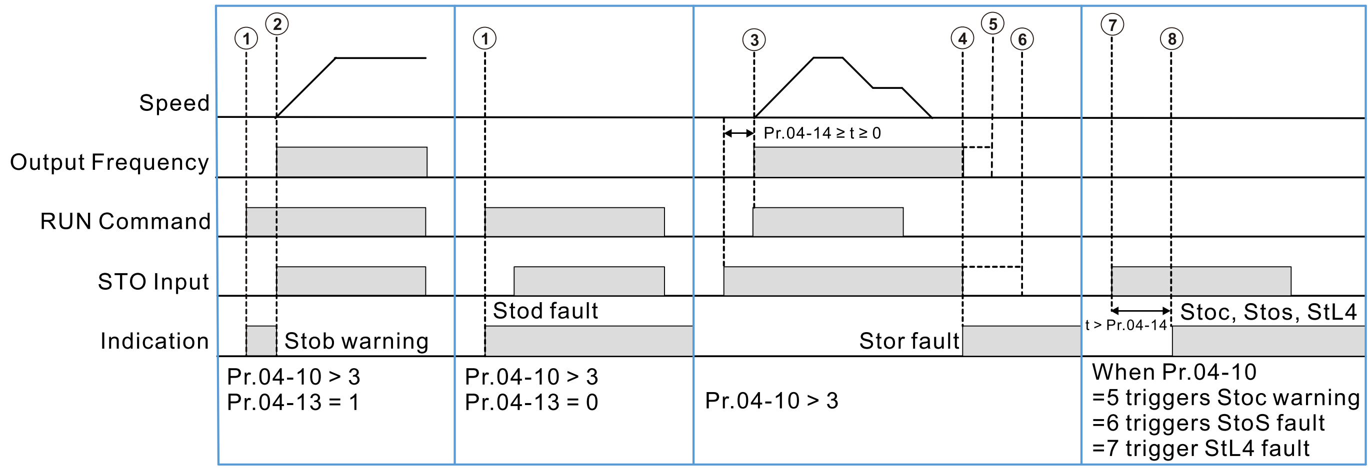
04-10 (STO Function Selection)	STL1 Fault	STL2 Fault	STL3 Fault	STL5 Fault	Stoo Fault	StoA Warning	Stoc Warning	StoS Fault	STL4 Fault	Stor Fault	Stod Fault (Pr.04-13=0)	Stob Warning (Pr.04-13=1)
	Hardware failure			24-hour sticking	STO circuit OFF		STO circuit sticks. Must cycle the power to clear the fault (STL4).			STO circuit is OFF during drive output	STO circuit should be ON but is not ON	
3	√	√	√	√*1		√						
4	√	√	√	√*1						√	√*2	√*2
5	√	√	√	√*1			√			√	√*2	√*2
6	√	√	√	√*1				√		√	√*2	√*2
7	√	√	√	√*1					√	√	√*2	√*2

NOTE:

*1: This function is set to be enabled by default, and can be disabled through MI=57 (STO signal check) settings.

*2: To display Fault or Warning depends on Pr.04-13.

📖 For more information on the timing diagram, see <Section 4-9 Drive's STO Function>.



STO Error Detection Timing Diagram

No.	Description
1	RUN command is ON but STO circuit is not activated.
2	RUN command is ON and STO circuit is activated. Drive outputs immediately.
3	STO circuit is activated before RUN command is ON.
4	STO circuit is deactivated while the drive is outputting.
5	Time that the drive stops outputting.
6	Time that STO circuit is deactivated in normal condition.
7	RUN command is not ON when STO circuit is activated.
8	After Pr.04-14 detection time, if RUN command is still OFF or STO circuit is not deactivated, then STO circuit sticking occurs.

04-11 Mechanical Brake Detection Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1.00

Settings 0.00–10.00 sec.

📖 When the mechanical brake function (Pr.01-00–Pr.01-07 are set to 42, 44) is not enabled within this setting time, the drive displays fault code MbF (Mechanical brake feedback error).

04-12 Magnetic Contactor Detection Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–10.00 sec.

- When the magnetic contactor function (Pr.01-00–Pr.01-07 are set to 41) is not enabled within this setting time, the drive displays fault code MCF (Magnetic contactor error).

04-13 STO Timing Activation

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Triggers fault if an error occurs on timing activation

1: Triggers warning if an error occurs on timing activation (valid only when using two-wire operation control)

- Used with Pr.04-10=4–7.

04-14 STO Sticking Detection Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 2.0

Settings 0.0–10.0 sec.

- When FWD/REV command is OFF and STO circuit is continuously ON for more than Pr.04-14 detection time, STO circuit sticking is malfunctioned.
- Pr.04-10=5: Stoc warning occurs. This warning will be automatically cleared when FWD/REV command is ON or STO circuit is OFF.
- Pr.04-10=6: StoS fault occurs. This fault can be cleared by pressing RESET key manually.
- Pr.04-10=7: StL4 fault occurs. This fault cannot be cleared and must be powered-on again.

04-15 MBF Reset

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: MbF can be reset

1: MbF cannot be reset

2: MbF can be reset, and automatically set to 1 after reset

- Steps before and after fault code MbF is triggered:
  1. Set Pr.04-15 = 1.
  2. When MbF fault is triggered, the fault can only be cleared after Pr.04-15 is manually set to 2.
  3. While pressing RESET to clear the fault, Pr.04-15 will be set to 1 again.
- Status of MbF treatment:

Pr.04-15 setting value	Treatment after MbF is triggered	Fault status after treatment	Pr.04-15 setting value after treatment
0	Send RESET command	None	0
	Cycle the power	MbF	0
1	Send RESET command	MbF	1
	Cycle the power	MbF	1
2	Send RESET command	None	1
	Cycle the power	MbF	2

Slip Compensation Level (Pr.04-20–04-22)

⌁ 04-20 Over-slip Action

Control Mode **SVC** **FOCPG** Default: 0

Settings 0: Warn and keep operation
1: Warn and ramp to stop
2: Warn and coast to stop

⌁ 04-21 Slip Deviation Level

Control Mode **SVC** **FOCPG** Default: 0.0

Settings 0.0–100.0%
0: Disable

⌁ 04-22 Slip Deviation Detection Time

Control Mode **SVC** **FOCPG** Default: 1.0

Settings 0.0–10.0 sec.

📖 Pr.04-20–Pr.04-22 set the allowable slip level and over-slip action when the drive is running.

Phase Loss Protection (Pr.04-30–04-37)

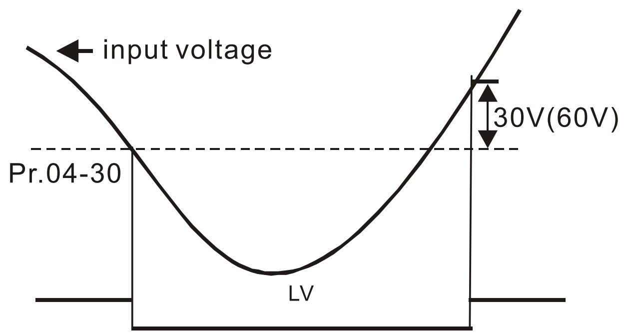
04-30 Low Voltage Level

Control Mode VF SVC FOCPG FOCPM Default: 180.0 / 360.0

Settings 230V models: 160.0–220.0 V

460V models: 320.0–440.0 V

- Sets the Lv level.



04-31 Input Phase-loss Protection during Operation

Control Mode VF SVC FOCPG FOCPM Default: 2

Settings 0: Warn and keep operation

1: Fault and ramp to stop

2: Fault and coast to stop

- Sets the phase-loss action. The phase-loss affects the drive's control characteristics and life.
- When Pr.04-31 is set to 1 (Fault and ramp to stop), if brake or operation contactor is OFF under the circumstance that STO or MI40 (Enable drive function) is not deactivated during deceleration, elevator still runs even brake has engaged (brake wear), and electric arc occurs when operation contactor is OFF.

04-32 Phase Loss Detection of Drive Output at Start-up (MPHL)

Control Mode VF SVC FOCPG FOCPM Default: 0

Settings 0: Disable

1: Enable

- 1: Auto-detect whether the connection between the drive and motor is normal whenever the drive runs. If an error occurs to the connection between the drive and the motor (broken or loose wiring) or there is no output for the drive's any or all of the three phases, the drive displays fault code MPHL (Motor phase loss) to indicate motor output phase loss.

04-33 MPHL Speed Level

Control Mode VF SVC FOCPG FOCPM Default: 10.00

Settings 0.00–15.00 Hz

- Sets difference between current feedback frequency and the drive output frequency before starting to count the times of motor output phase loss.

04-34 MPHL Current Level

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 5.50

Settings 0.00–10.00% (of rated current)

📖 Sets difference (percentage of rated current) between current command and feedback current before starting to count the times of motor output phase loss.

04-35 MPHL Count Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 30.0

Settings 10.0–1000.0

📖 When either Pr.04-33 or Pr.04-34 level is reached for more than Pr.04-35 count time, motor output phase loss occurs.

04-37 Over Ripple Protection

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1

Settings 0: Disable

1: Enable

📖 Sets to enable or disable over ripple protection for DC bus voltage ripple.

Over-torque (OT) (Pr.04-40–04-42)

04-40 Over-torque Detection (OT1)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings
0: Over-torque detection disabled
1: Over-torque detection during constant speed operation, continue to operate after detection
2: Over-torque detection during constant speed operation, stop operating after detection
3: Over-torque detection during operation, continue to operate after detection
4: Over-torque detection during operation, stop operating after detection

04-41 Over-torque Detection Level (OT1)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 150

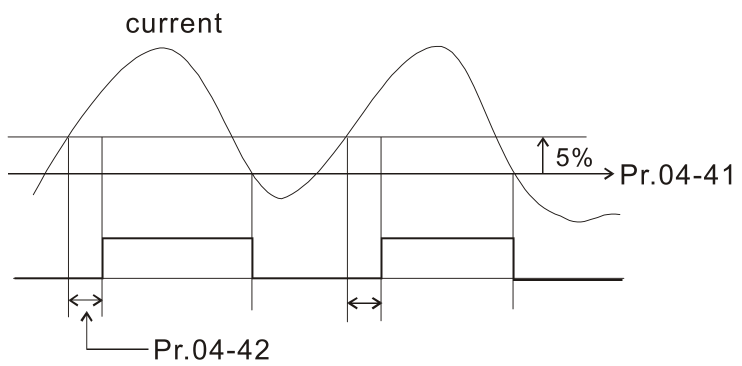
Settings 10–250% (rated current of the motor drive)

04-42 Over-torque Detection Time (OT1)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.1

Settings 0.1–60.0 sec.

- Pr.04-40 determines the drive's operating mode after over-torque is detected.
- Over-torque is detected according to the following method: if the output current exceeds the over-torque detection level (Pr.04-41, default is 150%) and also exceeds the over-torque detection time (Pr.04-42, default is 0.1 second), the keypad displays fault code ot1. If using a multi-function output terminal for over-torque detection, the output is ON. Refer to Pr.01-10–Pr.01-15 for details.



PTC / Temperature Detection (Pr.04-47–04-56)

✎ 04-47 PTC 1 (Positive Temperature Coefficient) Detection Action

Control Mode **VF SVC FOCPG FOCPM** Default: 0

Settings 0: Warn and keep operation
1: Fault and ramp to stop

📖 Sets the action after detecting PTC 1.

✎ 04-48 PTC 1 Level

Control Mode **VF SVC FOCPG FOCPM** Default: 50.0

Settings 0.0–100.0%

📖 Sets the PTC 1 level. 100% PTC 1 level corresponds to the maximum analog input value.

✎ 04-49 PTC 1 Detection Filter Time

Control Mode **VF SVC FOCPG FOCPM** Default: 0.20

Settings 0.00–10.00 sec.

📖 See Parameter Group 01 Analog Input / Output Settings for details.

✎ 04-50 PTC 2 (Positive Temperature Coefficient) Detection Action

Control Mode **VF SVC FOCPG FOCPM** Default: 0

Settings 0: Warn and keep operation
1: Fault and ramp to stop

📖 Sets the action after detecting PTC 2.

✎ 04-51 PTC 2 Level

Control Mode **VF SVC FOCPG FOCPM** Default: 50.0

Settings 0.0–100.0%

📖 Sets the PTC 2 level. 100% PTC 2 level corresponds to the maximum analog input value.

✎ 04-52 PTC 2 Detection Filter Time

Control Mode **VF SVC FOCPG FOCPM** Default: 0.20

Settings 0.00–10.00 sec.

📖 See Parameter Group 01 Analog Input / Output Settings for details.

04-53 Electronic Thermal Relay

Control Mode **VF SVC FOCPG FOCPM** Default: 2

Settings 0: Standard motor (motor with fan on the shaft)
1: Inverter motor (with external forced cooling)
2: Disabled

📖 Prevents self-cooled motor from overheating at low speeds. You can use an electrical thermal relay to limit the drive's output power.

📖 Setting the parameter to 0 is suitable for standard motor (motor fan is fixed on the rotor shaft). For this kind of motor, the cooling capacity is lower in low speed; therefore, the action of an electronic thermal relay reduces the action time to ensure the life of motor.

📖 Setting the parameter to 1 is suitable for an inverter motor (motor fan using an independent power supply). For this kind of motor, there is no significant correlation between cooling capacity and motor speed. Therefore, the action of electronic thermal relays remains stable in low speed to ensure the load capability of the motor in low speed.

📖 When the power is cycled frequently, if the power is switched OFF, the electronic thermal relay protection is reset; therefore, even setting the parameter to 0 or 1 may not protect the motor well.

04-54 Electronic Thermal Characteristic

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 60.0

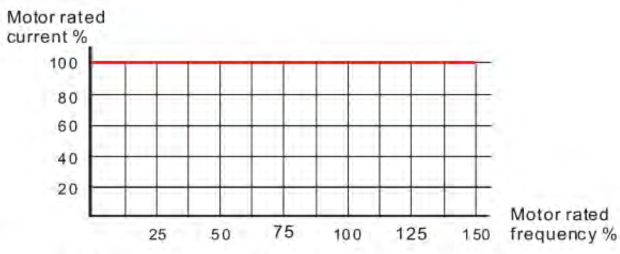
Settings 30.0–600.0 sec.

📖 Set the parameter to 150% of motor rated current and use with the setting of Pr.04-54 to prevent motor damage due to overheating. When it reaches the setting, the drive displays fault code EoL1, and the motor coasts to stop.

📖 Use this parameter to set the action time of the electronic thermal relay. It works based on the I^2t characteristic curve of electronic thermal relay, the output frequency and current of the drive, and the operation time to prevent the motor from overheating.

Motor cooling curve with shaft-fixed fan

Standard motor



Motor cooling curve with independent fan

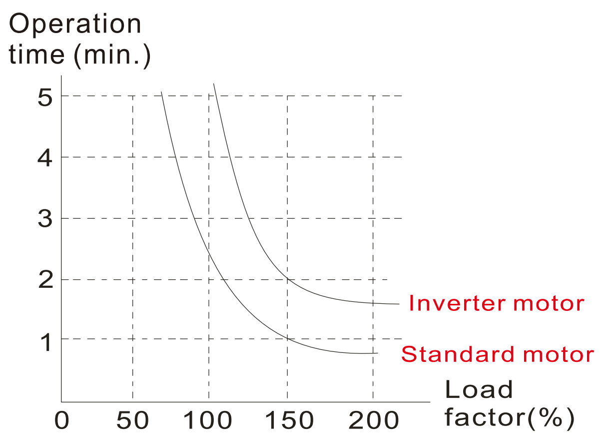
Inverter motor

📖 The action of electronic thermal relay depends on the setting for Pr.04-53.

- When Pr.04-53 is set to 0 (using standard motor):
  When the output current of the drive is higher than 150% of the motor rated current (refer to the motor rated current % corresponded to the motor rated frequency in the motor cooling curve with shaft-fixed fan), the drive starts to count the time. The electronic thermal relay acts when the accumulated time exceeds Pr.04-54.
- When Pr.04-53 is set to 1 (using inverter motor):
  When the output current of motor drive is higher than 150% of the motor rated current (refer to the motor rated current % corresponded to the motor rated frequency in the motor cooling curve with independent fan), motor drive starts to count the time. The electronic thermal relay acts when the accumulated time exceeds Pr.04-54.

📖 If the motor's rated current (Pr.00-12) is not set, then set 90% of the drive's rated current (Pr.07-01) as the default value of this parameter.

📖 The actual electronic thermal relay action time adjusts according to the drive output current (shown as the motor loading rate %). The action time is short when the current is high, and the action time is long when the current is low. Refer to the following diagram:



04-55 IGBT Overheat Warning (oH1)

Control Mode **VF** **SVC** **FOCPG** **FOCPM**

Default: varies with drive identity code

Settings 0.0–110.0°C

Models / Phase	Frame	Model Name	oH1 Fault Level	oH1 Warning Level	oH1 Reset Level
230V / Single-phase	A	VFD022ED21B	85	oH1 Fault Level-5 or Pr.04-55	OH1 Warning Level -5
		VFD037ED21B	90		
460V / Three-phase	A	VFD040ED43B	90		
		VFD055ED43B	90		
		VFD075ED43B	95		
	B	VFD110ED43B	100		
		VFD150ED43B	110		
		VFD185ED43B	110		

<u>OH (Overheating) Temperature Table</u>

Communication Detection (Pr.04-60–04-64)

04-60 COM Transmission Fault Treatment

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 3

Settings 0: Warn and keep operation
1: Fault and ramp to stop
2: Reserved
3: No action and no display

Determines the treatment if a transmission time-out error (such as disconnection) occurs during communication.

04-61 Time-out Detection

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings 0.0–100.0 sec.
0.0: Disable

Sets the communication time-out value.

04-62 Communication (RJ45) Fault Treatment

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 3

Settings 0–3
0: Warn and keep operation
1: Fault and ramp to stop
2: Reserved
3: No action and no display

Determines the treatment if a transmission time-out error (such as disconnection) occurs during communication.

04-63 Communication (RJ45) Time-out

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings 0.0–100.0

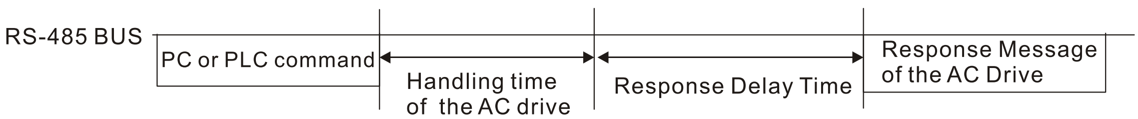
Sets the communication time-out value

04-64 Communication (RJ45) Delay Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 2.0

Settings 0.0–200.0

If the host computer does not finish the transmitting/receiving process, you can use this parameter to set the response delay time after the AC motor drive receives communication command as shown in the following picture.



PG Detection (Pr.04-70–04-76)

✎ 04-70 Encoder Feedback Signal Fault Action (PGF1, PGF2)

Control Mode FOCPG FOCPM Default: 2

Settings 0: Warn and keep operation
1: Fault and ramp to stop
2: Fault and stop operation

✎ 04-71 Encoder Feedback Signal Fault Detection Time

Control Mode FOCPG FOCPM Default: 1.0

Settings 0.0–10.0 sec.

- When there is a PG loss, encoder signal error, pulse signal setting error or signal error, if time exceeds the setting for this parameter (Pr.04-71), the PG signal error occurs. Refer to Pr.04-70 for the encoder feedback signal fault action.

✎ 04-72 Encoder Stall and Slip Error Action (PGF3, PGF4) (maximum output frequency Pr.03-50 = 100%)

Control Mode SVC FOCPG FOCPM Default: 2

Settings 0: Warn and keep operation
1: Fault and ramp to stop
2: Fault and stop operation

- When the difference of (rotation speed - motor frequency) exceeds the Pr.04-75 setting, and the detection time exceeds Pr.04-76 or the motor frequency exceeds Pr.04-73 setting, the drive starts to count time. If the detection time exceeds Pr.04-74, the encoder feedback signal error occurs.

✎ 04-73 Encoder Stall Level (PGF3)

Control Mode SVC FOCPG FOCPM Default: 115

Settings 0–120%
0: Disable

- Determines the maximum encoder feedback signal allowed before a fault occurs. (The maximum output frequency Pr.03-50 = 100%.)

✎ 04-74 Encoder Stall Detection Time (maximum output frequency Pr.03-50 = 100%)

Control Mode SVC FOCPG FOCPM Default: 0.1

Settings 0.0–2.0 sec.

✎ 04-75 Encoder Slip Range (PGF4) (maximum output frequency Pr.03-50 = 100%)

Control Mode SVC FOCPG FOCPM Default: 50

Settings 0–50%
0: Disable

✎ 04-76 Encoder Slip Detection Time (maximum output frequency Pr.03-50=100%)

Control Mode SVC FOCPG FOCPM Default: 0.5

Settings 0.0–10.0 sec.

Brake Resistor Detection (Pr.04-80–04-83)

04-80 Brake Resistor Detection during Operation

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–1

0: Does not detect brake resistor

1: Detects brake resistor

04-81 Brake Over-current Percentage

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 140

Settings 100–155%

📖 When brake current exceeds maximum brake over-current percentage, fault code Socb occurs.

04-82 Pulse Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 300

Settings 300–600

📖 Detects brake resistor before operation. Pr.04-82 determines brake transistor activation time.

04-83 Brake Resistor

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings 0.0–6553.5 ohm

Over-acceleration Detection (Pr.04-90–04-92)

04-90 Over-acceleration Detection Selection

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Always detect

1: Detect during operation

⚡ 04-91 Over-acceleration Level

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings 0.0–20.0 m/s^2

04-92 Over-acceleration Detection Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.05

Settings 0.01–5.00 sec.

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05 Advanced Setting Parameters

05 Advanced Setting Parameters

✍: You can set this parameter during operation.

CANopen (Pr.05-00–05-05)

05-00	CANopen Protocol				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 0

Settings 0: Disable CANopen
1: Enable CANopen and use CIA417 (CANLift) protocol
2: Reserved
3: DCP3
4: DCP4

05-01	CANopen Slave Address				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 0

Settings 0–65535

📖 Sets CAN-Id for EB3000.

05-02	CANopen Communication Status				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

Settings 0: Not ready for use state
1: Inhibit start state
2: Ready to switch on state
3: Switched on state
4: Enable operation state
7: Quick stop active state
13: Error reaction activation state
14: Error state

📖 Displays current communication status of CANopen.

05-03	CANopen Drive Status				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

Settings 0: Node reset state
1: Com reset state
2: Boot up state
3: Pre-operation state
4: Operation state
5: Stop state

📖 Displays current drive status of CANopen.

05-04	CAN Warning Record				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

Settings bit0: CANopen guarding time out
bit1: CANopen heartbeat time out
bit2: CANopen SYNC time out

bit3: CANopen SDO time out

bit4: CANopen SDO buffer overflow

bit5: CAN bus off

bit6: Error protocol of CANopen

bit8: The setting values of CANopen indexes are failed

bit9: The setting value of CANopen address is failed

bit10: The checksum value of CANopen indexes is failed

📖 Displays CAN warning records.

05-05 CAN PDO Disconnection Time

Control Mode	VF	SVC	FOCPG	FOCPM	Default: 0
	Settings	0–10000 ms			

📖 When EB3000 has disconnected with the controller for more than Pr.05-05, fault code CndL occurs.

CANLift (Pr.05-15–05-22)

05-15 Maximum Target Position

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 300.00

Settings 0.00–655.35 m

📖 In PP (Profile Position) mode, when target position received by the drive is larger than Pr.05-15, fault code CnLF occurs.

05-16 Minimum Target Position

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–655.35 m

📖 In PP (Profile Position) mode, when target position received by the drive is smaller than Pr.05-16, fault code CnLF occurs.

05-17 Position Unit (Pulse)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 10000

Settings 0–65535

📖 In PP (Profile Position) mode, shaft encoder passes through a few pulses within Pr.05-18 distance, which is used for unit conversion of PP mode. This parameter also refers to CANLift object 641Fh-01 in CANLift protocol.

05-18 Position Unit (mm)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 4473

Settings 0–65535

📖 In PP (Profile Position) mode, sets the length of shaft encoder, which is used for unit conversion of PP mode. This parameter also refers to CANLift object 641Fh-02 in CANLift protocol.

05-19 Velocity Window Range

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 10

Settings 0–1000 mm/s

📖 Sets the velocity window range in CANLift PV mode. When this setting is finished, object 6435h-01 will become this setting value.

05-20 Velocity Window Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 100

Settings 0–1000 m/s

📖 Sets the detection time for velocity window in CANLift PV mode. When this setting is finished, object 6435h-02 will become this setting value.

05-21 Velocity Threshold Range

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 10

Settings 0–1000 mm/s

📖 Sets the velocity threshold range in CANLift PV mode. When this setting is finished, object 6436h-01 will become this setting value.

05-22 Velocity Threshold Time

Control Mode	VF	SVC	FOCPG	FOCPM	Default: 100
	Settings	0–1000 m/s			

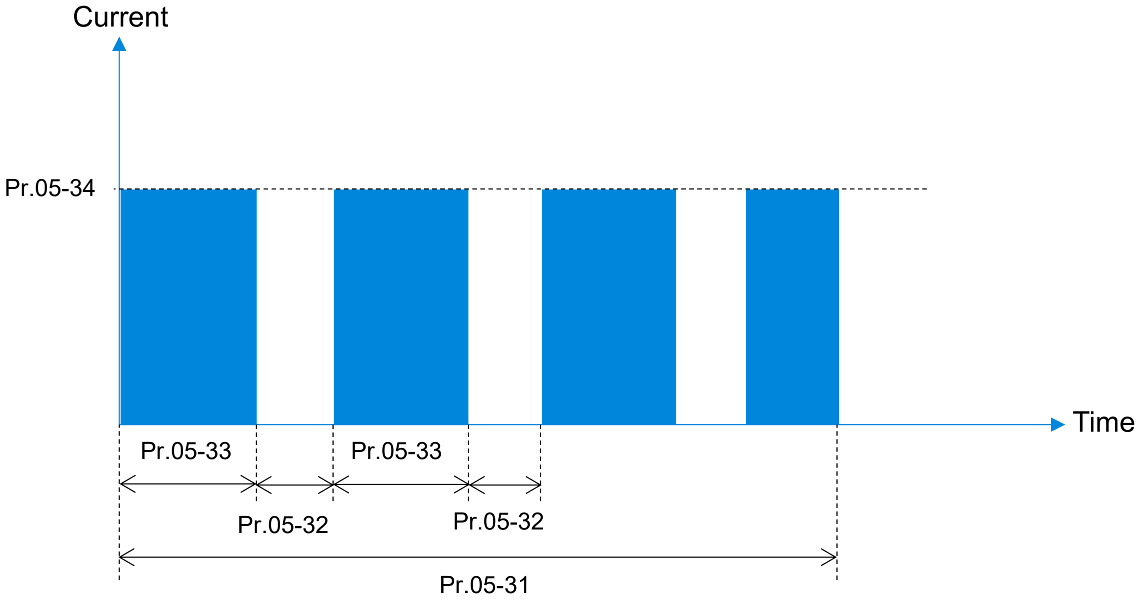
📖 Sets the detection time for velocity threshold in CANLift PV mode. When this setting is finished, object 6463h-02 will become this setting value.

Safety Gear Release (Pr.05-29–05-34)

05-29	Safety Gear Speed Level				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 50
	Settings	0–100% (drive's rated frequency)			

05-30	Safety Gear Release Enabled				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 0
	Settings	0: Disabled 1: Enabled			

📖 When the safety gear works, sometimes if the clamping force is too large, the safety gear cannot be released directly by making the elevator move in an upward direction. Instead, the drive should generate current pulse to release the safety gear.



05-31	Safety Gear Time				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 5.0
	Settings	0.0–10.0 sec.			

05-32	Safety Gear Pulse Low Time				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 0.2
	Settings	0.0–2.0 sec.			

05-33	Safety Gear Pulse High Time				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 0.5
	Settings	0.0–2.0 sec.			

05-34	Safety Gear Pulse Current Level				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 180
	Settings	0–250% (the drive's rated current)			

Rescue by Mechanical Brake Control (Pr.05-35–05-39)

05-35 Speed Upper Limit of Rescue by Mechanical Brake Control

Control Mode **FOCPG** **FOCPM** Default: 100

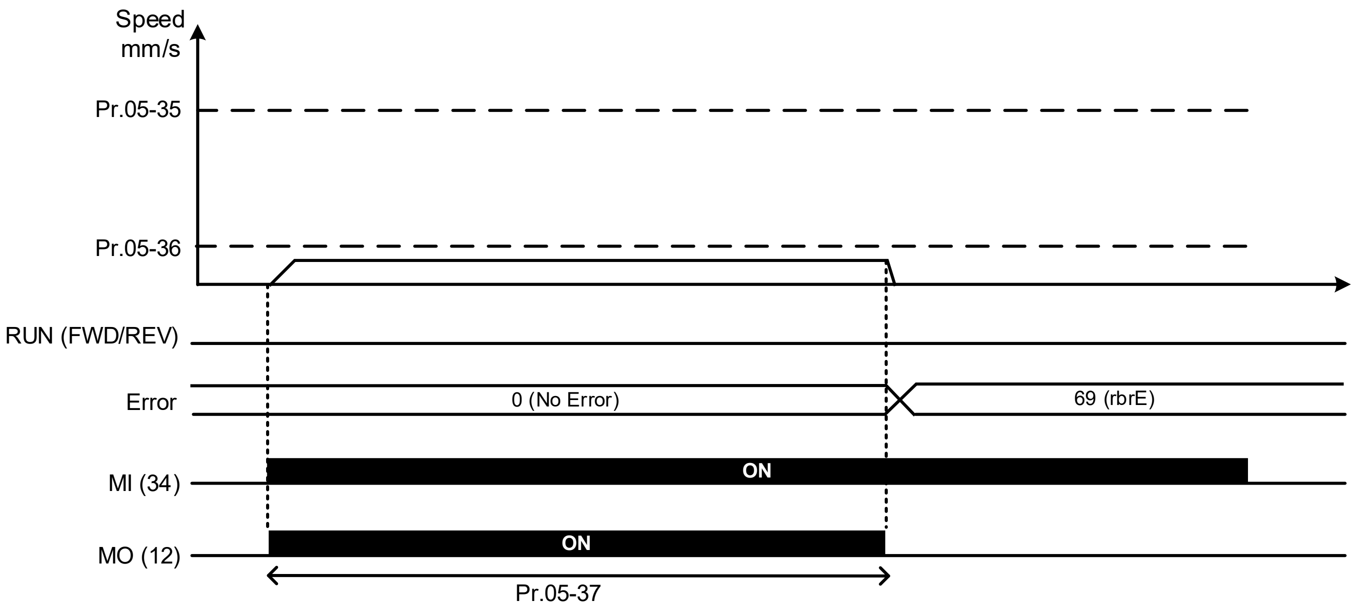
Settings 0–500 mm/s

05-36 Speed Lower Limit of Rescue by Mechanical Brake Control

Control Mode **FOCPG** **FOCPM** Default: 10

Settings 0–20 mm/s

- When MI=34 (Rescue by mechanical brake control) is activated, MO=12 (Mechanical brake release) outputs to make mechanical brake released, and, at the same time, speed feedback starts to be detected. If speed feedback is smaller than Pr.05-36, time starts to count. When counting time exceeds Pr.05-37 (Minimum Speed Detection Time of Rescue by Mechanical Brake Control), MO=12 stops outputting and makes the mechanical brake engaged. At this time, fault code 69 rbrE is triggered.
- If speed feedback is larger than Pr.05-36, time returns to zero. MO=12 continues to output.
- When fault code rbrE is triggered, MO=12 stops outputting. If you need to clear the fault by sending a reset command, MI=34 must be deactivated (OFF).



05-37 Minimum Speed Detection Time of Rescue by Mechanical Brake Control

Control Mode **FOCPG** **FOCPM** Default: 0.5

Settings 0.0–10.0 sec.

- Setting value = 0: Minimum speed limit is disabled.

05-38 Re-release Waiting Time of Rescue by Mechanical Brake Control

Control Mode **FOCPG** **FOCPM** Default: 0.0

Settings 0.0–10.0 sec.

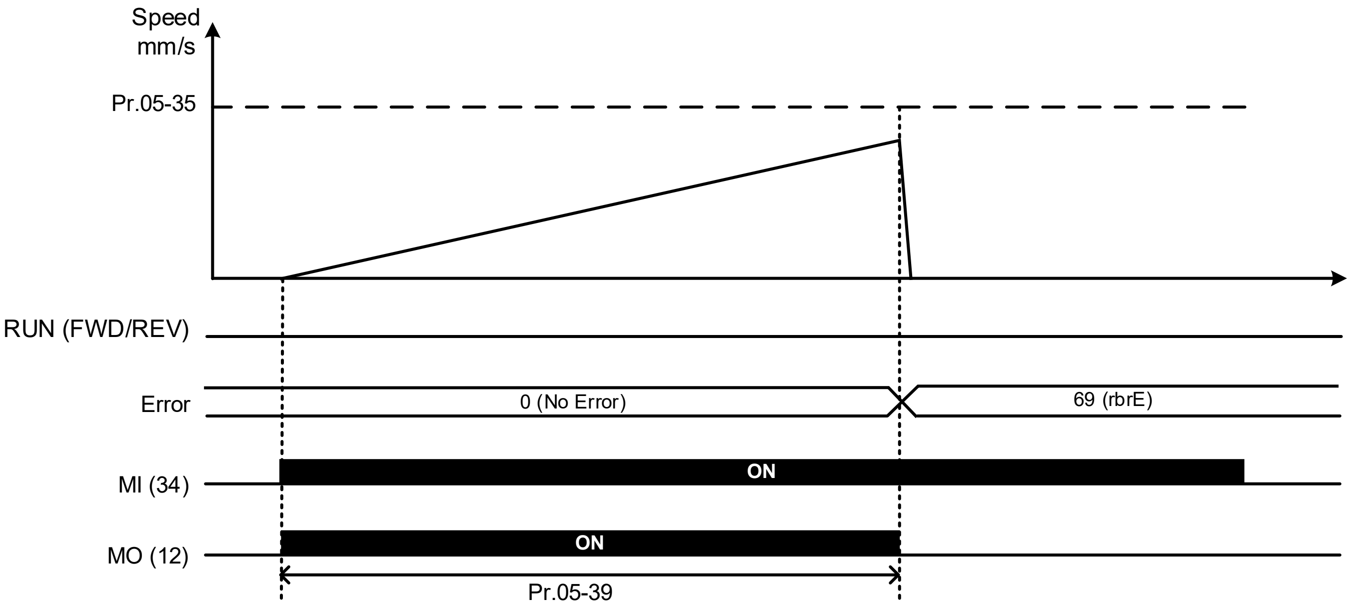
- Setting value = 0: Automatically release again is disabled.

05-39 Maximum Release Time of Rescue by Mechanical Brake Control

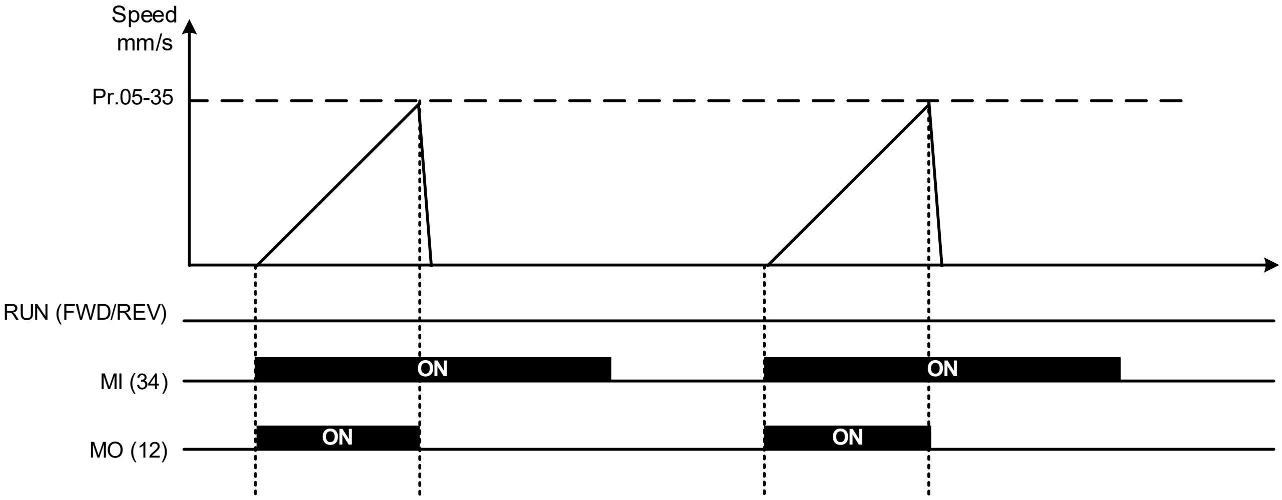
Control Mode FOCPG FOCPM Default: 5.0

Settings 0.0–20.0 sec.

- Setting value = 0: Maximum brake release time limit (time limit for releasing every time) is disabled.
- When MI=34 (Rescue by mechanical brake control) is activated, MO=12 (Mechanical brake release) outputs to make mechanical brake released, and, at the same time, MO=12 output time starts to be counted. If output time exceeds Pr.05-39, MO=12 stops outputting and makes the mechanical brake engaged. At this time, fault code 69 rbrE is triggered.
- When fault code rbrE is triggered, MO=12 stops outputting. If you need to clear the fault by sending a reset command, MI=34 must be deactivated (OFF).

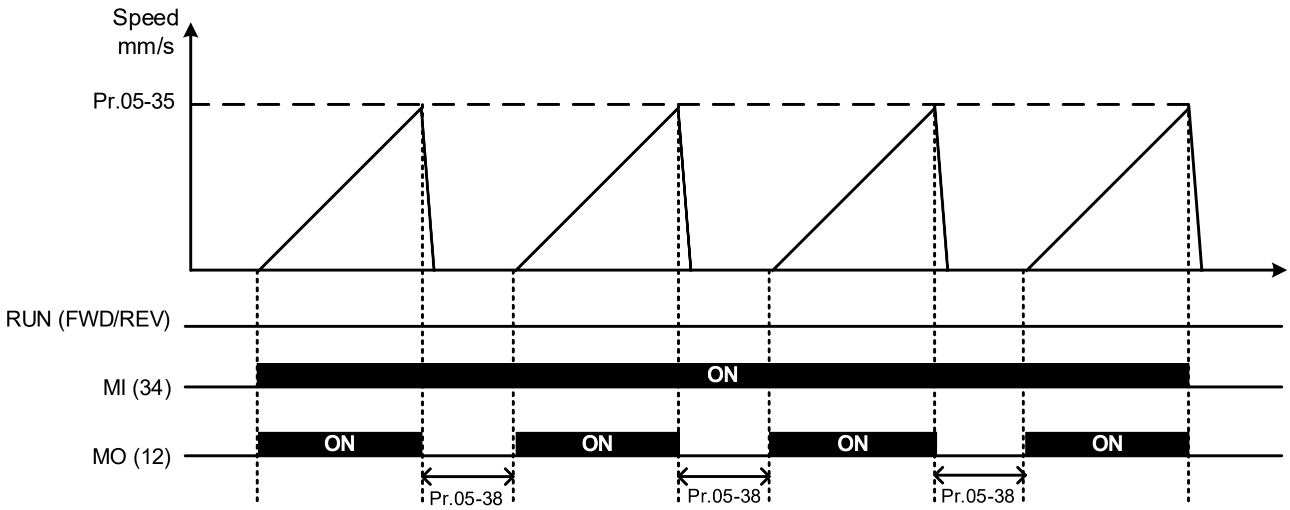


- Function of rescue by mechanical brake control:
  When power is not enough to make the motor run during power failure, use the drive instead to control the brake release. This is to make the car move toward the weighted until reaching the floor so as to perform rescue. To ensure passenger safety, pay attention to the speed and time limit while releasing the brake.
- Actions of rescue by mechanical brake control:
  1. Pr.05-38 =0
     When MI=34 (Rescue by mechanical brake control) is activated, MO=12 (Mechanical brake release) outputs to make mechanical brake released, and, at the same time, speed feedback starts to be detected. If speed feedback is larger than Pr.05-35 (Speed Upper Limit of Rescue by Mechanical Brake Control), MO=12 stops outputting and makes the mechanical brake engaged until MI=34 status from ON to OFF and then from OFF to ON.



2. Pr.05-38≠0

When MI=34 (Rescue by mechanical brake control) is activated, MO=12 (Mechanical brake release) outputs to make mechanical brake released, and, at the same time, speed feedback starts to be detected. If speed feedback is larger than Pr.05-35 (Speed Upper Limit of Rescue by Mechanical Brake Control), MO=12 stops outputting and makes the mechanical brake engaged. At this time, time starts to count. When counting time reaches Pr.05-38 (Re-release Waiting Time of Rescue by Mechanical Brake Control) setting time, MO=12 outputs again to make mechanical brake released until MI=34 is deactivated (OFF).



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06

Customized

Parameters

Customized Parameters

Pr.06-01–06-99

06 Customized Parameters

✎: You can set this parameter during operation.

Customized Parameters (Pr.06-01–06-99)

06-01 – 06-99	Customized Parameters				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: 0
	Settings	Contact Delta for more information			

07 System Parameters

07 System Parameters

✓: You can set this parameter during operation.

Drive Information (Pr.07-00–07-13)

07-00 AC Motor Drive Identity Code

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

07-01 AC Motor Drive Rated Current Display

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

- Pr.07-00 displays the AC motor drive identity code. The capacity, rated current, rated voltage and the maximum carrier frequency relate to the identity code. Use the following table to check how the AC motor drive rated current, rated voltage, and maximum carrier frequency correspond to the identity code.
- Pr.07-01 displays the AC motor drive rated current. By reading this parameter, you can check if the AC motor drive is correct.

	230V Models		460V Models					
Power (kW)	2.2*	3.7*	4.0	5.5	7.5	11	15	18.5
Horsepower (HP)	3	5	5	7.5	10	15	20	25
Motor Drive ID Code (Pr.07-00)	306	307	407	408	409	410	411	412
Rated Output Current (A)	11	18	10	15	18.5	27	33	39
Range of the Carrier Frequency (kHz)	2–15	2–15	2–15	2–15	2–15	2–15	2–15	2–15
Rated Max. Output Carrier Frequency (kHz)	10	10	10	8	8	8	8	8

*: Single-phase models.

07-02 Software Version

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

07-03 Date Code Y.WKD

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

- Displays the year / week / day that the program of this firmware version is completed. For example, 21.321 indicates that the program is completed on the first day of the 32th week in year 2021.

07-04 Extension Card Firmware Version

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

- If it displays 88.88, it means there is no firmware version for the extension card. Currently, only option card EMEB-PGSED-x displays firmware version.

07-05 Power Board Firmware Version

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

- Displays the firmware version of power board MCU

07-06 Power Board Default ID High Byte

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

📖 Displays the drive default value at the factory.

XXX (3 digits) + XX (2 digits)

Production factory code 0: Shanghai
1: Taoyuan
2: Wujiang

Drive identify code

07-07 Power Board Default ID Medium Byte

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

📖 Displays the drive default value at the factory.

XX (2 digits) + XX (2 digits)

Year Week

07-08 Power Board Default ID Low Byte

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

📖 Displays the drive default value at the factory.

XXXX (4 digits)

Production batch number

07-09 Power Board Current ID High Byte

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

📖 Displays the power board that is currently used.

XXX (3 digits) + X (1 digit)

Production factory code 0: Shanghai
1: Taoyuan
2: Wujiang

Drive identify code

07-10 Power Board Current ID Medium Byte

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

📖 Displays the power board that is currently used.

XX (2 digits) + XX (2 digits)

Year Week

07-11 Power Board Current ID Low Byte

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

📖 Displays the power board that is currently used.

XXXX (4 digits)

Production batch number

07-12 SD Card Formatting

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–1

📖 If SD card is not formatted yet, set Pr.07-12=1 to format the SD card so the parameters can be recorded. You can also use a computer to format more quickly. Note that the formatting format can only be FAT32.

07-13	Formatting Progress				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

📖 Displays the formatting progress bar

Drive Password Protection (Pr.07-20–07-23)

07-20 Password Input

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 1–9998, 10000–65535

Display 0–2 (number of wrong password attempts)

- Inputs the password that is set in Pr.07-21. Enter the correct password here to enable changing parameters. You are limited to a maximum of three attempts. After three consecutive failed attempts, "Password Error" is displayed, and you must restart the AC motor drive before you can try again to enter the correct password.
- If you forget the password, you can decode by setting this parameter to 9999 twice. Note that this resets the settings to the default.

07-21 Password Set

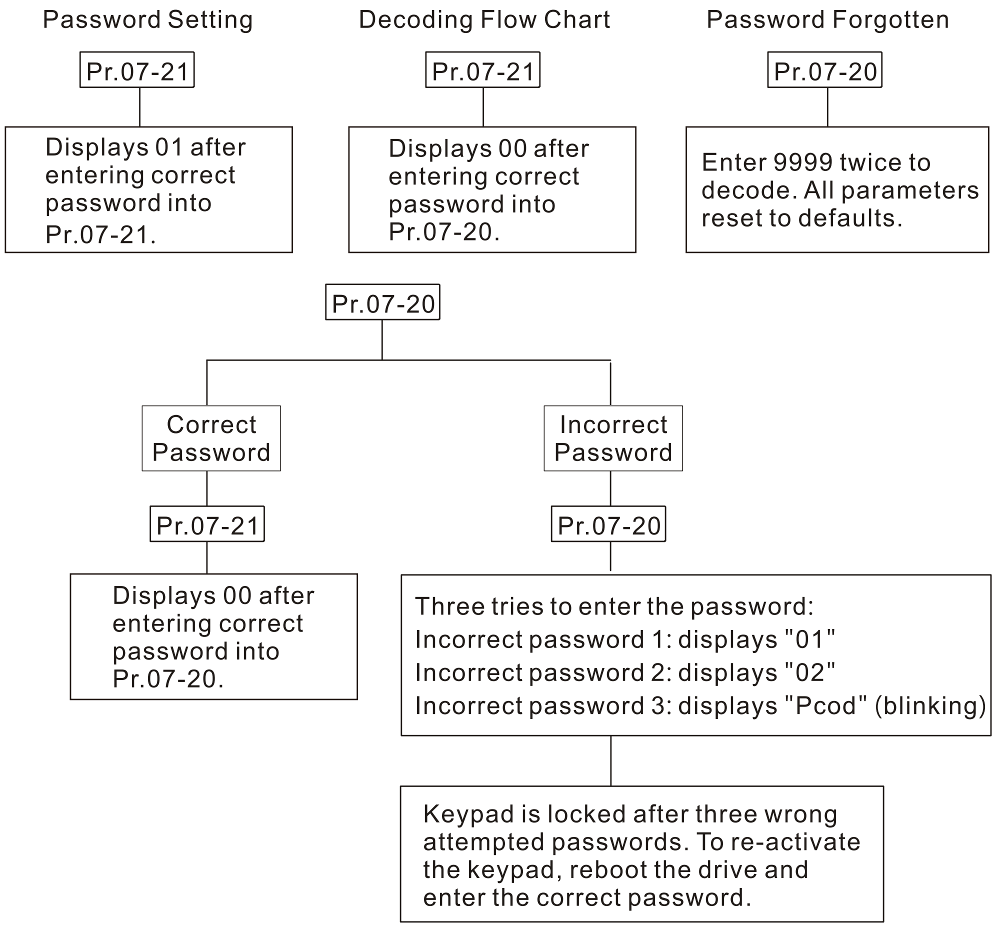
Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 1–9998, 10000–65535

Display 0: No password set or successful input in Pr.07-20

1: Password has been set

- This parameter is for setting the password protection. Password can be set directly the first time. After you set the password, the value of Pr.07-21 is 01, which means password protection is activated. However, if the value of Pr.07-21 is 00, the password protection is deactivated, which means you can change any of the parameter settings (including resetting the parameter protection password for Pr.07-21). When Pr.07-21 is 01 and if you want to change any of the parameter settings, you must enter the correct password in Pr.07-20 to deactivate the password, and this would make Pr.07-21 become 00. Note that if you set this parameter to 00 again, the password protection function is permanently deactivated. Otherwise, password protection is always reactivated after you reboot the motor drive. If you want to change any of the parameter settings after rebooting the motor drive, enter the correct password in Pr.07-20 to deactivate the password.
- How to make the password valid again after decoding by Pr.07-20:
  Method 1: Re-enter the original password into Pr.07-21 (or you can enter a new password if you want to use a changed or new one).
  Method 2: After rebooting, the password function is restored.
  Method 3: Entering a non-password value into Pr.07-20.
  Password Decode Flow Chart



07-22 Times of Drive Service

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

📖 Sets service times of the drive before enabling drive service. If service times=0, service time-out occurs.

07-23 Drive Service Setting

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0: Disable
1: Enable

PWM (Pulse Width Modulation) (Pr.07-30–07-37)

07-30 Carrier Frequency

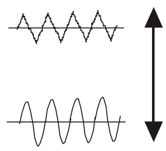
Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 12

Settings 2–15 kHz

- If the drive is in FOCPM control mode (Pr.00-01=3), the setting range of Pr.07-30 will be 4–15 kHz.
- Determines the PWM carrier frequency for the AC motor drive.

Models	3–5 HP	7.5–30 HP	40–100 HP
Settings	2–15 kHz	2–15 kHz	2–15 kHz
Default	10 kHz	8 kHz	6 kHz

Carrier Frequency	Acoustic Noise	Electromagnetic Noise or Leakage Current	Heat Dissipation	Current Wave
2 kHz	Significant	Minimal	Minimal	
8 kHz				
15 kHz	Minimal	Significant	Significant	



- From the table, you see that the PWM carrier frequency has significant influences on the motor's electromagnetic noise, the AC motor drive heat dissipation, and the motor acoustic noise. Therefore, if the surrounding noise is greater than the motor noise, lower the carrier frequency to reduce the temperature rise. Although the motor has quiet operation in the higher carrier frequency, consider the entire wiring and interference.
- If you set the carrier frequency higher than the defaults in the table above, the motor drive derates the capacity. See the rated output current derating (%) for different carrier frequencies in <Section 12-5 Derating Curve>.

07-31 PWM Mode (Pulse-Width Modulation Mode)

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: DPWM Mode (Discontinuous Pulse Width Modulation Mode)
1: SVPWM mode (Space-Vector Pulse Width Modulation Mode)

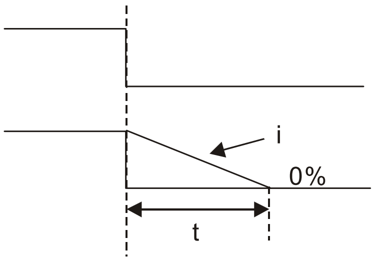
- 0: Effectively reduces the drive power components losses and provides better performance in long wire applications.
- 1: Effectively reduces the power loss and electromagnetic noise of the motor.

07-32 Time for Decreasing Torque at Stop

Control Mode **FOCPG** **FOCPM** Default: 0.000

Settings 0.000–5.000 sec.

- When the elevator is stopped and the mechanical brake is engaged, the drive stops output. At the same time, it produces noise from the reacting force between the motor and the mechanical brake. Use this parameter to decrease this reacting force and lower the noise.
- Sets the time when torque decreases from 300% to 0%.



$$\frac{i}{Pr.07\text{-}01} \times \frac{100\%}{300\%} \times (Pr.07\text{-}32) = t$$

07-33 Cooling Fan Control

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 2

Settings 0: Cooling fan is always ON.
1: One minute after AC motor drive stops, cooling fan is OFF.
2: AC motor drive runs and cooling fan is ON; AC motor drive stops and cooling fan is OFF.
3: Cooling fan is ON to run when preliminary IGBT temperature (°C) reached.
4: Cooling fan is always OFF.

- Use this parameter for the fan control.
- When Pr.07-33 is set to 3 and IGBT temperature is higher than 60°C, the fan starts to run until it is lower than 40°C.

07-36 Notch Filter Depth

Control Mode **FOCPG** **FOCPM** Default: 0

Settings 0–20 db

07-37 Notch Filter Frequency

Control Mode **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–200.00 Hz

- Sets the resonance frequency of the mechanical system. Adjust it to a smaller value to suppress the mechanical system resonance.
- A larger value improves resonance suppression function.
- The notch filter frequency is the mechanical frequency resonance.

Display Settings (Pr.07-40–07-41)

✎ 07-40 Start-up Display

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings
0: Display the Frequency command value (LED F)
1: Display the actual output frequency (LED H)
2: DC bus voltage (V)
3: Display the output current (A)
4: Output voltage (E)
5: User-defined (see Pr.07-41)

📖 Determines the start-up display page after power is applied to the drive.

✎ 07-41 Content of Multi-function Display

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings
0: Display the output current supplied to the motor from the drive (A) (Unit: Amp)
1: Reserved
2: Display the drive's actual output frequency (H) (Unit: Hz)
3: Display the drive's DC bus voltage (v) (Unit: V_{DC})
4: Display the terminals U, V, and W output voltage of the drive (E) (Unit: V_{AC})
5: Display the terminals U, V, and W output power factor angle to the motor (n) (Unit: deg)
6: Display the terminals U, V, and W output power to the motor (P) (Unit: kW)
7: Display the actual motor speed in rpm (r) (Unit: rpm)
8: Display the drive's estimated output torque in %; the motor's rated torque is 100% (t) (Unit: %)
9: Display the PG feedback (G) (See Pr.00-20 and Pr.00-21)
10: Display the electrical angle of drive output (d) (Unit: deg)
11: Display the AUI1 analog input terminal signal (1.) (Unit: %)
12: Display ACI1 (Unit: %)
13: Display the AUI2 analog input terminal signal (Unit: %)
14: Reserved
15: Display the IGBT temperature (T) (Unit: °C)
16: Display digital input status ON/OFF (i)
17: Display digital output status ON/OFF (o)
18: Display the step speed of multi-step speed that is executing (S)
19: The corresponding CPU digital input pin status (i.)
20: The corresponding CPU digital output pin status (o.)
21–23: Reserved
24: Output AC voltage when malfunction occurred (E) (Unit: V_{AC})
25: Output DC voltage when malfunction occurred (v) (Unit: V_{DC})
26: Motor frequency when malfunction occurred (H) (Unit: Hz)

27: Output current when malfunction occurred (A) (Unit: Amp)
28: Output frequency when malfunction occurred (F) (Unit: Hz)
29: Frequency command when malfunction occurred (F) (Unit: Hz)
30: Output power when malfunction occurred (P) (Unit: kW)
31: Output torque when malfunction occurred (t) (Unit: %)
32: Input terminal status when malfunction occurred (i)
33: Output terminal status when malfunction occurred (o)
34: Reserved
35: 24-hour detection for STO status
36: Reserved
37: Reserved
38: Reserved

- This parameter displays the content on the built-in keyboard panel KPED-LE02 user-defined page. Use this parameter to get the AC motor drive's status.
- Example 1:

bit	bit9	bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Terminal	MI8	MI7	MI6	MI5	MI4	MI3	MI2	MI1	REV	FWD
Status	0	0	1	0	0	0	0	1	1	0

0: OFF; 1: ON

MI1: Set Pr.01-00 to 1 (multi-step speed command 1).

MI6: Set Pr.01-05 to 8 (the 1st, 2nd acceleration/deceleration time selection).

If REV, MI1 and MI6 are ON, the value is 0000 0000 1000 0110 in binary and "0086H" in HEX. Meanwhile, if you set Pr.07-41 to 16, the built-in keyboard KPED-LE02 user-defined page displays "0086".

- Example 2:

bit	bit5	bit4	bit3	bit2	bit1	bit0
Terminal	MO2	MO1	RA4	RA3	RA2	RA1
Status	0	1	0	0	0	0

0: Normally open (N.O.); 1: Normally closed (N.C.)

MO1: Set Pr.01-14 to 9 (Drive is ready)

After applying the power to the AC motor drive, if there is no other error, the contact is N.C., the value is 0001 0000 in binary and "0010H" in HEX. Meanwhile, if you set Pr.07-41 to 17, the built-in keyboard KPED-LE02 user-defined page displays "0010".

Limit and Adjustment of Drive's Voltage and Current (Pr.07-50–07-57)

07-50 Automatic Voltage Regulation (AVR) Function

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Enable AVR

1: Disable AVR

2: Disable AVR when decelerating to stop

- The AVR function automatically regulates the AC motor drive output voltage to the motor's rated voltage when the input power is larger than the motor's rated voltages. For instance, if you set V/F curve to 200 V_{AC}/50 Hz and the input voltage is between 200–264 V_{AC}, then the output voltage to the motor is automatically regulated to 200 V_{AC}/50 Hz. If the input voltage is from 180 to 200 V_{AC}, the output voltage to the motor and the input voltage is in direct proportion to the input voltage.
- When the motor stops with deceleration, it shortens the deceleration time with AVR disabled. Setting this parameter to 1 with auto-acceleration/auto-deceleration results in quicker deceleration.

07-51 Brake Transistor Level

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 380.0 / 760.0

Settings 230V models: 350.0–450.0 V_{DC}

460V models: 700.0–900.0 V_{DC}

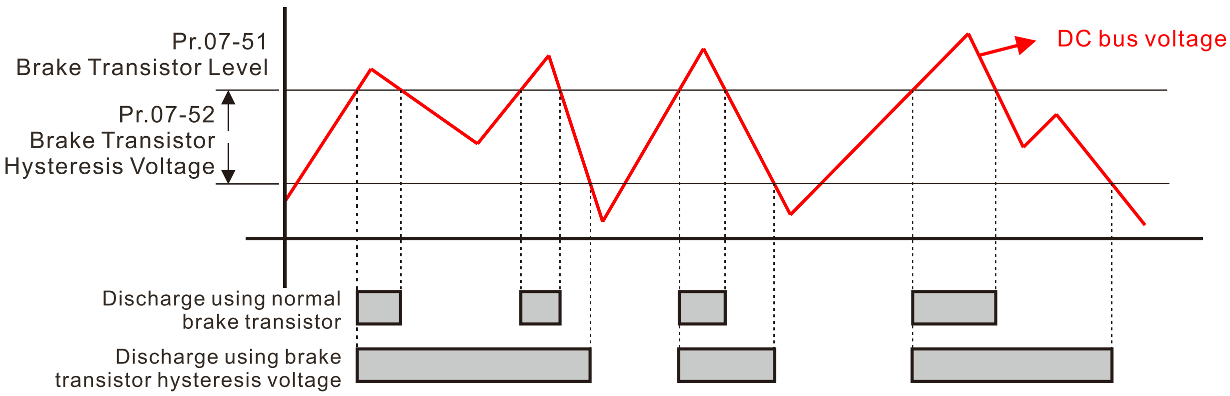
- Sets the DC bus voltage at which the brake transistor is activated.

07-52 Brake Transistor Hysteresis Voltage

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings 0.0–100.0

- Used with Pr.07-51 to make the activated voltage level within range in order to prevent the brake resistor from overheating due to frequent ON/OFF of the brake transistor caused by fluctuated DC bus voltage.



07-53 Current Limit

Control Mode **FOCPG** **FOCPM** Default: 200

Settings 0–250% (rated current of the motor drive)

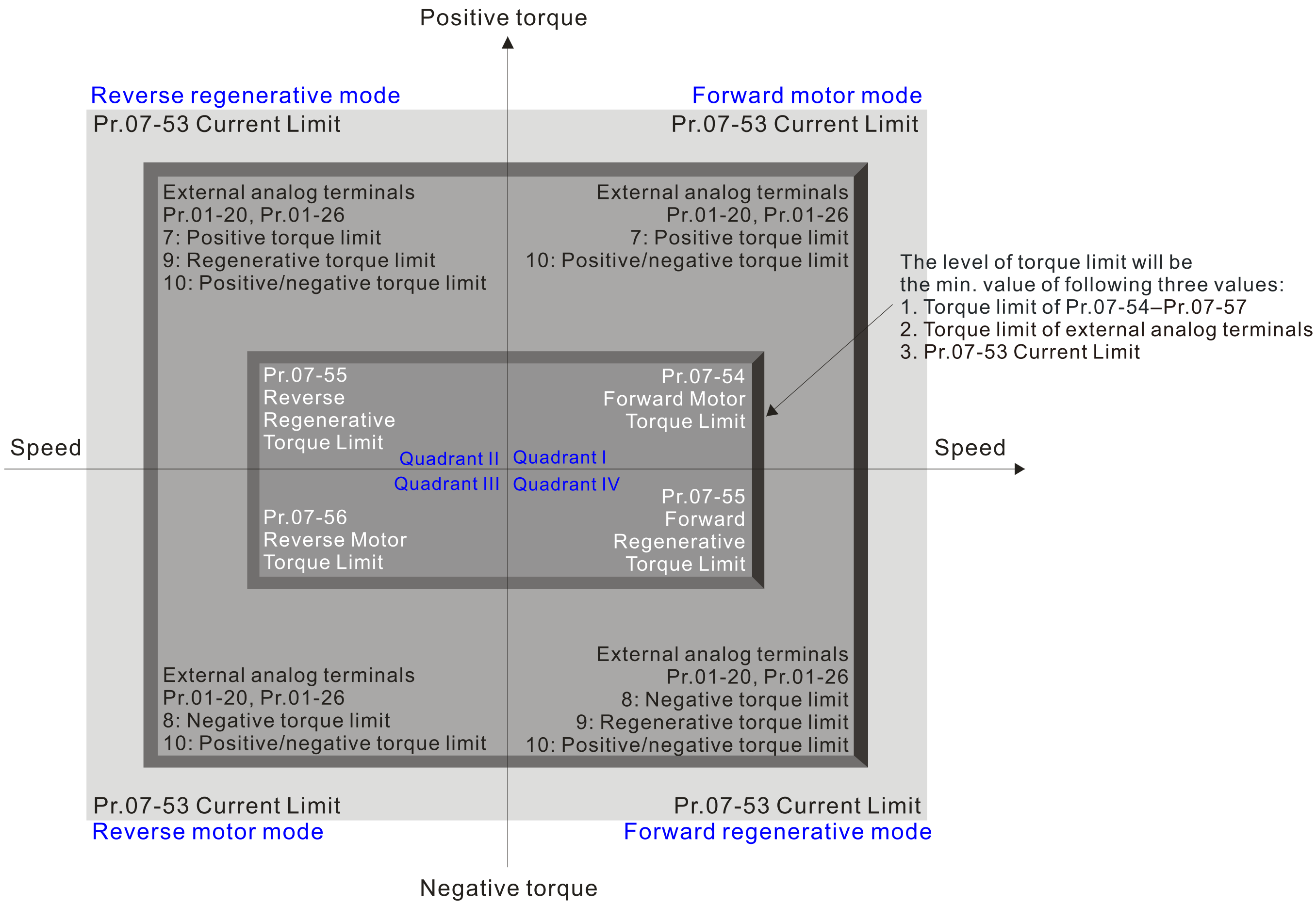
- Sets the drive's maximum output current.

✓	**07-54**	Forward Motor Torque Limit
✓	**07-55**	Forward Regenerative Torque Limit
✓	**07-56**	Reverse Motor Torque Limit
✓	**07-57**	Reverse Regenerative Torque Limit

Control Mode **FOCPG** **FOCPM** Default: 200

Settings 0–300% (rated torque of the motor drive)

📖 The motor rated torque is 100%. The settings for Pr.07-54–Pr.07-57 compare with Pr.01-20=7, 8, 9, 10. The minimum of the comparison result is torque limit. The diagram below illustrates the torque limit.



09 Communication Parameters

Modbus

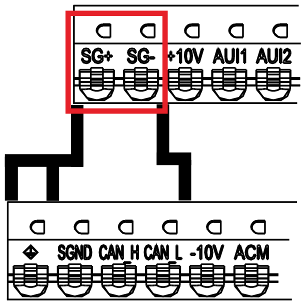
Pr.09-00–09-99

09 Communication Parameters

⚡: You can set this parameter during operation.

Modbus (Pr.09-00–09-99)

When using the communication interface, the diagram on the right shows the communication port pin definitions. It is recommended that you connect the AC motor drive to your PC by using Delta IFD6530 or IFD6500 as a communication converter. For details on Modbus communication protocol, see <Appendix B. Modbus Protocol>.



⚡ 09-00 Communication Address

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1

Settings 1–254

📖 Sets the communication address for the drive if the AC motor drive is controlled through RS-485 serial communication. The communication address for each AC motor drive must be unique.

⚡ 09-01 Transmission Speed

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 19.2

Settings 4.8–115.2 kbps

📖 Sets the transmission speed between the RS-485 master (PLC, PC, etc.) and the AC motor drive.

⚡ 09-02 Communication Protocol

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 13

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

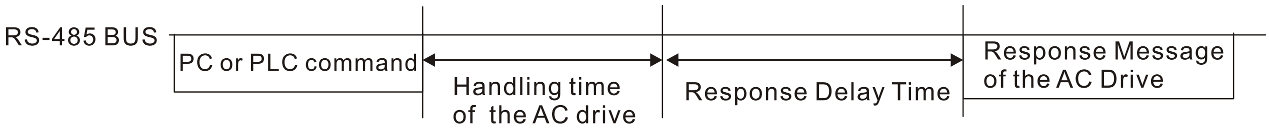
- Control by PC or PLC (Computer Link):
  Selects the desired mode along with the RS-485 serial port communication protocol in Pr.09-00.
- Modbus ASCII (American Standard Code for Information Interchange): Each data byte is the combination of two ASCII characters; for example, a 1-byte data: 64 Hex, is shown as ‘64’ in ASCII, and consists of ‘6’ (36 Hex) and ‘4’ (34 Hex).

09-03 Response Delay Time

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 2.0

Settings 0.0–200.0 ms

- If the host computer does not finish the transmitting/receiving process, you can use this parameter to set the response delay time after the AC motor drive receives communication command as shown in the following picture.



09-11 CAN Baud Rate

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: 1

Settings 0: 1M
1: 500k
2: 250k
3: 125k

09-04 – 09-99 Direct Docking Mode Only

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: -

Settings Contact Delta for more information

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10 DLC Parameters

Direct Docking

Pr.10-00–10-99

10 DLC Parameters

✓: You can set this parameter during operation.

Direct Docking (Pr.10-00–10-99)

10-00 – 10-99	Direct Docking Mode Only				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
	Settings	Contact Delta for more information			

11 Monitoring Function Parameters	Fault Record Pr.11-20–11-79

11 Monitoring Function Parameters

✓: You can set this parameter during operation.

Fault Record (Pr.11-20–11-79)

11-20	Accumulated Motor Operation Time (Min.)				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

11-21	Accumulated Motor Operation Time (Day)				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

📖 Pr.11-20 and Pr.11-21 record the motor operation time. The records can be cleared by setting the values to 0. Operating time that is less than 60 seconds is not recorded.

11-22	Accumulated Motor Power-on Time (Min.)				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

11-23	Accumulated Motor Power-on Time (Day)				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

11-24	Present Fault Record				
11-25	Second Most Recent Fault Record				
11-26	Third Most Recent Fault Record				
11-27	Fourth Most Recent Fault Record				
11-28	Fifth Most Recent Fault Record				
11-29	Sixth Most Recent Fault Record				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

Settings
0: No fault record
1: Over-current during acceleration (ocA)
2: Over-current during deceleration (ocd)
3: Over-current during constant speed (ocn)
4: Ground fault (GFF)
5: IGBT short-circuit (occ)
6: Over-current at stop (ocS)
7: Over-voltage during acceleration (ovA)
8: Over-voltage during deceleration (ovd)
9: Over-voltage during constant speed (ovn)
10: Over-voltage at stop (ovS)
11: Low voltage during acceleration (LvA)
12: Low voltage during deceleration (Lvd)
13: Low voltage during constant speed (Lvn)
14: Low voltage at stop (LvS)
15: Phase loss (PHL)
16: IGBT overheating fault (oH1)
18: IGBT temperature detection failure (tH1o)

21: Overload (oL)

22: Electronic thermal relay 1 protection (EoL1)

24: Motor over-heating PTC 2 (oH3_2)

26: Over-torque 1 (ot1)

30: FRAM writing error (cF1)

31: FRAM read error (cF2)

32: Current detection error (cd0)

33: U-phase error (cd1)

34: V-phase error (cd2)

35: W-phase error (cd3)

36: cc hardware failure (Hd0)

37: oc hardware failure (Hd1)

38: ov hardware failure (Hd2)

39: GFF hardware failure (Hd3)

40: Auto-tuning error (AUE)

42: Opposite PG feedback direction (PGF1)

43: PG feedback loss (PGF2)

44: PG feedback stall (PGF3)

45: PG slip error (PGF4)

49: External fault (EF)

50: Emergency stop (EF1)

52: Password is locked (Pcod)

54: Communication error 1 (CE01)

55: Communication error 2 (CE02)

56: Communication error 3 (CE03)

57: Communication error 4 (CE04)

58: Communication error 10 (CE10)

59: Digital keypad transmission time-out (CP10)

60: Brake transistor error (bF)

64: Mechanical brake feedback error (MbF)

65: PGSED communication error (PGF5)

66: Magnetic contactor error (MCF)

67: Motor phase loss (MPHL)

68: CAN Bus off (CAnF)

69: Rescue by mechanical brake control error (rbrE)

70: Safety gear release error (SFGE)

72: STO loss 1 (StL1)

73: PG cd wiring error (PGcd)

74: PG absolute signal error (PGHL)

75: PG Z-phase signal loss (PGAF)

76: Safe Torque Off function is enabled (Stoo)

77: STO loss 2 (StL2)

78: STO loss 3 (StL3)
81: Contact service (SERV)
85: Hardware brake over-current (Hocb)
86: Software brake over-current (Socb)
87: Brake resistor configuration error (brF)
88: Brake resistor is not connected (bro)
89: IGBT overload (oL3)
90: STO loss 4 (StL4)
91: STO loss 5 (StL5)
93: CANLift disconnection (CndL)
95: CANLift error (CnLF)
96: STO disconnection (Stod)
97: STO at running (Stor)
98: STO circuit sticking fault (StoS)
99: Ignore STO is ON (iSto)
100: Over Ripple Protection (orP)
105: Motor over-heating PTC 1 (oH3_1)

📖 The parameters record when the fault occurs and forces a stop. For the Lv, it records when it is operating, or it warns without recording.

11-30	Accumulated Drive Power-on Time at the First Fault (Min.)
11-32	Accumulated Drive Power-on Time at the Second Fault (Min.)
11-34	Accumulated Drive Power-on Time at the Third Fault (Min.)
11-36	Accumulated Drive Power-on Time at the Fourth Fault (Min.)
11-38	Accumulated Drive Power-on Time at the Fifth Fault (Min.)
11-40	Accumulated Drive Power-on Time at the Sixth Fault (Min.)

Control Mode **VF** **SVC** **FOCPG** Default: Read only

11-31	Accumulated Drive Power-on Time at the First Fault (Day)
11-33	Accumulated Drive Power-on Time at the Second Fault (Day)
11-35	Accumulated Drive Power-on Time at the Third Fault (Day)
11-37	Accumulated Drive Power-on Time at the Fourth Fault (Day)
11-39	Accumulated Drive Power-on Time at the Fifth Fault (Day)
11-41	Accumulated Drive Power-on Time at the Sixth Fault (Day)

Control Mode **VF** **SVC** **FOCPG** Default: Read only

11-42 Frequency Command when the Most Recent Fault Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-43 Output Frequency when the Most Recent Fault Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-44	Output Current when the Most Recent Fault Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-45	Motor Frequency when the Most Recent Fault Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-46	Output Voltage when the Most Recent Fault Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-47	DC Bus Voltage when the Most Recent Fault Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-48	Output Power when the Most Recent Fault Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-49	Output Torque when the Most Recent Fault Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-50	IGBT Temperature when the Most Recent Fault Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-51	Multi-input Terminals Status when the Most Recent Fault Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-52	Multi-output Terminals Status when the Most Recent Fault Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-53	Motor Drive Status when the Most Recent Fault Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

11-54	Output Frequency when Fault 2 Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-55	DC Bus Voltage when Fault 2 Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-56	Output Current when Fault 2 Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-57	IGBT Temperature when Fault 2 Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

11-58	Output Frequency when Fault 3 Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-59	DC Bus Voltage when Fault 3 Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-60	Output Current when Fault 3 Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only
11-61	IGBT Temperature when Fault 3 Occurred				
Control Mode	**VF**	**SVC**	**FOCPG**	**FOCPM**	Default: Read only

11-62 Output Frequency when Fault 4 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-63 DC Bus Voltage when Fault 4 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-64 Output Current when Fault 4 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-65 IGBT Temperature when Fault 4 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-66 Output Frequency when Fault 5 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-67 DC Bus Voltage when Fault 5 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-68 Output Current when Fault 5 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-69 IGBT Temperature when Fault 5 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-70 Output Frequency when Fault 6 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-71 DC Bus Voltage when Fault 6 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-72 Output Current when Fault 6 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-73 IGBT Temperature when Fault 6 Occurred

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

11-74 MBF Recorder

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

📖 When Pr.11-74=0, MbF is not triggered. When Pr.11-74=64, fault code MbF is triggered and is not cleared.

📖 The records of fault code MbF are kept even during power-off.

11-75 EoL Cnt Recorder H

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

📖 High byte of motor overload (EoL1) fault record.

11-76 EoL Cnt Recorder L

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

📖 Low byte of motor overload (EoL1) fault records.

11-79 STO 24-hour Counter

Control Mode **VF** **SVC** **FOCPG** **FOCPM** Default: Read only

- When STO is non-active, Pr.11-79 starts to count time.
- When it counts to 1440 minutes (24 hours), fault code stL5 occurs.

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12

Access

Favorite

Access Favorites

Pr.12-00–12-49

12 Access Favorite

〆: You can set this parameter during operation.

Access Favorites (Pr.12-00–12-49)

〆 **12-00** User-defined Parameter 1

Default: 700

Settings 0–1599

〆 **12-01** User-defined Parameter 2

Default: 702

Settings 0–1599

〆 **12-02** User-defined Parameter 3

Default: 703

Settings 0–1599

〆 **12-03** User-defined Parameter 4

Default: 1124

Settings 0–1599

〆 **12-04** User-defined Parameter 5

Default: 1125

Settings 0–1599

〆 **12-05** User-defined Parameter 6

Default: 1126

Settings 0–1599

〆 **12-06** User-defined Parameter 7

Default: 1127

Settings 0–1599

〆 **12-07** User-defined Parameter 8

Default: 1128

Settings 0–1599

〆 **12-08** User-defined Parameter 9

Default: 1129

Settings 0–1599

〆 **12-09** User-defined Parameter 10

Default: 1

Settings 0–1599

〆 **12-10** User-defined Parameter 11

Default: 2

Settings 0–1599

〆 **12-11** User-defined Parameter 12

Default: 3

Settings 0–1599

12-12 User-defined Parameter 13

Default: 10

Settings 0–1599

12-13 User-defined Parameter 14

Default: 11

Settings 0–1599

12-14 User-defined Parameter 15

Default: 12

Settings 0–1599

12-15 User-defined Parameter 16

Default: 13

Settings 0–1599

12-16 User-defined Parameter 17

Default: 14

Settings 0–1599

12-17 User-defined Parameter 18

Default: 15

Settings 0–1599

12-18 User-defined Parameter 19

Default: 20

Settings 0–1599

12-19 User-defined Parameter 20

Default: 21

Settings 0–1599

12-20 User-defined Parameter 21

Default: 22

Settings 0–1599

12-21 User-defined Parameter 22

Default: 23

Settings 0–1599

12-22 User-defined Parameter 23

Default: 40

Settings 0–1599

12-23 User-defined Parameter 24

Default: 42

Settings 0–1599

12-24 User-defined Parameter 25

Default: 50

Settings 0–1599

12-25 User-defined Parameter 26

Default: 51

Settings 0–1599

12-26 User-defined Parameter 27

Default: 52

Settings 0–1599

12-27 User-defined Parameter 28

Default: 53

Settings 0–1599

12-28 User-defined Parameter 29

Default: 71

Settings 0–1599

12-29 User-defined Parameter 30

Default: 72

Settings 0–1599

12-30 User-defined Parameter 31

Default: 82

Settings 0–1599

12-31 User-defined Parameter 32

Default: 90

Settings 0–1599

12-32 User-defined Parameter 33

Default: 91

Settings 0–1599

12-33 User-defined Parameter 34

Default: 92

Settings 0–1599

12-34 User-defined Parameter 35

Default: 93

Settings 0–1599

12-35 User-defined Parameter 36

Default: 95

Settings 0–1599

12-36 User-defined Parameter 37

Default: 100

Settings 0–1599

12-37 User-defined Parameter 38

Default: 101

Settings 0–1599

12-38 User-defined Parameter 39

Default: 102

Settings 0–1599

12-39 User-defined Parameter 40

Default: 103

Settings 0–1599

12-40 User-defined Parameter 41

Default: 104

Settings 0–1599

12-41 User-defined Parameter 42

Default: 105

Settings 0–1599

12-42 User-defined Parameter 43

Default: 106

Settings 0–1599

12-43 User-defined Parameter 44

Default: 107

Settings 0–1599

12-44 User-defined Parameter 45

Default: 110

Settings 0–1599

12-45 User-defined Parameter 46

Default: 111

Settings 0–1599

12-46 User-defined Parameter 47

Default: 112

Settings 0–1599

12-47 User-defined Parameter 48

Default: 113

Settings 0–1599

12-48 User-defined Parameter 49

Default: 114

Settings 0–1599

12-49 User-defined Parameter 50

Default: 115

Settings 0–1599

📖 If the setting value of Pr.12-00–Pr.12-49 is 0, it means no function is available.

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13

Display

Favorite

Display Favorites

Pr.13-00–13-49

13 Display Favorite

⁄ : You can set this parameter during operation.

Display Favorites (Pr.13-00–13-49)

13-00 – 13-49 View User-defined Parameters

13-00 AC Motor Drive Identity Code

Default: -

Display 0700 (Same as Pr.07-00)

13-01 Software Version

Default: -

Display 0702 (Same as Pr.07-02)

13-02 Date Code Y.WKD

Default: -

Display 0703 (Same as Pr.07-03)

13-03 Present Fault Record

Default: -

Display 1124 (Same as Pr.11-24)

13-04 Second Most Recent Fault Record

Default: -

Display 1125 (Same as Pr.11-25)

13-05 Third Most Recent Fault Record

Default: -

Display 1126 (Same as Pr.11-26)

13-06 Fourth Most Recent Fault Record

Default: -

Display 1127 (Same as Pr.11-27)

13-07 Fifth Most Recent Fault Record

Default: -

Display 1128 (Same as Pr.11-28)

13-08 Sixth Most Recent Fault Record

Default: -

Display 1129 (Same as Pr.11-29)

13-09 Control Mode

Default: -

Display 0001 (Same as Pr.00-01)

13-10 Master Frequency Command Source

Default: -

Display 0002 (Same as Pr.00-02)

13-11 Operation Command Source

Default: -

Display 0003 (Same as Pr.00-03)

13-12 Motor Rated Power

Default: -

Display 0010 (Same as Pr.00-10)

13-13 Motor Rated Voltage

Default: -

Display 0011 (Same as Pr.00-11)

13-14 Motor Rated Current

Default: -

Display 0012 (Same as Pr.00-12)

13-15 Motor Rated Frequency

Default: -

Display 0013 (Same as Pr.00-13)

13-16 Motor Rated Speed

Default: -

Display 0014 (Same as Pr.00-14)

13-17 Number of Motor Poles

Default: -

Display 0015 (Same as Pr.00-15)

13-18 Selection of Encoder

Default: -

Display 0020 (Same as Pr.00-20)

13-19 Encoder PPR

Default: -

Display 0021 (Same as Pr.00-21)

13-20 High Resolution SIN/COS and Communication Encoder

Default: -

Display 0022 (Same as Pr.00-22)

13-21 Encoder Input Type Setting

Default: -

Display 0023 (Same as Pr.00-23)

13-22 Elevator Speed

Default: -

Display 0040 (Same as Pr.00-40)

13-23 Traction Sheave Diameter

Default: -

Display 0042 (Same as Pr.00-42)

13-24 Zero Step Speed Frequency

Default: -

Display 0050 (Same as Pr.00-50)

13-25 1st Step Speed Frequency

Default: -

Display 0051 (Same as Pr.00-51)

13-26 2nd Step Speed Frequency

Default: -

Display 0052 (Same as Pr.00-52)

13-27 3rd Step Speed Frequency

Default: -

Display 0053 (Same as Pr.00-53)

13-28 Accel. Time of Set 1

Default: -

Display 0071 (Same as Pr.00-71)

13-29 Decel. Time of Set 1

Default: -

Display 0072 (Same as Pr.00-72)

13-30 Deceleration Time when Operating without RUN Command

Default: -

Display 0082 (Same as Pr.00-82)

13-31 S-curve for Acceleration Begin Time S1

Default: -

Display 0090 (Same as Pr.00-90)

13-32 S-curve for Acceleration Arrival Time S2

Default: -

Display 0091 (Same as Pr.00-91)

13-33 S-curve for Deceleration Begin Time S3

Default: -

Display 0092 (Same as Pr.00-92)

13-34 S-curve for Deceleration Arrival Time S4

Default: -

Display 0093 (Same as Pr.00-93)

13-35 S-curve for Deceleration Arrival Time S5

Default: -

Display 0095 (Same as Pr.00-95)

13-36 Multi-function Input Command 1 (MI1)

Default: -

Display 0100 (Same as Pr.01-00)

13-37 Multi-function Input Command 2 (MI2)

Default: -

Display 0101 (Same as Pr.01-01)

13-38 Multi-function Input Command 3 (MI3)

Default: -

Display 0102 (Same as Pr.01-02)

13-39 Multi-function Input Command 4 (MI4)

Default: -

Display 0103 (Same as Pr.01-03)

13-40 Multi-function Input Command 5 (MI5)

Default: -

Display 0104 (Same as Pr.01-04)

13-41 Multi-function Input Command 6 (MI6)

Default: -

Display 0105 (Same as Pr.01-05)

13-42 Multi-function Input Command 7 (MI7)

Default: -

Display 0106 (Same as Pr.01-06)

13-43 Multi-function Input Command 8 (MI8) (Enable Drive terminal)

Default: -

Display 0107 (Same as Pr.01-07)

13-44 Multi-function Output 1: RA1, RB1, RC1 (Relay 1)

Default: -

Display 0110 (Same as Pr.01-10)

13-45 Multi-function Output 2: RA2, RC2 (Relay 2)

Default: -

Display 0111 (Same as Pr.01-11)

13-46 Multi-function Output 3: RA3, RC3 (Relay 3)

Default: -

Display 0112 (Same as Pr.01-12)

13-47 Multi-function Output 4: RA4, RC4 (Relay 4)

Default: -

Display 0113 (Same as Pr.01-13)

13-48 Multi-function Output 5: MO1

Default: -

Display 0114 (Same as Pr.01-14)

13-49 Multi-function Output 6: MO2

Default: -

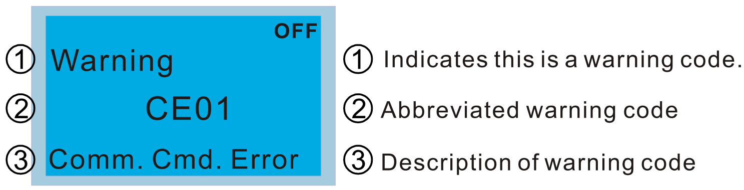
Display 0115 (Same as Pr.01-15)

Chapter 9 Warning and Fault Codes

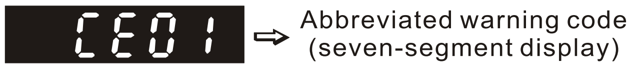
9-1 Warning Codes and Descriptions

Warning code displays differently on ***digital keypad KPC-CC01*** and ***built-in keyboard panel KPED-LE02***. Examples of their different displays show as below.

- Example of warning code shows on digital keypad KPC-CC01:



- Example of warning code shows on built-in keyboard panel KPED-LE02:



9-1-1 List of Warning Codes

ID No.	Warning Code	Warning Name	ID No.	Warning Code	Warning Name
0	No warning record		19	PHL	Phase loss
1	CE01	Communication error 1	20	ot1	Over-torque 1
2	CE02	Communication error 2	22	oH3_2	Motor over-heating PTC 2
3	CE03	Communication error 3	24	oSL	Over-slip warning
4	CE04	Communication error 4	25	tUn	Auto tuning
5	CE10	Communication error 10	27	dCAn	CAN bus disconnection
6	CP10	Digital keypad transmission time-out	28	StoA	Safe torque off loss
7	SE1	Save error 1	30	SE3	Save error 3
8	SE2	Save error 2	31	SERV	Contact service SERV
9	oH1	IGBT overheating warning	34	SdFMT	SD format error
14	AUE	Auto-tuning warning	35	CAnA	CAN alarm
15	PGF1	Opposite PG feedback direction	45	Stob	STO sequence
16	PGF2	PG feedback loss	46	Stoc	STO sticking warning
17	PGF3	PG feedback stall	50	oH3_1	Motor over-heating PTC 1
18	PGF4	PG slip error			

Check the abbreviated warning code to find related information on action, reset, causes and corrective actions.

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
1	CE01	CE01	Communication error 1	Illegal function code

Action and Reset		
Action Condition	When the function code is incorrect	
Action Time	Immediately act	
Warning Treatment Parameter	Pr.04-60 (Default: 3) 0: Warn and keep operation 1: Fault and ramp to stop 2: Reserved 3: No action and no display	
Reset Method	Auto	When Pr.04-60=0, CE01 is a warning and will be automatically cleared.
	Manual	When Pr.04-60=1, CE01 is a fault and must be reset manually.
Reset Condition	N/A	
Record	If CE01 is a warning, it will not be recorded. If CE01 is a fault, it will be recorded.	

Cause	Corrective Actions
Incorrect communication command from elevator controller	Check if the communication command is correct.
Malfunction caused by interference	Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.
Different communication setting from the elevator controller	Check if the setting for Pr.09-00–Pr.09-02 is the same as the setting for the elevator controller.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

<table>
<tr><th>ID No.</th><th>Abbreviated Warning Code</th><th>Display on KPED-LE02</th><th>Warning Name</th><th>Description</th></tr>
<tr><td>2</td><td>CE02</td><td>CE02</td><td>Communication error 2</td><td>Illegal data address</td></tr>
</table>

<table>
<tr><th colspan="3">Action and Reset</th></tr>
<tr><td>Action Condition</td><td colspan="2">When the input data address is incorrect</td></tr>
<tr><td>Action Time</td><td colspan="2">Immediately act</td></tr>
<tr><td>Warning Treatment Parameter</td><td colspan="2">Pr.04-60 (Default: 3)
0: Warn and keep operation
1: Fault and ramp to stop
2: Reserved
3: No action and no display</td></tr>
<tr><td rowspan="2">Reset Method</td><td>Auto</td><td>When Pr.04-60=0, CE02 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td>When Pr.04-60=1, CE02 is a fault and must be reset manually.</td></tr>
<tr><td>Reset Condition</td><td colspan="2">N/A</td></tr>
<tr><td>Record</td><td colspan="2">If CE02 is a warning, it will not be recorded.
If CE02 is a fault, it will be recorded.</td></tr>
<tr><th>Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td>Incorrect communication command from elevator controller</td><td colspan="2">Check if the communication command is correct.</td></tr>
<tr><td>Malfunction caused by interference</td><td colspan="2">Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.</td></tr>
<tr><td>Different communication setting from the elevator controller</td><td colspan="2">Check if the setting for Pr.09-00–Pr.09-02 is the same as the setting for the elevator controller.</td></tr>
<tr><td>Disconnection or bad connection of the cable</td><td colspan="2">Check the cable and replace it if necessary.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Warning Code</th><th>Display on KPED-LE02</th><th>Warning Name</th><th colspan="2">Description</th></tr>
<tr><td>3</td><td>CE03</td><td>CE03</td><td>Communication error 3</td><td colspan="2">Illegal data value. Occurs when communication data length exceeds limits.</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">When the length of communication data is too long</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Warning Treatment Parameter</td><td colspan="4">Pr.04-60 (Default: 3)
0: Warn and keep operation
1: Fault and ramp to stop
2: Reserved
3: No action and no display</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="3">When Pr.04-60=0, CE03 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="3">When Pr.04-60=1, CE03 is a fault and must be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">If CE03 is a warning, it will not be recorded.
If CE03 is a fault, it will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Incorrect communication command from elevator controller</td><td colspan="4">Check if the communication command is correct.</td></tr>
<tr><td colspan="2">Malfunction caused by interference</td><td colspan="4">Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.</td></tr>
<tr><td colspan="2">Different communication setting from the elevator controller</td><td colspan="4">Check if the setting for Pr.09-00–Pr.09-02 is the same as the setting for the elevator controller.</td></tr>
<tr><td colspan="2">Disconnection or bad connection of the cable</td><td colspan="4">Check the cable and replace it if necessary.</td></tr>
</table>

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
4	CE04	CE04	Communication error 4	Data is written to read-only address. Error occurs when trying to write values into read-only address such as 0x21xx, 0x22xx, and so on.

Action and Reset		
Action Condition	N/A	
Action Time	Immediately act	
Warning Treatment Parameter	Pr.04-60 (Default: 3) 0: Warn and keep operation 1: Fault and ramp to stop 2: Reserved 3: No action and no display	
Reset Method	Auto	When Pr.04-60=0, CE04 is a warning and will be automatically cleared.
	Manual	When Pr.04-60=1, CE04 is a fault and must be reset manually.
Reset Condition	N/A	
Record	If CE04 is a warning, it will not be recorded. If CE04 is a fault, it will be recorded.	

Cause	Corrective Actions
Incorrect communication command from elevator controller	Check if the communication command is correct.
Malfunction caused by interference	Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.
Different communication setting from the elevator controller	Check if the setting for Pr.09-00–Pr.09-02 is the same as the setting for the elevator controller.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

<table>
<tr><th>ID No.</th><th>Abbreviated Warning Code</th><th>Display on KPED-LE02</th><th colspan="2">Warning Name</th><th>Description</th></tr>
<tr><td>5</td><td>CE10</td><td>CE 10</td><td colspan="2">Communication error 10</td><td>Modbus transmission time-out</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="3">Action Condition</td><td colspan="3">N/A</td></tr>
<tr><td colspan="3">Action Time</td><td colspan="3">When communication time exceeds the detection time of Pr.04-61</td></tr>
<tr><td colspan="3">Warning Treatment Parameter</td><td colspan="3">Pr.04-60 (Default: 3)
0: Warn and keep operation
1: Fault and ramp to stop
2: Reserved
3: No action and no display</td></tr>
<tr><td colspan="3" rowspan="2">Reset Method</td><td>Auto</td><td colspan="2">When Pr.04-60=0, CE10 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="2">When Pr.04-60=1, CE10 is a fault and must be reset manually.</td></tr>
<tr><td colspan="3">Reset Condition</td><td colspan="3">N/A</td></tr>
<tr><td colspan="3">Record</td><td colspan="3">If CE10 is a warning, it will not be recorded.
If CE10 is a fault, it will be recorded.</td></tr>
<tr><th colspan="3">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="3">Incorrect communication command from elevator controller</td><td colspan="3">Check if the communication command is correct.</td></tr>
<tr><td colspan="3">Malfunction caused by interference</td><td colspan="3">Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.</td></tr>
<tr><td colspan="3">Different communication setting from the elevator controller</td><td colspan="3">Check if the setting for Pr.09-00–Pr.09-02 is the same as the setting for the elevator controller.</td></tr>
<tr><td colspan="3">Disconnection or bad connection of the cable</td><td colspan="3">Check the cable and replace it if necessary.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Warning Code</th><th>Display on KPED-LE02</th><th>Warning Name</th><th colspan="2">Description</th></tr>
<tr><td>6</td><td>CP10</td><td>CP10</td><td>Digital keypad transmission time-out</td><td colspan="2">Communication time-out for digital keypad KPC-CC01</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">When communication time exceeds Pr.04-63</td></tr>
<tr><td colspan="2">Warning Treatment Parameter</td><td colspan="4">Pr.04-62 (Default: 3)
0: Warn and keep operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No action and no display</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="3">When Pr.04-62=0, CP10 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="3">When Pr.04-62=1 or 2, CP10 is a fault and must be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">If CP10 is a warning, it will not be recorded.
If CP10 is a fault, it will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Disconnection or bad connection of the cable</td><td colspan="4">Check the cable and replace it if necessary.</td></tr>
<tr><td colspan="2">Digital keypad malfunction</td><td colspan="4">Replace the digital keypad</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Warning Code</th><th>Display on KPED-LE02</th><th>Warning Name</th><th colspan="2">Description</th></tr>
<tr><td>7</td><td>SE1</td><td></td><td>Save error 1</td><td colspan="2">Built-in keyboard panel copy error 1: copy time-out</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">“SE1” warning occurs when the built-in keyboard panel does not transmit the COPY command to the drive, or does not transmit any data to the drive again in five seconds at the time you copy the parameters to the drive.</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">5 seconds</td></tr>
<tr><td colspan="2">Warning Treatment Parameter</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets immediately</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">No</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Communication connection error</td><td colspan="4" rowspan="3">SE1: The causes of error are mostly communication problems between the built-in keyboard panel and control board. Potential causes include communication signal interference and the unacceptable communication command to the Slave. It is suggested to check the communication quality and remove the error causes first. Check if the error occurs randomly, or only occurs when copying certain parameters (the error displays on the upper right corner of the copy page). If you cannot clear the error, contact Delta.</td></tr>
<tr><td colspan="2">Built-in keyboard panel error</td></tr>
<tr><td colspan="2">Control board error</td></tr>
</table>

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
8	SE2	SE2	Save error 2	Built-in keyboard panel copy error 2: parameter writing error

Action and Reset	
Action Condition	"SE2" warning occurs when writing the parameters incorrectly at the time you copy parameters to the drive. For example, you copy the new firmware version with added parameters to the drive with old firmware version.
Action Time	N/A
Warning Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	No
Cause	**Corrective Actions**
Add new parameters to the old firmware version.	SE2: In this stage, the copied data has been transmitted to the Slave. The Slave compares and processes the copied data, and then saves the data to the Data ROM. During the process, the data error (should be attribution error) may occur, or the data cannot be saved to EEPROM. At this time, the warning occurs. It is suggested to check the status of Data ROM and remove the error causes first. If you cannot clear the error, contact Delta.
Malfunction caused by interference	Verify the wiring and grounding of the main circuit, control circuit and the encoder for effective anti-interference performance.

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
9	oH1	oH1	IGBT overheating warning	If IGBT temperature is higher than oH1 Fault Level shown in the table below when drive detects overheating of IGBT, keypad displays oH1 fault, not oH1 warning.

Action and Reset	
Action Condition	Pr.04-55 IGBT Overheat Warning (oH1)
Action Time	Immediately act
Warning Treatment Parameter	N/A
Reset Method	Auto reset
Reset Condition	Resets when temperature reaches the oH1 Reset Level shown in the table below
Record	No

Cause	Corrective Actions
Check if the ambient temperature or temperature inside the cabinet is too high, or if there is obstruction in the ventilation hole of the control cabinet.	1. Check the ambient temperature. 2. Regularly inspect the ventilation hole of the control cabinet. 3. Change the installed place if there are heating objects, such as brake resistors, in the surroundings. 4. Install/add cooling fan or air conditioner to lower the temperature inside the cabinet.
Check if there is any obstruction on IGBT or if the fan is running	Remove the obstruction or replace the cooling fan.
Insufficient ventilation space	Increase ventilation space of the drive.
Check if the drive matches the corresponded loading	1. Decrease loading. 2. Decrease the carrier. 3. Replace with a drive with larger capacity.
The drive has run 100% or more of the rated output for a long time	Replace with a drive with larger capacity.

Models / Phase	Frame	Model Name	oH1 Fault Level	oH1 Warning Level	oH1 Reset Level
230V / Single-phase	A	VFD022ED21B	85	oH1 Fault Level-5 or Pr.04-55	oH1 Warning Level -5
		VFD037ED21B	90		
460V / Three-phase	A	VFD040ED43B	90		
		VFD055ED43B	90		
		VFD075ED43B	95		
	B	VFD110ED43B	100		
		VFD150ED43B	110		
		VFD185ED43B	110		

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
14	AUE		Auto-tuning warning	Motor auto-tuning warning

Action and Reset	
Action Condition	Error occurs during motor auto-tuning and motor auto-tuning is not finished.
Action Time	Immediately act
Warning Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	No

Cause	Corrective Actions
Press STOP key during auto-tuning	Re-execute auto-tuning.
Incorrect motor capacity (too large or too small) and parameter setting	Verify motor specification and set motor parameter settings again (Pr.00-10–Pr.00-16).
Incorrect motor wiring	Check the wiring.
Motor shaft lock	Remove the cause of motor shaft lock.
The magnetic contactor installed at the drive output (U/V/W) is Open	Make sure the magnetic contactor is Closed.
The load is too large.	Reduce the load. Replace the motor with a larger capacity model.
Incorrect encoder signal (PGHH)	1. Check if the A/B/C/D wiring is correct. 2. Check if the signal line of the encoder is interfered.

<table>
<tr><th>ID No.</th><th>Abbreviated Warning Code</th><th colspan="2">Display on KPED-LE02</th><th>Warning Name</th><th>Description</th></tr>
<tr><td>15</td><td>PGF1</td><td colspan="2">PGF1</td><td>Opposite PG feedback direction</td><td>The motor runs in a reverse direction to the frequency command direction, and the time error occurred exceeds Pr.04-71 detection time.</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">1. Encoder input type does not set (Pr.00-23 = 0)
2. Feedback direction is opposite to the frequency command direction</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Pr.04-71 Encoder Feedback Signal Fault Detection Time (Default: 1.0 second)</td></tr>
<tr><td colspan="2">Warning Treatment Parameter</td><td colspan="4">Pr.04-70 (Default: 2)
0: Warn and keep operation
1: Fault and ramp to stop
2: Fault and stop operation</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="3">When Pr.04-70=0, PGF1 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="3">When Pr.04-70=1 or 2, PGF1 is a fault and must be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets immediately</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">If PGF1 is a warning, it will not be recorded.
If PGF1 is a fault, it will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Incorrect parameter setting of encoders</td><td colspan="4">Set encoder parameter settings again (Pr.00-23)</td></tr>
<tr><td colspan="2">Check if A/B wiring of the encoder is reverse</td><td colspan="4">Ensure the A/B wiring is correct.</td></tr>
</table>

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
16	PGF2	PGF2	PG feedback loss	When using control mode with PG feedback function and a speed command is given, drive detects that no encoder pulse signal is received by PG card for a certain time, and the time error occurred exceeds Pr.04-71 detection time.

Action and Reset		
Action Condition	No encoder pulse signal is received by PG card for a certain time during operation	
Action Time	Pr.04-71 Encoder Feedback Signal Fault Detection Time (Default: 1.0 second)	
Warning Treatment Parameter	Pr.04-70 (Default: 2) 0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and stop operation	
Reset Method	Auto	When Pr.04-70=0, PGF2 is a warning will be automatically cleared.
	Manual	When Pr.04-70=1 or 2, PGF2 is a fault and it must be reset manually.
Reset Condition	Resets immediately	
Record	If PGF2 is a warning, it will not be recorded. If PGF2 is a fault, it will be recorded.	
Cause	**Corrective Actions**	
Incorrect parameter setting of encoders	Set encoder parameter settings again (Pr.00-20–Pr.00-23).	
Improper wiring or bad connection of the encoder	Check if the wiring is correct.	
Motor locked under no overload	1. Check if improper wiring or bad connection of the encoder. 2. Remove the causes of motor locked.	

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
17	PGF3	PGF3	PG feedback stall	In PG mode, when motor frequency exceeds Pr.04-73 (Encoder Stall Level) and starts to count the time, and the time error occurred exceeds Pr.04-74 (Encoder Stall Detection Time), PGF3 occurs.

Action and Reset		
Action Condition		Pr.04-73 Encoder Stall Level (Default: 115% of Maximum Output Frequency (Pr.03-50))
Action Time		Pr.04-74 Encoder Stall Detection Time (Default: 0.10 second)
Warning Treatment Parameter		Pr.04-72 (Default: 2) 0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and stop operation
Reset Method	Auto	PGF3 is a warning when Pr.04-72=0. It will be automatically cleared when the difference between Frequency command and feedback frequency is smaller than encoder slip range.
	Manual	PGF3 is a fault when Pr.04-72= 1 or 2. You must reset it manually.
Reset Condition		Resets immediately
Record		If PGF3 is a warning, it will not be recorded. If PGF3 is a fault, it will be recorded.
Cause		Corrective Actions
Incorrect parameter setting of motor		Verify motor specification and set motor parameter settings again (Pr.00-10–Pr.00-16).
Incorrect parameter settings for ASR when in rated speed		Set ASR-related parameters again.
Incorrect settings for acceleration / deceleration time when in rated speed		Adjust acceleration /deceleration time (Pr.00-71–Pr.00-78).
Incorrect parameter settings for PG feedback stall		Properly increase Pr.04-73 and Pr.04-74 settings.

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
18	PGF4	PGF4	PG slip error	In PG mode, when motor the difference between output frequency command and motor feedback frequency is larger than encoder slip range (Pr.04-75) and starts to count the time, and the time error occurred exceeds Pr.04-76 (Encoder Slip Detection Time), PGF4 occurs.

Action and Reset		
Action Condition	Pr.04-75 Encoder Slip Range (Default: 50% of Maximum Output Frequency (Pr.03-50))	
Action Time	Pr.04-76 Encoder Slip Detection Time (Default: 0.05 second)	
Warning Treatment Parameter	Pr.04-72 (Default: 2) 0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and stop operation	
Reset Method	Auto	PGF4 is a warning when Pr.04-72=0. It will be automatically cleared when the difference between Frequency command and feedback frequency is smaller than encoder slip range.
	Manual	PGF4 is a fault when Pr.04-72= 1 or 2. You must reset it manually.
Reset Condition	Resets immediately	
Record	If PGF4 is a warning, it will not be recorded. If PGF4 is a fault, it will be recorded.	

Cause	Corrective Actions
Incorrect parameter setting of motor	Verify motor specification and set motor parameter settings again (Pr.00-10–Pr.00-16).
Incorrect parameter settings or wiring for encoders	Set encoder-related parameters again (Pr.00-20–Pr.00-23), and check if the wiring is correct.
Acceleration / deceleration time is set too short	Adjust acceleration /deceleration time (Pr.00-71–Pr.00-78).
Incorrect parameter settings for PG slip range	Properly increase Pr.04-75 and Pr.04-76 settings.

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
19	PHL	PHL	Phase loss	Input phase loss warning

Action and Reset	
Action Condition	1: Software detection: DC bus is lower than Pr.07-51 (Brake Transistor Level) and DC bus ripple is higher than 30V 2: Software detection: Power factor angle is smaller than 80 degree and DC bus ripple is higher than 30V 3: Hardware automatically detects external phase loss
Action Time	Hardware automatically detects external phase loss
Warning Treatment Parameter	Pr.04-31 (Input Phase-loss Protection during Operation)
Reset Method	This warning will be automatically cleared after drive stops.
Reset Condition	Resets once the drive stops
Record	Pr.04-31 Input Phase-loss Protection during Operation (Default: 2) When Pr.04-31=0, PHL is a warning and will not be recorded. When Pr.04-31=1 or 2, PHL is a fault and will be recorded.

Cause	Corrective Actions
Phase loss of the input power	Verify wiring of the main circuit.
Single-phase power input on a three-phase model	Use the model with voltage that matches the power.
The power voltage has changed	If the power of main circuit works well, check if the MC of the main circuit is broken. Cycle the power after verifying the power is normal. If PHL still occurs, return to the factory for repair.
Loose wiring terminal of input power	Tighten the terminal screws with the torque listed in the user manual.
Check if the input cable of three-phase power is broken	Make sure the wiring is correct. Replace the broken part of the cable.
Unbalanced three-phase of the input power	Check the status of three-phase power.
Brake discharge level is too high	Adjust Pr.07-51 (Brake Transistor Level) setting value.

<table>
<tr><th>ID No.</th><th>Abbreviated Warning Code</th><th>Display on KPED-LE02</th><th>Warning Name</th><th colspan="2">Description</th></tr>
<tr><td>20</td><td>ot1</td><td></td><td>Over-torque 1</td><td colspan="2">Output current is larger than over-torque detection level Pr.04-41</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">Pr.04-41 Over-torque Detection Level (OT1)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Pr.04-42 Over-torque Detection Time (OT1)</td></tr>
<tr><td colspan="2">Warning Treatment Parameter</td><td colspan="4">Pr.04-40 Over-torque Detection (OT1) (Default: 0)
0: Over-torque detection disabled
1: Over-torque detection during constant speed operation, continue to operate after detection
2: Over-torque detection during constant speed operation, stop operating after detection
3: Over-torque detection during operation, continue to operate after detection
4: Over-torque detection during operation, stop operating after detection</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="3">When Pr.04-40=1 or 3, ot1 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="3">When Pr.04-40=2 or 4, ot1 is a fault and must be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets when output current is smaller than over-torque detection level.</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">If ot1 is a warning, it will not be recorded.
If ot1 is a fault, it will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Incorrect parameter setting</td><td colspan="4">Configure the settings for Pr.04-41 and Pr.04-42 again.</td></tr>
<tr><td colspan="2">Mechanical error (e.g. mechanical lock due to over-torque)</td><td colspan="4">Remove the causes of malfunction.</td></tr>
<tr><td colspan="2">The load is too large</td><td colspan="4">Decrease the loading.
Replace with a motor with larger capacity.</td></tr>
<tr><td colspan="2">Accel./ Decel. time and working cycle are too short</td><td colspan="4">Increase the setting values for Pr.00-71–Pr.00-78 (accel./ decel. time).</td></tr>
<tr><td colspan="2">V/F voltage is too high when in open-loop circuit control</td><td colspan="4">Decrease the setting values for Pr.03-51–Pr.03-56 (V/F curve).</td></tr>
<tr><td colspan="2">The motor capacity is too small</td><td colspan="4">Replace with a motor with larger capacity.</td></tr>
<tr><td colspan="2">Overload occurs during low-speed operation</td><td colspan="4">Decrease the loading during low-speed operation.
Increase the motor capacity.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Warning Code</th><th>Display on KPED-LE02</th><th>Warning Name</th><th colspan="2">Description</th></tr>
<tr><td>22</td><td>oH3_2</td><td></td><td>Motor over-heating PTC 2</td><td colspan="2">Motor over-heating warning.
The drive detects the temperature inside the motor is too high.</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">PTC 2 input level > Pr.04-51 (default = 50%)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Warning Treatment Parameter</td><td colspan="4">Pr.04-50 PTC 2 (Positive Temperature Coefficient) Detection Action
0: Warn and keep operation
1: Fault and ramp to stop</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="3">When Pr.04-50=0, oH3_2 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="3">When Pr.04-50=1, oH3_2 is a fault and must be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets when temperature is lower than Pr.04-51 level</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">If oH3_2 is a warning, it will not be recorded.
If oH3_2 is a fault, it will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Motor locked</td><td colspan="4">Clear the motor lock status.</td></tr>
<tr><td colspan="2">The load is too large</td><td colspan="4">Decrease the loading.
Replace with a motor with larger capacity.</td></tr>
<tr><td colspan="2">Ambien temperature is too high</td><td colspan="4">Change the installed place if there are heating devices in the surroundings.
Install/ add cooling fan or air conditioner to lower the ambient temperature.</td></tr>
<tr><td colspan="2">Motor cooling system error</td><td colspan="4">Check the cooling system to make it work normally.</td></tr>
<tr><td colspan="2">Motor fan error</td><td colspan="4">Replace the fan.</td></tr>
<tr><td colspan="2">Operates at low-speed too long</td><td colspan="4">Decrease low-speed operation time.
Change to dedicated motor for the drive.
Increase the motor capacity.</td></tr>
<tr><td colspan="2">Accel./ Decel. time and working cycle are too short</td><td colspan="4">Increase setting values for Pr.00-71–Pr.00-78 (accel./ decel. time).</td></tr>
<tr><td colspan="2">V/F voltage is too high when in open-loop circuit control</td><td colspan="4">Decrease the setting values for Pr.03-51–Pr.03-56 (V/F curve).</td></tr>
<tr><td colspan="2">Check if the motor rated current matches the motor nameplate</td><td colspan="4">Configure the correct rated current value of the motor again.</td></tr>
<tr><td colspan="2">Check if the PTC 2 is properly set and wired</td><td colspan="4">Check the connection between PTC 2 thermistor and the heat protection.</td></tr>
<tr><td colspan="2">Check if the setting for stall prevention is correct</td><td colspan="4">Set the stall prevention to the proper value.</td></tr>
<tr><td colspan="2">Unbalanced three-phase impedance of the motor</td><td colspan="4">Replace the motor.</td></tr>
<tr><td colspan="2">Harmonics is too high</td><td colspan="4">Use remedies to reduce harmonics.</td></tr>
</table>

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
24	oSL		Over-slip warning	Over-slip occurs when driving asynchronous motor

Action and Reset		
Action Condition	Pr.04-21 Slip Deviation Level	
Action Time	Pr.04-22 Slip Deviation Detection Time	
Warning Treatment Parameter	Pr.04-20 Over-slip Action (Default: 0) 0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and coast to stop	
Reset Method	Auto	When Pr.04-20=0, oSL is a warning and will be automatically cleared.
	Manual	When Pr.04-20=1 or 2, oSL is a fault and must be reset manually.
Reset Condition	Automatically clears	
Record	If oSL is a warning, it will not be recorded. If oSL is a fault, it will be recorded.	

Cause	Corrective Actions
Check if the motor parameter is correct	Check the motor parameter.
The load is too large	Decrease the loading.
Check if the settings for Pr.04-21 and Pr.04-22 are properly set	Check the parameter settings for oSL protection.

<table>
<tr><th>ID No.</th><th>Abbreviated Warning Code</th><th>Display on KPED-LE02</th><th>Warning Name</th><th colspan="2">Description</th></tr>
<tr><td>25</td><td>tUn</td><td></td><td>Auto tuning</td><td colspan="2">Parameter auto-tuning is processing.
When running auto-tuning, the keypad displays “tUn”.</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">When running Pr.00-30 Motor Auto-tuning, the keypad displays “tUn”</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Warning Treatment Parameter</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">When auto-tuning is finished and no error occurs, the warning will be automatically cleared.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">When auto-tuning is finished and no error occurs.</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">No</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">The motor parameter is running auto-tuning</td><td colspan="4">When the auto-tuning is finished, the warning will be automatically cleared.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Warning Code</th><th>Display on KPED-LE02</th><th>Warning Name</th><th>Description</th></tr>
<tr><td>27</td><td>dCAn</td><td>dCAn</td><td>CAN bus disconnection</td><td>CAN bus disconnection or PDO communication time-out</td></tr>
<tr><th colspan="5">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">PDO communication time-out</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">N/A</td></tr>
<tr><td colspan="2">Warning Treatment Parameter</td><td colspan="3">N/A</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="3">Auto reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">Automatically clears</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">No</td></tr>
<tr><th colspan="2">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="2">Hardware communication error</td><td colspan="3">Verify the wiring of CAN.</td></tr>
<tr><td colspan="2">Incorrect communication setting</td><td colspan="3">Verify the communication setting between master and slave.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Warning Code</th><th>Display on KPED-LE02</th><th>Warning Name</th><th colspan="2">Description</th></tr>
<tr><td>28</td><td>StoA</td><td>StoA</td><td>Safe torque off loss</td><td colspan="2">STO function is OFF (active)</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">STO function is OFF (active) when Pr.04-10 = 1, 3</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Action time of STO1 and STO2 exceeds 20 ms</td></tr>
<tr><td colspan="2">Warning Treatment Parameter</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Auto reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Automatically clears</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">No</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">STO circuit is OFF (active)</td><td colspan="4">Check STO circuit.</td></tr>
</table>

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
30	SE3		Save error 3	Built-in keyboard panel copy error 3: writing model error occurs during copy process

Action and Reset	
Action Condition	1. Keypad is not allowed to copy parameters 2. Written model mismatches model identity code
Action Time	N/A
Warning Treatment Parameter	N/A
Reset Method	Auto reset
Reset Condition	Automatically clears
Record	No
Cause	**Corrective Actions**
Writing different parameter files of models	Verify the model and parameter files

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
31	SERV		Contact Service SERV	The operation exceeds the limit of number of times

Action and Reset	
Action Condition	When Pr.02-66 = 1 and Pr.02-62 × 10000 + Pr.02-63 > Pr.02-65 × 10, warning occurs
Action Time	Immediately act
Warning Treatment Parameter	Pr.02-62 Single Operation Direction Count (H) Pr.02-63 Single Operation Direction Count (L) Pr.02-65 Number of Times for Operation Direction
Reset Method	Clear the warning through setting Pr.02-66
Reset Condition	Pr.02-66 = 0
Record	No
Cause	**Corrective Actions**
Single operation direction count value exceeds the setting value	Check the elevator operation status on site by the elevator maintenance personnel. Confirm that the elevator status is normal, then set the parameter to clear the warning.

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
34	SdFMT		SD format error	Failure to open files or read/write data
Action and Reset				
Action Condition	N/A			
Action Time	N/A			
Warning Treatment Parameter	N/A			
Reset Method	Auto reset			
Reset Condition	N/A			
Record	No			
Cause				
SD card is not well inserted into the slot	Insert the SD card again.			

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
35	CAnA	CAnA	CAN alarm	CANopen communication error

Action and Reset	
Action Condition	CANopen communication error
Action Time	N/A
Warning Treatment Parameter	N/A
Reset Method	Auto reset
Reset Condition	Automatically clears
Record	No
Cause	**Corrective Actions**
Incorrect communication command from elevator controller	Check if the communication command is correct.
Communication cable is broken or bad connected	Check or replace the communication cable.

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
45	Stob	Stob	STO sequence	STO timing error

Action and Reset	
Action Condition	STO circuit is not ON when drive receives RUN command
Action Time	10 ms
Warning Treatment Parameter	N/A
Reset Method	Auto reset
Reset Condition	RUN command disappears or STO circuit is ON
Record	No
Cause	**Corrective Actions**
STO circuit error	Check STO circuit.

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
46	Stoc		STO sticking warning	STO circuit sticking

Action and Reset	
Action Condition	When Pr.04-10=5, STO circuit is not OFF after RUN command disappears
Action Time	Pr.04-14 STO Sticking Detection Time
Warning Treatment Parameter	N/A
Reset Method	Auto reset
Reset Condition	1 sec. after STO circuit is OFF
Record	No

Cause	Corrective Actions
Incorrect STO function mode	If this is an application for continuous activation of STO circuit, set Pr.04-10=4.
STO delayed deactivation time is too long	Check the STO delayed deactivation time for the elevator controller

ID No.	Abbreviated Warning Code	Display on KPED-LE02	Warning Name	Description
50	oH3_1	oH3_1	Motor over-heating PTC 1	Motor over-heating warning. The drive detects the temperature inside the motor is too high.

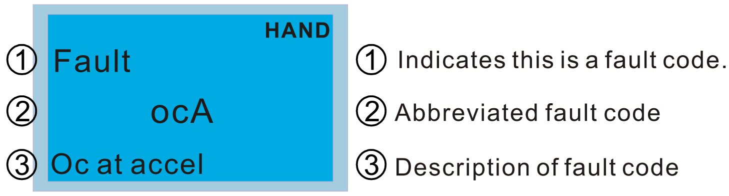
Action and Reset		
Action Condition	PTC 1 input level > Pr.04-48 (default = 50%)	
Action Time	Immediately act	
Warning Treatment Parameter	Pr.04-47 PTC 1 (Positive Temperature Coefficient) Detection Action 0: Warn and keep operation 1: Fault and ramp to stop	
Reset Method	Auto	When Pr.04-47=0, oH3_1 is a warning and will be automatically cleared.
	Manual	When Pr.04-47=1, oH3_1 is a fault and must be reset manually.
Reset Condition	Resets when temperature is lower than Pr.04-48 level	
Record	If oH3_1 is a warning, it will not be recorded. If oH3_1 is a fault, it will be recorded.	

Cause	Corrective Actions
Motor locked	Clear the motor lock status.
The load is too large	Decrease the loading. Replace with a motor with larger capacity.
Ambien temperature is too high	Change the installed place if there are heating devices in the surroundings. Install/ add cooling fan or air conditioner to lower the ambient temperature.
Motor cooling system error	Check the cooling system to make it work normally.
Motor fan error	Replace the fan.
Operates at low-speed too long	Decrease low-speed operation time. Change to dedicated motor for the drive. Increase the motor capacity.
Accel./ Decel. time and working cycle are too short	Increase setting values for Pr.00-71–Pr.00-78 (accel./ decel. time).
V/F voltage is too high when in open-loop circuit control	Decrease the setting values for Pr.03-51–Pr.03-56 (V/F curve).
Check if the motor rated current matches the motor nameplate	Configure the correct rated current value of the motor again.
Check if the PTC 1 is properly set and wired	Check the connection between PTC 1 thermistor and the heat protection.
Check if the setting for stall prevention is correct	Set the stall prevention to the proper value.
Unbalanced three-phase impedance of the motor	Replace the motor.
Harmonics is too high	Use remedies to reduce harmonics.

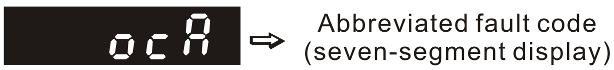
9-2 Fault Codes and Descriptions

Fault code displays differently on ***digital keypad KPC-CC01*** and ***built-in keyboard panel KPED-LE02***. Examples of their different displays show as below.

- Example of fault code shows on digital keypad KPC-CC01:



- Example of fault code shows on built-in keyboard panel KPED-LE02:



NOTE: Check Pr.11-24–Pr.11-29 for the most recent fault records.

9-2-1 List of Fault Codes

ID No.	Fault Code	Fault Name	ID No.	Fault Code	Fault Name
0	No fault record		45	PGF4	PG slip error
1	ocA	Over-current during acceleration	49	EF	External fault
2	ocd	Over-current during deceleration	50	EF1	Emergency stop
3	ocn	Over-current during constant speed	52	Pcod	Password is locked
4	GFF	Ground fault	54	CE01	Communication error 1
5	occ	IGBT short circuit between upper bridge and lower bridge	55	CE02	Communication error 2
			56	CE03	Communication error 3
6	ocS	Over-current at stop	57	CE04	Communication error 4
7	ovA	Over-voltage during acceleration	58	CE10	Communication error 10
8	ovd	Over-voltage during deceleration	59	CP10	Digital keypad transmission time- out
9	ovn	Over-voltage during constant speed	60	bF	Brake transistor error
10	ovS	Over-voltage at stop	64	MbF	Mechanical brake feedback error
11	LvA	Low voltage during acceleration	65	PGF5	PGSED communication error
12	Lvd	Low voltage during deceleration	66	MCF	Magnetic contactor error
13	Lvn	Low voltage during constant speed	67	MPHL	Motor phase loss
14	LvS	Low voltage at stop	68	CAnF	CAN Bus off
15	PHL	Phase loss	69	rbrE	Rescue by mechanical brake control error
16	oH1	IGBT overheating fault			
18	tH1o	IGBT temperature detection failure	70	SFGE	Safety gear release error
21	oL	Overload	72	StL1	STO loss 1
22	EoL1	Electronic thermal relay 1 protection	73	PGcd	PG cd wiring error
24	oH3_2	Motor over-heating PTC 2	74	PGHL	PG absolute signal error
26	ot1	Over-torque 1	75	PGAF	PG Z-phase signal loss
30	cF1	FRAM writing error	76	Stoo	Safe Torque Off function is enabled
31	cF2	FRAM read error	77	StL2	STO loss 2
32	cd0	Current detection error	78	StL3	STO loss 3
33	cd1	U-phase error	81	SERV	Contact Service SERV
34	cd3	V-phase error	85	Hocb	Hardware brake over-current
35	cd3	W-phase error	86	Socb	Software brake over-current
36	Hd0	cc hardware failure	87	brF	Brake resistor configuration error
37	Hd1	oc hardware failure	88	bro	Brake resistor is not connected
38	Hd2	ov hardware failure	89	oL3	IGBT overload
39	Hd3	GFF hardware failure	90	StL4	STO loss 4
40	AUE	Auto-tuning error	91	StL5	STO loss 5
42	PGF1	Opposite PG feedback direction	93	CndL	CANLift disconnection
43	PGF2	PG feedback loss	95	CnLF	CANLift error
44	PGF3	PG feedback stall	96	Stod	STO disconnection

ID No.	Fault Code	Fault Name	ID No.	Fault Code	Fault Name
97	Stor	STO at running	100	orP	Over Ripple Protection
98	StoS	STO circuit sticking fault	105	oH3_1	Motor over-heating PTC 1
99	iSto	Ignore STO is ON			

Check the abbreviated fault code to find related information on action, reset, causes and corrective actions.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
1	ocA		Over-current during acceleration	Output current exceeds three times the drive's rated current during acceleration.

Action and Reset	
Action Condition	300% of the drive's rated current
Action Time	Time that triggers a second time of over-current is shorter than 30 ms
Fault Treatment Parameter	PWM temporarily stops outputting for 30 ms, and then continues to output normally. If time that hardware triggers a second time of over-current is shorter than 30 ms, PWM stops outputting.
Reset Method	Manual reset
Reset Condition	5 seconds after output current is smaller than 37.6% of rated current
Record	Yes

Cause	Corrective Actions
Poor insulation of the wiring between the U/V/W terminals and the motor	Check for possible poor insulation of the wiring between the U/V/W terminals and the motor.
Check for possible burnout or aging insulation of the motor	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
The load inertia is too large due to the heavy door weight	Increase the acceleration time or increase the acceleration time setting for the S-curve.
Use special motor or motor with larger capacity than the drive	Check the motor capacity (the rated current on the motor's nameplate should ≤ the rated current of the drive)
V/F curve setting error in the IM open-loop circuit control	Adjust the V/F curve setting (Pr.03-51–Pr.03-56) and frequency/voltage. If error occurs, the frequency voltage corresponding to the output frequency will be too high, then, at this time, reduce the voltage.
Incorrect use of the control mode with motor	Check for the settings for Pr.00-01 control mode: For PM, set Pr.00-01 = 3 For IM, set Pr.00-01 = 0–2
Hardware failure	The ocA occurs due to the short circuit at the output side of the drive. Check for possible short circuits between the U/V/W terminals with the electric meter. If short circuits exist, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
2	ocd	ocd	Over-current during deceleration	Output current exceeds three times the drive's rated current during deceleration.

Action and Reset	
Action Condition	300% of the drive's rated current
Action Time	Time that triggers a second time of over-current is shorter than 30 ms
Fault Treatment Parameter	PWM temporarily stops outputting for 30 ms, and then continues to output normally. If time that hardware triggers a second time of over-current is shorter than 30 ms, PWM stops outputting.
Reset Method	Manual reset
Reset Condition	5 seconds after output current is smaller than 37.6% of rated current
Record	Yes

Cause	Corrective Actions
Poor insulation of the wiring between the U/V/W terminals and the motor	Check for possible poor insulation of the wiring between the U/V/W terminals and the motor.
Check for possible burnout or aging insulation of the motor	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
The load inertia is too large due to the heavy door weight	Decrease the deceleration time.
Use special motor or motor with larger capacity than the drive	Check the motor capacity (the rated current on the motor's nameplate should ≤ the rated current of the drive)
V/F curve setting error in the IM open-loop circuit control	Adjust the V/F curve setting (Pr.03-51–Pr.03-56) and frequency/voltage. If error occurs, the frequency voltage corresponding to the output frequency will be too high, then, at this time, reduce the voltage.
Incorrect use of the control mode with motor	Check for the settings for Pr.00-01 control mode: For PM, set Pr.00-01 = 3 For IM, set Pr.00-01 = 0–2
Hardware failure	The ocd occurs due to the short circuit at the output side of the drive. Check for possible short circuits between the U/V/W terminals with the electric meter. If short circuits exist, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
3	ocn	ocn	Over-current during constant speed	Output current exceeds three times the drive's rated current during constant speed.

Action and Reset	
Action Condition	300% of the drive's rated current
Action Time	Time that triggers a second time of over-current is shorter than 30 ms
Fault Treatment Parameter	PWM temporarily stops outputting for 30 ms, and then continues to output normally. If time that hardware triggers a second time of over-current is shorter than 30 ms, PWM stops outputting.
Reset Method	Manual reset
Reset Condition	5 seconds after output current is smaller than 37.6% of rated current
Record	Yes

Cause	Corrective Actions
Poor insulation of the wiring between the U/V/W terminals and the motor	Check for possible poor insulation of the wiring between the U/V/W terminals and the motor.
Check for possible burnout or aging insulation of the motor	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
Shaft lock occurs on the motor or transmission devices related to the elevator door	Check for possible shaft lock on the motor or transmission devices related to the elevator door.
Use special motor or motor with larger capacity than the drive	Check the motor capacity (the rated current on the motor's nameplate should ≤ the rated current of the drive)
V/F curve setting error in the IM open-loop circuit control	Adjust the V/F curve setting (Pr.03-51–Pr.03-56) and frequency/voltage.
Hardware failure	The ocn occurs due to the short circuit at the output side of the drive. Check for possible short circuits between the U/V/W terminals with the electric meter. If short circuits exist, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
4	GFF	GFF	Ground fault	When (one of) the output terminal(s) is grounded and a current short to ground exceeds 50% of drive's rated current, GFF occurs. **NOTE:** the short circuit protection is provided for drive protection, not to protect the user.

Action and Reset	
Action Condition	60% of the drive's rated current
Action Time	Time that triggers a second time of over-current short to ground is shorter than 30 ms
Fault Treatment Parameter	PWM temporarily stops outputting for 30 ms, and then continues to output normally. If time that hardware triggers a second time of over-current short to ground is shorter than 30 ms, PWM stops outputting.
Reset Method	Manual reset
Reset Condition	5 seconds after software checks output current is smaller than 50% of rated current
Record	Yes

Cause	Corrective Actions
Motor burnout or aging insulation occurred	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
Short circuit due to broken cable	Troubleshoot the short circuit. Replace the cable.
Larger stray capacitance of the cable and terminal ⏚	If the motor cable length exceeds 100 m, decrease the setting value for carrier frequency. Take remedies to reduce stray capacitance.
Malfunction caused by interference	Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.
Hardware failure	Cycle the power after checking the status of motor, cable and cable length. If GFF still exists, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
5	occ	oCC	IGBT short circuit between upper bridge and lower bridge	Short circuit is detected between upper bridge and lower bridge of the IGBT module

Action and Reset	
Action Condition	Hardware protection
Action Time	Immediately act
Fault Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	Yes

Cause	Corrective Actions
IGBT error	Check the motor wiring. Cycle the power, if occ still exists, return to the factory for repair.
Short circuit detecting circuit error	

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
6	ocS	ocS	Over-current at stop	Output current exceeds three times the drive's rated current at stop.

Action and Reset	
Action Condition	300% of the drive's rated current
Action Time	Time that triggers a second time of over-current is shorter than 30 ms
Fault Treatment Parameter	PWM temporarily stops outputting for 30 ms, and then continues to output normally. If time that hardware triggers a second time of over-current is shorter than 30 ms, PWM stops outputting.
Reset Method	Manual reset
Reset Condition	5 seconds after output current is smaller than 37.6% of rated current
Record	Yes
Cause	**Corrective Actions**
Malfunction caused by interference	Verify the wiring of the control circuit and the wiring/grounding of the main circuit to prevent interference.
Hardware failure	Check if other fault codes such as cd1–cd3 occur after cycling the power. If yes, return to the factory for repair.

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>7</td><td>ovA</td><td></td><td>Over-voltage during acceleration</td><td colspan="2">DC bus over-voltage during acceleration</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">DC bus is higher than 410V / 820V</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Stops output immediately, and coasts to stop.</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Use Pr.04-02 to set to reset automatically or manually</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets when DC bus is lower than 369V / 738V</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Acceleration time is too short</td><td colspan="4">If the DC bus over-voltage occurs due to the regenerative voltage of motor inertia, increase the acceleration time.</td></tr>
<tr><td colspan="2">Power voltage changes</td><td colspan="4">Check if the input voltage is within the rated drive input voltage range, and check for possible voltage spikes.</td></tr>
<tr><td colspan="2">Malfunction caused by interference</td><td colspan="4">Verify the wiring of the control circuit and the wiring/grounding of the main circuit to prevent interference.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th colspan="2">Fault Name</th><th>Description</th></tr>
<tr><td>8</td><td>ovd</td><td></td><td colspan="2">Over-voltage during deceleration</td><td>DC bus over-voltage during deceleration</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">DC bus is higher than 410V / 820V</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Stops output immediately, and coasts to stop.</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Use Pr.04-02 to set to reset automatically or manually</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets when DC bus is lower than 369V / 738V</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Deceleration time is too short</td><td colspan="4">If the DC bus over-voltage occurs due to the regenerative voltage of motor inertia, increase the deceleration time.</td></tr>
<tr><td colspan="2">Power voltage changes</td><td colspan="4">Check if the input voltage is within the rated drive input voltage range, and check for possible voltage spikes.</td></tr>
<tr><td colspan="2">Malfunction caused by interference</td><td colspan="4">Verify the wiring of the control circuit and the wiring/grounding of the main circuit to prevent interference.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
9	ovn		Over-voltage during constant speed	DC bus over-voltage during constant speed

Action and Reset	
Action Condition	DC bus is higher than 410V / 820V
Action Time	Immediately act
Fault Treatment Parameter	Stops output immediately, and coasts to stop.
Reset Method	Use Pr.04-02 to set to reset automatically or manually
Reset Condition	Resets when DC bus is lower than 369V / 738V
Record	Yes

Cause	Corrective Actions
Power voltage changes	Check if the input voltage is within the rated drive input voltage range, and check for possible voltage spikes.
Malfunction caused by interference	Verify the wiring of the control circuit and the wiring/grounding of the main circuit to prevent interference.

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>10</td><td>ovS</td><td></td><td>Over-voltage at stop</td><td colspan="2">DC bus over-voltage at stop</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">DC bus is higher than 410V / 820V</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Stops output immediately, and coasts to stop.</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Use Pr.04-02 to set to reset automatically or manually</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets when DC bus is lower than 369V / 738V</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Power voltage changes</td><td colspan="4">Check if the input voltage is within the rated drive input voltage range, and check for possible voltage spikes.</td></tr>
<tr><td colspan="2">Hardware failure in voltage detection</td><td colspan="4">Check if other fault codes such as Hd2 occurs after cycling the power. If yes, return to the factory for repair.</td></tr>
<tr><td colspan="2">Malfunction caused by interference</td><td colspan="4">Verify the wiring of the control circuit and the wiring/grounding of the main circuit to prevent interference.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th colspan="2">Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>11</td><td>LvA</td><td></td><td colspan="2">Low voltage during acceleration</td><td colspan="2">DC bus voltage is lower than Pr.04-30 (low voltage level) setting value during acceleration</td></tr>
<tr><th colspan="7">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="5">DC bus voltage level (Pr.04-30)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="5">Immediately act</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="5">Stops output immediately, and coasts to stop.</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="5">Use Pr.04-01 or Pr.04-02 to set to reset automatically or manually</td></tr>
<tr><td colspan="2" rowspan="2">Reset Condition</td><td>230V models</td><td colspan="4" rowspan="2">Resets when DC bus voltage is higher than Pr.04-30 + 30 V_{DC} and lasts for 50 ms</td></tr>
<tr><td>460V models</td></tr>
<tr><td colspan="2">Record</td><td colspan="5">Pr.04-01 (Default: 0)
When bit 0 = 0 (Display Lv fault and coast to stop), LvA is a fault and will be recorded.
When bit 0 = 1 (Display Lv warn and coast to stop), LvA is a warning and will not be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="5">Corrective Actions</th></tr>
<tr><td colspan="2">Power voltage changes</td><td colspan="5">Adjust the input voltage to the power range of the drive</td></tr>
<tr><td colspan="2">The load is too large</td><td colspan="5">Reduce the load.
Increase the drive capacity.</td></tr>
<tr><td colspan="2">Acceleration time is too short</td><td colspan="5">If the DC bus low voltage of the drive is caused by the heavy door weight, increase the acceleration time.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
12	Lvd		Low voltage during deceleration	DC bus voltage is lower than Pr.04-30 (low voltage level) setting value during deceleration

Action and Reset		
Action Condition	DC bus voltage level (Pr.04-30)	
Action Time	Immediately act	
Fault Treatment Parameter	Stops output immediately, and coasts to stop.	
Reset Method	Use Pr.04-01 or Pr.04-02 to set to reset automatically or manually	
Reset Condition	230V models 460V models	Resets when DC bus voltage is higher than Pr.04-30 + 30 V_{DC} and lasts for 50 ms
Record	Pr.04-01 (Default: 0) When bit 0 = 0 (Display Lv fault and coast to stop), Lvd is a fault and will be recorded. When bit 0 = 1 (Display Lv warn and coast to stop), Lvd is a warning and will not be recorded.	

Cause	Corrective Actions
Power voltage changes	Adjust the input voltage to the power range of the drive
Sudden load	Reduce the load. Increase the drive capacity.

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th colspan="2">Fault Name</th><th>Description</th></tr>
<tr><td>13</td><td>Lvn</td><td></td><td colspan="2">Low voltage during constant speed</td><td>DC bus voltage is lower than Pr.04-30 (low voltage level) setting value during constant speed</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">DC bus voltage level (Pr.04-30)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Stops output immediately, and coasts to stop.</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Use Pr.04-01 or Pr.04-02 to set to reset automatically or manually</td></tr>
<tr><td colspan="2" rowspan="2">Reset Condition</td><td>230V models</td><td colspan="3" rowspan="2">Resets when DC bus voltage is higher than Pr.04-30 + 30 V_{DC} and lasts for 50 ms</td></tr>
<tr><td>460V models</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">Pr.04-01 (Default: 0)
When bit 0 = 0 (Display Lv fault and coast to stop), Lvn is a fault and will be recorded.
When bit 0 = 1 (Display Lv warn and coast to stop), Lvn is a warning and will not be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Power voltage changes</td><td colspan="4">Adjust the input voltage to the power range of the drive</td></tr>
<tr><td colspan="2">Sudden load</td><td colspan="4">Reduce the load.
Increase the drive capacity.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>14</td><td>LvS</td><td></td><td>Low voltage at stop</td><td colspan="2">1. DC bus voltage is lower than Pr.04-30 (low voltage level) setting value at stop
2. Hardware failure in voltage detection</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">Pr.04-30 (Default = depending on the model)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately acts when DC bus voltage is lower than Pr.04-30</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Auto reset</td></tr>
<tr><td colspan="2" rowspan="2">Reset Condition</td><td>230V models</td><td colspan="3" rowspan="2">Resets when DC bus voltage is higher than Pr.04-30 + 30 V_{DC} and lasts for 50 ms</td></tr>
<tr><td>460V models</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">No</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Power-off</td><td colspan="4">Improve power supply condition.</td></tr>
<tr><td colspan="2">Incorrect drive models</td><td colspan="4">Check if the power specification matches the drive.</td></tr>
<tr><td colspan="2">Power voltage changes</td><td colspan="4">Adjust voltage to the power range of the drive.
Cycle the power after checking the power. If LvS still exists, return to the factory for repair.</td></tr>
<tr><td colspan="2">Start up the motor with large capacity</td><td colspan="4">Check the power system.
Increase the capacity of power equipment.</td></tr>
<tr><td colspan="2">DC bus</td><td colspan="4">Install DC reactor(s).</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
15	PHL	PHL	Phase loss	Input phase loss warning

Action and Reset	
Action Condition	1: Software detection: DC bus is lower than Pr.07-51 (Brake Transistor Level) and DC bus ripple is higher than 30V 2: Software detection: Power factor angle is smaller than 80 degree and DC bus ripple is higher than 30V 3: Hardware automatically detects external phase loss
Action Time	Hardware automatically detects external phase loss
Fault Treatment Parameter	Pr.04-31 (Input Phase-loss Protection during Operation)
Reset Method	Use Pr.04-02 to set to reset automatically or manually
Reset Condition	Resets immediately when DC bus voltage is higher than Pr.07-51 (Brake Transistor Level)
Record	Pr.04-31 Input Phase-loss Protection during Operation (Default: 2) When Pr.04-31=0, PHL is a warning and will not be recorded. When Pr.04-31=1 or 2, PHL is a fault and will be recorded.

Cause	Corrective Actions
Phase loss of the input power	Verify wiring of the main circuit.
Single-phase power input on a three-phase model	Use the model with voltage that matches the power.
The power voltage has changed	If the power of main circuit works well, check if the MC of the main circuit is broken. Cycle the power after verifying the power is normal. If PHL still occurs, return to the factory for repair.
Loose wiring terminal of input power	Tighten the terminal screws with the torque listed in the user manual.
Check if the input cable of three-phase power is broken	Make sure the wiring is correct. Replace the broken part of the cable.
Unbalanced three-phase of the input power	Check the status of three-phase power.
Brake discharge level is too high	Adjust Pr.07-51 (Brake Transistor Level) setting value.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
16	oH1		IGBT overheating fault	If IGBT temperature is higher than oH1 Fault Level shown in the table below when drive detects overheating of IGBT, keypad displays oH1 fault, not oH1 warning.

Action and Reset	
Action Condition	When IGBT temperature is higher than oH1 Fault Level shown in the table below
Action Time	When IGBT temperature is higher than the protection level for more than 100 ms
Fault Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	Resets manually when temperature is lower than [IGBT limits – 5°C]
Record	Yes

Cause	Corrective Actions
Check if the ambient temperature or temperature inside the cabinet is too high, or if there is obstruction in the ventilation hole of the control cabinet.	1. Check the ambient temperature. 2. Regularly inspect the ventilation hole of the control cabinet. 3. Change the installed place if there are heating objects, such as brake resistors, in the surroundings. 4. Install/add cooling fan or air conditioner to lower the temperature inside the cabinet.
Check if there is any obstruction on IGBT or if the fan is running	Remove the obstruction or replace the cooling fan.
Insufficient ventilation space	Increase ventilation space of the drive.
Check if the drive matches the corresponded loading	1. Decrease loading. 2. Decrease the carrier. 3. Replace with a drive with larger capacity.
The drive has run 100% or more of the rated output for a long time	Replace with a drive with larger capacity.

Models / Phase	Frame	Model Name	oH1 Fault Level	oH1 Warning Level	oH1 Reset Level
230V / Single-phase	A	VFD022ED21B	85	oH1 Fault Level-5 or Pr.04-55	oH1 Warning Level -5
		VFD037ED21B	90		
460V / Three-phase	A	VFD040ED43B	90		
		VFD055ED43B	90		
		VFD075ED43B	95		
	B	VFD110ED43B	100		
		VFD150ED43B	110		
		VFD185ED43B	110		

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
18	tH1o	tH1o	IGBT temperature detection failure	IGBT hardware failure in temperature detection

Action and Reset	
Action Condition	AN115 (TH1 signal) > 4000
Action Time	Immediately act
Fault Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	Resets manually when temperature is lower than [IGBT limits – 5°C]
Record	Yes
Cause	**Corrective Actions**
Hardware failure	Wait for 10 minutes, and then cycle the power. Check if tH1o protection still exists. If yes, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
21	oL		Overload	The drive overloads, and the output current exceeds the drive’s allowable current value. Sustains for 64.5 seconds when the drive outputs 150% of the drive’s rated current. Sustains for 4.8 seconds when the drive outputs 200% of the drive’s rated current.

Action and Reset	
Action Condition	1. 150% of the drive’s rated current 2. 200% of the drive’s rated current
Action Time	1. 150% of the drive’s rated current: 64.5 sec. 2. 180% of the drive’s rated current: 4.8 sec.
Fault Treatment Parameter	Stops output immediately, and coasts to stop.
Reset Method	Manual reset
Reset Condition	1. OL_Count: resets after 5 sec. 2. Energy Count: relates to output current 3. Resets after 5 seconds when software checks that output current is smaller than 270% of the drive’s rated current
Record	Yes

Cause	Corrective Actions
The load is too large	Reduce the load.
Acceleration time is too short	Adjust acceleration /deceleration time (Pr.00-71–Pr.00-78)
The capacity of the drive is too small	Replace the drive with a larger capacity model.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
22	EoL1		Electronic thermal relay 1 protection	Motor overload

Action and Reset	
Action Condition	150% of the motor’s rated current
Action Time	Electronic Thermal Characteristic (Pr.04-54)
Fault Treatment Parameter	Stops output immediately, and coasts to stop.
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	Yes
Cause	**Corrective Actions**
The load is too large	Reduce the load.
Acceleration time is too short	Adjust acceleration /deceleration time (Pr.00-71–Pr.00-78).
When using VFD dedicated motors, Pr.04-53 setting (Electronic Thermal Relay) is incorrect.	Pr.04-53 Electronic Thermal Relay selection: 0: Standard motor 1: Inverter motor 2: Disabled

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>24</td><td>oH3_2</td><td>oH3_2</td><td>Motor over-heating PTC 2</td><td colspan="2">Motor overheating (PTC 2) when using a motor with PTC installed</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">PTC 2 input level > Pr.04-51 (default = 50%)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Pr.04-50 PTC 2 (Positive Temperature Coefficient) Detection Action (Default: 0)
0: Warn and keep operation
1: Fault and ramp to stop</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="3">When Pr.04-50=0, oH3_2 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="3">When Pr.04-50=1, oH3_2 is a fault and must be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets when PTC 2 input level is lower than [Pr.04-51 – 5].</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">If oH3_2 is a warning, it will not be recorded.
If oH3_2 is a fault, it will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Motor locked</td><td colspan="4">Clear the motor lock status.</td></tr>
<tr><td colspan="2">The load is too large</td><td colspan="4">Decrease the loading.
Replace with a motor with larger capacity.</td></tr>
<tr><td colspan="2">Ambien temperature is too high</td><td colspan="4">Change the installed place if there are heating devices in the surroundings.
Install/ add cooling fan or air conditioner to lower the ambient temperature.</td></tr>
<tr><td colspan="2">Motor cooling system error</td><td colspan="4">Check the cooling system to make it work normally.</td></tr>
<tr><td colspan="2">Motor fan error</td><td colspan="4">Replace the fan.</td></tr>
<tr><td colspan="2">Operates at low-speed too long</td><td colspan="4">Decrease low-speed operation time.
Change to dedicated motor for the drive.
Increase the motor capacity.</td></tr>
<tr><td colspan="2">Accel./ Decel. time and working cycle are too short</td><td colspan="4">Increase setting values for Pr.00-71–Pr.00-78 (accel./ decel. time).</td></tr>
<tr><td colspan="2">V/F voltage is too high when in open-loop circuit control</td><td colspan="4">Decrease the setting values for Pr.03-51–Pr.03-56 (V/F curve).</td></tr>
<tr><td colspan="2">Check if the motor rated current matches the motor nameplate</td><td colspan="4">Configure the correct rated current value of the motor again.</td></tr>
<tr><td colspan="2">Check if the PTC 2 is properly set and wired</td><td colspan="4">Check the connection between PTC 2 thermistor and the heat protection.</td></tr>
<tr><td colspan="2">Check if the setting for stall prevention is correct</td><td colspan="4">Set the stall prevention to the proper value.</td></tr>
<tr><td colspan="2">Unbalanced three-phase impedance of the motor</td><td colspan="4">Replace the motor.</td></tr>
<tr><td colspan="2">Harmonics is too high</td><td colspan="4">Use remedies to reduce harmonics.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
26	ot1	ot 1	Over-torque 1	Output current is larger than over-torque detection level Pr.04-41

Action and Reset		
Action Condition	Pr.04-41 Over-torque Detection Level (OT1)	
Action Time	Pr.04-42 Over-torque Detection Time (OT1)	
Fault Treatment Parameter	Pr.04-40 Over-torque Detection (OT1) (Default: 0) 0: Over-torque detection disabled 1: Over-torque detection during constant speed operation, continue to operate after detection 2: Over-torque detection during constant speed operation, stop operating after detection 3: Over-torque detection during operation, continue to operate after detection 4: Over-torque detection during operation, stop operating after detection	
Reset Method	Auto	When Pr.04-40=1 or 3, ot1 is a warning and will be automatically cleared.
	Manual	When Pr.04-40=2 or 4, ot1 is a fault and must be reset manually.
Reset Condition	Resets when output current is smaller than over-torque detection level.	
Record	If ot1 is a warning, it will not be recorded. If ot1 is a fault, it will be recorded.	

Cause	Corrective Actions
Incorrect parameter setting	Configure the settings for Pr.04-41 and Pr.04-42 again.
Mechanical error (e.g. mechanical lock due to over-torque)	Remove the causes of malfunction.
The load is too large	Decrease the loading. Replace with a motor with larger capacity.
Accel./ Decel. time and working cycle are too short	Increase the setting values for Pr.00-71–Pr.00-78 (accel./ decel. time)
V/F voltage is too high when in open-loop circuit control	Decrease the setting values for Pr.03-51–Pr.03-56 (V/F curve)
The motor capacity is too small	Replace with a motor with larger capacity.
Overload occurs during low-speed operation	Decrease the loading during low-speed operation. Increase the motor capacity.

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th>Description</th></tr>
<tr><td>30</td><td>cF1</td><td></td><td>FRAM writing error</td><td>FRAM cannot be written</td></tr>
<tr><th colspan="5">Action and Reset</th></tr>
<tr><td>Action Condition</td><td colspan="4">Firmware internal detection writing error</td></tr>
<tr><td>Action Time</td><td colspan="4">Immediately acts when the drive detects the fault</td></tr>
<tr><td>Fault Treatment Parameter</td><td colspan="4">N/A</td></tr>
<tr><td>Reset Method</td><td colspan="4">Manual reset</td></tr>
<tr><td>Reset Condition</td><td colspan="4">Resets immediately</td></tr>
<tr><td>Record</td><td colspan="4">Yes</td></tr>
<tr><th>Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td>FRAM cannot be written</td><td colspan="4">1. Press RESET key. If cF1 still exists, return to the factory for repair.
2. Reset the parameter to the default setting. If cF1 still exists, return to the factory for repair.
3. Cycle the power. If cF1 still exists, return to the factory for repair.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
31	cF2		FRAM read error	FRAM cannot be read

Action and Reset	
Action Condition	Firmware internal detection read error
Action Time	Immediately acts when the drive detects the fault
Fault Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	Yes
Cause	**Corrective Actions**
FRAM cannot be read	1. Press RESET key. If cF2 still exists, return to the factory for repair. 2. Cycle the power. If cF2 still exists, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
32	cd0	cd0	Current detection error	Drive current detection error when powered-on

Action and Reset	
Action Condition	Output current is larger than 225% of the drive’s rated current while initializing
Action Time	Immediately acts
Fault Treatment Parameter	N/A
Reset Method	Cycle the power
Reset Condition	N/A
Record	Yes

Cause	Corrective Actions
Hardware failure	Cycle the power. If cd0 still occurs, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
33	cd1		U-phase error	Drive's U-phase current detection error when powered-on

Action and Reset	
Action Condition	U-phase current level deviation is larger than 10% of the drive's rated current while initializing
Action Time	Immediately act
Fault Treatment Parameter	N/A
Reset Method	Cycle the power
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
Hardware failure	Cycle the power. If cd1 still occurs, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
34	cd2		V-phase error	Drive's V-phase current detection error when powered-on

Action and Reset	
Action Condition	V-phase current level deviation is larger than 10% of the drive's rated current while initializing
Action Time	Immediately act
Fault Treatment Parameter	N/A
Reset Method	Cycle the power
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
Hardware failure	Cycle the power. If cd2 still occurs, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
35	cd3	cd3	W-phase error	Drive's W-phase current detection error when powered-on

Action and Reset	
Action Condition	W-phase current level deviation is larger than 10% of the drive's rated current while initializing
Action Time	Immediately act
Fault Treatment Parameter	N/A
Reset Method	Cycle the power
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
Hardware failure	Cycle the power. If cd3 still occurs, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
36	Hd0		cc hardware failure	Drive's cc (current clamp) hardware protection error when powered-on

Action and Reset	
Action Condition	cc hardware error detected while initializing
Action Time	Immediately acts when the drive detects the fault
Fault Treatment Parameter	N/A
Reset Method	Cycle the power
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
Hardware failure	Cycle the power. If Hd0 still occurs, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
37	Hd1		oc hardware failure	Drive’s oc hardware protection error when powered-on

Action and Reset	
Action Condition	oc hardware error detected while initializing
Action Time	Immediately acts when the drive detects the fault
Fault Treatment Parameter	N/A
Reset Method	Cycle the power
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
Hardware failure	Cycle the power. If Hd1 still occurs, return to the factory for repair.

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th>Description</th></tr>
<tr><td>38</td><td>Hd2</td><td></td><td>ov hardware failure</td><td>Drive’s ov hardware protection error when powered-on</td></tr>
<tr><th colspan="5">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">ov hardware error detected while initializing</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">Immediately acts when the drive detects the fault</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="3">N/A</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="3">Cycle the power</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">N/A</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="2">Hardware failure</td><td colspan="3">Cycle the power.
If Hd2 still occurs, return to the factory for repair.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
39	Hd3	Hd3	GFF hardware failure	Drive's GFF hardware protection error when powered-on

Action and Reset	
Action Condition	GFF hardware error detected while initializing
Action Time	Immediately acts when the drive detects the fault
Fault Treatment Parameter	N/A
Reset Method	Cycle the power
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
Hardware failure	Cycle the power. If Hd3 still occurs, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
40	AUE		Auto-tuning error	Motor auto-tuning error

Action and Reset	
Action Condition	1. When detecting stator resistance, output current is smaller than 5% of the drive's rated current and time exceeds 0.5 sec. 2. Incorrect encoder signal for PGHH during auto-tuning.
Action Time	0.5 sec.
Fault Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	Yes

Cause	Corrective Actions
Press STOP key during auto-tuning	Re-execute auto-tuning.
Incorrect motor capacity (too large or too small) and parameter setting	Verify motor specification and set motor parameter settings again (Pr.00-10–Pr.00-16).
Incorrect motor wiring	Check the wiring.
Motor shaft lock	Remove the cause of motor shaft lock.
The magnetic contactor installed at the drive output (U/V/W) is Open	Make sure the magnetic contactor is Closed.
The load is too large.	Reduce the load. Replace the motor with a larger capacity model.
Incorrect encoder signal (PGHH)	1. Check if the A/B/C/D wiring is correct. 2. Check if the signal line of the encoder is interfered.

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>42</td><td>PGF1</td><td>PGF 1</td><td>Opposite PG feedback direction</td><td colspan="2">The motor runs in a reverse direction to the frequency command direction, and the time error occurred exceeds Pr.04-71 detection time.</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="3">Action Condition</td><td colspan="3">1. Encoder input type does not set (Pr.00-23 = 0)
2. Feedback direction is opposite to the frequency command direction</td></tr>
<tr><td colspan="3">Action Time</td><td colspan="3">Pr.04-71 Encoder Feedback Signal Fault Detection Time (Default: 1.0 second)</td></tr>
<tr><td colspan="3">Fault Treatment Parameter</td><td colspan="3">Pr.04-70 (Default: 2)
0: Warn and keep operation
1: Fault and ramp to stop
2: Fault and stop operation</td></tr>
<tr><td colspan="3" rowspan="2">Reset Method</td><td>Auto</td><td colspan="2">When Pr.04-70=0, PGF1 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="2">When Pr.04-70=1 or 2, PGF1 is a fault and must be reset manually.</td></tr>
<tr><td colspan="3">Reset Condition</td><td colspan="3">Resets immediately</td></tr>
<tr><td colspan="3">Record</td><td colspan="3">If PGF1 is a warning, it will not be recorded.
If PGF1 is a fault, it will be recorded.</td></tr>
<tr><th colspan="3">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="3">Incorrect parameter setting of encoders</td><td colspan="3">Set encoder parameter settings again (Pr.00-23).</td></tr>
<tr><td colspan="3">Check if A/B wiring of the encoder is reverse</td><td colspan="3">Ensure the A/B wiring is correct.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
43	PGF2		PG feedback loss	When using control mode with PG feedback function and a speed command is given, drive detects that no encoder pulse signal is received by PG card for a certain time, and the time error occurred exceeds Pr.04-71 detection time.

Action and Reset		
Action Condition	No encoder pulse signal is received by PG card for a certain time during operation	
Action Time	Pr.04-71 Encoder Feedback Signal Fault Detection Time (Default: 1.0 second)	
Fault Treatment Parameter	Pr.04-70 (Default: 2) 0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and stop operation	
Reset Method	Auto	When Pr.04-70=0, PGF2 is a warning will be automatically cleared.
	Manual	When Pr.04-70=1 or 2, PGF2 is a fault and it must be reset manually.
Reset Condition	Resets immediately	
Record	If PGF2 is a warning, it will not be recorded. If PGF2 is a fault, it will be recorded.	

Cause	Corrective Actions
Incorrect parameter setting of encoders	Set encoder parameter settings again (Pr.00-20–Pr.00-23).
Improper wiring or bad connection of the encoder	Check if the wiring is correct.
Motor locked under no overload	1. Check if improper wiring or bad connection of the encoder 2. Remove the causes of motor locked.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
44	PGF3		PG feedback stall	In PG mode, when motor frequency exceeds Pr.04-73 (Encoder Stall Level) and starts to count the time, and the time error occurred exceeds Pr.04-74 (Encoder Stall Detection Time), PGF3 occurs.

Action and Reset		
Action Condition	Pr.04-73 Encoder Stall Level (Default: 115% of Maximum Output Frequency (Pr.03-50))	
Action Time	Pr.04-74 Encoder Stall Detection Time (Default: 0.10 second)	
Fault Treatment Parameter	Pr.04-72 (Default: 2) 0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and stop operation	
Reset Method	Auto	PGF3 is a warning when Pr.04-72=0. It will be automatically cleared when the difference between Frequency command and feedback frequency is smaller than encoder slip range.
	Manual	PGF3 is a fault when Pr.04-72= 1 or 2. You must reset it manually.
Reset Condition	Resets immediately	
Record	If PGF3 is a warning, it will not be recorded. If PGF3 is a fault, it will be recorded.	
Cause	**Corrective Actions**	
Incorrect parameter setting of motor	Verify motor specification and set motor parameter settings again (Pr.00-10–Pr.00-16)	
Incorrect parameter settings for ASR when in rated speed	Set ASR-related parameters again.	
Incorrect settings for acceleration / deceleration time when in rated speed	Adjust acceleration /deceleration time (Pr.00-71–Pr.00-78).	
Incorrect parameter settings for PG feedback stall	Properly increase Pr.04-73 and Pr.04-74 settings.	

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
45	PGF4		PG slip error	In PG mode, when motor the difference between output frequency command and motor feedback frequency is larger than encoder slip range (Pr.04-75) and starts to count the time, and the time error occurred exceeds Pr.04-76 (Encoder Slip Detection Time), PGF4 occurs.

Action and Reset		
Action Condition	Pr.04-75 Encoder Slip Range (Default: 50% of Maximum Output Frequency (Pr.03-50))	
Action Time	Pr.04-76 Encoder Slip Detection Time (Default: 0.05 second)	
Fault Treatment Parameter	Pr.04-72 (Default: 2) 0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and stop operation	
Reset Method	Auto	PGF4 is a warning when Pr.04-72=0. It will be automatically cleared when the difference between Frequency command and feedback frequency is smaller than encoder slip range.
	Manual	PGF4 is a fault when Pr.04-72= 1 or 2. You must reset it manually.
Reset Condition	Resets immediately	
Record	If PGF4 is a warning, it will not be recorded. If PGF4 is a fault, it will be recorded.	

Cause	Corrective Actions
Incorrect parameter setting of motor	Verify motor specification and set motor parameter settings again (Pr.00-10–Pr.00-16)
Incorrect parameter settings or wiring for encoders	Set encoder-related parameters again (Pr.00-20–Pr.00-23), and check if the wiring is correct.
Acceleration / deceleration time is set too short	Adjust acceleration /deceleration time (Pr.00-71–Pr.00-78)
Incorrect parameter settings for PG slip range	Properly increase Pr.04-75 and Pr.04-76 settings

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
49	EF	EF	External fault	When external fault terminal is OFF, drive stops output.

Action and Reset	
Action Condition	MI#10 = EF and the MI terminal is ON
Action Time	Immediately act
Fault Treatment Parameter	Pr.02-16 (Emergency Stop (EF) & Forced Stop) (Default: 0) 0: Coast to stop 1: According to deceleration Time 1 2: According to deceleration Time 2 3: According to deceleration Time 3 4: According to deceleration Time 4 5: According to Pr.00-82
Reset Method	Manual reset
Reset Condition	Resets only after the external fault is cleared (terminal status is recovered)
Record	Yes
Cause	**Corrective Actions**
External fault	Press RESET key after the fault is cleared.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
50	EF1		Emergency stop	When the contact of MIx = EF1 is ON, the output stops immediately and displays EF1 on the keypad. The motor is in free running.

Action and Reset	
Action Condition	MI#28 = EF1 and the MI terminal is ON
Action Time	Immediately act
Fault Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	Resets only after the external fault is cleared (terminal status is recovered)
Record	Yes

Cause	Corrective Actions
When MIx=EF1 activates	Verify if the system is back to normal condition, and then press RESET key to go back to the default.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
52	Pcod	Pcod	Password is locked	Entering the wrong password three consecutive times in Pr.07-20

Action and Reset	
Action Condition	Pr.07-21 password setting
Action Time	Immediately act
Fault Treatment Parameter	Set 9999 two times in Pr.07-20 to reset to default value.
Reset Method	Refer to the decoding method described in Pr.07-20
Reset Condition	Cycle the power
Record	Yes

Cause	Corrective Actions
Incorrect password input through Pr.07-20	Enter the correct password after rebooting the drive.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
54	CE01	CE01	Communication error 1	Illegal function code

Action and Reset		
Action Condition	When the function code is incorrect	
Action Time	Immediately act	
Fault Treatment Parameter	Pr.04-60 (Default: 3) 0: Warn and keep operation 1: Fault and ramp to stop 2: Reserved 3: No action and no display	
Reset Method	Auto	When Pr.04-60=0, CE01 is a warning and will be automatically cleared.
	Manual	When Pr.04-60=1, CE01 is a fault and must be reset manually.
Reset Condition	N/A	
Record	If CE01 is a warning, it will not be recorded. If CE01 is a fault, it will be recorded.	

Cause	Corrective Actions
Incorrect communication command from elevator controller	Check if the communication command is correct.
Malfunction caused by interference	Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.
Different communication setting from the elevator controller	Check if the setting for Pr.09-00–Pr.09-02 is the same as the setting for the elevator controller.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th colspan="2">Fault Name</th><th>Description</th></tr>
<tr><td>55</td><td>CE02</td><td>CE02</td><td colspan="2">Communication error 2</td><td>Illegal data address</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">When the input data address is incorrect</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Pr.04-60 (Default: 3)
0: Warn and keep operation
1: Fault and ramp to stop
2: Reserved
3: No action and no display</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="3">When Pr.04-60=0, CE02 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="3">When Pr.04-60=1, CE02 is a fault and must be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">If CE02 is a warning, it will not be recorded.
If CE02 is a fault, it will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Incorrect communication command from elevator controller</td><td colspan="4">Check if the communication command is correct.</td></tr>
<tr><td colspan="2">Malfunction caused by interference</td><td colspan="4">Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.</td></tr>
<tr><td colspan="2">Different communication setting from the elevator controller</td><td colspan="4">Check if the setting for Pr.09-00–Pr.09-02 is the same as the setting for the elevator controller.</td></tr>
<tr><td colspan="2">Disconnection or bad connection of the cable</td><td colspan="4">Check the cable and replace it if necessary.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th>Description</th></tr>
<tr><td>56</td><td>CE03</td><td></td><td>Communication error 3</td><td>Illegal data value. Occurs when communication data length exceeds limits.</td></tr>
</table>

<table>
<tr><th colspan="3">Action and Reset</th></tr>
<tr><td>Action Condition</td><td colspan="2">When the length of communication data is too long</td></tr>
<tr><td>Action Time</td><td colspan="2">Immediately act</td></tr>
<tr><td>Fault Treatment Parameter</td><td colspan="2">Pr.04-60 (Default: 3)
0: Warn and keep operation
1: Fault and ramp to stop
2: Reserved
3: No action and no display</td></tr>
<tr><td rowspan="2">Reset Method</td><td>Auto</td><td>When Pr.04-60=0, CE03 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td>When Pr.04-60=1, CE03 is a fault and must be reset manually.</td></tr>
<tr><td>Reset Condition</td><td colspan="2">N/A</td></tr>
<tr><td>Record</td><td colspan="2">If CE03 is a warning, it will not be recorded.
If CE03 is a fault, it will be recorded.</td></tr>
<tr><th>Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td>Incorrect communication command from elevator controller</td><td colspan="2">Check if the communication command is correct.</td></tr>
<tr><td>Malfunction caused by interference</td><td colspan="2">Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.</td></tr>
<tr><td>Different communication setting from the elevator controller</td><td colspan="2">Check if the setting for Pr.09-00–Pr.09-02 is the same as the setting for the elevator controller.</td></tr>
<tr><td>Disconnection or bad connection of the cable</td><td colspan="2">Check the cable and replace it if necessary.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
57	CE04	CE04	Communication error 4	Data is written to read-only address. Error occurs when trying to write values into read-only address such as 0x21xx, 0x22xx, and so on.

<table>
<tr><th colspan="3">Action and Reset</th></tr>
<tr><td>Action Condition</td><td colspan="2">N/A</td></tr>
<tr><td>Action Time</td><td colspan="2">Immediately act</td></tr>
<tr><td>Fault Treatment Parameter</td><td colspan="2">Pr.04-60 (Default: 3)
0: Warn and keep operation
1: Fault and ramp to stop
2: Reserved
3: No action and no display</td></tr>
<tr><td rowspan="2">Reset Method</td><td>Auto</td><td>When Pr.04-60=0, CE04 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td>When Pr.04-60=1, CE04 is a fault and must be reset manually.</td></tr>
<tr><td>Reset Condition</td><td colspan="2">N/A</td></tr>
<tr><td>Record</td><td colspan="2">If CE04 is a warning, it will not be recorded.
If CE04 is a fault, it will be recorded.</td></tr>
<tr><th>Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td>Incorrect communication command from elevator controller</td><td colspan="2">Check if the communication command is correct.</td></tr>
<tr><td>Malfunction caused by interference</td><td colspan="2">Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.</td></tr>
<tr><td>Different communication setting from the elevator controller</td><td colspan="2">Check if the setting for Pr.09-00–Pr.09-02 is the same as the setting for the elevator controller.</td></tr>
<tr><td>Disconnection or bad connection of the cable</td><td colspan="2">Check the cable and replace it if necessary.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>58</td><td>CE10</td><td>CE10</td><td>Communication error 10</td><td colspan="2">Modbus transmission time-out</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">When communication time exceeds the detection time of Pr.04-61</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Pr.04-60 (Default: 3)
0: Warn and keep operation
1: Fault and ramp to stop
2: Reserved
3: No action and no display</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="3">When Pr.04-60=0, CE10 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="3">When Pr.04-60=1, CE10 is a fault and must be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">If CE10 is a warning, it will not be recorded.
If CE10 is a fault, it will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Incorrect communication command from elevator controller</td><td colspan="4">Check if the communication command is correct.</td></tr>
<tr><td colspan="2">Malfunction caused by interference</td><td colspan="4">Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.</td></tr>
<tr><td colspan="2">Different communication setting from the elevator controller</td><td colspan="4">Check if the setting for Pr.09-00–Pr.09-02 is the same as the setting for the elevator controller.</td></tr>
<tr><td colspan="2">Disconnection or bad connection of the cable</td><td colspan="4">Check the cable and replace it if necessary.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>59</td><td>CP10</td><td>CP10</td><td>Digital keypad transmission time-out</td><td colspan="2">Communication time-out for digital keypad KPC-CC01</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">When communication time exceeds Pr.04-63</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Pr.04-62 (Default: 3)
0: Warn and keep operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No action and no display</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="3">When Pr.04-62=0, CP10 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="3">When Pr.04-62=1 or 2, CP10 is a fault and must be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">If CP10 is a warning, it will not be recorded.
If CP10 is a fault, it will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Disconnection or bad connection of the cable</td><td colspan="4">Check the cable and replace it if necessary.</td></tr>
<tr><td colspan="2">Digital keypad malfunction</td><td colspan="4">Replace the digital keypad.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
60	bF	bF	Brake transistor error	The brake transistor of the motor drive is abnormal.

Action and Reset	
Action Condition	Hardware detection
Action Time	Immediately act
Fault Treatment Parameter	N/A
Reset Method	Cycle the power
Reset Condition	Cycle the power
Record	Yes

Cause	Corrective Actions
Hardware error	1. Press RESET key to go back to the default. If bF still exists, return to the factory for repair. 2. When drive malfunctioned due to internal wiring error, power off the drive first. Then, use a meter to check if there is short circuit between B2 to DC-. If short circuit exists, return to the factory for repair.
Malfunction caused by interference	Verify wiring/grounding of the main circuit to prevent interference.
Using the incorrect brake resistor	Check if the resistance value of the brake resistor matches the drive.
Incorrect wiring of the brake resistor	See <Section 11-1 Brake Resistors and Brake Units Used in AC Motor Drives> for details, and verify the wiring.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
64	MbF		Mechanical brake feedback error	The feedback signal and the release signal of mechanical brake are not consistent.

Action and Reset	
Action Condition	When feedback signal and release signal of mechanical brake are not consistent
Action Time	Mechanical brake detection time (Pr.04-11) (Default: 1.00)
Fault Treatment Parameter	Stops output immediately, and coasts to stop.
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	Yes
Cause	**Corrective Actions**
Incorrect brake action	Check if the mechanical brake signal is correct.
Incorrect parameter settings	Check if the mechanical brake detection time setting (Pr.04-11) is correct.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
65	PGF5	PGF5	PGSED communication error	PGSED communication error

Action and Reset	
Action Condition	Internal communication error between ED-B and PGSED
Action Time	Connection failed when attempt to connect internal communication 20 times
Fault Treatment Parameter	Forces to stop
Reset Method	Manual reset
Reset Condition	Internal communication is back to normal condition
Record	Yes
Cause	**Corrective Actions**
Incorrect wiring	Verify the wiring.
Incorrect parameter setting of encoders	Set encoder parameter settings again (Pr.00-20).

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
66	MCF		Magnetic contactor error	The action signal and the release signal of magnetic contactor are not consistent.

Action and Reset	
Action Condition	When action signal and the release signal of magnetic contactor are not consistent.
Action Time	Magnetic contactor detection time (Pr.04-12) (Default: 0.00)
Fault Treatment Parameter	Stops output immediately, and coasts to stop.
Reset Method	Cycle the power
Reset Condition	Cycle the power
Record	Yes
Cause	**Corrective Actions**
Incorrect contactor action	Check if the magnetic contactor signal is correct.
Incorrect parameter settings	Check if the magnetic contactor detection time setting (Pr.04-12) is correct.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
67	MPHL		Motor phase loss	Motor output phase loss

Action and Reset	
Action Condition	Acts according to Pr.04-33 (MPHL Speed Level) and Pr.04-34 (MPHL Current Level)
Action Time	Pr.04-35 (MPHL Count Time)
Fault Treatment Parameter	Pr.04-32 Phase Loss Detection of Drive Output at Start-up (MPHL) 0: Disable 1: Enable
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	Yes
Cause	**Corrective Actions**
Unbalanced three-phase impedance of the motor	Replace the motor.
Incorrect wiring	1. Verify the wiring of the cable. 2. Replace the cable.
Single-phase motor is used	Use a three-phase motor.
Check if current sensor is malfunctioned	1. Check if the wiring of control board is loose. If loose, arrange the wiring correctly and run again. If fault still exists, return to the factory for repair. 2. Check if the three-phase current is balanced using current clamp meter. If balanced is reached but MPHL still occurs, return to the factory for repair.
Temporary power is used or grounding fault	Ground the grounding terminals correctly to prevent damage from a lightning strike or electric shock and reduce noise interference.
Any unusual surge or drop of motor current	Such as CC (Current Clamp)

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>68</td><td>CAnF</td><td></td><td>CAN Bus off</td><td colspan="2">CAN Bus disconnection</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">1. Flag register of message loss for CAN function alerts
2. Time-out of waiting for receiving for CAN function</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Stops output immediately, and coasts to stop.</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Stops output immediately, and coasts to stop.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets immediately</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">CAN communication data error</td><td colspan="4">Check that CAN Bus is wired correctly.</td></tr>
<tr><td colspan="2">CAN communication time-out</td><td colspan="4">Verify that there is no PDO communication time-out.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
69	rbrE	rbrE	Rescue by mechanical brake control error	Rescue by mechanical brake control error

Action and Reset	
Action Condition	1. Releasing time exceeds Pr.05-39 (Maximum Release Time of Rescue by Mechanical Brake Control) 2. Speed feedback is smaller than Pr.05-36 (Speed Lower Limit of Rescue by Mechanical Brake Control) 3. Both MI=34 and RUN signals are activated at the same time
Action Time	Immediately act
Fault Treatment Parameter	Set MO=12 (Mechanical brake release) to stop outputting and make the mechanical brake engaged.
Reset Method	When MO=12 (Mechanical brake release) stops outputting and MI=34 (Rescue by mechanical brake control) is OFF.
Reset Condition	Resets immediately
Record	Yes
Cause	**Corrective Actions**
A too long release time	Check if Pr.05-39 (Maximum Release Time of Rescue by Mechanical Brake Control) is set too long.
A too small speed feedback	1. Check Pr.05-36 (Speed Lower Limit of Rescue by Mechanical Brake Control) 2. Verify the mechanical brake was released.
Error in RUN command	Check if RUN command is malfunctioned.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
70	SFGE	SFGE	Safety gear release error	Safety gear release error

Action and Reset	
Action Condition	1. Counting time exceeds Pr.05-30 (Safety Gear Release Enabled) 2. Speed feedback is larger than the percentage of Pr.05-29 (Safety Gear Speed Level) settings of Pr.03-50 (Maximum Output Frequency).
Action Time	Immediately act
Fault Treatment Parameter	Stops output immediately, and coasts to stop.
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	Yes
Cause	**Corrective Actions**
A too long action time	Check if Pr.05-31 (Safety Gear Time) is set too long.
Safety gear has been released	After verifying safety gear was released, set Pr.05-30=0 to disable the safety gear release function.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
72	StL1	StL1	STO loss 1	STO1 is OFF and STO2 is ON

Action and Reset	
Action Condition	Hardware detection
Action Time	110 ms
Fault Treatment Parameter	N/A
Reset Method	Hardware failure, and cannot reset. Cycle the power.
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
STO1 is not connected to 24V	Verify the short circuit wiring.
Hardware failure	After you make sure all the wiring is correct, if STL1 still exists after cycling the power, return to the factory for repair.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
73	PGcd		PG cd wiring error	Incorrect wiring of encoder C+, C-, D+, D-
Action and Reset				
Action Condition	Incorrect wiring of encoder signal C / D			
Action Time	0.1 sec.			
Fault Treatment Parameter	Stops output immediately, and coasts to stop.			
Reset Method	N/A			
Reset Condition	Resets immediately			
Record	Yes			
Cause	Corrective Actions			
Incorrect wiring	Check PG card and encoder C+, C-, D+, D- wiring.			
Incorrect parameter settings	Check Pr.00-26 PG Card C+ / C- selection.			

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
74	PGHL		PG absolute signal error	PG absolute signal error

Action and Reset	
Action Condition	Encoder feedback signal fault detection time (Pr.04-71) (Default: 1 sec.)
Action Time	Pr.04-71 Encoder Feedback Signal Fault Detection Time
Fault Treatment Parameter	Pr.04-72 Encoder Stall and Slip Error Action (maximum output frequency Pr.03-50 = 100%) (Default: 2) 0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and stop operation
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	Yes
Cause	**Corrective Actions**
Incorrect wiring	Check if the encoder absolute positions (C+/C- and D+/D-) and PG card are properly wired.
Incorrect wiring	If the cables are properly wired but the fault code still displays on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair.
PGSED increment/ absolute signal error	Check the wiring of the encoder increment / absolute signal or if there is any abnormal signal caused by interference.
Encoder communication error	Check if the setting of Pr.00-22 (High Resolution SIN/COS and Communication Encoder) matches the encoder specification.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
75	PGAF		PG Z-phase signal loss	PG Z-phase signal loss

Action and Reset	
Action Condition	N/A
Action Time	Immediately act
Fault Treatment Parameter	Stops output immediately, and coasts to stop.
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	Yes
Cause	**Corrective Actions**
Incorrect wiring	Check if the encoder’s Z-phase signal and PG card are properly wired.
Incorrect wiring	If the cables are properly wired but the fault code still displays on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair.

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>76</td><td>Stoo</td><td>Stoo</td><td>Safe Torque Off (STO)</td><td colspan="2">Safe Torque Off function is enabled</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">Hardware detection</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">10 ms</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">When Pr.04-10 = 0, 2 and STO function is non-active</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Manual reset after STO error is cleared.
NOTE: It can be reset when STO contacts are engaged, or manually reset when STO function is in different modes.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets until STO error is cleared.</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">STO1 and STO2 function are active</td><td colspan="4">Check the wiring and cycle the power.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
77	StL2		STO loss 2	STO2 is OFF and STO1 is ON

Action and Reset	
Action Condition	Hardware detection
Action Time	110 ms
Fault Treatment Parameter	N/A
Reset Method	Hardware failure, and cannot reset. Cycle the power.
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
STO2 is not connected to 24V	Verify the short circuit wiring.
Hardware failure	After you make sure all the wiring is correct, if STL2 still exists after cycling the power, return to the factory for repair.

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>78</td><td>StL3</td><td>StL3</td><td>STO loss 3</td><td colspan="2">Internal and external circuit error detected by hardware</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">Hardware detection</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Hardware failure, and cannot reset. Cycle the power.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Hardware failure</td><td colspan="4">After you make sure all the wiring is correct, if STL3 still exists after cycling the power, return to the factory for repair.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>81</td><td>SERV</td><td>SErv</td><td>Contact Service SERV</td><td colspan="2">The operation exceeds the limit of number of times</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">When Pr.02-66 = 2 and Pr.02-62 × 10000 + Pr.02-63 > Pr.02-65 × 10, fault occurs</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Pr.02-62 Single Operation Direction Count (H)
Pr.02-63 Single Operation Direction Count (L)
Pr.02-65 Number of Times for Operation Direction</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Clears by setting Pr.02-66</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Pr.02-66 = 0</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Single operation direction count value exceeds the setting value</td><td colspan="4">Check the elevator operation status on site by the elevator maintenance personnel.
Confirm that the elevator status is normal, then set the parameter to clear the warning.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
85	Hocb	Hocb	Hardware brake over-current	Hardware triggers brake transistor to over-current

Action and Reset	
Action Condition	Hardware protection
Action Time	Immediately act
Fault Treatment Parameter	Stops output immediately, and coasts to stop.
Reset Method	Manual reset
Reset Condition	N/A
Record	Yes

Cause	Corrective Actions
Improper parameter settings for acceleration / deceleration	Increase deceleration time
Brake resistor error	Select the brake resistor model as the user manual recommended
Brake discharge level is too high	Adjust Pr.07-51 (Brake Transistor Level) setting value.

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>86</td><td>Socb</td><td>Socb</td><td>Software brake over-current</td><td colspan="2">Software triggers brake transistor to over-current</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="3">Action Condition</td><td colspan="3">Current detection range is 100–155%. Fault occurs when brake current exceeds the maximum brake over-current percentage (Pr.04-81).</td></tr>
<tr><td colspan="3">Action Time</td><td colspan="3">Immediately act</td></tr>
<tr><td colspan="3">Fault Treatment Parameter</td><td colspan="3">Stops output immediately, and coasts to stop.</td></tr>
<tr><td colspan="3">Reset Method</td><td colspan="3">Manual reset</td></tr>
<tr><td colspan="3">Reset Condition</td><td colspan="3">N/A</td></tr>
<tr><td colspan="3">Record</td><td colspan="3">Yes</td></tr>
<tr><th colspan="3">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="3">Improper parameter settings for acceleration / deceleration</td><td colspan="3">Increase deceleration time</td></tr>
<tr><td colspan="3">Brake resistor error</td><td colspan="3">Select the brake resistor model as the user manual recommended</td></tr>
<tr><td colspan="3">Brake discharge level is too high</td><td colspan="3">Adjust Pr.07-51 (Brake Transistor Level) setting value.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
87	brF		Brake resistor configuration error	Brake resistor configuration error

Action and Reset	
Action Condition	When brake current is larger than 110% of the maximum brake current
Action Time	Immediately act
Fault Treatment Parameter	Stops output immediately, and coasts to stop.
Reset Method	Manual reset
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
Brake resistor error	Select the brake resistor model as the user manual recommended.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
88	bro	bro	Brake resistor is not connected	Brake resistor is not connected

Action and Reset	
Action Condition	When brake current is smaller than 16% of the maximum brake current
Action Time	Immediately act
Fault Treatment Parameter	Stops output immediately, and coasts to stop.
Reset Method	Manual reset
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
Brake resistor error	Select the brake resistor model as the user manual recommended.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
89	oL3	oL3	IGBT overload	IGBT overload occurs during low-speed operation

Action and Reset	
Action Condition	Software detection
Action Time	Immediately act
Fault Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	Yes
Cause	**Corrective Actions**
The load is too large	Check if the drive specifications match the load.
Accel./ Decel. time is too short	Increase the setting values for Pr.00-71–Pr.00-78 (accel./ decel. time).
V/F voltage is too high	Decrease the setting values for Pr.03-51–Pr.03-56 (V/F curve).
Not enough drive capacity	Choose a drive model that matches the capacity.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
90	StL4	StL4	STO loss 4	Contacts stick on STO hardware circuit (cannot be reset)

Action and Reset	
Action Condition	When Pr.04-10 = 7, STO circuit is not OFF after RUN command disappears.
Action Time	Pr.04-14 STO Sticking Detection Time
Fault Treatment Parameter	N/A
Reset Method	Cycle the power.
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
Incorrect Pr.04-10 setting	If this is an application for continuous activation of STO circuit, set Pr.04-10=4.
STO delayed deactivation time is too long	Check if the STO circuit is deactivated too slowly or Pr.04-14 detection time is set too short.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
91	StL5	StL5	STO loss 5	STO is not active for more than 24 hours

Action and Reset	
Action Condition	STO is non-active continuously for more than 24 hours.
Action Time	Immediately act
Fault Treatment Parameter	N/A
Reset Method	Manual reset after removing STO terminal
Reset Condition	N/A
Record	Yes
Cause	**Corrective Actions**
STO is non-active	Check if short circuit occurs on STO terminals (E24V-STO1-STO2).

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>93</td><td>CndL</td><td>CndL</td><td>CANLift disconnection</td><td colspan="2">CANLift disconnection</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">CANLift is disconnected</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Based on the communication time of elevator controller</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Stops output immediately, and coasts to stop.</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Reset signal is received</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets immediately</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">CANLift communication time-out</td><td colspan="4">Check CAN Bus wiring and time setting for CANLift heartbeat of elevator controller.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
95	CnLF	CnLF	CANLift error	CANLift PDO error

Action and Reset	
Action Condition	CANLift PDO error
Action Time	Immediately act
Fault Treatment Parameter	Stops output immediately, and coasts to stop.
Reset Method	Reset signal is received
Reset Condition	Resets immediately
Record	Yes
Cause	**Corrective Actions**
CANLift PDO error	Check PDOs sent by elevator controller, including check if target speed is larger than maximum elevator speed (Pr.00-40), if target position is within limit range (Pr.05-16 to Pr.05-15), and if target unit is set correctly (Pr.05-17 and Pr.05-18).

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>96</td><td>Stod</td><td></td><td>STO disconnection</td><td colspan="2">STO circuit is OFF during running</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">STO circuit is OFF while drive outputs</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">20 ms</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">N/A</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">STO function is active before running</td><td colspan="4">Make sure STO function is non-active before sending a RUN command.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th>Description</th></tr>
<tr><td>97</td><td>Stor</td><td></td><td>STO at running</td><td>STO circuit is OFF when frequency outputs</td></tr>
<tr><td colspan="5">Action and Reset</td></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">STO circuit is OFF while drive outputs</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">10 ms</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="3">N/A</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="3">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">N/A</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">Yes</td></tr>
<tr><td colspan="2">Cause</td><td colspan="3">Corrective Actions</td></tr>
<tr><td colspan="2">DC braking time is too long</td><td colspan="3">Time for STO circuit deactivation must be longer than DC braking time.</td></tr>
</table>

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
98	StoS		STO circuit sticking fault	STO circuit sticking fault (can be reset)

Action and Reset	
Action Condition	When Pr.04-10=6, STO circuit is not OFF within Pr.04-14 detection time after FWD/REV command disappears.
Action Time	Pr.04-10 STO Function Selection, Pr.04-14 STO Sticking Detection Time
Fault Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	1 sec. after STO circuit is OFF
Record	Yes

Cause	Corrective Actions
Incorrect Pr.04-10 setting	If this is an application for continuous activation of STO circuit, set Pr.04-10=4.
STO delayed deactivation time is too long	Check if the STO circuit is deactivated too slowly or Pr.04-14 detection time is set too short.

ID No.	Abbreviated Fault Code	Display on KPED-LE02	Fault Name	Description
99	iSto	iSto	Ignore STO is ON	Setting MI=57 triggers iSto

Action and Reset	
Action Condition	When Multi-function Input (MI) terminal #57 is active
Action Time	Immediately act
Fault Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	Resets immediately
Record	Yes
Cause	**Corrective Actions**
MI=57 is active	Close 24-hour detection function or disable MI=57. For details on MI=57, see Parameter Group 01 Input / Output Parameters in <Chapter 8 Descriptions of Parameter Settings>.

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>100</td><td>orP</td><td>orP</td><td>Over Ripple Protection</td><td colspan="2">orP is triggered when DC bus voltage ripple is too high. The drive stops once orP occurs.</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">When DC bus voltage ripple is higher than protection level</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Depends on models and their protection levels</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Stops output immediately, and coasts to stop.</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="4">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">The counting value of over ripple protection level returns to zero</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Unstable input power</td><td colspan="4">Provide with stable input power.</td></tr>
</table>

<table>
<tr><th>ID No.</th><th>Abbreviated Fault Code</th><th>Display on KPED-LE02</th><th>Fault Name</th><th colspan="2">Description</th></tr>
<tr><td>105</td><td>oH3_1</td><td>oH3_ 1</td><td>Motor over-heating PTC 1</td><td colspan="2">Motor overheating (PTC 1) when using a motor with PTC installed</td></tr>
<tr><th colspan="6">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="4">PTC 1 input level > Pr.04-48 (default = 50%)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="4">Immediately act</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="4">Pr.04-47 PTC 1 (Positive Temperature Coefficient) Detection Action (Default: 0)
0: Warn and keep operation
1: Fault and ramp to stop</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="3">When Pr.04-47=0, oH3_1 is a warning and will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="3">When Pr.04-47=1, oH3_1 is a fault and must be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="4">Resets when PTC 1 input level is lower than [Pr.04-48 – 5].</td></tr>
<tr><td colspan="2">Record</td><td colspan="4">If oH3_1 is a warning, it will not be recorded.
If oH3_1 is a fault, it will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="4">Corrective Actions</th></tr>
<tr><td colspan="2">Motor locked</td><td colspan="4">Clear the motor lock status.</td></tr>
<tr><td colspan="2">The load is too large</td><td colspan="4">Decrease the loading.
Replace with a motor with larger capacity.</td></tr>
<tr><td colspan="2">Ambien temperature is too high</td><td colspan="4">Change the installed place if there are heating devices in the surroundings.
Install/ add cooling fan or air conditioner to lower the ambient temperature.</td></tr>
<tr><td colspan="2">Motor cooling system error</td><td colspan="4">Check the cooling system to make it work normally.</td></tr>
<tr><td colspan="2">Motor fan error</td><td colspan="4">Replace the fan.</td></tr>
<tr><td colspan="2">Operates at low-speed too long</td><td colspan="4">Decrease low-speed operation time.
Change to dedicated motor for the drive.
Increase the motor capacity.</td></tr>
<tr><td colspan="2">Accel./ Decel. time and working cycle are too short</td><td colspan="4">Increase setting values for Pr.00-71–Pr.00-78 (accel./ decel. time).</td></tr>
<tr><td colspan="2">V/F voltage is too high when in open-loop circuit control</td><td colspan="4">Decrease the setting values for Pr.03-51–Pr.03-56 (V/F curve).</td></tr>
<tr><td colspan="2">Check if the motor rated current matches the motor nameplate</td><td colspan="4">Configure the correct rated current value of the motor again.</td></tr>
<tr><td colspan="2">Check if the PTC 1 is properly set and wired</td><td colspan="4">Check the connection between PTC 1 thermistor and the heat protection.</td></tr>
<tr><td colspan="2">Check if the setting for stall prevention is correct</td><td colspan="4">Set the stall prevention to the proper value.</td></tr>
<tr><td colspan="2">Unbalanced three-phase impedance of the motor</td><td colspan="4">Replace the motor.</td></tr>
<tr><td colspan="2">Harmonics is too high</td><td colspan="4">Use remedies to reduce harmonics.</td></tr>
</table>

Chapter 10 Maintenance and Troubleshooting

The AC motor drive has various warnings and protections against errors such as over-voltage, low voltage, or over-current. Once an error occurs, the protections activate, the AC motor drive stops output, activates the error contacts, and the motor coasts to stop. Please refer to the warning/fault display from the AC motor drive and look up the corresponding causes and corrective actions in <Chapter 9 Warning and Fault Codes>. The fault record is stored in the AC motor drive 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 AC motor drive 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 AC motor drive 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 AC motor drive's operation, and to make sure nothing unusual happens. Check the situations listed in the following table.

CAUTION	☑ Wait five seconds after a fault has been cleared before pressing RESET with the input terminal keypad. ☑ The drive must first be switched off for at least five minutes for ≤ 22 kW models, and 10 minutes for ≥ 30kW models until the charging indicator turns off, and the voltage between terminals + – - must be lower than 25 V_{DC} before it is safe to open the cover to begin maintenance operations. ☑ 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.) ☑ Never modify internal components or wiring. ☑ The performance and the surrounding environment should meet the standard specifications. There should be no abnormal noise, vibration, or odor.

10-1 Maintenance and Inspections

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 (≤ 25 V_{DC}).

Ambient environment				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check the ambient temperature, humidity, and vibration and check for any dust, gas, oil or water drops.	Visual inspection and measurement with equipment with standard specification	○		
Check for any dangerous objects	Visual inspection	○		

Voltage				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check that the voltage of main circuit and control circuit are correct.	Measure with multimeter with standard specifications.	○		

Digital keypad display				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check that the display is clear for reading	Visual inspection	○		
Check for any missing characters	Visual inspection	○		

Mechanical parts				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check for any abnormal sound or vibration	Visual and audible inspection		○	
Check for any loose bolts	Securely tighten		○	
Check for any deformed or damaged parts	Visual inspection		○	
Check for any color change caused by overheating	Visual inspection		○	
Check for any dust or dirt	Visual inspection		○	

Main circuit				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check for any loose or missing bolts	Securely tighten	○		
Check for machine or insulator deformation, crack, damage or color change due to overheating or ageing	Visual inspection		○	
Check for any dust or dirt	Visual inspection		○	

Main circuit terminals and wiring				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check the terminal and copper plate for color change or deformation due to overheating	Visual inspection		○	
Check for damage to the wiring insulation or color change	Visual inspection		○	

Main circuit terminal block				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check for any damage	Visual inspection	○		

Main circuit filter capacitor				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check for any liquid leaks, color change, crack or buckling of the exterior cover	Visual inspection	○		
Check if the safety valve is not removed or if the valve is obviously expanded	Visual inspection	○		
Measure static capacity when required	-	○		

Main circuit resistor				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check for any odors or insulation cracks due to overheating	Visual inspection, smell	○		
Check for any disconnections	Visual inspection	○		
Check for damaged connections	Measure with multimeter with standard specifications	○		

Main circuit transformer and reactor				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check for any abnormal vibration or odors	Visual, audible inspection and smell	○		

Main circuit magnetic contactor and relay				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check for any sound of vibration while running	Audible inspection	○		
Check that the contact works correctly	Visual inspection	○		

Main circuit PCB and connector				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check for any loose screws and connectors	Tighten the screws and press the connectors firmly in place.		○	
Check for any odors and color change	Visual and smell inspection		○	
Check for any crack, damage, deformation or corrosion	Visual inspection		○	
Check for any liquid leaks or deformation in capacity	Visual inspection		○	

Cooling system cooling fan				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check for any abnormal sound or vibration	Visual, audible inspection, and turn the fan by hand (turn off the power before operation) to see if it rotates smoothly.		○	
Check for any loose bolts	Securely tighten		○	
Check for any color change due to overheating	Visual inspection		○	

Cooling system ventilation channel				
Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check for any obstruction in the heat sink, air intake or air outlet	Visual inspection		○	

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

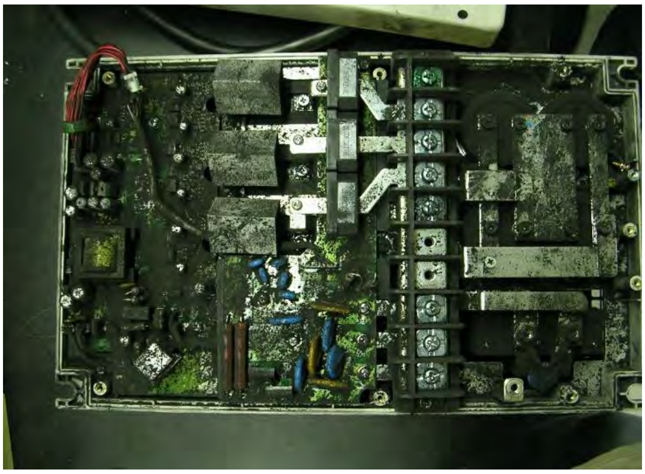
10-2 Greasy Dirt Problems

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 drive.

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

Solution:

Install the AC motor drive in a standard cabinet to keep it away from greasy dirt. Clean and remove greasy dirt regularly to prevent damage to the drive.



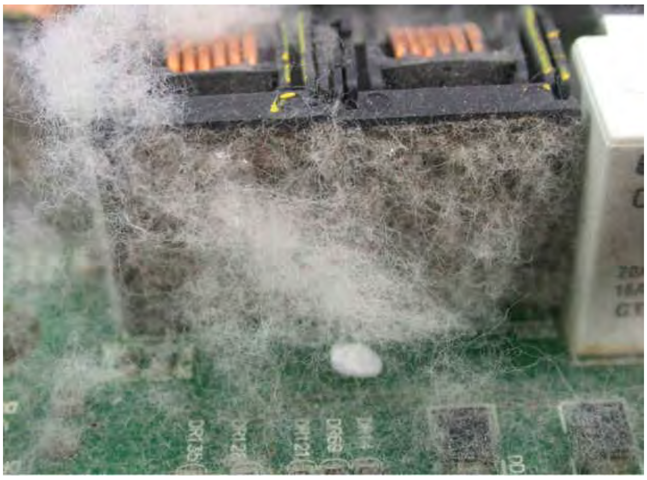
10-3 Fiber Dust Problems

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

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 drive to burn out, become damaged or explode due to wet fiber dust adhering to the devices.

Solution:

Install the AC motor drive in a standard cabinet to keep it away from fiber dust. Clean and remove fiber dust regularly to prevent damage to the drive.



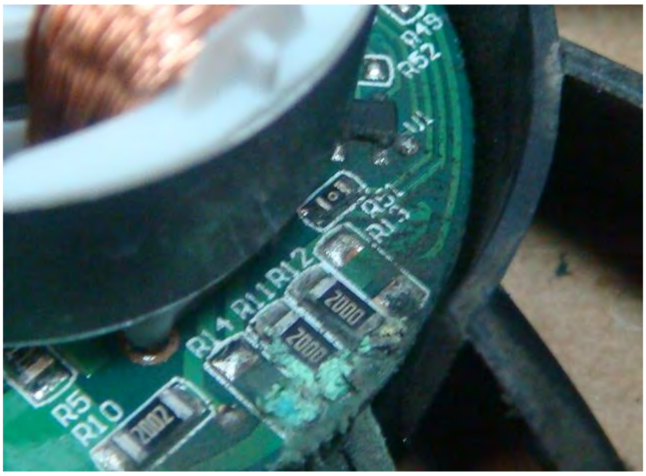
10-4 Corrosion Problems

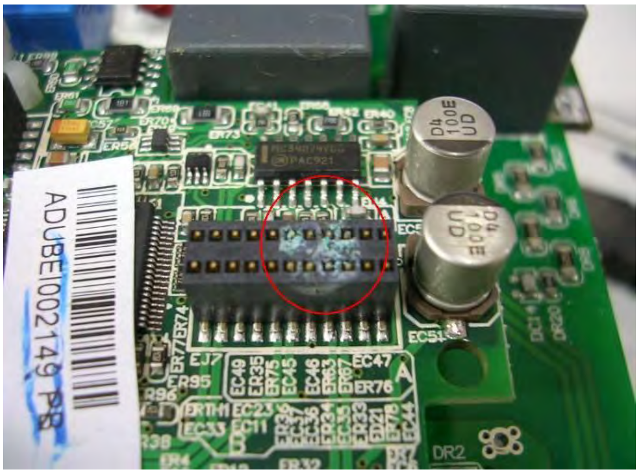
Corrosion problems may occur if any fluids flow into the drives. Please be aware of the possible damages that corrosion may cause to your drive.

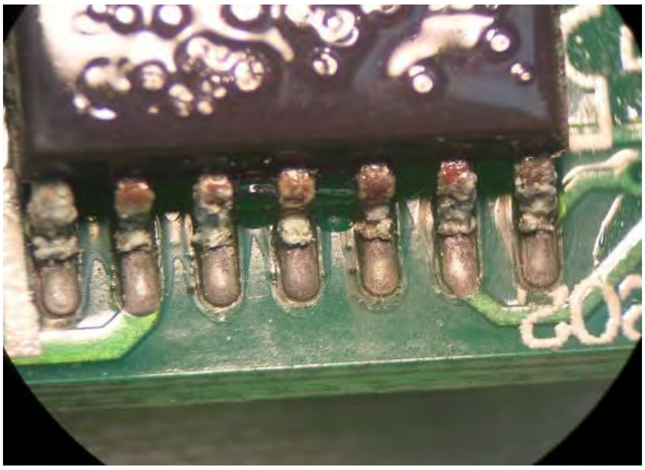
1. Corrosion of internal components may cause the drive to malfunction and possibility to explode.

Solution:

Install the AC motor drive in a standard cabinet to keep it away from fluids. Clean the drive regularly to prevent corrosion.







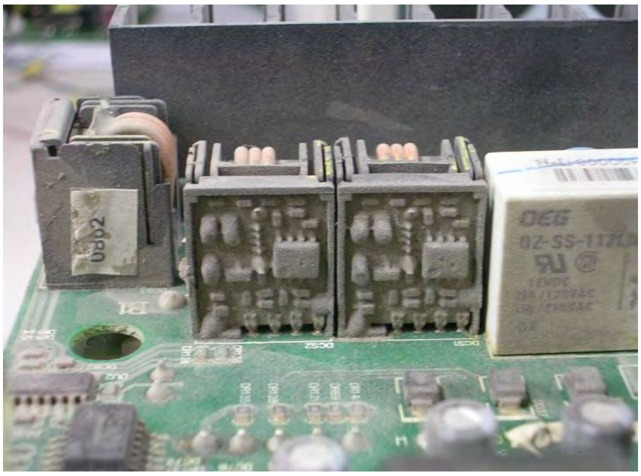
10-5 Industrial Dust Problems

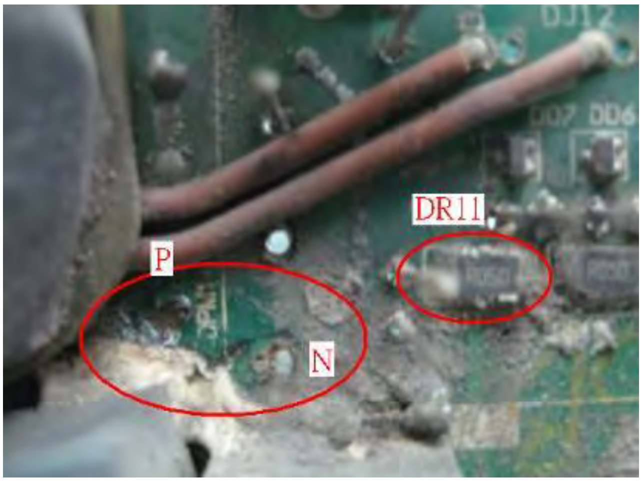
Serious industrial dust pollution frequently occurs in environments such as stone processing plants, flour mills, cement plants, and so on. Please be aware of the possible damages that industrial dust may cause to your drives.

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

<u>Solution:</u>

Install the AC motor drive in a standard cabinet and cover the drive with a dust cover. Clean the cabinet and ventilation holes regularly for good ventilation.





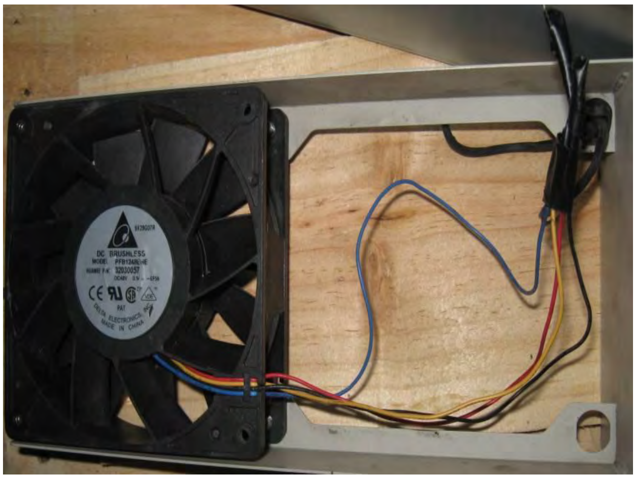
10-6 Installation and Wiring Problems

When wiring the drive, 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 drives.

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

Solution:

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



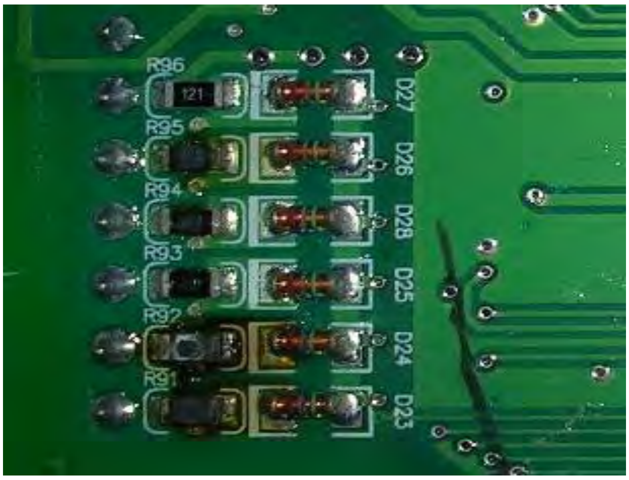
10-7 Multi-function Input / Output Terminal Application Problems

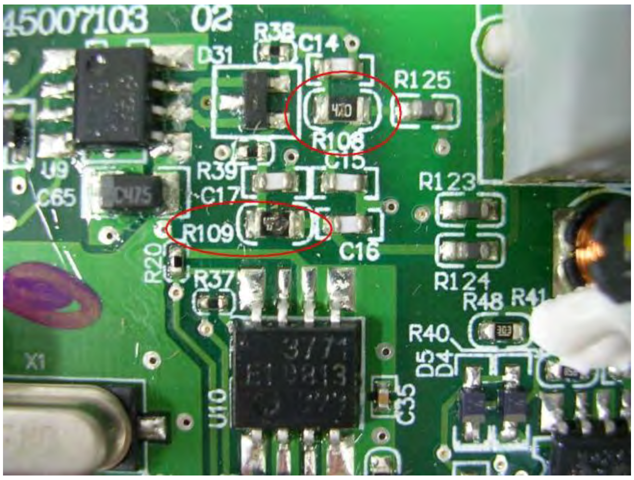
Multi-function input / output terminal errors are generally caused by over-usage of the terminals and not following the specifications. Please be aware of the possible damages that multi-function input / output terminal errors may cause to your drives.

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 11 Optional Accessories

The optional accessories listed in this chapter are available upon request. Installing additional accessories to your drive can substantially improve the drive's performance. Select accessories according to your needs or contact your local distributor for suggestion.

11-1 Brake Resistors and Brake Units Used in AC Motor Drives

Recommended Model Selection

Voltage	Delta's Motor Drive Model	IM 10% ED*1			PM 30% ED*2		
		Min. Resistor Value*3 (Ω)	Max Resistor Value*4 (Ω)	Suggested Braking Power (kW)	Min. Resistor Value*3 (Ω)	Max Resistor Value*4 (Ω)	Suggested Braking Power (kW)
230V	VFD022ED21B VFD022ED21BE	38.0	65.6	0.3	38.0	65.6	1.0
	VFD037ED21B VFD037ED21BE	19.0	39	0.5	19.0	39	1.5
460V	VFD040ED43B VFD040ED43BE	54.3	144.4	0.5	54.3	144.4	2.0
	VFD055ED43B VFD055ED43BE	48.4	105	1.0	48.4	105	2.0
	VFD075ED43B VFD075ED43BE	39.4	77	1.0	39.4	77	3.0
	VFD110ED43B VFD110ED43BE	30.8	52.5	1.5	30.8	52.5	4.0
	VFD150ED43B VFD150ED43BE	25.0	38.5	2.0	25	38.5	6.0
	VFD185ED43B	20.8	31.2	2.0	20.8	31.2	7.2

Table 11-1

NOTE:

*1: The brake resistor should be able to endure 10 times the overload capacity.

*2: The brake resistor should be able to endure 3.3 times the overload capacity.

*3: If you choose other brake resistors instead of Delta's, calculate the maximum power and average power of the selected braking power to ensure that they meet the requirements. Maximum power: Vb^2/R; average power: Vb^2/R x ED%. (Vb stands for braking voltage; R stands for brake resistor value.)

*4: If the brake resistor value you used is larger than maximum resistor value, the elevator may not have enough time to decelerate, further triggering an OV error on the drive.

IM Elevator System (Using Delta's Brake Resistor)

Voltage	Applicable Delta's Motor Drive		125% Braking Torque/10% ED*1							Max. Braking Torque		
	HP	Model	Braking Torque*2 (kg-m)	Brake Unit VFDB	Brake Unit #	Delta's Brake Resistor*3 Part No.	Delta's Brake Resistor*3 #	Delta's Brake Resistor*3 Configuration	Braking Current (A)*4	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
230V	3	VFD022ED21B VFD022ED21BE	1.5	-	-	BR300W070	1	-	5.4	38.0	10.0	3.8
	5	VFD037ED21B VFD037ED21BE	2.5	-	-	BR500W030	1	-	12.7	19.0	20.0	7.6
460V	5	VFD040ED43B VFD040ED43BE	2.7	-	-	BR500W100	1	-	7.6	54.3	14.0	10.6
	7.5	VFD055ED43B VFD055ED43BE	3.7	-	-	BR1K0W075	1	-	10.1	48.4	15.7	11.9
	10	VFD075ED43B VFD075ED43BE	5.1	-	-	BR1K0W075	1	-	10.1	39.4	19.3	14.7
	15	VFD110ED43B VFD110ED43BE	7.5	-	-	BR1K5W043	1	-	17.7	30.8	24.7	18.8
	20	VFD150ED43B VFD150ED43BE	10.1	-	-	BR1K0W016	2	2 in series	23.8	25.0	30.4	23.1
	25	VFD185ED43B	12.5	-	-	BR1K0W016	2	2 in series	23.8	20.8	36.5	27.7

Table 11-2

NOTE:

*1: Calculation of 125% braking torque: (kW)*125%*0.8; where 0.8 is the motor efficiency.
Since there is a resistor power consumption limit, the longest operation time for 10% ED is 10 seconds (ON: 10 seconds / OFF: 90 seconds).

*2: The calculation of the brake resistor is based on a four-pole motor (1800 rpm).

*3: To dissipate heat, mount a resistor of 400 W or lower to a frame to keep the surface temperature below 250°C (482°F). Fix a resistor of 1000 W or higher to a surface to keep the surface temperature below 600°C (1112°F). (If the resistor temperature is higher than 350°C, install extra cooling. If the resistor temperature is higher than the temperature limit, increase the size of the resistor.)

*4: The calculation of the braking current is based on Delta's brake resistor and default braking voltage (220V_{AC}: 380V_{DC}; 440V_{AC}: 760V_{DC}).

PM Elevator System (Using Delta's Brake Resistor)

Voltage	Applicable Delta's Motor Drive		125% Braking Torque/30% ED*1							Max. Braking Torque		
	HP	Model	Braking Torque*2 (kg-m)	Brake Unit		Delta's Brake Resistor *3			Braking Current (A)*4	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
				VFDB	#	Part No.	#	Configuration				
230V	3	VFD022ED21B VFD022ED21BE	1.5	-	-	BR1K0W050	1	-	7.6	38.0	10.0	3.8
230V	5	VFD037ED21B VFD037ED21BE	2.5	-	-	BR1K0W016	2	2 in series	11.9	19.0	20.0	7.6
460V	5	VFD040ED43B VFD040ED43BE	2.7	-	-	BR1K0W050	2	2 in series	7.6	54.3	14.0	10.6
460V	7.5	VFD055ED43B VFD055ED43BE	3.7	-	-	BR1K0W050	2	2 in series	7.6	48.4	15.7	11.9
460V	10	VFD075ED43B VFD075ED43BE	5.1	-	-	BR1K0W020	3	3 in series	12.7	39.4	19.3	14.7
460V	15	VFD110ED43B VFD110ED43BE	7.5	-	-	BR1K0W050	4	2 in series 2 parallel	15.2	30.8	24.7	18.8
460V	20	VFD150ED43B VFD150ED43BE	10.1	-	-	BR1K5W039	4	2 in series 2 parallel	19.5	25.0	30.4	23.1
460V	25	VFD185ED43B	12.5	-	-	BR1k2W039	6	2 in series 3 parallel	29.2	20.8	36.5	27.7

Table 11-3

NOTE:

*1: Calculation of 125% braking torque: (kW)*125%*0.8; where 0.8 is the motor efficiency.
Since there is a resistor power consumption limit, the longest operation time for 30% ED is 30 seconds (ON: 30 seconds / OFF: 70 seconds).

*2: The calculation of the brake resistor is based on a four-pole motor (1800 rpm).

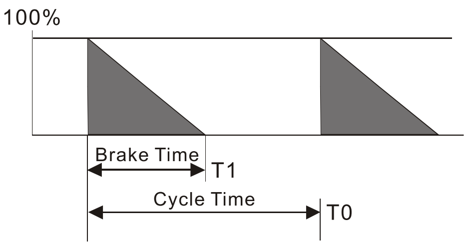
*3: To dissipate heat, mount a resistor of 400 W or lower to a frame to keep the surface temperature below 250°C (482°F). Fix a resistor of 1000 W or higher to a surface to keep the surface temperature below 600°C (1112°F). (If the resistor temperature is higher than 350°C, install extra cooling. If the resistor temperature is higher than the temperature limit, increase the size of the resistor.)

*4: The calculation of the braking current is based on Delta's brake resistor and default braking voltage (220V_{AC}: 380V_{DC}; 440V_{AC}: 760V_{DC}).

NOTE:

1. Select the resistance value, power and brake usage (ED %) according to Delta rules.

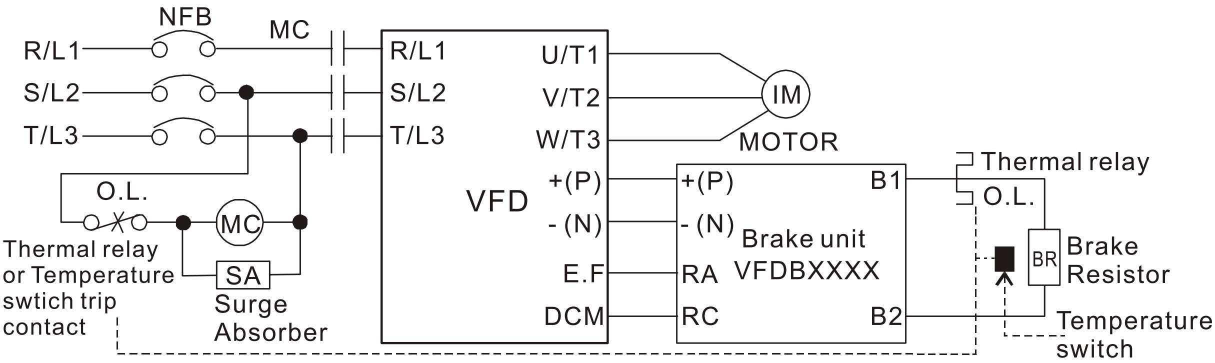
Definition for Brake Usage ED%



ED% = T1 / T0 x 100(%)

Explanation:
Brake usage ED (%) is the amount of time needed for the brake unit and brake resistor to dissipate heat generated by braking. When the brake resistor heats up, the resistance increases with temperature, and braking torque decreases accordingly.

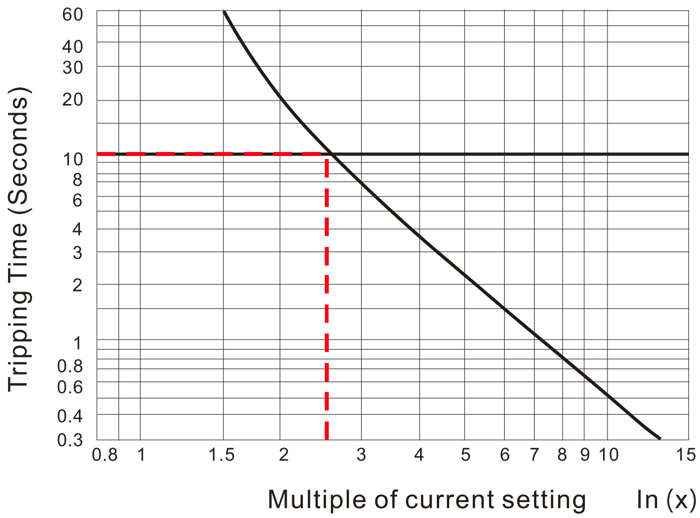
For safety, install a thermal overload relay between the brake unit and the brake resistor in conjunction with the magnetic contactor (MC) at the drive mains input for additional protection. The thermal overload relay protects the brake resistor from overheat damage due to frequent or continuous braking. Under such circumstances, turn off the power to prevent damage to the brake resistor and the drive. **NOTE:** Never use it to disconnect the brake resistor.



- When the drive is equipped with a DC reactor, read the user manual for the correct wiring for the brake unit input circuit +(P).
- DO NOT connect the input circuit -(N) to the neutral point of the power system.

2. Any damage to the drive or other equipment caused by using brake resistors and brake units that are not provided by Delta voids the warranty.
3. Consider environmental safety factors when installing the brake resistors. If you use the minimum resistance value, consult your local dealers for the power calculation.
4. The selection tables are for normal use. If the AC motor drive requires frequent braking, increase the Watts by two to three times.
5. Thermal Overload Relay (TOR):

   Thermal overload relay selection is based on its overload capacity. A standard braking capacity of the VFD-ED is 10%ED (Tripping time = 10s). As shown in the graph below, a 460V, 11 kW VFD-ED requires the thermal relay to take 260% overload capacity for 10 seconds (hot starting) and the braking current is 17.7 A. In this case, select a thermal overload relay larger than 17.7 / 2.6 = 6.8 (A). The specification of each thermal relay may vary among different manufacturers. Carefully read the specification before using it.



11-2 Non-fuse Circuit Breaker

Comply with the UL standard: Per UL 508, paragraph 45.8.4, part a.

The rated current of the non-fuse circuit breaker should be two to four times the drive's maximum rated input current.

Single-phase	
Model	Recommended non-fuse breaker (A)
VFD022ED21B VFD022ED21BE	50
VFD037ED21B VFD037ED21BE	75

Table 11-4

Three-phase	
Model	Recommended non-fuse breaker (A)
VFD040ED43B VFD040ED43BE	20
VFD055ED43B VFD055ED43BE	30
VFD075ED43B VFD075ED43BE	40
VFD110ED43B VFD110ED43BE	50
VFD150ED43B VFD150ED43BE	60
VFD185ED43B	75

Table 11-5

11-3 Fuse Specification Chart

Fuse specifications lower than the table below are allowed.

Model	Input Current (A)	Line Fuse		
		I (A)	Bussmann P/N	Voltage
VFD022ED21B VFD022ED21BE	26	60	JJN-60	300 V_{AC}
VFD037ED21B VFD037ED21BE	37	90	JJN-90	300 V_{AC}
VFD040ED43B VFD040ED43BE	11.5	25	JJS-25	600 V_{AC}
VFD055ED43B VFD055ED43BE	14	35	JJS-35	600 V_{AC}
VFD075ED43B VFD075ED43BE	17	45	JJS-45	600 V_{AC}
VFD110ED43B VFD110ED43BE	24	70	JJS-70	600 V_{AC}
VFD150ED43B VFD150ED43BE	30	80	JJS-80	600 V_{AC}
VFD185ED43B	37	90	JJS-90	600 V_{AC}

Table 11-6

11-4 AC and DC Reactor

11-4-1 AC Input Reactor

Installing an AC reactor on the input side of an AC motor drive can increase line impedance, improve power factor, reduce input current, and reduce interference generated from the motor drive. It also reduces momentary voltage surges or abnormal current spikes. For example, when the main power capacity is higher than 500 kVA, or when using a switching capacitor bank, momentary voltage and current spike may damage the AC motor drive's internal circuit. An AC reactor on the input side of the AC motor drive protects it by suppressing surges.

Installation

Install an AC input reactor in series with the main power to the three input phases R S T as shown in the figure below:

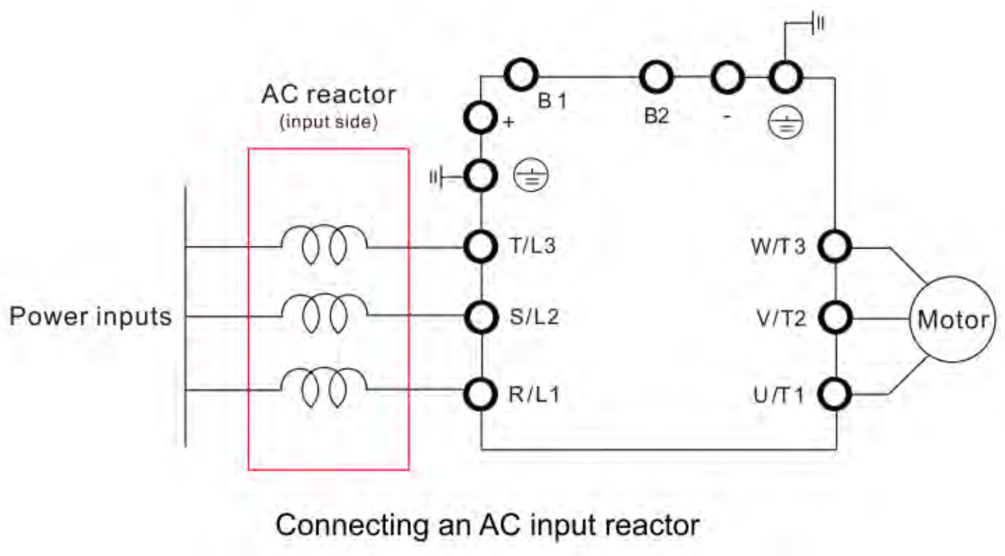


Figure 11-1

THDi (Total Harmonic Distortion)

The table below shows the THDi specifications when using Delta's drives (three-phase power models) to work with AC/DC reactors.

Motor Drive Spec.	Models without AC/DC Reactors	Models without Built-in DC Reactors	
Reactors in Series Spec.		3% Input AC Reactor	5% Input AC Reactor
5th	73.3%	38.5%	30.8%
7th	52.74%	15.3%	9.4%
11th	7.28%	7.1%	6.13%
13th	0.4%	3.75%	3.15%
THDi	91%	43.6%	34.33%

NOTE:

Table 11-7

1. THDi may vary due to different installation conditions and environment (wires, motors).
2. For three-phase power models, Delta provides 5% AC reactors. Refer to the following sections to select your applicable reactors.

Applicable Reactors

To comply with EN12015, install reactors according to the specifications as shown in the tables below.

200V–230V / 50–60 Hz (Single-phase power)

Model	Grid Frequency (Hz)	AC Reactors				DC Reactors			
		35%		48%		35%		48%	
		Input Current (A)	AC Input Reactors (mH)	Input Current (A)	AC Input Reactors (mH)	Input Current (A)	DC Input Reactors (mH)	Input Current (A)	DC Input Reactors (mH)
VFD022ED21B/BE	50	15.4	13.60	16.6	7.90	15.2	14.50	16.6	7.85
	60	15.3	11.20	16.6	6.40	15.2	12.00	16.6	6.40
VFD037ED21B/BE	50	25.1	8.40	27.2	4.80	25.0	8.70	27.1	4.80
	60	25.1	6.84	27.0	3.94	24.8	7.50	27.0	3.95

Table 11-8

380V–460V / 50–60 Hz (Three-phase power)

Model	Grid Frequency (Hz)	AC Reactors				DC Reactors			
		35%		48%		35%		48%	
		Input Current (A)	AC Input Reactors (mH)	Input Current (A)	AC Input Reactors (mH)	Input Current (A)	DC Input Reactors (mH)	Input Current (A)	DC Input Reactors (mH)
VFD040ED43B/BE	50	7.8	5.35	8.2	2.95	9.5	8.50	9.9	4.61
	60	7.9	4.35	8.3	2.37	9.4	7.10	9.9	3.66
VFD055ED43B/BE	50	11.9	3.52	12.3	2.00	14.1	5.75	14.8	3.10
	60	11.9	2.95	12.4	1.60	14.2	4.75	14.8	2.52
VFD075ED43B/BE	50	14.6	2.86	15.2	1.60	17.6	4.55	18.3	2.50
	60	14.6	2.40	15.2	1.30	17.2	3.75	18.1	2.07
VFD110ED43B/BE	50	21.3	1.90	22.2	1.01	25.4	2.90	26.6	1.61
	60	21.2	1.55	22.2	0.81	25.2	2.47	26.6	1.26
VFD150ED43B/BE	50	26.1	1.55	27.2	0.83	31.2	2.40	32.4	1.31
	60	26.0	1.28	27.0	0.67	30.9	2.05	32.5	1.03
VFD185ED43B/BE	50	30.6	1.32	31.9	0.72	36.8	2.00	38.3	1.13
	60	30.9	1.07	32.0	0.57	36.5	1.75	38.5	0.87

Table 11-9

11-5 Zero Phase Reactor

You can also suppress interference by installing a zero phase reactor at the main input or the motor output of the drive, depending on the location of the interference. Due to the large current passed through the main input/motor output side, pay attention to core saturation issue.

Casing ***without*** mechanical fixed part

Adopts nanocrystalline core developed by CHINA AMORPHOUS TECHNOLOGY®, and has high initial magnetic permeability, high saturation induction density, low iron loss and perfect temperature characteristic. If the zero phase reactor does not need to be fixed mechanically, use this solution.

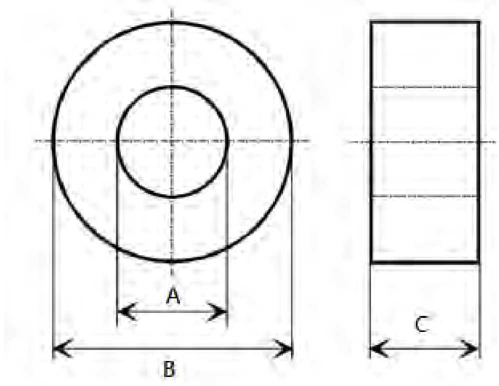


Figure 11-2

Zero Phase Reactor Model*[1]	Recommended Wire Size		Wiring Method	Qty	Applicable Motor Drives	
RF008X00N	≤ 8 AWG	≤ 8.37 mm^2	Diagram A Diagram B	1	VFD022ED21B	VFD022ED21BE
					VFD037ED21B	VFD037ED21BE
					VFD040ED43B	VFD040ED43BE
					VFD055ED43B	VFD055ED43BE
					VFD075ED43B	VFD075ED43BE
					VFD110ED43B	VFD110ED43BE
					VFD150ED43B	VFD150ED43BE
					VFD185ED43B	

*[1]: 600 V insulated cable wire

Table 11-10

Installation

During installation, pass the cable through at least one zero phase reactor. Use a suitable cable type (insulation class and wire section) so that the cable passes easily through the zero phase reactor. Do not pass the grounding cable through the zero phase reactor; only pass the motor wire through the zero phase reactor. With longer motor cables the zero phase reactor can effectively reduce interference at the motor output. Install the zero phase reactor as close to the output of the drive as possible. Diagram A shows the installation diagram for a single turn zero phase reactor. If the wire diameter allows several turns, Diagram B shows the installation of a multi-turn zero phase reactor. The more turns, the better the noise suppression effect.

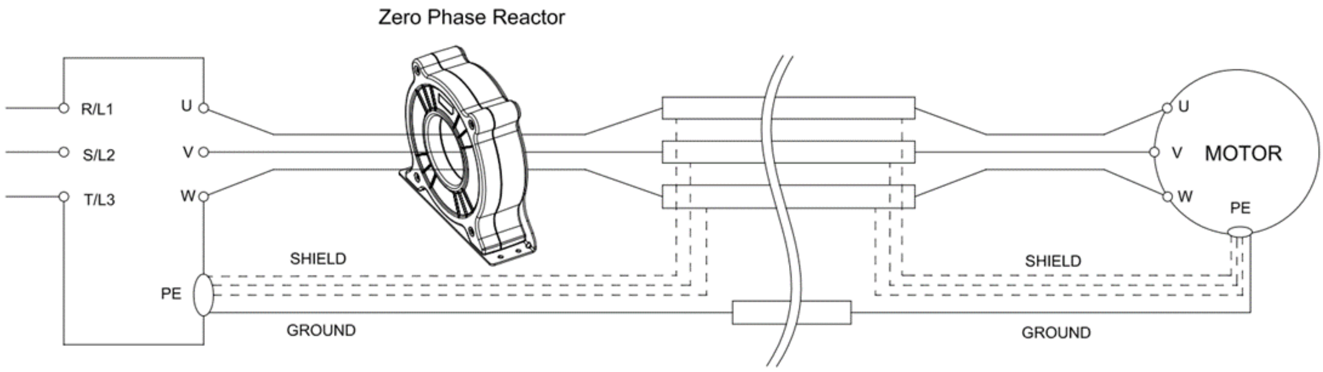


Diagram A. Single turn wiring diagram for shielding wire with a zero phase reactor

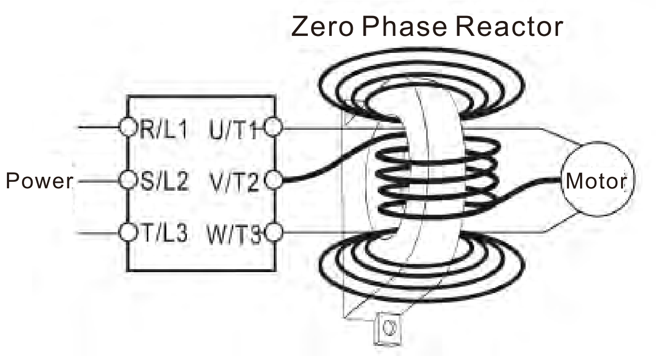


Diagram B. Multi-turn zero phase reactor

Installation Precaution

Install the zero phase reactor at the drive's output terminal (U/T1, V/T2, W/T3). After the zero phase reactor is installed, it reduces the electromagnetic radiation and load stress emitted by the wiring of the frequency converter. The number of zero phase reactors required for the drive depends on the wiring length and the drive voltage.

The normal operating temperature of the zero phase reactor should be lower than 85°C (176°F). However, when the zero phase reactor is saturated, its temperature may exceed 85°C (176°F). In this case, increase the number of zero phase reactors to avoid saturation. The following are reasons that might cause saturation of the zero phase reactors: the drive wiring is too long; the drive has several sets of loads; the wiring is in parallel; or the drive uses high capacitance wiring. If the temperature of the zero phase reactor exceeds 85°C (176°F) during the operation of the drive, increase the number of zero phase reactors.

Recommended maximum wiring gauge when installing zero phase reactor:

Zero Phase Reactor Model	Max. Wire Gauge or LUG Width	Max. Wire Gauge AWG (1C*3)		Max. Wire Gauge AWG (4C*1)	
		75 C	90 C	75 C	90 C
RF008X00N	13 MM	3 AWG	1 AWG	3 AWG	1 AWG

Table 11-11

11-6 EMC Filter

The tables below show external EMC filter models for models end with “B” of EB3000 series motor drive. Choose corresponding EMC filter and EMC core and applicable motor cables according to the required IEC 61800-3 Class levels to reduce noise emission and electromagnetic interference for the best configuration and anti-interference performance.

Conducted Emission

Voltage / Frame Size	IEC 61800-3 Class C2		IEC 61800-3 Class C3	
	EMC Filter	EMC Core	EMC Filter	EMC Core
Input with **external** EMC filter				
240V / Frame A	EMF27AM21B	Input: RF008X00N Output: RF008X00N	EMF27AM21B	Input: RF008X00N Output: RF008X00N
Input with **internal** EMC filter				
240V / Frame A	None	None	None	None
Input with **external** EMC filter				
480V / Frame A	EMF033A43A	Input: RF008X00N Output: RF008X00N	EMF033A43A	Input: RF008X00N Output: RF008X00N
480V / Frame B	B84143D0050R127	Input: RF008X00N Output: RF008X00N	B84143D0050R127	Input: RF008X00N Output: RF008X00N
Input with **internal** EMC filter				
480V / Frame A	-	--	None	None
480V / Frame B	-	-	None	None

Table 11-12

Radiated Emission

Voltage / Frame Size	IEC 61800-3 Class C2		IEC 61800-3 Class C3	
	EMC Filter	EMC Core	EMC Filter	EMC Core
Input with **external** EMC filter				
240V / Frame A	EMF27AM21B	Input: RF008X00N Output: RF008X00N	EMF27AM21B	Input: RF008X00N Output: RF008X00N
Input with **internal** EMC filter				
240V / Frame A	None	None	None	None
Input with **external** EMC filter				
480V / Frame A	EMF033A43A	Input: RF008X00N Output: RF008X00N	EMF033A43A	Input: RF008X00N Output: RF008X00N
480V / Frame B	B84143D0050R127	Input: RF008X00N Output: RF008X00N	B84143D0050R127	Input: RF008X00N Output: RF008X00N
Input with **internal** EMC filter				
480V / Frame A	None	None	None	None
480V / Frame B	None	None	None	None

Table 11-13

Motor Cable Length

Frame Size	IEC 61800-3 Class C2		IEC 61800-3 Class C3	
	Conducted Emission	Radiated Emission	Conducted Emission	Radiated Emission
External filter				
Frame A	10 m	10 m	10 m	10 m
Frame B	-	10 m	10 m	10 m
Internal filter				
Frame A	10 m	10 m	10 m	10 m
Frame B	-	10 m	10 m	10 m

Table 11-14

EMC Filter Installation

All electrical equipment, including AC motor drives, generates high frequency / low frequency noise and interferes with peripheral equipment by radiation or conduction during operation. Installing an EMC filter helps eliminate much interference. It is recommended to use DELTA EMC filter to have the best interference elimination performance.

Install and wire AC motor drive and EMC filter according to the instructions in the user manual to ensure compliance with the following regulations:

- IEC 61800-5-1:2007/A1:2016
- EN 61800-5-1:2007/A11:2021
- EN IEC 61000-3-2:2019/A1:2021
- EN 12015:2020
- EN 12016:2013
- IEC 61800-3:2018
- EN 61800-3:2018
- EN 61000-3-12:2011

General Precautions

To achieve optimal effect on suppressing interference of AC motor drive, follow the instructions in the user manual to install and wire the AC motor drive. Moreover, pay attention to the precautions below.

☑ Install EMC filter and AC motor drive on the same metal plate.

☑ Install AC motor drive on footprint EMC filter or install EMC filter as close as possible to the AC motor drive.

☑ Do the wiring as short as possible.

☑ Ground the metal plate.

☑ Fix the cover of EMC filter and AC motor drive or grounding on the metal plate. Leave the contact area as large as possible.

Choose Suitable Motor Cable and Precautions

An improper installation and wrong choice of motor cable would affect the performance of EMC filter. Be sure to observe the following precautions when selecting the motor cable.

☑ Use the motor cable with copper braid shielded wire (double shielded would be better). Ground the copper braid shielded wire on both ends of the motor cable with the shortest distance and largest contact area.

☑ Remove the protective painting where the metal plate fixes with two-hole straps to ensure a good contact, as Figure A below shows.

☑ Connect the copper braid shielded wire of the motor cable correctly with the metal plate. Use two-hole straps to fix both ends of the copper braid shielded wire of the motor cable on the metal plate, as Figure B below shows.

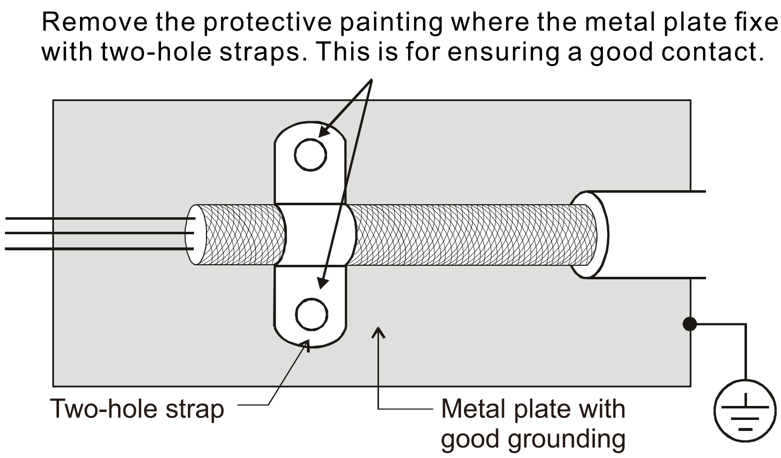


Figure A

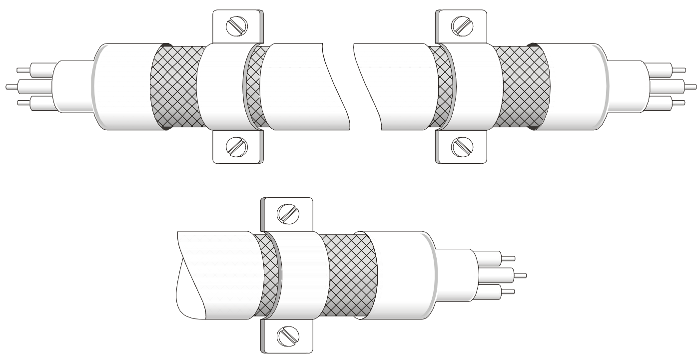


Figure B

EMC Filter Dimension

EMC Filter Model #: EMF27AM21B

Unit: mm [inch]

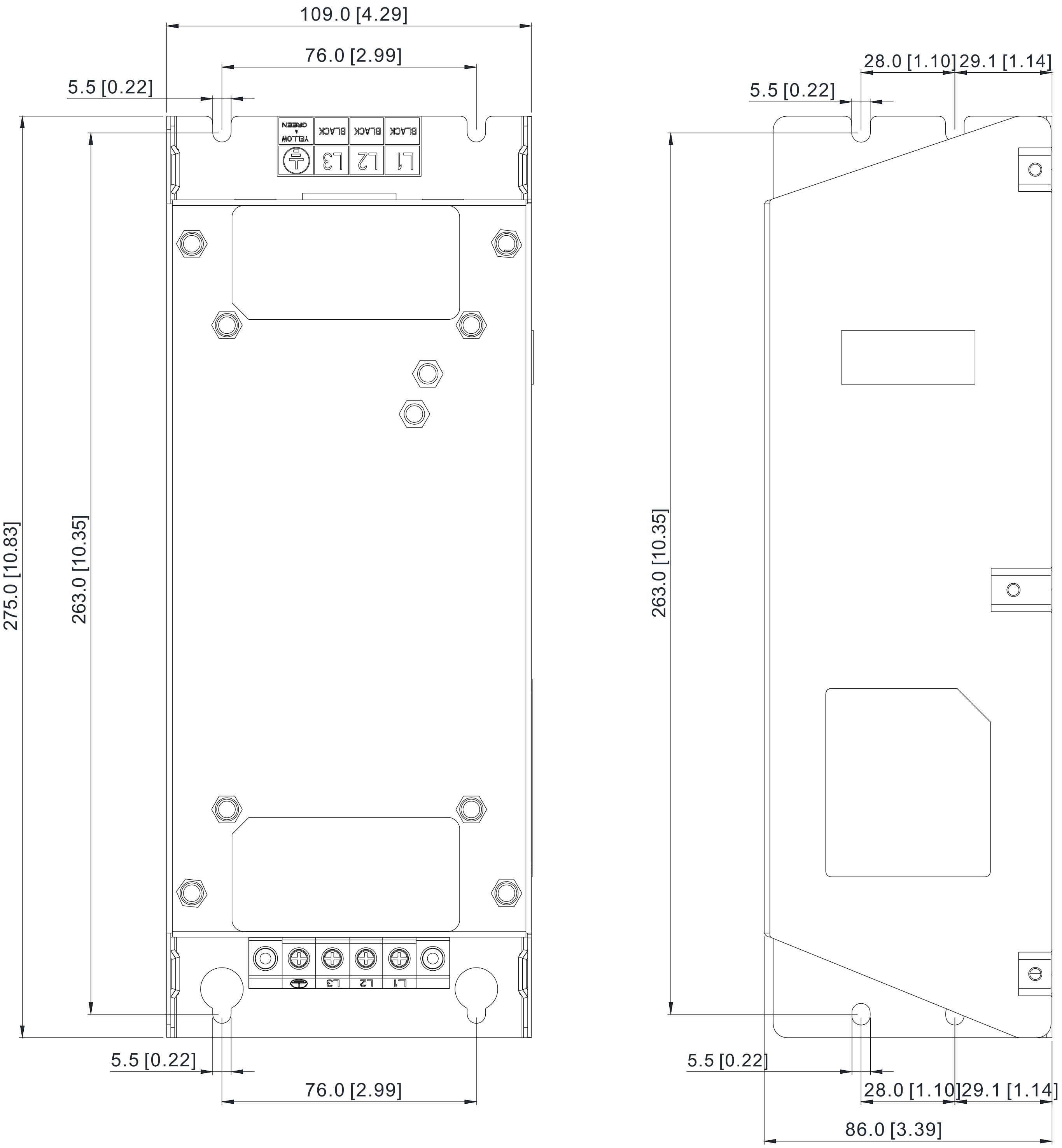


Figure 11-3

EMC Filter Model #: EMF033A43A

Unit: mm [inch]

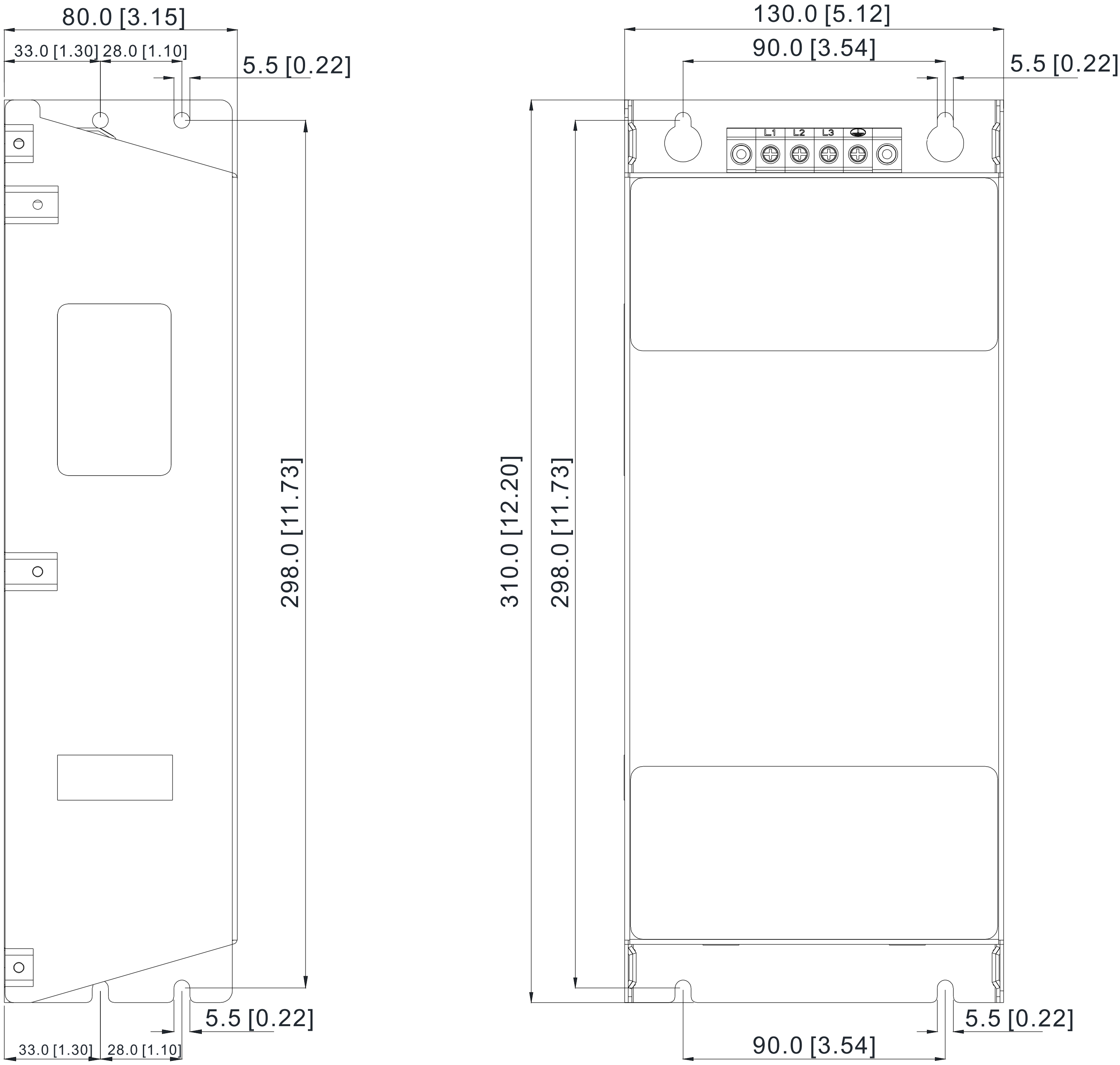


Figure 11-4

EMC Filter Model #: B84143D0050R127

Unit: mm [inch]

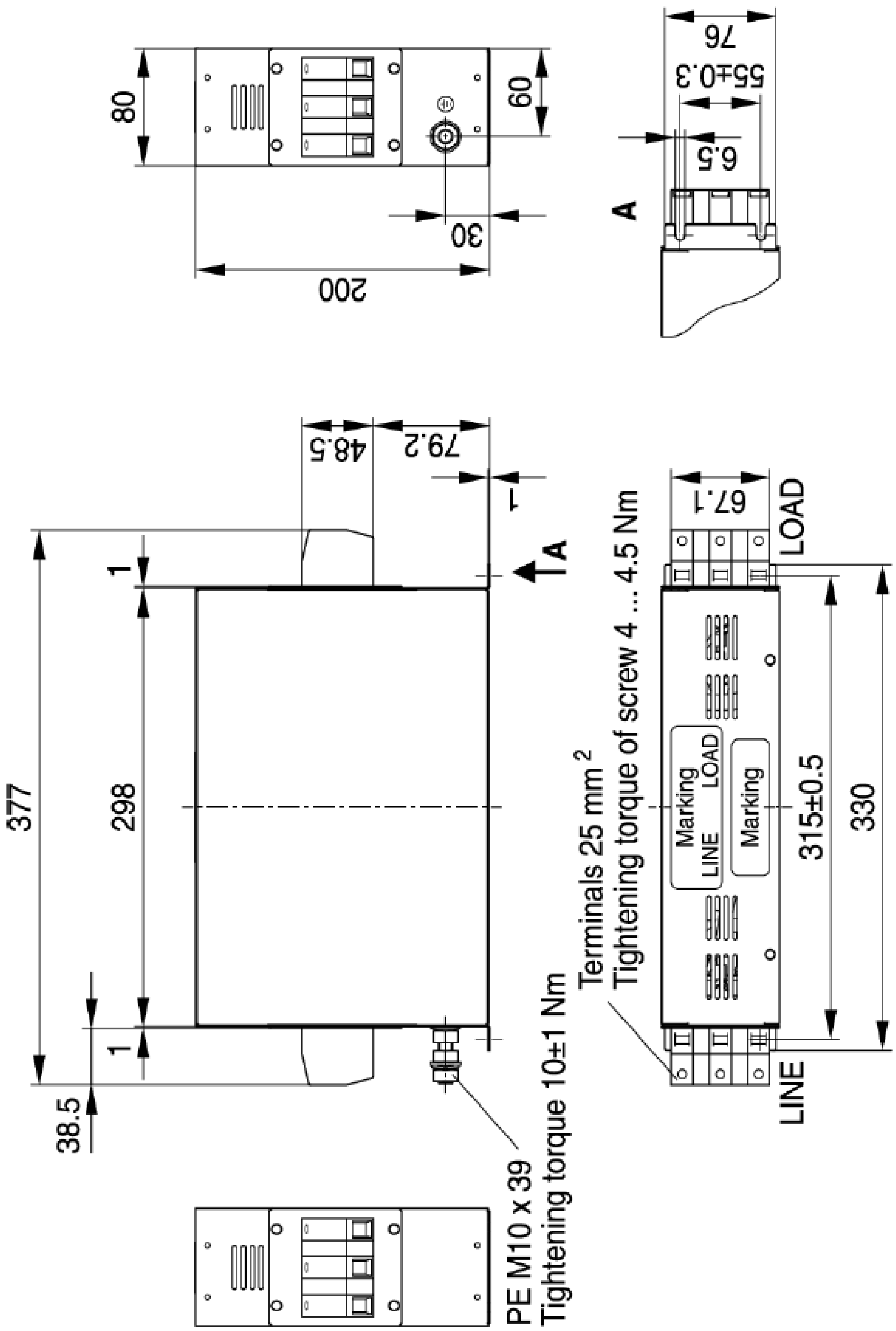


Figure 11-5

11-7 EMC Shield Plate

11-7-1 Model Name and Appearance

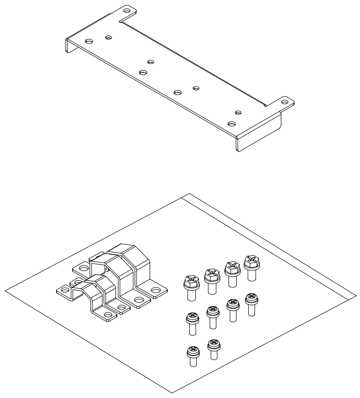
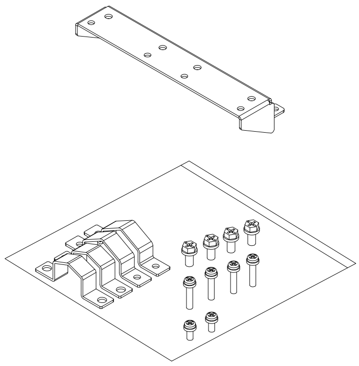
Frame	Model Name	Reference Figure	Item	Qty.
A	MKEB-EPA	 Figure 11-6	Screw M5 * P0.8 * L12	4
			Screw M4 * P0.7 * L12	4
			Screw M4 * P0.7 * L10	2
			Clamp 60 * 12 * 21.2 (For 6–8 AWG)	2
			Clamp 47 * 9 * 14.6 (For 10–12 AWG)	2
			EMC Plate	1
B	MKEB-EPB	 Figure 11-7	Screw M5 * P0.8 * L12	4
			Screw M4 * P0.7 * L20	4
			Screw M4 * P0.7 * L10	2
			Clamp 60 * 12 * 21.2 (For 6–8 AWG)	2
			Clamp 67 * 12 * 21.8 (For 4–6 AWG)	2
			EMC Plate	1

Table 11-15

11-7-2 Installation

This illustration uses Frame A as an example. Follow the steps below to install the EMC shield plate.

1. Loosen the two screws at the bottom of the drive. **NOTE:** Step 1 is only applicable for Frame A.

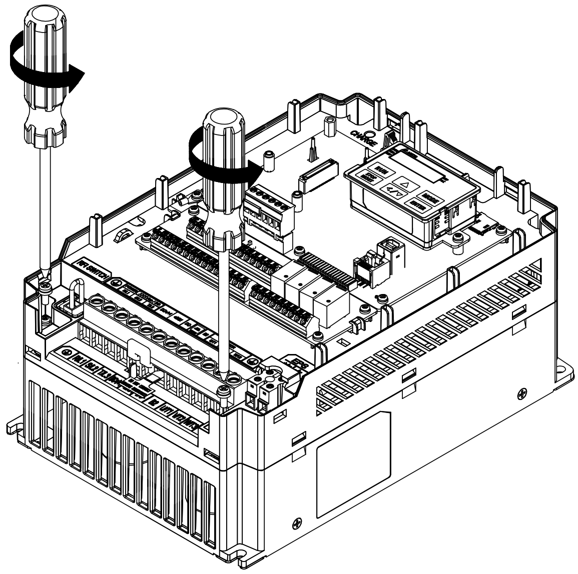


Figure 11-8

2. ① Insert the EMC shield plate into the grooves at the bottom of the drive.

   ② Then, fix the plate using the enclosed screws with the torque value recommended in the table below.

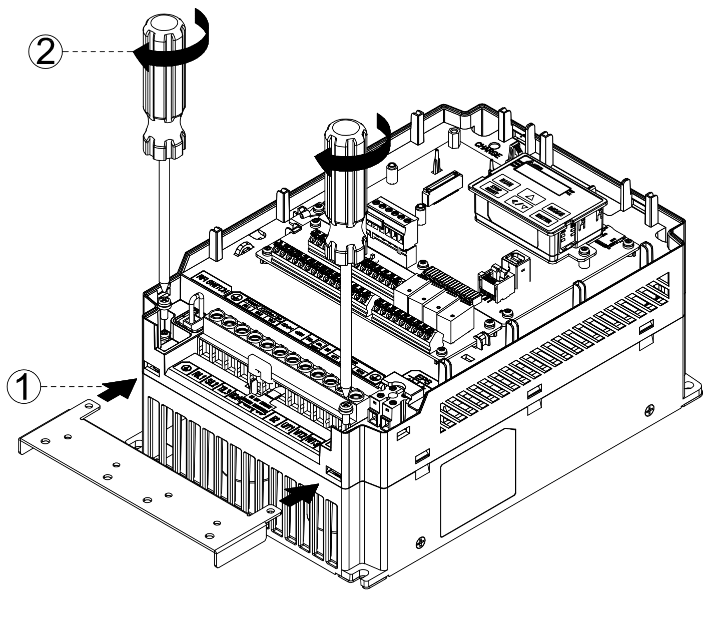


Figure 11-9

Frame	Screw	Qty.	Recommended Torque
A	M4 * P0.7 * L10	2	12–16 kg-cm / (10.42–13.89 lb-in.) / (1.18–1.57 N-m)
B	M4 * P0.7 * L10	2	12–16 kg-cm / (10.42–13.89 lb-in.) / (1.18–1.57 N-m)

Table 11-16

3. Select the suitable clamps that correspond to the wire size of the shielding cable, and then fix the clamps using the enclosed screws with the torque value recommended in the table below. Then, the installation is completed.

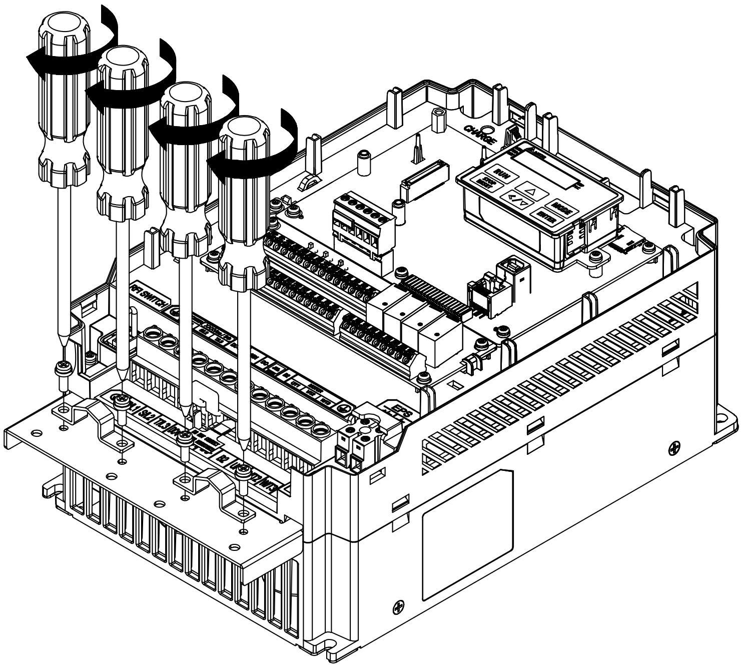


Figure 11-10

Frame	Wire Size	Clamp Size	Screw	Qty.	Recommended Torque
A	6–8 AWG	60 * 12 * 21.2	M5 * P0.8 * L12	4	28–30 kg-cm / (24.30–26.04 lb-in.) / (2.74–2.94 N-m)
	8–10 AWG	47 * 9 * 14.6	M4 * P0.7 * L12	4	12–16 kg-cm / (10.42–13.89 lb-in.) / (1.18–1.57 N-m)
B	4–6 AWG	67 * 12 * 21.8	M4 * P0.7 * L20	4	12–16 kg-cm / (10.42–13.89 lb-in.) / (1.18–1.57 N-m)
	6–8 AWG	60 * 12 * 21.2	M5 * P0.8 * L12	4	28–30 kg-cm / (24.30–26.04 lb-in.) / (2.74–2.94 N-m)

Table 11-17

11-7-3 Dimension

Frame A

Unit: mm [inch]

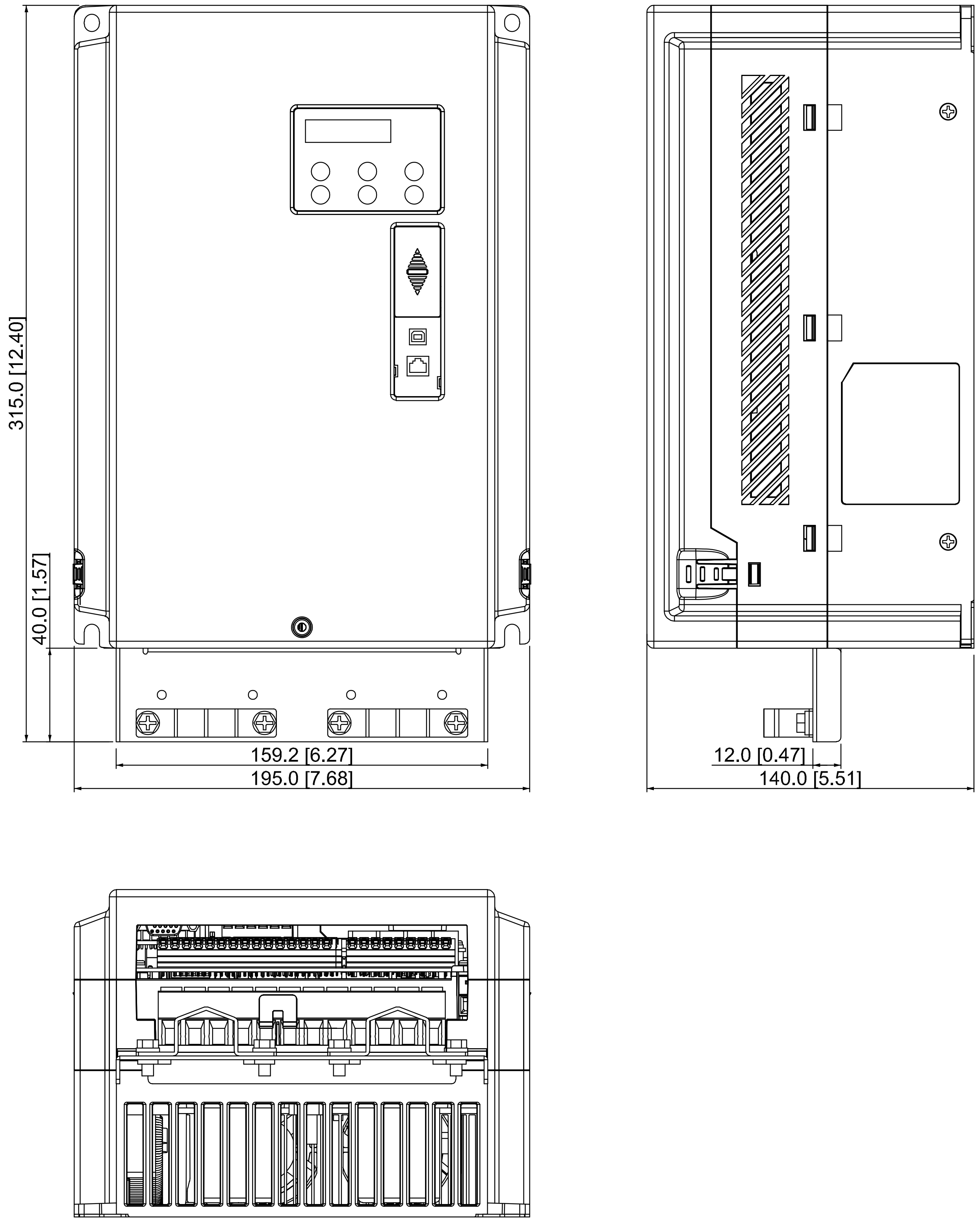


Figure 11-11

Frame B

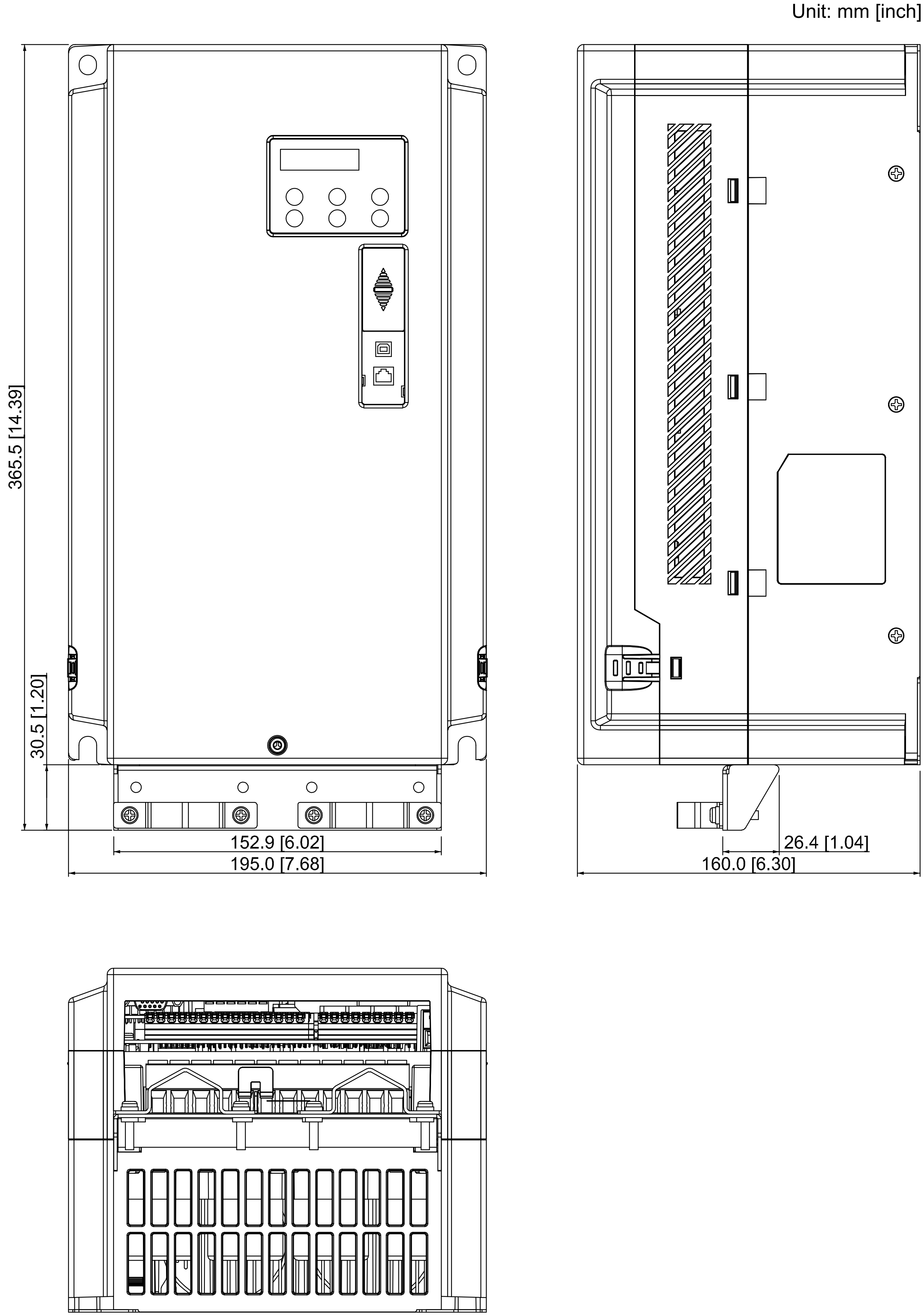


Figure 11-12

11-8 Conduit Box

11-8-1 Model Name and Appearance

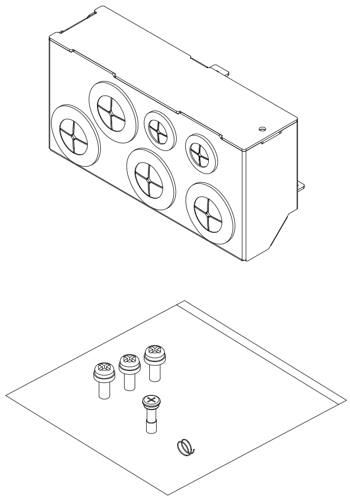
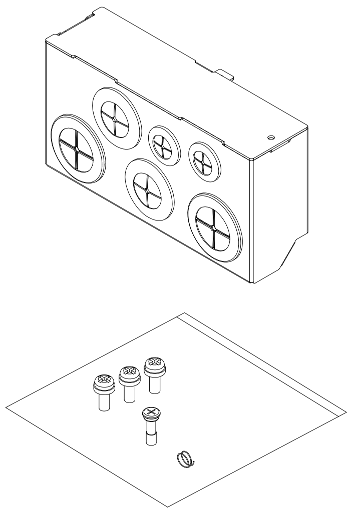
Frame	Model Name	Reference Figure	Item	Qty.
A	MKEB-AN1CB	 Figure 11-13	Conduit box base	1
			Conduit box cover	1
			Bushing Ø21.5	2
			Bushing Ø33.5	4
			Screw M4 * P0.7 * L10	3
			Screw M4 * P0.7 * L12	1
			Spring	1
B	MKEB-BN1CB	 Figure 11-14	Conduit box base	1
			Conduit box cover	1
			Bushing Ø21.5	2
			Bushing Ø33.5	2
			Bushing Ø43.8	2
			Screw M4 * P0.7 * L10	3
			Screw M4 * P0.7 * L12	1
			Spring	1

Table 11-18

11-8-2 Installation

This illustration uses Frame A as an example. Follow the steps below to install the conduit box.

1. Loosen the two screws at the bottom of the drive. **NOTE:** Step 1 is only applicable for Frame A.

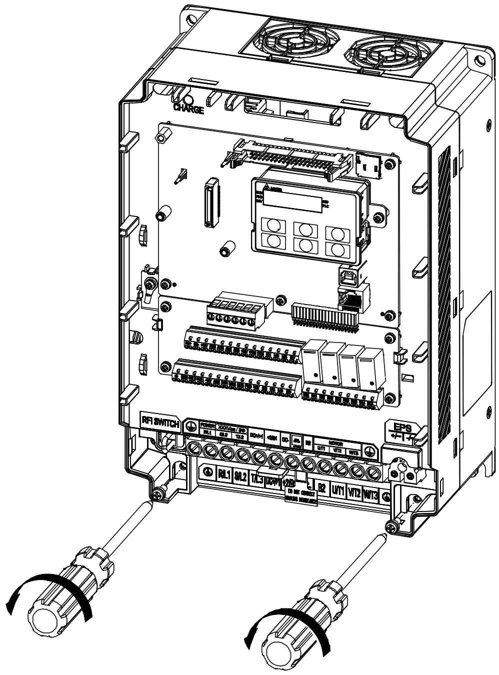


Figure 11-15

2. Hook the fold (each on both sides) of the conduit box base to the middle case of the drive, and make sure its underneath has been inserted into the grooves at the bottom of the drive. Then, rotate the conduit box in a direction as the narrow shows in the figure.

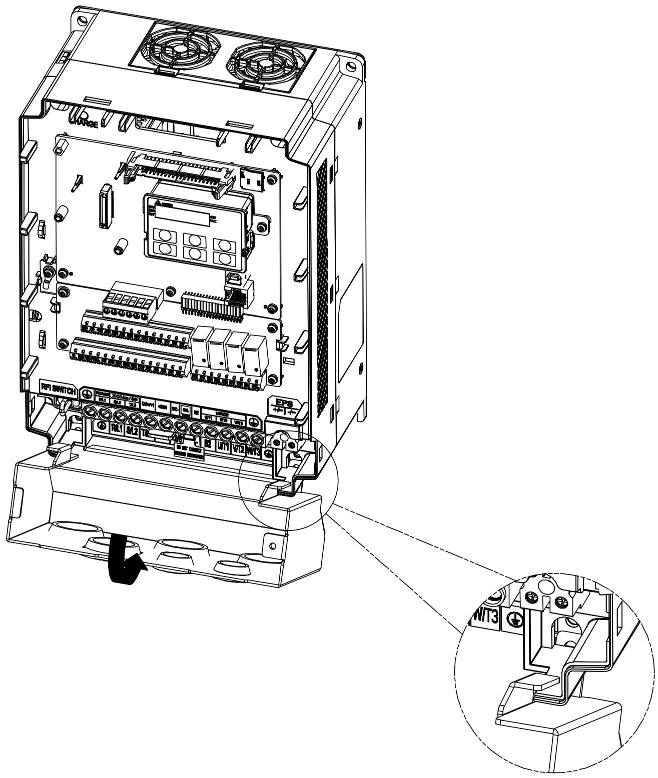


Figure 11-16

3. Fix the base of conduit box using the enclosed screws with the torque value recommended in the table below.

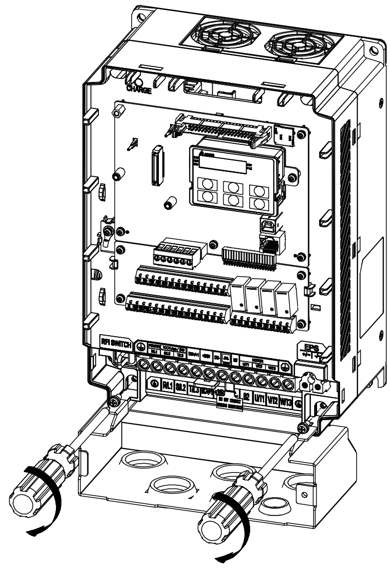


Figure 11-17

Frame	Screw	Qty.	Recommended Torque
A	M4 * P0.7 * L10	2	12–16 kg-cm / (10.42–13.89 lb-in.) / (1.18–1.57 Nm)
B	M4 * P0.7 * L10	2	12–16 kg-cm / (10.42–13.89 lb-in.) / (1.18–1.57 Nm)

Table 11-19

4. ① Insert the groove of conduit box cover into the bend of the base, and rotate the cover in a direction as the narrow shows in the figure.
② Then, attach the cover and tighten it using the enclosed screws with the torque value recommended in the table below.

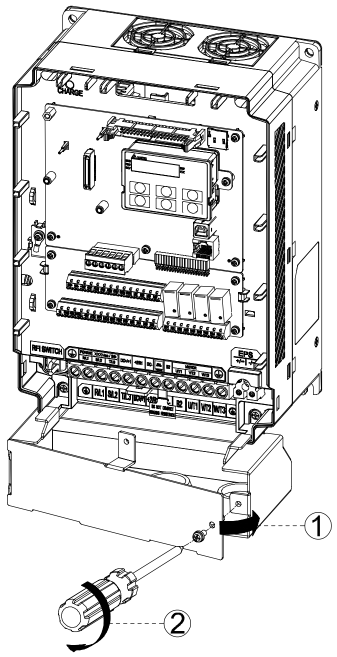


Figure 11-18

Frame	Screw	Qty.	Recommended Torque
A	M4 * P0.7 * L10	1	12–16 kg-cm / (10.42–13.89 lb-in.) / (1.18–1.57 Nm)
B	M4 * P0.7 * L10	1	12–16 kg-cm / (10.42–13.89 lb-in.) / (1.18–1.57 Nm)

Table 11-20

5. Attach the plastic cover of the drive using the instructions mentioned in Step 5 either in <Section 3-1-1 Detach and Attach the Top Cover> or <Section 4-5 Remove the Cover before Wiring>. Finally, use the enclosed flat head screw passing through the spring to fix the plastic cover to the lock hole of conduit box cover. The installation is completed.

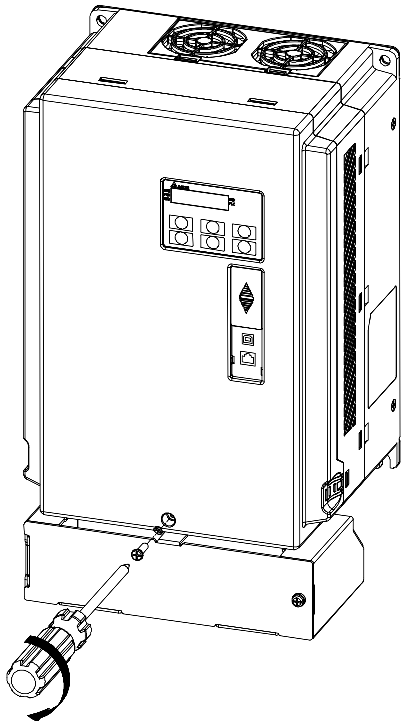


Figure 11-19

Frame	Screw	Qty.	Recommended Torque
A	M4 * P0.7 * L12	1	8–10 kg-cm / (6.94–8.68 lb-in.) / (0.78–0.98 Nm)
B	M4 * P0.7 * L12	1	8–10 kg-cm / (6.94–8.68 lb-in.) / (0.78–0.98 Nm)

Table 11-21

11-8-3 Dimension

Frame A

Unit: mm [inch]

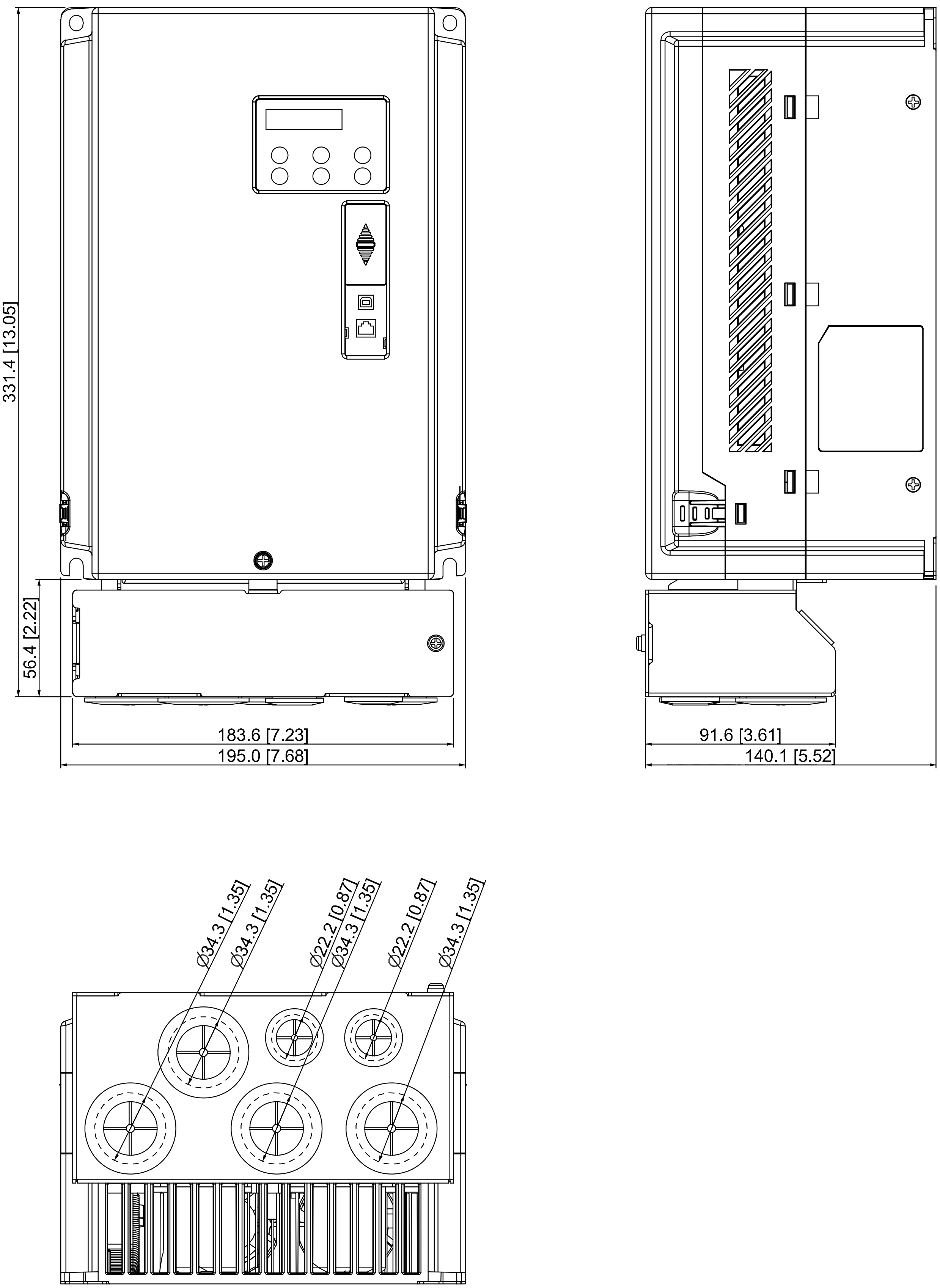


Figure 11-20

Frame B

Unit: mm [inch]

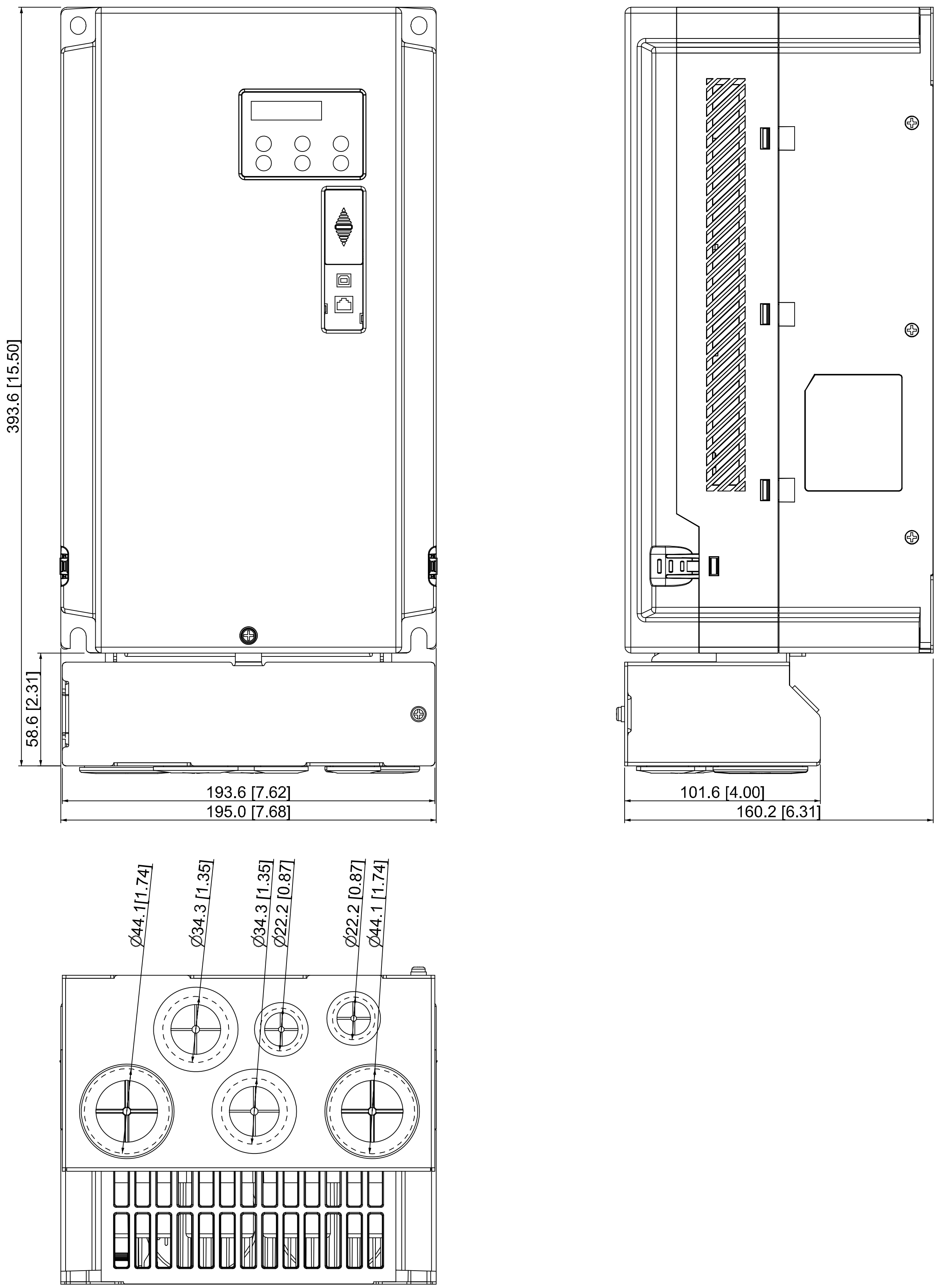


Figure 11-21

11-9 Digital Keypad

KPC-CC01

Communication Interface

RJ45 (socket), RS-485 interface

Communication protocol:

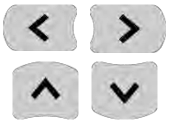
RTU19200, 8, N, 2

Installation Method

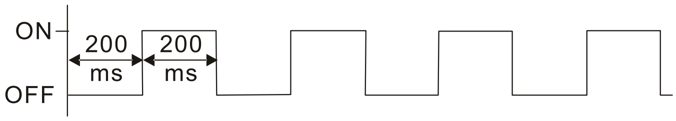
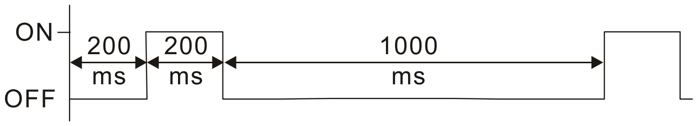
1. Embedded type and can be put flat on the surface of the control box. The front cover is water proof.
2. Buy a MKC-KPPK model to do wall mounting or embedded mounting. Its protection level is IP66.
3. The maximum RJ45 extension lead is 5 m (16ft)
4. This keypad can only be used on Delta's motor drive C2000, CH2000, CP2000, and EB3000.

Descriptions of Keypad Functions

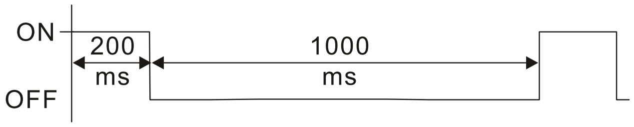
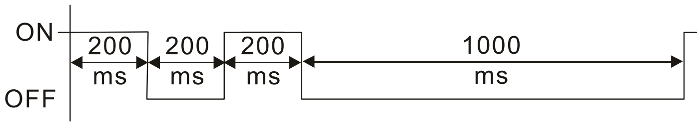
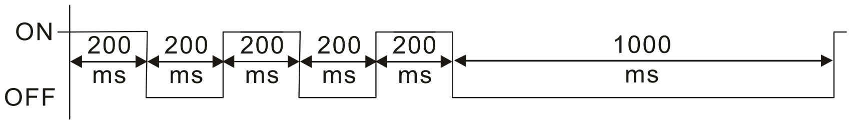
Key	Descriptions
	Start Operation Key 1. Only valid when the source of operation command is the keypad. 2. Operates the AC motor drive by the function setting. The RUN LED will be ON. 3. Can be pressed repeatedly at the stop process.
	Stop Command Key. 1. This key has the highest priority when the command is from the keypad. 2. When it receives the STOP command, regardless of whether the AC motor drive is in operation or stop status, the AC motor drive needs to execute the "STOP" command. 3. Use the RESET key to reset the drive after a fault occurs. 4. If you cannot reset after the fault: (1) The condition which triggers the fault is not cleared. After you clear the condition, you can then reset the fault. (2) The drive is in the fault status when powered on. After you clear the condition, restart and then you can reset the fault.
	Operation Direction Key 1. Only controls the operation direction, NOT the drive activation. FWD: forward, REV: reverse. 2. Refer to the LED descriptions for more details.
	ENTER Key Goes to the next menu level. If at the last level, press ENTER to execute the command.
	ESC Key Leaves the current menu and returns to the previous menu; also functions as a return key or cancel key in a sub-menu.

<table>
<tr><th>Key</th><th>Descriptions</th></tr>
<tr><td>
</td><td>MENU key. Returns to the main menu. Menu items:
1. Parameter Setup
2. Copy Parameter
3. Fault Record
4. Language Setup
5. Time Setup
6. Keypad Locked
7. Display Setup
8. Start-up
9. Main Page
10. PC Link
NOTE: Menu items that are not listed above are not supported in EB3000.</td></tr>
<tr><td></td><td>Direction: Left / Right / Up / Down
3. In the numeric value setting mode, moves the cursor and changes the numeric value.
4. In the menu / text selection mode, selects an item.</td></tr>
<tr><td>
</td><td>Function Key
The functions keys have defaults and can also be user-defined. The defaults for F1 and F4 work with the function list below. For example, F1 is the JOG function, and F4 is a quick setting key for adding / deleting user-defined parameters.</td></tr>
</table>

Descriptions of LED Functions

<table>
<tr><th>LED</th><th>Descriptions</th></tr>
<tr><td>
</td><td>Steady ON: STOP indicator for the AC motor drive.
Blinking: the drive is in standby.
Steady OFF: the drive does not execute the “STOP” command.</td></tr>
<tr><td>
</td><td>Operation Direction LED
1. Green light: the drive is running forward.
2. Red light: the drive is running backward.
3. Flashing light: the drive is changing direction.</td></tr>
<tr><td>CANopen–
“RUN”</td><td>RUN LED:
<table>
<tr><th>LED Status</th><th>Condition / State</th></tr>
<tr><td>OFF</td><td>CANopen at initial
No LED</td></tr>
<tr><td>Blinking</td><td>CANopen at pre-operation

</td></tr>
<tr><td>Single flash</td><td>CANopen at stop

</td></tr>
<tr><td>ON</td><td>CANopen at operation status

</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>LED</th><th>Descriptions</th></tr>
<tr><td>CANopen–
“ERR”</td><td>ERR LED:
<table>
<tr><th>LED Status</th><th>Condition / State</th></tr>
<tr><td>OFF</td><td>No Error</td></tr>
<tr><td>Single flash</td><td>One message fail

</td></tr>
<tr><td>Double flash</td><td>Node guarding failure or heartbeat message failure

</td></tr>
<tr><td>Triple flash</td><td>Synchronization failure

</td></tr>
<tr><td>ON</td><td>Bus off

</td></tr>
</table>
</td></tr>
</table>

Dimension

Unit: mm [inch]

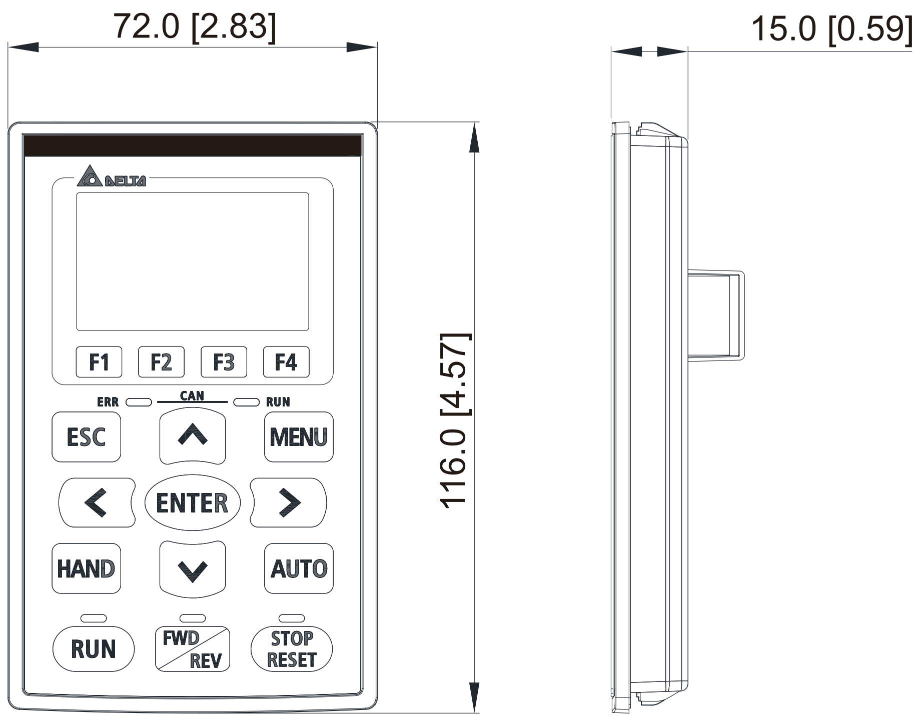


Figure 11-22

RJ45 Extension Lead for Digital Keypad

Part No.	Description
CBC-K3FT	RJ45 extension lead, 3 feet (approximately 0.9 m)
CBC-K5FT	RJ45 extension lead, 5 feet (approximately 1.5 m)
CBC-K7FT	RJ45 extension lead, 7 feet (approximately 2.1 m)
CBC-K10FT	RJ45 extension lead, 10 feet (approximately 3 m)
CBC-K16FT	RJ45 extension lead, 16 feet (approximately 4.9 m)

Table 11-22

NOTE: When you need to buy communication cables, buy non-shielded, 24 AWG, four-wire twisted pair, 100 ohms communication cables.

11-10 USB/RS-485 Communication Interface IFD6530

Warning

✓ *Thoroughly read this instruction sheet before installation and putting it into use.*

✓ *The content 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.*

Introduction

IFD6530 is a convenient RS-485-to-USB converter that does not require an external power supply and a complex setting process. It supports baud rates from 75 to 115.2 kbps and auto-switching of the data transmission direction. In addition, it adopts the RJ45 in RS-485 connector for convenient wiring. Its small size, use of plug-and-play and hot-swappable provide more conveniences for connecting all DELTA IABG products to your PC. Applicable Models: All DELTA IABG products.

(Application & Dimension)

Figure 11-23

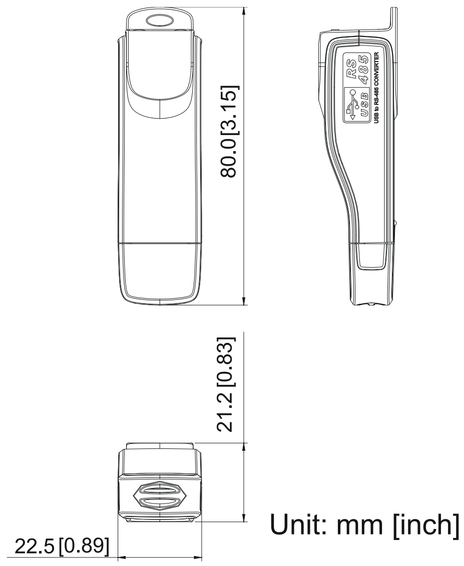


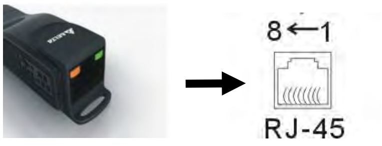
Figure 11-24

Specifications

Power Supply	No external power is needed
Power Consumption	1.5 W
Isolated Voltage	2,500 V_{DC}
Baud Rate	75 Kbps, 150 Kbps, 300 Kbps, 600 Kbps, 1,200 Kbps, 2,400 Kbps, 4,800 Kbps, 9,600 Kbps, 19,200 Kbps, 38,400 Kbps, 57,600 Kbps, 115,200 Kbps
RS-485 Connector	RJ45
USB Connector	A type (plug)
Compatibility	Full compliance with USB V2.0 specification
Max. Cable Length	RS-485 Communication Port: 100 m
Support RS-485 half-duplex transmission	

Table 11-23

■ **RJ45**



PIN	Description
1	Reserved
2	Reserved
3	GND
4	SG-

Table 11-24

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

Table 11-25

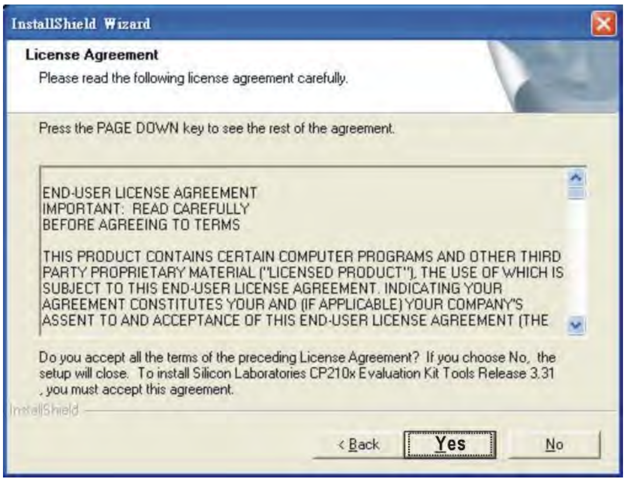
Preparations before Driver Installation

Extract the driver file (IFD6530_Drivers.exe) by following steps. Download the driver file (IFD-6530_Drivers.exe) at www.deltaww.com/iadownload_acmotordrive/IFD6530_Drivers.

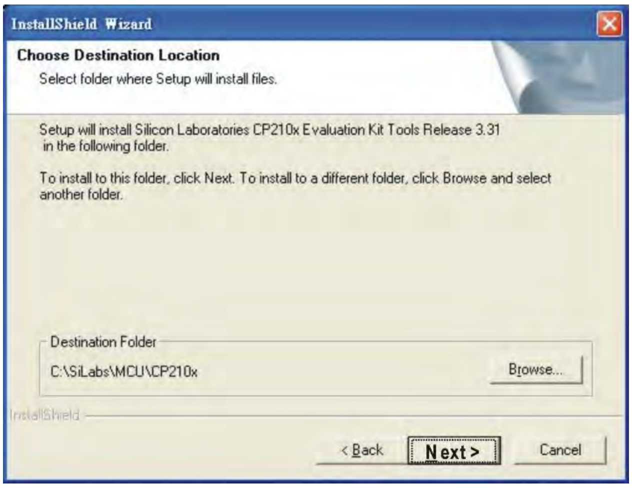
NOTE: DO NOT connect IFD6530 to PC before extracting the driver file.

STEP 1

STEP 2



STEP 3



STEP 4

STEP 5

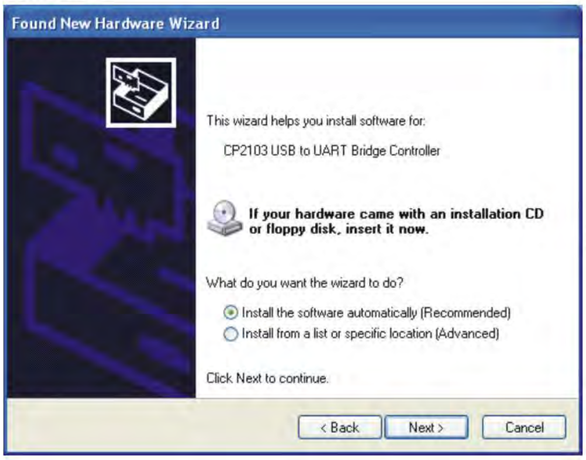
You should have a folder marked SiLabs under drive C. c:\ SiLabs

1. Driver Installation

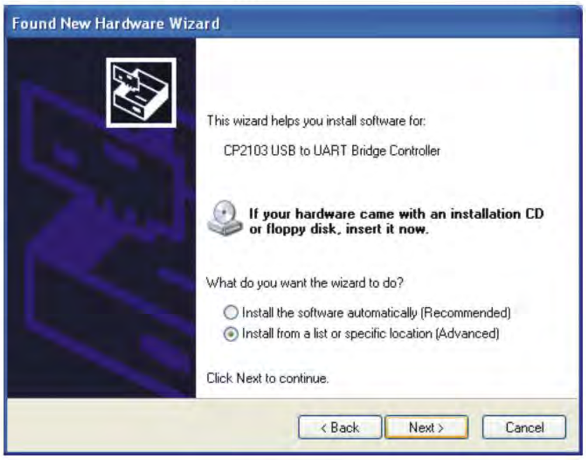
   After connecting IFD6530 to PC, install driver by following steps.

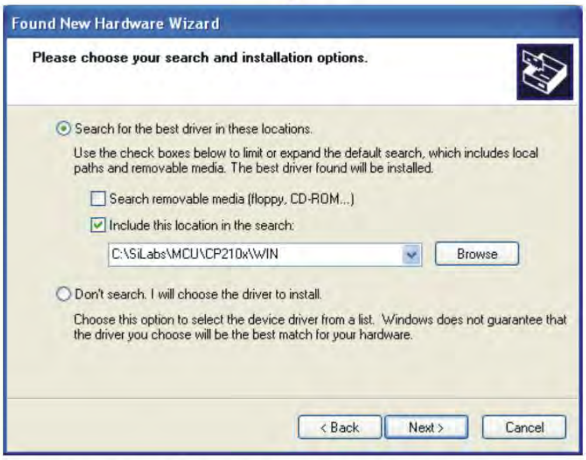
STEP 1

STEP 2



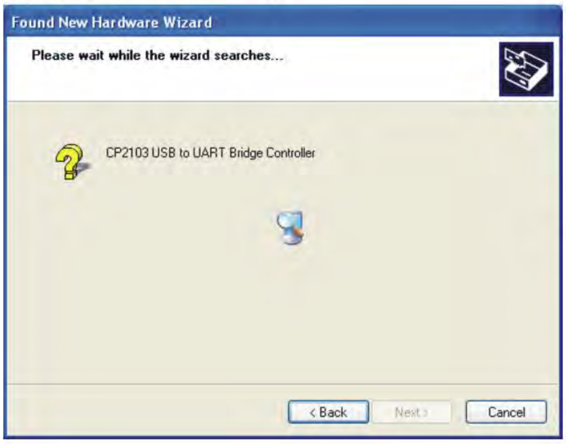
OR





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

STEP 3



STEP 4

STEP 5
Repeat Step 1 to Step 4 to complete COM PORT setting.

2. LED Display
   (1) Steady Green LED ON: power is ON.
   (2) Blinking orange LED: data is transmitting.

11-11 Bluetooth Dongle

With the bluetooth dongle VFD-BT01, you can use a smartphone to monitor EB3000. Download the APP to experience monitoring EB3000 now! **NOTE:** This APP supports v.8 (or higher) Android system.

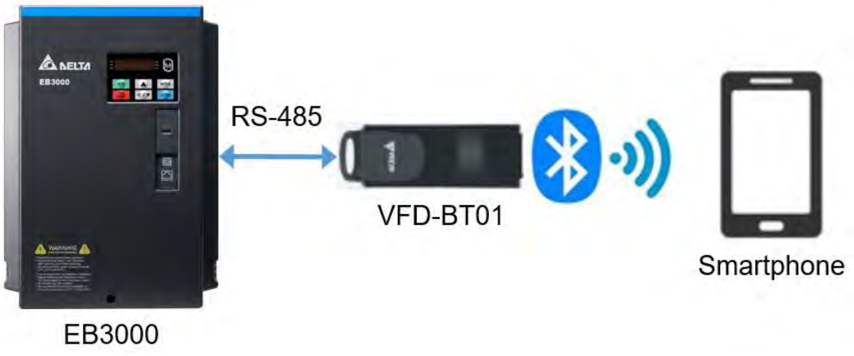


Figure 11-25

Dimensions

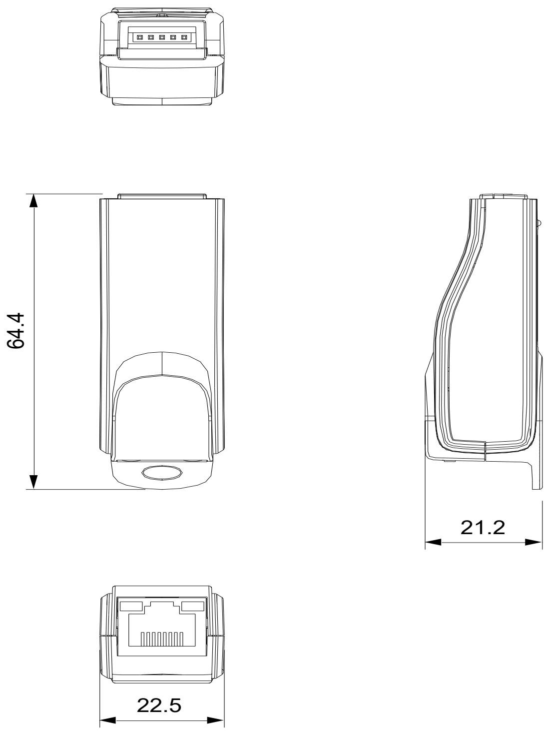


Figure 11-26

Unit: mm

W (Width)	H (Height)	D (Depth)
22.5	64.4	21.2

Table 11-26

Specifications

Power Supply	Voltage	DC+15V ± 2%
	Power	0.8 W
Communication	Baud Rate (bps)	19200 (factory setting), maximum baud rate supported by hardware 921600
	Network Protocol	Modbus / BLE
Wireless Specifications	Interface	Bluetooth 5.1
	Network Protocol	LE GATT 1Mbps/2Mbps PHY
	Channel	2.402–2.48 GHz
	RF Output Power	10 dBm
	Safety Mechanisms	AES-128
	Communication Distance	In an environment without obstruction and interference in accordance with GATT (The Generic Attribute Profile): about 30 meters.
	Data Transmission Rate	LE GATT 2Mps PHY
	Maximum Bluetooth Packet	244 Bytes
	Antenna	Built-in chip antenna
Environment	Operating Ambient Temperature	-10–55°C
	Storage Ambient Temperature	-40–60°C
	Operating Ambient Humidity	95%, non-condensing
	Storage Ambient Humidity	95%, non-condensing
	Cooling method	Convective cooling
	Working Environment	Without corrosive/inflammable gasses
	Installation Location	Without metal obstruction
	Pollution Level	2
	Protection Rating	IP20
Certifications		CE, FC, IC, SRRC, UK CA CAN ICES-003 (B)/NMB-003(B) Contains IC:5123A-GM210P

Table 11-27

APP Download

Scan the QR code or browse the URL to install our APP ***Delta Drive Tool***.

https://play.google.com/store/apps/details?id=com.deltaww.deltadrivetool&hl=en&gl=US

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Chapter 12 Specifications

12-1 230V Models

	Frame Size	A			
	Model*[1] VFD_ _ _ED21□□	022	022	037	037
		B	BE	B	BE
	Applicable Motor Output (kW)	2.2		3.7	
	Applicable Motor Output (HP)	3		5	
Output Rating	Rated Output Capacity (kVA)	4.2		6.9	
	Rated Output Current (A)	11		18	
	Maximum Output Voltage (V)	Proportional to input voltage			
	Output Frequency Range (Hz)	0.00–400			
	Carrier Frequency Range (kHz)	2–15			
	Rated Output Maximum Carrier Frequency (kHz)	10 (Default)			
Input Rating	Input Current (A)	24.2		39.6	
	Rated Voltage / Frequency	Single-phase, 200–240V / 50–60 Hz			
	Input Voltage Range (V_{AC})	170–264			
	Input Frequency Range (Hz)	47–63			
	Efficiency (%)	97			
	Power Factor	> 0.98			
	Weight (kg)	3.45	3.85	3.55	3.95
	Cooling Method	Fan Cooling			
	Braking Chopper	Built-in			
	DC Choke	Optional			
	Acoustic Noise (dBA)*[2]	50.35			
	Power Loss (W)*[3]	14.96			

NOTE:

Table 12-1

*[1]: Model name ends with “BE” has built-in EMC filter.

*[2]: No load with fan ON. 2.2kW and 3.7kW models are tested under 10 kHz carrier frequency.

*[3]: Fan is OFF.

12-2 460V Models

Frame Size		A						B				
Model*[1] VFD_ _ _ED43□□		040		055		075		110		150		185
		B	BE	B	BE	B	BE	B	BE	B	BE	B
Applicable Motor Output (kW)		4		5.5		7.5		11		15		18.5
Applicable Motor Output (HP)		5		7.5		10		15		20		25
Output Rating	Rated Output Capacity (kVA)	7.6		11.4		14.1		20.6		25.1		29.7
	Rated Output Current (A)	10		15		18.5		27		33		39
	Maximum Output Voltage (V)	Proportional to input voltage										
	Output Frequency Range (Hz)	0.00–400										
	Carrier Frequency Range (kHz)	2–15										
	Rated Output Maximum Carrier Frequency (kHz)	10 (Default)		8 (Default)								
Input Rating	Input Current (A)	11		16.5		20.4		29.7		36.3		42.9
	Rated Voltage / Frequency	Three-phase, 380–480V / 50–60 Hz										
	Input Voltage Range (V_{AC})	323–528										
	Input Frequency Range (Hz)	47–63										
Efficiency (%)		97										
Power Factor		> 0.98										
Weight (kg)		3.45	3.9	3.65	4.1	3.75	4.15	5.65	6.2	5.7	6.3	5.8
Cooling Method		Fan Cooling										
Braking Chopper		Built-in										
DC Choke		Optional										
Acoustic Noise (dBA)*[2]		49.325		51.92				49.84				
Power Loss (W)*[3]		19.52						20.17				

NOTE: Table 12-2

*[1]: Model name ends with "BE" has built-in EMC filter.

*[2]: No load with fan ON. 4kW model is tested under 10 kHz carrier frequency; 5.5–18.5 kW models are tested under 8 kHz carrier frequency.

*[3]: Fan is OFF.

12-3 General Specifications

Control Characteristics	Control Mode	1: V/F, 2: SVC, 3: FOC+PG, 4: FOC+PM
	Starting Torque	Reach up to 150% or above at 0.5 Hz. In FOC+PG or FOC+PM mode: 150% at 0 Hz.
	V/F Curve	Adjustable V/F curve using 4 independent points and square curve.
	Speed Response Capacity	5 Hz (Up to 30Hz for vector control)
	Torque Limit	Maximum is 200% torque current
	Max. Output Frequency (Hz)	0.00–400 Hz
	Frequency Output Accuracy	Digital command: 0.005%; Analog command: 0.5%
	Frequency Setting Resolution	Digital command: 0.01 Hz Analog command: 1 ÷ 4096 (12 bit) of the maximum output frequency
	Frequency Setting Signal	± 10V
	Accel. / Decel. Time	0.00–600.00 seconds
	Speed Control Range	1:50 (up to 1:1000 when using PG card)
	Speed Control Resolution	± 0.5% (up to ± 0.02% when using PG card)
	Brake Torque	About 125% while ED is 30% (use optional brake resistor) NOTE: ED is “Executive Duty”
Protection Characteristics	Motor Protection	Electronic thermal relay protection
	Over-current Protection	The current is limited by 220% of the drive’s I_{rated} and the limit for over-current protection is 300% of the drive’s I_{rated}.
	Over-temperature Protection	Built-in temperature sensor
	Overload Capacity	150% 60s, 200% 3s
	Voltage Protection	Over-voltage level: [230V models] V_{DC} > 410 V [460V models] V_{DC} > 820 V Low-voltage level: [230V models] V_{DC} < 180 V [460V models] V_{DC} < 360 V
	Over-voltage Protection for the Input Power	Varistor (MOV)
	Grounding Leakage Current Protection	Leakage current is higher than 50% of rated current of the AC motor drive

<table>
<tr><td rowspan="7">Certifications*[1]</td><td rowspan="3">EMC Directives</td><td colspan="2">EN 12015:2020, EN 12016:2013, EN IEC 61800-3:2018
IEC 61000-3-12:2011+AMD1:2021
EN IEC 61000-3-2:2019</td></tr>
<tr><td>Emission</td><td>1. RE: C2
2. CE (Models with built-in filter and external filter)
<table><tr><td>Power ratings (kW)</td><td>2.2–4.0</td><td>5.5–7.5</td><td>11–18.5</td></tr><tr><td>Switching frequency (kHz)</td><td>10</td><td>8</td><td>8</td></tr><tr><td>Motor cable length (m)</td><td>10</td><td>10</td><td>10</td></tr><tr><td>CE level</td><td>C2</td><td>C2</td><td>C2</td></tr></table></td></tr>
<tr><td>Immunity</td><td>Second environment (industrial)</td></tr>
<tr><td>Product Compliance</td><td colspan="2">EN 61800-5-1:2007/A11:2021
IEC 61800-5-1:2007/A1:2016</td></tr>
<tr><td>Product Certifications</td><td colspan="2">CE, UL, EAC, RoHS, UKCA</td></tr>
<tr><td>Safety Certifications</td><td colspan="2">TUV (STO SIL3), EN81-20/50:2020</td></tr>
</table>

Table 12-3

NOTE:

*[1]: For information on Certifications and Declaration of Conformity (Doc), visit

Delta | Download Center (deltaww.com)

12-4 Operation, Storage and Transportation Environments

<table>
<tr><td colspan="4">DO NOT expose the AC motor drive to a poor environment, such as one with dust, direct sunlight, corrosive or inflammable gases, humidity, liquids or excessive vibration. The salt in the air must be less than 0.01 mg/cm^2 every year.</td></tr>
<tr><td rowspan="10">Environment</td><td>Installation Location</td><td colspan="2">IEC60364-1/IEC60664-1 Pollution degree 2. Indoor use only.</td></tr>
<tr><td rowspan="2">Surrounding Temperature</td><td>Operation</td><td>-10–45°C. For information on derating, see <Section 12-5 Derating Curve>.</td></tr>
<tr><td>Storage and Transportation</td><td>-20–70°C</td></tr>
<tr><td rowspan="2">Ambient Humidity</td><td>Operation</td><td rowspan="2">Below 90% RH (non-condensing)</td></tr>
<tr><td>Storage / Transportation</td></tr>
<tr><td>Altitude</td><td>Operation</td><td>0–1000 m
For altitudes of 1000–2000 m, decrease the drive’s rated current by 2% for every 100m increase in altitude.</td></tr>
<tr><td>Atmospheric Pressure</td><td colspan="2">86–106 kPa</td></tr>
<tr><td>Power System</td><td colspan="2">TN system[*1][*2]</td></tr>
<tr><td>Environmental Requirement (IEC60721)</td><td colspan="2">Operation: Class 3C2; Class 3S2
Transportation: Class 2C2; Class 2S2
Storage: Class 1C2; Class 1S2</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="2">Package Drop</td><td>Storage</td><td colspan="2" rowspan="2">ISTA procedure 1A (according to weight) IEC60068-2-31</td></tr>
<tr><td>Transportation</td></tr>
<tr><td>Vibration</td><td colspan="3">3 mm: 2 to less than 9 Hz
9.8 m/s^2: 9 to less than 20 Hz
2 m/s^2: 20 to less than 55 Hz
1 m/s^2: 55 to less than 200 Hz</td></tr>
<tr><td>Impact</td><td colspan="3">Compliance with IEC/EN 60068-2-27</td></tr>
<tr><td>Protection Level</td><td colspan="3">IP20 OPEN TYPE
NEMA1 (met when conduit box is used)
The device shall be mounted in a cabinet of at least IP54.</td></tr>
<tr><td>OVC</td><td colspan="3">Overvoltage category III</td></tr>
</table>

NOTE:

Table 12-4

[*1]: TN system: The neutral point of the power system connects directly to the ground. The exposed metal components connect to the ground through the protective grounding conductor.

[*2]: Single-phase models use a single-phase three-wire power system.

12-5 Derating Curve

☑ To choose the right model for your applications, consider derating factors such as ambient temperature, altitude, carrier frequency, and so on.

Ambient Temperature Derating Curve

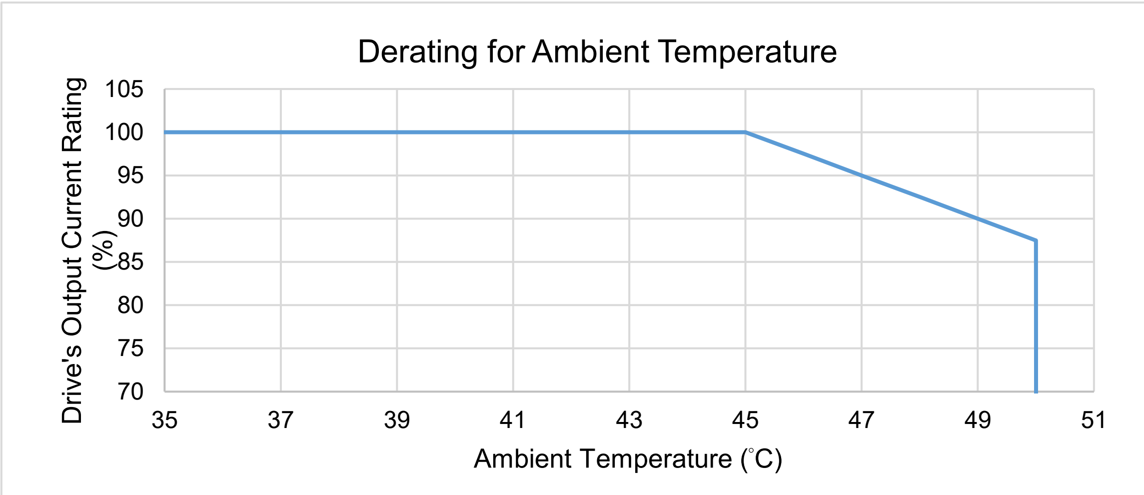

Figure 12-1

The rated output current derating (%) for different ambient temperature:

Ambient Temperature (°C)	0	45	46	47	48	49	50
Output Current / Rated Current (%)	100	100	97.5	95	92.5	90	87.5

Table 12-5

Altitude Derating Curve

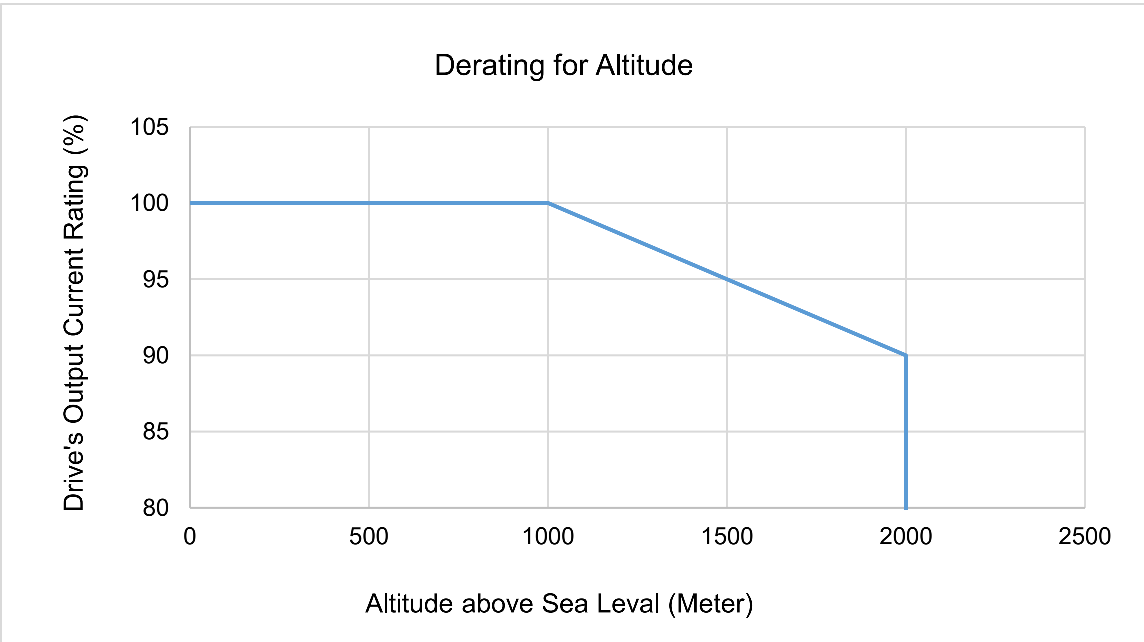

Figure 12-2

The rated output current derating (%) for different altitudes above sea level:

Altitude above Sea Level (Meter)	0	1000	1500	2000
Output Current / Rated Current (%)	100	100	95	90

Table 12-6

Carrier Frequency Derating Curve

DPWM (Discontinuous Pulse Width Modulation)

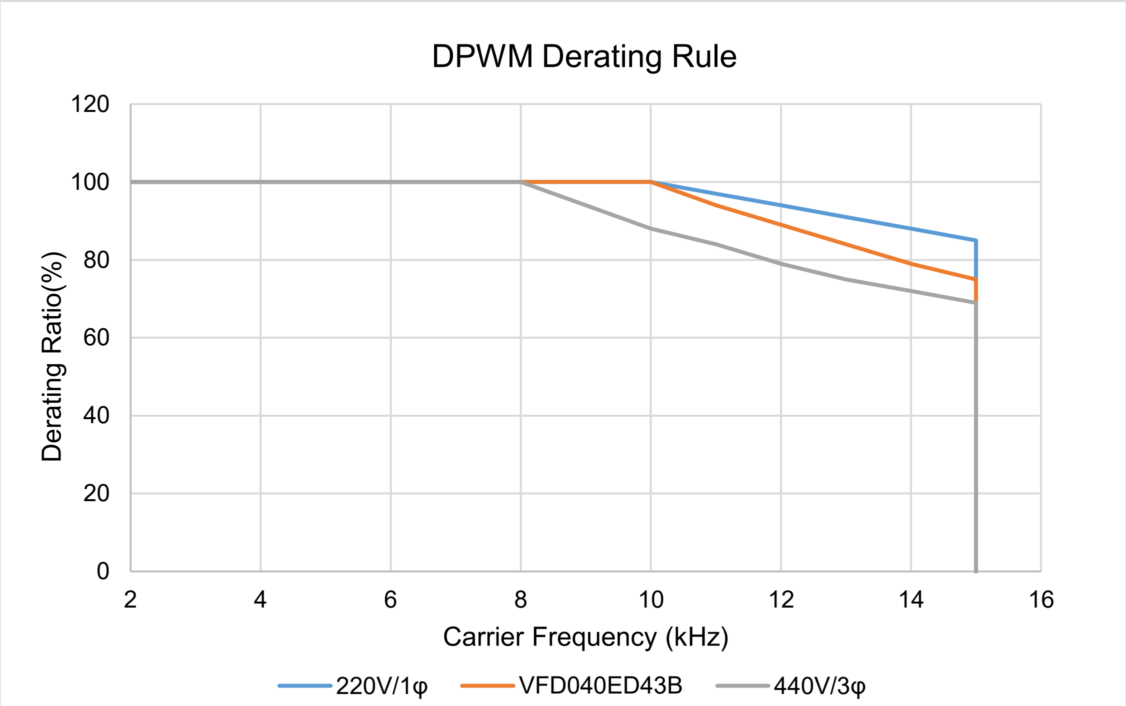

Figure 12-3

The rated output current derating (%) of DPWM for different carrier frequencies:

DPWM (Default)	Derating Ratio (%) VS. Carrier Frequency (kHz)		
Carrier Frequency (kHz)	Single-phase 220V	Three-phase 440V	
		VFD040ED43B	Other Models
2	100	100	100
3	100	100	100
4	100	100	100
5	100	100	100
6	100	100	100
7	100	100	100
8	100	100	100
9	100	100	94
10	100	100	88
11	97	94	84
12	94	89	79
13	91	84	75
14	88	79	72
15	85	75	69

Table 12-7

SVPWM (Space Vector Pulse Width Modulation)

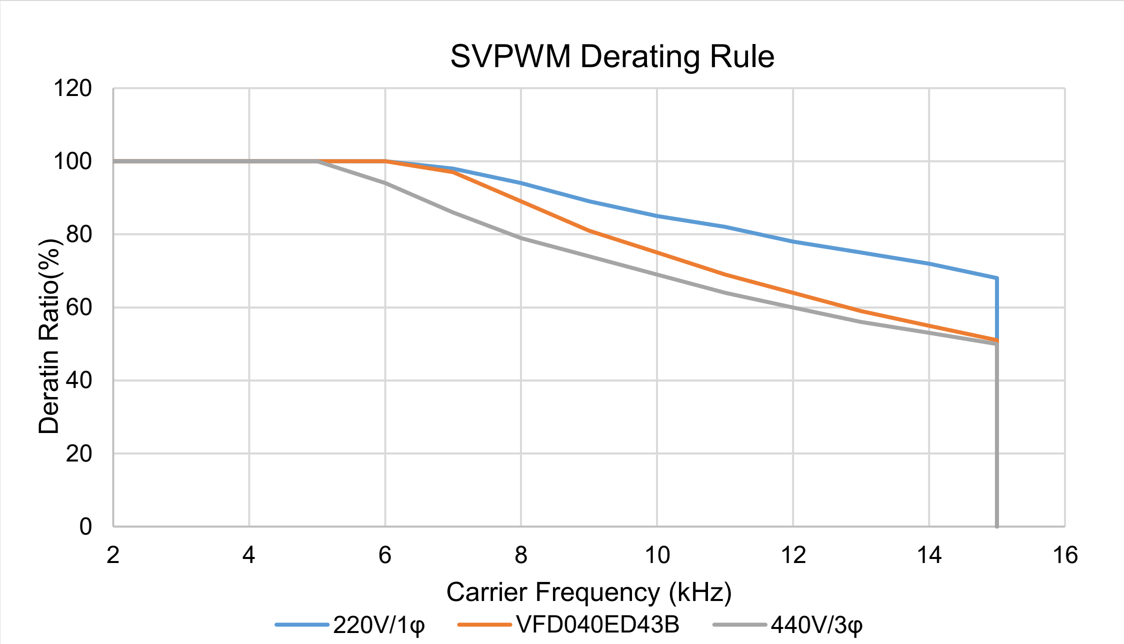

Figure 12-4

The rated output current derating (%) of SVPWM for different carrier frequencies:

SVPWM	Derating Ratio (%) VS. Carrier Frequency (kHz)		
Carrier Frequency (kHz)	Single-phase 220V	Three-phase 440V	
		VFD040ED43B	Other Models
2	100	100	100
3	100	100	100
4	100	100	100
5	100	100	100
6	100	100	94
7	98	97	86
8	94	89	79
9	89	81	74
10	85	75	69
11	82	69	64
12	78	64	60
13	75	59	56
14	72	55	53
15	68	51	50

Table 12-8

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Appendix A. AC Motor Drives EMC Standard Installation Guide

EMC Compliance Practice

Preface

When an AC motor drive is installed in a noisy environment, radiated and/or conducted noise via signal and power cables can interfere with the correct functioning, cause errors or even damage to the drive. To prevent this, some AC motor drives have an enhanced noise resistance but the results are limited and it is not economical. Therefore, an effective method would be finding the cause of the noise and use the right solution to achieve “no emission, no transmission and no reception of noise”. All three solutions should be applied.

Finding the Noise

- Ensure whether the error is caused by noise.
- Find the source of the noise and its transmission path.
- Confirm the signal and the source of noise

Solutions

- Ensure whether the error is caused by noise.
- Find the source of the noise and its transmission path.
- Confirm the signal and the source of noise

A-1 Introduction

A-1-1 What is EMC

Electromagnetic Compatibility (EMC) is the ability of an electrical device to function properly in electromagnetic environments. It does not emit electromagnetic noise to surrounding equipment and is immune to interference from surrounding equipment. The goal is to achieve high immunity and low emission; these two properties define the quality of EMC. In general, electrical devices react to high and low frequency phenomena. High frequency phenomena are electrostatic discharge (ESD); pulse interference; radiated electromagnetic field; and conducted high frequency electrical surge. Low frequency phenomena refer to mains power harmonics and imbalance.

The standard emission and immunity levels for compliance depend on the installation location of the drive. A Power Drive System (PDS) is installed in an industrial or domestic environment. A PDS in a domestic environment must have lower emission levels and is allowed to have lower immunity levels. A PDS in an industrial environment is allowed to have higher emission levels but must have more severe immunity levels.

A-1-2 EMC for AC Motor Drive

When an AC motor drive is put into operation, harmonic signal will occur at the AC drive's power input and output side. It creates a certain level of electromagnetic interference to the surrounding electrical devices and the mains power network. An AC motor dive is usually applied in industrial environments with a strong electromagnetic interference. Under such conditions, an AC drive could disturb or be disturbed.

Installing the AC motor drive accurately will decrease EMC influences and ensure long-term stability of the electricity system. It is strongly suggested to follow Delta's user manual for wiring and grounding. If any difficulties or problems arise, follow the instructions and measures as indicated in this EMC Standard Installation Guide.

A-2 How to Prevent EMC

A-2-1 Types of EMC: Common-mode and Differential Mode Noise

The electromagnetic noise of an AC motor drive can be distinguished into common-mode and differential-mode noise. Differential-mode noise is caused by the stray capacitance between the conducting wires and common-mode noise is caused by the common-mode coupling current path created by the stray capacitance between the conducting wires and ground.

Basically, differential-mode noise has a greater impact to the AC motor drive and common-mode noise has a greater impact to high-sensitivity electronic devices. An excessive amount of differential-mode noise may trigger the circuit protection system of the AC motor drive. Common-mode noise affects peripheral electronic devices via the common ground connection.

EMC problems can be more serious when the following conditions apply:

- When a large horsepower AC motor drive is connected to a large horsepower motor.
- The AC motor drive's operation voltage increases.
- Fast switching of the IGBTs.
- When a long cable is used to connect the motor to the AC motor drive.

A-2-2 How does EMC Transmit (Noise Transmission)

Noise disturbs peripheral high-sensitivity electrical devices/systems via conduction and radiation, their transmission paths are shown hereafter:

1. Noise current in the unshielded power cable is conducted to ground via stray capacitances into a common-mode voltage. Whether or not other modules are capable to resist this common-mode noise depends on their Common-Mode Rejection Ratio (CMRR), as shown in Figure A-1.

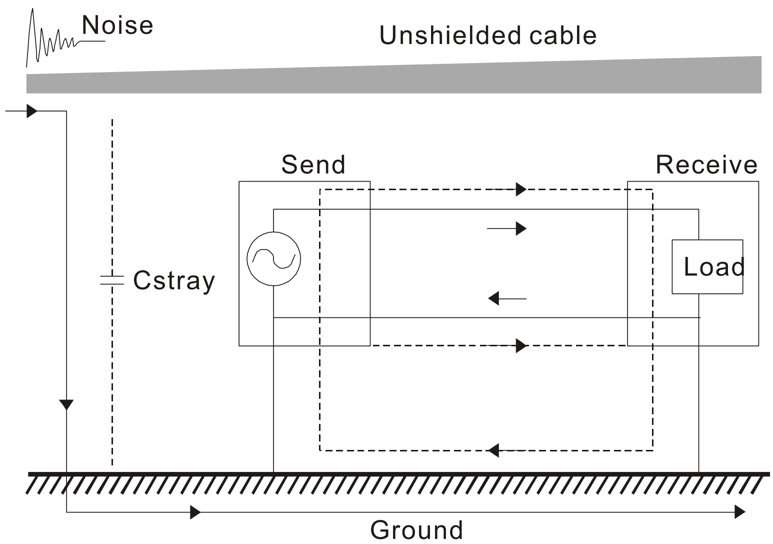


Figure A-1

2. Common-mode noise in the power cable is transmitted through the stray capacitance and coupled into the adjacent signal cable, as shown in Figure A-2. Several methods can be applied to reduce the effect of this common-mode noise; for example, shield the power cable and/or the signal cables, separate the power and signal cables, take the input and output side of the signal cable and twist them together to balance out the stray capacitance, let power cables and signal cables cross at 90°, etc.

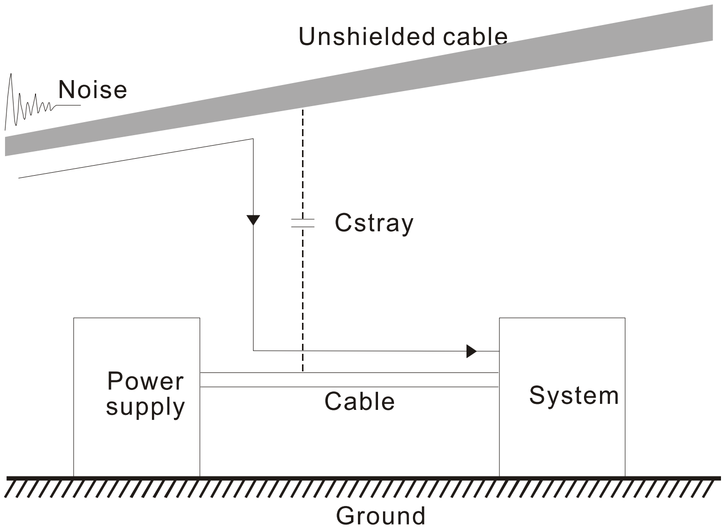


Figure A-2

3. Common-mode noise is coupled via the power cable to other power systems then the cable of such a power system is coupled to the transmission system, as shown in Figure A-3.

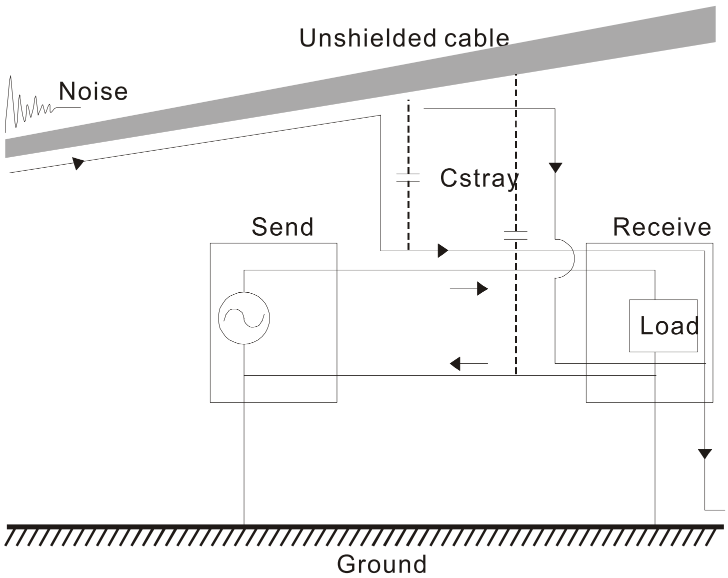


Figure A-3

4. The common-mode noise of an unshielded power cable is transmitted to the ground via the stray capacitance. Since both shielded wire and unshielded wire are connected to a common ground, other systems can be interfered with by the common-mode noise that is transmitted from the ground back to the system via the shield. See Figure A-4.

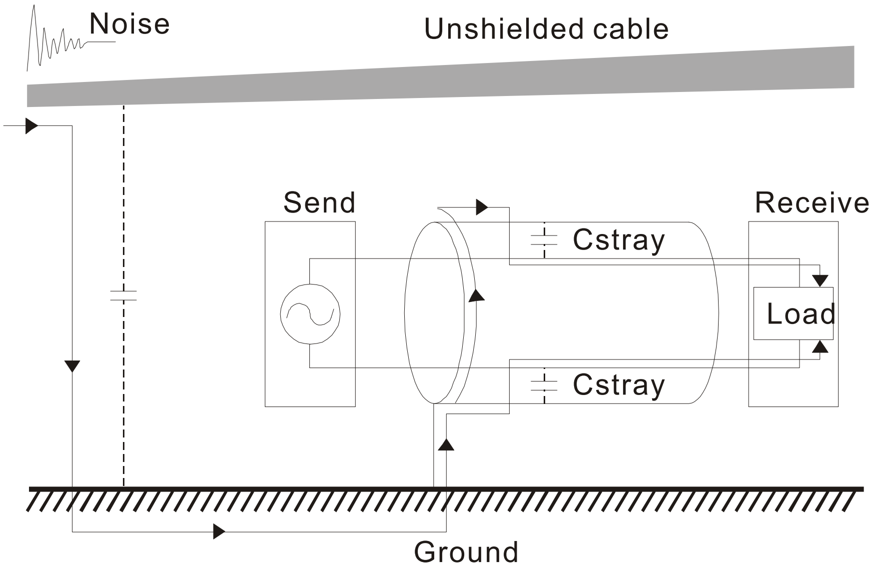


Figure A-4

5. When excessive pulse modulated currents pass through an un-grounded AC drive cable, it acts as an antenna and creates radiated interference.

A-3 Solution to EMC: Grounding

The leakage current of an electronic equipment is conducted to ground via the grounding wire and the ground electrode. According to Ohm's law, potential differences may arise when the electrode's ground and the ground's ground resistance are different.

According to Ohm's law, the earth resistance for electrode and the ground are different; in this case, potential differences may arise.

A-3-1 Protective Grounding & Functional Grounding

Please carefully read the following instructions if two types of grounding are applied at the same time.

Protective grounding is applied outside buildings and must have low resistance. On the other hand, functional grounding can be applied inside buildings and must have low impedance.

The goal of EMC is to avoid any interference effects. Grounding for EMC can be distinguished by frequency. For frequencies lower than 10 kHz, a **single point ground** *system* should be used and for frequencies higher than 10 kHz, a **multiple point ground** *system* should be used.

- **Single Point Grounding**: all signal grounds of all IT equipment are connected in series to form a single reference point. This point can be grounded directly to earth; to the designated grounding point or to the safety point that is already grounded.
- **Multiple Point Grounding***:* all signals of all IT equipment are grounded independently.
- **Hybrid Grounding***:* this type of grounding behaves differently for low and high frequencies. When two pieces of IT equipment (A and B) are connected via a shielded cable, one end is connected directly to ground while the other end is connected to ground via a capacitor. This type of grounding system fulfils the criteria for high and low frequency grounding.
- **Floating grounding***:* the signals of all IT equipment are isolated from each other and are not grounded.

DC current flows evenly throughout the conductor section. But AC current flows towards the conductor's surface as frequency increases; this is called the "skin effect". It causes the effective cross-section area to be reduced with increasing frequency. Therefore, it is suggested to increase the effective ground cross-section area for high frequencies by replacing pigtail grounding by braided conductors or strip conductors. Refer to the Figure A-5 below.

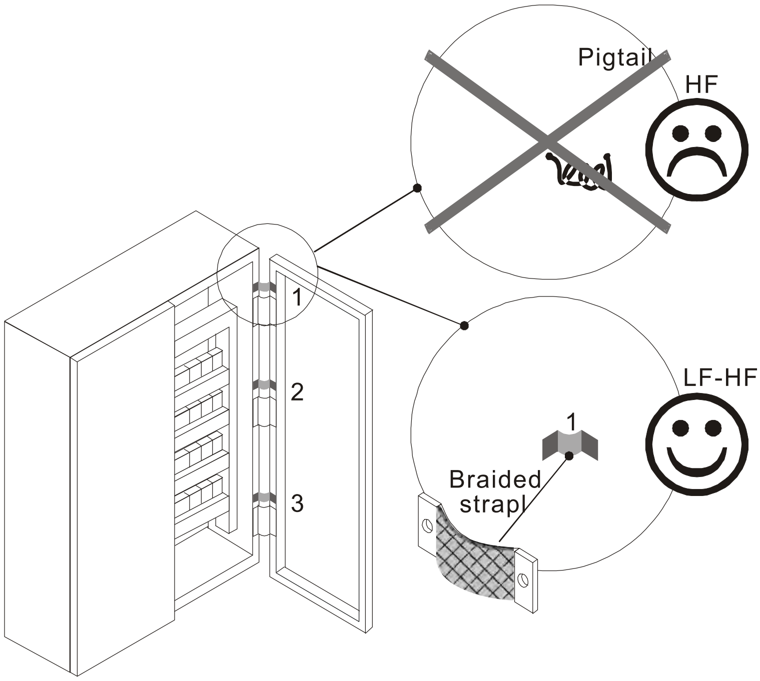


Figure A-5

This is why a thick short ground wire must be implemented for connecting to the common grounding path or the ground busbar. Especially when a controller (e.g. PLC) is connected to an AC motor drive, it must be grounded by a short and thick conducting wire. It is suggested to use a flat braided conductor (ex: metal mesh) with a lower impedance at high frequencies.

If the grounding wire is too long, its inductance may interfere structure of the building or the control cabinet and form mutual inductance and stray capacitance. As shown in the Figure A-6, a long grounding wire could become a vertical antenna and turn into a source of noise.

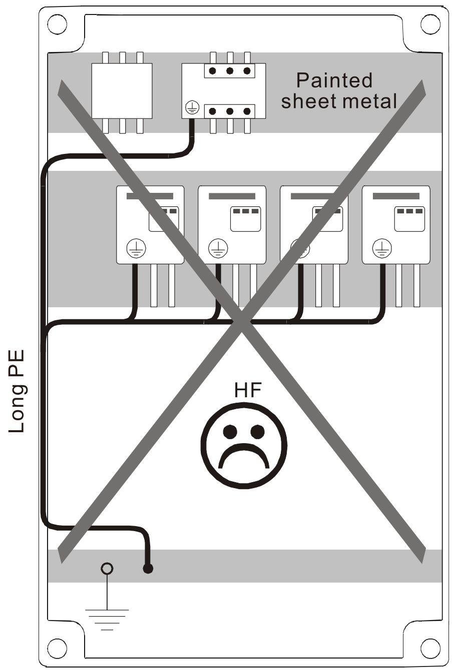


Figure A-6

A-3-2 Ground Loops

A **ground loop** occurs when the pieces of equipment are connected to more than one grounding path. In this case, the ground current may return to the grounding electrode via more than one path. There are three methods to prevent ground loops:

1. Use a common power circuit
2. Single point grounding
3. Isolate signals, e.g. by photocouplers

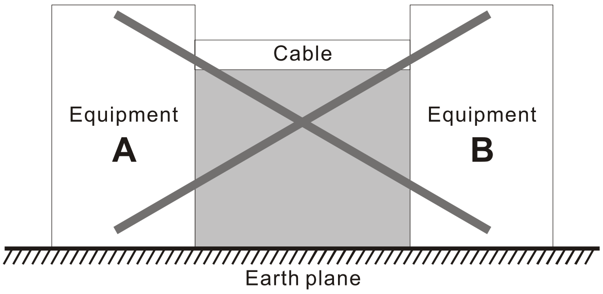


Figure A-7

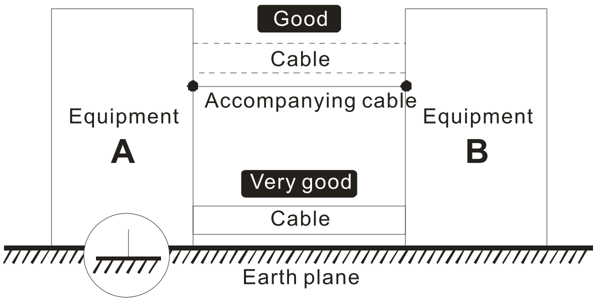


Figure A-8

In order to avoid "Common Mode Noise", use parallel wires or twisted pair wiring. Follow this rule and also avoid long wires, it is suggested to place the two wires as close to each other as possible.

A-3-3 Earthing Systems

The international standard IEC60364 distinguishes three different earthing system categories, using the two-letter codes TN, TT, IT.

- The **first letter** indicates the type of earthing for the power supply equipment (generator or transformer).
  T: One or more points of the power supply equipment are connected directly to the same earthing point.
  I: Either no point is connected to earth (isolated) or it is connected to earth via high impedance.
- The **second letter** indicates the connection between earth and the power supply equipment.
  T: Connected directly to earth (This earthing point is separate from other earthing points in the power supply system.)
  N: Connected to earth via the conductor that is provided by the power supply system
- The **third and fourth letter** indicate the location of the earth conductor.
  S: Neutral and earth conductors are separate
  C: Neutral and earth are combined into a single conductor

TN system

TN: The neutral point of the low voltage transformer or generator is earthed, usually the star point in a three-phase system. The body of the electrical device is connected to earth via this earth connection at the transformer.

Protective earth (PE): The conductor that connects the exposed metallic parts of the consumer.
Neutral (N): The conductor that connects to the start point in a three-phase system or that carries the return current in a single-phase system.

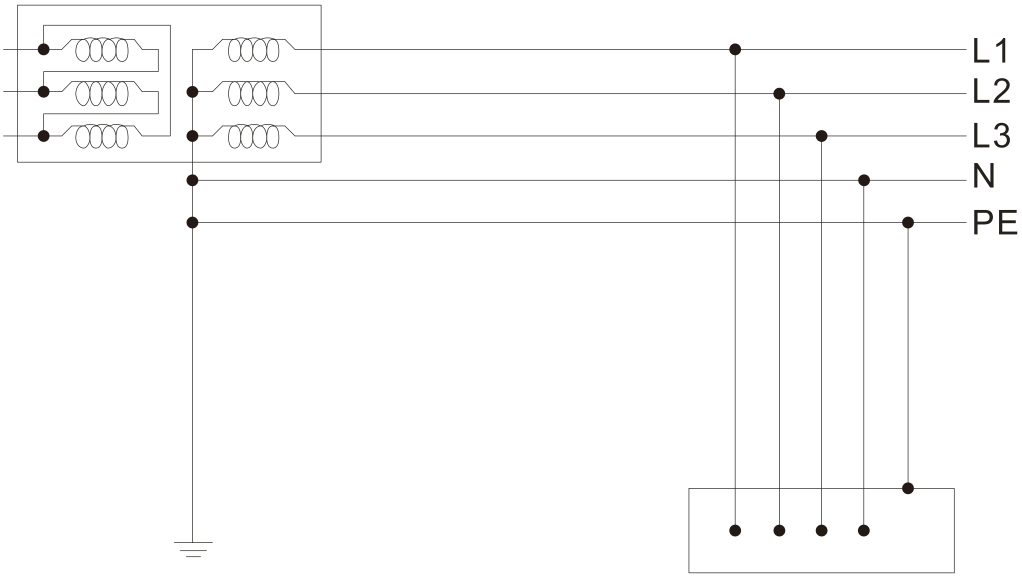


Figure A-9

TN-S system

TN-S: PE and N are two separate conductors that are combined together only near the power source (transformer or generator). It is the same as a three-phase five-wire system.

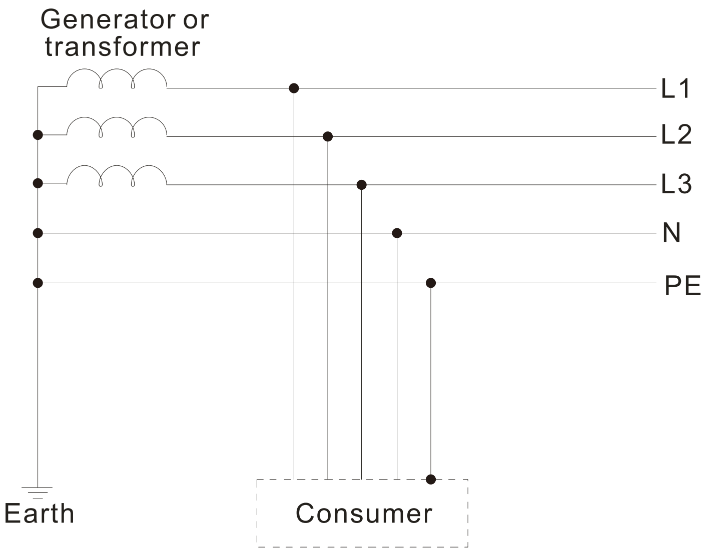


Figure A-10

TN-C system

TN-C: PE and N are two separate conductors in an electrical installation similar to a three-phase five-wire system, but near the power side, PE and N are combined into a PEN conductor similar to a three-phase four-wire system.

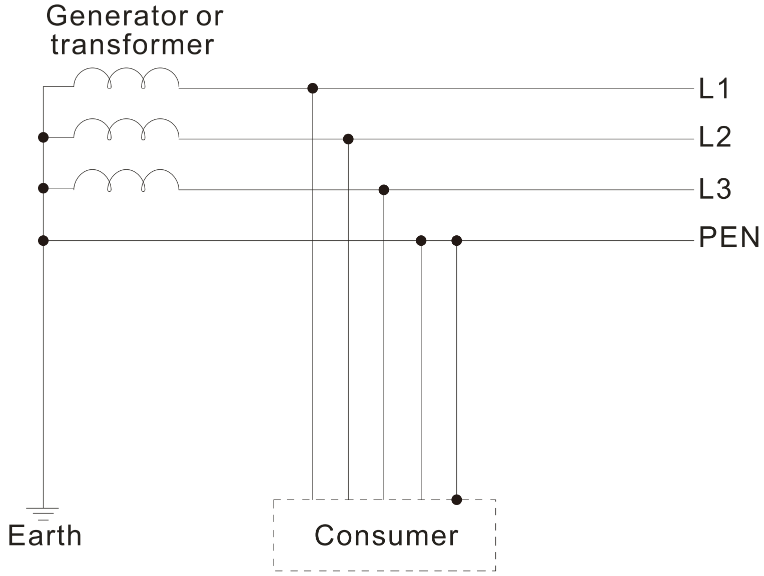


Figure A-11

TN-C-S system

TN-C-S: A combined earth and neutral system (PEN conductor) is used in certain systems but eventually split up into two separate conductors PE and N. A typical application of combined PEN conductor is from the substation to the building but within the building PEN is separated into the PE and N conductors. Direct connection of PE and N conductors to many earthing points at different locations in the field will reduce the risk of broken neutrals. Therefore, this application is also known as **protective multiple earthing (PME)** in the UK or as **multiple earthed neutral (MEN)** in Australia

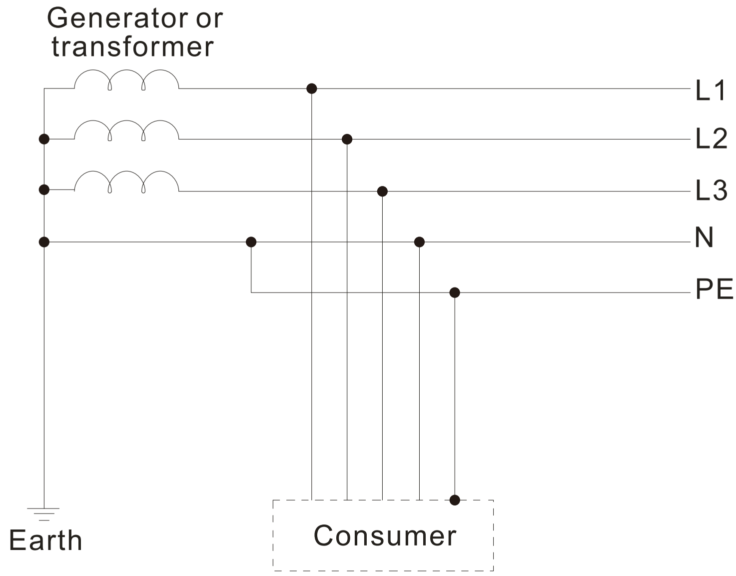


Figure A-12

TT system

TT: The neutral point (N) of the low voltage transformer and the equipment frames (PE) are connected to a separate earthing point. The Neutral (N) of the transformer and electrical equipment are connected.

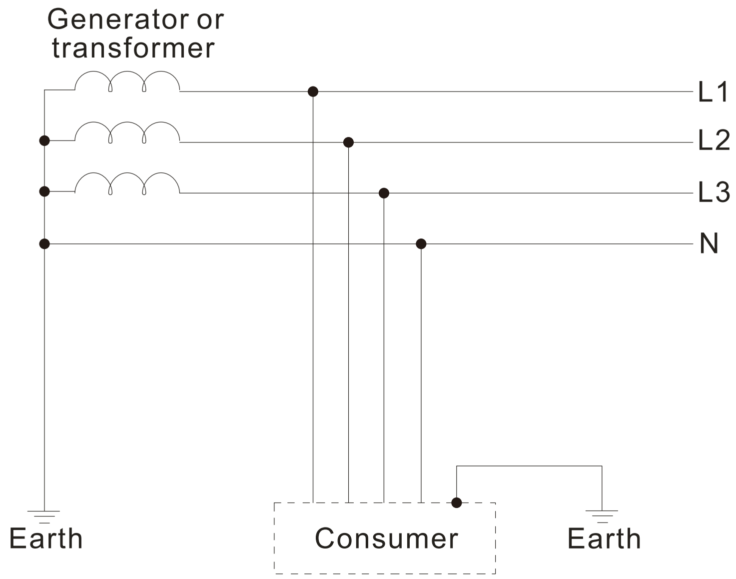


Figure A-13

IT system

IT: The neutral point of the transformer and electrical equipment are not earthed, only the equipment frames PE are earthed.

In the IT network, the power distribution system Neutral is either not connected to earth or is earthed via high impedance. In such a system, an insulated monitoring device is used for impedance monitoring.

A built-in filter should be disconnected by the RFI-jumper and an external filter should not be installed when the AC motor drive or the AC servo motor drive is connected to an IT system.

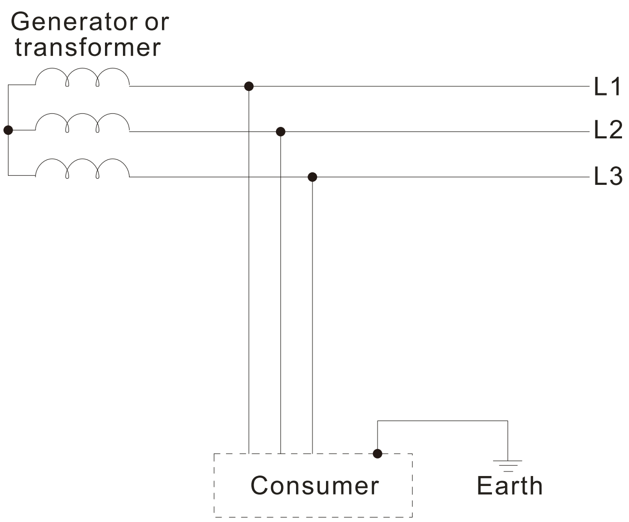


Figure A-14

Criteria for Earthing System and EMC

	TN-S	TN-C	TT	IT
Safety of Personnel	***Good*** Continuity of the PE conductor must be ensured throughout the installation	***Good*** Continuity of the PE conductor must be ensured throughout the installation	***Good*** RCD is mandatory	***Good*** Continuity of the PE conductor must be ensured throughout the installation
Safety of Property	***Poor*** High fault current (around 1kA)	***Poor*** High fault current (around 1kA)	***Good*** Medium fault current (< a few dozen amperes)	***Good*** Low current at the first fault (< a few dozen mA) but high current at the second fault
Availability of Energy	***Good***	***Good***	***Good***	***Excellent***
EMC Behavior	***Excellent*** • Few equipotential Problems: • Need to handle the high leaking currents problem of the device • High fault current (transient disturbances)	***Poor (prohibited)*** • Neutral and PE are the same • Circulation of disturbance currents in exposed conductive parts (high magnetic-field radiation) • High fault currents (transient disturbances)	***Good*** • Over-voltage risk • Equipotential Problems: • Need to handle the high leaking currents problem of the device • RCD (Residual-current device)	***Poor (should be avoided)*** • Over-voltage risk • Common–mode filters and surge arrestors must handle the phase-to-phase voltage. • RCDs subject to nuisance tripping when common-mode capacitors are present • Equivalent to TN system for second fault

A-4 Solution to EMC: Shielding

A-4-1 What is Shielding

Electrostatic shielding is used to isolate equipment so that it will not create electromagnetic field interference or be influenced by an external electromagnetic field. A conductive material is used for electrostatic shielding to achieve this isolation.

A Faraday cage can be made from a mesh of metal or a conductive material.
One characteristic of metal is that it is highly conductive and not electrostatic, which offers shielding and prevents interference by external electrical fields. Metal with its high conductivity protects the internal devices from high voltages—no voltage will enter the cage even when the cage is experiencing a high current. In addition, electromagnetic fields can also pass through the Faraday cage without causing any disturbance.

Electromagnetic shielding is applied to some electrical devices and measurement equipment for the purpose of blocking interference. Examples of shielding include:

- Earth high-voltage indoor equipment using a metal frame or a high-density metal mesh
- Shielding a power transformer is achieved by wrapping a metal sheet between the primary and secondary windings or by adding an enamel wire to the winding wire which is then earthed.
- A shielding coating, which is made of metal mesh or conductive fibers to provide effective protection for the workers who work in a high-voltage environment.

In the picture below, the radio appears to be not fully covered by metal but if the conductivity of the metal is high, radio waves are completely blocked and the radio will not receive any signal.

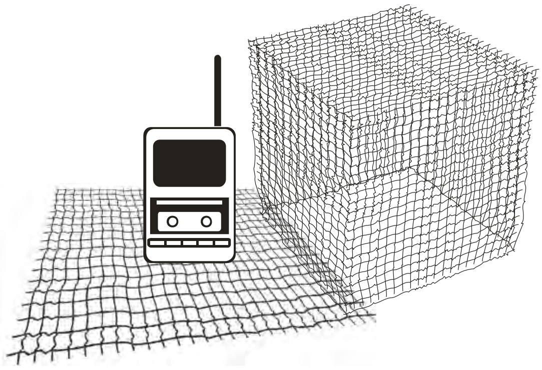


Figure A-15

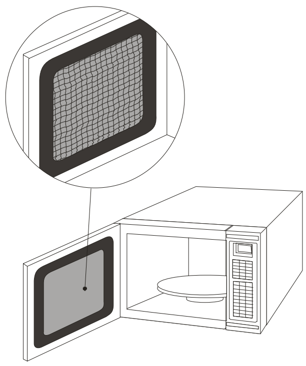


Figure A-16

Mobile phone connections are also established through the transmission of radio waves. This is why the mobile phone reception is often cut off when we walk into an elevator. The metal walls of the elevator create the same shielding effect just as if we had entered a metal cage. Another example is a microwave oven. The microwave door may seem transparent in visible light, but the density of the metal mesh in the microwave door blocks the electromagnetic waves. A higher density of the metal mesh offers better shielding.

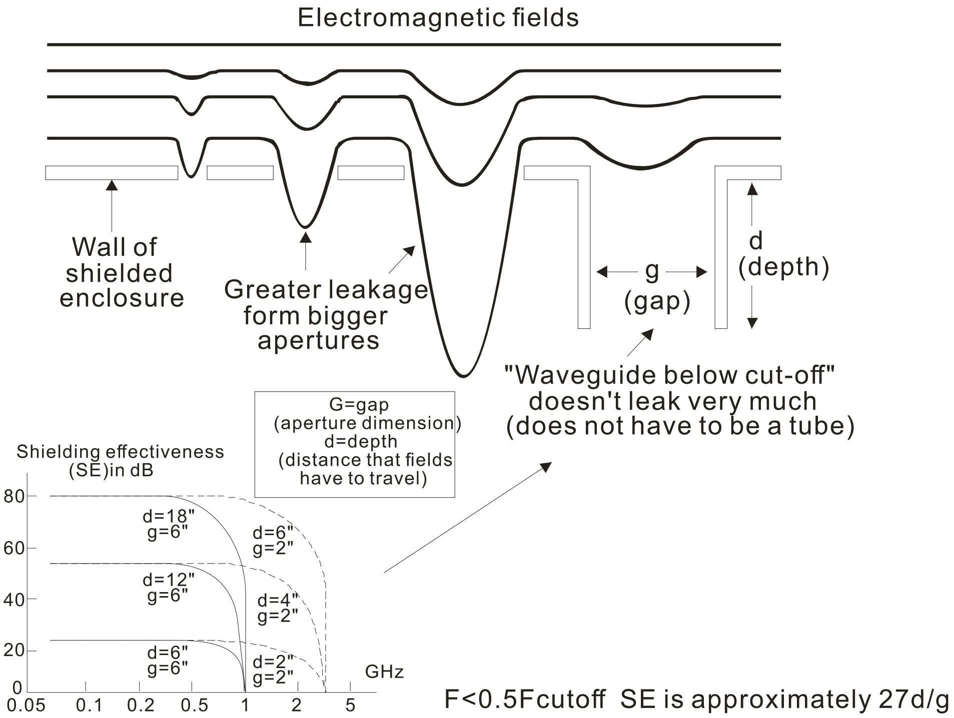


Figure A-17

A-4-2 How to Reduce EMC by Shielding

Iron and other metals are high conductivity materials that provide effective shielding at extremely low frequencies. But conductivity will decrease as:

1. High frequency signals are applied to the conductor
2. Equipment is located in a strong magnetic field
3. The shielding frame is forced into a specific form by machines

It is difficult to select a suitable high-conductivity material for shielding without the help from a shielding material supplier or a related EMC institution.

Metallic Shielding Effectiveness

Shielding Effectiveness (SE) is used to assess the applicability of the shielding shell. The formula is:

SEdB=A+R+B (Measures in dB)	where	A= Absorption loss (dB)
		R= Reflection loss (dB)
		B= Correction factor (dB) (for multiple reflections in thin shields)

The absorption loss refers to the amount of energy loss as the electromagnetic wave travels through the shield. The formula is:

AdB=1.314(fσμ) 1/2t	where	f= frequency (MHz)
		μ= permeability relative to copper
		σ= conductivity relative to copper
		t= thickness of the shield in centimeters

The reflection loss depends on the source of the electromagnetic wave and the distance from that source. For a rod or straight wire antenna, the wave impedance increases as it moves closer to the source and decreases as it moves away from the source until it reaches the plane wave impedance (377) and shows no change. If the wave source is a small wire loop, the magnetic field is dominant and the wave impedance decreases as it moves closer to the source and increases as it moves away from the source; but it levels out at 377 when the distance exceeds one-sixth of the wavelength.

Electrical Cabinet Design

In a high frequency electric field, shielding can be achieved by painting a thin layer of conductive metal on the enclosure or on the internal lining material. However, the coating must be thorough and all parts should be properly covered without any seams or gaps (just like a Faraday cage). That is only the ideal. Making a seamless shielding shell is practically impossible since the cage is composed of metal parts. In some conditions, it is necessary to drill holes in the shielding enclosure for installation of accessories (like optional cards and other devices).

1. If the metallic components are properly welded using sophisticated welding technology to form an electrical cabinet, deformation during usage is unlikely to occur. But if the electrical cabinet is assembled with screws, the protective insulating layer under the screw must be properly removed before assembly to achieve the greatest conductivity and best shielding.
2. Drilling holes for the installation of wires in the electrical cabinet lowers the shielding effectiveness and increases the chance of electric waves leaking through the openings and emitting interference. We recommend that the drilled holes are as narrow as possible. When the wiring holes are not used, properly cover the holes with metal plates or metal covers. The paint or the coating of the metal plate and metal cover should be thoroughly removed to ensure a metal-to-metal contact or a conductive gasket should be installed.
3. Install industrial conductive gaskets to completely seal the electrical cabinet and the cabinet door without gaps. If conductive gaskets are too costly, please screw the cabinet door to the electrical cabinet with a short distance between the screws.
4. Reserve a grounding terminal on the electrical cabinet door. This grounding terminal shall not be painted. If the paint already exists, please remove the paint before grounding.

Electrical Wires and Cables

Shielded Twisted Pair (STP) is a type of cable where two insulated copper wires are twisted together with a metal mesh surrounding the twisted pair that forms the electromagnetic shielding and can also be used for grounding.

The individual electrical wires and complete cable are surrounded by (synthetic) rubber that provides insulation and also protects against damage.

There are two types of electrical cables: high voltage and low voltage. The high voltage cable differs from the low voltage cable in that it has an additional insulation layer called the dielectric insulator within the plastic sleeve. The dielectric insulator is the most important component in insulation. The low voltage cable is usually only filled with a soft polymer material for keeping the internal copper wire in place.

The shield has two functions:

1. To shield the electrical wire and cable.
   (1) Electric currents increase as power flows through the power cable and generate an electrical field. Such interference can be suppressed inside the cable by shielding the power cables or the electrical wires.
   (2) To form a protective earthing. When the cable core is damaged, the leakage current will flow via the shield to ground
2. To protect the cable. A power cable used for the computer control purpose generates only relatively low amount of current inside the cable. Such power cable will not become the source of interferences but has great possibility to be interfered by the surrounding electrical devices.

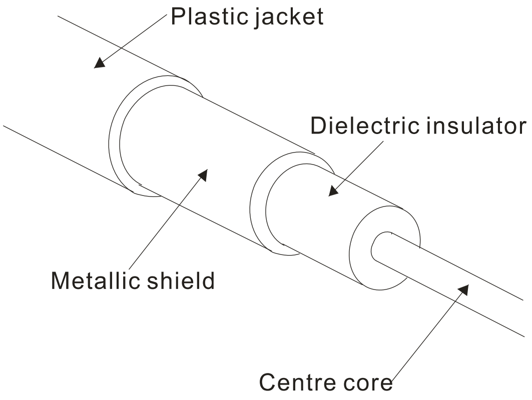


Figure A-18

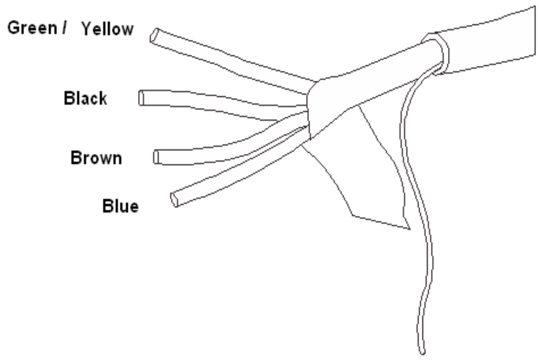


Figure A-19

A-5 Solution to EMC: Filter

A-5-1 Filter

Electromagnetic interference is transmitted in two ways, by radiation and by conduction. The most effective and economical method of reducing radiated interference is to use shielding and of reducing conducted interference is to use an electromagnetic filter.

Noise interference can be divided into two categories: high frequency (150 kHz–300 MHz) and low frequency (100–3000 Hz). High-frequency noise fades more over distance and has a shorter wave-length, while low-frequency noise fades less over distance and has a longer wave-length. Both types of interference are transmitted through power cables and power leads, affecting the power supply side.

High-frequency interference at the power side can be eliminated or attenuated by mounting a filter. The filter consists of coils and capacitors. Some drives do not have a built-in filter, in which case the installation of an external option filter is required. Figure A-20 below shows a standard filter diagram.

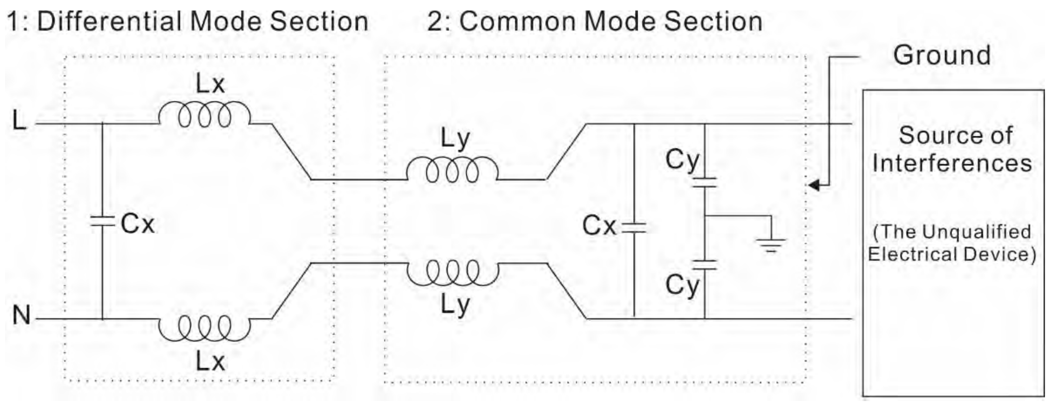


Figure A-20

A filter is composed of a Differential Mode section (to eliminate noise below 150 kHz) and a Common Mode section (to eliminate noise above 150 kHz). For high-frequency noise, the inductor acts as a high impedance to form an open circuit and the capacitor acts as a low impedance to form a short circuit. Proper design and dimensioning of inductors and capacitors give a resonant circuit to absorb harmonic currents. Capacitor Cy is earthed to lead the harmonic currents to the ground.

External Filter

The filter and the AC drive should be installed in the control cabinet or on the mounting plate that is earthed to ground. The motor cable must be shielded and as short as possible. Use the filters recommended by Delta to ensure compliance with EMC standards.

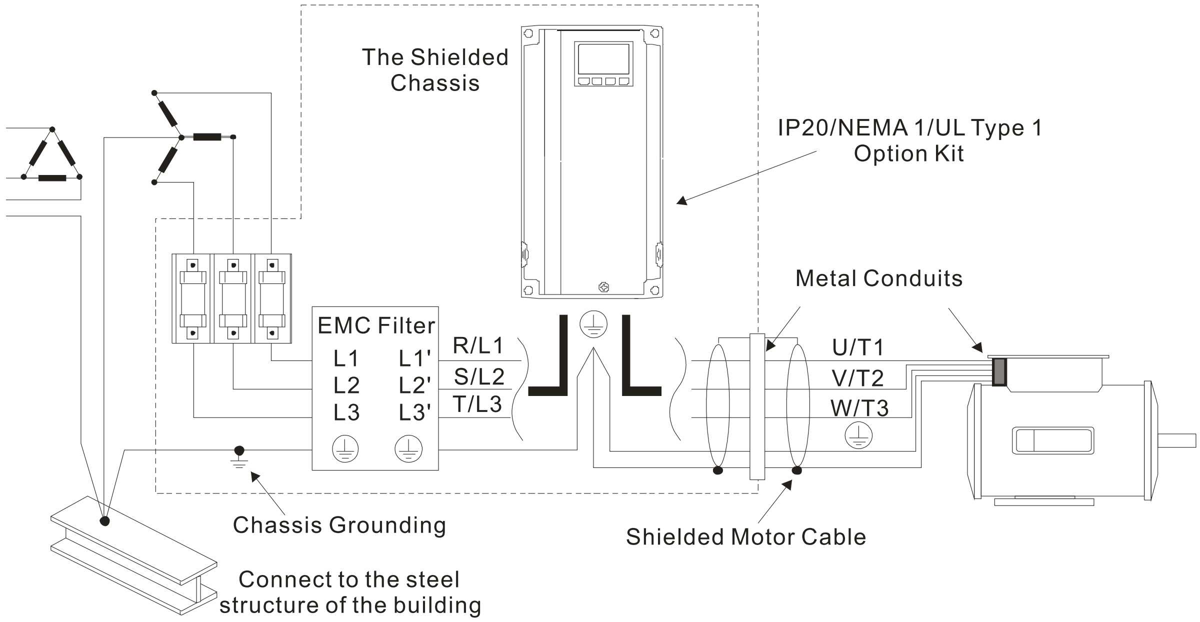


Figure A-21

AC Motor Drives with Built-in Filter

1. Since interferences are suppressed by installing an earthed capacitor in the filter, the amount of current to ground (leakage current) could result in electric shocks to personnel or the power system. Please be aware of this problem.
2. Since the leakage current to ground can be high, it is crucial to implement protective earthing to prevent electrical shocks.

Filter Installation (With and Without)

< 15 m @ 60 Hz with EMC Filter

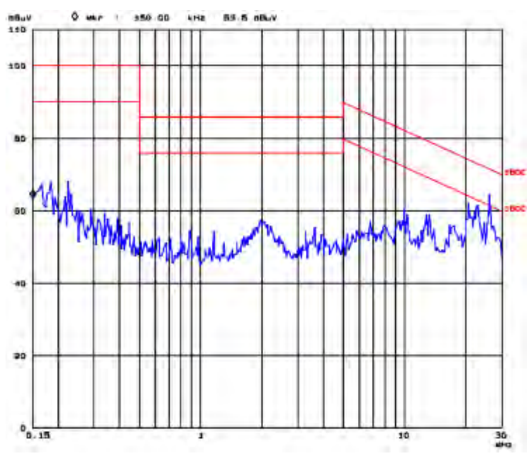


Figure A-22

< 15 m @ 60 Hz without EMC Filter

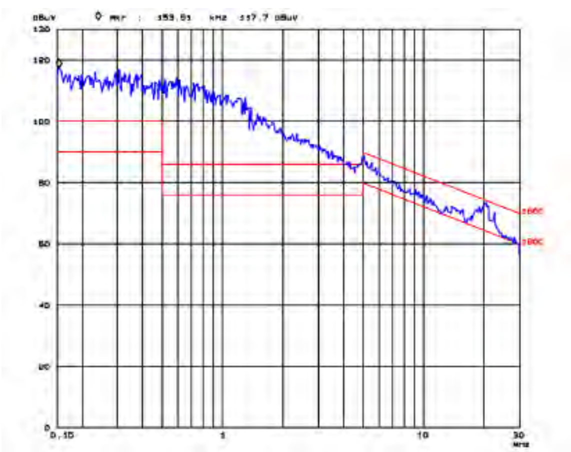


Figure A-23

Zero Phase Reactor (Choke)

Interferences can also be suppressed by installing a zero phase reactor at the power supply side and/or the AC Motor Drive's output, depending on where the interference is. Since currents are large at the power input and the AC Motor Drive's output, please carefully select the magnetic core with suitable current handling capability. An ideal magnetic material for large currents is compound magnetic powder. It has a higher current handling capability and higher impedance compared to pure metallic magnetic cores. It is therefore suitable to implement in a high frequency environment. The impedance can also be enhanced by increasing the turn ratio.

Zero Phase Reactor Installation

There are two installation methods, depending on the size of the zero phase reactor and the motor cable length.

1. Wind the motor cable through the middle of a zero-phase reactor four times. Place the reactor and the AC Motor Drive as close to each other as possible.

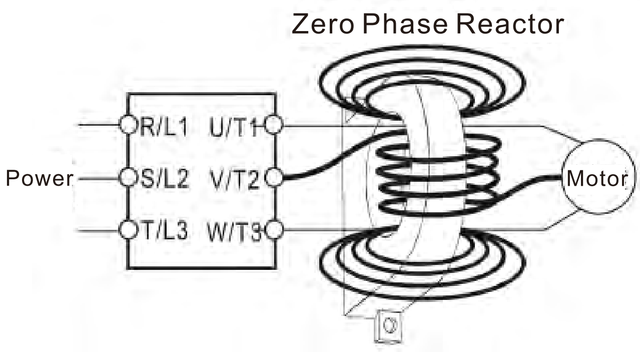


Figure A-24

2. Place all wires through the middle of four zero-phase reactors without winding.

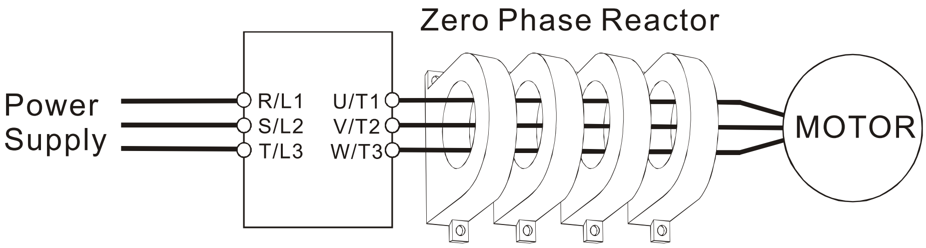


Figure A-25

Analog Input Signals

If the analog input signals are affected by noise from the AC motor drive, connect a capacitor and a ferrite core as indicated in Figure A-26 below. Wind the wires around the core in same direction for 3 times or more.

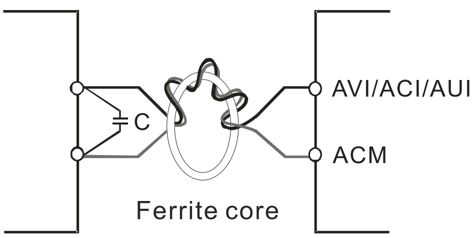


Figure A-26

A-5-2 Harmonic Interference

The AC motor drive's input current is non-linear, the input rectifier generates harmonics. Harmonics must be limited to within a certain range to avoid impact the mains power and to avoid current distortion to ensure surrounding devices are not influenced. An AC Motor Drive with built-in DC reactor suppresses harmonic currents (Total Harmonic Current Distortion THID) effectively and therefore reduces the harmonic voltage peaks (Total Harmonic Voltage Distortion).

Harmonic Current at the Power Supply Side

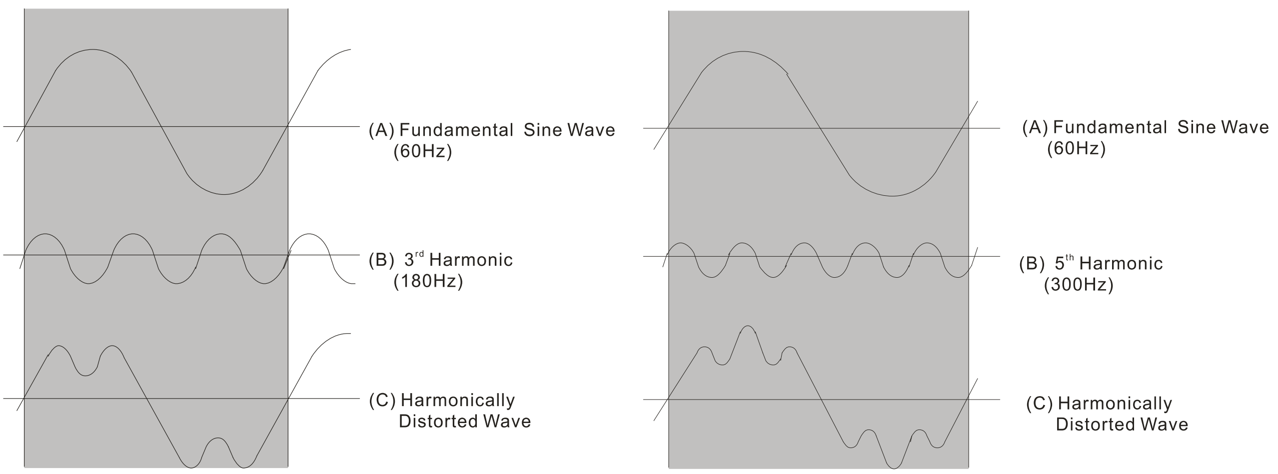


Figure A-27

Suppression of Harmonic Currents

When a large portion of lower order harmonic currents (5th, 7th, 11th, etc.) occur at the power input, surrounding devices will be disturbed and the power factor will be low as a result of reactive power. Installing a reactor at the AC Motor Drive's input effectively suppresses lower order harmonic currents.

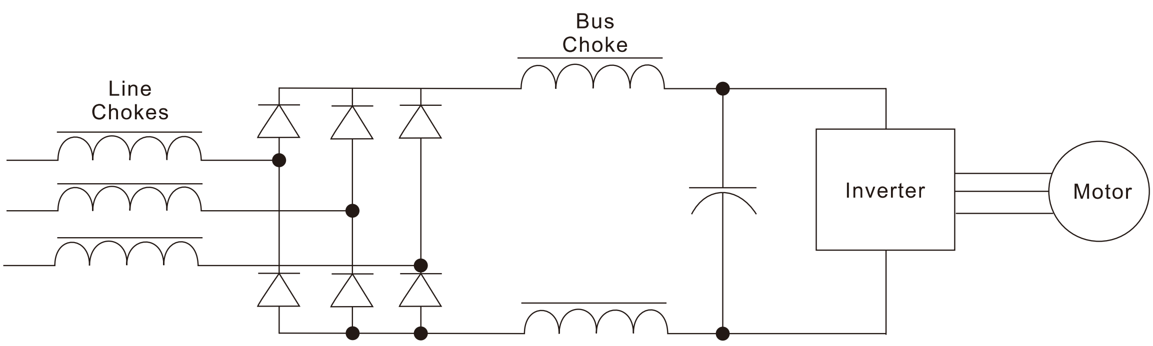


Figure A-28

AC Reactor

Installed in series with the power supply and is effective in reducing low order current harmonics. Features of an AC reactor include:

1. Reduces the harmonic currents to the AC Motor Drive and increases the impedance of the power supply.
2. Absorbs interferences generated by surrounding devices (such as surge voltages, currents, and mains surge voltages) and reduce their effect on the AC Motor Drive.
3. Increases the power factor.

DC Reactor

A DC-Reactor is installed between the rectifier and the DC-bus capacitor to suppress harmonic currents and to achieve a higher power factor.

Current Wave Diagrams

Without Reactor

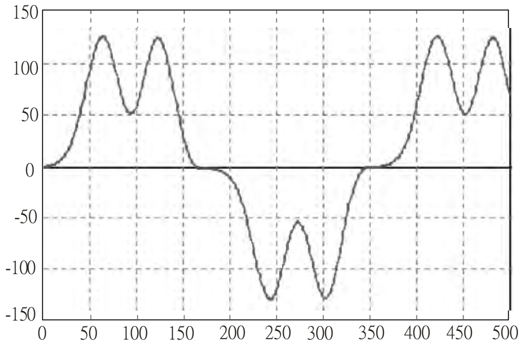


Figure A-29

With Reactor

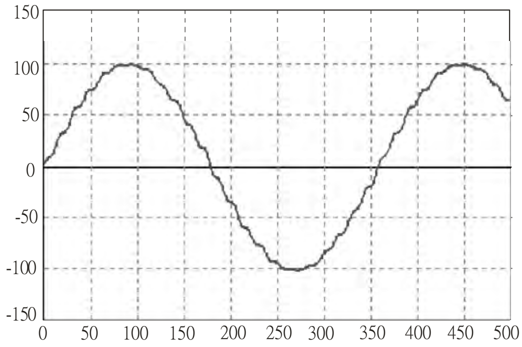


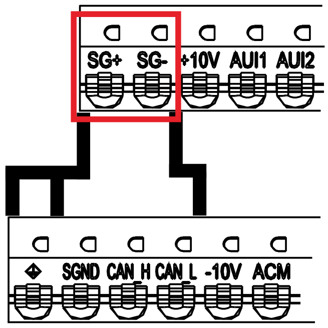
Figure A-30

Appendix B. Modbus Protocol

B-1 Introduction

Modbus, originally published in 1979, is a data communication protocol for connecting between automation devices. It was developed for industrial applications, and mainly used for transmitting data through serial data lines. It helps users to control by computers and monitor drive parameters and status through Modbus by using RS-485 serial communication interface.

When using the communication interface, the diagram on the right shows the communication port pin definitions. It is recommended that you connect the AC motor drive to your PC by using Delta IFD6530 or IFD6500 as a communication converter.

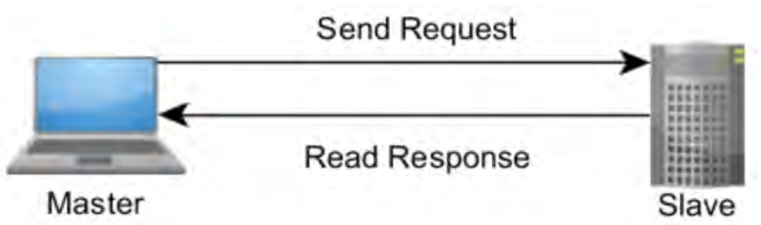


The default communication formats for communication port:

- Modbus RTU mode
- 19200 bps serial communication baud rates
- 8-bit data character
- No parity bit
- 2 stop bit

What is Modbus protocol?

Modbus, a request-response protocol, is made up of master and slave architecture. The master-and-slave architecture communication always appears in pairs, that is, there must be a device that sends request and waits for response, and this device (master) is responsible for initiating each communication. Generally speaking, master device is PLC (Programmable Logic Controller) or PC (Personal Computer), and slave device is the drive.



Master-Slave Architecture

B-2 Code Description

The communication protocol is in hexadecimal, ASCII: “0”…“9”, “A”…“F”, every hexadecimal value represents an ASCII code. The table below shows some example.

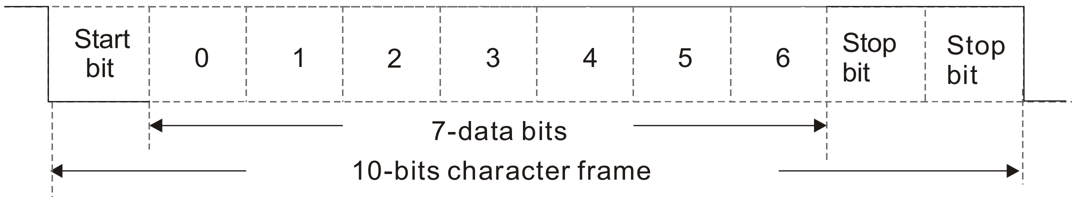
Character	‘0’	‘1’	‘2’	‘3’	‘4’	‘5’	‘6’	‘7’
ASCII code	30H	31H	32H	33H	34H	35H	36H	37H

Character	‘8’	‘9’	‘A’	‘B’	‘C’	‘D’	‘E’	‘F’
ASCII code	38H	39H	41H	42H	43H	44H	45H	46H

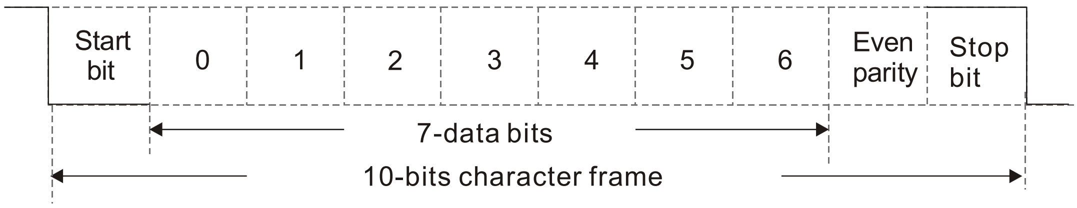
B-3 Data Format

10-bit character frame (For ASCII):

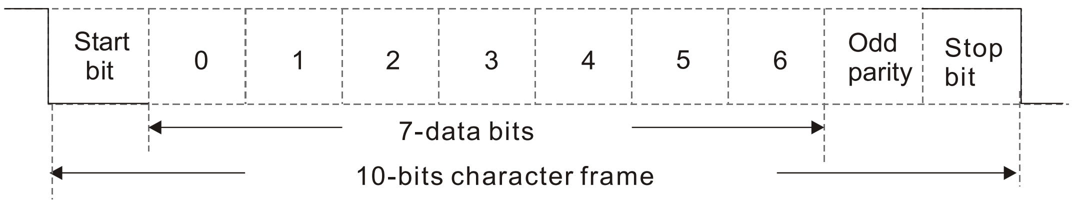
(Format: 7, N, 2)



(Format: 7, E, 1)

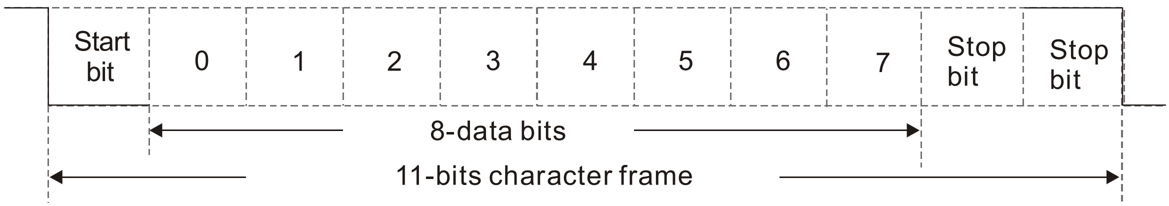


(Format: 7, O, 1)

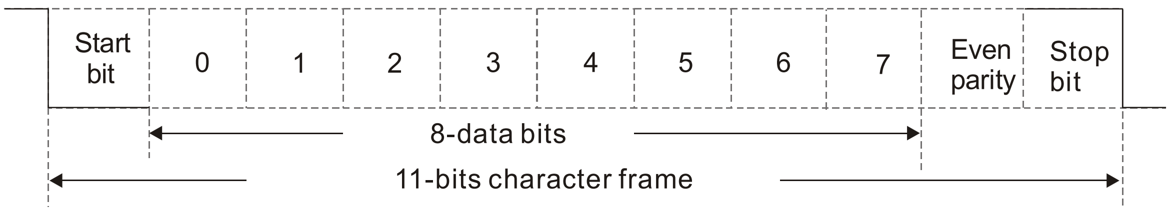


11-bit character frame (For RTU)

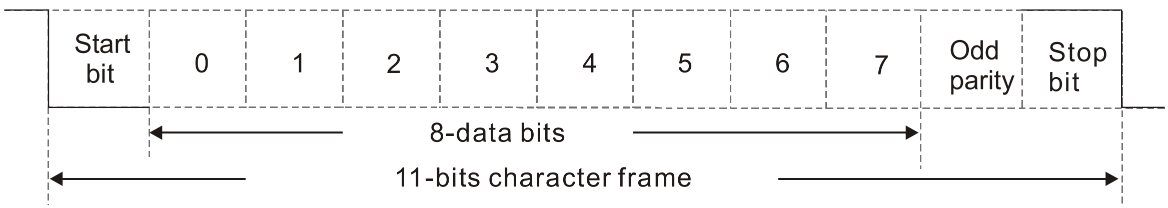
(Format: 8, N, 2)



(Format: 8, E, 1)



(Format: 8, O, 1)



B-4 Communication Protocol

B-4-1 Communication Data Frame

ASCII mode:

STX	Start character = ‘:’ (3AH)
Address High	Communication address:
Address Low	one 8-bit address consists of 2 ASCII codes
Function High	Command code:
Function Low	one 8-bit command consists of 2 ASCII codes
DATA (n-1) to DATA 0	Contents of data: n x 8-bit data consists of 2n ASCII codes n ≤ 16, maximum of 32 ASCII codes (20 sets of data)
LRC Check High	LRC checksum:
LRC Check Low	one 8-bit checksum consists of 2 ASCII codes
END High	End characters:
END Low	END1= CR (0DH), END0 = LF (0AH)

RTU mode:

START	Defined by a silent interval of larger than / equal to 10 ms
Address	Communication address: 8-bit binary address
Function	Command code: 8-bit binary command
DATA (n-1) to DATA 0	Contents of data: n × 8-bit data, n ≤ 16
CRC Check Low	CRC checksum:
CRC Check High	one 16-bit CRC checksum consists of 2 8-bit binary characters
END	Defined by a silent interval of larger than / equal to 10 ms

B-4-2 Communication Address (Address)

00H: broadcast to all AC motor drives

01H: AC motor drive of address 01

0FH: AC motor drive of address 15

10H: AC motor drive of address 16

:

FEH: AC motor drive of address 254

B-4-3 Function (Function Code) and DATA (Data Characters)

1. 03H: read data from a register

   Example: Reading two continuous data from register address 2102H, AMD address is 01H.

ASCII mode:

Command Message

STX	‘:’
Address	‘0’
	‘1’
Function	‘0’
	‘3’
Starting register	‘2’
	‘1’
	‘0’
	‘2’
Number of register (count by word)	‘0’
	‘0’
	‘0’
	‘2’
LRC Check	‘D’
	‘7’
END	CR
	LF

Response Message

STX	‘:’
Address	‘0’
	‘1’
Function	‘0’
	‘3’
Number of register (count by byte)	‘0’
	‘4’
Content of starting register 2102H	‘1’
	‘7’
	‘7’
	‘0’
Content of register 2103H	‘0’
	‘0’
	‘0’
	‘0’
LRC Check	‘7’
	‘1’
END	CR
	LF

RTU mode:

Command Message

Address	01H
Function	03H
Starting data register	21H
	02H
Number of register (count by word)	00H
	02H
CRC Check Low	6FH
CRC Check High	F7H

Response Message

Address	01H
Function	03H
Number of register (count by byte)	04H
Content of register address 2102H	17H
	70H
Content of register address 2103H	00H
	00H
CRC Check Low	FEH
CRC Check High	5CH

2. 06H: single write, write single data to a register
   Example: Writing data 6000 (1770H) to register 0100H. AMD address is 01H.

   ASCII mode:

Command Message

STX	‘:’
Address	‘0’
	‘1’
Function	‘0’
	‘6’
Target register	‘0’
	‘1’
	‘0’
	‘0’
Register content	‘1’
	‘7’
	‘7’
	‘0’
LRC Check	‘7’
	‘1’
END	CR
	LF

Response Message

STX	‘:’
Address	‘0’
	‘1’
Function	‘0’
	‘6’
Target register	‘0’
	‘1’
	‘0’
	‘0’
Register content	‘1’
	‘7’
	‘7’
	‘0’
LRC Check	‘7’
	‘1’
END	CR
	LF

RTU mode:

Command Message

Address	01H
Function	06H
Target register	01H
	00H
Register content	17H
	70H
CRC Check Low	86H
CRC Check High	22H

Response Message

Address	01H
Function	06H
Target register	01H
	00H
Register content	17H
	70H
CRC Check Low	86H
CRC Check High	22H

3. 10H: write multiple registers (can write at most 20 sets of data simultaneously)
   Example: Set the multi-step speed Pr.00-50 = 50.00 (1388H) of an AC motor drive (address is 01H),

   ASCII mode:

Command Message

STX	':'
ADR 1	'0'
ADR 0	'1'
CMD 1	'1'
CMD 0	'0'
Target register	'0'
	'0'
	'3'
	'2'
Number of register (count by word)	'0'
	'0'
	'0'
	'2'
Number of register (count by byte)	'0'
	'4'
The first data content	'1'
	'3'
	'8'
	'8'
The second data content	'0'
	'F'
	'A'
	'0'
LRC Check	'9'
	'A'
END	CR
	LF

Response Message

STX	':'
ADR 1	'0'
ADR 0	'1'
CMD 1	'1'
CMD 0	'0'
Target register	'0'
	'0'
	'3'
	'2'
Number of register (count by word)	'0'
	'0'
	'0'
	'2'
LRC Check	'E'
	'8'
END	CR
	LF

RTU mode:

Command Message

ADR	01H
CMD	10H
Target register	00H
	32H
Number of register (count by word)	00H
	02H
Quantity of data (byte)	04
The first data content	13H
	88H
The second data content	0FH
	A0H
CRC Check Low	'9'
CRC Check High	'A'

Response

ADR	01H
CMD	10H
Target register	00H
	32H
Number of register (count by word)	00H
	02H
CRC Check Low	41H
CRC Check High	04H

4. Checksum

ASCII mode (LRC Check)

LRC (Longitudinal Redundancy Check) is calculated by summing up the values of the bytes from ADR1 to the last data character then calculating the hexadecimal representation of the 2's-complement negation of the sum.

Example:

01H + 03H + 21H + 02H + 00H + 02H = 29H, the 2's-complement negation of 29H is **D7**H.

RTU mode (CRC check)

CRC (Cyclical Redundancy Check) is calculated with the following steps:

Step 1: Load a 16-bit register (called CRC register) with FFFFh.

Step 2: Exclusive OR the first 8-bit byte of the command message with the low order byte of the 16-bit CRC register, putting the result in the CRC register.

Step 3: Examine the LSB of CRC register.

Step 4: If the LSB of CRC register is 0, shift the CRC register one bit to the right, fill MSB with zero, then repeat step 3. If the LSB of CRC register is 1, shift the CRC register one bit to the right, fill MSB with zero, Exclusive OR the CRC register with the polynomial value A001H, then repeat step 3.

Step 5: Repeat step 3 and 4 until you perform eight shifts. This processes a complete 8-bit byte.

Step 6: Repeat step 2 through 5 for the next 8-bit byte of the command message. Continue doing this until all bytes are processed. The final contents of the CRC register are the CRC value. When transmitting the CRC value in the message, the upper and lower bytes of the CRC value must be swapped, that is, the lower order byte is transmitted first.

The following is an example of CRC generation using C language. The function takes two arguments:

```
unsigned char* data     ← // a pointer to the message buffer
unsigned char length    ← // the quantity of bytes in the message buffer
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;                    // return register to CRC
      }
```

5. Address list

ASCII mode:

- Reads one or more parameter values: 3Ah (start bit ' : ') + 30h 31h (station address 01) + 30h 33h (function code 03h) + 30h 30h xxh xxh–32h 36h xxh xxh (Modbus address 00xxh–26xxh) + xxh xxh xxh xxh (reading length 1) + LRC (checksum) + CR/LF
- Writes one parameter value: 3Ah (start bit ' : ') + 30h 31h (station address 01) + 30h 36h (function code 06h) + 30h 30h xxh xxh–32h 36h xxh xxh (Modbus address 00xxh–26xxh) + xxh xxh xxh xxh (writing value) + LRC (checksum) + CR/LF
- Writes 20 parameter values: 3Ah (start bit ' : ') + 30h 31h (station address 01) + 31h 30h (function code 10h) + 30h 30h xxh xxh–32h 36h xxh xxh (Modbus address 00xxh–26xxh) + 30h 30h 31h 34h (word data length) + 32h 38h (byte data length) + xxh xxh xxh xxh (the first writing value) + ... + xxh xxh xxh xxh (the 20th writing value) + LRC (checksum) + CR/LF

RTU mode:

- Reads one or more parameter values: 01h (station address 01) + 03h (function code 03h) + 00xxh–26xxh (Modbus address) + xxxxh (reading length) + CRC (checksum)
- Writes one parameter value: 01h (station address 01) + 06h (function code 06h) + 00xxh–26xxh (Modbus address) + xxxxh (writing value) + CRC (checksum)
- Writes 20 parameter values: 01h (station address 01) + 10h (function code 10h) + 00xxh–26xxh (Modbus address) + 0014h (data length, count by word) + 28h (data length, count by byte) + xxxxh (the first writing value) + ... + xxxxh (the 20th writing value) + CRC (checksum)

AC motor drive parameters (GGnnH): communication station address is Pr.09-00 setting value

Modbus Address	Attribute (Function Code)	Description
GGnnH	R (03H) / W (06H, 10H)	GG means parameter group, nn means parameter number. For example, the Modbus address of Pr.04-10 is 040AH when reading by Delta VFDsoft.

Control command (20xx): communication station address is Pr.09-00 setting value

Function Name	Modbus Address	Attribute (Function Code)	Description		
Operation command	2000H	R (03H) / W (06H, 10H)	bit1–0	00b: No function	1. Remains the status specified by a first command until a second command is received. 2. Valid only when operation command source is set to communication (Pr.00-03=2).
				01b: Stop	
				10b: Run	
				11b: JOG + Run	
			bit3–2	Reserved	
			bit5–4	00b: No function	
				01b: FWD	
				10b: REV	
				11b: Change direction	

<table>
<tr><th>Function Name</th><th>Modbus Address</th><th>Attribute (Function Code)</th><th colspan="3">Description</th></tr>
<tr><td rowspan="22"></td><td rowspan="22"></td><td rowspan="22"></td><td rowspan="4">bit7–6</td><td>00b: 1st accel. / decel.</td><td rowspan="20">1. Valid only when 2000h bit12 is set to 1.
2. Obtain the current running speed by reading 2107h.</td></tr>
<tr><td>01b: 2nd accel. / decel.</td></tr>
<tr><td>10b: 3rd accel. / decel.</td></tr>
<tr><td>11b: 4th accel. / decel.</td></tr>
<tr><td rowspan="16">bit11–8</td><td>0000b: zero step speed</td></tr>
<tr><td>0001b: 1st step speed</td></tr>
<tr><td>0010b: 2nd step speed</td></tr>
<tr><td>0011b: 3rd step speed</td></tr>
<tr><td>0100b: 4th step speed</td></tr>
<tr><td>0101b: 5th step speed</td></tr>
<tr><td>0110b: 6th step speed</td></tr>
<tr><td>0111b: 7th step speed</td></tr>
<tr><td>1000b: 8th step speed</td></tr>
<tr><td>1001b: 9th step speed</td></tr>
<tr><td>1010b: 10th step speed</td></tr>
<tr><td>1011b: 11th step speed</td></tr>
<tr><td>1100b: 12th step speed</td></tr>
<tr><td>1101b: 13th step speed</td></tr>
<tr><td>1110b: 14th step speed</td></tr>
<tr><td>1111b: 15th step speed</td></tr>
<tr><td>bit12</td><td colspan="2">1: Enable bit06–11 function</td></tr>
<tr><td>bit13–15</td><td colspan="2">Reserved</td></tr>
<tr><td>Frequency command</td><td>2001H</td><td>R (03H) / W (06H, 10H)</td><td colspan="3">Frequency command (XXX.XX Hz). There are two decimal places for general-purpose drives.</td></tr>
<tr><td rowspan="3">Fault / control command source</td><td rowspan="3">2002H</td><td rowspan="3">R (03H) / W (06H, 10H)</td><td>bit0</td><td>1: External Fault (E.F.) ON</td><td>Used to trigger an external fault to the drive to make it stop running. Drive’s stop method can be set through drive parameters.</td></tr>
<tr><td>bit1</td><td>1: Reset</td><td>Used to clear the fault status</td></tr>
<tr><td>bit15–2</td><td colspan="2">Reserved</td></tr>
</table>

Status monitor read only (21xx): communication station address is Pr.09-00 setting value

Function Name	Modbus Address	Attribute (Function Code)	Description
Fault status	2100H	R (03H)	bit7–0: Fault code bit15–8: Warning code

Function Name	Modbus Address	Attribute (Function Code)	Description	
Drive operation status	2101H	R (03H)	bit1–0	00b: Drive fully stops (RUN indicator is OFF / STOP indicator is ON) 01b: Drive is stopping (RUN indicator flashes / STOP indicator is ON) 10b: Drive is in standby status (RUN indicator is ON / STOP indicator flashes) 11b: Drive is running (RUN indicator is ON / STOP indicator is OFF)
			bit2	1: JOG command
			bit4–3	Operation direction 00b: FWD 01b: from REV to FWD 10b: from FWD to REV 11b: REV
			bit8	1: Master frequency controlled by communication interface
			bit9	1: Master frequency controlled by analog / external terminal signal
			bit10	1: Operation command controlled by communication interface
			bit11	1: Parameter locked
			bit15–12	Reserved
Frequency command	2102H	R (03H)	Drive's frequency command (XXX.XX Hz)	
Output frequency	2103H	R (03H)	Drive's output frequency (XXX.XX Hz)	
Output current	2104H	R (03H)	Drive's output current (XX.XX A). Decimal places can be referred by the high byte of 211F	
DC bus voltage	2105H	R (03H)	Drive's DC bus voltage (XXX.X V)	
Output voltage	2106H	R (03H)	Drive's output voltage (XXX.X V)	
Multi-step speed status	2107H	R (03H)	Drive's current running speed step given by multi-step speed command (0 is zero step speed)	
Output power factor angle	210AH	R (03H)	Drive's output power factor angle (XXX.X°) (0.0–180.0°)	
Actual motor speed	210CH	R (03H)	Actual motor speed (XXXXX rpm)	
Number of PG feedback pulses	210DH	R (03H)	Number of PG feedback pulses (0–65535)	
Power output	210FH	R (03H)	Drive's output power (XX.XX kW)	
Multi-function display	2116H	R (03H)	Used to display the selected item of user-defined function.	
Maximum user-defined value	211BH	R (03H)	Maximum output frequency (Pr.03-50)	

Status monitor read only (22xx): communication station address is Pr.09-00 setting value

Function Name	Modbus Address	Attribute (Function Code)	Description
Output current	2200H	R (03H)	Displays drive's output current
Output frequency	2202H	R (03H)	Actual motor frequency (XXX.XX Hz)
DC bus voltage	2203H	R (03H)	Drive's DC bus voltage (XXX.X V)
Output voltage	2204H	R (03H)	Drive's U, V, W output value (XXX.X V)
Power factor angle	2205H	R (03H)	Drive's output power factor angle (XXX.X°)
Power output	2206xH	R (03H)	Displays output power of U, V, W (XXXX.X kW)
Actual motor speed	2207H	R (03H)	Displays motor speed in rpm estimated by the drive or by encoder feedback (XXXXX rpm)
Output torque	2208H	R (03H)	Displays positive/negative output torque in %, estimated by the drive (XXX.X %)
Feedback position	2209H	R (03H)	Displays PG feedback
AUI1 analog input	220BH	R (03H)	Displays signal of AUI1 analog input terminal, -10–10 V corresponds to -100.00–100.00%
ACI analog input	220CH	R (03H)	Displays signal of ACI analog input terminal, 4–20 mA / 0–10 V corresponds to 0.00–100.00%
AUI2 analog input	220DH	R (03H)	Displays signal of AUI2 analog input terminal, -10–10 V corresponds to -100.00–100.00%
IGBT temperature	220EH	R (03H)	IGBT temperature of drive power module (XXX.X°C)
Drive capacitance temperature	220FH	R (03H)	Drive's capacitance temperature (XXX.X°C)
Digital input status	2210H	R (03H)	The status of digital input (ON / OFF), see Pr.07-41 Example 1 for details.
Digital output status	2211H	R (03H)	The status of digital output (ON / OFF), see Pr.07-41 Example 2 for details.
Multi-step speed	2212H	R (03H)	Drive's current running speed step given by multi-step speed command
The corresponding CPU pin status of digital input	2213H	R (03H)	The corresponding CPU pin status of digital input, see Pr.07-41 Example 1 for details.
The corresponding CPU pin status of digital output	2214H	R (03H)	The corresponding CPU pin status of digital output, see Pr.07-41 Example 2 for details.
Overload counter	2219H	R (03H)	Times of overload counter (the maximum is 64050)
GFF	221AH	R (03H)	Ground fault (GFF) current short to ground value (XXX.XX%)
DC bus voltage ripples	221BH	R (03H)	DC bus voltage ripples (XXX.X V)
User page displays	221EH	R (03H)	Displays of user-defined values
Control mode	2223H	R (03H)	Drive's control mode (0: speed mode / 1: torque mode)

Function Name	Modbus Address	Attribute (Function Code)	Description	
Carrier frequency	2224H	R (03H)	Drive's carrier frequency (XX kHz)	
Drive status	2226H	R (03H)	bit1–0	00b: No direction 01b: FWD 10b: REV
			bit3–2	01b: Drive is ready 10b: Fault
			bit4	0: Drive does not output 1: Drive outputs
			bit5	0: No warning 1: Warning

6. Exception response

When the drive is using the communication connection, if an error occurs, the drive responds to the error code and sets the highest bit (bit 7) of the command code to 1 (function code AND 80H) then responds to the control system to signal that an error occurred. If the keypad displays "CE-XX" as a warning message, "XX" is the error code at that time. Refer to the table of error codes below for communication error for reference.

ASCII mode:

STX	':'
Address	'0'
	'1'
Function	'8'
	'6'
Exception code	'0'
	'2'
LRC Check	'7'
	'7'
END	CR
	LF

RTU mode:

Address	01H
Function	86H
Exception code	02H
CRC Check Low	C3H
CRC Check High	A1H

The explanation of exception codes:

Error Code	Description
1	Function code is not supported or unrecognized.
2	Address is not supported or unrecognized.
3	Data is not correct or unrecognized.
4	Failure to execute this function code.
10	Transmission time-out

Appendix C. Revision History

Firmware Version: V1.01

Issued Edition: 00

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Added	
Descriptions	Chapters
• Added option card EMEB-PGSED-2 • Added wiring description for option cards • Added Ground terminal markings for EMEB-PGHH-1 & EMEB-PGSED-1	Section 3-1, Section 3-6, Section 6-2-2-2, Pr.00-20, Pr.03-90, Pr.07-04
• Added impedance in current mode for control terminals AUI1 / ACI1 • Added analog output 1 and 2 for control terminals AFM1 / AFM2 • Added NOTE information for internal safety circuit • Added information for 24-hour detection function	Section 4-8. Section 4-9
• Added information on turning software VFD Explorer Lite	Section 5-2
• Added tuning information on deceleration time when operating without RUN command for multi-step speed settings	Section 6-2-2-4
• Added setting value 7 for DCP serial communication (SG±)	Pr.00-02, Pr.00-03
• Added information on motor rated speed for inductor motors (IM)	Pr.00-14

• Added function of rescue by mechanical brake control in:
  • Multi-function input terminal #34
  • Parameter settings from Pr.05-35 to Pr.05-39
	MI=34 (Pr. Group 01)
	Pr.05-35–Pr.05-39

• Added MO function #53	Pr.01-10–Pr.01-15
• Added PTC wiring diagram for AUI1/AUI2/ACI selections	Pr.01-20, Pr.01-26, Pr.01-32
• Added PPI information to zero speed position control	Pr.03-30–Pr.03-33
• Added parameter description regarding the operation speed under EPS mode, and moved notes from Pr.02-22 to Pr.02-23.	Pr.02-23
• Added parameter regarding torque offset setting	Pr.02-46
• Added treatment when fault code MbF is triggered	Pr.04-15
• Added temperature detection of PTC 1.	Pr.04-47–Pr.04-49
• Added DCP setting value 3 and 4 for CANopen protocol selections	Pr.05-00
• Added function of Safety Gear Release in parameter settings	Pr.05-29–Pr.05-34
• Added descriptions of PWM and SVPWM mode settings	Pr.07-31
• Added conditions in which the fault code MbF is triggered	Pr.11-74

Added	
Descriptions	Chapters
• Added fault code 69 rbrE and 70 SFGE corresponding to new functions of Rescue by Mechanical Brake Control and Safety Gear Release in parameter settings	Section 9-2, Pr.02-70, Pr.02-71–Pr.02-74 Pr.11-24–Pr.11-29
• Added warning and fault code oH3_1 regarding function of motor over-heating PTC1. Warning and fault code oH3 become oH3_2, regarding function of motor over-heating PTC2. • Added warning and fault code SERV	Section 9-1, Section 9-2, Pr.02-70, Pr.02-71–Pr.02-74 Pr.11-24–Pr.11-29

Changed	
Descriptions	Chapters
• Changed terminal No. 10 to C- and No.11 to C+ for both EMEB-PGHH1 (Terminal J2) and EMEB-PGSED-1 (Terminal J2) PIN definition using encoder Heidenhain ERN1387	Section 3-2-2 Section 3-5-2
• Deleted description of setting Pr.00-26 to 1 for EMEB-PGSED-2 (Terminal J2) PIN definition using encoder Heidenhain ERN1387	Section 3-6-2
• Updated terminal function description for control circuit terminals AUI1 / AUI2 / ACI1	Section 4-8
• Updated descriptions of isolating main power from ground	Section 4-10
• Changed the function description of displayed LASE to none	Section 5-1-1
• Deleted sections of SD card	Section 5-2, Pr. Group 08
• Updated tuning information on motor rated speed for motor settings • Updated mechanical inertia reference value for PM / with load	Section 6-2-2-1 Section 6-2-2
• Updated name of acceleration/deceleration time 1–4 to acceleration/deceleration time of set 1–4.	Pr.00-71–Pr.00-78, Pr.00-81, Pr.00-94, Pr.03-35, Pr.13-28, Pr.13-29, MI=8, MI=9 (Pr. G01)
• Updated diagram of S-curve • Updated parameter name	Pr.00-94
• Updated AUI1/AUI2/ACI setting value 4 to 6 to PTC1 and PTC2	Pr.01-20, Pr.01-26, Pr.01-32
• Updated parameter name, setting range and default value	Pr.02-23
• Clarified battery ON/OFF in UPS	Pr.02-28, Pr.02-29
• Updated parameter default value	Pr.03-11
• Updated PPI information on zero speed position control • Updated default value of PPI gain	Pr.03-30–Pr.03-33
• Deleted “Pr.03-90=0 (default)” in the flowchart of Bit0=1 parameter description.	Pr.03-90
• Corrected default value from 0002h to 0000h.	Pr.04-01
• Updated default value from 0.00 to 1.00 seconds	Pr.04-11
• Updated parameter name from Phase Loss Protection during Operation to Input Phase-loss Protection during Operation, and updated parameter descriptions.	Pr.04-31, waring code PHL, fault code PHL
• Changed temperature detection from PTC to PTC 2.	Pr.04-50–Pr.04-52
• Updated setting values	Pr.05-02–Pr.05-04

Changed	
Descriptions	Chapters
• Changed parameter number from Pr.07-42 to Pr.00-05 (Speed Unit)	Pr.00-05, Pr.07-42
• Removed the markings of parameters can be set during operation	Pr.07-20, Pr.07-21
• Updated default values and descriptions in accessing favorite parameters	Pr. Group 12
• Updated user-defined parameters in displaying favorites	Pr. Group 13
• Updated information on certifications regarding emission	Section 12-3

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